THE REPUBLIC OF TURKEY
REPORT ON
THE MINERAL EXPLORATION
OF
KÜRE AREA

PHASE 3

MARCH 1995

JAPAN INTERNATIONAL COOPERATION AGENCY
METAL MINING AGENCY OF JAPAN

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PREFACE

The Government of Japan, in response to the request extended by the Government of the Republic of Turkey, agreed to conduct a metallic mineral exploration survey in the Küre Area, and commissioned its implementation to the Japan International Cooperation Agency (JICA).

The agency, taking the importance of the technical nature of the survey work into consideration, sought the cooperation of the Metal Mining Agency of Japan (MMAJ) to accomplish the task.

The Government of the Republic of Turkey appointed the Etibank to execute the survey as a counterpart to the Japanese team. The survey was carried out from 1992 jointly by experts from both governments.

1994 is the third year of this project and MMAJ organized a survey team consisting of seven experts which carried out field work during the period of 27 September 1994 to 30 January 1995.

The work was completed on schedule thanks to the excellent cooperation of the staff of ETİBANK.

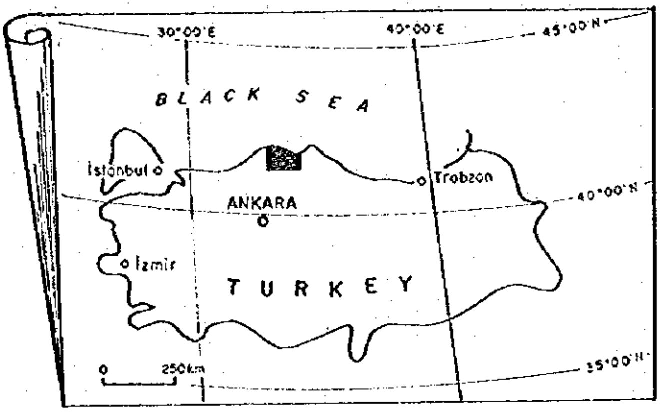
We hope that this report will serve for the development of the project and contribute to the promotion of friendly relationship between the two countries.

We wish to express our sincere appreciation to the officials concerned of the Government of the Republic of Turkey for their close cooperation extended to the team.

March 1995

Kimio FUJITA
President,
Japan International Cooperation Agency

Takashi ISHIKAWA
President,
Metal Mining Agency of Japan



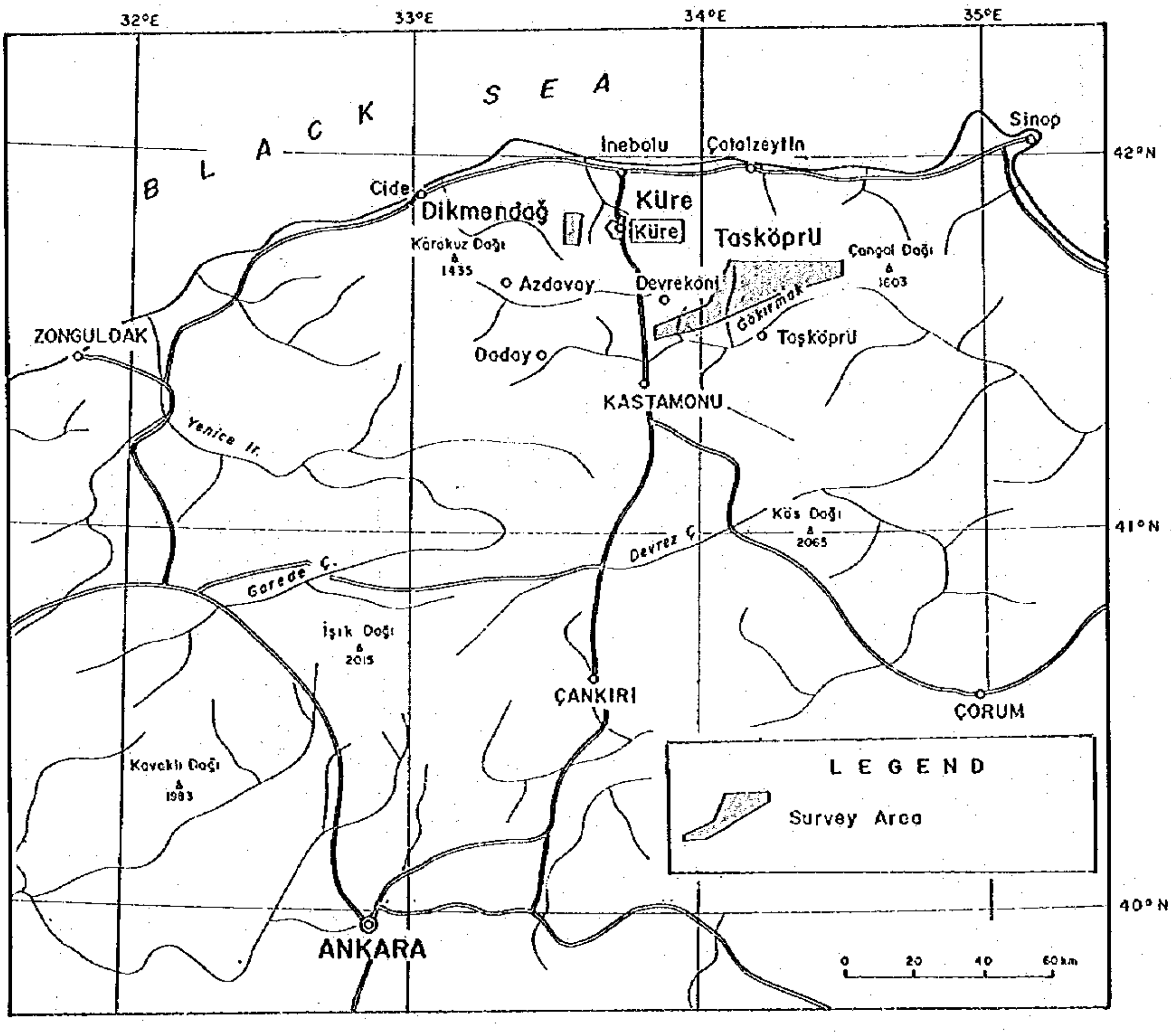


Fig. 1-1 Index Map of the Survey Area

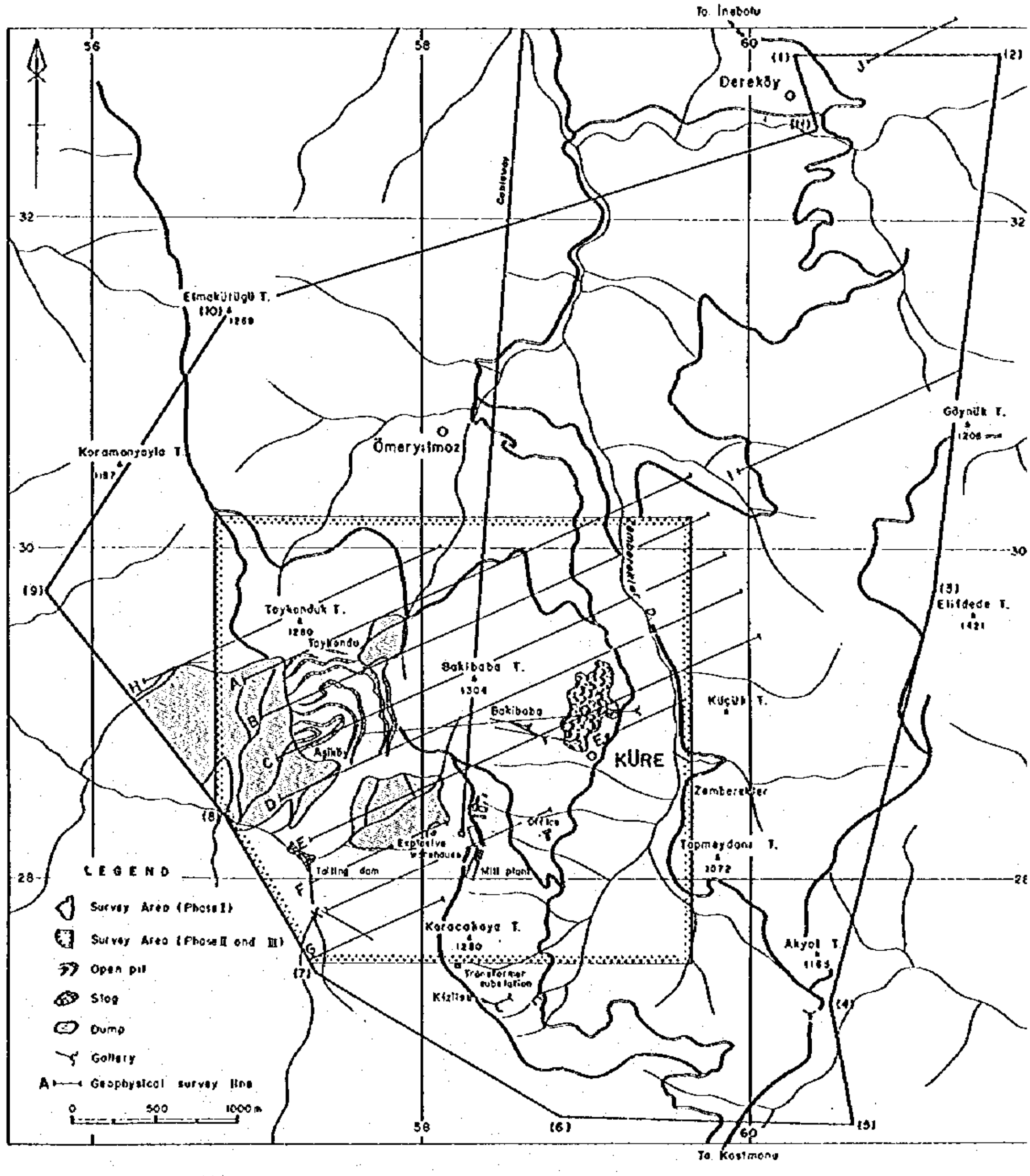


Fig. 1-2 Location Map of the Küre Zone

SUMMARY

The work reported in this paper corresponds to the third phase of the three-phase cooperative mineral exploration programme in the Küre area. The principal objective of the project is to find new mineral deposits in the area through the exploration and examination of geology and mineralization.

The geology of the Küre zone consists of pre-Jurassic ultramafic rocks, Jurassic basalt, sedimentary rocks of the Küre Formation, fossiliferous limestone of the Lower Cretaceous Karadana Formation, marl of the Upper Cretaceous Çağlayan Formation, intrusive diorite and dacite.

Basalt of the Küre Formation that occupies the major part of the zone is composed of pillow lava, hyaloclastite and massive basalt.

Sedimentary facies of the Küre Formation is composed of angularly fragmented graywacke and sheared/argillized black shale.

Basalt and brecciated sediments of the Küre Formation are interpreted as a constituent of melange. The period of melange formation is considered to be Middle Jurassic because the intrusion of dacite into the melange is inferred to be later Dogger epoch.

The geologic structure of this zone is characterized by many faults. They are divided into two systems: N-S and E-W.

Basalt is interpreted to constitute the footwall or the horizon of ore deposits. It extends to the N-S and NNW-SSE directions with imbricate structure.

The known ore deposits are categorized as the Cyprus-type deposits. It is expected that deposits of the same type occur in this zone.

Ore deposits has been dislocated by the melange formation and later tectonic movement, but it is inferred that most ore deposits have been displaced with the displacement of footwall mineralized zone and hangingwall pelitic rocks.

The results of the measurement of physical properties on cores were harmonious with those on surface rock samples conducted in the first phase. It was confirmed that massive sulfide, black shale and some sandstone had low resistivity. Based on the measurement on cores in this phase, it is possible that pyrite dissemination and argillization of basalt may become a low resistivity zone.

Drilling in this phase resulted in locating a massive ore deposit with the drilled length of 75 cm and 4% Cu grade at the area to the southwest of the Bakibaba Deposit. The location and depth of ore correspond the low resistivity zone defined by CSAMT. The characteristic of the ore is similar to that of the known ore deposits. The potential of the Cyprus-type ore deposit was confirmed by the drilling.

Argillization similar to that observed in the above mentioned drill hole occurs in the other drill hole at the north of the Bakibaba Deposit. So the area in the vicinity of this hole is promising for the future exploration.

Limonite network and dissemination are widely developed near the Bakibaba deposit. The past exploration in this area covered only a limited location and depth. An aggressive exploration covering a wide area is necessary.

Vein network and dissemination occur over the orebody at the Bakibaba Deposit. Overturned structure is inferred in the surrounding area. The main orebody of Kızılsu Deposit is believed to be the vein network in the footwall side of the orebody. On the basis of the above evidence, it is concluded that the gossan which is exposed between Bakibaba and Kızılsu Deposits is most probably the altered products in the footwall side of the mineralized zone. It is recommended that drilling survey should be carried out in this zone in the future.

On the basis of the results of drilling survey done in the past two years, the low resistivity anomalies by CSAMT are considered to indicate zones dominated by pelitic rock and/or fractured zone aside from some ore deposits. From the results of physical properties measurement in the first and present phase, it has been proved that massive ore, vein network, black shale and some sandstone produce low resistivity anomalies . Therefore, the suitable method for the exploration in this zone is the IP survey. As the size of known massive orebodies is small except Aşıköy Deposit, it is necessary to conduct such IP survey that has the line and station allocation of short distance. A much denser drilling programme is also necessary for this deposit.

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PART 1 OVERVIEW

PART 1 OVERVIEW

CHAPTER 1 INTRODUCTION

1-1 Background and Objective of the Survey

The Turkey-Japan Cooperative Mineral Exploration has been carried out in four areas of the Republic of Turkey as an example, Çanakkale (1988-1990). As a result of these works, a large amount of information relevant to metallic mineral resources was obtained.

The Government of Turkey planned to conduct mineral exploration in the Küre area, and requested the cooperation of the Japanese Government. In December 1991, the Japanese Government, complying with the request, sent a mission for project- finding, discussing the Scope of Work and to make a preliminary survey trip to the area. As a result of consultations with Etibank, the counterpart of the Metal Mining Agency of Japan (MMAJ), an agreement was reached for cooperative mineral exploration work in the Küre area on March 11, 1992.

The principal objective of the project is to find a new mineral deposit in the Küre area through the exploration and examination of geology and mineralization. Technology transfer to the counterpart organization is also an important objective of the project.

The first phase survey of this project was carried out in fiscal 1992. The purpose of the first phase was to clarify the geological environment and thereby understand the occurrence and conditions of ore deposits of the Küre area. The works carried out in the first phase were; compilation of available geological and geophysical information, geological survey of the whole area, and geophysical survey over the Küre zone.

In fiscal 1993, four holes totaling 1,003.55m in length were drilled in the promising areas which were delineated by the geological and geophysical surveys during the previous year. Also two holes were electrically logged. Geophysical survey (IP, 21 line-km) was carried out at Cünür and Cozoğlu of the Taşköprü area since these were concluded to be promising by geological survey during the first year.

In fiscal 1994, drilling exploration comprising four holes totaling 953.70m in length continued on the Küre zone.

1-2 Conclusions and Recommendations of the Second Phase Survey

1-2-1 Conclusions

Küre Zone

(1) The geology of the zone consists of pre-Jurassic ultramafic rocks, Jurassic basalt, sedimentary rocks of the Küre Formation, grayish white fossiliferous limestone of the Lower Cretaceous Karadana Formation, pale brown and white marl of the Upper Cretaceous Çağlayan Formation, talus deposits and intrusive diorite and dacite.

(2) The major part of the zone is occupied by the Jurassic Küre Formation. The basalt is composed of pillow lava, hyaloclastite, and massive basalt. Sedimentary facies of the Küre Formation is composed of angularly fragmented graywacke and tectonically sheared/argillized black shale. The matrix consists of pelitic materials.

Basalt and brecciated sediments of the Küre Formation are interpreted as a constituent of melange. The period of melange formation is inferred to be Middle Jurassic, since intrusion into the melange is inferred to be Later Dogger epoch.

(3) The geologic structure of this zone is characterized by many faults. They are divided into two systems; N-S and E-W. The former system is crosscut by the latter. With the exception of the diorite and dacite intrusive bodies and the Karadana Formation, the boundaries of all geologic units, including ultramafic bodies, have been dislocated. The surface elongation of the intrusive bodies is harmonious with the strike of the faults in the vicinity and with the boundary between sediments and basalt of the Küre Formation.

Basalt is interpreted to be footwall rocks of ore deposits. It is distributed extending to N-S and NNW-SSE direction with imbricate structure.

(4) The known ore deposits are the Cyprus-type deposits. The new ore deposits of the same type are expected to occur in the zone. They occur at the boundary between hyaloclastite and black shale of the Küre Formation and also within hyaloclastite. They consist of massive ore, brecciated ore, network ore and disseminated ore.

(5) Ore deposits together with footwall mineralized zone and hanging-wall pelitic rock are considered to be dislocated by the tectonic movements.

(6) The results of drilling and electric logging show that pelitic rocks of the Küre Formation have extremely low resistivities. Basalt whose cracks and fractures caused by tectonic movements are filled by underground water, may show rather low resistivity.

(7) Drilling in this phase results in finding a mineralized zone at the northern extension of Zemberekler mineralized zone. The results of the survey indicate that the known ore deposits and mineralized zones are distributed in the N-S and NNW-SSE directions. The zones which are located in the N-S and NNW-SSE extensions from the mineralized zones in basalt with low resistivity anomalies, are promising for future exploration. Extremely low resistivity zones same as those in the known ore deposits are full of promise for finding of new ore deposits.

It is necessary to mind for deciding of drilling location that pelitic rocks show low resistivities, and it is difficult to distinguish ore deposits from pelitic rocks by resistivities.

Cünür Prospect in the Taşköprü Zone

(1) The geology around the prospect is the Çangal meta-ophiolite consisting of pelitic schist, massive basalt, and green schist.

(2) The mineralized zone is composed of eight lenses and bedded gossans in green schist. The gossans consist of quartz-limonite-pyrite network and limonite dissemination in the silicified and argillized parts of mafic rocks.

(3) The results of time-domain IP survey show that resistivities of the zone extended below gossans are similar to those of the surrounding non-mineralized zone, and chargeabilities are lower than those of the surrounding silicified zones. The size of mineralized zones expected to occur below gossans is estimated to be small.

(4) Blind mineralized zones may not be expected below the extensively silicified zone which occurs around gossans, because chargeabilities of the zones below silicified zone are similar to those of surface outcrops.

(5) High chargeability anomalies are identified at the southern margin of the zone. These anomalies are located adjoining to the silicified zone. The shape on cross sections, chargeabilities, resistivities of these anomalies and geology suggest that these anomalies may indicate the existence of disseminated sulphide minerals.

Cozoğlu Prospect in the Taşköprü Zone

(1) The geology around this prospect is composed mainly of the Çangal meta-ophiolite, the Kızacik Formation, and the Alaçam Formation. The meta-ophiolite consists of pelitic schist, massive metabasalt and green schist. The Kızacik Formation consists of grayish white limestone and the Alaçam Formation of quartz arenite and black mudstone.

(2) There are two openings of old adits, a large amount of slag and waste dumps on the surface. They are distributed in the Çangal meta-ophiolite.

(3) The mineralized zone observed in outcrops in this prospect is only a weak dissemination of pyrite.

(4) The results of geophysical survey in this phase show that high chargeability anomalies are distributed from the above zones which are covered by slags and waste dumps to the eastern part of this prospect. The shape of these anomalies on cross sections and the geology may indicate that bedded cupriferous pyrite deposits probably occur within these zones.

(5) The other high chargeability anomalies having similar values to the above mentioned anomalies are identified in the southern margin of the prospect, where is covered by the Çangal meta-ophiolite. It is considered that bedded cupriferous deposits may occur in these anomalous zones.

1-2-2 Recommendations for the Third Phase Survey

Küre Zone

It is recommended that drilling exploration should be carried out in the following localities for the purpose of clarifying the conditions of subsurface copper mineralization in the third phase of the project.

(1) South-southeast of the Aşıköy ore deposit
(2) North-northwest of the Bakibaba ore deposit
(3) East of the Bakibaba ore deposit and north-northwest of the Zemberekler mineralized zone

Cünür Prospect in the Taşköprü Zone

No further work is recommended in the Cünür prospect.

Cozoğlu Prospect in the Taşköprü Zone

It is recommended that drilling works should be carried out in the geophysical anomalies which are identified in the east of the localities where are occupied by slags for the purpose of clarifying the conditions of subsurface copper mineralization.

1-3 Outline of the Third Phase Survey

1-3-1 Coordinates of the Survey Areas

The locality surveyed during the period of this report is in the Küre zone. The coordinates of the survey area is as follows and is shown in Figure 1-2.

Survey Area		Latitude	Longitude		Latitude	Longitude
Küre Zone	1.	41°49.00'N	33°41.12'E	2.	41°49.00'N	33°43.04'E
	3.	41°47.55'N	33°43.09'E	4.	41°47.58'N	33°41.40'E
	5.	41°47.99'N	33°41.12'E			

1-3-2 Objectives

(1) Major themes

The major geological units of this area are; pre-Jurassic metamorphic rocks, Jurassic mafic rocks, and Jurassic to Paleogene sedimentary rocks. Mineralization hosted in the mafic bodies are observed in the Küre area. Based on the results of the previous year, the following work was carried out as the main line of work for the third phase.

Drilling

To clarify the direction of extension of the Aşıköy and Bakibaba Deposits and the occurrence and the grade of the copper deposits.

1-3-3 Method of exploration

(1) Drilling

1) The low resistivity zones confirmed by the geophysical work of the first phase in the vicinity of Aşıköy and Bakibaba Deposits were drilled.
2) Drilling machine and some tools were rented from MTA, other equipment used were those of ETiBANK and NED.
3) The final diameter of the cores was larger than BQ.
4) Recovery of cores
   i) As a rule, all cores were to be recovered with the exception of the soil.
   ii) At least 80% of the cores was to be recovered even when recovery was difficult. All efforts were made particularly in the mineralized zones, bottom and at the boundaries of geologic units.
5) Core handling
   i) Recovered cores were placed in core boxes with the directions clearly marked and were stored in core shack designated by ETiBANK.

6) Study of cores

i) The cores were studied with care and 1:200 scale columns were prepared.

ii) Microscopic studies of the cores were made as necessary.

1-3-4 Amount of work in relation with drilling

Amount of works done this phase is summarized in Table 1-1.

Table 1-1 Amount of Survey and Laboratory Studies

Survey	Type of Survey	Amount
Drilling	Number of holes	4 holes
	Total Length drilled	953.70m
	Thin Section	15 pcs
	Polished Section	16 pcs
	Ore Grade Assay (Au, Ag, Cu, Co, S)	31 pcs
	X-Ray Diffraction	9 pcs
	Rock Resistivity and polarization	30 pcs

1-4 Members of the Third Phase Survey

(1) Field Supervision

From November 29 to December 9, 1993 :Takahisa YAMAMOTO(MMAJ)
Yoshiaki IGARASHI(MMAJ)

(2) Members Participating in the Project

The work of the third phase was carried out during the period of 18 July 1994 to 28 February 1995. Field work was done from 27 September 1994 to 30 January 1995. The members of the survey team are as follows.

Turkish Side

Assistant General Manager İsmet SIVRIOĞLU

Mineral Exploration Department of ETİBANK

Director	Suat AYBEK
Ass. Director	Adil ŞUŞOĞLU
Manager	Ahmet ÜNSAL
Manager	Ekrem UTKUÇAL
Manager	İhsan DUR

Küre Mine

General Manager	Kemal Aydın ÇELİK
Deputy Manager	Mahir TEZCAN
Deputy Manager	Avni SAATÇIOĞLU

Survey Members of Etibank

Coordinator Necmettin ÇELİK

Drilling Engineer Sadik KELEŞOĞLU

Ass. Manager Cemalettin SOLAK

Japanese Side

Metal Mining Agency of Japan

Coordinator Takahisa YAMAMOTO

Coordinator Yoshiaki IGARASHI

Survey Members of NED

Team leader Yoneharu MATANO

Drilling Engineer Saichi ISHII

Drilling Engineer Yoshio SASAKI

Drilling Engineer Tadateru SUGIBUCHI

Drilling Engineer Mitsuo SASAKI

Drilling Engineer Mitsuo NOMURA

Drilling Engineer Hiromasa INABE

CHAPTER 2 GEOGRAPHY

2-1 Location and Access

The Küre mining district is located 50 km north of Kastamonu City, which with a population of 50,000 is the capital of the province and is the largest city in the northern Anatolia. The area is located about 225 km north of Ankara and 400 km east of İstanbul, the largest city in Turkey.

The main road in the area is National Highway 765 traversing Küre area in the north-south direction and also Provincial Highway 30 runs parallel to the Gökırmak River. These roads are almost totally paved. There are also roads connecting the highways and the villages. These are not paved and although is passable in the winter, they are not gravelled and at times become impassable to vehicles particularly in the rainy season. İnebolu-Kastamonu-Ankara road is paved and good, but the bus service is intermittent and inconvenient for the 56 km between Kastamonu and Küre.

The base camp for the third phase was established at the Küre mine.

2-2 Topography and Drainage System

2-2-1 Topography

The Küre area is located in the northern part of the Anatolia plateau. It is bounded to the north by the Black Sea and to the south by the northern Anatolia Fault extending in the E-W direction. Küre Range traverses the survey area in the east-west direction, represented by Mt. Karakuz (1,435 m) in the west and Mt. Çangal (1,605 m) in the east. The topography is relatively rugged and the elevation is about 1,000 m near the Küre mine.

2-2-2 Drainage System

Küre area is located in the upper reaches of Gökırmak River which flows eastward. Küre and Dikmendağ areas are both situated in the upper reaches of Karacehennemboğazi River which flows into the Black Sea. Most of these rivers flow only in the spring thaw. In the Küre Range, streams flow and it drizzles even in the summer.

2-3 Climate and Vegetation

2-3-1 Climate

The annual precipitation and annual average temperature in Küre area are estimated to be more than 600 mm and 10°C respectively, while those of Kastamonu in the inland zone are 400mm and 9.1°C. The survey area is somewhat higher in altitude and the average temperature is estimated to be around 10°C. It is cool in the summer and the winters are quite cold with snowfall amounting to 3 m during December to March. The maximum snowfall during the present survey was 1.5 m.

Along the Gökırmak River from Kastamonu to Taşköprü lies a very fertile flat land with vegetable farms, orchards, wheat growing and cattle raising are flourishing. In the intermontane flats, wheat is grown and forestry is very prosperous.

The monthly average temperature and precipitation recorded by the Kastamonu Meteorological Station is as follows.

Table 1-2 Monthly Temperature of Kastamonu

Month(°C)	Jan	Feb	Mar	Apl	May	June	July	Aug	Sep	Oct	Nov	Dec	Annual
Max.	17.0	14.2	26.4	23.8	26.0	32.0	35.0	35.0	29.2	29.0	17.0	9.8	
Min.	-8.9	-6.8	-2.4	-2.1	5.2	10.0	11.1	10.5	0.5	4.3	-3.8	-10.0	
Average	-2.5	-0.7	4.7	9.1	12.9	16.9	19.6	19.8	14.8	10.8	4.1	-0.8	9.0

(Data range from 1989 to November 1993)

Table 1-3 Monthly Precipitation of Kastamonu

	Jan	Feb	Mar	Apl	May	June	July	Aug	Sep	Oct	Nov	Dec	Annual
Ave. (mm)	20	12	18	47	64	96	24	19	24	39	36	37	438

(Data range from 1989 to November 1993)

CHAPTER 3 GEOLOGY OF THE SURVEY AREA

3-1 General Geology of Kastamonu Region

The Kastamonu region, bounded by the Bolu metamorphic massif on the west, covers the Daday-Devrekani metamorphic massif in the central part and the Ilgaz metamorphic massif to the east. It includes granitoid intrusions.

The Bolu massif consists of a metamorphic assemblage of Precambrian period, formed under the middle-pressure amphibolite facies and overlain by Silurian-Devonian age non-metamorphic arkose conglomerate.

The Ilgaz massif consists of metamorphic rocks of Precambrian period, formed under the conditions from glaucophane schist to green schist facies.

Two tectono-stratigraphic assemblages have been identified in the Daday-Devrekani massif. From bottom to top, they are composed of the Daday-Devrekani meta-sedimentary group of Precambrian period and the Çangal meta-ophiolite of pre-Liassic epoch.

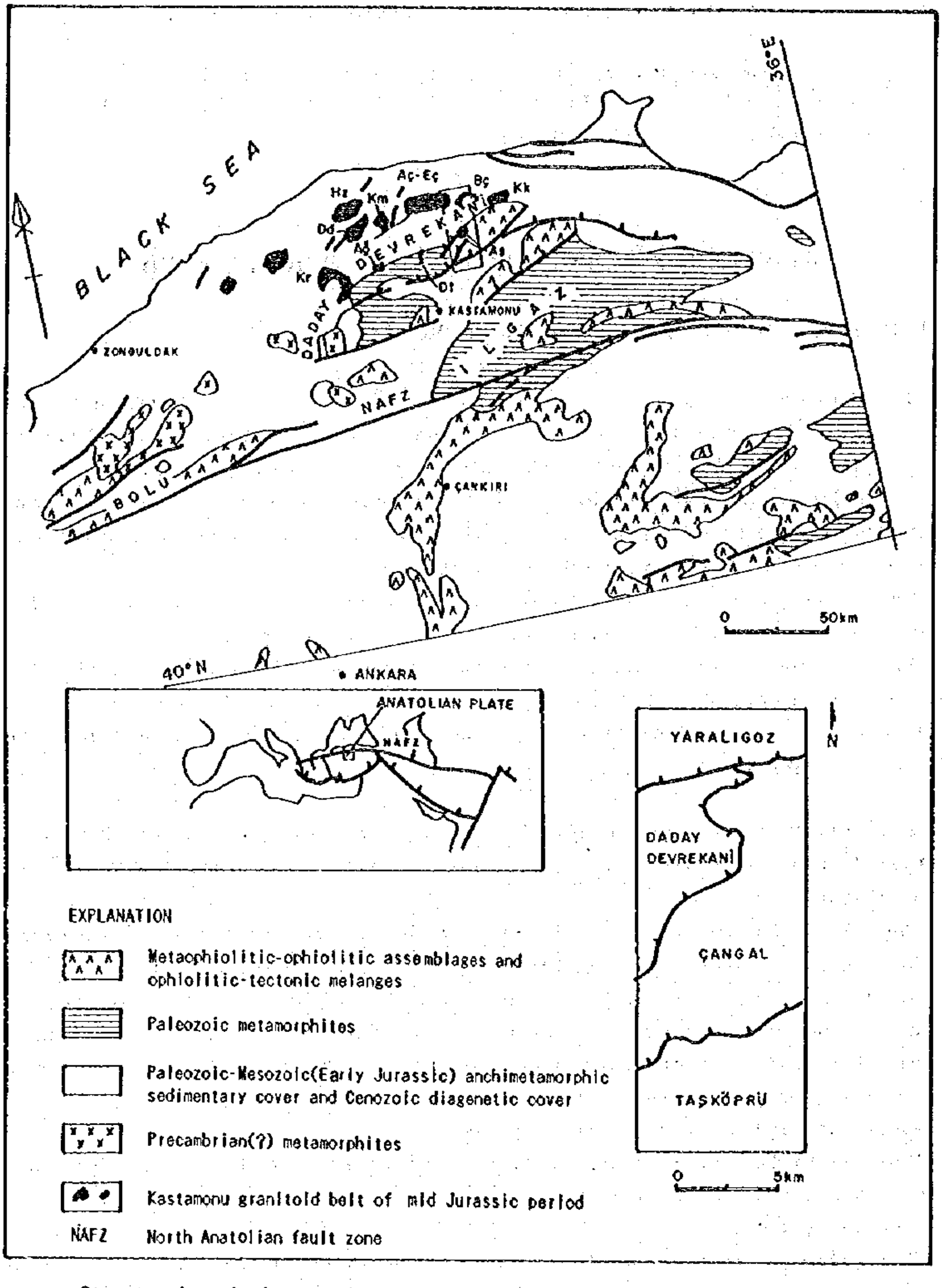
Four major formations which are underlain by the above mentioned massif are distributed in the region; Akgöl Formation, Bürnük Formation, Inalti Formation and Çağlayan Formation.

The Akgöl Formation is composed of black shale, siltstone, fine-grained sandstone, limestone, spilite, diabase, gabbro and serpentinite. It has a common feature of deep marine environment. Some part of this formation are metamorphosed due to the Early Dogger tectonics and by the Dogger intrusions.

The Bürnük Formation which deposited in intermontane alluvial environment has lithologies such as red colored conglomerate, sandstone, siltstone and sandy limestone of Later Dogger to Early Malm epoch.

The Inalti Formation consists of calcareous rocks and sandstone of shallow marine environment of Malm epoch. It is mostly unconformable with the overlying Cretaceous system.

The Çağlayan Formation of Aptian-Cenomanian epoch consists of turbidity sandstone, conglomerate and carbonaceous shale.



Structural-geologic map of Kastamonu granitoid belt and surrounding areas, modified after Yılmaz (1979) and Boztuğ et al.(1985). Rectangle outlines: mapped area, enlarged at lower right. Granitoid outcrops: Bç, Büyükçay; Aç-Eç, Ahiçay-Elmaliçay; Kk, Karacakaya; As, Asarcık; Dd, Dikmendağ; Hz, Hayzer; Ağ, Ağlı; Kr, Kürek; Km, Karaman; Dt, Deverkani town.

Fig. 1-3 Structural-Geologic Map of Kastamonu Granitoid Belt and Surrounding Areas

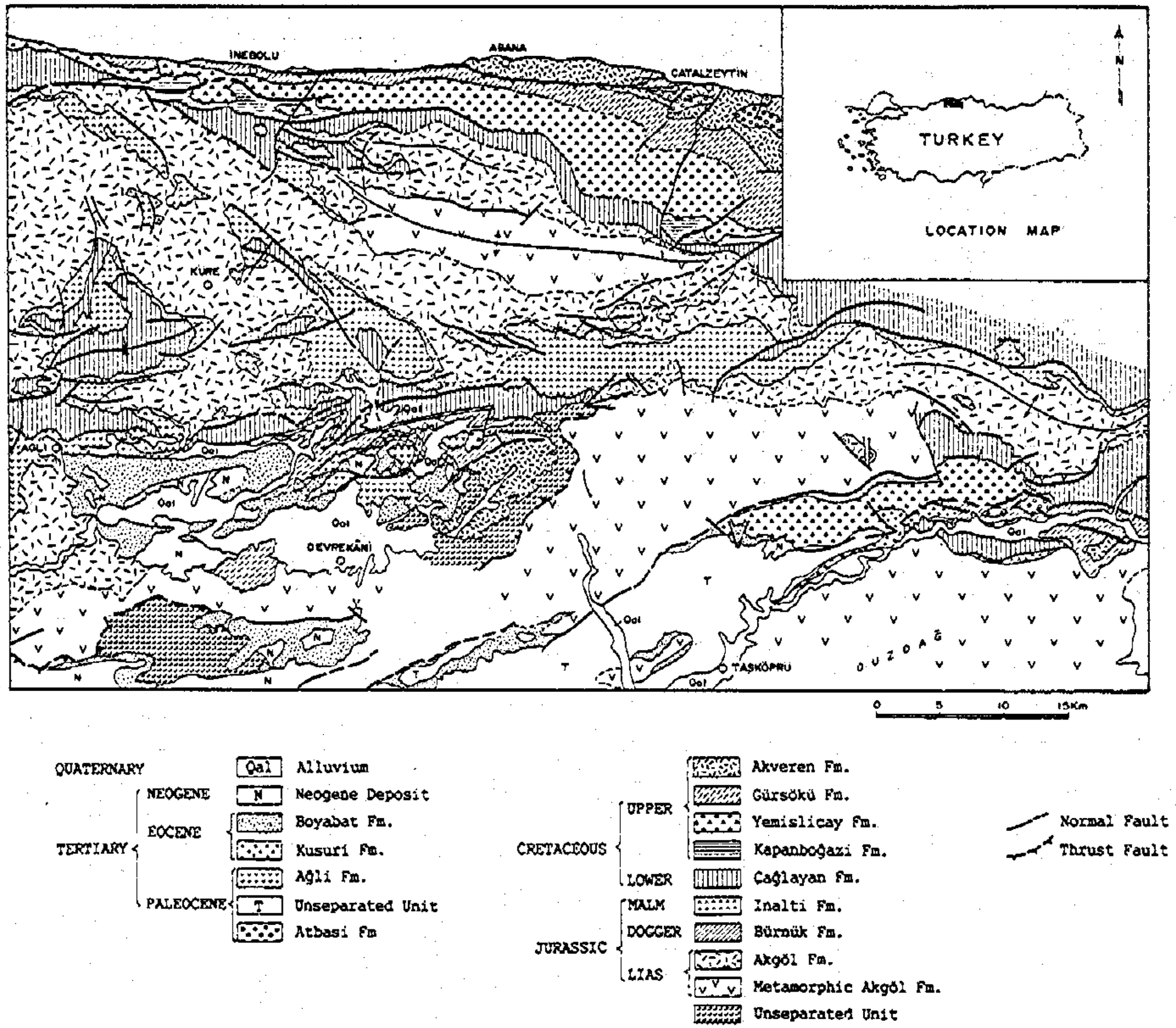


Fig. 1-4 Geologic Map of the Inebolu-Kastamonu Area

3-2 Geology and Geologic Structure of the Survey area

(1) Küre Zone

The geology of the Küre zone consists of pre-Jurassic ultramafic rocks, Jurassic basalt, sedimentary rocks of the Küre Formation, grayish white fossiliferous limestone of the Lower Cretaceous Karadana Formation, pale brown and white marl of the Upper Cretaceous Çağlayan Formation, talus deposits, intrusive diorite and dacite. The major part of the zone is occupied by the Jurassic Küre Formation. The basalt is composed of pillow lava, hyaloclastite, and massive basalt. Sedimentary facies of the Küre Formation is composed of angularly fragmented graywacke and tectonically sheared/argillized black shale. The matrix consists of pelitic materials.

Basalt and brecciated sediments of the Küre Formation are interpreted as a constituent of melange.

The geologic structure of this zone is characterized by many faults. They are divided into two systems; N-S and E-W. The former system is crosscut by the latter. With the exception of diorite and dacite intrusive bodies and the Karadana Formation, the boundaries of all geologic units, including ultramafic bodies, have been displaced. The surface elongation of the intrusive bodies is harmonious with the strike of faults in the vicinity and with the boundary between sediments and basalt of the Küre Formation.

3-3 Mineralization

(1) Küre Zone

Aşıköy, Toykondu, Bakibaba, and Kızılsu are the known ore deposits in this zone. These deposits occur at the boundary between hyaloclastite and black shale of the Küre Formation. They also occur within hyaloclastite. The other large mineralized zone which is distributed on the surface occurs in Zemberek-ler.

The Aşıköy deposit is the largest one in this zone. It is composed of many orebodies which have the largest dimensions of 380m east to west, 200m north to south, and 15 to 30m thick.

Ores are classified into massive ore, brecciated ore comprising fragments of massive ore filled in a matrix of chalcopyrite and pyrite, brecciated ore comprising subrounded to subangular massive ore fragments of 10 to 30cm in diameter in black shale, network ore and disseminated ore. The ore contains very large amount of pyrite with smaller amounts of chalcopyrite, sphalerite and marcasite, and minor amount of covelline, tetrahedrite and pyrrhotite. The gangue minerals are quartz with rutile, leucoxene, clay minerals and carbonates.

The ore grade of Aşıköy in drill cores range from 1 to 9 % Cu and from 40 to 48 % S.

Hyaloclastite on the footwall side of massive ore is sometimes silicified for a thickness of 1-3 m containing a large amount of quartz and minor sericite. The host rock of network zone is generally green, but it is bleached and silicified where the network is dense and sulfide minerals are strongly disseminated.

The Toykondu Deposit comprises a massive orebody with 200 m x 50 m extension in a locality further north of the northern part of Aşıköy Pit and several smaller bodies (50 m x 20 m) nearby.

The orebody to the north of the above pit confirmed by drilling is 3-15 m in core width with Cu 1-4 %, S 32-51 %.

The Toykondu massive ores contain large amount of pyrite, smaller amounts of chalcopyrite and sphalerite, and minor content of bornite, tetrahedrite, marcasite and pyrrhotite. The gangue mineral is quartz.

Hyaloclastite immediately below the massive orebody is leached and silicified (1-2 cm thick), but underlying hyaloclastite does not show signs of alteration except the occurrence of hematite.

Bakibaba Deposit comprises black shale, sandstone and massive orebody emplaced at the boundary of or within hyaloclastite. The massive orebody extends in the dip direction and the lateral section is oblong to circular with size ranging from 40 x 70 - 80 x 80 m. The dip of the orebody id 50-60° SE and extends over 130 m.

The Bakibaba massive ore contains a large amount of pyrite, smaller amounts of chalcopyrite and sphalerite, and minor amounts of covelline and pyrrhotite. The major gangue mineral is quartz. There are locally high grade parts with Cu 4-15 %, and S over 40 %.

Sulfide minerals on the surface have been oxidized to reddish colour within 600 x 500 m of Bakibaba Deposit.

Kızılsu Deposit consists of network and massive orebodies emplaced in hyaloclastite. The lateral extent of the orebodies are in the order of 300 x 150 m. Drilling results confirmed that most of the orebodies are network and the massive body is 80 x 40 m in lateral extent and the core width is 15 m. Both massive and network ore contain a large amount of pyrite, smaller amount of chalcopyrite, and minor amount of sphalerite, bornite, covelline, tetrahedrite and marcasite. The major gangue mineral is quartz.

The assay of massive ore shows Cu 4 %, S 40 %. The upper parts of the orebodies are gossan and the host rock hyaloclastite is silicified leached with a large amount of quartz and some sericite.

The geologic environment, mode of occurrence, and mineral composition of these orebodies show a common feature which is characteristic to the Cyprus-type ore deposits.

Chapter 4 DISCUSSIONS OF THE RESULTS OF THE THIRD PHASE SURVEY

4-1 Geology, Geologic Structure and Mineralization

(1) Küre Zone

The geology of the zone studied in this phase consists of pre-Jurassic ultramafic rocks, the Jurassic Küre Formation, and diorite and dacite which are intruded into the Küre Formation. The known ore deposits occur in the Küre Formation.

The Küre Formation is composed of basalt, and brecciated formations comprising fragments of pelitic and flysh rocks, and being cemented by pelitic materials.

Basalt is divided into pillow lava, hyaloclastite, and massive basalt. The chemical composition of the basalt is characterized by mid-ocean ridge basalt. Secondary minerals such as chlorite, epidote, prehnite and actinolite are generally observed in basalt under the microscope.

Breccia is composed of fragments of greywacke and black shale. The fragments are angular to subrounded and their size ranges from several centimeters to several meters. The matrix is pelitic and is either fractured and argillized or has scaly cleavage. This pelitic rock dissolves easily and is argillized. The black shale fragments are generally schistose with minor faults and minor folds in some places. There are in some localities, small basalt bodies within the breccia.

The geologic structure of this area is characterized by many faults and there are many fractured zones and faults in the basalt bodies.

It is thus considered that the Küre Formation is a melange.

The known ore deposits in this zone tend to occur at the boundary between hyaloclastite and black shale of the Küre Formation also within hyaloclastite. Ore is divided into massive, brecciated, disseminated and network ones. Massive and brecciated ores occur at the boundary between hyaloclastite and black shale. Disseminated and network ores occur within hyaloclastite.

The major part of massive ore is composed of sulphide minerals. The brecciated ore is composed of quartz, clay minerals and sulphide minerals.

The major ore minerals are pyrite and chalcopyrite with a minor amount of bornite, pyrrhotite, magnetite, sphalerite, galena, marcasite, electrum, bravoite and carrollite.

Massive and brecciated ores sometimes contain minute pyrite of colloform and gel-form together with coarse pyrite. In many cases, such pyrite shows cataclastic feature. Chalcopyrite fills the insterstices between the pyrite grains.

Alteration zone below massive ores is composed of chlorite, epidote, carbonate minerals, and locally quartz and sericite. Wall rocks of network zone generally show green color. They are silicified, and contain numerous veinlet and dissemination.

Basalt is submarine effusive rock. It is considered that the basalt erupted on the deep ocean floor, because tuffs formed by steam explosion do not occur in this zone. There are massive ores comprising a large amount of pyrite, a small amount of chalcopyrite and sphalerite, and a minor amount of marcasite and pyrrhotite.

Considering to these evidences, the known ore deposits in this zone are interpreted to be a Cyprus-type.

On the basis of these considerations, the process of ore deposit formation and emplacement is inferred as follows.

Hydrothermal systems accompanied by basalt eruption were formed on the mid-ocean ridge. Massive ores were formed from minute pyrite of colloform and gel-form together with coarse pyrite, and chalcopyrite filled among the pyrite grains.

After the formation of ore deposits, ores were covered by deep ocean pelitic sediments. The ores with basalt and pelitic sediments were sheared and mixed with flysh sediments which deposited around the subduction zone by obduction. Thus a melange was formed.

The period of melange formation is interpreted to be Middle Jurassic, prior to the intrusion of dacite.

The Küre Formation which is interpreted as a melange, is characterized by the arrangement of basalt and sedimentary rocks which extend in the direction of N-S to NNW-SSE. This direction is harmonious with the major faults. It agrees with the distribution of pillow lava and hyaloclastite around the Aşıköy and Bakibaba ore deposits. It also agrees with the surface elongation of intrusive rocks.

Tectonically dislocated ore deposits are distributed in the same direction as the distributions of Aşıköy - Toykondu and Bakibaba - Kızılsu ore deposits.

Basalt shows an imbricate structure. The boundary between basalt and sedimentary rocks are proposed as interesting zones for future exploration. The N-S to NNW-SSE extension of the known ore deposits are considered to be promising zones for exploration.

4-2 Geophysical Prospecting and Mineralization

During the first phase, low resistivity anomalies were confirmed by CSAMT and IP survey. These anomalies are considered to be related to ore deposits of Aşıköy, Bakibaba and kızılsu. Of particular interest is the many small anomalies detected southeast of Aşıköy orebody as these occur as several linearly oriented groups of anomalies and they apparently are continuous to the Kızılsu deposit to the southeast. Also small but continuous anomalies were detected to the north and south of Bakibaba Deposit. Weak anomalies were detected near the mineral showings to the northeast of Bakibaba and these are considered to continue to the Zemberekler mineralized zone.

Also the following three localities were selected to be being promising for future prospecting from study of the results of the above survey as well as those obtained by ETİBANK previously and the conditions of the mineral showings and the known deposits. These areas are; (1) south and north of Aşiköy Deposit, (2) north and south of Bakibaba Deposit, and (3) north-northwestern extension of the Zemberekler mineralized zone.

During the present phase, four holes were drilled with the above anomalies as targets. They are; (1) south of Aşıköy Deposit MJTK-2, (2) north of Bakibaba Deposit MJTK-3, (3) north of Aşiköy Deposit MJTK-5, and (4) southwest of Bakibaba Deposit MJTK-8.

MJTK-2

This borehole was aimed at the low resistivity (45-100 ohm-m) zone encountered at Station Nos.8-10, CSAMT Line-E. Two-dimensional analysis indicated the existence of low resistivity zones of 16-25 ohm-m at 100-200 m depth.

In this hole, breccia (fragments of greywacke or black shale with pelitic matrix) continues from the surface to 250 m depth (147 m vertical depth). Circulation losing zone continues throughout the hole.

It is believed that in this site, the low resistivity zone is caused by the pelitic nature of the matrix and the groundwater in the circulation losing zone.

MJTK-3

This borehole was aimed at the low resistivity (25-40 ohm-m) zone confirmed at Station Nos.24-26, CSMT Line-C by two-dimensional analysis.

The geology of the site is basalt from the surface to 301 m depth. Sulfide veinlets and network including pyrite occur at 4-72 m, 112-130 m, and 177-216 m depth. Zone of circulation loss was encountered at 107-154 m.

In the vicinity of this hole, as in the case of last year at MJTK-6, the water in the fractured zone contain ions dissolved from sulfide minerals. This is also a large factor in lowing the resistivity.

MJTK-5

This borehole was aimed at the low resistivity (below 4 ohm-m) zone confirmed at Station Nos.8-10, CSMT Line-B by two-dimensional analysis.

The geology of the site is basalt from the surface to 201 m depth. Sulfide veinlets and network including pyrite occur throughout the hole. Zone of circulation loss was encountered at 110 m.

The existence of sulfide minerals and the circulation losing zone are considered to be the reason for the decrease of resistivity.

MJTK-8

This borehole was aimed at the low resistivity (60-100 ohm-m) zone confirmed at Station Nos.22-24, CSMT Line-E by two-dimensional analysis.

The geology of the site is basalt from the surface to 117.8 m depth. Sedimentary rocks occur at 117.8-154.4 m and basalt at 154.4-201 m. A massive sulfide deposit is confirmed at 95.25-96.0 m. Basalt underlying the ore horizon is partly argillized. Zone of circulation loss was encountered near 92 m.

The existence of sulfide minerals and the circulation losing zone are considered to be the reason for the decrease of resistivity.

It is now clear from the four holes drilled this year that the low resistivity anomalies identified by CSAMT survey are caused mainly by the existence of sulfides (MJTK-5 and MJTK-8), black shale and breccia (argillaceous matrix MJTK-2).

4-3 Potential of Resources

(1) Küre Zone

The Küre Formation which contains the known ore deposits, is considered as a melange. Basalt and breccia formation are distributed with imbricate structure. All directions of lateral extension of basalt, the distribution of known ore deposits and strike of major faults, are N-S to NNW-SSE.

Basalt shows submarine effusive facies. Tuffs which imply steam explosion do not occur in this zone. It is interpreted that the basalt erupted in deep ocean. Ore deposits are composed of massive, brecciated, network ores with a large amount of pyrite, a small amount of chalcopyrite and sphalerite, and a minor amount of marcasite and pyrrhotite. No hydrothermal alteration zone occurs in the footwall basalt below massive ores. From the above facts, the known ore deposits in this zone are interpreted to be a Cyprus-type.

The Küre Formation is melange and fractured by tectonic movement. However, in the three of the four known deposits namely Aşıköy, Toykondu and Bakibaba Deposits, larger massive orebodies are often accompanied by sulfide network and dissemination.

If we assume that the scale of the ore deposits anticipated to occur in this area is more or less similar to those of the known deposits, the maximum would be in the order of 400x200x30 m. In the known deposits, however, in places dip steeply, the deposits are cut by faults into small bodies in many localities, and the hanging and foot walls are sometimes in fault contact with the orebodies. Therefore, sufficient numbers and depths of drilling is necessary for evaluating mineral prospects and the extensions of known deposits.

As mentioned above, ore deposits occur very close to a mineralized zone in footwall basalt. The existence of mineralized zone in basalt suggests some possibility of massive ore occurrence in the vicinity of such zones.

Massive sulfide deposit was confirmed at one borehole during the course of the present survey. Although the core width of the orebody was rather thin at 75 cm, assay showed a high grade of Cu 4 %, and this confirmed the existence of a massive sulfide orebody to the southwest of Bakibaba Deposit. This borehole is located to the southwest of Bakibaba and it is also to the south of the mineralized alteration zone on the surface. Drilling conducted this year supports the hypothesis that tracing the mineralized alteration zone is a very effective guide for mineral exploration. The dimensions of this newly found orebody must be determined and thus drilling survey should be continued.

Aşıköy and Toykondu Deposits are accompanied by mineralized hyaloclastite on the footwall side and by black shale on the hanging wall side, and thus it is believed that they retain the stratigraphic relations at the time of ore formation. On the other hand, the network and dissemination zones occur at a stratigraphic position higher than the ore horizon at the Bakibaba Deposit and overturned structure is inferred. It is believed that this overturned structure continues from Bakibaba Deposit to the southeast of Kızılsu Deposit.

The mineralized alteration zone exposed between the above two deposits is very likely the footwall altered zone of the deposit anticipated to occur in this zone.

It was clarified from the drilling and studies of the cores of the present survey that; pelitic rocks have low resistivity, and the normally high resistivity values of basalt also decreases when the rock is fractured and the insterstices are filled with water. Thus low resistivity does not necessarily indicate the existence of mineralized zones.

It is apparent from the above that the localities for future exploration are; north of Bakibaba Deposit, and the mineralized zone between east of Bakibaba and Zemberekler .

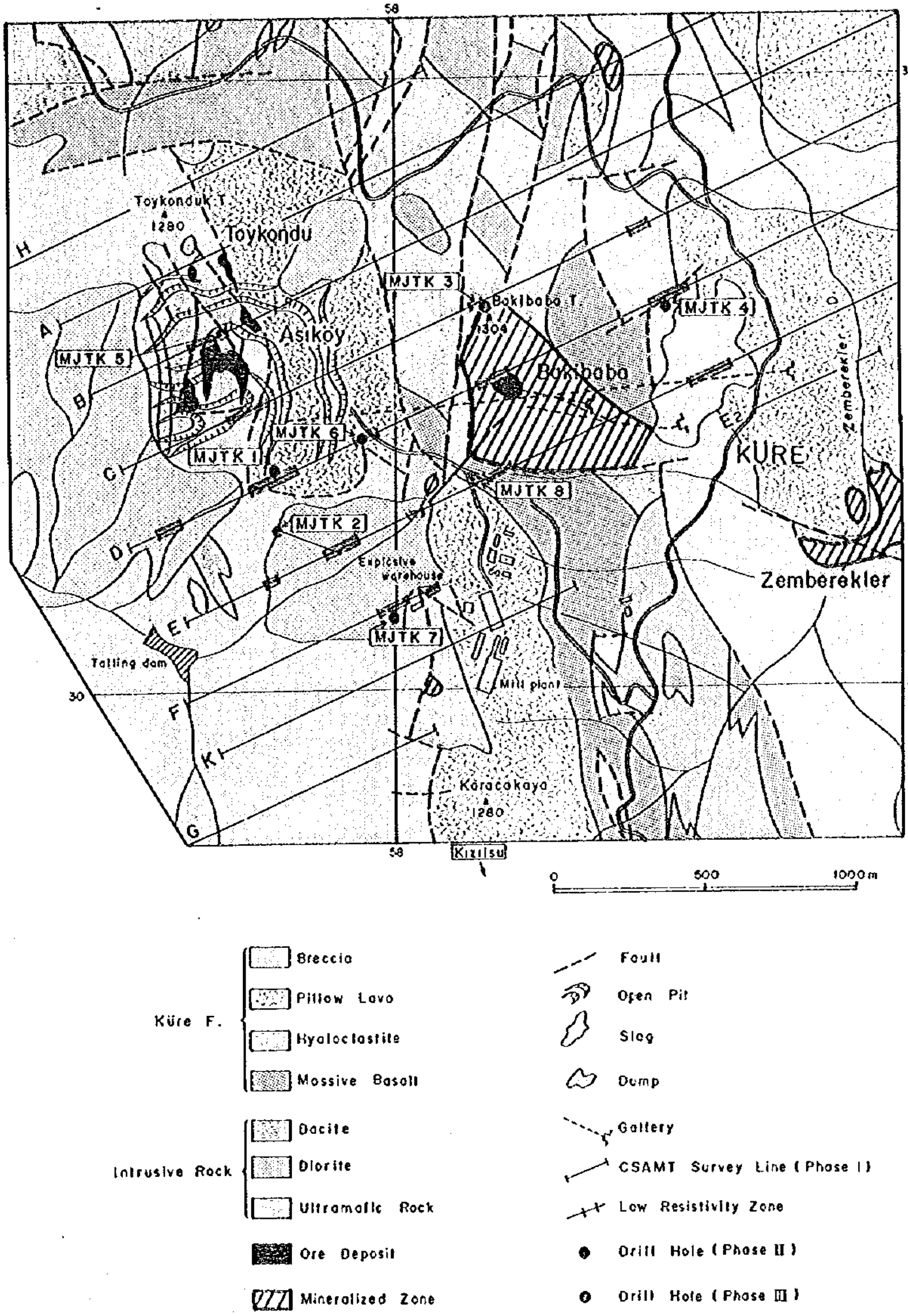


Fig. 1-5 Integrated Interpretation of the Survey Results in the Küre Zone

CHAPTER 5 CONCLUSIONS AND RECOMMENDATIONS

5-1 Conclusions

Drilling survey was conducted in the Küre Zone. The major objective of this phase was to clarify the conditions of subsurface copper mineralization in this zone. Following conclusions are obtained as the results of the third phase work.

(1) Drilling in this phase resulted in locating a massive ore with the drilled length 75 cm long and 4% Cu grade at the area to the southwest of the Bakibaba Deposit. The location and depth of ore correspond a weakly low resistivity zone defined by CSAMT. The characteristic of ore is similar to that of the known ore deposits. The potential of the Cyprus-type was confirmed by the drilling.

(2) A low resistivity zone obtained at the north of Bakibaba Deposit by CSAMT consists of basalt. Veinlets composed mainly of pyrite were observed in this zone. The lithology and mineralization of this hole are considered not to cause this low resistivity. Argillization similar to that observed in the above mentioned drill hole occurs in this hole. Thus, the area in the vicinity of this hole is promising for the future exploration.

(3) In the target of MJTK-2, namely the low resistivity zone to the south of Aşıköy Deposit, it was anticipated that massive orebodies would occur in the shallow parts due to displacement by a fault. The results of the survey in the second and this phase indicate that this low resistivity zone represents pelitic rocks and fault fractured zone. Therefore, it is considered that the possibility of the existence of massive orebodies of the scale of Aşıköy is low. The existence of massive orebodies expected to occur in the deep parts could not examine due to the shortness of the drilling length.

(4) A low resistivity zone located between Aşıköy and Toykondu Deposits is interpreted to be the network in the footwall of massive ores from the relationship with the Aşıköy massive deposit.

(5) The results of the measurement of physical properties on cores in this phase were harmonious with those on surface rock samples conducted in the first phase. It was confirmed that massive sulfide, black shale and some sandstone had low resistivity. Based on the measurement on cores in this phase, it is possible that pyrite dissemination or argillization of basalt may become low resistivity zone.

(6) On the basis of the results of drilling survey done in the past two years, the low resistivity anomalies by CSAMT are considered to indicate zones dominated by pelitic rocks and/or fractured zones aside from some ore deposits. From the re-

sults of physical properties measurement in the first and this phase, it have been proved that massive ore, sulfide network, black shale and some sandstone cause low resistivity anomalies. Therefore, the suitable method for the exploration in this zone is the IP survey. As the size of known massive orebodies is small except Aşıköy Deposit, It is necessary to conduct such IP survey that has the line and station allocation of short distances. A much denser drilling is also necessary for this deposit.

(7) Limonite network and dissemination are widely developed near the Bakibaba Deposit. The past exploration of this area covered only a limited location and depth. An aggressive exploration covering a wide area is necessary.

(8) The massive deposit confirmed at the south of Bakibaba Deposit is accompanied by a silicified zone. Noting this characteristic, the silicified zones of Mt. Bakibaba to the north of Bakibaba Deposit and Mt. Karacakaya between the Bakibaba and Kızılsu Deposits will be targets for exploration.

(9) Vein network and dissemination occur over the orebody at Bakibaba Deposit. Overturned structure is inferred in the surrounding area. The main orebody of Kızılsu Deposit is believed to be the vein network in the footwall side of the orebody.
On the basis of the above evidence, it is concluded that the gossan which is exposed between Bakibaba and Kızılsu Deposits is most probably the altered products in the footwall side of the mineralized zone.

5-2 Recommendations for the Future Exploration

It is recommended that drilling exploration should be carried out in the following localities for the purpose of clarifying the conditions of subsurface copper mineralization.

(1) Detailed drilling survey in the vicinity of MJTK-8, the south and the north of Bakibaba Deposit

(2) An area between Bakibaba and Kızılsu Deposits

(3) An area from the east of Bakibaba Deposit to Zemberekler mineralized zone

IP survey is recommended to carry out over the low resistivity zones by CSAMT, where have not been explored by drilling in this study.

PART 2 DETAILED DISCUSSIONS

PART 2 DETAILED DISCUSSIONS

CHAPTER 1 OUTLINE OF KÜRE ZONE

1-1 Outline of the Zone

The Küre zone is located in the central northern part of the Küre area. The land consists of well-vegetated mountains extending in the east to west direction. It is bounded to the north by the Black Sea and to the south by the Anatolia plateau.

The office of the Küre mine is located at 1,100 m above sea level. The relief around the mine is steep.

The Küre mine is only one operating mine in the area exploiting ores from the Aşıköy and Bakibaba Deposits.

The Aşıköy Deposit dips largely southeastward and occurs from the surface (1.100 m above sea-level) and continues deeper than 700 m in altitude. The upper part is being mined by open pit which is presently the main operation. Underground mining is being planned for the future and 920 ML adit has been opened. This adit has connected the lower parts of both Aşıköy and Bakibaba Deposits and will serve as the main transportation adit. Also an inclined shaft was opened from the southern part of the Aşıköy Deposit. Underground drilling is being carried out from the 920 ML in order to confirm the lower part of the Aşıköy Deposit.

Geological and geophysical (CSAMT, IP) surveys were conducted in the first phase. The extensional localities of the Aşıköy and Bakibaba ore deposits and Zemberekler mineralized zone were extracted as the next exploration targets.

Of these targets, northern and southern extensions of both Aşıköy and Bakibaba Deposits were investigated this year by drilling four boreholes, a total length of 953.70 m, at low resistivity zones identified by CSAMT.

1-2 Geology and Mineralization

The geology of the zone consists of pre-Jurassic ultramafic rocks, Jurassic basalt, sedimentary rocks of the Küre Formation, fossiliferous limestone of the Lower Cretaceous Karadana Formation, marl of the Upper Cretaceous Çağlayan Formation, intrusive diorite and dacite.

Basalt of the Küre Formation that occupies the major part of the zone is composed of pillow lava, hyaloclastite and massive basalt.

Sedimentary facies of the Küre Formation is composed of angularly fragmented graywacke and sheared/argillized black shale.

The geologic structure of this zone is characterized by many faults. They are divided into two systems; N-S and E-W. With the exception of diorite and dacite intrusive bodies, the boundary of all geologic units, including ultramafic bodies, have been displaced. The surface elongation of intrusive bodies is harmonious with the strike of faults in the vicinity and with the boundary between sediments and basalt of the Küre Formation. Basalt bodies occur in an area elongated in the N-S or NNW-SSE direction and is considered to have imbricate structure. Many fractured zones and faults are observed in the basalt bodies.

Aşıköy, Toykondu, Bakibaba and Kızılsu are the known ore deposits in this zone. These deposits occur at the boundary between hyaloclastite and black shale of the Küre Formation also within the hyaloclastite. They consist of massive, brecciated, network and disseminated ores. They contain a large amount of pyrite with a small amount of chalcopyrite and a minor of sphalerite. The geologic environment, mode of occurrence, and mineral composition of these orebodies show a common feature which is characteristic to the Cyprus-type ore deposits.

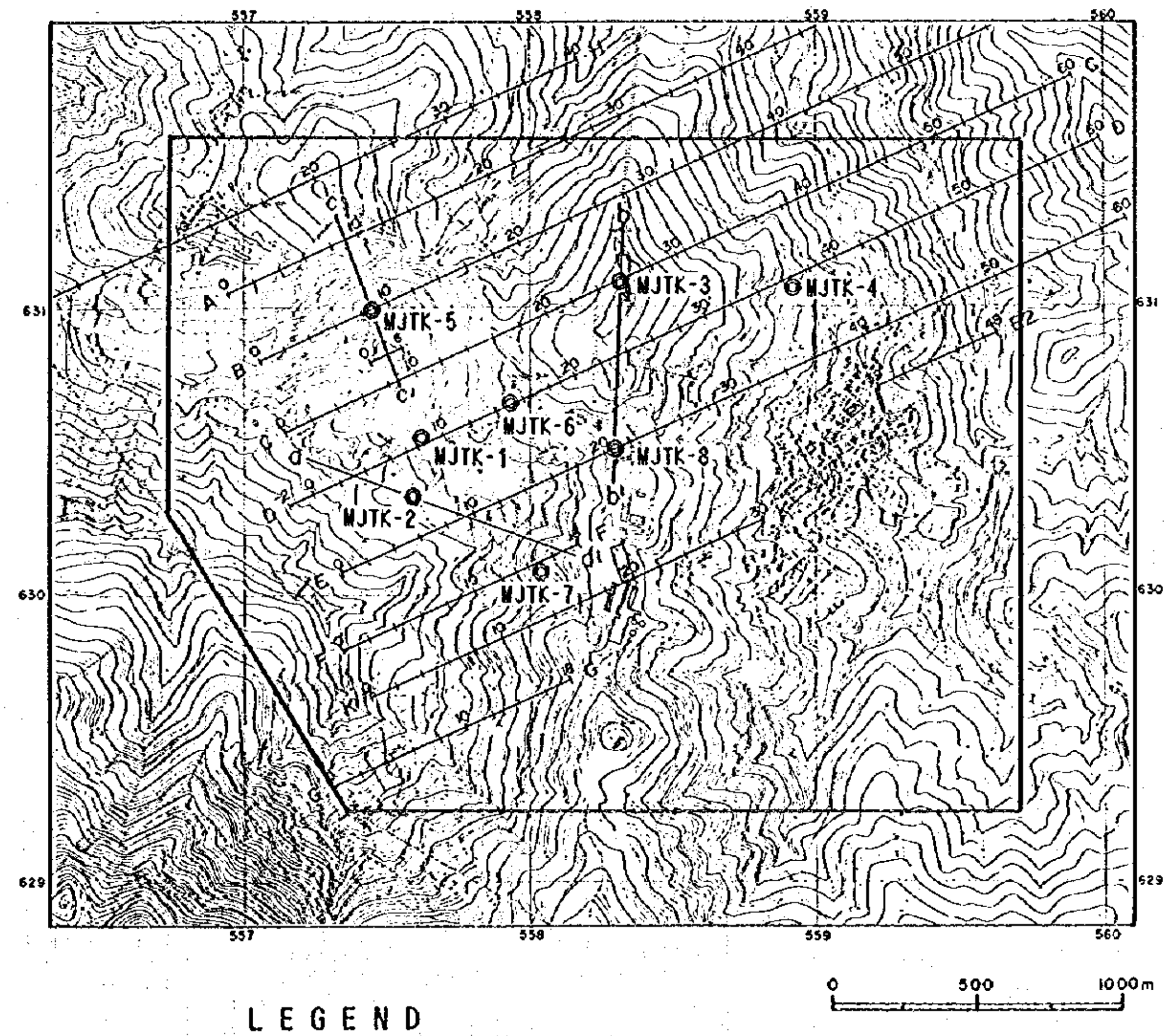
CHAPTER 2 DRILLING SURVEY

2-1 Outline of Drilling

Geological and geophysical surveys of the first phase and the drilling of the second phase enabled the extraction of northern and southern extensions of both Aşıköy and Bakibaba Deposits as the promising targets for further exploration in the Küre area.

The objective of the third phase - this year - was set at clarifying the mineral occurrence and the grade of the extensions of the above two deposits by drilling and thereby increasing the copper reserves of the Küre mine. Four holes totaling 953.70 m in length were drilled. The location and the lengths of each hole are shown in Table 2-1. The location of the sites, schematic geologic section and geologic cross section of each hole are shown in Figures 2-1 to 2-3. Two machines were used for drilling MJTK-2,3,5 and 8.

Regarding the study of cores, columns at 1:200 scale and colored photographs of all cores were prepared. Thin sections of 15 samples, polished sections of 16 samples, X-ray diffraction of 9 samples and chemical analysis of 31 samples were carried out.



LEGEND

A—— CSAMT Surver Line

b——b' Geological Section

◎ Drill Hole

Fig. 2-1 Location Map of Drill Holes

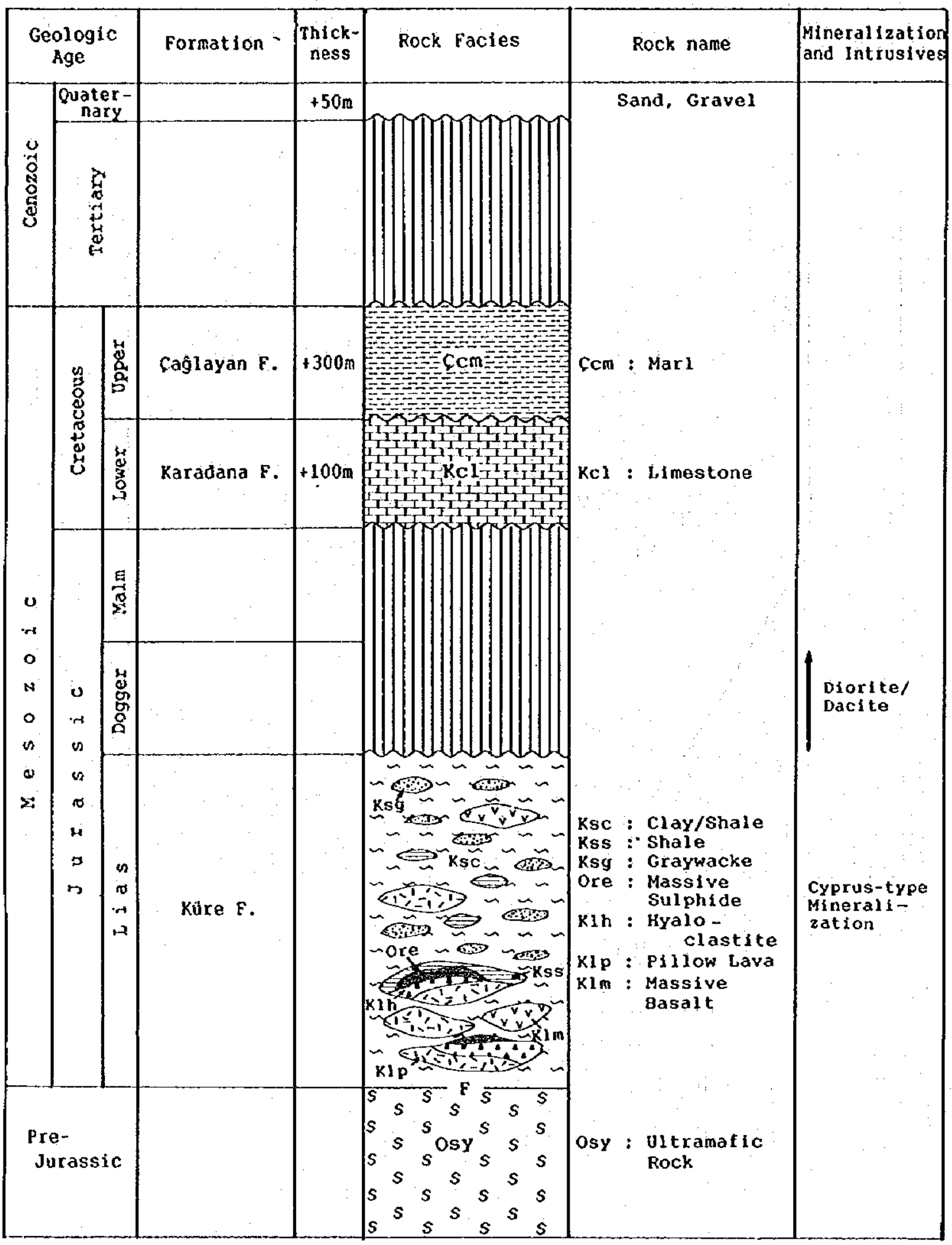


Fig. 2-2 Schematic Geologic Column of the Küre Zone

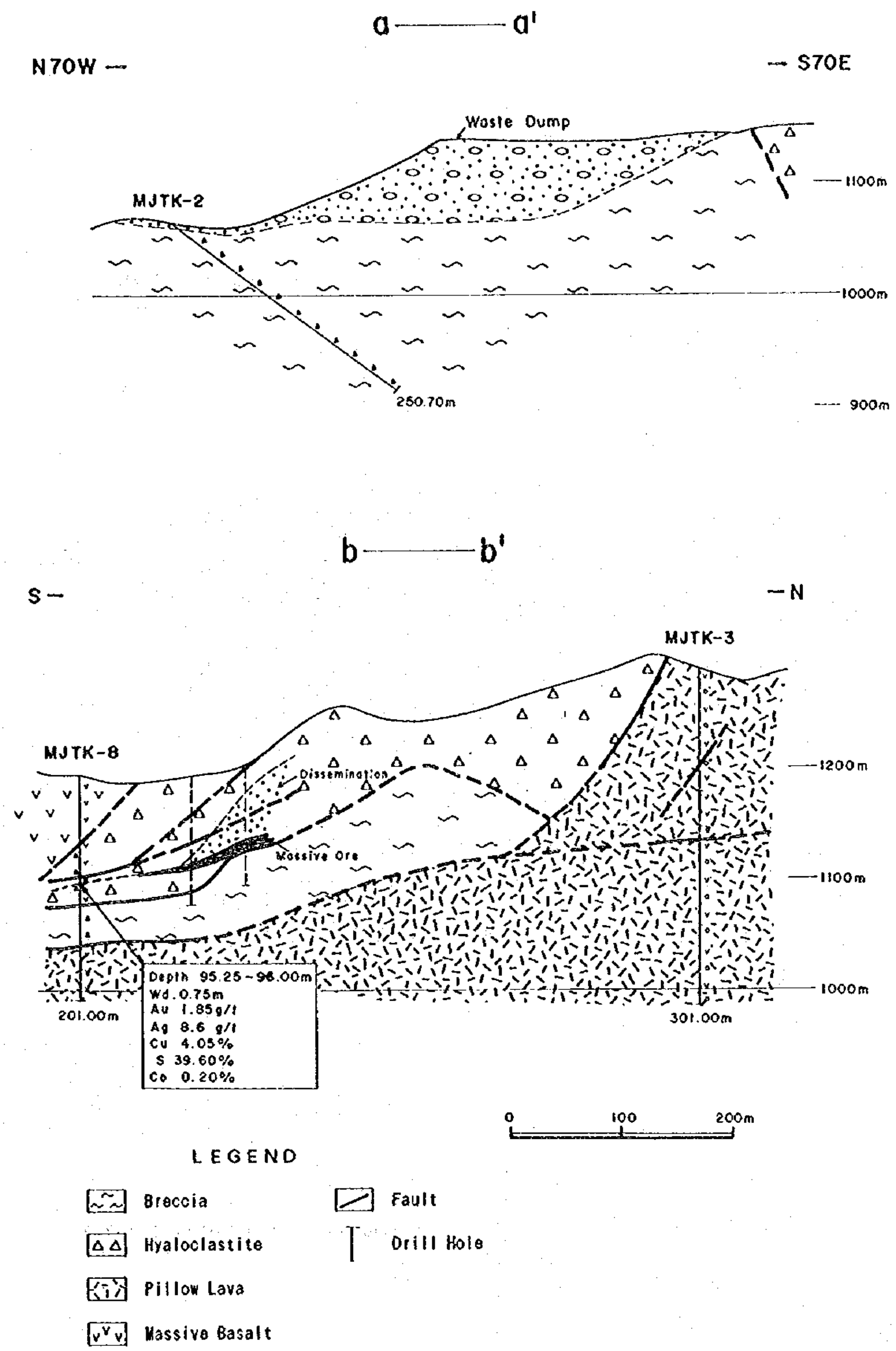


Fig. 2-3 Geologic Cross Section along the Drill Holes (1/2)

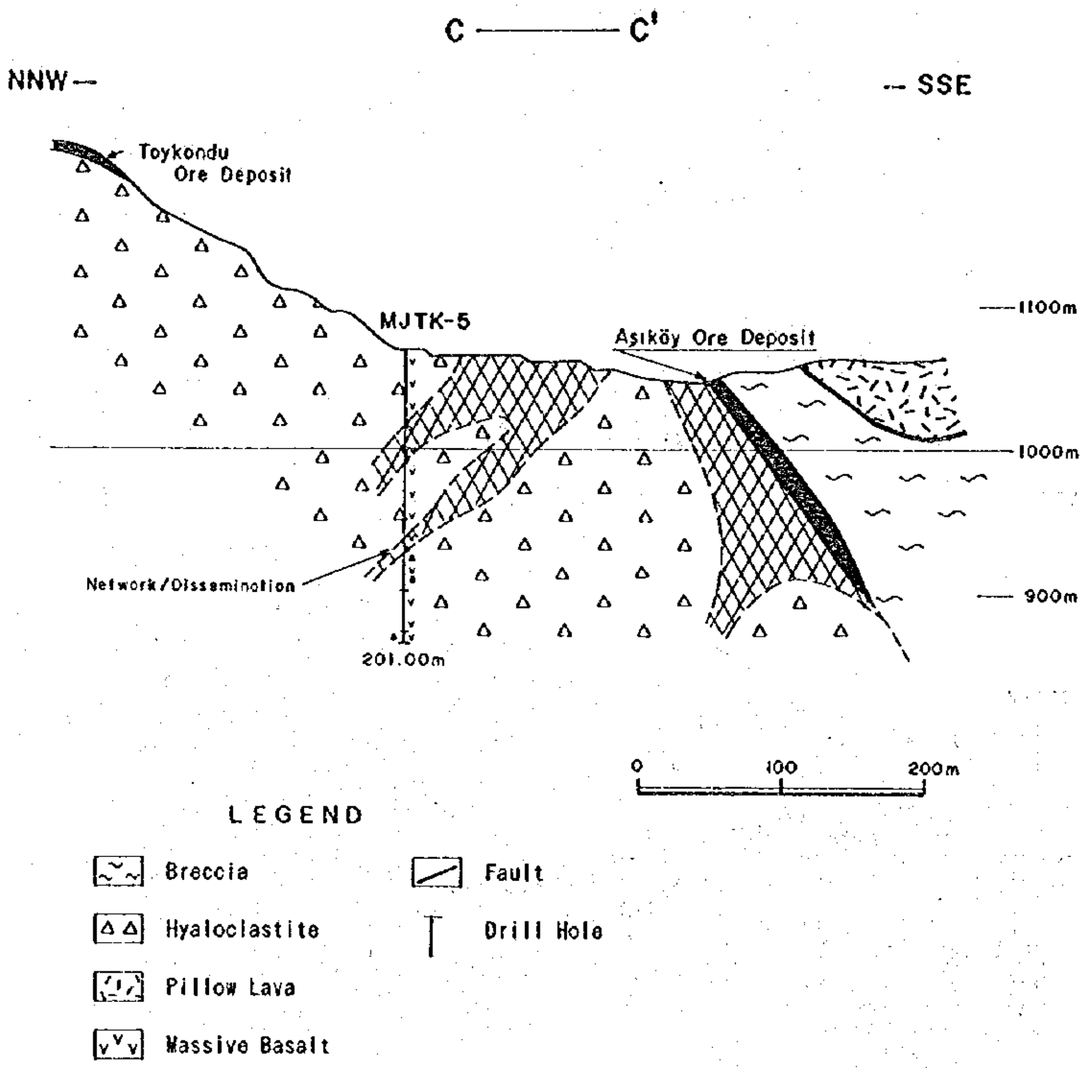


Fig. 2-3 Geologic Cross Section along the Drill Holes (2/2)

Table 2-1 Coordinates of Drill Holes and Hole Length

Hole No.	Locality	Coordinates		Elevation	Azimuth	Incli-nation	Drilled Length
MJTK-2	South of Aşiköy	30,342N	57,598E	1,065m	110°	-36°	250.70m
MJTK-3	North of Bakibaba	31,070N	58,330E	1,287m	-	-90°	301.00m
MJTK-5	North of Aşiköy	30,996N	57,435E	1,067m	-	-90°	201.00m
MJTK-8	South of Bakibaba	30,512N	58,315E	1,191m	-	-90°	201.00m

2-2 Geology and Mineralization

2-2-1 Geology

The geology of the survey zone consists of pre-Jurassic ultramafic rocks, basalt and sedimentary rocks of the Jurassic Küre Formation, intrusive diorite and dacite.

Basalt of the Küre Formation that occupies the major part of the zone is composed of pillow lava, hyaloclastite and massive basalt.

Sedimentary facies of the Küre Formation is composed of angularly fragmented graywacke and sheared/argillized black shale.

The geologic structure of this zone is characterized by many faults. They are divided into two systems; N-S and E-W. With the exception of the diorite and dacite intrusive bodies, the boundary of all geologic units, including the ultramafic bodies, have been displaced. The surface elongation of the intrusive bodies is harmonious with the strike of faults in the vicinity and with the boundary between sediments and basalt of the Küre Formation. All basalt bodies are all regarded to be footwall or that hosting ore deposits and sediments are believed to be hanging wall rocks.

2-2-2 Mineralization

Aşiköy, Toykondu, Bakibaba and Kizilsu are the known ore deposits in this zone. These deposits occur at the boundary between hyaloclastite and black shale of the Küre Formation. They also occur within the hyaloclastite. They consist of massive, brecciated, network and disseminated ores. They contain a large amount of pyrite with a small amount of chalcopyrite and a minor amount of sphalerite. The geologic environment, mode of occurrence, and mineral composition of these orebodies show a common feature which is characteristic to the Cyprus-type ore deposits.

Low resistivity zones extending from the Aşiköy orebodies southeastward were obtained by CSAMT survey in the first phase. The other low resistivity zones with an elongation of NW-SE to the Zemberekler mineralized zone at the east of the Bakibaba Deposit and the other similar zones at the north and south of the Bakibaba orebody were detected.

The measurement of physical properties of the rock samples in the first year revealed that the resistivity decreased in the order of serpentine, basalt, sandstone, black shale and that massive ores had very low values compared to other rocks. The electric logging of the boreholes in the second year showed that pelitic rocks have low resistivity in the same order as the ores and thus the difficulty of differentiating the two by resistivity values was pointed out.

Geologically promisings as well as low resistivity zones were extracted and drilled during the present third year.

2-3 Drilling Method, Equipment and Progress

2-3-1 Drilling Method and Equipment

(1) Method

For surface and shallow parts, drilling was done by HQ wireline (98 mm in diameter), then reamed by HW casing shoe (114 mm in diameter) and inserting HW casing pipes were inserted.

For the bedrock zone, wireline method was adopted with HQ, NQ and BQ oversized diamond bits (79 mm and 62 mm in diameter respectively) and its core tubes.

Bentonite mud was usually mixed in the circulating drill water. The drilling water was often lost because of the fractures developed. For preventing circulation loss, TELSTOP (squeezed refuse of cottonseed) were injected. Cementing was done when TELSTOP was not sufficient. The density of mud water was kept high to prevent the collapse of wall.

(2) Equipment

The drilling machines were L-44 and L-38 of Longyear. Specifications of drilling machine and equipment are shown in Table 2-2. Diamond bits and expendable items used during the drilling are listed in Tables 2-3 and 2-4 respectively.

Table 2-2 Specifications of Drilling Machine and Equipment

Drilling Machine Model "L-44"	1 set
Specifications:	
Capacity	975m(BW), 1,035m(BQ)
Dimension L x W x H	2,743mm x 1,448mm x 2,057mm
Hoisting capacity	7,659kg
Spindle speed	Forward 210, 436, 800, 1,350rpm
Engine model "Deutz F5L-912"	81hp / 2,200rpm
Drilling Machine Model "L-38"	1 set
Specifications:	
Capacity	700m(BW), 775m(BQ)
Dimension L x W x H	2,440mm x 1,070mm x 1,450mm
Hoisting capacity	kg
Spindle speed	Forward 236, 490, 900, 1,510rpm
Engine model "Deutz 4FL"	60hp / 2,200rpm
Drilling Pump Model "WL-MG-15h"	1 set
Specifications:	
Piston diameter	68mm
Stroke	75mm
Capacity	discharge capacity 130 liter/min
Dimension L x W x H	2,240mm x 840mm x 1,140mm
Engine "Yanmar NFD150"	15hp / 2,400rpm
Drilling Pump Model "NP-200"	1 set
Specifications:	
Piston diameter	73mm
Stroke	75mm
Capacity	discharge capacity 110 liter/min
Dimension L x W x H	2,400mm x 560mm x 1,245mm
Engine "Isuzu SKR1"	36hp / 3,600rpm
Generator	2 set
Specifications:	
Capacity	2.7kw 50hz 220v
Derrick for L-44	
Specifications:	
Height	17m
Max load capacity	20,000kg
Derrick for L-38	
Specifications:	
Height	6.1m
Max load capacity	17,000kg
Drilling tools	
Drilling rod HQ-WL 3.05m	40 pcs
NQ-WL 3.05m	120 pcs
BQ-WL 3.05m	200 pcs
Casing pipe HW 1.0m	18 pcs
NX-NU 1.5m	10 pcs
NX-NU 3.0m	40 pcs
BX-NU 1.5m	60 pcs
BX-NU 3.0m	92 pcs

Table 2-3 Drilling Meterage and Diamond Bit Consumption

Item	Size	Bit No.	Drilling Meterage MJTK-2	MJTK-3	MJTK-5	MJTK-8	Total (m)
Diamond Bit	HQ	3245755-6		4.00		10.55	14.55
		3245755-7	52.00				52.00
		Total	52.00	4.00	0.00	10.55	66.55
		Drilling Length/Bit 33.3m					
	NQ	NNT-1		41.65			41.65
		NNT-2		58.55			58.55
		NNT-3		27.70			27.70
		NNT-4	37.10				37.10
		NNT-5	43.00				43.00
		NNT-6	17.90				17.90
		NNT-7			47.90		47.90
		NNT-8			45.00		45.00
		131088				45.45	45.45
		131089				39.25	39.25
		Total	98.00	127.90	92.90	45.45	364.25
		Drilling Length/Bit 36.4m					
	BQ	NBT-1		42.15			42.15
		NBT-2		59.50			59.50
		NBT-3		37.75			37.75
		NBT-4		29.70			29.70
		NBT-5	32.45				32.45
		13444	29.85				29.85
		13445	38.40				38.40
		13446			34.85		34.85
		13447			37.15		37.15
		13448			33.00		33.00
		13449				31.25	31.25
		13450				38.65	38.65
		13451				35.85	35.85
		Total	100.70	169.10	105.00	105.75	480.55
		Drilling Length/Bit 37.0m					

Table 2-4 Consumption of Expendable Items

Description	Specifi-cations	Unit	Quantity				
			MJTK-2	MJTK-3	MJTK-5	MJTK-8	Total
Light oil		liter	3,500	3,200	2,500	2,400	11,600
Hydraulic oil		liter	123	26	16	51	216
Engine oil		liter	96	45	48	234	423
Gear oil		liter	23	14	11	12	60
Greas		kg	35	16	18	32	101
Bentonite		kg	24,950	14,150	2,350	6,300	47,750
C.M.C.		kg	210	130	50	61	451
Tel-stop		kg	150	114		30	294
Seaclay		kg	30	25		20	75
Libonite		kg	125	353	70	57	605
Cleanlub		kg	26	12	14	24	76
Mud oil		liter	54	12	10	32	108
Cement		kg	200	150	75	625	1,050
Diamond bit	HQ-WL	pc	1	1			2
Diamond bit	NQ-WL	pc	8	2	2	2	14
Diamond bit	BQ-WL	pc	9	5	3	3	20
Diamond shoe	HW	pc			1		1
Metal shoe	HW	pc	4			2	6
Metal shoe	NW	pc	6	1	1	5	13
Metal shoe	BW	pc	2	1	1	1	5
Diamond reamer	HQ-WL	pc	1	1			2
Diamond reamer	NQ-WL	pc	1	1	1	1	4
Diamond reamer	BQ-WL	pc	1	1	1	1	4
Core barrel Ass'y	HQ-WL	set	1	1			2
Core barrel Ass'y	NQ-WL	set	1	1			2
Core barrel Ass'y	BQ-WL	set	1	1			2
Inner tube Ass'y	NQ-WL	set	1	1			2
Inner tube Ass'y	BQ-WL	set	1	1			2
Inner tube	HQ-WL	pc	1	1			2
Inner tube	NQ-WL	pc	1	1			2
Inner tube	BQ-WL	pc	1	1			2
Core lifter case	HQ-WL	pc	3	1		2	6
Core lifter case	NQ-WL	pc	4	3	3	3	13
Core lifter case	BQ-WL	pc	3	3	4	3	13
Core lifter	HQ-WL	pc	3	1		1	5
Core lifter	NQ-WL	pc	4	3	3	3	13
Core lifter	BQ-WL	pc	3	3	4	3	13
Stop ring	HQ-WL	pc	3	1		1	5
Stop ring	NQ-WL	pc	4	3	3	3	13
Stop ring	BQ-WL	pc	3	3	4	3	13
Thrust ball bearing	NQ-WL	pc	2	2	2	2	8
Thrust ball bearing	BQ-WL	pc	2	2	2	2	8
Hanger bearing	HQ-WL	pc	1	1		1	3
Hanger bearing	NQ-WL	pc	2	2	2	2	8
Hanger bearing	BQ-WL	pc	2	2	2	2	8
Chuck piece	HQ-WL	pc	1	1			2
Chuck piece	NQ-WL	pc	1	1			2
Chuck piece	BQ-WL	pc	1	1			2
Hoisting wire rope	16mm	meter	30	50			80
Wireline rope	6mm	meter	300	400			700
Waste		kg	40	50	30	40	160
Core box	HQ-WL	box	15	1	1	3	20
Core box	NQ-WL	box	22	24	19	15	80
Core box	BQ-WL	box	35	25	16	18	94

(3) Working System

Drilling operation was carried out by three shifts per day (8 hours per shift), while the appurtenant works, such as road construction, rig construction, mobilization and demobilization, were done by one shift per day. A shift crew consists of one drilling engineer and three workers normally. Additional one worker was involved in case of pumping water. A base camp for drilling operation was set in Küre mine. The commuting between the base camp and the drilling site was by car.

(4) Transportation

L-44 and a part of the equipment were provided by ETiBANK at Küre mine. L-38 and a part of the equipment were rented from MTA. Other equipment, all diamond bits and a part of the drilling mud were shipped by surface freight. After landing at Istanbul they were transported to Küre mine by trucks.

(5) Drilling Water

Water for drilling was taken directly from a spring in the open pit of the Küre mine and transported by a tank lorry to the drilling site or to a tank nearby and then pumped to the site. Also when possible it was hosed to the site from the mine water supply.

(6) Withdrawal

After the completion of drilling programme, the machine and equipment of ETiBANK, and drilling cores were stored in a drilling warehouse in the Küre mine. The drilling machine and equipment of MTA were returned to MTA Ankara. The equipment sent from Japan were shipped by surface freight.

2-3-2 Progress of Drilling

The progress of each drill hole is described below. Summary of working time, records of drilling operation, records of drilling performance and charts of drilling progress are shown in Tables 2-5 to 2-13 and Figures 2-4 to 2-7 respectively.

(1) MJTK-2

Drilling machine Longyear L-38 was employed for this hole.

Surface basalt and weathered materials were drilled by HQ-WL diamond bit with bentonite to 19.2 m, reamed to that depth by HW casing bit, and then HW casing pipes were inserted. HQ-WL diamond bit was used to 60.0 m and NX casing pipes were inserted. To 60.0 m, collapse and loss of circulation occurred intermittently, and repeated cleaning and high mud density, and TELSTOP prevented serious disturbances.

Table 2-5 Summary of Working Time

Hole No.	Bit Size	Drilling		Shift		Men Working		Working Time							
		Drilling Length	Core Length	Drilling	Total	Engineer	Worker	Drilling	Other Works	Recovering	Total	Assemblage	Dismantlement	Transportation	Grand Total
		m	m	shift	shift	men	men	hours	hours	hours	hours	hours	hours	hours	hours
MJTK-2	HQ	52.00	39.60	20	24	24	72	94	63	35	192	64	56		312
	NQ	98.00	85.45	40	42	42	126	215	121		336				336
	BQ	100.70	98.05	37	44	45	135	188	164		352				352
	Total	250.70	223.10	97	110	111	333	497	348	35	880	64	56		1000
MJTK-3	HQ	4.00	1.30	1	1	1	4	7	1		8	67	32		107
	NQ	127.90	123.80	41	41	41	136	262	66		328				328
	BQ	169.10	159.75	48	60	60	200	268	156	72	496				496
	Total	301.00	284.85	90	102	102	340	537	223	72	832	67	32		931
MJTK-5	HW	1.10	1.10	1	1	1	3	3	5		8	48	48		104
	NX	2.00	2.00												
	NQ	92.90	92.90	22	33	39	117	127	44	93	264				264
	BQ	105.00	104.10	24	26	26	78	136	72		208				208
	Total	201.00	200.10	47	60	66	198	266	121	93	480	48	48		576
MJTK-8	HQ	10.55	7.65	6	6	6	18	24	24		48	80	40		168
	NQ	84.70	77.60	33	37	37	132	153	108	27	288				288
	BQ	105.75	104.55	25	36	36	140	140	64	84	288				288
	Total	201.00	189.90	64	79	79	290	317	196	111	624	80	40		744

Table 2-6 Record of Drilling Operation (MJTK-2)

	Drilling Length			Total		Shift		Working Man	
	Shift 1 (m)	Shift 2 (m)	Shift 3 (m)	Drilling (m)	Core Length (m)	Drilling (shift)	Total (shift)	Enginner (man)	Worker (man)
Oct/13	Preparation						1	3	9
Oct/14	ditto						1	3	9
Oct/15	ditto						1	3	9
Oct/16	ditto						1	3	9
Oct/17	Assemblage						1	3	9
Oct/18	ditto						1	3	9
Oct/19	ditto						1	3	9
Oct/20	ditto						1	3	9
Oct/21	ditto						1	3	9
Oct/22	ditto						1	3	9
Oct/23	ditto						1	3	9
Oct/24	2.00	3.50	1.30	6.80	2.20	3	3	3	9
Oct/25	3.15	3.75	2.90	9.80	4.90	3	3	3	9
Oct/26	Repairing	Repairing	Repairing				3	3	9
Oct/27	Repairing	2.70	3.60	6.30	4.55	2	3	3	9
Oct/28	0.90	2.40	1.20	4.50	4.50	3	3	3	9
Oct/29	0.95	3.05	1.85	5.85	5.80	3	3	3	9
Oct/30	3.35	1.60	4.90	9.85	9.45	3	3	3	9
Oct/31	3.40	1.65	3.85	8.90	8.20	3	3	3	9
Nov/ 1	CP ins	3.00	5.00	8.00	6.35	2	3	3	9
Nov/ 2	2.30	3.15	CP ext	5.45	3.99	2	3	3	9
Nov/ 3	1.55	2.10	2.20	5.85	4.65	3	3	3	9
Nov/ 4	2.05	1.85	2.60	6.50	5.20	3	3	3	9
Nov/ 5	2.25	2.75	2.75	7.75	6.85	3	3	3	9
Nov/ 6	2.45	1.10	2.55	6.10	4.55	3	3	3	9
Nov/ 7	2.95	3.40	2.75	9.10	9.10	3	3	3	9
Nov/ 8	1.50	2.50	1.45	5.45	5.45	3	3	3	9
Nov/ 9	2.55	1.40	3.35	7.30	6.25	3	3	3	9
Nov/10	2.75	2.60	1.80	7.15	4.45	3	3	3	9
Nov/11	2.45	1.30	3.00	6.75	6.60	3	3	3	9
Nov/12	3.05	1.65	3.20	7.90	7.90	3	3	3	9
Nov/13	1.90	2.65	2.90	7.45	6.95	3	3	3	9
Nov/14	2.40	2.55	2.30	7.25	7.25	3	3	3	9
Nov/15	CP ins	CP ins	CP ins				3	3	9
Nov/16	0.70	1.20	1.30	3.20	2.60	3	3	3	9
Nov/17	2.75	2.75	2.45	7.95	7.70	3	3	3	9
Nov/18	3.05	2.35	2.00	7.40	6.85	3	3	3	9
Nov/19	4.05	3.30	3.25	10.60	10.60	3	3	3	9
Nov/20	3.30	2.30	3.10	8.70	8.70	3	3	3	9
Nov/21	3.00	2.60	1.45	7.05	6.05	3	3	3	9
Nov/22	2.95	2.55	3.05	8.55	8.55	3	3	3	9
Nov/23	3.30	2.50	3.05	8.85	8.85	3	3	3	9
Nov/24	0.55	2.20	3.35	6.10	6.10	3	3	3	9
Nov/25	3.90	3.70	4.05	11.65	11.65	3	3	3	9
Nov/26	4.05	3.00	2.25	9.30	9.05	3	3	3	9
Nov/27	1.80	2.95	3.25	8.00	8.00	3	3	3	9
Nov/28	3.35	Extract	Extract	3.35	3.35	1	3	3	9
Nov/29	Extract	Extract					2	3	9
Nov/30	Dismantle						1	3	9
Dec/ 1	ditto						1	3	9
Dec/ 2	ditto						1	3	9
Dec/ 3									
Dec/ 4									
Dec/ 5	Snow-rem						1	3	9
Dec/ 6	Snow-rem						1	3	9
Dec/ 7	Dismantle						1	3	9
Dec/ 8	ditto						1	3	9
Total				250.70	223.10	97	125	156	468

Repairing: Repairing of machine
CP ins : Casing pipes inserting
CP ext : Casing pipes extending

Extract : Extraction of casing pipes
Dismantle: Dismantlement
Snow-rem : Remove the snow

Table 2-7 Record of Drilling Operation (MJTK-3)

	Drilling Length			Total		Shift		Working Man	
	Shift 1 (m)	Shift 2 (m)	Shift 3 (m)	Drilling (m)	Core Length (m)	Drilling (shift)	Total (shift)	Enginner (man)	Worker (man)
Oct/ 3	Preparation						1	3	19
Oct/ 4	ditto						1	3	19
Oct/ 5	ditto						1	3	19
Oct/ 6	ditto						1	3	19
Oct/ 7	Assemblage						1	3	19
Oct/ 8	ditto						1	3	19
Oct/ 9	ditto						1	3	9
Oct/10	ditto						1	3	9
Oct/11	ditto						1	3	9
Oct/12	ditto						1	3	9
Oct/13	ditto						1	3	9
Oct/14	ditto						1	3	9
Oct/15	ditto						1	3	9
Oct/16	3.40	1.80	4.60	9.80	7.00	3	3	3	10
Oct/17	3.85	1.30	2.55	7.70	7.30	3	3	3	10
Oct/18	2.20	4.90	1.95	9.05	9.05	3	3	3	10
Oct/19	4.85	3.10	3.10	11.05	11.05	3	3	3	10
Oct/20	3.10	3.05	1.90	8.05	8.05	3	3	3	10
Oct/21	3.25	3.65	2.45	9.35	9.35	3	3	3	10
Oct/22	2.35	3.15	3.55	9.05	9.05	3	3	3	10
Oct/23	1.50	3.15	4.60	9.25	9.25	3	3	3	10
Oct/24	4.10	2.00	3.55	9.65	9.65	3	3	3	10
Oct/25	3.85	2.95	3.80	10.60	8.45	3	3	3	10
Oct/26	4.35	4.00	2.30	10.65	10.65	3	3	3	10
Oct/27	3.15	3.35	3.05	9.55	9.30	3	3	3	10
Oct/28	3.40	3.00	3.70	10.10	10.10	3	3	3	10
Oct/29	2.70	2.75	2.60	8.05	6.85	3	3	3	10
Oct/30	CP ins	3.95	4.00	7.95	7.40	3	3	3	10
Oct/31	3.40	Prevent	3.50	6.90	5.90	3	3	3	10
Nov/ 1	3.85	CP ext	3.05	6.90	2.25	3	3	3	10
Nov/ 2	1.20	1.65	4.55	7.40	4.25	3	3	3	10
Nov/ 3	4.75	3.50	5.10	13.35	13.35	3	3	3	10
Nov/ 4	3.40	3.55	3.05	10.00	10.00	3	3	3	10
Nov/ 5	3.30	2.50	Cement	5.80	5.80	3	3	3	10
Nov/ 6	Cement	Cement	Cement			3	3	3	10
Nov/ 7	Snow-rem	Snow-rem	Snow-rem			3	3	3	10
Nov/ 8	Drillout	Drillout	2.70	2.70	2.70	3	3	3	10
Nov/ 9	2.90	3.95	2.90	9.75	9.75	3	3	3	10
Nov/10	3.45	4.75	3.25	11.45	11.45	3	3	3	10
Nov/11	3.85	2.15	3.10	9.10	9.10	3	3	3	10
Nov/12	3.40	2.95	4.00	10.35	10.35	3	3	3	10
Nov/13	4.95	3.10	2.60	10.65	10.65	3	3	3	10
Nov/14	4.25	3.05	6.10	13.40	13.40	3	3	3	10
Nov/15	3.00	3.15	3.15	9.30	9.30	3	3	3	10
Nov/16	4.40	3.00	4.55	11.95	11.95	3	3	3	10
Nov/17	4.45	3.05	3.90	11.40	11.40	3	3	3	10
Nov/18	2.25	4.85	3.65	10.75	10.75	3	3	3	10
Nov/19	Extract	Extract					2	3	10
Nov/20	Dismantle						1	3	10
Nov/21	ditto						1	3	10
Nov/22	ditto						1	3	10
Nov/23	ditto						1	3	10
Total				301.00	284.85	102	108	117	390

CP ins : Casing pipes inserting
Prevent : Prevention of water loss
CP ext : Casing pipes extending
Cement : Cementing of hole

Snow-rem : Remove the snow
Extract : Extraction of casing pipes
Dismantle: Dismantlement

Table 2-8 Record of Drilling Operation (MJTK-5)

	Drilling Length			Total		Shift		Working Man	
	Shift 1 (m)	Shift 2 (m)	Shift 3 (m)	Drilling (m)	Core Length (m)	Drilling (shift)	Total (shift)	Enginner (man)	Worker (man)
Nov/24	Assemblage						1	3	10
Nov/25	ditto						1	3	10
Nov/26	ditto						1	3	10
Nov/27	ditto						1	3	10
Nov/28	ditto						1	3	10
Nov/29	ditto						1	3	10
Nov/30	2.00	3.60	3.15	8.75	8.75	3	3	3	9
Dec/ 1	3.55	4.05	3.50	11.10	11.10	3	3	3	9
Dec/ 2	4.65	4.00	4.65	13.30	13.30	3	3	3	9
Dec/ 3	3.45	0.70	Snow	4.15	4.15	2	3	6	18
Dec/ 4	Snow	Snow	Snow				3	6	18
Dec/ 5	Snow	Snow	Snow				3	3	9
Dec/ 6	Snow	Snow	Snow				3	3	9
Dec/ 7	Snow	5.40	5.20	10.60	10.60	2	3	3	9
Dec/ 8	4.95	4.50	5.05	14.50	14.50	3	3	3	9
Dec/ 9	3.90	4.65	3.35	11.90	11.90	3	3	3	9
Dec/10	5.60	5.85	5.10	16.55	16.55	3	3	3	9
Dec/11	5.15	4.25	4.25	13.65	13.65	3	3	3	9
Dec/12	4.10	1.70	CP ext	5.80	4.90	3	3	3	9
Dec/13	3.95	5.60	3.45	13.00	13.00	3	3	3	9
Dec/14	3.95	3.60	6.00	13.55	13.55	3	3	3	9
Dec/15	5.40	5.45	5.50	16.35	16.35	3	3	3	9
Dec/16	5.60	4.25	3.05	12.90	12.90	3	3	3	9
Dec/17	1.90	5.35	6.20	13.45	13.45	3	3	3	9
Dec/18	5.60	3.45	4.75	13.80	13.80	3	3	3	9
Dec/19	3.80	3.85	Extract	7.65	7.65	2	3	3	9
Dec/20	Dismantle						1	3	9
Dec/21	ditto						1	3	9
Dec/22	ditto						1	3	9
Dec/23	ditto						1	3	9
Dec/24	ditto						1	3	9
Dec/25	ditto						1	3	9
Total				201.00	200.10	48	72	102	312

Snow : Heavy snow fall

CP ext : Casing pipes extending

Extract : Extraction of casing pipes

Dismantle: Dismantlement

Table 2-9 Record of Drilling Operation (MJTK-8)

	Drilling Length			Total		Shift		Working Man	
	Shift 1 (m)	Shift 2 (m)	Shift 3 (m)	Drilling (m)	Core Length (m)	Drilling (shift)	Total (shift)	Enginner (man)	Worker (man)
Dec/ 9	Assemblage						1	3	9
Dec/10	ditto						1	3	9
Dec/11	ditto						1	3	9
Dec/12	ditto						1	3	9
Dec/13	ditto						1	3	9
Dec/14	ditto						1	3	9
Dec/15	ditto						1	3	9
Dec/16	ditto						1	3	9
Dec/17	ditto						1	3	9
Dec/18	ditto						1	3	9
Dec/19	2.50	3.30	0.40	6.20	4.50	3	3	3	9
Dec/20	2.80	1.15	0.95	4.90	3.70	3	3	3	9
Dec/21	Repairing	1.80	1.65	3.45	3.45	2	3	3	9
Dec/22	2.55	2.30	2.55	7.40	5.45	3	3	3	9
Dec/23	1.00	2.85	0.35	4.20	1.75	3	3	3	9
Dec/24	Repairing	3.05	2.20	5.25	4.30	2	3	3	9
Dec/25	CP ext	2.10	1.65	3.75	3.55	3	3	3	9
Dec/26	0.65	CP ext	0.70	1.35	1.35	3	3	3	12
Dec/27	2.55	3.25	1.70	7.50	7.50	3	3	3	12
Dec/28	3.65	2.70	3.05	9.40	8.00	3	3	3	12
Dec/29	2.60	2.15	3.15	7.90	7.75	3	3	3	12
Dec/30	3.85	4.85	4.05	12.75	12.75	3	3	3	12
[illegible]	4.60	4.55	4.35	13.50	13.50	3	3	3	12
Jan/ 1	3.75	3.55	0.40	7.70	7.70	3	3	3	12
Jan/ 2	Repairing	Repairing	Repairing				3	3	12
Jan/ 3	Repairing	Repairing	Repairing				3	3	12
Jan/ 4	Repairing	Repairing	Repairing				3	3	12
Jan/ 5	Repairing	0.85	4.10	4.95	4.30	2	3	3	12
Jan/ 6	4.65	4.10	4.65	13.40	12.85	3	3	3	12
Jan/ 7	4.90	3.10	4.90	12.90	12.90	3	3	3	12
Jan/ 8	2.65	4.80	3.25	10.70	10.70	3	3	3	12
Jan/ 9	5.00	4.40	5.20	14.60	14.60	3	3	3	12
Jan/10	3.40	3.80	6.15	13.35	13.35	3	3	3	12
Jan/11	3.15	5.55	4.55	13.25	13.25	3	3	3	12
Jan/12	3.75	6.25	5.50	15.50	15.50	3	3	3	12
Jan/13	4.05	3.05	Extract	7.10	7.10	2	3	3	12
Jan/14	Dismantle						1	3	12
Jan/15	Dismantle						1	3	12
Jan/16	Dismantle						1	3	12
Jan/17	Dismantle						1	3	12
Jan/18	Dismantle						1	3	12
Total				201.00	189.8	65	93	123	441

Repairing:Repairing of machine
CP ext : Casing pipes extending
Extract : Extraction of casing pipes
Dismantle: Dismantlement

Table 2-10 Record of Drilling Performance (MJTK-2)

	Survey period: Period	Survey period: Days	Survey period: Work day	Survey period: Off day	Total man day: Engineer	Total man day: Worker
Operation			days	days	men	men
Preparation	15.10.1994 - 23.10.1994	9	8	1	24	72
Drilling	24.10.1994 - 29.11.1994	37	Drilling 36		107	321
			Recovering 1		4	12
Removing	30.11.1994 - 8.12.1994	9	7	2	21	63
Total						

Drilling Length			
Length planned	250.00 m	Overburden	13.70m
Increase or Decrease in length		Core length	223.10m
Length drilled	250.70 m	Core recovery	89.0%

Core recovery of 100m hole

Depth of hole (m)	Core recovery (%)	Core recovery cumulated (%)
0.00 - 100.00	79.6	79.6
100.00 - 200.00	93.1	86.4
200.00 - 250.70	99.5	89.0

Working hours	h	%	%
Drilling	497	56.5	49.7
Other working	348	39.5	34.8
Recovering	35	4.0	3.5
Total	880	100.0	88.0
Assemblage	64		6.4
Dismantlement	56		5.6
Water transportation			
Road construction and transportation			
Grand total	1,000		100.0

Efficiency of drilling

Total m / work period (m/day)	250.70m/37days (6.78 m / day)
Total m / work shift (m/shift)	250.70m/110shifts (2.28 m / shift)

Drilling length/bit (each sized bit)

Bit size	HQ	NQ	BQ
Drilled length	52.00	98.00	100.70
Core length	39.60	85.45	98.05

Casing pipe inserted

Size	Meterage (m)	Meterage drilling length X 100 (%)	Recovery (%)
HW	19.2	7.7	100.0
NX	60.0	23.9	100.0
BX	150.0	59.8	100.0

Table 2-11 Record of Drilling Performance (MJTK-3)

	Survey period				Total man day	
	Period	Days	Work day	Off day	Engineer	Worker
Operation			days	days	men	men
Preparation	05.10.1994 - 15.10.1994	10	8	2	24	125
Drilling	16.10.1994 - 19.11.1994	35	Drilling 32		96	320
			Recovering 3		9	30
Removing	20.11.1994 - 23.11.1994	4	4		12	120
Total		49	47	2	141	595

Drilling Length			
Length planned	300.00 m	Overburden	3.00m
Increase or Decrease in length		Core length	284.85m
Length drilled	301.00 m	Core recovery	94.6%

Core recovery of 100m hole		
Depth of hole (m)	Core recovery (%)	Core recovery cumulated (%)
0.00 - 100.00	94.7	94.7
100.00 - 200.00	89.0	91.9
200.00 - 301.00	100.0	94.6

Working hours	h	%	%
Drilling	537	64.5	57.7
Other working	223	26.8	24.0
Recovering	72	8.7	7.7
Total	832	100.0	89.4
Assemblage	67		7.2
Dismantlement	32		3.4
Water transportation			
Road construction and transportation			
Grand total	931		100.0

Efficiency of drilling	
Total m / work period (m/day)	301.00m/35days (8.60 m / day)
Total m / work shift (m/shift)	301.00m/104shifts (2.89 m / shift)

Drilling length/bit (each sized bit)			
Bit size	HQ	NQ	BQ
Drilled length	4.00	127.90	169.10
Core length	1.30	123.80	159.75

Casing pipe inserted			
Size	Meterage (m)	Meterage drilling length X 100 (%)	Recovery (%)
HW			
NX	15.0	5.0	100.0
BX	154.4	51.3	100.0

Table 2-12 Record of Drilling Performance (MJTK-5)

	Survey period				Total man day	
	Period	Days	Work day	Off day	Engineer	Worker
Operation			days	days	men	men
Preparation	24.11.1994 - 29.11.1994	6	8		18	60
Drilling	30.11.1994 - 19.12.1994	20	Drilling 17		51	153
			Recovering 3		15	45
Removing	20.12.1994 - 25.12.1994	6	6		18	54
Total		32	32		102	313

Drilling Length			
Length planned	200.00 m	Overburden	m
Increase or Decrease in length		Core length	200.10m
Length drilled	201.00 m	Core recovery	99.6%

Core recovery of 100m hole		
Depth of hole (m)	Core recovery (%)	Core recovery cumulated (%)
0.00 - 100.00	100.0	100.0
100.00 - 201.00	99.1	99.6

Working hours	h	%	%
Drilling	266	55.4	46.2
Other working	121	25.2	21.0
Recovering	93	19.4	16.1
Total	832	100.0	83.3
Assemblage	48		8.3
Dismantlement	48		8.3
Water transportation			
Road construction and transportation			
Grand total	931		100.0

Efficiency of drilling	
Total m / work period (m/day)	201.00m/20days (10.05 m / day)
Total m / work shift (m/shift)	201.00m/60shifts (3.35 m / shift)

Drilling length/bit (each sized bit)				
Bit size	HW	NX	NQ	BQ
Drilled length	1.1	2.0	92.9	105.0
Core length	1.1	2.0	92.9	104.1

Casing pipe inserted			
Size	Meterage (m)	Meterage drilling X 100 length (%)	Recovery (%)
HW	1.1	0.5	
NX	3.1	1.5	100.0
BX	111.0	55.2	100.0

Table 2-13 Record of Drilling Performance (MJTK-8)

	Survey period				Total man day	
	Period	Days	Work day	Off day	Engineer	Worker
Operation			days	days	men	men
Preparation	9.12.1994 - 18.12.1994	10	10		30	90
Drilling	19.12.1994 - 13. 1.1995	26	Drilling 23		66	251
			Recovering 3		12	42
Removing	14. 1.1995 - 18. 1.1995	5	5		15	60
Total		41	41		123	443

Drilling Length			
Length planned	201.00 m	Overburden	4.50m
Increase or Decrease in length		Core length	189.80m
Length drilled	201.0 m	Core recovery	94.4%

Core recovery of 100m hole		
Depth of hole (m)	Core recovery (%)	Core recovery cumulated (%)
0.00 - 100.00	89.4	89.4
100.00 - 201.00	99.5	94.4

Working hours	h	%	%
Drilling	317	50.8	42.6
Other working	196	31.4	26.3
Recovering	111	17.8	14.9
Total	624	100.0	83.8
Assemblage	80		10.8
Dismantlement	40		5.4
Water transportation			
Road construction and transportation			
Grand total	744		100.0

Efficiency of drilling	
Total m / work period (m/day)	201.00m/26days (7.73 m / day)
Total m / work shift (m/shift)	201.00m/ 78shifts (2.58 m / shift)

Drilling length/bit (each sized bit)			
Bit size	HQ	NQ	BQ
Drilled length	10.55	84.70	105.75
Core length	7.65	77.60	104.55

Casing pipe inserted			
Size	Meterage (m)	Meterage drilling length X 100 (%)	Recovery (%)
HW	9.1	4.5	100.0
NX	36.0	17.9	100.0
BX	96.0	47.8	100.0

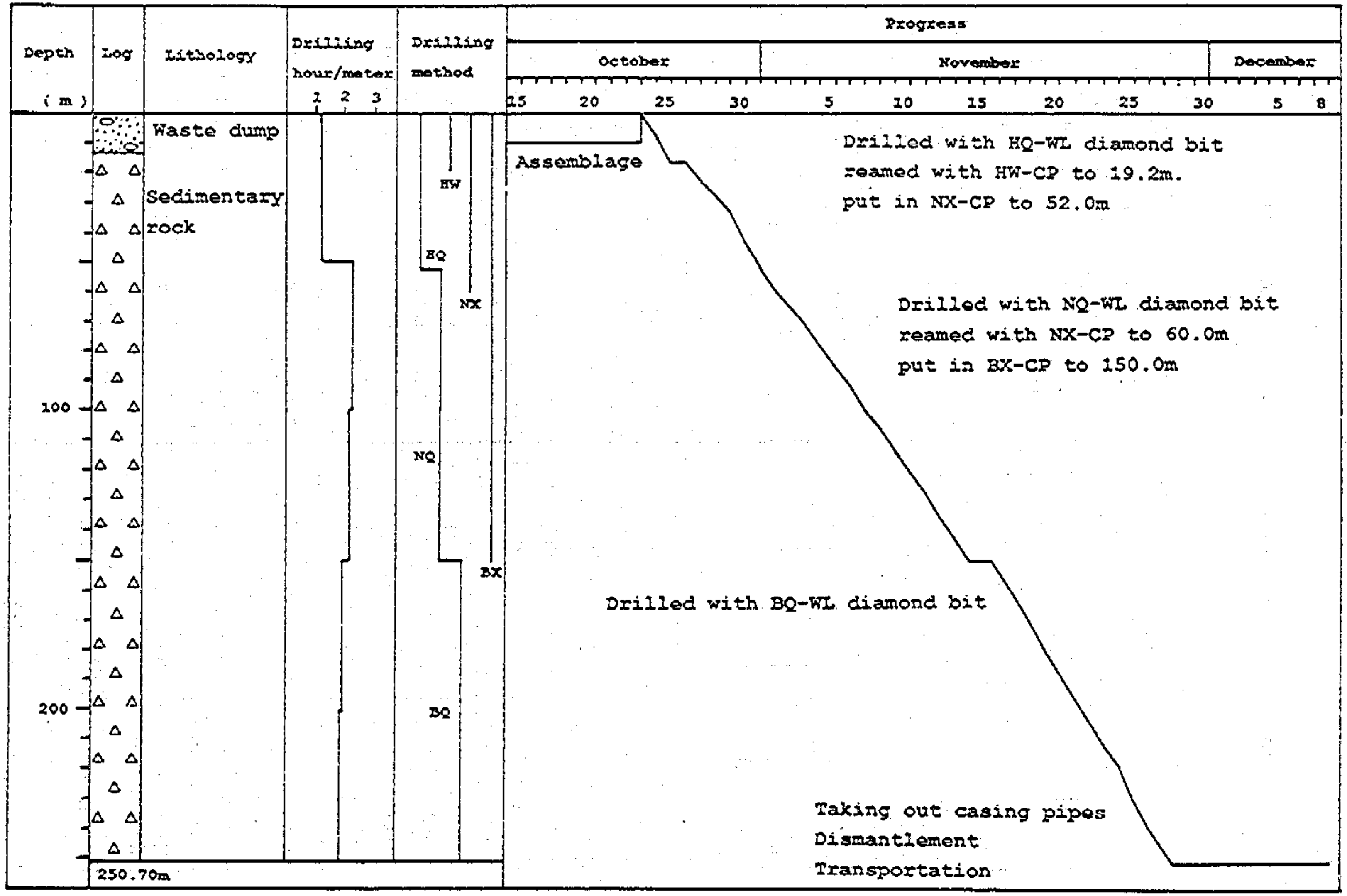


Fig. 2-4 Chart of Drilling Progress (MJTK-2)

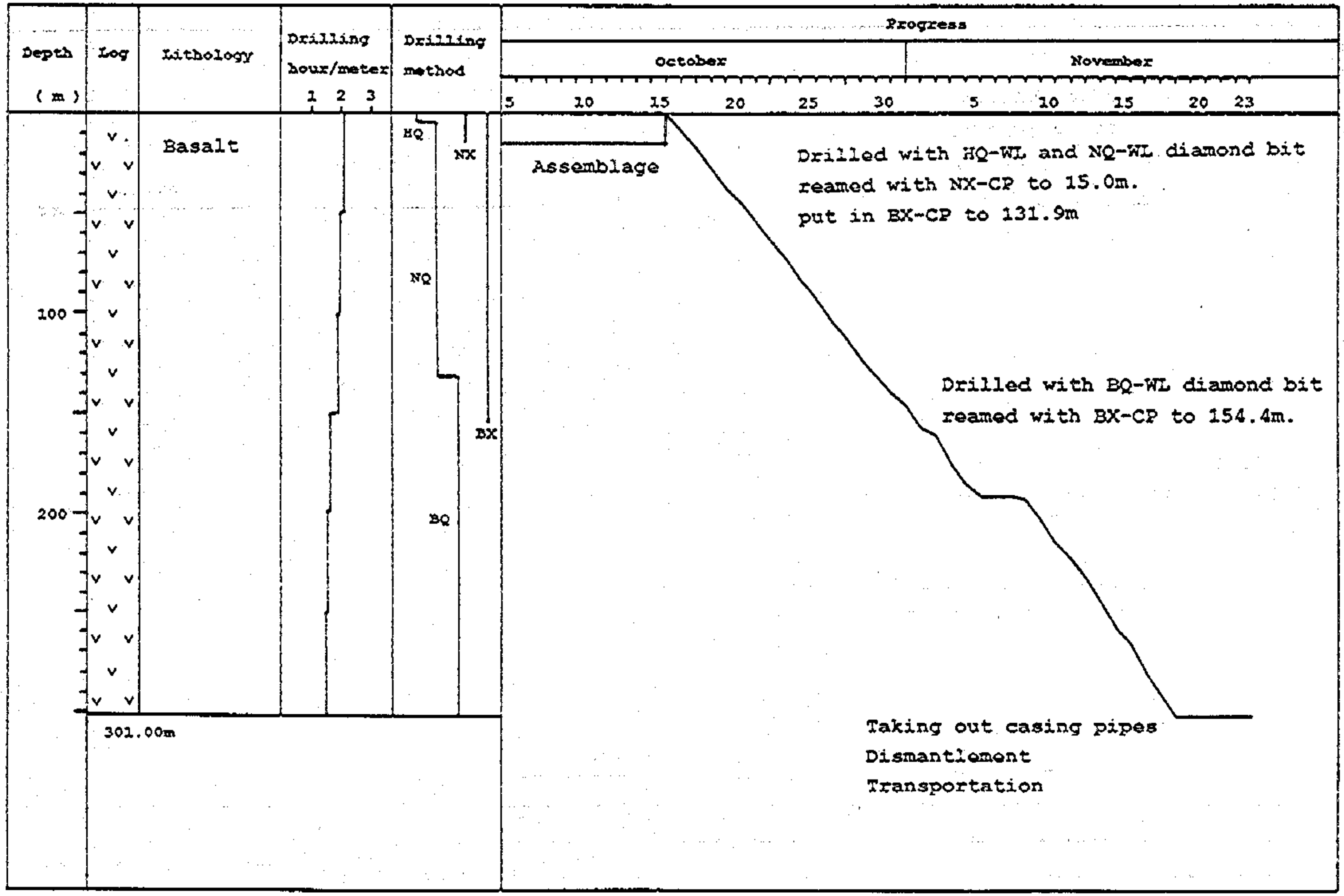


Fig. 2-5 Chart of Drilling Progress (MJTK-3)

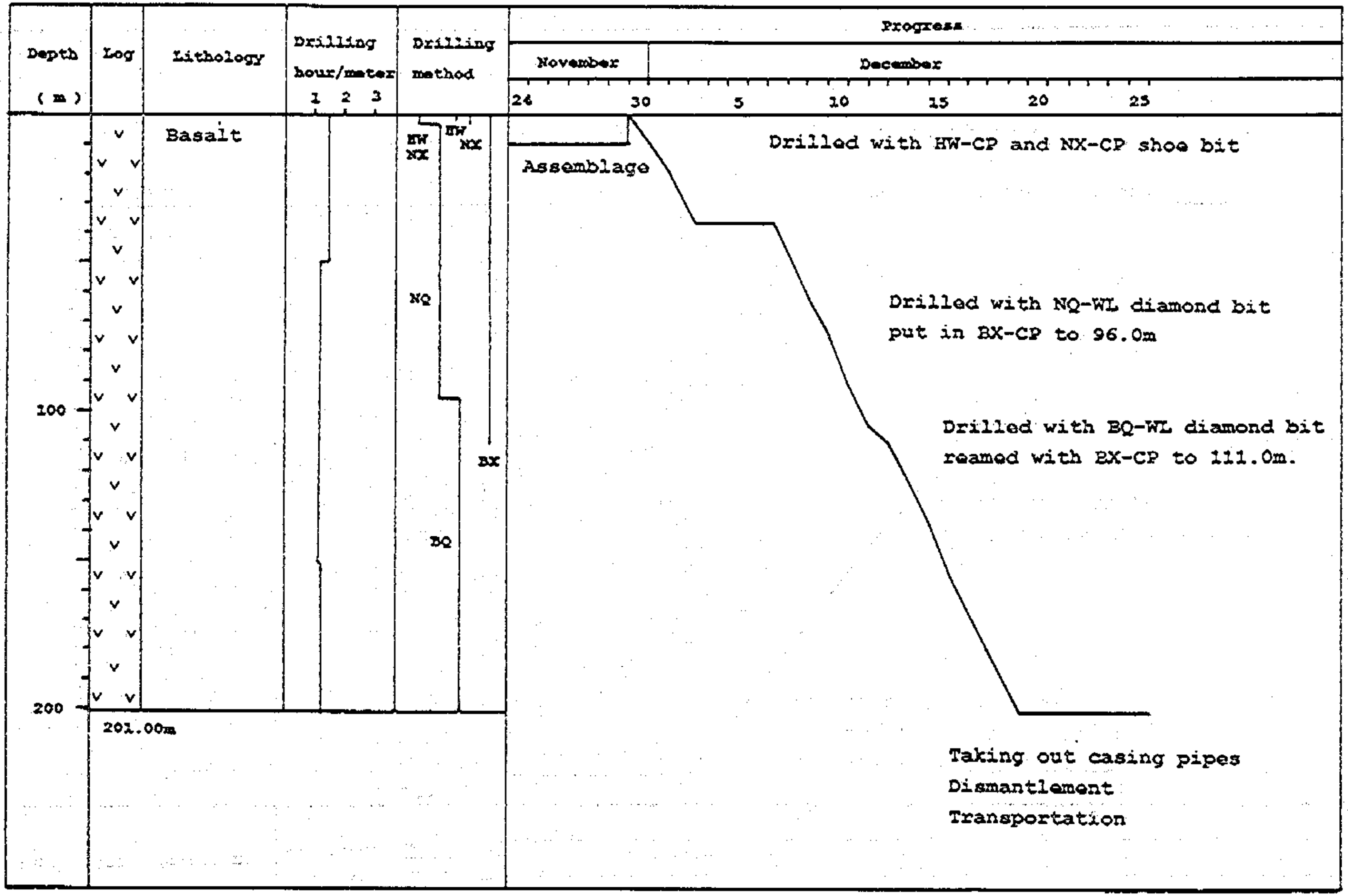


Fig. 2-6 Chart of Drilling Progress (MJTK-5)

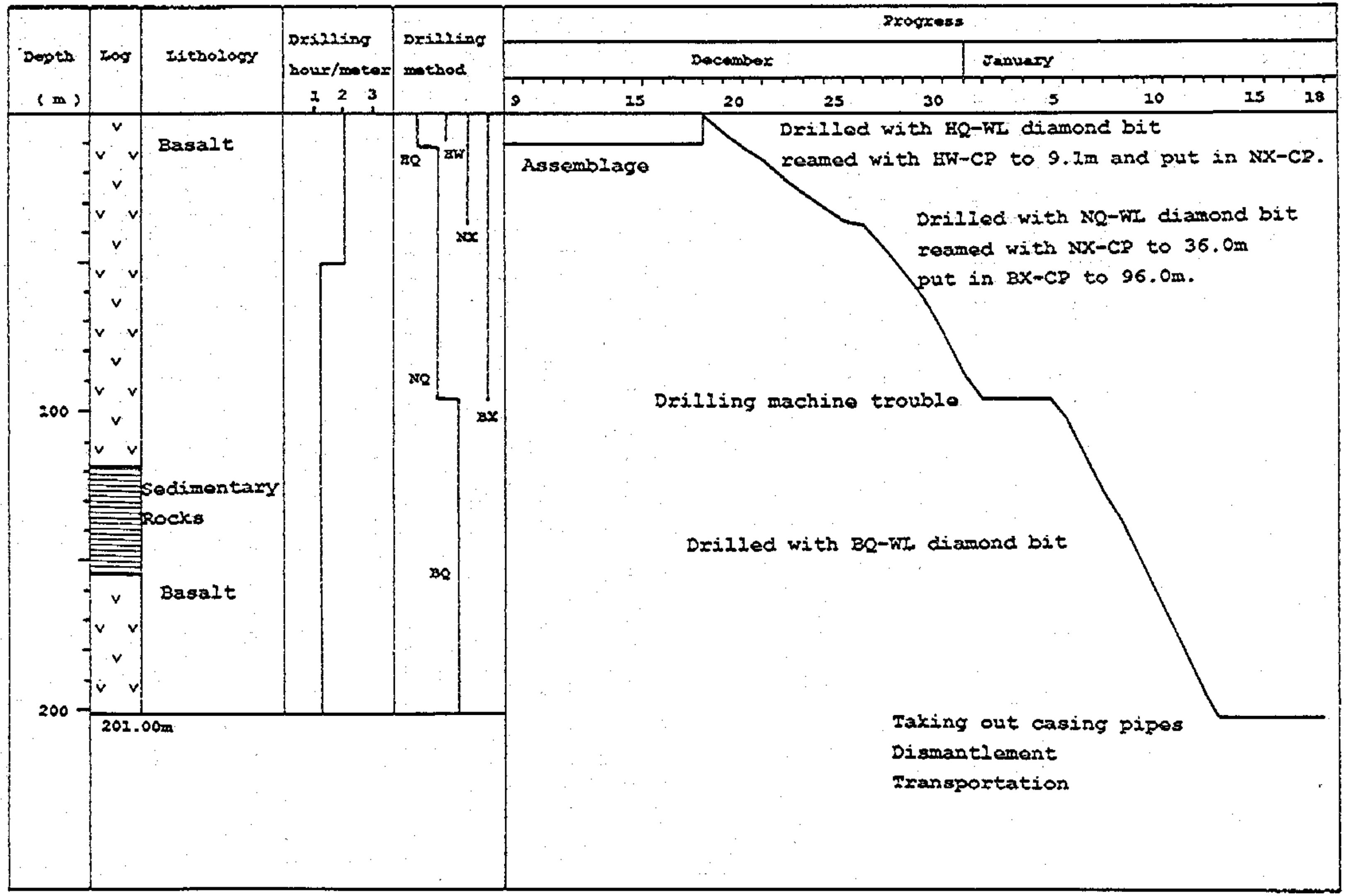


Fig. 2-7 Chart of Drilling Progress (MJTK-8)

From 60.0 m to 150.0 m, NQ wireline with bentonite mud was used and BX casing pipes were inserted. During this time, about 2/3 of the injected circulation was continuously lost, but the mud density was maintained at a high level and work continued without wall collapse.

BQ wireline with bentonite was used to the planned depth from 150.0 m.

(2) MJTK-3

Drilling machine Longyear L-44 was employed for this hole.

For surface talus deposits and weathered rocks, HQ-WL diamond bit with bentonite mud was used to 4.0 m and NX casing pipes were inserted to that depth. Then NQ wireline was used to 15 m. Circulation was completely lost intermittently, the hole was reamed by NX-CP shoe and NX casing pipes inserted to 15 m.

From 15 m to 131.9 m, NQ-WL diamond bit and BX casing pipes inserted, then to 301.0 m, BQ wireline with bentonite mud were used. Complete loss of circulation occurred from 142 to 153 m, TELSTOP and seaclay were not effective, cementing was done after drilling to 190.2 m and loss was stopped. Loss occurred intermittently further down, but TELSTOP was effective and attained the planned depth.

(3) MJTK-5

Drilling machine Longyear L-44 was employed for this hole.

For superficial material, HW-CP shoe and NX-CP shoe and bentonite mud were used to 1.1 m and 3.1 m respectively, and HW and NX casing pipes were inserted. Then to 96.0 m, NQ wireline and bentonite mud were used. There were intermittent loss of circulation, but TELSTOP was effective. After inserting BX casing pipes to 96.0 m, drilled to 201.0 m with BQ wireline and bentonite mud. Complete loss of circulation occurred near 110 m, thus the hole was reamed by BX-CP shoe to 111 m, and BX casing pipes extended.

Supply of water became difficult due to heavy snow fall and the operation was halted temporarily. After the snow fall ceased, drilling continued by pumping water.

(4) MJTK-8

Drilling machine Longyear L-38 was employed for this hole.

Superficial units were drilled by HW-CP shoe with bentonite mud and HW casing pipes were inserted at 3.0 m. Then HQ wireline with bentonite mud was used to 10.55 m. Complete loss of circulation occurred continuously during this interval and the hole was reamed by HW-CP shoe and the HW pipes were extended to 9.1 m.

NQ wireline with bentonite was the method used to 95.25 m after inserting NX casing pipes to 10.55 m. Some loss of circulation occurred during this time and NX casing pipes were extended to 36.0 m.

BX casing was inserted to 96.0 m, then BQ wireline with bentonite was used to 201.0 m. Loss of circulation was small after 96.0 m and the operation was smooth.

The engine of this machine broke down three times during drilling and the total time loss amounted to 111 hours.

2-4 Geology and Mineralization of Drill Holes

The results of thin section microscopy, polished section microscopy, X-ray diffraction, and ore assay of the cores are shown in Tables 2-14 - 2-17. The core columns are laid our in Figures 2-8 to 2-11.

2-4-1 Geology

The rocks drilled during the present third phase are basalt and sedimentary rocks of the Küre Formation.

Basalt consists of pillow lava, massive basalt and hyaloclastite.

The pillow basalt consists of both close-packed and pillow breccia.

The basalt mostly has ophitic texture. Some parts of basalt show porphyritic or microspherulitic texture. Fresh plagioclase is extremely rare. Clinopyroxene occurs as the mafic mineral, but most of them are altered to secondary minerals. Altered minerals are quartz, sericite, chlorite, calcite, pyrite and hematite. The basalt in all the boreholes are generally chloritized with partly silicified, carbonatized and argillized portions.

Sedimentary rocks consist of breccia and black shale. The breccia comprises fragments of graywack and black shale. Graywacke fragments are composed of massive and graded ones. The fragments of graywacke are composed of quartz, feldspar, mafic minerals, opaque minerals, shale, chert and mafic igneous rocks. Most of the quartz grains show wavy extinction. Cracks of graywacke are at times filled with pelitic matrix.

The shape of breccia fragments is angular to sub-angular. The size of the fragments ranges from several centimeters up to several meters.

Matrix of breccia is composed of pelitic rocks. It has scaly cleavages. These argillaceous rocks are easily dissolved in water.

Under the microscope, schistose structure, micro-fault and micro-folding were observed in black shale which appears massive to the unaided eyes. Black shale is composed of quartz, illite, chlorite and bituminous material. Minute faults and foldings are at times observed.

Table 2-14 Results of Microscopic Observation of Thin Sections

Drill Hole	Depth (m)	Rock Name	Phenocryst							Groundmass							Remark
			Qz	Pl	Mm	Op				Cc	Se	Ch	Py	Cl	Ep	Qz	
MJTK-3	56.4	Pillow Lava		◎	△					△		△		·	·	△	Ophitic
MJTK-3	64.0	Basalt		◎	△					△		△				△	Ophitic
MJTK-3	73.5	Hyaloclastite		◎	△					△		△				△	Ophitic
MJTK-3	97.1	Pillow Lava		◎	△					△	△	△			·	△	Ophitic, Amygdaloidal
MJTK-3	114.6	Massive Basalt		◎	△							△		·	·		Ophitic
MJTK-3	142.3	Siderite vein								◎							
MJTK-3	208.3	Basalt		◎	·							△			△		Ophitic
MJTK-3	238.7	Altered Basalt		◎	·							△		·	·		Ophitic
MJTK-3	268.0	Altered Basalt		◎	·							△			△		Ophitic
MJTK-5	19.3	Massive Basalt		◎		△						△					Ophitic
MJTK-5	35.0	Hyaloclastite								△		△				△	
MJTK-5	79.4	Altered Basalt										◎				◎	
MJTK-5	97.5	Hyaloclastite		◎		·						△				△	Ophitic
MJTK-8	49.1	Massive Basalt		◎	△							△					Ophitic
MJTK-8	64.0	Hyaloclastite		◎	△							△			△	△	Ophitic, Brecciated

Abbreviation

Qz:Quartz
Fd:Feldspar
Mm:Mafic mineral
Op:Opaque mineral

Cc:Carbonate
Se:Sericite
Ch:Chlorite
Py:Pyrite

Cl:Clinozoisite
Ep:Epidote
Qz:Quartz

◎:Abundant - Common
△:Few
・:Rare

Table 2-15 Results of Microscopic Observation of Polished Sections

Drill Hole	Depth (m)	Description	Ore Mineral									Gangue Mineral					Remark
			Py	Mc	Cp	Ct	Bo	Sp	Br	He	Li	Qz	Ch	Cc	Sn		
MJTK-3	16.8	Py-Qtz Vein	◎		·					Δ	Δ	Δ	·				Py:Cataclastic
MJTK-3	179.5	Py Vein	◎		·				·			Δ	·		·		Py:Cataclastic
MJTK-3	193.3	Py Vein	◎		Δ	·	·					Δ	·	·			
MJTK-5	20.1	Py Vein	◎		·			·		◎		Δ	Δ				Py:Cataclastic
MJTK-5	27.8	Hematite Vein	Δ		·					◎		Δ	Δ				
MJTK-5	59.2	Py-Cp Vein	◎		◎			Δ		·		Δ	Δ	Δ			Py:Cataclastic
MJTK-5	123.2	Py Network/Dissemi	◎		Δ			·		Δ		Δ	◎	Δ			Py:Cataclastic
MJTK-5	131.9	Py Veinlet	◎							Δ		Δ	◎	Δ			Py:Cataclastic
MJTK-5	133.9	Py-Cp network	◎		Δ			·		·		Δ	◎	Δ			Py:Cataclastic
MJTK-5	134.9	Py Veinlet	◎									Δ	◎				
MJTK-5	159.0	Py Network	◎		·					·		Δ	◎	·			Py:Cataclastic
MJTK-5	167.9	Py Veinlet	◎		Δ					·		Δ	Δ	Δ			Py:Cataclastic
MJTK-5	190.5	Py Veinlet	◎							Δ		Δ	◎				Py:Cataclastic
MJTK-5	198.4	Py Veinlet	◎		·					Δ		Δ	◎				
MJTK-5	200.0	Py Veinlet	◎		·					Δ		Δ	◎				Py:Cataclastic
MJTK-8	95.6	Massive Sulfide Ore	◎	Δ	◎			Δ				Δ	Δ	◎			Py:Cataclastic

Abbreviation

Py:Pyrite
Mc:Marcasite
Cp:Chalcopyrite

Ct:Chalcocite
Bo:Bornite
Sp:Sphalerite

Br:Bravoite
He:hematite
Li:Limonite

Qz:Quartz
Ch:Chlorite
Cc:Calcite
Sn:Sphene

◎:Abundant - Common
Δ:Few
·:Rare

Table 2-16 Results of X-Ray Diffraction Analysis

Drill Hole	Depth (m)	Rock Name	Mineral							
			Qz	Ch	Si	La	Pl	Ep	He	Py
MJTK-3	142.3	Silicified	○		◎					
MJTK-3	145.0	Argillized basalt	△	○	○		△			
MJTK-3	238.7	Altered basalt		○		◎				
MJTK-3	268.0	Altered basalt	◎	△				○		
MJTK-5	27.8	Hematite vein	△		△				◎	
MJTK-5	179.5	Altered basalt	○	◎						•
MJTK-8	35.8	Clay		△			◎			
MJTK-8	77.6	Clay	○	◎						
MJTK-8	96.0	Altered basalt	◎	○	○					

Abbreviations

Qz:Quartz	Ep:Epidote	◎:Abundant
Ch:Chlorite	Pl:Plagioclase	○:Common
Si:Siderite	He:Hematite	△:Few
La:Laumontite	Py:Pyrite	•:Rare

Table 2-17 Assay Results of Ore Samples

No.	Drill Hole	Depth(m)	Au(g/t)	Ag(g/t)	Cu(%)	S (%)	Co(%)
K-401	MJTK-5	53.0 - 54.0	< 0.03	< 0.3	0.12	1.98	0.019
K-402	MJTK-5	54.0 - 55.0	< 0.03	< 0.3	0.59	1.38	0.066
K-403	MJTK-5	55.0 - 56.0	< 0.03	< 0.3	0.12	0.40	0.010
K-404	MJTK-5	56.0 - 57.0	< 0.03	< 0.3	0.06	0.20	0.010
K-405	MJTK-5	57.0 - 58.0	< 0.03	< 0.3	0.24	2.23	0.023
K-406	MJTK-5	58.0 - 59.0	< 0.03	< 0.3	0.22	4.56	0.028
K-407	MJTK-5	59.0 - 60.0	< 0.03	< 0.3	0.05	0.79	0.012
K-408	MJTK-5	60.0 - 61.0	< 0.03	< 0.3	0.12	1.75	0.013
K-409	MJTK-5	61.0 - 62.0	< 0.03	< 0.3	0.32	2.07	0.012
K-410	MJTK-5	62.0 - 63.0	< 0.03	< 0.3	0.42	3.56	0.015
K-411	MJTK-5	63.0 - 64.0	< 0.03	< 0.3	0.18	4.68	0.017
K-412	MJTK-5	64.0 - 65.0	< 0.03	< 0.3	0.10	4.41	0.018
K-413	MJTK-5	65.0 - 66.0	< 0.03	< 0.3	0.17	5.91	0.021
K-414	MJTK-5	66.0 - 67.0	< 0.03	< 0.3	0.83	14.20	0.043
K-415	MJTK-5	67.0 - 68.0	< 0.03	< 0.3	0.45	4.33	0.019
K-416	MJTK-5	68.0 - 69.0	< 0.03	< 0.3	0.15	3.71	0.017
K-417	MJTK-5	69.0 - 70.0	< 0.03	< 0.3	0.08	3.86	0.021
K-418	MJTK-5	70.0 - 71.0	< 0.03	< 0.3	0.21	1.95	0.017
K-419	MJTK-5	71.0 - 72.0	< 0.03	< 0.3	0.05	8.00	0.035
K-420	MJTK-5	72.0 - 73.0	< 0.03	< 0.3	0.04	12.30	0.048
K-421	MJTK-5	73.0 - 74.0	< 0.03	< 0.3	0.06	11.10	0.046
K-422	MJTK-5	74.0 - 75.0	< 0.03	< 0.3	0.12	5.87	0.033
K-423	MJTK-5	75.0 - 76.0	< 0.03	< 0.3	0.03	5.14	0.029
K-424	MJTK-5	76.0 - 77.0	< 0.03	< 0.3	0.02	0.73	0.021
K-425	MJTK-5	132.0 -133.0	< 0.03	< 0.3	0.26	6.87	0.018
K-426	MJTK-5	133.0 -134.0	0.07	0.3	2.79	13.20	0.030
K-427	MJTK-5	134.0 -135.0	< 0.03	< 0.3	1.60	10.90	0.039
K-428	MJTK-5	135.0 -136.0	< 0.03	< 0.3	0.56	8.16	0.053
K-429	MJTK-5	136.0 -137.0	< 0.03	< 0.3	0.02	1.18	0.025
K-430	MJTK-5	137.0 -138.0	< 0.03	< 0.3	0.01	5.22	0.039
K-431	MJTK-8	95.25- 96.0	1.85	8.6	4.05	39.60	0.197

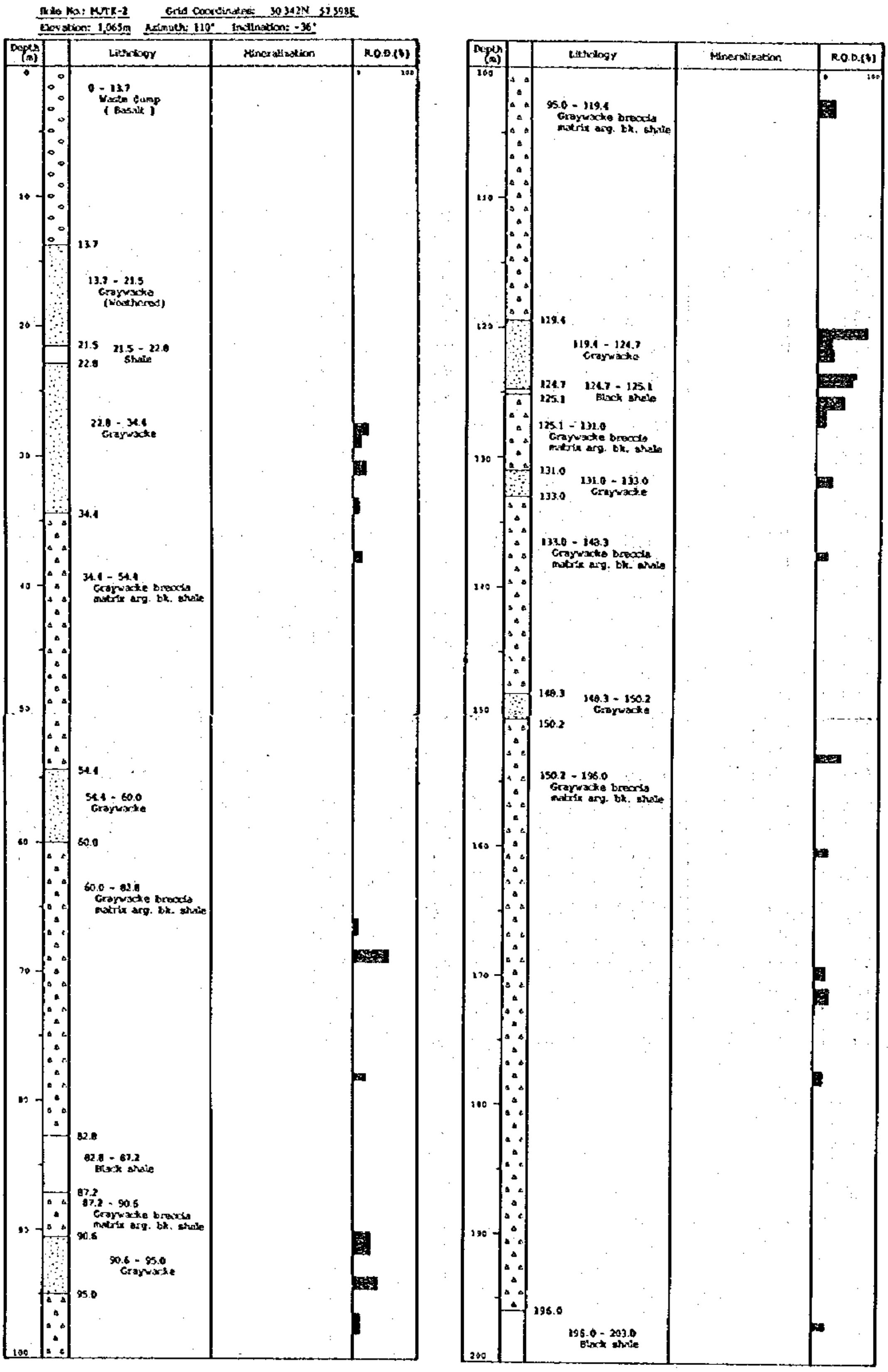


Fig. 2-8 Summary of Drill Logs (MJTK-2, 1/2)

Hole No.: MJTK-2

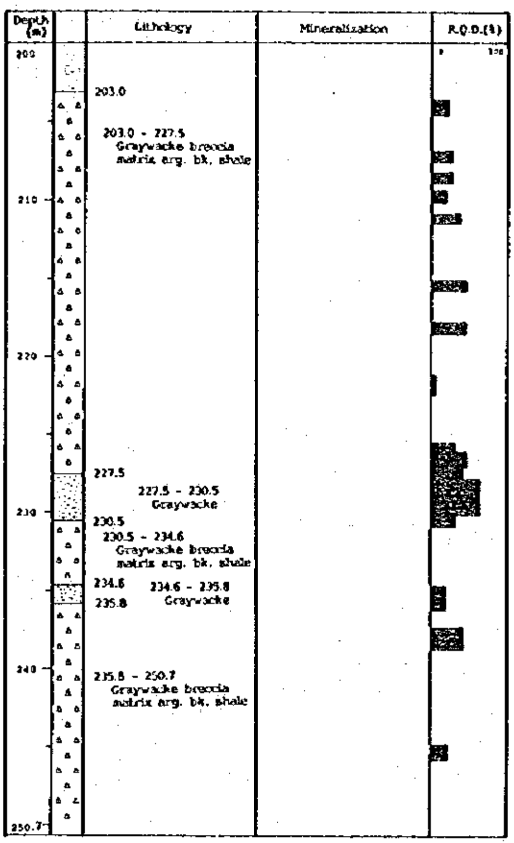


Fig. 2-8 Summary of Drill Logs (MJTK-2, 2/2)

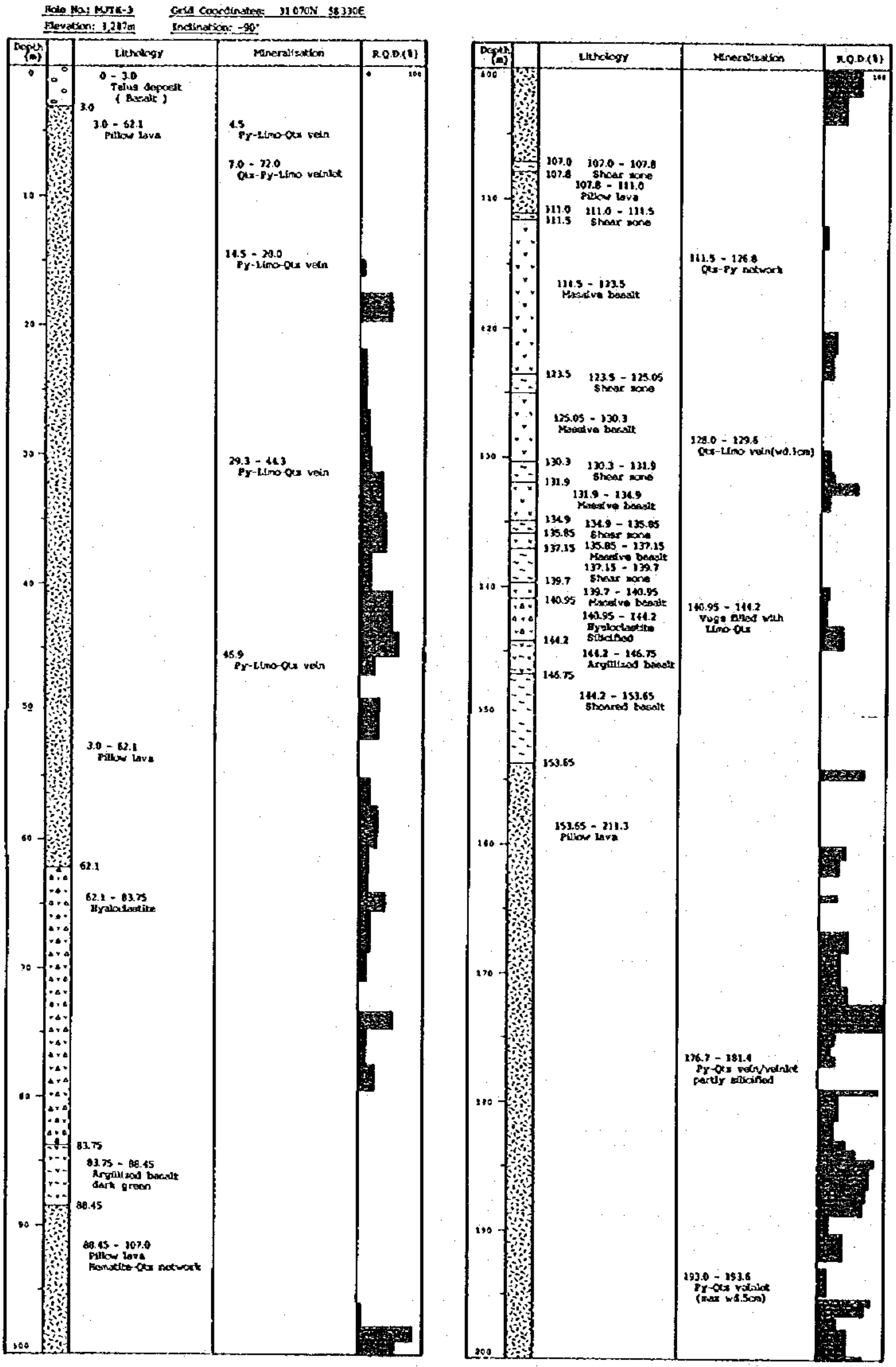


Fig. 2-9 Summary of Drill Logs (MJTK-3, 1/2)

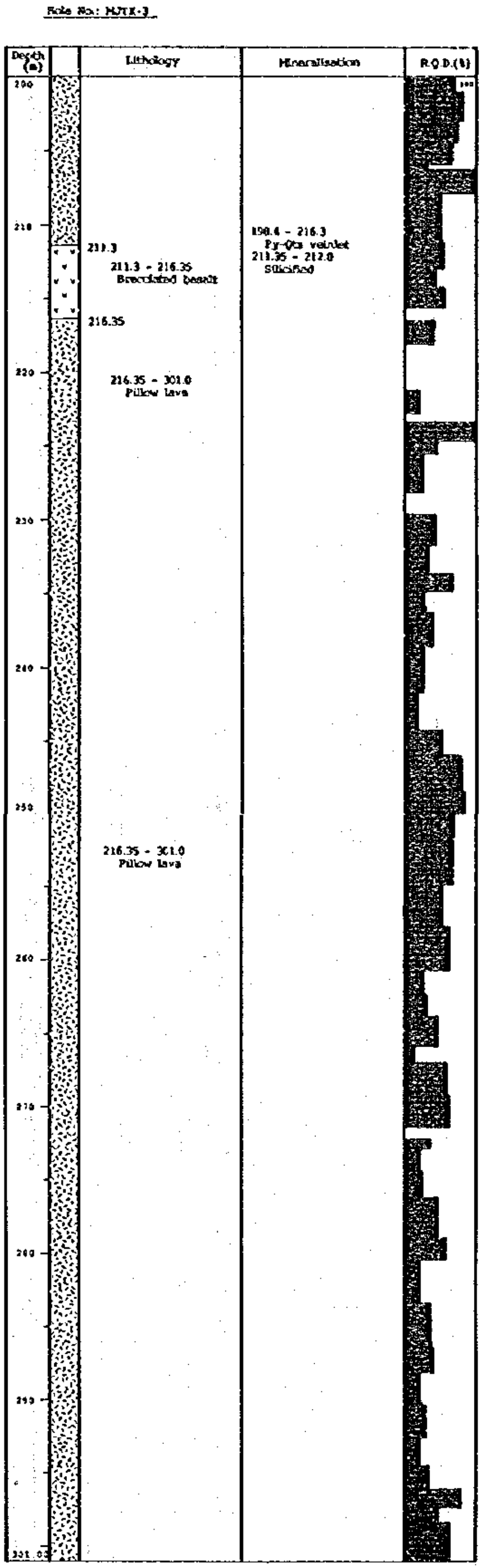


Fig. 2-9 Summary of Drill Logs (MJTK-3, 2/2)

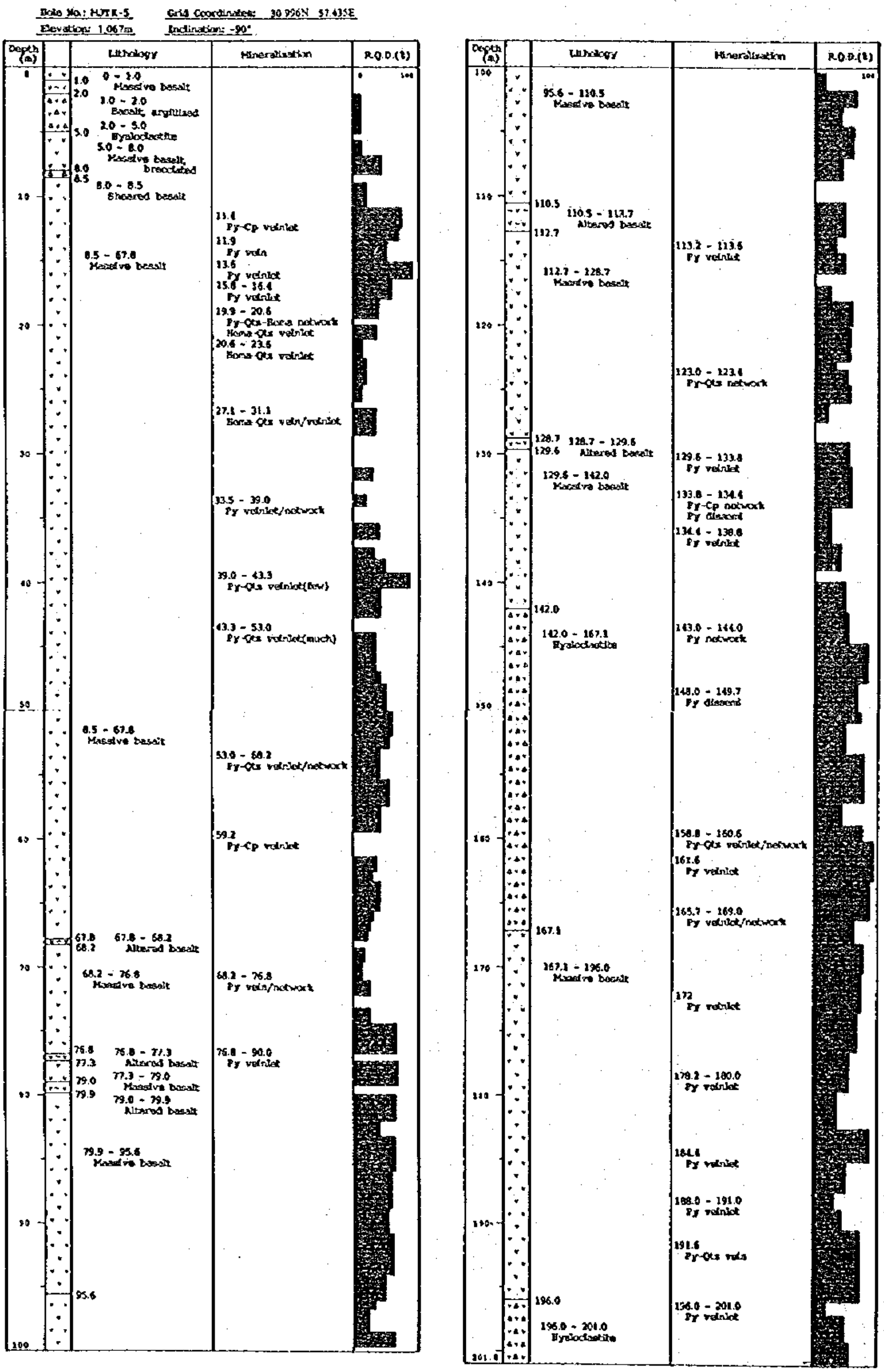


Fig. 2-10 Summary of Drill Logs (MJTK-5)

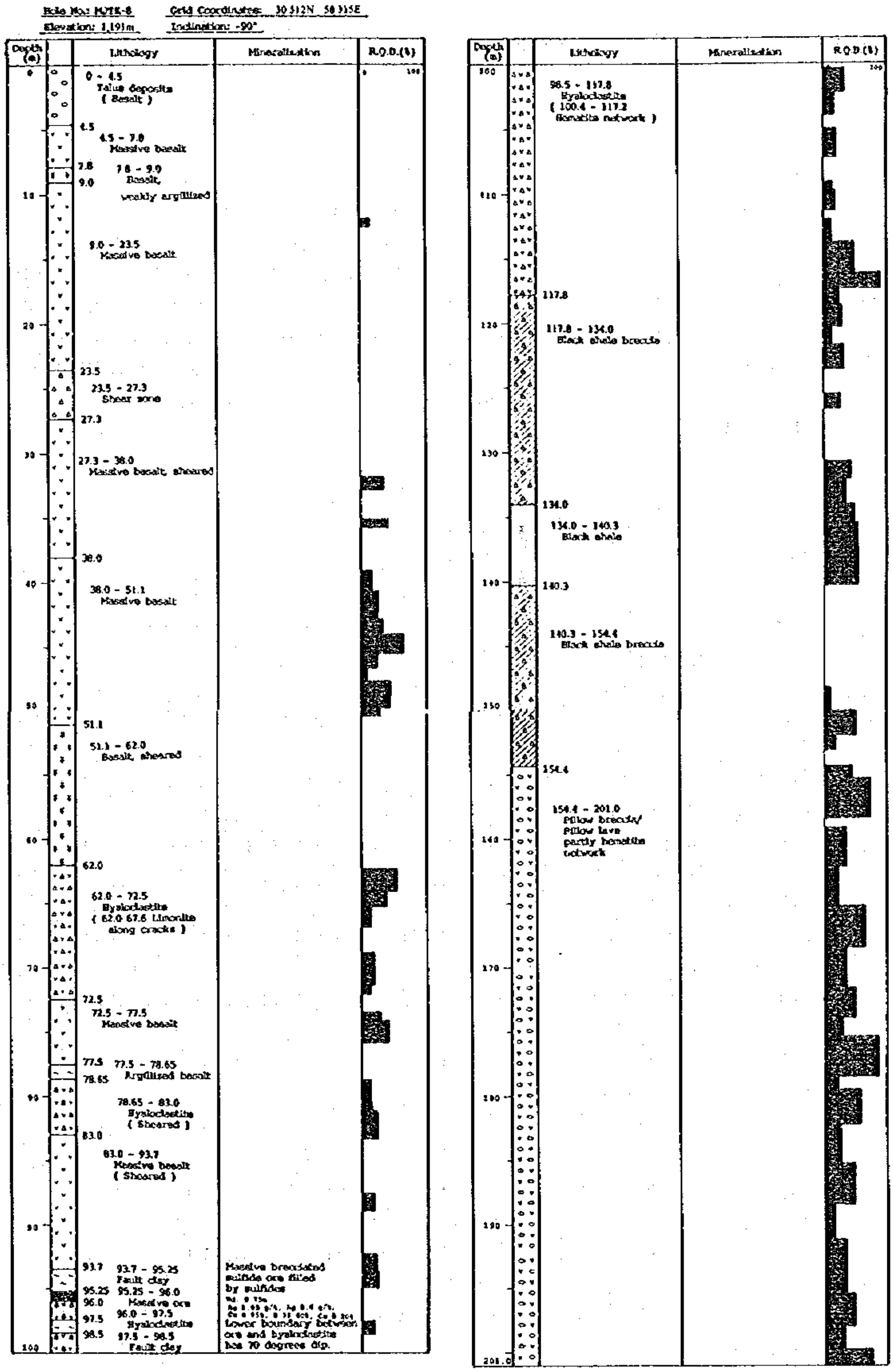


Fig. 2-11 Summary of Drill Logs (MJTK-8)

2-4-2 Drill Hole Description

MJTK-2

The drill hole MJTK-2 is located at 170 meter to northwest from the Station 8.5 of the Line E of CSAMT survey. The hole was drilled with an inclination of -36° with the direction of 110°, because the surface part of the above CSAMT Station is covered by thick waste dump. It targeted to the low resistivity anomalies extending from 100 to 200 meter in depth. The location of this hole is the south of Aşiköy Deposit. A tectonically dislocated massive ore was expected to exist in this low resistivity zone, because the southern extension of the deposit is believed to occur in the deeper part. Geology and mineralization in MJTK-2 are described as follows:

0 - 13.7 m	Waste dump (Basalt)
13.7 - 21.5 m	Graywacke (Weathered)
21.5 - 22.8 m	Shale (Weathered)
22.8 - 34.4 m	Graywacke
34.4 - 54.4 m	Graywacke breccia, matrix of argillized black shale
54.4 - 60.0 m	Graywacke
60.0 - 82.8 m	Graywacke breccia, matrix of argillized black shale
82.8 - 87.2 m	Black shale
87.2 - 90.6 m	Graywacke breccia, matrix of argillized black shale
90.6 - 95.0 m	Graywacke
95.0 - 119.4 m	Graywacke breccia, matrix of argillized black shale
119.4 - 124.7 m	Graywacke
124.7 - 125.1 m	Black shale
125.1 - 131.0 m	Graywacke breccia, matrix of argillized black shale
131.0 - 133.0 m	Graywacke
133.0 - 148.3 m	Graywacke breccia, matrix of argillized black shale
148.3 - 150.2 m	Graywacke
150.2 - 196.0 m	Graywacke breccia, matrix of argillized black shale
190.6 - 203.0 m	Black shale
203.0 - 227.5 m	Graywacke breccia, matrix of argillized black shale
227.5 - 230.5 m	Graywacke
230.5 - 234.6 m	Graywacke breccia, matrix of argillized black shale
234.6 - 235.8 m	Graywacke
235.8 - 250.7 m	Graywacke breccia, matrix of argillized black shale

Any mineralization is not observed in the drill hole.

MJTK-3

The drill hole MJTK-3 is located at the Station 25.5 of the Line C of CSAMT survey. It targeted to the low resistivity anomalies extending from 150 to 300 meter in depth. The location of the hole is the north of Bakibaba Deposit. The network and dissemination of limonite in basalt are distributed between the hole and Bakibaba Deposit. A massive ore was expected to occur below this mineralized zone. Geology and mineralization in MJTK-3 are described as follows:

0 - 3.0 m	:	Talus deposit (Basalt)
3.0 - 62.1 m	:	Pillow lava
62.1 - 83.75 m	:	Hyaloclastite
83.75 - 88.45 m	:	Argillized basalt
88.45 - 107.0 m	:	Pillow lava
107.0 - 107.8 m	:	Shear zone
107.8 - 111.0 m	:	Pillow lava
111.0 - 111.5 m	:	Shear zone
111.5 - 123.5 m	:	Massive basalt
123.5 - 125.05 m	:	Shear zone
125.05 - 130.3 m	:	Massive basalt
130.3 - 131.9 m	:	Shear zone
131.9 - 134.9 m	:	Massive basalt with Hematite-Qtz network
134.9 - 135.85 m	:	Shear zone
135.85 - 137.15 m	:	Massive basalt with Hematite-Qtz network
137.15 - 139.7 m	:	Shear zone
139.7 - 140.95 m	:	Massive basalt with Hematite-Qtz network
140.95 - 144.2 m	:	Hyaloclastite (Silicified)
144.2 - 146.75 m	:	Argillized basalt
146.75 - 153.65 m	:	Sheared basalt
153.65 - 211.3 m	:	Pillow lava
211.3 - 216.35 m	:	Brecciated basalt
216.35 - 301.0 m	:	Pillow lava

4.5 m	:	Py-Limo-Qtz vein
7.0 - 72.0 m	:	Qtz-Py-Limo veinlet
14.5 - 20.0 m	:	Py-Limo-Qtz vein
29.3 - 44.3 m	:	Py-Limo-Qtz vein
46.9 m	:	Py-Limo-Qtz vein
111.5 - 126.8 m	:	Qtz-Py network
128.0 - 129.6 m	:	Qtz-Limo vein(wd.1cm)
140.95 - 144.2 m	:	Vugs filled with Limo-Qtz
176.7 - 181.4 m	:	Py-Qtz vein/veinlet, partly silicified
193.0 - 193.6 m	:	Py-Qtz vein(max wd.5cm)
198.4 - 216.3 m	:	Py-Qtz veinlet

211.35 - 212.0 m : Silicified

MJTK-5

The drill hole MJTK-5 is located at the Station 8.5 of the Line B of CSAMT survey. It targeted to the low resistivity anomalies extending from 50 to 200 meter in depth. This location is the middle of Aşıköy and Toykondu Deposits. A tectonically isolated massive ore or a network zone in basalt was expected to exist in this low resistivity zone. Geology and mineralization in MJTK-5 are described as follows:

0 - 1.0 m	: Massive basalt
1.0 - 2.0 m	: Basalt, argillized
2.0 - 5.0 m	: Hyaloclastite
5.0 - 8.0 m	: Massive basalt, brecciated
8.0 - 8.5 m	: Sheared basalt
8.5 - 67.8 m	: Massive basalt
67.8 - 68.2 m	: Altered basalt
68.2 - 76.8 m	: Massive basalt
76.8 - 77.3 m	: Altered basalt
77.3 - 79.0 m	: Massive basalt
79.0 - 79.9 m	: Altered basalt
79.9 - 95.6 m	: Massive basalt
95.6 - 110.5 m	: Massive basalt
110.5 - 112.7 m	: Altered basalt
112.7 - 128.7 m	: Massive basalt
128.7 - 129.6 m	: Altered basalt
129.6 - 142.0 m	: Massive basalt
142.0 - 167.1 m	: Hyaloclastite
167.1 - 196.0 m	: Massive basalt
196.0 - 201.0 m	: Hyaloclastite

11.4 m	: Py-Cp veinlet
11.9 m	: Py vein
13.6 m	: Py veinlet
15.8 - 16.4 m	: Py veinlet
19.9 - 20.6 m	: Py-Qtz-Hema network, Hema-Qtz veinlet
20.6 - 23.6 m	: Hema-Qtz veinlet
27.1 - 31.1 m	: Hema-Qtz vein/veinlet
33.5 - 39.0 m	: Py veinlet/network
39.0 - 43.3 m	: Py-Qtz veinlet(few)
43.3 - 53.0 m	: Py-Qtz veinlet(much)
53.0 - 68.2 m	: Py-Qtz veinlet/network
59.2 m	: Py-Cp veinlet

68.2 - 76.8 m : Py vein/network
76.8 - 90.0 m : Py veinlet
113.2 - 113.6 m : Py veinlet
123.0 - 123.4 m : Py-Qtz network
129.6 - 133.8 m : Py veinlet
133.8 - 134.4 m : Py-Cp network, Py dissemi
134.4 - 138.8 m : Py veinlet
143.0 - 144.0 m : Py network
148.0 - 149.7 m : Py dissemi
158.8 - 160.6 m : Py-Qtz veinlet/network
161.6 m : Py veinlet
165.7 - 169.0 m : Py veinlet/network
172.0 m : Py veinlet
178.2 - 180.0 m : Py veinlet
184.4 m : Py veinlet
188.0 - 191.0 m : Py veinlet
191.6 m : Py-Qtz vein
196.0 - 201.0 m : Py veinlet

MJTK-8

The drill hole MJTK-8 is located at the Station 22 of the Line E of CSAMT survey. It targeted to the low resistivity anomalies extending from 100 to 150 meter in depth. This location is the southwest of Bakibaba Deposit. The gossan is widely distributed close by the hole and continues to the Deposit. A massive ore was expected to occur in the vicinity of this gossan. Geology and mineralization in MJTK-8 are described as follows:

0 - 4.5 m : Talus deposits composed of basalt
4.5 - 7.8 m : Massive basalt
7.8 - 9.0 m : Basalt argillized partly
9.0 - 23.5 m : Massive basalt
23.5 - 27.3 m : Shear zone
27.3 - 38.0 m : Massive basalt, sheared
38.0 - 51.1 m : Massive basalt
51.1 - 62.0 m : Basalt, sheared
62.0 - 72.5 m : Hyaloclastite, cracks from 62.0m to 67.6m filled by limonite
72.5 - 77.5 m : Massive basalt
77.5 - 78.65m : Argillized basalt
78.65- 83.0 m : Hyaloclastite, sheared
83.0 - 93.7 m : Massive basalt, sheared
93.7 - 95.25m : Fault clay

95.25- 96.0 m : Massive ore, breccias of massive sulfide filled by pyrite. The boundary with lower hyaloclastite has a dip of 70°. Assay result is Au 1.85g/t, Ag 8.6g/t, Cu 4.05%, S 39.6%.

96.0 - 97.5 m : Argillized hyaloclastite with hematite dissemination.

97.5 - 98.5 m : Fault clay

98.5 - 117.8 m : Hyaloclastite. Hematite network is observed from 100.4m to 117.2m.

117.8 - 134.0 m : Breccia of black shale, matrix of sheared black shale

134.0 - 140.3 m : Black shale

140.3 - 154.4 m : Breccia of black shale, matrix of sheared black shale

154.4 - 201.0 m : Pillow breccia and pillow lava with hematite network.

2-4-3 Mineralization

Ore minerals observed in drill cores are pyrite, marcasite, chalcopyrite, chalcocite, sphalerite, bornite and hematite. Gangue minerals are quartz, calcite and chlorite.

The mineralization observed in the cores are massive, veinlets to network and dissemination.

In MJTK-8, massive ores are confirmed at 59.25-60.0 m, it appears to the unaided eyes that pyrite and chalcopyrite grains fill the interstices of pyrite fragments (about 1 cm in diameter). It is in fault contact with the upper massive basalt. The alteration of the overlying basalt is weak. The orebody is in contact with the lower hyaloclastite at a high angle. The footwall hyaloclastite is argillized and consists of quartz, chlorite and siderite. The massive ore at this hole is; 75 cm in core width, Au 1.85 g/t, Ag 8.6 g/t, Cu 4.05 %, S 39.6 %.

The microscopic characteristics of the above ore are as follows. Pyrite constitutes the major part of the ore and it is euhedral to subhedral with cataclastic texture. The maximum dimension of the crystals is 1.2-1.5 mm. The interstices between the crystal grains and the fractures of the grains are filled by chalcopyrite and colloform pyrite, chalcopyrite, marcasite, and by gangue minerals. Colloform pyrite shows concentric bands and botryoidal structure and is accompanied by chalcopyrite, sphalerite, carbonates and quartz.

The amount of chalcopyrite is small, it fills the interstices of pyrite grains and the fractures, it has euhedral to subhedral form or is associated with colloform pyrite.

A small amount of marcasite is observed. It occurs together with colloform pyrite and chalcopyrite. A small amount of sphalerite is observed in the fractures and interstices of pyrite grains.

Native gold occurs together with chalcopyrite in the fractures of pyrite grains. The size of the gold grains is 5-7 micron.

The gangue minerals are; from abundant to rare, carbonates, quartz and chlorite.

These microscopic characteristics are similar to those of the Aşıköy and Bakibaba ores.

In MJTK-3 basalt, pyrite-quartz veins, veinlets and pyrite dissemination are observed.

The vein pyrite is euhedral to subhedral and the maximum diameter is 1-1.5 mm. These often show cataclastic texture.

There are small amount of chalcopyrite. They occur filling the interstices of pyrite grains and fissures in the pyrite grains. Bornite and chalcocite occur very rarely.

The gangue minerals of these veins are quartz and chlorite with rare occurrence of carbonate minerals and epidote. Titanium minerals and hematite are very rarely observed in these veins.

Dissemination of sulfide minerals are observed very locally and the major ore mineral is pyrite.

In MJTK-5, pyrite veins, veinlets, network and pyrite dissemination are observed. The ore minerals are pyrite, hematite, chalcopyrite and sphalerite. The gangue minerals are chlorite, quartz and epidote.

The pyrite generally has a diameter of 0.5-1.5 mm. These often show cataclastic texture. Also at 131.9 m and 198.4 m, colloform pyrite occurs filling the interstices of the cataclastic pyrite grains.

Hematite occurs in the gangue minerals or as inclusions in pyrite grains. However, at 27.8 m, hematite forms veins and pyrite-quartz are observed within the hematite veins.

Chalcopyrite occurs filling the interstices of pyrite grains and the cracks of these grains. They occur rarely within pyrite crystals.

Occurrence of sphalerite is similar to that of chalcopyrite.

Disseminated sulfide mineral is pyrite, but the frequency of occurrence is low. It is believed that most of them have replaced magnetite in the host rock.

For MJTK-5 where relatively large amount of veinlets were confirmed, one fourth of the core for every meter for the intervals 53.0-77.0 m and 132.0-138.0 m were assayed for Au, Ag, Cu, S, and Co. The results are laid out in Table 2-17.

2-5 Physical Properties of the Cores

Thirty core samples were collected for the measurement of physical properties such as resistivity and FE value by the same equipment used in the first phase. Samples were taken each 10 samples from three drill holes, namely MJTK-3, MJTK-5 and MJTK-8. The results are shown for each rock in Table 2-18 and Figure 2-12.

The highest resistivity at 8,291 ohm-m was obtained from No.29. The lowest value is 80 ohm-m of No.6. The average values of resistivity are 3,770 ohm-m of massive basalt, 3,705 ohm-m of pillow breccia and 1,730 ohm-m of hyaloclastite in descending order. The lowest average is 137 ohm-m of black shale. A gray shale sample and a silicified rock show 137 and 837 ohm-m respectively.

The highest FE value was 52.6% of No.13 and the lowest one was 1.0% of Nos.23 and 30.

The rock with the highest FE value, excluding samples with pyrite veinlets and pyrite dissemination namely Nos. 7, 13, 16 and 17, is massive basalt at 6.9% followed by black shale at 5.6%, hyaloclastite, pillow lava and pillow breccia at 1.9%.

Mineralization or argillization normally leads to the decreasing of resistivity and the increasing of FE value. The decreasing of resistivity by pyrite dissemination were observed in this measurement. Low resistivities and high FE values were detected in samples Nos. 13 and 16 of MJTK-5. It is believed that pyrite veinlets along the direction of electrodes in these samples caused above phenomena.

Any ore sample is not included in measured samples and only three sediments were measured. This is due that some parts of drilled cores were not able to cut the suitable forms.

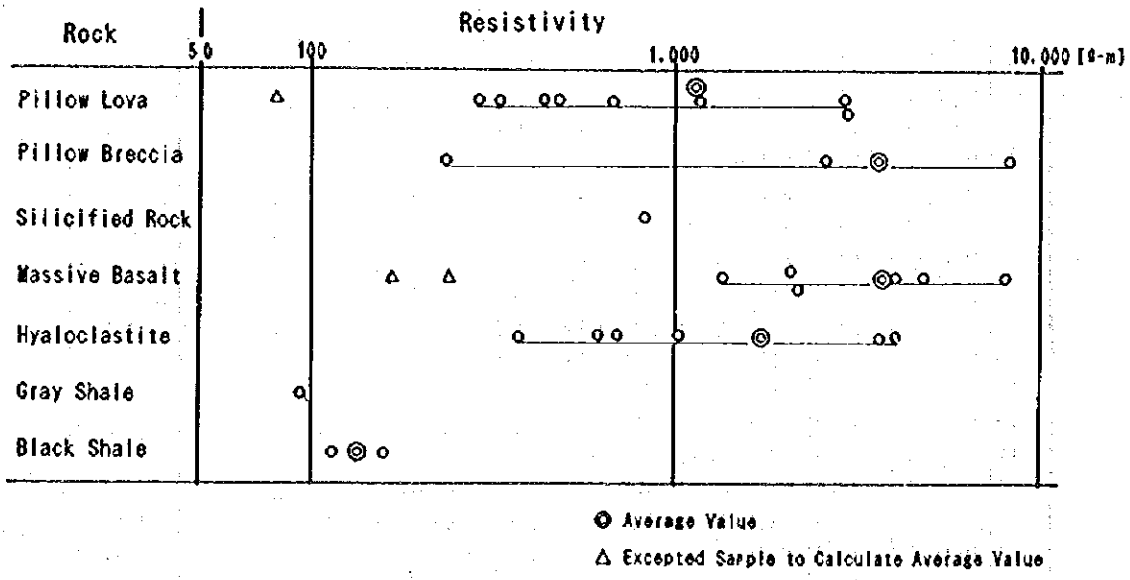
Limited samples allow that there is a significant difference in resistivity between basalt and sediments, namely black shale and gray shale. Regarding FE values, there is a tendency that dense pyrite veinlets and dissemination cause the increasing of FE value and the drop of resistivity.

The results of physical properties measurement is harmonious with that of the first phase collected from outcrops. It could be confirmed that massive sulfide indicated low resistivity at 7.5 ohm-m, and black shale and some sandstone indicated low resistivity below 250 ohm-m. It is clarified from the work in this phase that pyrite dissemination or argillization in basalt which has high resistivity above 1,000 ohm-m possibly makes low resistivity zone.

Table 2-18 Results of the Measurement of Physical Properties on Cores

No.	Drill Number	Depth (m)	D e s c r i p t i o n	F E (%)	Resistivity (Ω·m)
1	MJTK-3	18.6	Pillow lava with Py network	3.3	436
2	MJTK-3	44.7	Pillow lava	3.1	2935
3	MJTK-3	77.0	Pillow lava with calcite network	2.2	287
4	MJTK-3	100.0	Pillow lava	3.2	327
5	MJTK-3	143.4	Silicified rock	4.3	835
6	MJTK-3	175.5	Pillow lava with carbonate veinlet	4.3	* 80
7	MJTK-3	193.2	Pillow lava with Py veinlet	* 9.2	477
8	MJTK-3	209.8	Pillow lava with Py-Qtz veinlet	1.4	662
9	MJTK-3	250.0	Pillow lava	1.5	1168
10	MJTK-3	290.8	Pillow lava with hematite veinlet	2.0	2980
11	MJTK-5	16.5	Massive basalt with calcite veinlet	3.1	4985
12	MJTK-5	39.8	Massive basalt with Py-Qtz veinlet	14.0	2121
13	MJTK-5	61.5	Massive basalt with Py-carbonate veinlet	* 52.6	* 234
14	MJTK-5	82.3	Massive basalt with Py veinlet	11.7	4025
15	MJTK-5	107.0	Massive basalt with calcite-Py veinlet	9.4	1337
16	MJTK-5	135.5	Massive basalt with Py veinlet	* 52.0	* 165
17	MJTK-5	150.3	Hyaloclastite with Py dissemination	* 15.1	616
18	MJTK-5	162.0	Hyaloclastite	1.2	4022
19	MJTK-5	182.1	Massive basalt with Py veinlet	1.9	8068
20	MJTK-5	200.0	Hyaloclastite	4.9	3656
21	MJTK-8	32.5	Massive basalt	1.4	2084
22	MJTK-8	63.5	Hyaloclastite	2.1	374
23	MJTK-8	82.0	Hyaloclastite	1.0	1020
24	MJTK-8	100.9	Hyaloclastite with hematite network	7.9	693
25	MJTK-8	119.0	Gray shale with patches of carboniferous material	3.9	94
26	MJTK-8	140.0	Black shale	4.0	159
27	MJTK-8	150.8	Black shale	7.2	115
28	MJTK-8	169.0	Pillow breccia (hyaloclastite part)	2.0	234
29	MJTK-8	178.0	Pillow breccia (massive part, hematite network)	2.7	8291
30	MJTK-8	195.0	Pillow breccia (massive part, hematite network)	1.0	2592
			Average value of massive basalt (6 pcs.)	6.9	3770
			Average value of pillow breccia (3 pcs.)	1.9	3705
			Average value of hyaloclastite (5 pcs.)	3.4	1730
			Average value of pillow lave (8 pcs.)	2.6	1159
			Average value of black shale (2 pcs.)	5.6	137

Samples with mark(*) were excepted to calculation of average.



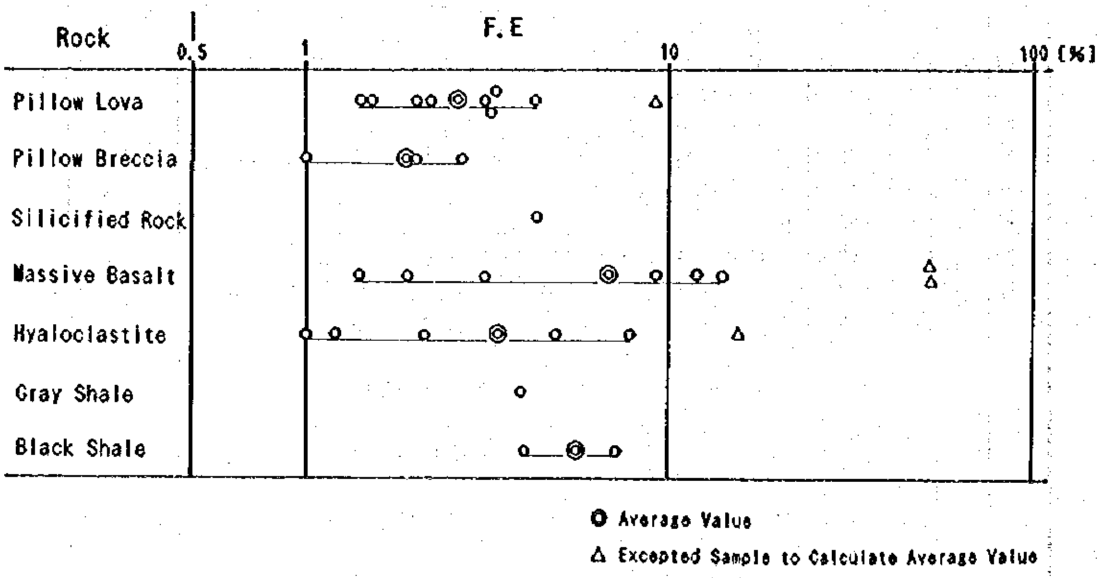


Fig. 2-12 Distribution of Physical Properties on Cores

2-6 Discussions

It is interpreted from the observation of drilling cores that sedimentary rocks of the Küre Formation consist of breccia containing allochthonous blocks as graywacke, and being filled by pelitic materials. A small block of basalt found in pelitic rock on the surface around MJTK-4. Pelitic rocks filling breccia have schistose texture and scaly cleavages.

From the above facts, it is inferred that these sedimentary rocks constitute a melange. Basalt is also inferred to be a constituent of the melange.

It is noted by the drilling carried out this year that a massive ore deposit was confirmed in MJTK-8 and network ores in MJTK-5.

MJTK-8 is located 300 m southwest of Bakibaba Deposit. Bakibaba is a massive ore deposit which occurs at the boundary between sediments and hyaloclastite, or within hyaloclastite. The deposit is irregularly elongated in the dip direction. The lateral shape of the deposit is oblong to circular and the dimensions are 40x70 m - 80x80 m. The dip is 50-60° and the length exceeds 130 m. Existence of massive deposit is confirmed by ETiBANK drilling in an area of 200x150 m south of Bakibaba Deposit. These data show that the core width of the orebodies are generally in the range of 10-30 m. MJTK-8 lies further southwest of these drilling sites.

The hanging wall of MJTK-8 massive orebody is massive basalt with almost no alteration and the footwall is argillized hyaloclastite. The contact between the ore and the basalt is through a fault. Alteration minerals such as chlorite, quartz, and siderite are observed in the hyaloclastite.

Boreholes nearby drilled by ETiBANK have argillized zone in the overlying unit and leached silicified zone in the underlying unit. Limonite dissemination-network zone occurs in parts of the overlying unit. If these are the results of alteration associated with the formation of the massive deposits, it may be significant that the massive deposits to the south of Bakibaba are accompanied by alteration zones on both overlying and underlying formations, which is different from that of Aşiköy.

The depth of the orebody confirmed at MJTK-8 and that of the low resistivity zone by CSAMT agrees quite well. But the orebody in MJTK-8 is not sufficiently thick to cause such low resistivity. Therefore, the existence of larger orebody in the vicinity is anticipated.

The argillization similar to that observed in the hyaloclastite under the orebody at MJTK-8 also occurs in the basalt in MJTK-3 (near 145 m) north of the Bakibaba Deposit. The fact that similar argillization occurs at; MJTK-8, deposit to the south of Bakibaba and at MJTK-3 which is located on the extension of the line joining the above two deposits and Bakibaba, is interpreted to indicate the possibility of massive ore deposit occurrence near MJTK-3.

Limonite network and dissemination are widely developed near the Bakibaba Deposit. The past exploration of this area has covered only a limited area and depth, aggressive exploration covering a wide area is desired. The massive deposit confirmed at the south of Bakibaba is accompanied by a silicified zone immediately below the orebody. Noting this characteristic, the silicified zones of Mt. Bakibaba to the north of Bakibaba Deposit and Mt. Karacakaya between the Bakibaba and Kızılsu Deposits will be targets for exploration.

The mineralized zone of MJTK-5 consists of veinlets and network. The major ore mineral is pyrite accompanied by small amounts of chalcopyrite and hematite, and minor content of sphalerite. This zone is believed to be the veinlets-network of the footwall from the relationship with the Aşıköy massive deposit.

In the target of MJTK-2, namely the low resistivity zone to the south of Aşıköy Deposit, it was anticipated that massive orebodies would occur in the shallow parts due to displacement by a fault. The result of the survey indicate that this low zone represents pelitic rocks and fault fractured zone. The strong low resistivity anomalies of Aşıköy Deposit and to the southeast is now considered to indicate, aside from known deposits, zones dominated by pelitic rocks and/or fractured zones. This is the interpretation of MJTK-1, -7 of last year and of the drilling this year. Therefore, it is believed that the possibility of the existence of massive orebodies of the scale of Aşıköy Deposit is low.

In MJTK-3 and -8, many fault fractured zones and fault clay were observed. The Küre Formation, host of known deposits is interpreted to be melange, and all constituent rocks, namely breccia and basalt could be displaced by faults.

For MJTK-8 or Bakibaba Deposit which are accompanied by basalt both for hanging and foot wall, it was not possible to determine whether the basalt was displaced to both sides of the deposit after the ore formation, or there were igneous activities covering the orebody at the time of ore formation.

The distribution of basaltic rocks of this area can be interpreted as having imbricate structure elongated in the NNW-SSE direction. They are divided largely into, from the west, basalt hosting Aşıköy Deposit, Aşıköy East basalt, that hosting Bakibaba and Kizilsu Deposits, that hosting Zemberekler Deposit, and Fareast basalt. These are all regarded to be footwall basalt or that hosting ore deposits.

Aşıköy and Toykondu Deposits have altered hyaloclastite or vein network for footwall and black shale for hanging wall. They are considered to have retained the stratigraphic sequence of the time of ore formation. On the other hand, vein network and dissemination is situated over the orebody at Bakibaba Deposit and overturned structure in the vicinity is inferred. The main orebody of Kızılsu Deposit is believed to be the vein network of the footwall side.

From the above, it is concluded that the gossan which is exposed between Bakibaba and Kızılsu Deposits is most probably the altered product of the mineralized zone on the footwall side. There are localities where the footwall basalt has separated from the massive orebody and the altered zone is not exposed on the surface. Thus dense drilling, similar to the vicinity of the deposits, is desirable for the zone between the two deposits.

PART 3 CONCLUSIONS AND RECOMMENDATIONS

PART 3 CONCLUSIONS AND RECOMMENDATIONS

CHAPTER 1 CONCLUSIONS

Drilling survey was conducted in the Küre Zone. The major objective of this phase was to clarify the conditions of subsurface copper mineralization in this zone. Following conclusions are obtained as the results of the third phase work.

(1) Drilling in this phase resulted in locating a massive ore with the drilled length 75 cm long and 4% Cu grade at the area to the southwest of the Bakibaba Deposit. The location and depth of ore correspond a weakly low resistivity zone defined by CSAMT. The characteristic of ore is similar to that of the known ore deposits. The potential of the Cyprus-type was confirmed by the drilling.

(2) A low resistivity zone obtained at the north of Bakibaba Deposit by CSAMT consists of basalt. Veinlets composed mainly of pyrite were observed in this zone. The lithology and mineralization of this hole are considered not to cause this low resistivity. Argillization similar to that observed in the above mentioned drill hole occurs in this hole. Thus, the area in the vicinity of this hole is promising for the future exploration.

(3) In the target of MJTK-2, namely the low resistivity zone to the south of Aşiköy Deposit, it was anticipated that massive orebodies would occur in the shallow parts due to displacement by a fault. The results of the survey in the second and this phase indicate that this low resistivity zone represents pelitic rocks and fault fractured zone. Therefore, it is considered that the possibility of the existence of massive orebodies of the scale of Aşiköy is low. The existence of massive orebodies expected to occur in the deep parts could not examine due to the shortness of the drilling length.

(4) A low resistivity zone located between Aşiköy and Toykondu Deposits is interpreted to be the network in the footwall of massive ores from the relationship with the Aşiköy massive deposit.

(5) The results of the measurement of physical properties on cores in this phase were harmonious with those on surface rock samples conducted in the first phase. It was confirmed that massive sulfide, black shale and some sandstone had low resistivity. Based on the measurement on cores in this phase, it is possible that pyrite dissemination or argillization of basalt may become low resistivity zone.

(6) On the basis of the results of drilling survey done in the past two years, the low resistivity anomalies by CSAMT are considered to indicate zones dominated by

pelitic rocks and/or fractured zones aside from some ore deposits. From the results of physical properties measurement in the first and this phase, it have been proved that massive ore, sulfide network, black shale and some sandstone cause low resistivity anomalies. Therefore, the suitable method for the exploration in this zone is the IP survey. As the size of known massive orebodies is small except Aşiköy Deposit, it is necessary to conduct such IP survey that has the line and station allocation of short distances. A much denser drilling is also necessary for this deposit.

(7) Limonite network and dissemination are widely developed near the Bakibaba Deposit. The past exploration of this area covered only a limited location and depth. An aggressive exploration covering a wide area is necessary.

(8) The massive deposit confirmed at the south of Bakibaba Deposit is accompanied by a silicified zone. Noting this characteristic, the silicified zones of Mt. Bakibaba to the north of Bakibaba Deposit and Mt. Karacakaya between the Bakibaba and Kizilsu Deposits will be targets for exploration.

(9) Vein network and dissemination occur over the orebody at Bakibaba Deposit. Overturned structure is inferred in the surrounding area. The main orebody of Kizilsu Deposit is believed to be the vein network in the footwall side of the orebody.
On the basis of the above evidence, it is concluded that the gossan which is exposed between Bakibaba and Kizilsu Deposits is most probably the altered products in the footwall side of the mineralized zone.

CHAPTER 2 RECOMMENDATIONS FOR THE FUTURE EXPLORATION

It is recommended that drilling exploration should be carried out in the following localities for the purpose of clarifying the conditions of subsurface copper mineralization.

(1) Detailed drilling survey in the vicinity of MJTK-8, the south and the north of Bakibaba Deposit

(2) An area between Bakibaba and Kizilsu Deposits

(3) An area from the east of Bakibaba Deposit to Zemberekler mineralized zone

IP survey is recommended to carry out over the low resistivity zones by CSAMT, where have not been explored by drilling in this study.

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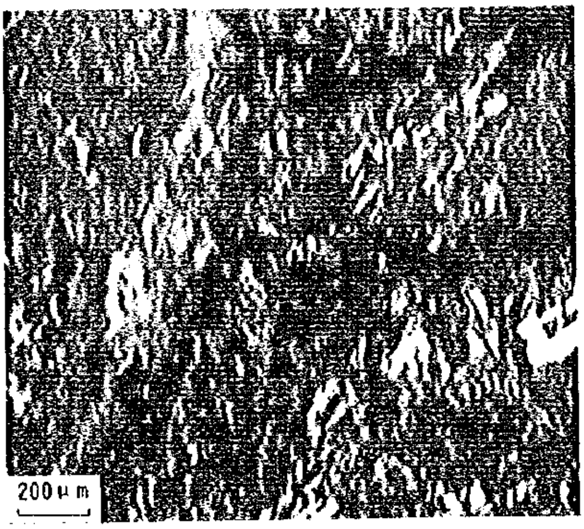
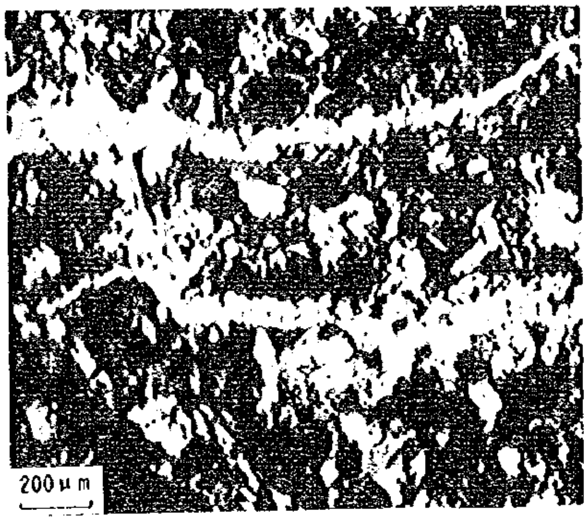
Photographs



(Cross Nicol)

Rock Name : Altered Basalt
with Siderite Veinlet

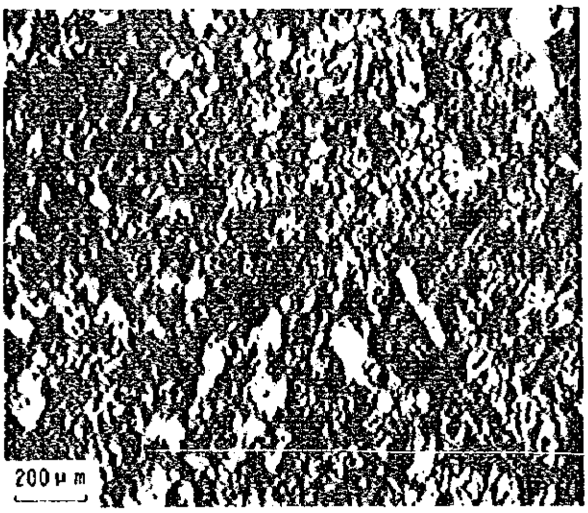
Location : MJTK-3 17.1m



(Cross Nicol)

Rock Name : Altered Basalt
(Chloritized, Silicified)
with Carbonate veinlet

Location : MJTK-5 79.4m

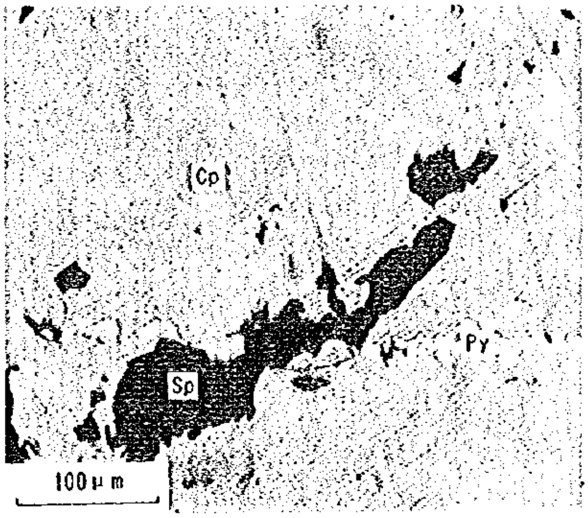


(Cross Nicol)

Rock Name : Altered Pillow Lava
(Chloritized, Silicified, Opaque Mineral)

Location : MJTK-5 97.5m

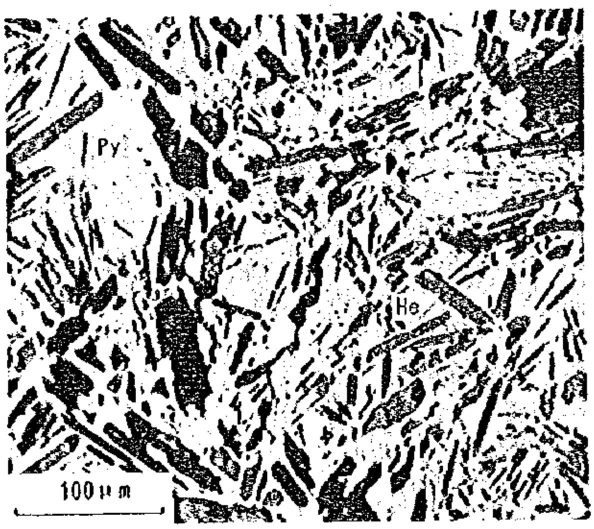
Photo. 1 Photomicrographs of Thin Sections



(Open Nicol)

Sample Name : Chalcopyrite-Pyrite-Sphalerite Vein

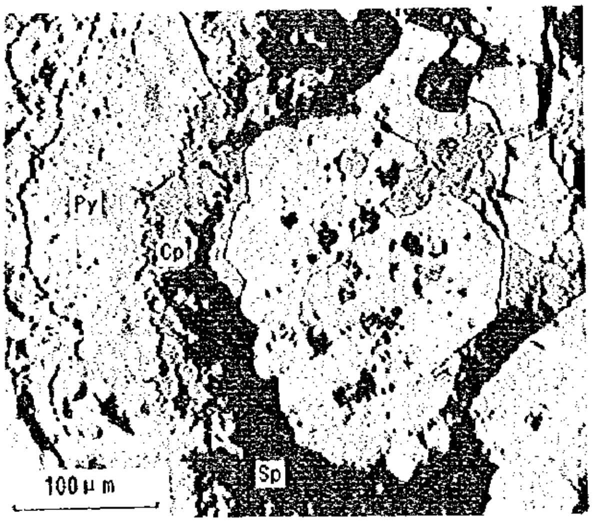
Location : MJTK-5 59.2m



(Open Nicol)

Sample Name : Pyrite-Hematite Vein

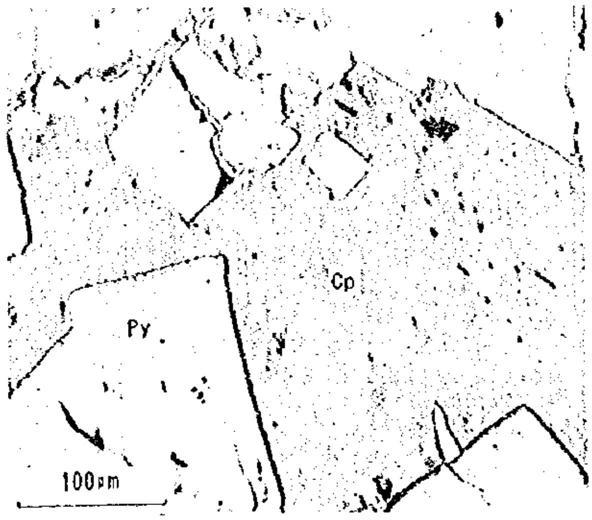
Location : MJTK-5 123.2m



(Open Nicol)

Sample Name : Massive Ore

Location : MJTK-8 95.6m



(Open Nicol)

Sample Name : Massive Ore

Location : MJTK-8 95.6m

Photo. 2 Photomicrographs of Polished Sections

JICA