THE REPUBLIC OF TURKEY
REPORT ON
THE MINERAL EXPLORATION
OF KÜRE AREA
PHASE 1
MARCH 1993
JAPAN INTERNATIONAL COOPERATION AGENCY
METAL MINING AGENCY OF JAPAN

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PREFACE

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

The JICA and MMAJ sent a survey team headed by Mr. Hisashi Mizumoto to the Republic of Turkey from 29 June to 26 September 1992.

The team exchanged views with the officials concerned of the Government of the Republic of Turkey and conducted a field survey in the Küre area. After the team returned to Japan, further studies were made and the present report is the result.

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

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

December 1992

Kensuke YANAGIYA
President,
Japan International Cooperation Agency

Takashi ISHIKAWA
President,
Metal Mining Agency of Japan

Summary

Geoscientific and resources information and data acquired through previous geological, geochemical, and geophysical surveys of the Küre Area were made available to the survey team. They were analyzed and interpreted. The results formed the basis in planning and implementing the geological and geophysical field survey of the first year of the project.

Geological reconnaissance survey was carried out covering 559km^2 in the Taşköprü Zone and 66km^2 in the Dikmendağ Zone and the results are expressed in 1/50,000 scale geological maps. Several promising mineral prospects were extracted from the above survey and a total of 4km^2 was geologically surveyed in semi-detail at Cozoğlu, Cünür, and Alayürek of Taşköprü Zone, and also 2km^2 at Masköy of Dikmendağ Zone. The results of the semi-detailed survey are shown in 1/5,000 scale geological maps. There is an operating mine at Küre Mining Zone with promising mineral prospects and thus similar semi-detailed survey was carried out over 22km^2 of that zone.

In geophysical prospecting, 513 stations were measured by CSAMT method and 4 line-km by IP method in the Küre Mining Zone. The method employed was CSAMT array with 400 measurements in the east-west direction transecting the ore deposit and 113 measurements set randomly outside of the above traverse. IP was applied in order to assess the CSAMT anomalies.

In the Taşköprü Zone, Çangal Meta-ophiolite of pre-Lias time is dominant, and the mineral prospects occur in the basalt and green schist. The mineralizations accompanied by silicification and argillization. In the Küre Mining and Dikmendağ Zones, ore deposits and prospects were found in the basaltic rocks of the Lias Series. Although different in age, possible ophiolite-related mineralization are Besshi-type metamorphic deposit in the Taşköprü Zone, and Cyprus-type massive deposit in the Küre Mining and Dikmendağ Zones.

The lowermost geologic units of this area are Paleozoic Devrekani Metamorphics and the overlying Pre-Lias Çangal Meta-ophiolite. The former unit consists of gneiss and the latter mainly of metamorphic rocks of mafic igneous origin. These metamorphic bodies occur in the Taşköprü Zone. Mineralization of copper is observed in the meta-ophiolite.

The formations of the Lias Series are the Küre Formation of the Küre Mining and Dikmendağ Zones, and the Kayadibi Formation of the Taşköprü

Zone. They comprise mafic basaltic rocks and sandstone-shale alternations. The presently operating Küre Mine and the prospects in the vicinity are all hosted by the basaltic rocks (hyaloclastite) of the Küre Formation.

During the Dogger Epoch in Middle Jurassic, intrusive activities took place and this became the site of limestone and flysch-type deposition. Strong tectonic movements occurred in this area and E-W and N-S system faults are dominant together with branch faults of the NE-SW and NW-SE system. Many of the fold structures have E-W trending axis in line with the general regional trend.

Küre Mine operated by Etibank is located in the central part of the survey area. The mineralization is massive cupriferous pyrite type. Lias sedimentary rocks such as sandstone, pelitic rocks, and conglomerate occur together with mafic submarine volcanic rocks and pillow basalt. The hanging wall is dominantly black shale with flysch-type sediments in the higher horizons. The intrusive bodies near the deposit consist of serpentinized ultramafic rocks, gabbro, and diorite. These are called Küre Ophiolite. From these characteristics, this mineralization is considered to be of Cyprus-type.

In the Küre Mining Zone, the Lias Series, the host formation of the ore deposits, is very well developed and copper mineral showings are found in many localities. These have been explored in the past, but notable ore-bodies have not been found with the exception of the Küre Deposit. Copper showings are known to occur in several localities in the green metamorphic rocks of the Taşköprü Zone.

The Küre Mine comprises Aşıköy-Toykondu, Bakibaba, and Kızılsu Deposits. The Aşıköy is a large orebody and the upper part is being mined by open pit method and preparations are underway for tunneling of the lower parts. The Bakibaba and Kizilsu are small deposits and the high-grade parts are being mined by sub-level method. There is a stock of more than 2 million tons of slag from smelting in the Roman period near the Bakibaba Deposit. The slag contains gold, copper, and cobalt. Since the start of mining as the Küre Mine of Etibank, the Aşiköy produced 3 million tons of ore and there are, at present, ore reserves of 12 million tons. Bakibaba was mined by K.B.I. (Black Sea Mining Co.) until it merged with Etibank last year (1991) with a total production of 800 thousand tons. The remaining ore reserves are said to be 800 thousand tons.

The results of the past exploration and the present survey indicate that:

1. Cyprus-type deposits related to the Jurassic mafic rocks in the Küre Formation which extends in the east-west direction around the Küre Mine.

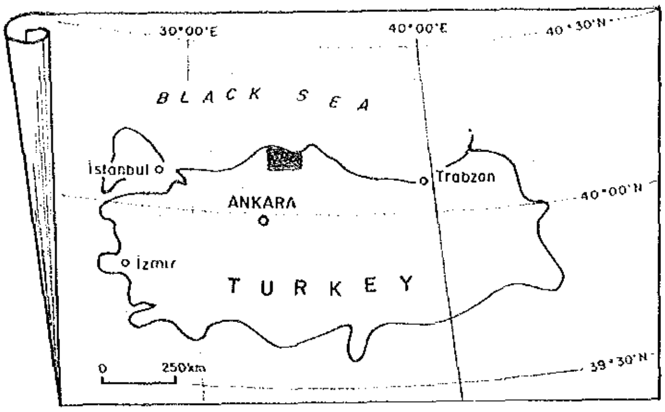
2. Metamorphosed Besshi-type deposits in the Çangal Meta-ophiolite which extends in the east-west direction in the Taşköprü Zone with sporadic distribution of slag heaps and copper showings.

are the type of mineralization which would be the target of future exploration activities.

The following localities were extracted as being promising for metallic exploration as the result of the geological and geophysical survey of the first phase. It is recommended that geological survey, geophysical prospecting, and drilling be conducted in these localities in accordance with the conditions of each site.

Zone	Promising Localities	Geochemical Survey	Geophysical Prospecting	Drilling Survey
Küre Mining	Southern Part of Aşıköy Orebody			Reco
	Vicinity of Entrance to Gallery 920ML			Reco
	North and South of Bakibaba Deposit			Reco
	South of İpsinler Mineralized Zone.		Reco	
	Zemberekler and Kızılsu Deposits			Reco
Taşköprü	Cozoğlu Mineralized Zone		Reco	
	Cünür Mineralized Zone	Reco	Reco	
	Alayürek Mineralized Zone	Reco		
Dikmendağ	Distribution Area of Basic Rock	Reco ?	Reco	
Distribution Area of Ophiolite		Reco		

Reco:recommendation



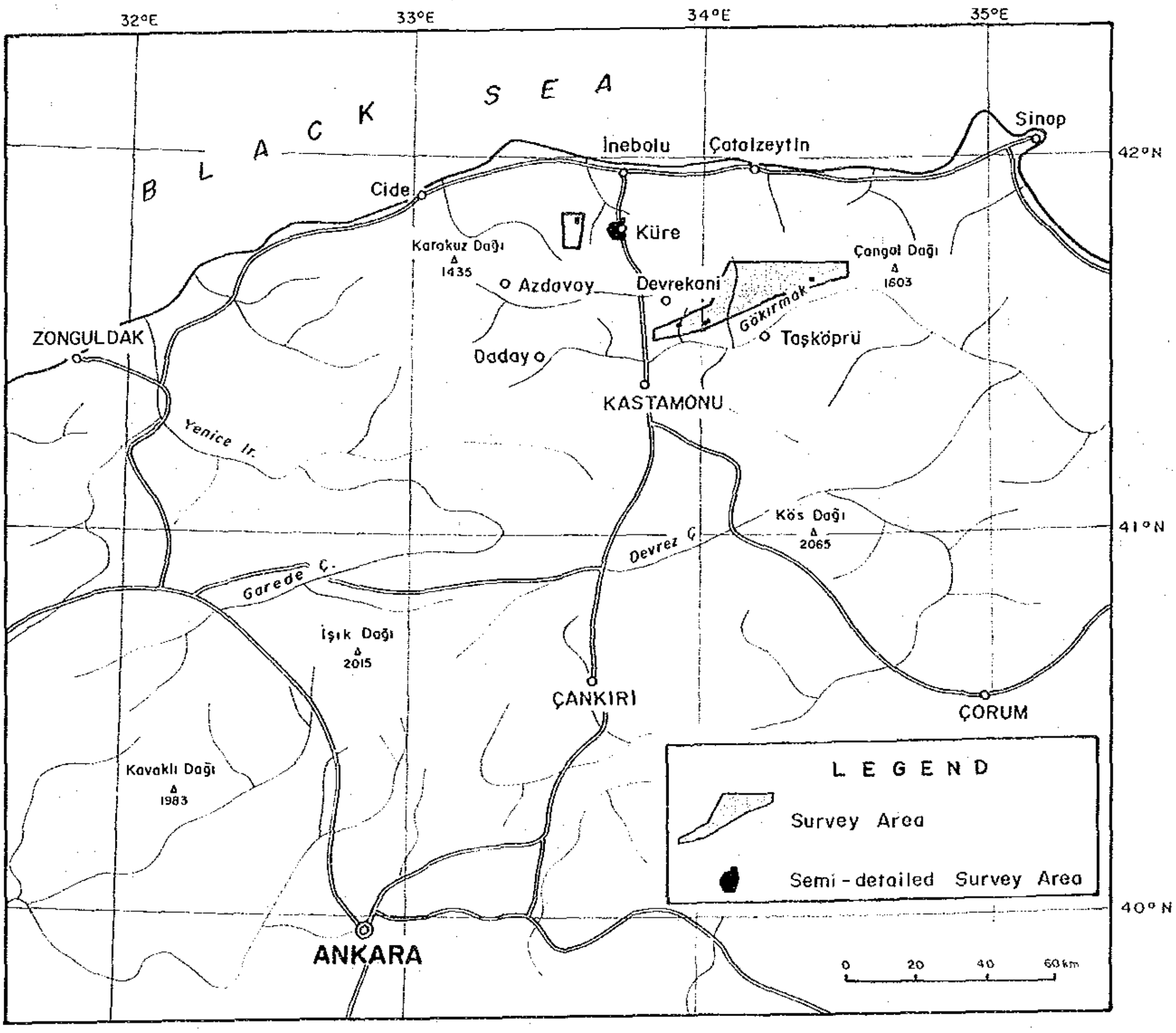


Figure 1-1 Index Map of the Survey Area

CONTENTS

PART 2 COMPILE OF PREVIOUS SURVEY

PART 3 KÜRE MINING ZONE

PART 4 TAŞKÖPRÜ ZONE

PART 5 DIKMENDAĞ ZONE

PART 6 CONCLUSIONS AND RECOMMENDATIONS

Photographs

FIGURES

TABLES

PLATES

PART 1 OVERVIEW

PART 1 OVERVIEW

CHAPTER 1 INTRODUCTION

1-1 Background and Objective of the Survey

The survey was conducted with the purpose of clarifying the metal deposits and of assessing the metallic resource potential of the Küre Area. Prior to the field survey, data related to previous work (data compile) were studied, and Landsat image analysis of an area of 7,700km^2 was carried out. As a result of these studies, three promising Zones, Küre, Taşköprü and Dikmendağ, were delineated for field work of the first phase. Reconnaissance and semi-detailed surveys were conducted in these zones.

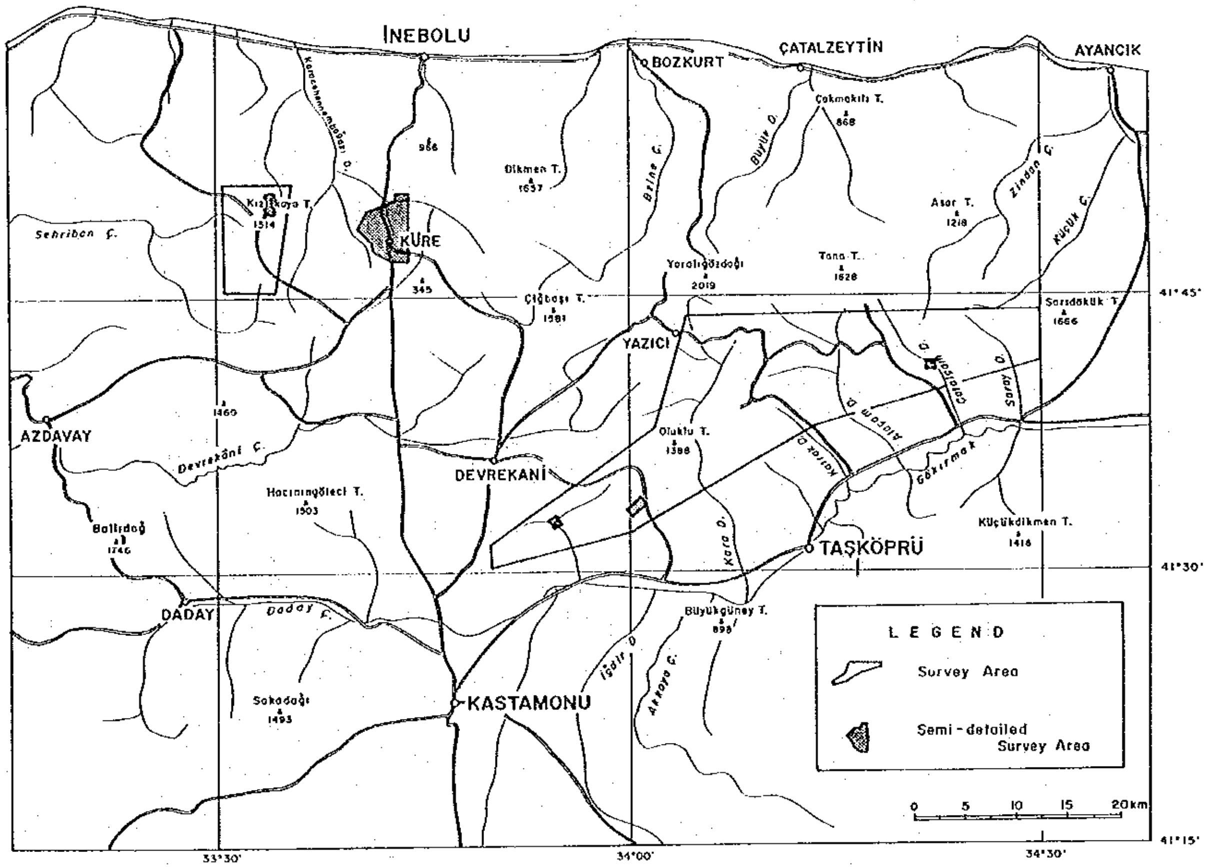


Figure 1-2 Location Map of the Küre Area

1-2 Areal Extent and Work Operation of the First Phase Survey

1-2-1 Coordinates and Contents of the Survey Areas

The localities surveyed during the period of this report is shown in Figures 1-2, 1-3 and 1-4. The survey contents and laboratory studies are shown by Tables 1-1, 1-2 and 1-3.

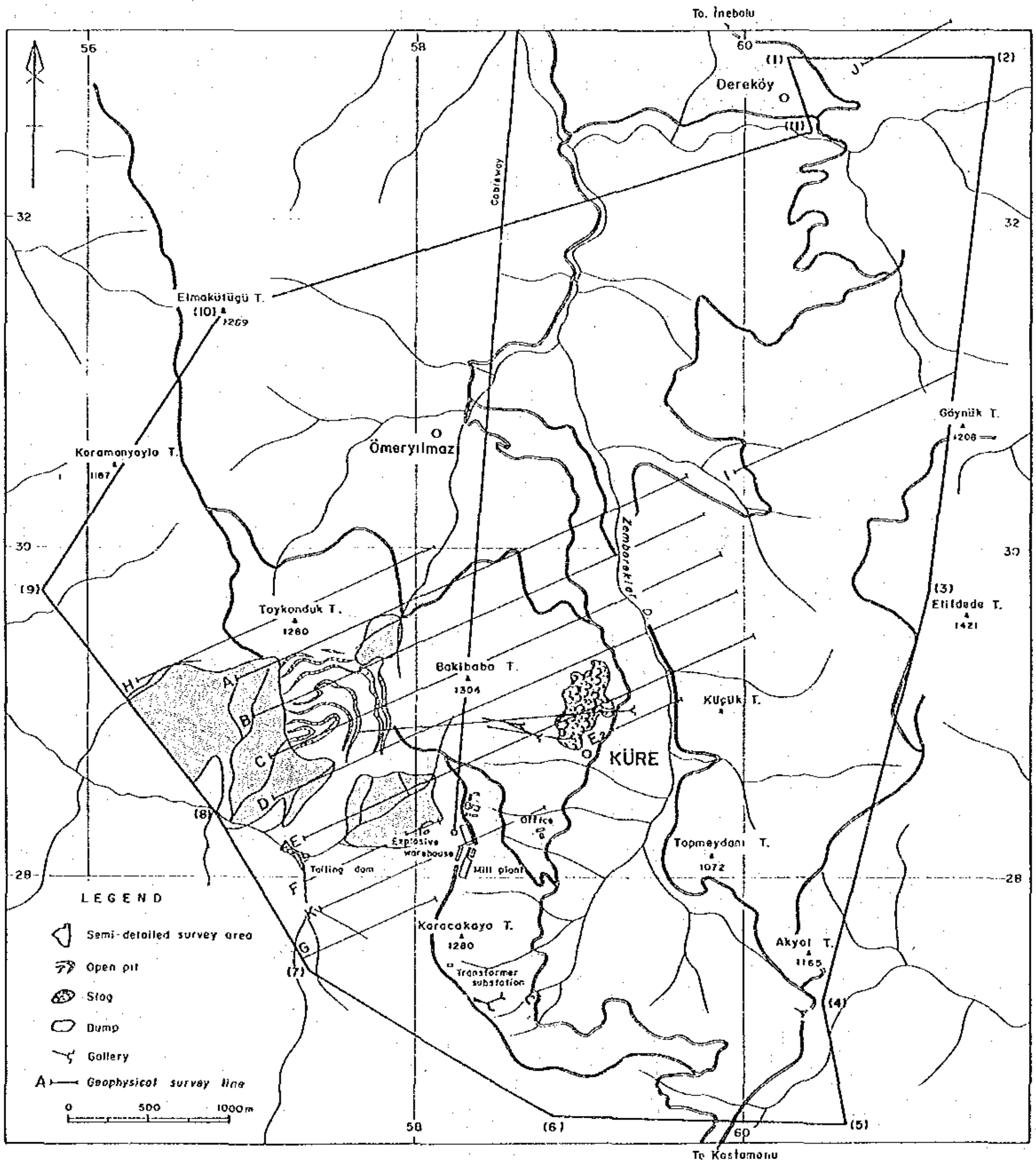


Figure 1-3 Location Map of the Küre Mining Zone

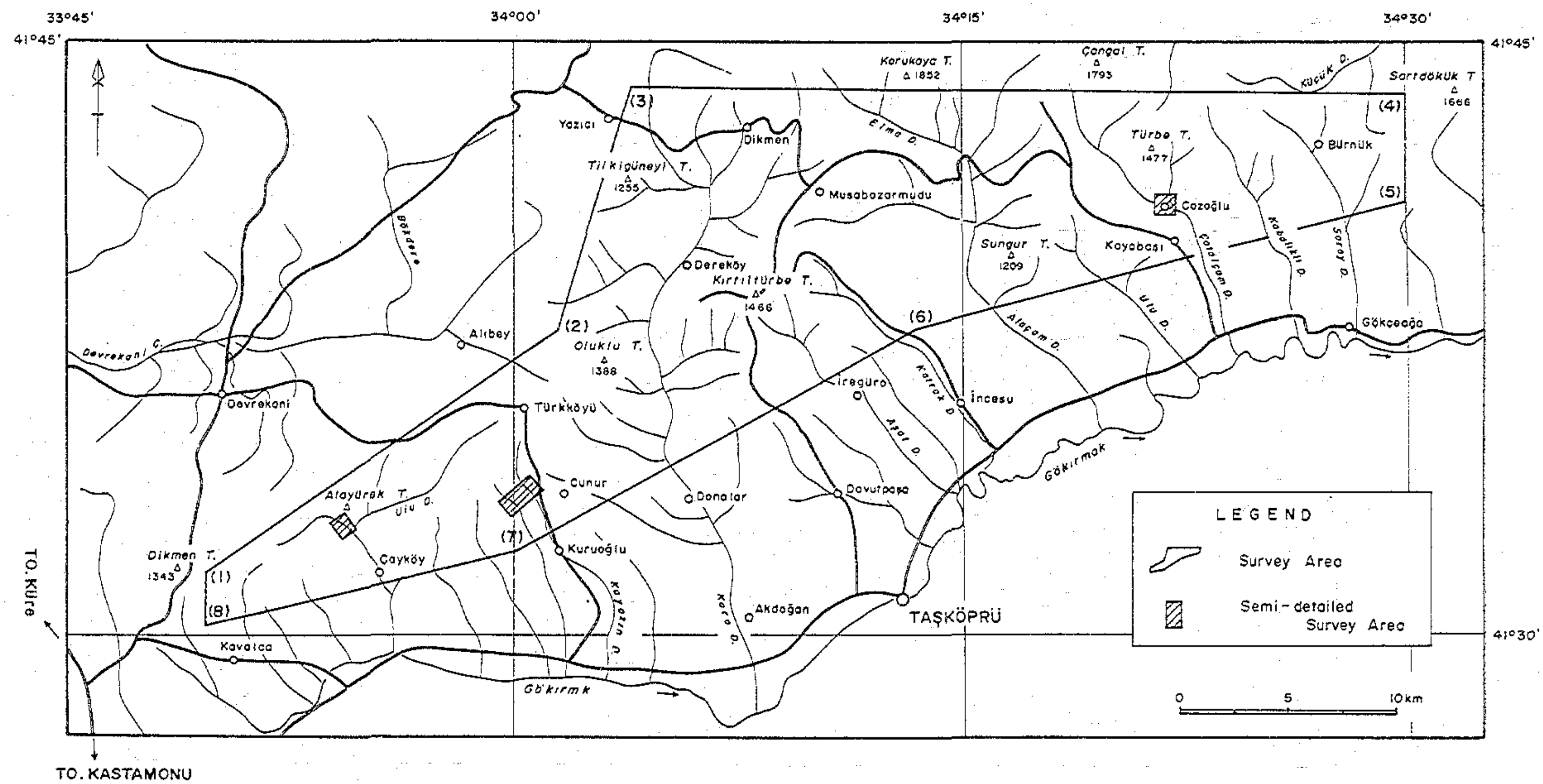


Figure 1-4 Location map of the Taşköprü Zone

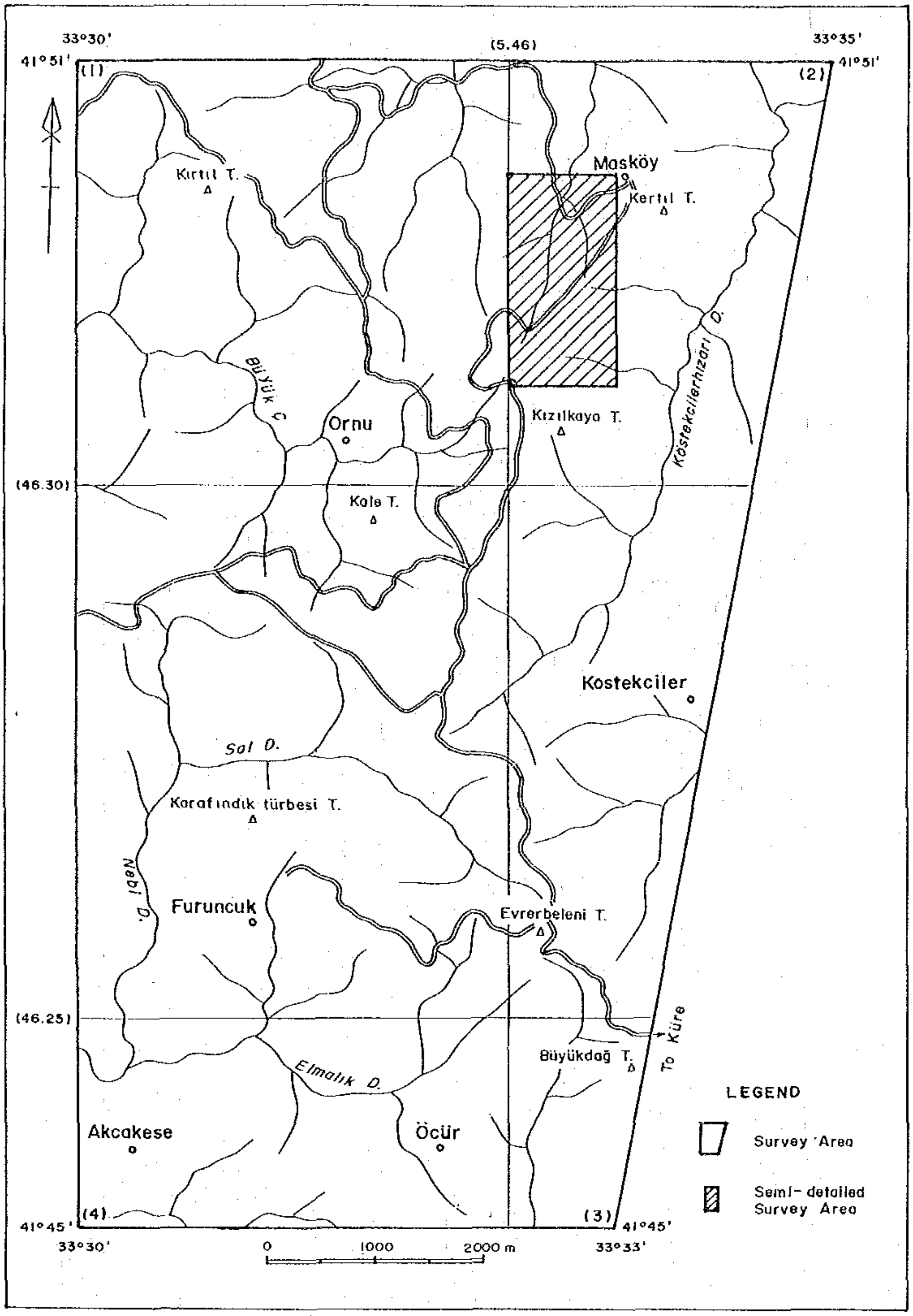


Figure 1-5 Location Map of the Dikmendağ Zone

Table 1-1 Coordinates of Survey Areas

Reconnaissance Areas

Survey Area		Latitude	Longitude		Latitude	Longitude
Taşköprü Zone	1	41°31.63'	33°49.63'	2	41°37.50'	34°01.07'
	3	41°43.85'	34°03.77'	4	41°43.65'	34°30.00'
	5	41°40.77'	34°30.00'	6	41°37.50'	34°13.27'
	7	41°31.55'	34°00.00'	8	41°30.17'	33°49.63'
Dikmendağ Zone	1	41°51.36'	33°30.36'	2	41°51.34'	33°35.42'
	3	41°45.41'	33°33.92'	4	41°45.42'	33°30.31'

Semi-detailed Areas

Survey Area		Latitude	Longitude		Latitude	Longitude
Küre Mining Zone	1	41°50.77'	33°43.58'	2	41°50.77'	33°44.48'
	3	41°49.00'	33°44.17'	4	41°47.62'	33°43.68'
	5	41°47.26'	33°43.78'	6	41°47.25'	33°42.50'
	7	41°47.73'	33°41.40'	8	41°48.27'	33°40.98'
	9	41°49.00'	33°40.25'	10	41°49.92'	33°41.05'
	11	41°50.48'	33°43.67'			
Masköy of Dikmendağ	1	41°50.80'	33°33.22'	2	41°50.80'	33°33.95'
	3	41°49.70'	33°33.95'	4	41°49.70'	33°33.22'
Alayürek of Taşköprü	1	41°32.78'	33°53.78'	2	41°33.01'	33°54.32'
	3	41°32.75'	33°54.80'	4	41°32.38'	33°54.27'
Cünür of Taşköprü	1	41°33.32'	33°58.42'	2	41°34.05'	33°59.48'
	3	41°33.63'	33°59.97'	4	41°32.92'	33°58.90'
Cozoğlu of Taşköprü	1	41°41.01'	34°21.53'	2	41°41.01'	34°22.27'
	3	41°40.58'	34°22.27'	4	41°40.58'	34°21.53'

Table 1-2 Survey Contents

Survey	Localities	Type of Survey	Amount
Geological	Küre	semi-detailed	22 km^2
	Taşköprü	reconnaissance	559 km^2
		semi-detailed	4 km^2
	Dikmendağ	reconnaissance	66 km^2
		semi-detailed	2 km^2
Geophysical	Küre	CSAMT	513 point
		IP method	4 km

Table 1-3 Laboratory Studies

Type of Study	Amount
Ore Grade Analysis (Au,Ag,Cu,Pb,Zn,Co,S)	124 pcs
Whole Rock Analysis	30 pcs
Thin Section	137 pcs
Polished Section	60 pcs
EPMA	7 pcs
S-Isotope	7 pcs
X-ray Diffraction	12 pcs
Rock Resistivity and Polarization	43 pcs

1-2-2 Priority Activities of the Survey

(1) Geological Survey

The following problems and items were the priority activities during the first phase survey.

Collection of basic rocks and mineralized samples with emphasis on delineated altered and mineralized zones.

Relationship between ophiolites and mineralization.

Extent of mineralization at depth.

Determination of geophysical anomalous zones and clarification of their characteristics.

(2) Geophysical Prospecting

The individual line length and measuring points of the Küre Mining Zone are as follows:

Method	Line Name	Length(m)	Number of Points
ARRAY CSAMT	A	3,000	60
	B	3,000	60
	C	3,000	60
	D	3,000	60
	E	3,000	60
	F	900	18
	G	900	18
	H	2,000	40
	I	600	12
	J	600	12
RANDOM CSAMT			113
IP	DD	1,000	30
	II	1,500	55
	K	1,500	55

The following specifications were applied for these prospectings.

Array CSAMT Method
- a) Spacing of measuring point:50m
- b) Frequency:4 Hz-2,048 Hz
- c) Transmitting Dipole:1,900m
- d) Maximum Current:11 amp

IP Method
- a) Electrode Configuration:Dipole
- b) Electrode Spacing:100m, horizontal
- c) Frequency:0.3 and 3 Hz
- d) Electrode Separation Coefficient:1-5

Laboratory rock measurements were conducted with the same frequencies on representative rock and ore samples collected in the field. Forty three samples were measured.

1-3 Members of the First Phase Survey

(1) Mission for Project Finding

From 10 December 1991 to 18 December 1991

Turkish Members

Cumhur YILDIZ	Planning and Coordination Department
Sadık KAFADAR	Planning and Coordination Department
Ahmet ÜNSAL	Mineral Exploration Department

Japanese Members

Nobuyuki MASUDA	Metal Mining Agency of Japan (MMAJ)
Naotaka ADACHI	Metal Mining Agency of Japan (MMAJ)

(2) Mission for Scope of Work

From 7 March 1992 to 17 March 1992

Turkish Members

Taşkın AKDENİZ	General Manager, Etibank
N.Kemal ATALAN	Assistant General Manager
Ergün GÜRCAN	Head of Mineral Exploration Department
Cumhur YILDIZ	Ass. Director of Planning and Coordination Department

Japanese Members

Yasuo NOGUCHI	Metal Mining Agency of Japan
Norio NAKANO	Ministry of Foreign Affairs
Masahiko NISHITOH	Ministry of International Trade and Industry
Masamichi MAEJIMA	Japan International Cooperation Agency
Nobuyuki MASUDA	Metal Mining Agency of Japan (MMAJ)
Tetsuo SUZUKI	Metal Mining Agency of Japan (MMAJ)
Naotaka ADACHI	Metal Mining Agency of Japan (MMAJ)

(3) Coordinators of MMAJ and Survey Team

From 11 July 1992 to 18 July 1992 :Nobuyuki OKAMOTO

From 9 September to 17 September 1992 :Takafumi TSUJIMOTO

:Kazuko MATSUMOTO

Survey Team: Geological and Geophysical Surveys:June 30-September 23

(4) Members Participating in the Project

Turkish Side

Assistant General Manager İbrahim BOZAN

Planning and Coordination Department

Director Ayhan ALP

Mining Engineer Sadık KAFADAR

Mineral Exploration Department

Director Ergün GÜRCAN

Küre Mine

General Manager Kemal Aydın ÇELİK

Deputy Manager Fuat ATALAY

Deputy Manager Mehmet ZENGİN

Deputy Manager İrfan ŞİŞMANOĞLU

Survey Members of Etibank

Coordinator Ahmet ÜNSAL

Geologist Latif YİĞİT

Geologist Necmettin ÇELİK

Geologist Mürsel ÖZTÜRK

Geophysicist Tayfun AKKUŞ

Geophysicist Orhan ERSÖZ

Japanese Side

Metal Mining Agency of Japan

Coordinator Takafumi TSUJIMOTO

Coordinator Kazuko MATSUMOTO

Coordinator Nobuyuki OKAMOTO

Survey Members of NED

Team leader Hisashi MIZUMOTO

Geologist Yoneharu MATANO

Geologist Kenji SATO

Geologist Kazuyasu SUGAWARA

Geophysicist Masao YOSHIZAWA

Geophysicist Ikuo TAKAHASHI

Geophysicist Shinichi SUGIYAMA

CHAPTER 2 GEOGRAPHY

2-1 Location and Access

The Küre mining district is in Küre County, Kastamonu Province, about 255 km from Ankara. Kastamonu is the capital of the province and is the largest city in the northern Anatolia. Küre mine is located approximately 60km north of Kastamonu and about 300km west of the largest city in Turkey, İstanbul. The coordinates of 41°41' north and 33°42' east are near its center. The population of Kastamonu city is about 50,000. Taşköprü is the second largest city of the Kastamonu Province, and its population is more than 20,000, and population of Küre town is about 4,000. Besides, small villages are scattered in the area.

By road, the distance from Ankara to Küre is approximately 300km through Çankırı and Kastamonu, long-distance bus takes 5 hours. The survey area is under the jurisdiction of Küre Mine which has the second most productive copper district in the Republic Turkey.

Main roads are almost totally paved. There are automobile roads which connects the major highways and the villages. These roads are unpaved, accessible but become very bad roads in the winter because they are not gravel roads, in the wet season they become extremely muddy. The major highway between Ankara and İnebolu via Kastamonu is paved and the about 240km can be covered by car in about four hours. The base camp of the first phase survey was set in Küre mine and the field work for Taşköprü and Dikmendağ was conducted by using rent a car for transport from Küre mine. The travel time from Küre mine to Taşköprü was one and half hours, to Dikmendağ one hour.

2-2 Topography and Drainage

2-2-1 Topography

The Küre Area located in the northern part of Anatolia plateau is bound to the north by Black Sea, to the west by Karakuz Mountain (highest peak 1,435m), to the east by Çangal Mountain (highest peak 1,605m), and to the south by the northern Anatolia Fault extending in E-W direction. Within the Landsat images used, the highest peak of the area is the Kös Mountain with elevation of 2,065m which is located near the southernmost part of the survey area.

As the survey Area is in the central Pontids Mountains the terrain is mountainous, with narrow valleys and moderately sharp ridges. The elevation range from 650m, in the gorge of the Zemberekler River on the küre mining area to 1,304m, Bakibaba Mountain. There are many villages in the flat area below 600m elevation and vegetables and fruits are actively cultivated. Above 1,000m in the higher lands, cultivation of wheat and cattle raising are very active.

2-2-2 Drainage

Küre and Dikmendağ areas are located in the upstream part of Karacehennemboğazı River which flows into the Black Sea. Taşköprü area is in the upstream part of the Gökırmak System which flows into Taşköprü basin and into the Black Sea. All of these rivers flow during the snow-melting season in early spring, but otherwise are dry.

2-3 Climate and Vegetation

2-3-1 Climate

Because of the survey area with fairly high elevation, the weather fluctuates rapidly and temperature range from very cold to hot. The area is generally cold about eight months of the year, and the winters are quite snowy. The summers are delightfully warm, and occasionally hot, and blanketing fog or brief showers are not uncommon. It is inferred that the annual precipitation of the Küre mining area amount to more than 600 mm and the annual average temperature is cool at 10°C, but since it is in higher latitude. The monthly average temperature and precipitation published by the Kastamonu and İnebolu Meteorological Stations are as follows.

Table 1-4 Average Monthly Temperature of İnebolu

1990

Month(°C)	Jan	Feb	Mar	Apl	May	June	July	Aug	Sep	Oct	Nov	Dec	Annual
Max.	16.6	15.2	18.1	20.7	28.8	32.0	38.8	34.2	30.0	24.2	18.8	17.6	
Min.	-1.7	-2.2	-0.2	1.4	5.4	12.3	14.6	13.3	11.0	2.0	-2.4	-5.8	
Average	7.9	6.7	9.3	11.5	16.8	22.7	26.8	25.5	20.8	14.8	7.7	6.9	14.8

1991

Month(°C)	Jan	Feb	Mar	Apl	May	June	July	Aug	Sep	Oct	Nov	Dec	Annual
Max.	13.7	17.4	19.5	24.3	26.6	32.2	32.8	33.5	30.0	25.8	21.8	16.0	
Min.	-4.0	-4.7	2.0	8.0	5.6	12.0	16.4	14.6	13.2	6.4	-2.7	-4.0	
Average	4.4	2.1	10.1	15.2	16.7	21.3	24.6	24.9	21.0	14.8	9.7	7.4	14.4

1992

Month(°C)	Jan	Feb	Mar	Apl	May	June	July	Aug	Sep	Oct	Nov	Dec	Annual
Max.	14.1	19.6	21.3	23.0	30.2	36.0	34.0	34.3					
Min.	-4.1	-1.1	-1.3	3.8	3.4	8.6	16.7	15.8					
Average	4.8	7.3	9.6	13.4	17.0	21.6	25.4	24.6					

Table 1-5 Monthly Precipitation of İnebolu

	Jan	Feb	Mar	Apl	May	June	July	Aug	Sep	Oct	Nov	Dec	Annual
1990 (mm)	87	51	75	56	1	37	4	–	30	21	202	199	763
1991 (mm)	2	3	58	9	28	19	–	25	32	85	76	94	431
1992 (mm)	5	12	25	37	12	50	7	1					

Table 1-6 Average Monthly Temperature of Kastamonu

1989

Month(°C)	Jan	Feb	Mar	Apl	May	June	July	Aug	Sep	Oct	Nov	Dec	Annual
Max	2.6	14.2	12.2	19.3	19.9	20.7	24.1	24.6	21.5	13.0	9.4	4.2	
Min	-8.9	-6.8	-0.2	8.8	7.1	11.4	15.0	18.5	11.1	4.6	-3.8	-10.0	
Average	-3.0	0.8	6.8	13.3	13.2	16.3	19.2	21.1	15.2	8.6	4.3	-1.4	9.4

1990

Month(°C)	Jan	Feb	Mar	Apl	May	June	July	Aug	Sep	Oct	Nov	Dec	Annual
Max	2.7	6.9	13.8	15.2	19.5	24.1	28.3	26.1	22.7	18.2	12.0	5.7	
Min	-6.0	-3.0	-2.4	3.9	6.4	10.0	12.7	10.5	17.9	4.3	2.0	-1.8	
Average	-2.2	1.4	4.7	9.0	12.5	17.0	20.8	18.1	14.5	10.1	6.2	1.3	9.4

1991

Month(°C)	Jan	Feb	Mar	Apl	May	June	July	Aug	Sep	Oct	Nov	Dec	Annual
Max	17.0	9.6	26.4	23.8	26.0	32.0	35.0	35.0	29.2	29.0	17.0	9.8	
Min	-3.8	-5.5	0.2	4.7	7.2	11.5	12.7	12.6	0.5	6.2	1.2	3.2	
Average	-1.0	-1.8	5.1	9.2	12.4	17.5	20.6	19.7	14.8	11.5	5.	-0.8	9.4

1992

Month(°C)	Jan	Feb	Mar	Apl	May	June	July	Aug	Sep	Oct	Nov	Dec	Annual
Max	1.9	1.6	9.0	16.7	20.8	23.2	24.1	28.8					
Min	-6.7	-6.5	-2.0	2.3	5.2	10.9	12.3	11.7					
Average	-2.9	-2.7	2.9	9.3	13.4	16.7	18.0	20.4					

Table 1-7 Monthly Precipitation of Kastamonu

	Jan	Feb	Mar	Apl	May	June	July	Aug	Sep	Oct	Nov	Dec	Annual
1989 (mm)	19	13	33	20	32	99	28	1.2	27	62	74	24	433
1990 (mm)	7	5	16	76	89	17	12	33	44	43	19	40	420
1991 (mm)	23	19	14	81	72	168	37	31	22	33	14	38	333
1992 (mm)	21	13	18	25	11	168	36	2.5					

2-3-2 Vegetation

The large amount of precipitation is reflected in the luxurious growth of the vegetation. About three-fourths of the area is covered with forest, which is locally quite dense, and the flat parts of the area now in wheat fields has apparently been cultivated for farming, but other parts are used for grazing. Some of the forest contains trees large enough to support timber industry, but much of it consists of trees and bushes too small to be used for timber. The trees are dominantly deciduous but locally, especially on Toykondu, Bakibaba, and the high southern area of Taşköprü and Dikmendağ, conifers (pines and cedars) predominate.

CHAPTER 3 OUTLINE OF THE KÜRE MINE

3-1 History of the Mine

The oldest works in the area are not exactly known but the old tunnels have been built in Roman and Greek style. The only evidence for the old works are the presence of slag dumps. During the Ottoman Empire the iron and copper used in construction of cannon balls for the conquest of the Istanbul were supplied from Küre mine.

Ottoman Empire works continued intermittently until 1845. Between 1845-1895 the mine was operated by the Byzantine (Prof. Nikitin, 1925).
Between 1895 and 1913 years, various foreign companies worked in the area. Prospecting and Mining Ltd. company examined slags. According to this, reserves of 1,500,000 tons with 1 % Cu and 200,000 ton with 2-2.5 % Cu are present.

The works between 1914 and 1925 was continued by French Balya Karaaydin Company. After the establishment of the Turkish Republic, Prof. V. Nikitin confirmed the slag values within 1925-1939 period.

After this the M.T.A. continued the works and gave the work to V. Kovenko in 1939, the geological and geophysical studies were carried out, then Bakibaba, Aşıköy and Kızılsu deposits were delineated. Geological and geophysical studies, and drilling were carried out by Etibank since 1939, reserve estimations were completed by Mr. Kudret Sarıcan ln 1968.

In November 1968, Bakibaba ore deposit was transferred to the Black Sea Copper Works Corporation from Etibank. The project and production preparations were continued until 1972 and began production in the same year.

3-2 Mining Activity of Küre Mine

3-2-1 Investment

Etibank had meetings with Outokumpu Company (Finland) and, evaluated the

Küre-Aşıköy ore, it is understood that copper concentrate (15% Cu and 46% S) with 82% productivity can be gained when the concentrator is fed with crude ore with 1,73% Cu and 37% S. An agreement was signed between Etibank and Outokumpu Company in august 1977 to design the concentrator foundation and supply the outer equipment in return for the Finland Government credit and establishment of concentrator foundation which can operate 600 000ton/year ore from Aşıköy open pit; 270 000 ton/year ore from Aşıköy underground mining and 60 000 ton/year ore from Bakibaba underground mining.

And it was taken into the Etibank's investment program with "Küre Copper facility investment". It is made up of 5 different units; 1) Aşıköy open pit, 2) Aşıköy underground mining, 3) concentrator facility: a- enrichment, b- concentrate drying, c- heat power station, 4) cable railway facility, 5) İnebolu loading facility.

3-2-2 Aşıköy Open Pit

It was determined that the Aşıköy ore deposit can be operated by a open pit from the current level to + 948 ML (meter level) and open pit project was prepared in 1986. By taking care of the general dip angles of 35° and 40° and keeping the 12 m. step height constant; step slope angles and step widths were determined to be 72° and 76° and 13m and 11m respectively.

3-2-3 Aşıköy Underground Mining

Because the 948 ML of Aşıköy orebody is the base boundary of the open pit operation, the economical and modern underground mining methods have to be operated from 948 ML to the 756 ML. Detailed engineering works were done and award stage has come through. Ore production and mining transportation will be conducted in two stages.

The crude ores of Bakibaba orebody will be transported to Küre copper-pyrite milling plant and crushed, then 920 ML gallery for main transportation are conducted, now, passed through the lower part of Bakibaba orebody and has reached beneath the Aşıköy orebody, it will be transporting the material, equipment and workers to the underground and to dump the underground water out.

The 1991 reserve condition is given in the following table.

Table 1-8 Observable Reserves

Ore Reserves	Grade		Proved	Probable	Possible	Total
	Cu%	S%				
Aşiköy	1.74	37.06	11,573,643	1,450,378		13,024,021
Bakibaba	3.24		855,848			855,848
Kızılsu	1.30			1,540,000		1,540,000
Toykondu	3.00			400,000		400,000
Total			12,429,491	3,390,378		15,819,869

3-2-4 Milling Operation

Enrichment: 90,000 ton/year copper concentrate with 15% Cu grade and 460,000 ton/year pyrite concentrate with 46% S grade will be produced by feeding the concentrator with 930 000 ton/year ore of 1.73% Cu and 37% S grades. The ores supplied from open pit and underground mining, are transported the ore grain-store with 100 m^3. They are crushed to be different sizes like 15 cm, 20mm. The crushed ore is prepared for the flotation by transporting it to the four different conditioning tank of 25 m^3. After the flotation, the copper concentrate is cleaned, transported to the filter and to drying circuit.

3-2-5 Cable Railway Transportation

The cable railway transportation was decided to be economical for the transporting of the dried concentrates. Therefore, an agreement between Etibank and West German Company PBH Wesserhutte AG. PHB company guarantied all the detailed engineering works and the supply of main equipments.

3-2-6 Stripping and Production Activities

Stripping and open pit:Production has been continuing in the open pit since 1985, and the amounts of stripping and ore production are given in the following table.

Precipitation pools:Precipitated copper is produced by precipitating the copper by reacting the copper sulfate water with the tin clippings and waste iron in the channels. The precipitated copper amounts and grades are shown in Table 1-9.

Table 1-9 Production of the Aşıköy Ore

Year	Amount of Stripping	Production of O/P		Precipitation	
		Amount	Cu	Amount	Cu
	m^3	ton	%	ton	%
1955-58		137,015			
1959-77	5,381,186	1,673,348			
1978-80	771,762	154,408			
1981-83	850,083	77,102		54.5	37.55
1984-86	1,699,667	-	-	102.0	40.75
1987	1,100,000	23,856	1.96	32.0	27.75

Table 1-10 Production of the Bakibaba Ore

Year	Copper Ore		Sulfur Ore	
	Amount	Cu	Amount	S
	ton	%	ton	%
1972-73	58,309	6.30	-	
1974-82	298,999	5.71	200,281	43.61
1983-89	194,881	3.53	-	-
1990-92	-		-	
Total	562,189	4.95	200,281	43.61

3-2-7 Supporting Services

Laboratory equipments have jaw crusher, roller pin crusher, marble mill, pulverization and flotation cell for ore preparation. There are atomic absorption instrument, electrolysis instrument, sulfur analysis instrument, distillation instrument, digital libra and microscope. Chemical analysis of Cu, S, Fe, Co, Zn, CaO and FeS can be conducted. Moisture and density, sieve analysis and measurement of water hardness can be done.

Energy:Electricity is supplied by the T.E.K.(Turkish Electric Power Corporation). 34.5 Kvolt electricity is reduced to 6.3 kvolt in the power station and used as distribution tension. 6.3 Kvolt is used in the mills and 0.4 kvolt is used in the concentrates, crusher, Aşıköy, water pump, social foundations etc. The reducing power station at each unit ; reduces the 6.3 kvolt tension to 0.4 kvolt. Two generators of 380 and 200 watt can be able to feeds the places which can stop the process for energy cuttings.

3-2-8 Rationalization of Mine

Aşıköy mine development project was signed between Etibank and Teknomad A.Ş. on 2 January 1991 concerning engineering services of Aşıköy Orebody. Teknomad handed in the bidding file concerning primary development of Aşıköy underground mine on 4 March 1991.

Automation project of Küre concentrator was sighed with Outomec, Amdel and Denver participated in the bidding on 13 August 1992. It will increase productivity by reducing the loses caused by manual control.

CHAPTER 4 RESULTS OF INVESTIGATION

4-1 Laboratory Work

4-1-1 Thin Section Microscopy

A total of 137 thin sections were prepared. List of sectioned samples is shown in Table 1-12 and the results of the microscopic studies in Table 1-13. A summary of the results are as follows.

Table 1-11 Rock Groups of the Thin Sections

Zone	pcs	Kind of Rocks	pcs	Remarks
Küre Mining	65	Basic rocks Intrusives Sedimentary Rocks	43 15 7	 serpentinite 1, gabbro 5, diorite 3 pyroxenite 1, dacite 5 sandstone 5, shale 1, limestone 1
Taşköprü	59	Basic rocks Intrusives Sedimentary Rock	43 14 1	 Gneiss 1, Serpentinite 1, Diorite 9 Dacite 4, Limestone 1
Dikmendağ	13	Basic rocks Intrusives	10 3	 Dacite 2,Diorite 1
	137		137	

(1) Küre Mining Zone

The rocks studied from this zone are; basaltic rocks of the Küre Formation, serpentine which forms the basement, diorite which intruded into the Küre basalt, gabbro, pyroxenite, dacite (Dogger Series), black shale and sandstone of the Küre Formation, and limestone of the Karadana Formation.

Basaltic rocks: These rocks occur as pillow, hyaloclastite, and massive in form. These three types of lithology is expressed in the 1/5,000 scale geological map of this zone. Most of the basalts have intersertal and ophitic textures. There are some albitized spilitic rocks and coarse-grained diabase-type rocks (Table 1-13).

The constituent minerals are mainly plagioclase and clinopyroxene with small amount of olivine, orthopyroxene and ilmenite. The rocks are altered to various degrees. The common alteration found in these rocks is chloritization, epidotization, carbonitization, sericitization, and silicification. Albitization is also found. Strong chloritization and silicification occur only near the orebody.

Serpentinite: Almost all of the olivine and pyroxene have altered to cryso-tile and there are relicts of olivine. Calcite also occur (sample H015).

Pyroxenite: The major constituent, pyroxene is almost all diopside and the SiO_2 content is 38.40%. The pyroxene is serpentinized (sample Y008).

Gabbro: The major constituents are plagioclase, hornblende, and augite. Idiomorphic plagioclase is surrounded by amphibole and pyroxene. The plagio-clase is zoned and sericitized. Some of the pyroxene have been altered to uralite and relicts are observed. Small amounts of accessory quartz and opaque ilmenite occur along the fissures. There are secondary calcite (samples A007, H019, M014, M049, S004).

Diorite: The major constituent minerals are plagioclase and hornblende, some of the hornblende is chlorititized. Small amounts of accessory sphene and ilmenite occur (samples M026, Y027, Y009).

Dacite: Quartz, plagioclase, biotite form the phenocrysts of the porphyritic texture. The plagioclase is chloritized and sericitized. Glass has devitri-fied to quartz (samples H002, H012, S033, Y096, Y097).

Sandstone: The constituent minerals are quartz and plagioclase. The grain size ranges from 0.06-0.4mm. Mica and calcite occur filling the interstitial space between the sand grains (samples A040, K019, Y002, Y003, Y026).

Black shale: The constituents are amorphous minerals, minute clay micaceous mineral and carbonates. These are very minute flakes with slight orientation (sample Y041).

Limestone: This rock consists of microcrystalline calcite and fossil frag-ments have been found (sample A003).

(2) Taşköprü Zone

Basaltic rocks: These rocks were not affected strongly by metamorphism and major characteristics of the rocks still remain. Porphyroblastic, granoblas-tic, and poikiloblastic textures are the common textures found in these rocks. Plagioclase and pyroxene (augite) have been altered to albite, preh-nite, chlorite, epidote, and sericite.

Table 1-12 Samples of the Thin Sections(1)

Küre Mining Zone

No.	Description	Locality	Y	X
A001	Diorite	W.Kızılsu	2559530	4628600
H019	Diorite	NE.Kızana M.	2557600	4631920
S004	Diorite	N.Yunusköy.	2559000	4634170
M026	Sil rock(diorite)	NE.Küre	2557970	4632600
A007	Gabbro	W.Kızılsu	2559325	4629060
H002	Dacite	S.Aşıköy	2557410	4630290
H012	Dacite	W.Bediroğlu	2555820	4631800
S033	Dacite	E.Elmakütüğü T.	2557715	4633580
Y004	Dacite	SE.Küre	2560375	4628710
A002	Massive basalt	W.Kızılsu	2559765	4628650
A040	Sandstone	Kızılsu KS-4 78m	2558331	4629105
H014	Massive basalt	NW.Bediroğlu	2556320	4631670
H016	Massive ba with ep-hem	NW.Kızana M.	2556880	4631960
K010	Massive basalt	E.Dereköy	2561300	4634530
K014	Massive basalt	İpsinler	2561080	4633510
L023	Massive basalt	NW.Kuşça M.	2560773	4631922
M044	Massive basalt	N.Küre	2559120	4631335
M055	Massive basalt	NW.Küre	2558400	4631700
N025	Massive basalt	NE.Yunusköy	2559415	4633810
Y036	Massive basalt	Aşıköy	2557425	4631185
Y027	Massive ba(Intrusive)	S.Yunusköy	2559000	4632835
A013	Brec basalt with mala	Aşıköy	2558205	4630650
A010	Brec basalt with hem	N.Kızılsu	2558250	4629520
A028	Brec basalt with hem	Aşıköy	2557467	4630847
A036	Brec basalt with py-cp	KS-25 34.8m	2558502	4629125
A038	Brec basalt with py-cp	Ks-48 33.5m	2558562	4628959
A030	Altered basalt	Aşıköy	2557410	4630840
A037	Altered basalt	KS-18 41.3m	2558411	4629067
A039	Altered basalt with py	KS-24 38m	2558502	4629067
M039	Altered basalt	N.Küre	2559000	4632140
M014	Silicified rock	W.Küre	2556625	4632860
S050	Pillow lava with py	NE.Küre	2560130	4631920
S057	Altered pillow lava	NE.Küre	2560125	4631460
Y003	Massive basalt	SE.Küre	2560320	4629000
Y014	Brecciated basalt	E. Küre	2559950	4630580
Y030	Brecciated basalt	Aşıköy	2557395	4631205
Y039	Brecciated basalt	Aşıköy	2557265	4631175
Y020	Brecciated basalt	NW.Katıruçtuğu S	2559000	4632500
Y023	Pillow lava	E.Küre	2559570	4630310
Y034	Massive basalt	Aşıköy	2557435	4631250
Y042	Brecciated basalt	Aşıköy	2557568	4631010
Y044	Brecciated basalt	Aşıköy	2557507	4631025
Y045	Massive basalt	Aşıköy	2557430	4631025
Y046	Massive basalt	Aşıköy	2557430	4630960
A003	Massive limestone	S.Kızılsu	2558420	4628580
K019	Silicified sandstone	İpsinler	2561000	4633950
Y002	Sandstone	SE.Küre	2629060	4560285
Y026	Sandstone	S.Yunusköy	2632850	4559000
Y041	Black shale	Aşıköy	2557560	4631000

Table 1-12 Samples of the Thin Sections(2)

Taşköprü Zone

No.	Description	Locality	Y	X
A101	Diorite	Kepez M.	2592460	4618460
A112	Diorite	N.Binektaşı Sr.	2607620	4619260
H040	Diorite	NW.Sarısökü	2604000	4620100
H044	Diorite	SE.Şule Y.	2607580	4619550
H047	Diorite	S.Hasanöldü T.	2615620	4620620
M276	Diorite	E.Çankırsak T.	2621100	4619580
A102	Dacite	Kepez M.	2592480	4618520
K248	Dacite	NW.Karıncalık Sr	2594900	4616000
S091	Dacite	S.Neçipburnu	2590580	4606130
Y089	Quartz porphyry	E.Çaltepe	2621850	4618310
Y091	Granite	SW.Yelli T.	2621240	4620120
Y086	Granite	N.İfritoğlu Y.	2610580	4620580
K200	Biotite gneiss	S.Kuzupınar Sr.	2577900	4603820
M211	Gneiss	NE.Salmançalı T.	2570650	4598000
A108	Meta basalt	S.Kayadibi	2600140	4619500
H033	Meta basalt	S.Asmakaya T.	2601340	4615140
K206	Meta basalt	SW.Ahlatlık T.	2580060	4603400
K252	Meta basalt	Çebiş M.	2594400	4615500
L045	Meta basalt	S.Nuraçal T.	2586000	4605920
K227	Meta basalt	NW.Dikmen T.	2579750	4599790
L048	Meta basalt	W.Hatibinyolu T	2588230	4604720
L068	Meta basalt with py	E.Boynueğri T.	2586650	4607520
L082	Meta basalt	W.Karaahmet D.	2595600	4613420
M216	Meta basalt	W.Yaşlı T.	2573440	4597640
M256	Meta basalt with lim	E.Tahtakuzu T.	2592670	4605220
N055	Meta basalt	SW.Bakacak T.	2621180	4619380
N060	Meta basalt with py	NE.Namazlık T.	2581780	4601000
N064	Meta basalt	W.Bakabey T.	2592500	4616520
Y057	Meta basalt	W.Ahmetöldüğü T	2584820	4603280
Y060	Meta basalt with py	E.Ketendoruğu T	2589000	4602860
Y065	Meta ba with epi-hem	NE.Bakacak T.	2583240	4602640
Y077	Meta basalt	SE.Asarcık	2588380	4617120
Y082	Meta basalt	E.Domuzburnu T.	2591390	4615770
Y087	Meta basalt	SE.Atçayırı T.	2611340	4620660
L050	Altered meta basalt	E.Kara T.	2590580	4602760
L058	Silicified meta basalt	S.Uçurumkaya T.	2588270	4603640
A104	Green schist	W.Kepezçalı T.	2592630	4619000
A121	Green schist	S.Evçalukları Sr	2606280	4615770
K222	Green schist	NE.Kabuklu T.	2580060	4601000
H035	Pelitic schist	E.Akkütük T.	2602820	4616150
L046	Pelitic schist	E.Kökluyol T.	2586100	4605620
H041	Silicified rock	W.Sarısoku	2604000	4619840
L062	Silicified rock	S.Horozbiçtiği T	2586300	4603200
M252	Silicified rock	Avgun Sr.	2592890	4606060
M231	Gossan(schist)	SW.Gökyar D.	2594260	4609470
Y079	Serpentinite	SE.Tilkigüneyi T	2589500	4615900
A103	Massive limestone	W.Kepez M.	2592210	4618460

Table 1-12 Samples of the Thin Sections(3)

Dikmendağ Zone

No.	Description	Locality	Y	X
H049	Sil dacite with py	Delihasanoğlu M.	2543800	4626660
K114	Dacite	N.Dikmendağ	2546700	4631501
M106	Diorite	N.Kızılelma	2542250	4632750
L042	Porphyritic rock	N.Delihasanoğlu	2543760	4628940
H051	Brecciated basalt	Öcür M.	2545560	4623880
K116	Massive basalt	N.Satıköy	2546400	4628620
K101	Massive basalt with py	NW.Yayla M.	2544750	4628300
K102	Massive basalt	NW.Yayla M.	2544600	4628440
S110	Massive basalt	N.Yayla M.	2545560	4628600
Y093	Massive basalt	N.Masköy	2547400	4633980
Y094	Massive basalt	E.Dikmendağ	2547520	4630500

Green schist:The constituent minerals are plagioclase and pyroxene which have been metamorphosed to albite, chlorite, epidote, carbonates, and calcite. The texture is lepidoblastic and nematoblastic.

Pelitic schist:The rock has nematoblastic texture and the constituent minerals are quartz, albite, chlorite, sericite with tremolite and actinolite (sample H035, L046).

Gneiss:This has holocrystalline texture and the constituent minerals are quartz, plagioclase, biotite, and hornblende with secondary chlorite and sericite.

Serpentinite:Crysotile is almost the sole constituent of this rock. There are no relicts of olivine or pyroxene. Opaque constituent is probably chromite (sample Y079).

Diorite:The sample is from a body named Çangal Granite during the field survey. The major mineral is plagioclase with hornblende, pyroxene, and biotite. They are chloritized and sericitized. The sample considered in the field as granite, Y075, has SiO_2 content of 56% (intermediate rock) and that labeled as diorite, M286, has 51% (mafic rock). Therefore, although believed to be granitic in the field it has the characteristics of intermediate to mafic rocks (samples A101, A112, H040, H044, H047, M286, Y075, Y086, Y091).

Dacite:This is sericitized as in the case of the dacite in the Küre Zone (samples A102, K248, S091, Y089).

Limestone:The constituent mineral is mostly microcrystalline and crystalline calcite with minor quartz. The crystals are oriented by the effect of metamorphism.

(3) Dikmendağ Zone

Basaltic rocks: This has porphyritic texture and the phenocrysts are mostly plagioclase, and biotite and pyroxene. They are chloritized and sericitized. There is a very minor amount of quartz. The SiO_2 content is 56% for sample M108 and 65 for Y102. Although field label for this rock is basalt, the chemistry and microscopic work indicate intermediate nature.

Dacite: This has porphyritic texture and the phenocrysts are quartz, plagioclase, and biotite. The plagioclase is chloritized and sericitized. Glass has been devitrified to quartz (samples Y093, K114).

Gabbro: The major constituent minerals are plagioclase, hornblende, and augite. The idiomorphic plagioclase is surrounded by hornblende and pyroxene. The plagioclase is zoned and sericitized. There are relicts of pyroxenes altered to uralite. Small amount of quartz and opaque ilmenite fill the cracks as accessories. Calcite occurs as a secondary mineral (sample M106).

4-1-2 Total Chemical Analysis

A total of 30 samples representing the survey area of the first year were selected for total chemical analysis. They are 22 basalt samples (10 from Küre Mining, 2 from Dikmendağ, and 10 from Taşköprü Zones), eight intrusive samples (6 from Küre Mining and 2 from Taşköprü Zones).

The basaltic rocks are considered to be of Lias Epoch in the Küre Mining Zone and pre-Lias in the Taşköprü Zone. The intrusive rocks are the basement serpentinite in the Küre Mining Zone, and the diorite and dacite intruded into the basalts of the Küre Formation. The samples from the Taşköprü Zone are Çangal Granite of the Dogger Epoch.

The analysis was carried out by potassium permanganate titration for FeO and the ICP-AES method for other elements. The normative minerals and solidification index (SI) were calculated from the analytical results and are shown in Table 1-14. Sulfur contents were determined for all samples, but they are all less than 0.1%, negligible for various considerations. The analyzed samples have been studied microscopically (Table 1-13). Güner(1980) reported on the analytical results of the Küre Mine. He used both major and minor contents of 30 basalt samples and concluded that these were typical ridge-type tholeiite. The following consideration was made referring to the results of Güner and Kosaka (1975).

Table 1-13 Microscopic Observations of the Thin Sections (1)

Sample No.	Rock Name	Rock unit	Texture	Phenocryst									Groundmass									Alteration
				Qz	Kf	Pl	Bi	Ho	Py	Hy	Mf	Op	Qz	Pl	Bi	Ho	Py	Hy	Mf	Op	G	
A008	Pyroxinite	Osg	holocrystalline			□			◎			△										pyroxine-serpentine
H015	Serpentinite	Osg	holocrystalline		◎					◎		△										olivine-serpentine
M049	Gabbro	Di	holocrystalline	△		◎			○			△										pl-ser, py-calcite
Y009	Diorite	Di	holocrystalline			◎		◎			□	□										ho, pl-ch
Y096	Dacite	Da	porphyritic	○		◎							◎						○	○		pl-ser, ch
Y097	Dacite	Da	porphyritic	◎		○	□						◎	○	□							bi-ch
L021	Pillow lava	Klp	intergranular			○			□					○			□		○	○		pl-carbonite ◎, ch, albite
S047	Pillow lava	Klp	sub-ophitic			○			□					○			□		○	□		pl, py-ch ◎, ep
Y005	Pillow lava	Klp	sub-ophitic			◎			□					○			□		◎	□		pl-albite, calcite
Y098	Pillow lava	Klp	intersertal		□	◎			□					○			□			□		olivine-serpentine, pl, py-ch
Y099	Hyaloclastite	Klh	sub-ophitic			○			□					○			□			△		pl, py-ser, ch, ep
Y100	Hyaloclastite	Klh	ophotic			○			□					○			□			△		pl-carb, ch, ser
A047	Hyaloclastite	Klh	phitic			○			□					○			□			△		
M036	Massive basalt	Klm	sub-ophitic			○			□				△	○			□			△		pl, py-ch, cal, ep, carb
Y007	Massive basalt	Klm	ophitic			◎			□					○			△			□		pl-ch, carb
Y025	Massive basalt	Klm	sub-ophitic			◎			□					□			□			△		pl-albite, ep
M108	Massive basalt	Klm	felsitic	◎		○								○						○		pl-ch
Y102	Massive basalt	Klm	ophitic			○			○				△	○			□			□		pl-ch, py-prehnite
H043	Green schist	Clb	-											○			△			○		pl-ch ◎, carb ◎
M202	Green schist	Clb	-										○	○			□					pl, py-ch, ep, carb ◎
M261	Green schist	Clb	felsitic										◎	○								pl-ch, ep
M289	Green schist	Clb	porphyritic ?			○							◎							□		pl-ser
M200	Meta basalt	Clb											□	□					□			pl, py-ch, cal, ep ◎
M205	Meta basalt	Clb	porphyritic ?			○							○				○		○			pl, py-ch, cal, ep
M230	Meta basalt	Clb	sub-ophitic			○			○				□	□			□			△		pl, py-ch, cal, ep

Abbreviations:

◎:Abundant ○:Common □:Few △:Rare

Qz:Quartz, Kf:Potassium feldspar, Pl:Plagioclase, Bi:Biotite, Ho:Hornblende, Py:Pyroxene, Hy:Hypersthene,

Mf:Mafic mineral, Op:Opaque minerals, Ser:Sericite, Ch:Chlorite, Ep:Epidote, Cal:Calcite, Carb:Carbonate, G:Glass

vs:very strong arg:argillization

Table 1-13 Microscopic Observations of the Thin Sections (2)

Sample No.	Rock Name	Rock unit	Texture	Phenocryst Qz	Phenocryst Kf	Phenocryst Pl	Phenocryst Bi	Phenocryst Ho	Phenocryst Au	Phenocryst Hy	Phenocryst Mf	Phenocryst Op	Groundmass Qz	Groundmass Pl	Groundmass Bi	Groundmass Ho	Groundmass Au	Groundmass Hy	Groundmass Mf	Groundmass Op	Groundmass G	Alteration
M277	Meta basalt	Çlb	ophitic			◎			□					○			□			□		pl. py→ch. cal. ser
M287	Green schist	Çlb	lepidoblastic										◎	○			□			□		pl. py→ch. ep
M288	Green schist	Çlb	lepidoblastic										△	◎			□					pl. py→ch. cal
M286	Diorite	Çg	porphyritic			○		□						○		□				□		pl. py→ser, cal
Y075	Biotite granite	Çg	holocrystalline	△		○		○				△										ho→ch
A001	Altered basalt	Klm	porphyritic			◎			□					○			□					pl. py→ch. ser, cal
H019	Gabbro	Di	holocrystalline			○		○	◎			□										py→ho
S004	Gabbro	Di	holocrystalline			○			◎			△										ho, pl→ch
M026	Silicified diorite	Di	holocrystalline			○		□	○			△										pl. py→ch. cal +qz
A007	Massive basalt	Klm	holocrystalline			○			○			△										pl→ser, ch
H002	Dacite	Da	porphyritic	◎		○	□	□					◎	○						□		
H012	Dacite	Da	felsitic	◎		□		□					◎	□						△		pl→ser
S033	Dacite	Da	porphyritic	◎		□							◎	□						△	□	cal. ch. ser ◎
Y004	Dacite	Da	intergranular			◎							○	○			○			□		pl→ser. cal
A002	Massive basalt	Klm	ophitic			◎			○			△		□			□					pl→ch
A040	Sandstone	Kss	granular										○	○						△		pl→ser, ch
H014	Massive basalt	Klm	porphyritic			◎			○				△				○			□		pl. py→ch. cal ◎
H016	Massive basalt	Klm	intersertal			◎			○					○			○			△		pl. py→ch. cal. ser
K010	Massive basalt	Klm	intergranular			○			○				△	○			□			△		pl. py→ch. ser, cal
K014	Massive basalt	Klm	ophitic			○			○				◎							□		pl. py→cal. ser
L023	Massive basalt	Klm	sub-ophitic			◎			□											□		pl→ch
M044	Massive basalt	Klm	intergranular			○								◎			○			□		pl→ser ◎ +qz
M055	Massive basalt	Klm	intergranular			◎			□			□		○			○			△		pl. py→ch. carb
N025	Massive basalt	Klm	lepidoblastic	□		◎						□										pl. py→ch. ser +qz
Y036	Massive basalt	Klm	intergranular			◎			○					○			○			△		pl. py→ch. cal

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Mf:Mafic mineral, Op:Opaque minerals, Ser:Sericite, Ch:Chlorite, Ep:Epidote, Cal:Calcite, Carb:Carbonate, G:Glass

vs:very strong arg:argillization +qz:silicification

Table 1-13 Microscopic Observations of the Thin Sections (3)

Sample No.	Rock Name	Rock unit	Texture	Phenocryst									Groundmass									Alteration
				Qz	Kf	Pl	Bi	Ho	Au	Hy	Mf	Op	Qz	Pl	Bi	Ho	Au	Hy	Mf	Op	G	
Y027	Massive basalt	Klm	cataclastic			◎					□	□										mf→ch, carb
A013	Hyaloclastite	Klh	porphyritic ?			○			□					○			○			○		pl, py→ch, ser, cal +qz
A010	Hyaloclastite	Klh	porphyritic			◎							○							□	□	pl→ch, ser +lim
A028	Hyaloclastite	Klh	intergranular			○			○					◎			□					pl, py→ch, carb +qz
A036	Altered tuff	Klh	-										○	○						□		pl, py→ch, cal, ep
A038	Hyaloclastite	Klh	intergranular			○			△					◎			○					pl, py→ch, cal, ep, carb
A030	Altered basalt	Klm	porphyritic			○			○				◎							□		pl→ch +qz
A037	Altered basalt	Klm	poikilitic			◎			○					○			□			□		pl→ser
A039	Altered basalt	Klm	porphyritic	○		○							◎							◎		pl→ch, ser +qz
M039	Altered basalt	Klm	porphyritic			◎								○			□			□		pl→ch ◎
M014	Gabbro	Di	holocrystalline			○		○	○			□										pl→ser
S050	Pillow lava	Klp	intersertal			◎			○					○			○			○		pl, py→ch, cal, ep
S057	Altered pillow lava	Klp	intergranular			◎			□					○			□			○		pl→ser, ch
Y003	Silicified sandstone	Kss	granular										○	○								ch, size:0.04-0.4mm
Y014	Hyaloclastite	Klh	porphyritic			◎			◎					○			○			○		pl, py→ch, carb, mf→limonite
Y030	Hyaloclastite	Klh	porphyritic			◎			○					○			○			○		pl, py→ch, cal, carb
Y039	Hyaloclastite	Klh	intergranular			◎			○			□		○			○			△		pl, py→ch, carb
Y020	Hyaloclastite	Klh	intergranular			◎			□					○			□			□		pl, py→albite, ch, cal, carb
Y023	Pillow lava	Klp	hayalo-ophitic			◎			○					◎			○			□		pl, py→albite, ch, cal, carb
Y034	Massive basalt	Klm	ophitic			◎			○			□										pl, py→ch, ser, carb
Y042	Hyaloclastite	Klh	porphyritic			◎			○					○			○			△		pl, py→albite, ch, carb
Y044	Hyaloclastite	Klh	porphyritic			◎			○					○			○			□		pl, py→ser, carb +qz
Y045	Massive basalt	Klm	intersertal			◎			○					○			○			□		pl, py→ch, carb
Y046	Massive basalt	Klm	micro-porphyritic			◎			○					◎			◎			□		
A003	Massive limestone	Kcl	crystocrystalline										△									fossile, cal ◎

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Mf:Mafic mineral, Op:Opaque minerals, Ser:Sericite, Ch:Chlorite, Ep:Epidote, Cal:Calcite, Carb:Carbonate, G:Glass

vs:very strong arg:argillization +qz:silicification

Table 1-13 Microscopic Observations of the Thin Sections (4)

Sample No.	Rock Name	Rock unit	Texture	Phenocryst									Groundmass									Alteration
				Qz	Kf	Pl	Bi	Ho	Py	Hy	Mf	Op	Qz	Pl	Bi	Ho	Py	Hy	Mf	Op	G	
K019	Silicified sandstone	Kss	granular										◎									size:0.06-0.4(mm), cal
Y002	Sandstone	Kss	granular										◎	○								mica, ser
Y026	Sandstone	Kss	granular										◎	○								mica, ser
Y041	Black shale	Kss	granular										○	○								clay, ser, carb
H049	Altered basalt	Klb	intergranular			◎			○					○			○			△		pl, py→ch, ep, carb
K114	Dacite	Da	porphyritic	○		◎							◎						○	○		pl→ser, ch
M106	Gabbro	Di	holocrystalline			◎		△	○			△										
L042	Porphyritic rock	Klb	porphyritic			○	□							○						□		pl→ch
H051	Brecciated basalt	Klb	intergranular			○			△					◎			○					pl, py→ch, ep, carb
K116	Massive basalt	Klb	porphyritic			○			□					□			□			□		pl→ch, ser
K101	Massive basalt	Klb	porphyritic			○			□					□			□			□		pl→ch ◎, ser
K102	Massive basalt	Klb	porphyritic	△		◎	□		△					□			△			△		pl→ch
S110	Massive basalt	Klb	porphyritic	△		◎	□		□					□			△			△		pl→ch
Y093	Massive basalt	Klb	porphyritic	△		○	□							□			△			△		pl→ser, ch, cal
Y094	Massive basalt	Klb	porphyritic			○					□			□			△			△		pl→ser
A101	Diorite	Cg	porphyritic	△		○								□			△			△		pl→ser
A112	Diorite	Cg	porphyritic	□		○			□			△										
H040	Diorite	Cg	holocrystalline	□		○		○				△										pl→ser ◎, ch
H044	Diorite	Cg	holocrystalline	△		◎					□	△										pl, mf→ser ◎, ch
H047	Diorite	Cg	holocrystalline	□		◎	□	○														pl→ch
M276	Meta basalt	Klb	hayaloophytic			◎			□					○			□			△		pl→ch
A102	Dacite	Da	porphyritic			○						△	◎	○						△		pl→ser, cal
K248	Andesite	Clb	porphyritic	△		○			△					○			□			△		
S091	Dacite	Da	porphyritic	◎		○							◎	○						△		pl→ser
Y089	Dacite	Da	porphyritic	○		○	□						◎	○						△		pl, bi→ch, ser

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Mf:Mafic mineral, Op:Opaque minerals, Ser:Sericite, Ch:Chlorite, Ep:Epidote, Cal:Calcite, Carb:Carbonate, G:Glass

vs:very strong   arg:argillization

Table 1-13 Microscopic Observations of the Thin Sections (5)

Sample No.	Rock Name	Rock unit	Texture	Phenocryst Qz	Kf	Pl	Bi	Ho	Py	Hy	Mf	Op	Groundmass Qz	Pl	Bi	Ho	Py	Hy	Mf	Op	G	Alteration
Y091	Granite	Çg	holocrystalline	△		◎																
Y086	Granite	Çg	holocrystalline		□	○	□		□													
K200	Green schist	Dpg	-										□							△		cal
M211	Gneiss	Dpg	holocrystalline	□	□	○	□	□														
A108	Meta basalt	Çlb	-										◎	□								ep. ch. muscovite
H033	Meta basalt	Çlb	-										○									eo, ch ◎, muscovite, ilmenite
K206	Meta basalt	Çlb	hayaloophitic			◎		○						○			○				□	pl, py-ch, carb
K252	Meta basalt	Çlb	porphyritic			○							◎									ch ◎
L045	Meta basalt	Çlb	-											◎			○			○		ch, carb
K227	Meta basalt	Çlb	-											◎			○			○		ch, cal
L048	Meta basalt	Çlb	intergranular			◎			○			□		○			○					pl, py-ch, ep, cal
L068	Meta basalt	Çlb	intergranular			◎			○			□		○			○					pl, py-ep, carb
L082	Meta basalt	Çlb	porphyritic	○									◎	○						△		pl-ser, ep
M216	Meta basalt	Çlb	intergranular	□		○			○					○			○					pl, py-ch, cal
N055	Meta basalt	Çlb	-										○			□	□			△		pl, py-ser, ch, ep
M256	Meta basalt	Çlb	lepidoblastic			○			□				△	○			□					
N060	Meta basalt	Çlb	lepidoblastic	○		○														□		pl, py-ch ◎, ep, cal
N064	Meta basalt	Çlb	lepidoblastic			◎								◎						△		pl, py-ch, ep
Y057	Meta basalt	Çlb	intergranular			◎			○			□		□			○					pl, py-ep, carb
Y060	Meta basalt	Çlb?	lepidoblastic	△		◎			□					○						△		pl, py-cal, ch ◎, ep
Y065	Meta basalt	Çlb	sub-ophitic			◎			□					○			□			△		pl, py-ch, carb
Y077	Meta basalt	Çlb	ophitic			◎							△									pl, py-ch, ep +qz
Y082	Meta basalt	Çlb	granobrastic	○										○		○				△		pl, py-ch, ep, carb
Y087	Meta basalt	Çlb	ophitic			○			□											□		
L050	Altered meta basalt	Çlb	porphyritic			○			□				◎				□			△		pl, py-ch, ep +qz

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vs:very strong arg:argillization +qz:silicification

Table 1-13 Microscopic Observations of the Thin Sections (6)

Sample No.	Rock Name	Rock unit	Texture	Phenocryst									Groundmass									Alteration
				Qz	Kf	Pl	Bi	Ho	Py	Hy	Mf	Op	Qz	Pl	Bi	Ho	Py	Hy	Mf	Op	G	
L058	Silicified meta basalt	Ҫlb	porphyritic	○		◎	□		□					○			□			□		pl, py→ser, ch, ep
A104	Green schist	Ҫlb	nematoblastic										◎									ch, ser, ep
A121	Grren schist	Ҫlb	nematoblastic										○									ch ◎
K222	Green schist	Ҫlb	nematoblastic										◎				○					ch, cal, ep
H035	Pelitic schist	Ҫlp	nematoblastic										◎	◎								ch, ser
L046	Pelitic schist	Ҫlp	nematoblastic											○						□		ch, ep, tremonite, actinolite
H041	Silicified rock	Ҫlb	porphyritic			◎		□						○		□				△		pl, py→ser, ch, ep +qz
L062	Silicified rock	Ҫlb	-										◎							△		ser, ch, ep +qz
M252	Silicified rock	Ҫlb	porphyritic			◎							◎	○								pl, py→ch, ep, cal +qz
M231	Gossan (schist)	Ҫlb	-										◎									mica +qz, +Fe
Y079	Serpentinite	Ҫls	-																	△		serpentine ◎
A103	Massive limestone	Ҫtl	granular										△									cal ◎

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vs:very strong arg:argillization +qz:silicification

AFM diagram (Figure 1-6):The intrusive rocks clearly plots within the range of calc-alkali rock series. The Na_2O+K_2O of the basalts is higher than normal mafic rocks and indicates the strong albitization. It belongs to the calc-alkali rock series. It lies within the range similar to that of Güner (1980).

Na_2O+K_2O-SiO_2 diagram (Figure 1-7):The basalts of this area have high Na_2O+K_2O content because of alteration and many of them plot in the alkali rock series range.

SiO_2-FeO/MgO diagram (Figure 1-8):Most of the intrusive rocks plot in the calc-alkali rock series while many of the basic rocks fall in the tholeiite range.

Alkali-alumina-silica diagram (Figure 1-9):In the basalt classification of Kuno (1960), the rocks of the Küre Area plot in the alkali rock series because of their high alkali content, but some of the low silica basalts are observed to fall in the tholeiite group.

Al_2O_3-TiO_2 diagram (Figure 1-10):In the diagram with average values of ridge-type and ocean island- type tholeiites plotted (Hubbard, 1969), The present rocks plots in the high alumina-low titanium ridge-tholeiite group.

S.I. and titanium-alumina diagram (Figure 1-11):In the diagram using the solidification index by Kuno (1957), the rocks of the Küre Area plots in the area ranging from the ridge-type to ocean-island-type.

TiO_2-FeO/MgO diagram (Figure 1-12):In the diagram by Miyashiro (1975) with Güner's plots, the results of the present work plot in the area ranging from ridge to ocean-island-type tholeiite.

P_2O_5-TiO_2 diagram (Figure 1-13):These rocks have low titanium and phosphorus contents and plots in the ridge-type tholeiite range.

Minor elements: As evident from the total analysis and microscopic observation, all 22 samples of mafic rocks (green rocks) are altered. The content of rare earth elements is considered to be relatively less affected by alteration and metamorphism. Kawabe (1974) has inferred tectonic conditions from the minor element content and his method is applied as follows.

The contents of rare earths Ba, Nb, Sr, Y. Zr were determined and the results are laid out in Figure 1-14. The tectonic conditions of the basalt samples are inferred from these rare earths to be; ocean ridge type M036, S047, Y007, Y0025, Y098, Y099, Y100 in the Küre Zone, M108 in Dikmendağ, and M202, M205, M230, M287, M288 in Taşköprü Zone. These amount to more than half of the samples.

It is seen that although the alkali contents are high in the altered basalts and they plot in the alkali rock area of the diagrams, the major chemical components and some minor element contents both indicate ridge-type tholeiite as the original rock.

Condition of Structure	Magma Type	Rb ppm	Sr ppm	Ba ppm	K/Rb	Cr ppm	Ni ppm	Rare Metal Pattern
Ridge	Tholeiites	0.2-5	70-150	6-30	1,000	200-400	300-200	Solid Type
Island basin	Tholeiites Tholeiites	3-6 5	150-200 200	25-47 75	600-1,000 1,000	150-300 50	50-90 30	Solid Type Solid Type
Island	Calc-alkali B. Alkali Basalt	10 75	330 700	115 1,000	340 200	40 30	25 20	Liquid Type Liquid Type

Table 1-14 Chemical Analysis and CIPW Norms (1)

	A047	L021	M036	S047	Y005	Y007	Y025	Y098	Y099	Y100	Y102	M108
SiO_2 wt%	47.73	34.67	48.44	46.24	47.93	53.44	50.23	45.72	49.65	52.69	65.62	56.63
TiO_2	1.66	0.95	0.43	0.69	1.06	1.21	1.24	1.78	1.05	1.29	0.64	0.62
Al_2O_3	14.13	15.09	14.54	17.01	15.72	15.56	15.39	14.17	14.52	15.34	14.41	15.21
Fe_2O_3	5.59	1.57	1.22	5.54	3.09	2.59	3.59	3.72	5.02	3.04	2.05	1.29
FeO	5.19	7.32	5.82	7.19	4.80	7.07	6.07	7.48	4.53	5.95	2.21	5.59
MnO	0.19	0.65	0.15	0.12	0.13	0.14	0.16	0.17	0.14	0.13	0.10	0.16
MgO	7.32	5.21	9.62	9.57	5.77	5.56	5.51	7.57	8.72	5.63	2.00	6.35
CaO	7.76	13.72	5.66	2.38	6.95	3.01	7.51	10.67	7.46	3.57	2.92	1.61
Na_2O	4.11	2.83	4.65	3.80	4.80	5.59	4.89	2.89	3.92	5.16	6.16	6.10
K_2O	0.93	0.95	0.08	0.19	0.54	0.08	0.19	0.20	0.18	0.21	1.35	0.05
P_2O_5	0.10	0.01	0.01	0.01	0.05	0.04	0.04	0.11	0.01	0.10	0.12	0.01
LOI	3.28	15.33	7.99	5.10	8.90	4.23	3.60	3.49	3.59	5.81	3.59	4.67
Cr_2O_3	0.01	0.01	0.04	0.01	0.01	0.01	0.01	0.01	0.01	0.03	0.01	0.02
Total	98.00	98.31	98.65	97.85	99.75	98.53	98.43	97.98	98.80	98.95	101.18	98.31
FeO*	10.22	8.73	6.92	12.18	7.58	9.40	9.30	10.83	9.05	8.69	4.06	6.75
Fe/Mg	1.40	1.68	0.72	1.27	1.31	1.69	1.69	1.43	1.04	1.54	2.03	1.06
Con.P	45.26	49.28	32.53	47.31	40.56	45.57	46.76	50.39	41.38	44.12	29.89	35.07
Q	0.00		0.00	0.59	0.00	1.88	0.00	0.00	0.00	3.17	16.37	4.25
C	0.00		0.00	6.25	0.00	0.91	0.00	0.00	0.00	0.38	0.00	2.22
or	5.50		0.47	1.12	3.19	0.47	1.12	1.18	1.06	1.24	7.98	0.30
ab	34.76		39.32	32.14	39.26	47.27	41.35	24.44	33.15	43.64	52.09	51.59
an	17.37		18.58	11.74	19.76	14.67	19.49	25.11	21.50	17.06	7.70	7.92
ne	0.00		0.00	0.00	0.72	0.00	0.00	0.00	0.00	0.00	0.00	0.00
di-wo	8.55		3.94	0.00	6.01	0.00	7.30	11.32	6.44	0.00	2.51	0.00
di-en	6.68		2.63	0.00	4.15	0.00	4.65	7.38	5.09	0.00	1.77	0.00
di-fs	0.93		1.02	0.00	1.37	0.00	2.18	3.15	0.63	0.00	0.53	0.00
hy-en	0.37		1.96	23.82	0.00	13.84	3.52	2.70	14.61	14.02	3.21	15.81
hy-fs	0.05		0.76	7.71	0.00	9.11	1.65	1.15	1.82	6.53	0.96	8.47
ol-fo	7.83		13.57	0.00	7.16	0.00	3.89	6.14	1.41	0.00	0.00	0.00
ol-fa	1.20		5.77	0.00	2.61	0.00	2.01	2.89	0.19	0.00	0.00	0.00
mt	8.10		1.77	8.03	4.48	3.75	5.20	5.39	7.28	4.41	2.97	1.87
hm	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
il	3.15		0.82	1.31	2.01	2.30	2.36	3.38	2.00	2.45	1.22	1.18
ap	0.24		0.02	0.02	0.12	0.10	0.10	0.26	0.02	0.24	0.28	0.02
TOTAL	94.71		90.61	92.72	90.82	94.28	94.80	94.48	95.18	93.11	97.57	93.61
Femic	37.09		32.25	40.90	27.91	29.09	32.85	43.76	39.49	27.64	13.45	27.35
S.I.	32.42	29.40	45.23	37.18	30.87	26.95	27.70	35.23	39.87	31.83	14.74	32.99

	A047	L021	M036	S047	Y005	Y007	Y025	Y098	Y099	Y100	Y102	M108
Ba ppm	240	230	10	20	60	< 20	< 20	20	< 20	20	240	20
Nb	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Rb	16	27	< 5	5	22	5	11	11	5	11	71	< 5
Sr	180	90	70	70	100	20	30	130	150	70	90	60
Y	40	20	10	20	20	30	30	50	30	30	20	10
Zr	110	50	20	30	50	50	70	120	60	80	150	50

Area	Sample No.	Rock Name	Rock Unit	Location	Coordinates
Küre	A047	Breciated basalt	Küre F.	KS-3:72m	2558370 4629068
Küre	L021	Pillow lava	Küre F.	W.Kusça M.	2561015 4631375
Küre	M036	Massive basalt	Küre F.	W.Katıructugu T	2559000 4632140
Küre	S047	Pillow lava	Küre F.	NE.Kızana M.	2557340 4631930
Küre	Y005	Pillow lava	Küre F.	SE.Küre	2560310 4628680
Küre	Y007	Massive basalt	Küre F.	S.Küre	2559740 4629085
Küre	Y025	Massive basalt	Küre F.	N.Küre	2559160 4631975
Küre	Y098	Pillow lava	Küre F.	Asıköy	2575240 4630802
Küre	Y099	Breciated basalt	küre F.	NW.Küre	2558300 4631700
Küre	Y100	Breciated basalt	küre F.	N.Küre	2559300 4631600
Dikmendag	Y102	Massive basalt	Küre F.	E.Masköy	2548300 4632503
Dikmendag	M108	Massive basalt	Küre F.	S.Kızılelma	2542600 4631100

Table 1-14 Chemical Analysis and CIPW Norms (2)

	H043	M200	M202	M205	M230	M261	M277	M287	M288	M289
SiO_2 wt%	47.13	56.43	46.74	46.77	54.90	45.11	52.11	52.03	48.11	67.44
TiO_2	1.05	0.86	0.24	0.83	1.18	1.27	1.14	0.86	1.94	0.58
Al_2O_3	14.03	14.43	12.87	14.65	14.84	17.63	17.07	16.28	14.17	14.62
Fe_2O_3	5.18	6.76	4.41	4.35	7.01	4.13	1.23	4.40	3.12	1.86
FeO	3.85	2.45	3.92	4.09	5.01	6.86	5.13	6.93	7.86	4.43
MnO	0.17	0.15	0.15	0.16	0.19	0.23	0.12	0.22	0.19	0.07
MgO	7.72	2.71	11.73	7.53	3.63	9.15	5.46	5.53	4.63	2.58
CaO	7.14	11.82	10.47	12.10	4.08	4.45	4.22	4.82	6.18	0.56
Na_2O	4.67	0.28	2.04	2.53	6.74	4.46	4.99	3.73	4.72	1.59
K_2O	1.58	0.24	0.22	0.05	0.17	0.38	1.56	0.03	0.23	3.72
P_2O_5	0.06	0.02	0.01	0.01	0.04	0.04	0.10	0.01	0.21	0.07
LOI	5.93	3.27	5.42	5.76	1.41	4.53	6.71	3.62	7.07	2.76
Cr_2O_3	0.01	0.01	0.12	0.02	0.01	0.09	0.03	0.01	0.01	0.01
Total %	98.52	99.43	98.33	98.83	99.21	98.33	99.87	98.47	98.44	100.29
FeO*	8.51	8.53	7.89	8.01	11.32	10.58	6.24	10.89	10.67	6.10
Fe/Mg	1.10	3.15	0.67	1.06	3.12	1.16	1.14	1.97	2.30	2.37
Con.P	37.86	72.54	36.06	44.19	51.78	43.05	34.18	53.96	52.69	43.62
Q	0.00	29.14	0.00	0.27	2.42	0.00	0.00	8.02	0.00	36.49
C	0.00	0.00	0.00	0.00	0.00	1.89	0.00	1.38	0.00	7.13
or	9.34	1.42	1.30	0.30	1.01	2.25	9.22	0.18	1.36	21.99
ab	28.94	2.37	17.25	21.40	57.00	37.25	42.20	31.54	39.92	13.45
an	12.66	37.41	25.31	28.48	9.75	21.81	19.58	23.84	16.81	2.33
ne	5.72	0.00	0.00	0.00	0.00	0.25	0.00	0.00	0.00	0.00
wo	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
di-wo	9.34	7.81	11.08	13.14	4.27	0.00	0.29	0.00	5.21	0.00
di-en	7.65	6.75	8.79	10.18	3.20	0.00	0.18	0.00	2.83	0.00
di-fs	0.55	0.00	1.04	1.55	0.64	0.00	0.09	0.00	2.21	0.00
hy-en	0.00	0.00	15.31	8.57	5.84	0.00	6.92	13.77	6.28	6.42
hy-fs	0.00	0.00	1.80	1.30	1.17	0.00	3.43	8.08	4.90	5.77
ol-fo	8.11	0.00	3.57	0.00	0.00	15.96	4.55	0.00	1.70	0.00
ol-fa	0.64	0.00	0.46	0.00	0.00	5.81	2.49	0.00	1.46	0.00
mt	7.51	5.89	6.39	6.31	10.16	5.99	1.78	6.38	4.52	2.70
hm	0.00	2.69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
il	2.00	1.63	0.46	1.58	2.24	2.41	2.17	1.63	3.69	1.10
ap	0.14	0.05	0.02	0.02	0.10	0.10	0.24	0.02	0.50	0.17
TOTAL	92.57	96.15	92.76	93.04	97.78	93.68	93.12	94.84	91.36	97.51
Femic	35.92	25.82	48.93	42.63	27.62	30.26	22.14	29.88	33.29	16.16
S.I	34.04	23.04	53.61	41.56	16.61	37.24	29.92	27.40	22.86	18.44

	H043	M200	M202	M205	M230	M261	M277	M287	M288	M289
Ba ppm	20	10	50	10	10	20	220	10	30	470
Nb	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Rb	28	5	< 5	5	< 5	11	43	< 5	5	76
Sr	10	350	110	70	30	50	200	210	70	< 10
Y	20	20	< 10	20	20	30	30	20	50	20
Zr	50	60	30	30	50	60	120	40	130	100

Area	Sample No.	Rock Name	Rock Unit	Location	Coordinates
Taşköprü	H043	Green schist	Çangal metaophiolite	Yalak Dere	2605020 4617920
Taşköprü	M200	Green schist	Çangal metaophiolite	S.Kuzpınar Sr	2574300 4599680
Taşköprü	M202	Green schist	Çangal metaophiolite	Alıclıduz Sr	2574850 4599480
Taşköprü	M205	Meta basalt	Çangal metaophiolite	S.Sazak D.	2574570 4593640
Taşköprü	M230	Meta basalt	Çangal metaophiolite	Gökyar T.	2594200 4609680
Taşköprü	M261	Green schist	Çangal metaophiolite	SW.Ortaköy	2604500 4616500
Taşköprü	M277	Meta basalt	Çangal metaophiolite	S.Taşlıtepe	2621200 4619220
Taşköprü	M287	Green schist	Çangal metaophiolite	E.Çaltepe	2598900 4614260
Taşköprü	M288	Green schist	Çangal metaophiolite	SE.Karaoglan M.	2580980 4603970
Taşköprü	M289	Meta basalt	Çangal metaophiolite	S.Çaylak T.	2595730 4618320

Table 1-14 Chemical Analysis and CIPW Norms (3)

	A008	H015	M049	Y009	Y096	Y097	M286	Y075
SiO_2 wt%	38.40	37.61	49.29	54.15	66.37	69.48	51.61	56.22
TiO_2	0.26	0.01	0.25	1.24	0.30	0.34	1.14	0.96
Al_2O_3	4.48	0.81	16.06	15.77	15.32	16.28	18.26	17.53
Fe_2O_3	4.48	3.85	3.40	4.45	0.86	0.86	2.60	1.98
FeO	8.11	3.43	2.98	5.12	2.01	2.14	3.99	4.18
MnO	0.19	0.11	0.13	0.12	0.06	0.04	0.03	0.12
MgO	31.28	39.11	10.05	4.47	1.56	1.24	5.23	4.28
CaO	3.58	0.89	11.93	4.62	3.34	2.87	8.62	6.43
Na_2O	0.19	0.11	1.51	5.94	3.40	3.13	4.34	3.54
K_2O	0.08	0.02	0.51	0.30	2.45	3.46	1.17	1.76
P_2O_5	0.01	0.01	0.01	0.03	0.12	0.15	0.07	0.20
LOI	5.78	12.38	3.03	2.42	5.61	1.53	2.57	2.07
Cr_2O_3	0.35	0.30	0.01	0.01	0.01	0.01	0.02	0.01
Total %	97.19	98.64	99.16	98.64	101.41	101.53	99.65	99.28
FeO*	12.14	6.90	6.04	9.13	2.78	2.91	6.33	5.96
Fe/Mg	0.39	0.18	0.60	2.04	1.79	2.35	1.21	1.39
Con.P	27.79	14.95	33.35	46.01	27.31	27.12	37.08	38.36
Q	0.00	0.00	2.02	1.79	26.91	29.23	0.00	8.02
C	0.00	0.00	0.00	0.00	1.29	2.53	0.00	0.00
or	0.47	0.12	3.01	1.77	14.48	20.45	6.92	10.40
ab	1.61	0.93	12.77	50.23	28.75	26.47	36.70	29.94
an	11.14	1.66	35.54	15.49	15.79	13.26	26.90	26.75
di-wo	2.74	1.12	9.84	3.02	0.00	0.00	6.43	1.61
di-en	2.13	0.95	7.90	2.06	0.00	0.00	4.65	1.04
di-fs	0.31	0.03	0.79	0.72	0.00	0.00	1.20	0.46
hy-en	12.76	17.68	17.12	9.07	3.88	3.09	1.80	9.62
hy-fs	1.82	0.60	1.71	3.18	2.60	2.73	0.46	4.22
ol-fo	44.14	55.18	0.00	0.00	0.00	0.00	4.61	0.00
ol-fa	6.94	2.07	0.00	0.00	0.00	0.00	1.31	0.00
mt	6.49	5.58	4.93	6.45	1.25	1.25	3.77	2.87
hm	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
il	0.49	0.02	0.48	2.36	0.57	0.65	2.17	1.82
ap	0.02	0.02	0.02	0.07	0.28	0.36	0.17	0.47
TOTAL	91.04	85.95	96.10	96.20	95.80	99.99	97.06	97.20
Femic	77.84	83.25	42.78	26.92	8.58	8.07	26.55	22.11
S.I.	71.60	84.76	55.49	32.53	15.31	11.55	30.64	27.54

	A008	H015	M049	Y009	Y096	Y097	M286	Y075
Ba ppm	< 10	< 10	100	20	230	430	150	200
Nb	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Rb	< 5	< 5	5	5	109	114	38	76
Sr	< 10	< 10	60	100	160	220	310	270
Y	< 10	< 10	10	30	10	10	30	20
Zr	10	< 10	80	70	100	100	40	90

Area	Sample No.	Rock Name	Location	Coordinates
Küre	A008	Pyroxinite	N.Kızılsu	2558710 4629470
Küre	H015	Serpentinite	NW.Kızana M.	2556200 4632350
Küre	M049	Gabbro	NE.Kızılsu	2559020 4629400
Küre	Y009	Diorite	S.Küre	2559500 4629120
Küre	Y096	Dacite	Aşıköy	2575220 4630793
Küre	Y097	Dacite	NW.Toykondu	2555770 4631800
Taşköprü	M286	Diorite	NE.Yalakdere	2605700 4619140
Taşköprü	Y075	Bio-granite	NE.Ambarkaya	2587740 4617790

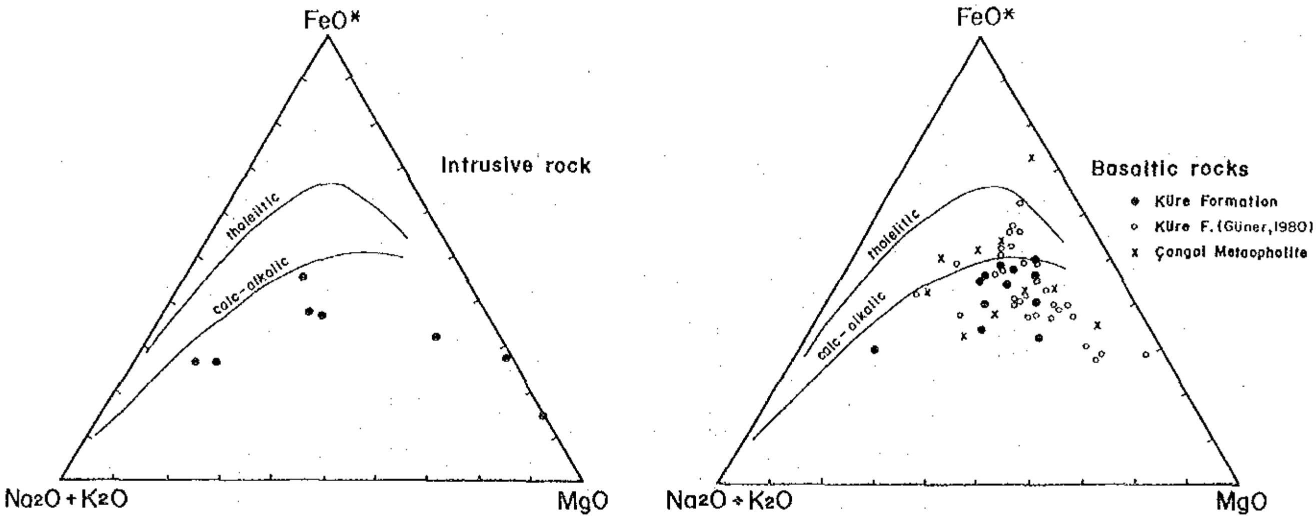

Figure 1-6 AFM Diagram

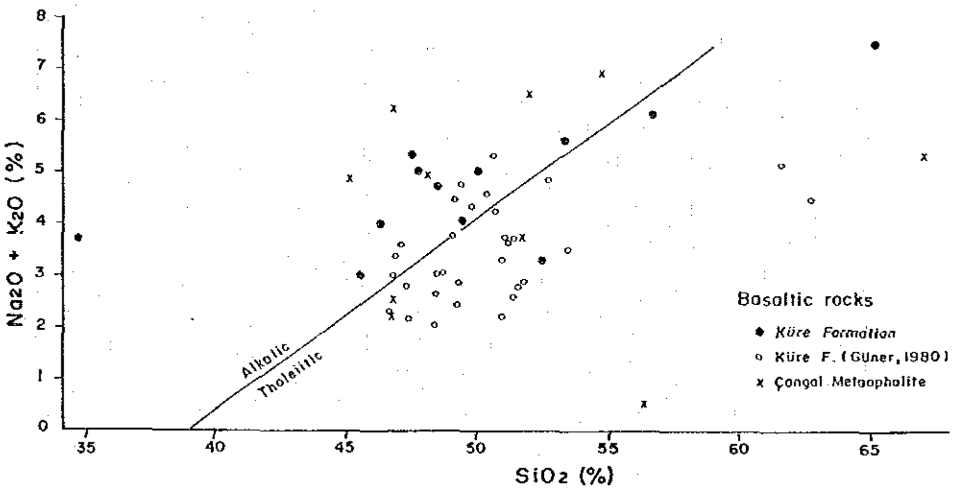

Figure 1-7 SiO_2-(Na_2O-K_2O) Diagram for Basic Volcanics

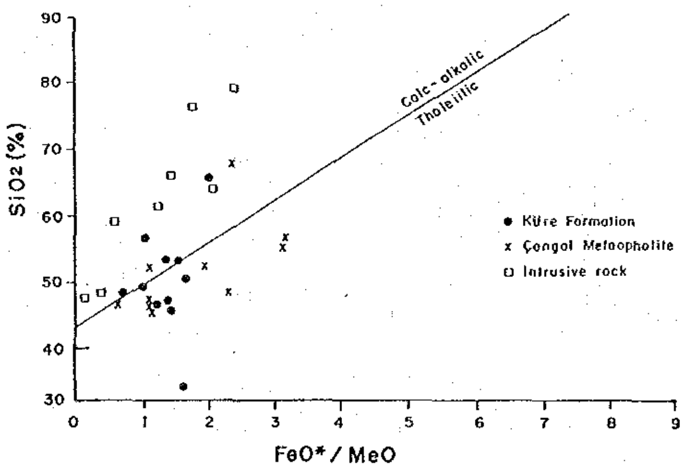

Figure 1-8 SiO_2-FeO*/MgO Diagram

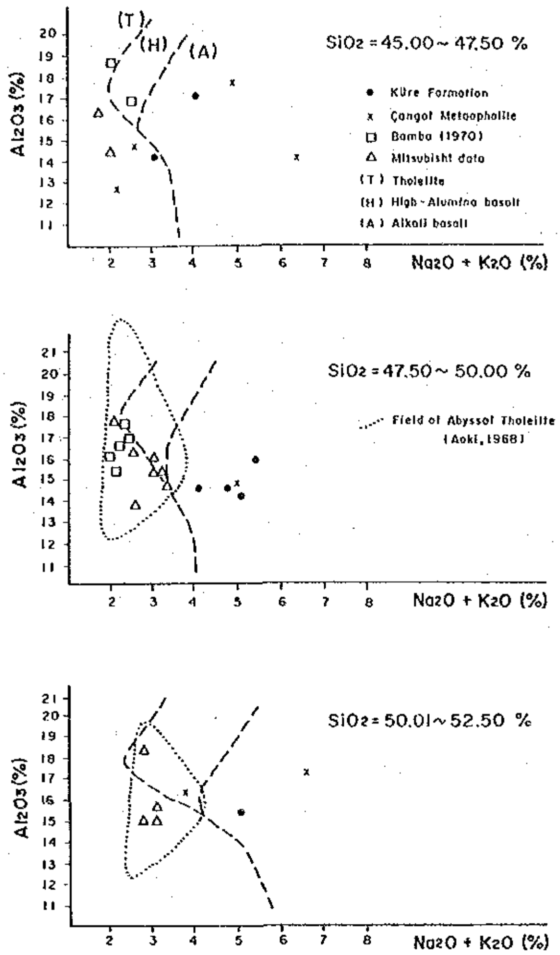

Figure 1-9 Al_2O_3-Na_2O+K_2O, SiO_2 Diagrams

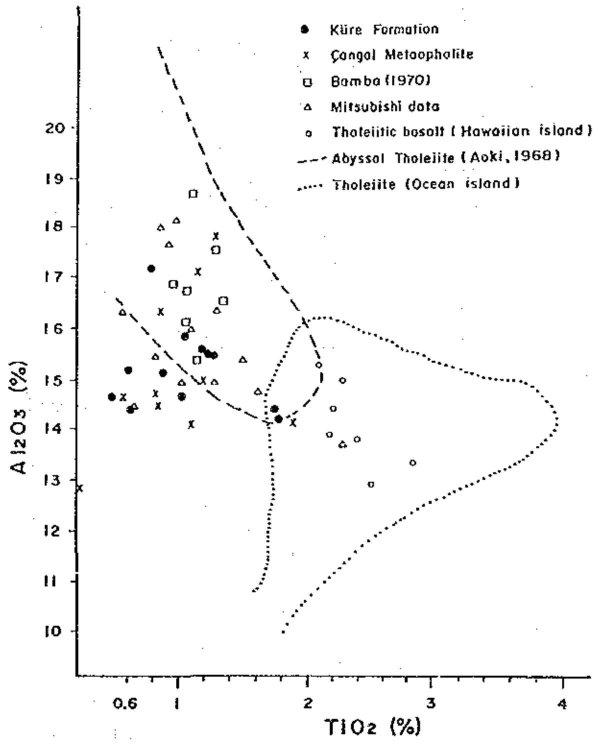

Figure 1-10 Al_2O_3-TiO_2 Diagrams

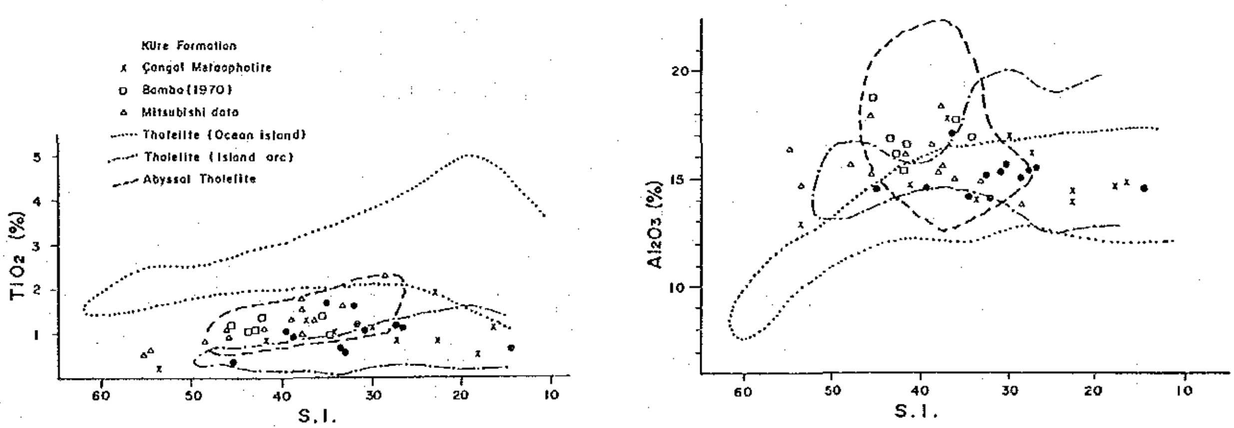

Figure 1-11 S.I.-TiO_2 and Al_2O_3 Diagram

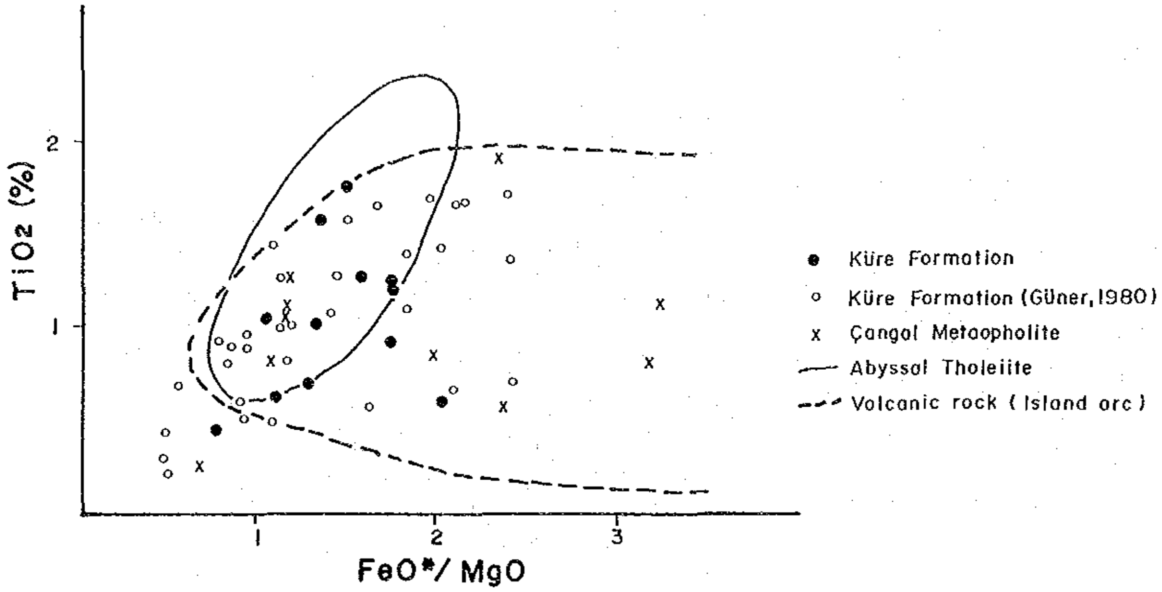

Figure 1-12 TiO2-FeO*/MgO Diagram

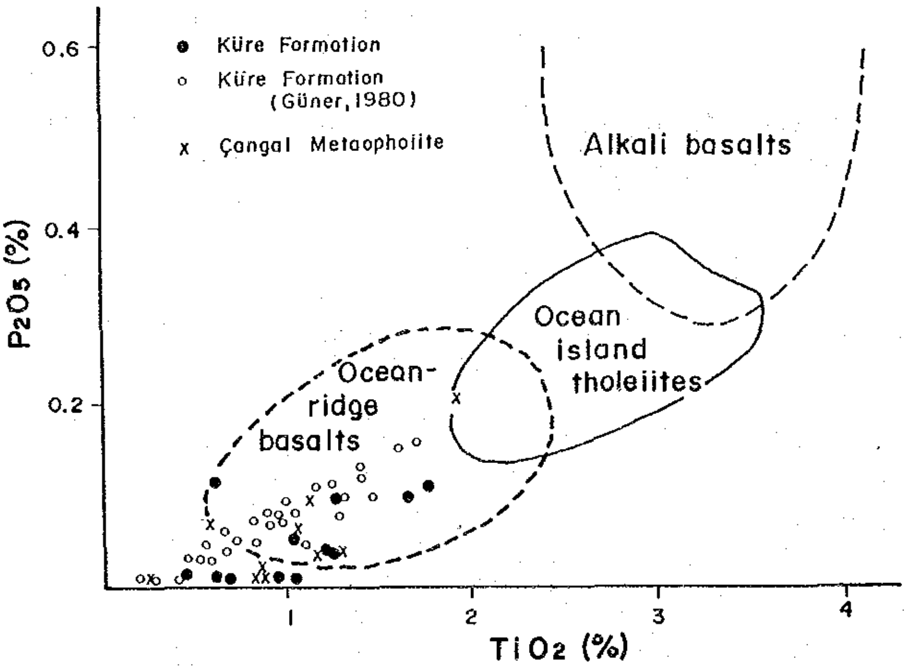

Figure 1-13 P2O5-TiO2 Diagrams

4-1-3 Ore Microscopy

A total of 60 polished sections were prepared, 56 samples from Küre Deposits and four from Taşköprü Zone. The sampling locations are shown in the appended map, the coordinates in Table 1-15, the results of microscopic studies in Table 1-16, and photomicrographs in Photo 2 of the appendix.

The ores of the Küre Deposits are massive, brecciated, disseminated and vein ores. All of these ores contain chalcopyrite and pyrite in varying proportions and the average grade of copper is 3% in Aşıköy Orebody and 6% in Bakibaba Deposit. The major ore minerals are chalcopyrite and pyrite with minor content of bornite, pyrrhotite, magnetite, sphalerite, galena, marcasite, electrum, bravoite, carrollite and others.

Massive ores consist mostly of sulfides, but the brecciated ore contains gangue and clay minerals filling the matrix of the breccias.

The massive ores contain minute pyrite grains in colloform and gel form together with coarse pyrite and chalcopyrite occurs filling the interstices. In many cases the pyrite is cataclastic.

The amount of sulfides in the disseminated ores is less than a third. The basalt host rocks are considerably altered with occurrence of chlorite and sericite.

The mineral content of the vein ores ranges from chalcopyrite-rich to only pyrite and the boundary of vein ores with the foot wall basalt is sharp. The sulfide minerals are coarse-grained.

The microscopic characteristics of the ores are summarized as follows.

Pyrite: It is observed abundantly and consist of two types; one of them is euhedral-subhedral, interfingered with cataclastic structure. This type of pyrite which is the oldest sulfide mineral is replaced by the other sulfide minerals. This type of pyrite sometimes show zonation. The other pyrite type is colloform (melnicovite) pyrite. Concentric crusted, kidney-like, grape-like and locally with radial texture melnicovite (colloform) pyrites grew within each other with chalcopyrite and sphalerite. Melnicovite pyrites are generally very minute grains

Chalcopyrite: It is very abundant. Chalcopyrite fills the interspaces and cataclastic fractures of euhedral cataclastic pyrites and sometimes is associated with the concentric crusted kidney-like, radial texture of melnicovite (colloform) pyrites.

Sphalerite and galena: These minerals are observed as small anhedral grains within the chalcopyrite, gangue minerals and pyrites. Sphalerite contains local chalcopyrite exsolutions.

Cobalt minerals: Carrollite has the same crystal structure as pyrite and is a polymorph of linnaeite and bravoite are observed. The former mineral occurs as small grains and the latter as large crystals. There are high cobalt parts in the veins.

Titanium minerals: Leucoxene, rutile, and anatase occur in the ores. These minerals form fine exsolution texture in pyrite. Leucoxene occurs in gangue minerals as an alteration product of mafic minerals. The other two minerals occur as minute crystals in pyrite and gangue mineral.

Minerals in slags: Sulfide content is chalcopyrite, bornite, digenite, and pyrrhotite. Also wustite and hercynite characteristic of slags were identified.

Table 1-15 Samples of the Polished Sections (1)

Küre Mining Zone (1)

No.	Description	Locality	Y	X
A023	Massive cp-py ore	Aşıköy	2557522	4630811
L100	Massive cp-py ore	Aşıköy	2557516	4630798
A028	Brec basalt with hem	Aşıköy	2557467	4630847
A032	Massive py-cp ore	Aşıköy	2557526	4631150
A025	Massive py ore	Aşıköy	2557518	4630870
A057	Brec py ore	Aşıköy	2557488	4630957
A058	Basalt with net py-cp	Aşıköy	2557458	4630808
A059	Massive py-cp ore	Aşıköy	2557492	4630908
L095	Massive py ore	Aşıköy	2557539	4630862
L101	Massive py ore	Aşıköy	2557461	4630750
A027	Massive colloform py	Aşıköy	2557475	4630890
L097	Massive py ore(Col.)	Aşıköy	2557524	4630797
M058	Massive py ore	Aşıköy,920ML	2576105	4630788
M059	Massive py ore	Aşıköy,920ML	2576105	4630788
Y031	Massive ore	Aşıköy	2557400	4631200
Y032	Massive ore	Aşıköy	2557400	4631220
Y033	Massive ore	Aşıköy	2557423	4631250
Y040	Massive ore	Aşıköy	2557550	4631000
L106	Diss py sil. ore	Aşıköy	2557345	4630816
Y038	Brecciated ore	Aşıköy	2557265	4631176

Table 1-15 Samples of the Polished Sections (2)

Küre Mining Zone (2)

No.	Description	Locality	Y	X
A026	Basalt with cp-py ore	Aşıköy	2557513	4630876
A029	Crystallized py ore	Aşıköy	2557400	4630834
A068	Massive py-cp	S-136:433.5m	2557647	4630635
A069	Massive py-cp	S-155:196.6m	2557420	4630750
A070	Massive cp ore	S-138:53.8m	2557351	4631358
A071	Massive py-cp ore	S-106:8.0m	2557492	4631020
A072	Basalt with py-cp	S-82:45-50m	2557519	4630856
A073	Bre basalt with py	S-67:47.0m	2557327	4630778
A074	Basalt with py	S-64:138.0m	2557539	4630739
A034	Silicified cp-py ore	Bakibaba	2558390	4628892
A035	Massive cp ore	Bakibaba	2558416	4630770
M060	Massive cp ore, 920ML	Bakibaba	2558460	4630780
M061	Massive py-cp(1014ML)	Bakibaba	2558430	4630741
M062	Massive py ore(1014ML)	Bakibaba	2558433	4630740
M063	Brecciated cp-py ore	Bakibaba,1080	2558464	4630723
M064	Massive py-cp ore	Bakibaba,1080	2558465	4630719
K064	Brec basalt with lim	Bakibaba	2558410	4630770
A017	Slag	Bakibaba	2558450	4630620
H025	Slag	Bakibaba	2559135	4630990
N091	Slag	Bakibaba	2558920	4630685
N094	Slag	Bakibaba	2558950	4630930
N097	Slag	Bakibaba	2559030	4630780
A041	No.163:22-24m	T-163:23m	2557370	4631353
A044	No.164:40.5-43m	T-164:41.5m	2557379	4631310
A046	No.164:45.2-47.5m	T-164:46m	2557379	4631310
A060	No.165:62m	T-165:62m	2557258	4631294
A061	Bre py-co ore	KS-49:34.2m	2558365	4629110
A062	Massive cp-py ore	KS-50:25m	2558384	4629077
A063	Massive py-cp ore	KS-24:62.1m	2558502	4629067
A064	Basalt with cp-py ore	KS-2 :61.8m	2558423	4629088
A065	Basalt with cp-py ore	KS-43:50.4m	2558595	4628990
A066	Basalt with cp-py ore	KS-33:18.5m	2558560	4628986
A067	Basalt with cp-py ore	KS-33:36.4m	2558560	4628986
A056	Massive cp-py ore	KS-32:33.7m	2558580	4628975
L013	Gossan	N.Zemberekler	2559765	4630570
Y012	Silicified py veinlet	Zemberekler	2559670	4630400

Taşköprü Zone

No.	Description	Locality	Y	X
A122	Slag	Cozoğlu	2613530	4615300
N057	Pyrite ore	S.Karaoğlan	2581070	4603950
H036	Pyrite ore	Boyalı	2603000	4615963
N066	Gossan with py	Kepez	2593600	4619400

Table 1-16 Microscopic Observations of the Polished Sections(1)

Sample No.	Ore	Ore Minerals												Gangue Minerals					Texture		Remarks
		Py	Cp	Sp	Bo	Co	Te	Mr	Pr	Mg	He	Lu	Ru	Qz	Ch	Se	Ca	Cr	CC	CF	
A023	Massive cp-py ore	◎	○	□				□				△		◎					●	•	native gold △
L100	Massive cp-py ore	◎	○	□		△	△							○	○	○	○				galena △
A028	Brec basalt with hem		□							△	△	△		○				○	•	●	ophitic texture
A032	Massive cp-py ore	◎	○	□				△						□					•	●	
A025	Massive py ore	◎	□	□										□					•	●	
A057	Brec py ore	◎	□	○				○						□					●		
A058	Basalt with net py-cp	◎	○	□							△		△	◎	○			○	•	•	ophitic texture
A059	Massive cp-py ore	◎	○	□										□					●	•	
L095	Massive py ore	◎	○	□				□						□					●	•	
L101	Massive cp-py ore	◎	○	△									△	◎	○	△		□	●	•	bravoite □, chromite △
A027	Massive py ore	◎	□	□									△	□					●	•	
L097	Massive py ore	◎	□	△										□						●	
M058	Massive py ore	◎	□	□									△	□					●		chromite △
M059	Massive ore	◎	□	□				○					△	□					●	•	
Y031	Massive ore	◎	□						△		△			□					●		
Y032	Massive py ore	◎	□	□		△								□	□			□	●		digenite-covelline △
Y033	Massive py ore	◎	□	□									△	□					●		
Y040	Massive py ore	◎	□	□										□	○	□		○	●	●	
L106	Diss py sil ore	◎	□	□				□						◎					●	•	
Y038	Brec ore	◎	○											◎					●		
A026	Basalt with cp-py ore	□	△	△								△		◎	○	□		□	●		chromite △
A029	Crystallized py ore	◎	□	△										◎	○	○		○	•		
A068	Massive cp-py ore(core)	◎	○										△	◎	○				•		
A069	Massive cp-py ore(core)	◎	○	□				□					△	◎	□				●	•	
A070	Massive cp ore(core)	◎	□	□	○		□							□					●	•	digenite
A071	Massive cp-py ore(core)	◎	○	□				□					△	□	○				●	•	ilmenite △
A072	Basalt with py-cp(core)	○	□	□							△	△	△		○			○	•		ophitic texture
A073	Basalt with py(core)	○	□	□				□				△	△		○	□		□			
A074	Basalt with py(core)	○	□	□				□				△	△		○	○		○	•		
A034	Sil cp-py ore	○	○	□							△		△	□					●	•	

Abbreviations:

◎:Abundant ○:Common □:Few △:Rare

Cp:chalcopyrite, Py:pyrite, Sp:sphalerite, Bo:bornite, Co:covelline, Te:tetrahedrite, Mr:marcasite,
Pr:pyrohtite, Mg:magnetite, He:hematite, Lu:leucoxene, Ru:rutile-anatase
Qz:quartz, pl:plagioclase, chlorite, Se:sericite, Ep:epidote, Ca:calcite, Cr:carbonite,
CC:cataclastic, CF:colloform ●:Major •:minor

Table 1-16 Microscopic Observations of the Polished Sections(2)

Sample No.	Ore	Ore Minerals												Gangue Minerals					Texture		Remarks
		Py	Cp	Sp	Bo	Co	Te	Mr	Pr	Mg	He	Lu	Ru	Qz	Ch	Se	Ca	Cr	CC	CF	
A035	Massive cp ore	◎	○	□									△	○					●	•	
M060	Massive cp ore (920ML)	◎	○											◎					•		chromite △
M061	Massive py-cp(1014ML)	◎	○	□		□								○					•		
M062	Massive py ore(1014ML)	◎	○	△		△			△					△							
M063	Brec cp-py ore	◎	○											□	○	○			•	•	
M064	Massive py-cp ore	◎	○	△										○							limonite, bravoite △
K064	Brec basalt with lim	△										△	△	○							limonite, chromite △
A017	Slag		△		△	△			△	△	△										digenite, wustite,
H025	Slag		△		△	△			△	△	△										hersinite, fayalite
N091	Slag		△		△																
N094	Slag		△		△				△												
N097	Slag		△		△				△												
A041	Massive cp-py ore(core)	◎	○	□										○					●	•	
A044	Massive cp-py ore(core)	○	□	□				□	□					□							bravoite □
A046	Massive cp-py ore(core)	◎	□			□		□						○					●		
A060	Massive cp-py ore(core)	◎	○	□								△		○	□	○		□	●		
A061	Bre py-cp ore(core)	◎	○									△	△	○	○	○			●	•	
A062	Massive cp-py ore(core)	◎	□		□	□	△							□					•	●	carrollite △
A063	Massive cp-py ore(core)	◎	□	△									△	○					●		
A064	Basalt with cp-py(core)	○	□									△	△	○	○	○		○	•		limonite □
A065	Basalt with cp-py(core)	□	○									△	△								chromite △
A066	Basalt with cp-py(core)	○	□								△			◎	○	○			•		
A067	Basalt with cp-py(core)	○	□	△			△	△					△	○					•	•	
A056	Massive cp-py ore(core)	◎	□				□							○					●		bravoite △
L013	Gossan	□											△	□		□				•	
Y012	Silicified py veinlet	□						△													sphane, chromite △
A122	Slag		□		△				□	○	□										
N057	Pyrite ore	◎	□	□										○		○?		○			galena △
H036	Pyrite ore	◎	□	□		△							△	○	○						ilmenite △, actinolite □
N066	Gossan with py	○	□			△					△		△	◎	○	○		○			marachite, limonite △

Abbreviations:

◎:Abundant ○:Common □:Few △:Rare

Cp:chalcopyrite, Py:pyrite, Sp:sphalerite, Bo:bornite, Co:covelline, Te:tetrahedrite, Mr:marcasite,
Pr:pyrohtite, Mg:magnetite, He:hematite, Lu:leucoxene, Ru:rutile-anatase
Qz:quartz, pl:plagioclase, chlorite, Se:sericite, Ep:epidote, Ca:calcite, Cr:carbonite,
CC:cataclastic, CF:colloform ● :Major • :minor

4-1-4 Ore Assay

The ores were assayed as follows. The sampling localities are shown in the sampling map and the locations described in Table 1-17.

Zone	Amount
Küre Mining Zone	89 pcs
Taşköprü Zone	30 pcs
Dikmendağ Area	5 pcs
Total	124 pcs

Gold: Although there are high-grade ores such as 8g/t in the Bakibaba samples, most of them contain 1-2g/t. The maximum grade of Toykondu samples is 4g/t. There were samples containing around 1g/t from Kizilsu Deposit, surface gossan at Bakibaba, and slags at Bakibaba.

Silver: The silver content of most of the ores is less than the limit of detection. The maximum value found is 25g/t at Küre and 100g/t at Taşköprü.

Copper, lead, and zinc: Some copper content was discovered by the semi-detailed survey at Taşköprü, but notable showings were not discovered. Almost all samples contained less than 1% lead and zinc.

Cobalt: The maximum content at Küre: is 0.5% and 0.01% or less at other localities. Content of 3.31% was found in the slag at Bakibaba.

Sulfur: The content is high at Küre ranging from 40 to 50%, but is several percent in other localities.

Table 1-17 Samples of the Ore Analysis (1)

Küre Mining Zone (1)

No.	Description	Locality	Y	X
A041	No.163:22-24m	Toykondu	2557370	4631353
A042	No.163:24-25.7m	Toykondu	2557370	4631353
A043	No.164:39.2-40.5m	Toykondu	2557379	4631310
A044	No.164:40.5-43m	Toykondu	2557379	4631310
A045	No.164:43-45.2m	Toykondu	2557379	4631310
A046	No.164:45.2-47.5m	Toykondu	2557379	4631310
A023	Massive cp-py ore	Aşıköy	2557522	4630811
L100	Massive cp-py ore	Aşıköy	2557516	4630798
A032	Massive py-cp ore	Aşıköy	2557526	4631150
L108	Massive py-cp ore	Aşıköy	2557339	4630835

Table 1-17 Samples of the Ore Analysis (2)

Küre Mining Zone (2)

No.	Description	Locality	Y	X
A025	Massive py ore	Aşıköy	2557518	4630870
L095	Massive py ore	Aşıköy	2557539	4630862
L096	Massive py ore	Aşıköy	2557521	4630793
L098	Massive py ore	Aşıköy	2557524	4630802
L099	Massive py ore	Aşıköy	2557516	4630791
L101	Massive py ore	Aşıköy	2557461	4630750
L102	Massive py ore	Aşıköy	2557468	4630790
L105	Massive py ore	Aşıköy	2557350	4630817
A027	Massive colloform py	Aşıköy	2557475	4630890
L097	Massive py ore(Col.)	Aşıköy	2557524	4630797
M058	Massive py ore	Aşıköy,920ML	2576105	4630788
M059	Massive py ore	Aşıköy,920ML	2576105	4630788
Y031	Massive ore	Aşıköy	2557400	4631200
Y032	Massive ore	Aşıköy	2557400	4631220
Y033	Massive ore	Aşıköy	2557423	4631250
Y040	Massive ore	Aşıköy	2557550	4631000
L103	Diss py ore	Aşıköy	2557422	4630806
L104	Diss py arg ore	Aşıköy	2557405	4630813
L106	Diss py sil. ore	Aşıköy	2557345	4630816
L107	Diss py ore	Aşıköy	2557330	4630835
L110	Diss py ore	Aşıköy	2557389	4630841
L111	Diss py ore	Aşıköy	2557395	4630844
L112	Diss py ore	Aşıköy	2557335	4630807
Y038	Brecciated ore	Aşıköy	2557265	4631176
A026	Cp vein	Aşıköy	2557513	4630876
A029	Crystallized py ore	Aşıköy	2557400	4630834
L109	Crystallized py ore	Aşıköy	2557439	4630875
A076	Pyrite Concentrate(A)	Aşıköy		
A077	Pyrite Concentrate(B)	Aşıköy		
A078	Pyrite Concentrate(C)	Aşıköy		
A079	Copper Concentrate(A)	Aşıköy		
A080	Copper Concentrate(B)	Aşıköy		
A081	Copper Concentrate(C)	Aşıköy		
A013	Basalt with malachite	Bakibaba	2558200	4630650
A034	Silicified cp-py ore	Bakibaba	2559330	4630830
A035	Massive cp ore	Bakibaba	2559330	4630830
M060	Massive cp ore, 920ML	Bakibaba	2558460	4630780
K064	Brec basalt with lim	Bakibaba	2558600	4630780
M061	Massive py-cp(1014ML)	Bakibaba	2558430	4630741
M062	Massive py ore(1014ML)	Bakibaba	2558433	4630740
M063	Brecciated cp-py ore	Bakibaba,1080	2558464	4630723
M064	Massive py-cp ore	Bakibaba,1080	2558465	4630719
N083	Gossan	Bakibaba	2558495	4630950
N084	Gossan	Bakibaba	2558490	4630405
N085	Gossan	Bakibaba	2558482	4630857
N086	Gossan	Bakibaba	2558550	4630910
N087	Gossan	Bakibaba	2558538	4630860
N088	Gossan	Bakibaba	2558538	4630820
N089	Gossan	Bakibaba	2558532	4630763
N090	Gossan	Bakibaba	2558521	4630685
A017	Slag	Bakibaba	2558450	4630620
H025	Slag	Bakibaba	2559135	4630990
N091	Slag	Bakibaba	2558920	4630685
N092	Slag	Bakibaba	2558900	4630770
N093	Slag	Bakibaba	2558850	4630735
N094	Slag	Bakibaba	2558950	4630930
N095	Slag	Bakibaba	2559050	4631035
N096	Slag	Bakibaba	2559150	4630865
N097	Slag	Bakibaba	2559030	4630780
A050	Gossan	Kızılsu	2558339	4629135

Table 1-17 Samples of the Ore Analysis (3)

Küre Mining Zone (3)

No.	Description	Locality	Y	X
A051	Gossan	Kızılsu	2558487	4629041
A052	Slag	Kızılsu	2558453	4629063
A053	Gossan	Kızılsu	2558537	4629039
A054	Gossan	Kızılsu	2558528	4629058
A055	Gossan	Kızılsu	2558561	4629042
A056	KS-32:33.7m	Kızılsu	2558580	4628975
K009	Gossan with py	Ersızler	2561200	4634535
K018	Gossan	İpsinler	2561020	4633840
L013	Gossan	N.Zemberekler	2559765	4630570
L014	Gossan	N.Zemberekler	2559640	4630630
L015	Gossan	N.Zemberekler	2559625	4630675
L019	Gossan	NE.Bakibaba	2559460	4631360
L028	Gossan	SE.İpsinler	2561500	4632540
M044	Basalt with py	NE.Bakibaba	2559110	4631375
N029	Basalt with py	SW İpsinler	2559650	4632670
N039	Slag	S.İpsinler	2559840	4632060
Y012	Silicified py veinlet	Zemberekler D.	2559670	4630400
Y019	Silicified py veinlet	N.Bakibaba	2558980	4632490
Y024	Silicified py veinlet	Zemberekler D.	2559500	4630250

Taşköprü Zone

No.	Description	Locality	Y	X
A122	Slag	Cozoğlu	2613600	4615200
A123	Altered basalt with ma	Cozoğlu	2613600	4615200
Y200	Gr.sch with Ox Cu	Cozoğlu	2613590	4615510
Y203	Gr.sch with Ox Cu	Cozoğlu	2613700	4615460
Y204	Qtz vein with Ox Cu	Cozoğlu	2613760	4615440
Y207	Slag	Cozoğlu	2613580	4615300
H032	Pyrite ore	Sey Y.	2597510	4612100
N057	Pyrite ore	S.Karaoğlan	2581070	4603950
H036	Pyrite ore	Boyalı	2603000	4615963
H037	Slag	Boyalı	2603800	4616160
H038	Gossan	Boyalı	2604100	4615800
K228	Gossan	N.Sökü	2578760	4600000
K224	Gossan with py	N.Sökü	2580100	4600500
Y067	Quartz vein with mala	N.Sökü	2583380	4602340
Y165	Basalt with seco.cp	W.Çünür	2582030	4601320
L051	Limonitic rock	Süleymanköy	2590590	4602700
L052	Limonitic rock	Süleymanköy	2590820	4602500
M234	Gossan	SE.Deliimam M.	2594470	4609140
M257	Basalt with py	NE.Gano M.	2592900	4604800
N063	Gossan(Basalt with py)	S.Dikmen	2594300	4616800
N066	Gossan with py	Kepez	2593600	4619400
N072	Limonitic rock with py	NW.Sarpın	2597100	4618800
N108	Gr.sch with cp+py	S.Alayürek	2575430	4600045
N111	Gossan(lim)	S.Alayürek	2575470	4600090
K422	Arg.gr.sch with py	S.Alayürek	2575300	4600160
S076	Slag	S.Alayürek	2575360	4600080
S077	Gossan(g.s with lim)	S.Alayürek	2575370	4600060
S095	Gossan(g.s with py)	S.Alayürek	2592340	4608510
S097	Gossan(g.s with py)	S.Alayürek	2607500	4612700
A075	Altered basalt with py	SE.Karakuz Y.	2596625	4619625

Table 1-17 Samples of the Ore Analysis (4)

Dikmendağ Zone

No.	Description	Locality	Y	X
K111	Gossan	SE.Kale T.	2547000	4632340
S111	Slag with magnetite	SE.Kale T.	2545690	4629000
K405	Slag	SW.Kale T.	2544380	4629330
S261	Sil rock with py	S.Masköy	2546585	4631900
S262	Sil rock with py	S.Masköy	2546565	4631835

(1) Copper Ore Samples collected from Open Pit of Aşıköy Orebody

Table 1-18 Analytical Results of the Ore Samples (1)

Sample No.	Au g/T	Ag g/T	Cu %	Pb %	Zn %	Co %	S %	Remarks
A023	0.3	15	8.38	0.06	1.56	0.10	46.21	EPMA, S-isotope
A025	<0.1	5	2.66	0.04	0.05	0.24	44.01	EPMA
A026	0.2	< 5	1.65	0.06	0.17	0.07	13.09	S-isotope
A027	1.6	5	1.30	0.06	0.05	0.04	45.55	EPMA, S-isotope
A032	<0.1	5	1.45	0.06	0.12	0.11	44.93	EPMA
L095	<0.1	< 5	1.69	0.02	0.05	0.04	46.51	
L096	8.1	5	1.90	0.19	0.08	0.03	45.91	
L100	1.9	5	7.38	0.12	0.13	0.08	43.29	
L101	0.9	5	1.55	0.09	0.05	0.04	43.26	
L102	0.8	5	3.78	0.07	0.87	0.08	42.56	
L105	<0.1	5	1.48	0.07	0.21	0.05	49.81	
L108	<0.1	< 5	3.22	0.04	0.07	<0.006	49.56	
L112	0.3	< 5	1.73	0.02	0.03	0.13	43.59	
Y031	1.5	5	2.88	0.04	0.05	0.03	42.60	
Y032	3.4	5	1.49	0.06	0.11	0.02	47.71	
Y033	1.8	5	1.60	0.02	0.05	0.31	40.60	
Y040	8.5	15	2.38	0.12	0.11	0.11	45.40	

(2) Pyrite Ore Samples collected from Open Pit of Aşıköy Orebody

Table 1-18 Analytical Results of the Ore Samples (2)

Sample No.	Au g/T	Ag g/T	Cu %	Pb %	Zn %	Co %	S %	Remarks
A029	<0.1	5	0.07	0.19	0.10	0.04	47.11	S-isotope
L097	1.4	5	0.31	0.07	0.07	0.05	48.95	
L098	<0.1	5	0.54	0.20	0.05	0.04	48.04	
L099	0.6	5	0.81	0.19	0.08	0.06	43.69	
L103	<0.1	< 5	0.04	0.12	0.11	0.08	20.49	
L104	0.5	< 5	0.28	0.15	0.12	0.06	30.63	
L106	0.8	< 5	0.12	0.01	0.05	0.01	40.51	
L107	3.0	5	0.20	<0.01	0.11	0.01	46.57	
L109	<0.1	5	0.04	0.01	0.11	0.03	48.68	
L110	<0.1	< 5	0.03	0.01	0.12	0.05	39.81	
L111	0.6	< 5	0.02	0.04	0.54	0.11	46.99	
Y038	0.8	5	0.40	0.02	0.06	0.03	44.14	