REPORT ON THE MINERAL EXPLORATION IN THE ÇANAKKALE AREA REPUBLIC OF TURKEY

PHASE III

FEBRUARY 1991

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 Çanakkale 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 20 June to 8 November 1990.

The team exchanged views with the officials concerned of the Government of the Republic of Turkey and conducted a field survey in the Çanakkale 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.

February 1991

Kensuke Yanagiya

Kensuke YANAGIYA
President,
Japan International Cooperation Agency

Gen-ichi FUKUHARA
President,
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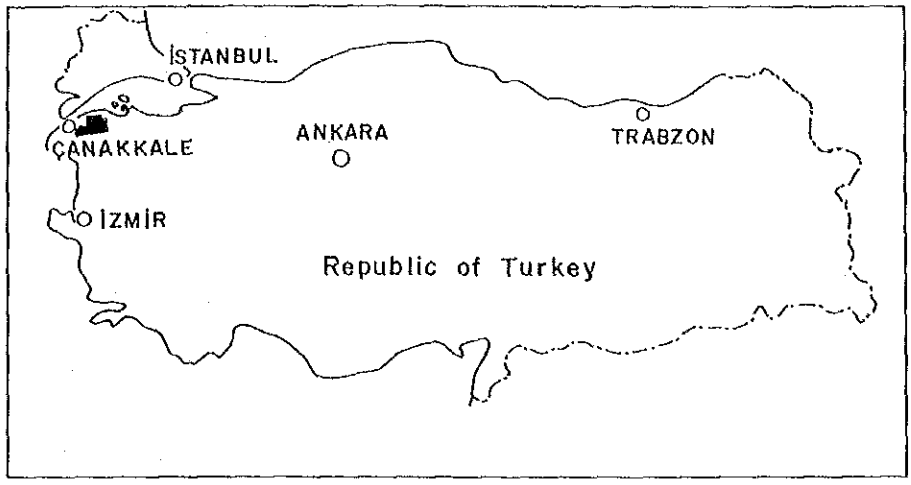

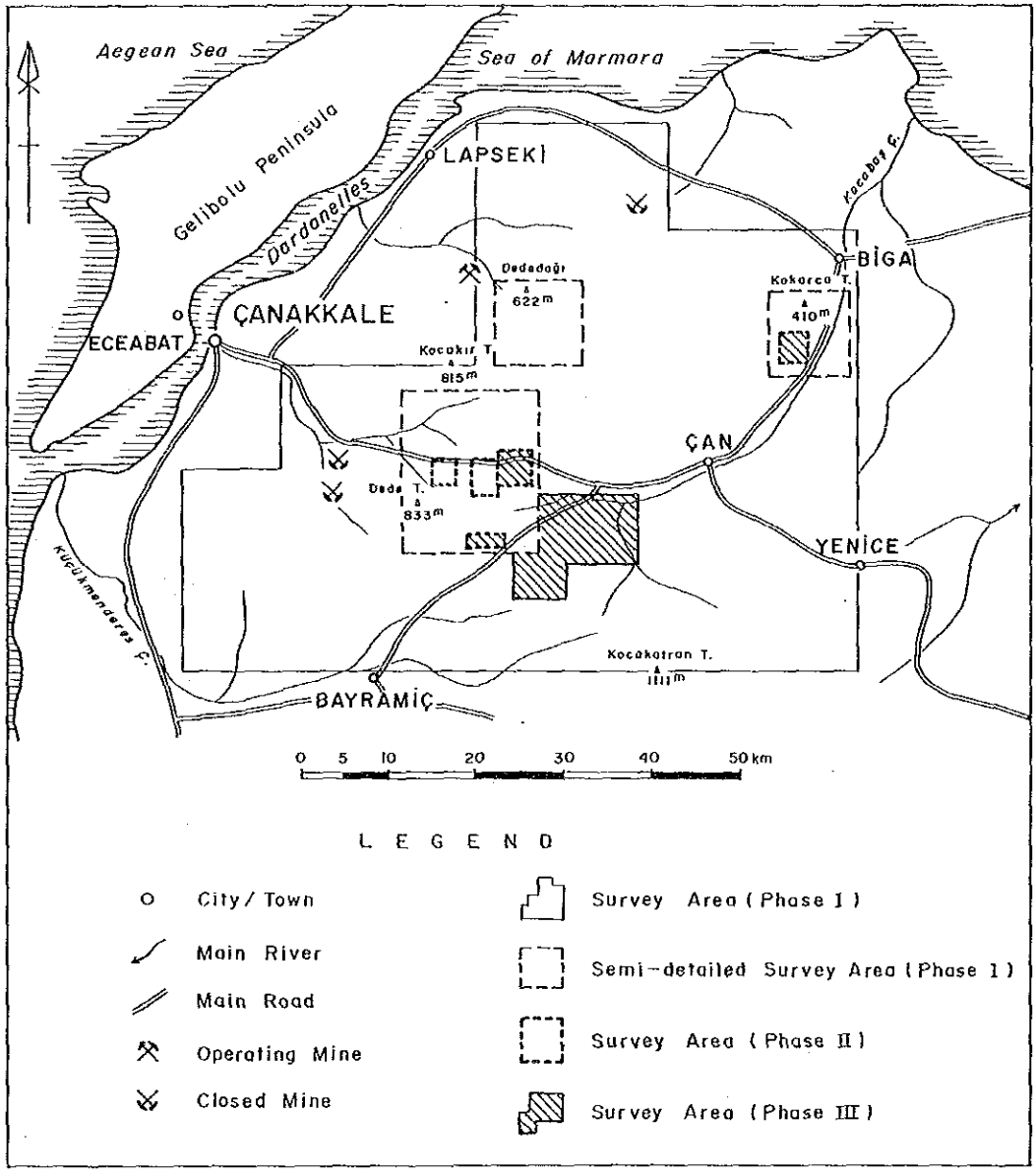

Figure 1- 1 Index Map of the Survey Area

Summary

The objective of the present survey was to clarify the mode of occurrence of various metal deposits of the Çanakkale Area.

Prior to the survey of the first phase, Landsat images totaling 3,400km^2 in areal extent were analyzed and interpreted; available data regarding previous work on geology and geochemical prospecting were acquired and studied. From the results, Zones A and B were isolated as warranting investigation for precious metals, and Zone C for metallic deposits.

In addition to the geological survey, systematic collection of rock samples for geochemical prospecting, heavy mineral investigation was carried out. Also, the remainder of the stream sediment samples previously collected by MTA was analyzed for gold and other additional elements. As a result of the survey of the first phase, four localities (Arlık Stream, Karaibrahimler, Kestane Mt. and Piren Hill) in Zone B and one (Dikmen) in Zone C were isolated as promising.

In the second phase, the detailed geological survey, rock samples were systematically collected for geochemical prospecting, and heavy mineral investigation, geophysical prospecting and drill survey were carried out in the above-mentioned localities. On the basis of these results, surveys of the third phase were conducted as follows:

Localities	Geological Survey	Geochemical Survey	Drill Survey
Arlık Stream		Trench 1,245m, 404 pcs	1,208m (8 holes)
Piren Hill		Trench 334m, 104 pcs	
Etili	115km^2(120km)	Rock Samples 69 pcs	302m (2 holes)
	20km^2(45km)	Rock Samples 389 pcs	
Dikmen			150m (1 hole)
Total		966 pcs	1,660m(11 holes)

The results of survey are summarized as follows:

(1) Arlık Stream: Many rock samples bearing gold were found in the silicified zones, and gold mineralization zones of low grade were detected by trench and drill surveys conducted in the Sartaş and Güvemalanı silicified zones.

(2) Piren Hill: Although limonitic gold-bearing argillized zones were intersected by drill hole MJTC-2 carried out in the Davulgılı alteration zones, significant gold mineralization zones on the surface could not be detected by trench survey.

(3) Etili: Many more rock samples containing gold were found in the Hamam and Halilaga silicified zones. The limonitic, porous and brecciated parts of the former contain gold, the massive parts are mined as brick-sized stone. The latter is limonitic, argillically silicified, of small scale, and extending NE-SW. Auriferous zones of a small scale were intersected by drill hole MJTC-16 near the surface.

(4) Dikmen: A porphyry molybdenum-copper mineralization associated with the intrusion of the Dikmen Granite and porphyry was discovered. The subsurface

extent of mineralization from the outcrop downward was shown by delineating the PFE anomalies by geophysical methods. The lithology of MJTC-15 consists of altered rocks of Emeşe Formation which are strongly silicified and are accompanied with quartz veinlets of various orientations. The content of antimony and mercury is high, indicating the halo of gold mineralization.

The mineralizations of the survey areas are largely divided into epithermal and dissemination (porphyry molybdenum) types. Epithermal-type mineralization is low-grade large-scale gold deposits in Zone B. The dissemination type is found in Zone C. It is associated with the intrusion of Dikmen Granite and porphyry, and also, low-grade (Mo) mineralization is developed in the host rocks.

Concerning the relationship between geologic structure and mineralization, serpentinite and Dikmen Granite, together with the associated porphyry, and epithermal mineralization are arranged in the direction of the major lineaments, NE-SW and E-W. In Zone B, gold mineralization is observed associated with the NE-SW faults near the uplifted basement and with the younger NEN-SWS and NW-SE fractures. As for the geochemical anomalies and mineralization zones, it was concluded that rock samples are more effective indicators, and delineation was carried out using component scores of a multivariate analysis method. This conclusion is based on the analysis of rock samples and the results of the analysis of heavy mineral samples. Gold grains were found in heavy mineral samples about 1-2km downstream of the exposures and this agrees with the results of rock sample analysis.

A comprehensive study of the above work resulted in delineation of the following zones for future prospecting.

Zone B: Geochemical anomalies of gold were discovered in the alteration zones in the Miocene Şapçı Volcanics which are distributed in the vicinity of the basement complex. The basement is composed of the Taşdibek/Sakar Dagı Formation and granites. From the mineralization and extent of the geochemically anomalous zone, the three localities (Sartaş and Güvemalanı Hills of Arlık Stream, eastern Piren Hill and Tepeköy of Etili) are expected to bear large-scale low-grade gold deposits.

Zone C: A porphyry molybdenum-copper deposit associated with the intrusion of Dikmen Granite and porphyry was discovered in this zone. Molybdenite, chalcopyrite, pyrite and other sulfide minerals occur in minor amounts and analysis of rocks showed the association of gold, arsenic, and other metals. Thus it is considered that epithermal mineralization occurred after the porphyry molybdenum mineralization, and that the two overlapped. It is supposed that this type of mineralization extends to the lower parts and should prove to be a large-scale low-grade deposit.

The objective of future exploration will be to clarify the subsurface extension of the mineralized zone. It is recommended that a drill survey be conducted in the promising areas delineated above.

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PART I OVERVIEW

PART I 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 Çanakkale Area. Prior to the field survey, data related to previous geoscientific work were studied, and Landsat image analysis of an area of 3,400km^2 was carried out. As a result of these studies, three promising Zones, A, B and C, were delineated for field work of the first phase. Geological survey and geochemical prospecting were conducted in these zones.

The results of the second phase work in Zone B indicate the possibility of large-scale low-grade gold deposits in the alteration zones near the basement rocks. The porphyry molybdenum deposit in Zone C is also expected to be a large-scale low-grade deposit as this type of mineralization is extensive at depth. This deposit locally contains gold and antimony, and it may turn out to be a very important target if significant gold is found in the overlapping portion.

The third-phase survey included trench and diamond drilling surveys in the Arlık Stream Area, trench in the Piren Hill Area, diamond drill survey in the Dikmen Area, and geology, geochemistry and diamond drill surveys in the Etili Area in which gold grains were detected by the heavy mineral study.

1-2 Conclusions and Recommendations of the Second Phase

1-2-1 Conclusions of the Second Phase

During the second phase, geological and geochemical surveys were conducted in the Arlık Stream, Karaibrahimler, Kestane Mountain, Piren Hill and Dikmen Areas. Further geophysical prospecting was carried out in the Dikmen, and drill survey in the Arlık Stream and Piren Hill Areas. The summary of the five areas is as follows:

(1) Arlık Stream: Silicified and argillized zones occur in Şapçı Volcanics and part of Kirazlı Conglomerate. The Kocataş silicified zones occurring in Şapçı Volcanics were evident to 100m in MJTC-5 and 6, after which Kirazlı

Conglomerate was intersected, but the Sartaş silicified zones continued for at least 150m in MJTC-4. Altered zones with limonite are predominant on the outcrops, but pyrites are not observed. Of the results of the drill survey, the following are significant: fine-grained pyrites are developed in the section underneath the surface, limonitic silicified zones with open spaces (caves) were found by drill hole MJTC-4 and the low-grade auriferous zones continued from near surface to bottom in hole MJTC-4. Therefore, it is considered that the potential for gold deposits is high.

Generally, auriferous mineralization in the silicified body did not extend further downward, and silicified veins were observed in the periphery of the silicified zones. Thus it is considered that their shapes are "jellyfish-like" in geologic section.

(2) Karaibrahimler: The Şapçı Volcanics and Kirazlı Conglomerate have suffered hydrothermal alteration in the vicinity. Altered zones with limonite and hematite are predominant on the outcrops, and pyrites are rarely observed because of oxidation. It is considered that the Şapçı Volcanics becomes thin because of proximity to the basement rocks. Silicified veins occur in Şapçı Volcanics and Kirazlı Conglomerate, and are exposed rock from lower levels of the formation after erosion of the upper levels.

(3) Kestane Mountain: The Şapçı Volcanics and Kirazlı Conglomerate have suffered hydrothermal alteration in this vicinity. In particular, the Şapçı Volcanics has suffered strong silicification and argillization. Altered zones with limonite and hematite are predominant on the outcrops, and pyrites are usually not observed due to oxidation. Silicified bodies which form the mountain consist of massive, porous and brecciated parts. Silicified veins were not observed in the periphery of silicified bodies. Thus it is considered that they are "mushroom-shaped" in geologic section.

(4) Piren Hill: The geology consists of Şapçı Volcanics in this vicinity. The original rocks cannot be distinguished in the altered zones. The volcanic rocks become thicker with distance from the geologic basement. Altered zones with limonite and hematite are predominant on the outcrops, and pyrites are not observed because of oxidation.

Gold anomalies were detected in the silicified zones located in the southern part of the large alteration zone. The zones extend in an E-W direction in the vicinity of Piren Hill. The auriferous zones, which occur in limonitic clay such as those in fault zones, were detected by drill hole MJTC-2. Silicified zones are considered to be "jellyfish-shaped" in geologic section.

(5) Dikmen: Geophysical prospecting was carried out together with a detailed geological survey and geochemical prospecting. The detailed geological survey has clarified the distribution and conditions of gold occurrence, argillized zones and skarnization. The geochemical work has revealed two types of mineralization. By geophysical methods, the subsurface extent of mineralization from the outcrop downward was shown by delineating the low-resistivity zone and FE anomalies by IP; detailed SIP work provided the promising section through the interpretation of simulations.

A porphyry molybdenum-copper deposit associated with the intrusion of the Dikmen Granite and porphyry was discovered. The mineralization extends from the eastern side of the Dikmen Granite in a NW-SE direction to the Emeşe Formation in the Sığırirek Stream. The Emeşe Formation is altered, and minor amounts of sulfides such as molybdenite, chalcopyrite, wolframite, sphalerite and pyrite occur in the quartz veinlets. The analytical results show the existence of gold, arsenic, mercury and antimony. This shows that epithermal mineralization occurred after the porphyry molybdenum mineralization and they now overlap spatially.

1-2-2 Recommendations of the Second Phase

It is recommended that the following work be conducted in the promising areas.

In the four localities of Zone B, epithermal gold mineralization is anticipated because of the gold showings of the alteration zones which were identified by geological and geochemical surveys. The hydrothermal gold mineralization is expected to extend both horizontally and vertically. Here, detailed geological survey clarified the distribution and extent of the alteration zone and heavy mineral investigation in the vicinity located the position of the gold mineralization. On the basis of these findings, inclined drilling should be carried out in order to clarify the state of subsurface mineralization.

(1) Arlık Stream: Auriferous zones have been detected in Kocataş, Sartaş and Güvemalanı Hills; these localities belong to the concession of MTA. The drilling survey should be continued in these localities because the auriferous zones were intersected by drill hole MJTC-4.

(2) Karaibrahimler: The silicified zones were not predominant because the upper portions of altered zones had been eroded. As the possibility of detection of gold deposits is low, the survey should be completed within the second phase.

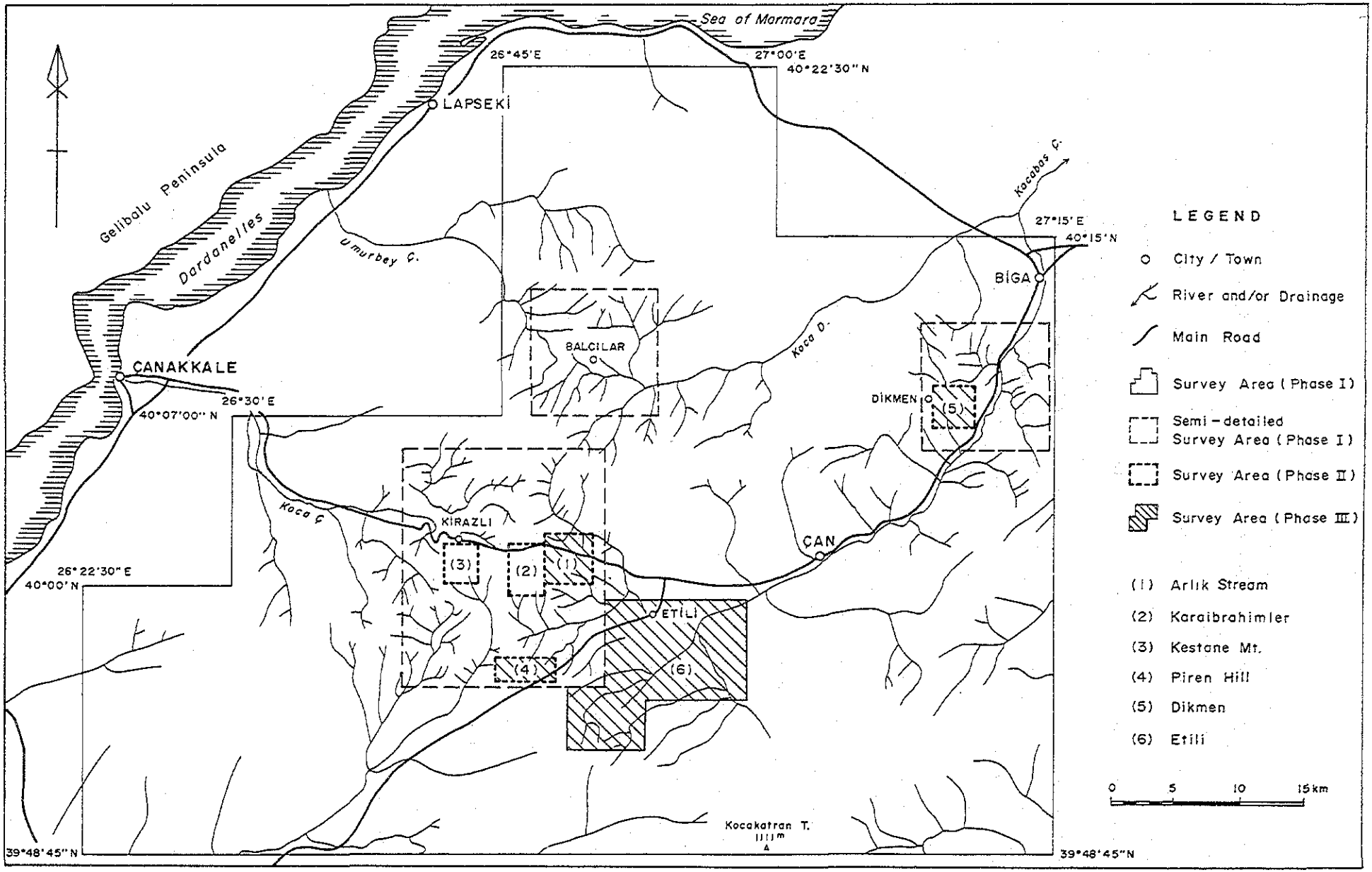


Figure 1- 2 Map of Location of the Survey area

(3) Kestane Mountain: The concession of the Kestane Mountain Area has been purchased by Tüprag Company which has its head office in Istanbul and which has commenced joint exploration with a private West German company. Geochemical prospecting (soil sampling and trench) and geophysical survey (resistivity method) was carried out in 1989. Therefore, the survey should be completed within the second phase.

(4) Piren Hill: Gold anomalies were detected in the silicified zones which are located in the southern part of the large alteration zone. Also, the zone extends in an E-W direction in the vicinity of the Piren Hill. The auriferous zone was found by drill hole MJTC-2 in the Davulgılı silicified zones belonging to the concession of MTA. During the third phase, drilling survey should be carried out in the southeastern part of the Piren silicified zones.

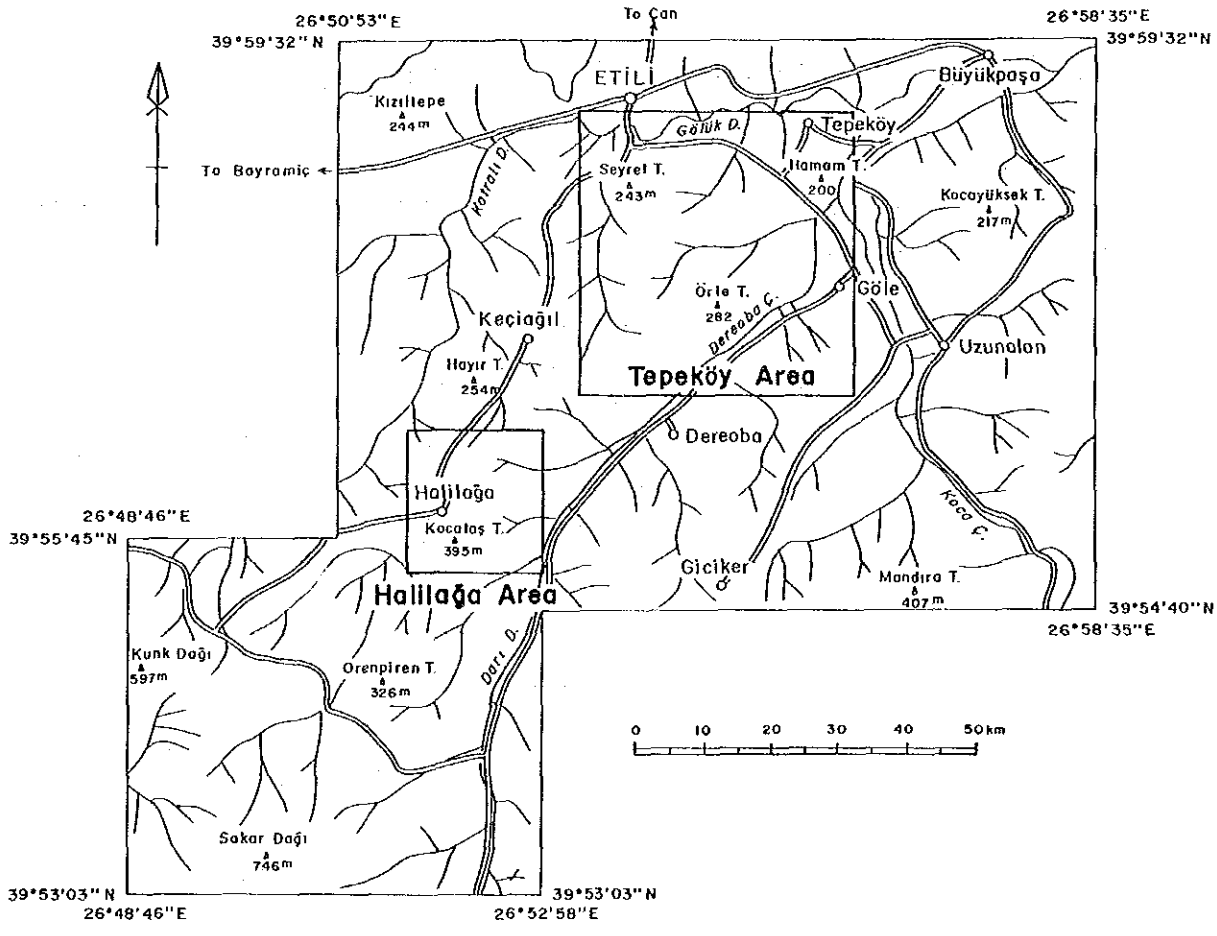


Figure 1- 3 Map of Location of the Etili area

(5) Dikmen: Geophysical prospecting was carried out along with detailed geological survey and geochemical prospecting. By geophysical methods, the subsurface extent of mineralization from the outcrop downward was shown by delineating the low-resistivity zone and FE anomalies by IP; detailed SIP work provided the necessary information. Drill survey should be conducted in the mineralized zone of the localities distributed in the Dikmen Granite and porphyry.

(6) Etili: Etili locates in the southeast area of Zone B. Silicified zones are predominant in the Şapçı Volcanics which is widely distributed in the vicinity. A hot spring near Etili village has been used as a bath for medical purposes. Gold grains have been detected in the soil samples collected from nearby the hot spring. The Etili Area is considered to be a promising area, and a drill survey should be carried out after the geological survey and geochemical prospecting.

1-3 Areal Extent and Work Operation of the Third Phase Survey

1-3-1 Coordinates and Contents of the Survey Areas

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

Table 1-1 Survey Contents

Localities	Area (km^2)	Route Length	Geochemical Prospecting	Drill Survey
Arlık Stream	-	-	Trench 1,224m 404pcs	1,208m (8 holes)
Piren Hill	-	-	Trench 334m 104pcs	
Etili	115	120km	Rock Samples 69pcs	
	20	45km	Rock Samples 389pcs	302m (2 holes)
Dikmen	-	-		150m (1 hole)
Total		165km	966pcs	1,660m (11holes)

Table 1-2 Laboratory Studies

Type of Study	Element from Chemical Analysis	Amount (Samples)	Arlık Stream	Piren Hill	Etili	Dikmen
Rock Samples	Au, Cu, Mo, Pb, Zn, Ag, As, Se, Hg F, Ba, Tl	458			458	
Trench Samples	Au, Cu, Mo, Pb, Zn, Ag, As, Se, Hg F, Ba, Tl	508	404	104		
Drilled Cores	Au, Ag, Cu, Pb, Zn, Sb, Hg, Mo	552	402		100	50
Whole Rock Analysis	SiO_2, TiO_2, Al_2O_3, Fe_2O_3, FeO, MnO, CaO, Na_2O, K_2O, P_2O_3, LOI	18			13	5
Thin Section		18			13	5
X-ray Diffraction		104	36		62	6

1-3-2 Priority Activities of the Survey

(1) Geological and geochemical survey

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

① Collection of geochemical rock and trench samples with emphasis on delineated altered zones.

② Relationship between geochemical anomalies and mineralization.

③ Extent of mineralization at depth.

④ Determination of geochemically anomalous zones and clarification of their characteristics.

(2) Drilling Survey

The following holes were drilled in the Arlık Stream, Etili and Dikmen Areas.

Table 1-3 Location of Drill Holes

Area	No.	Coordinates		Length	Direction	Dip
Arlık Stream	MJTC- 7	82325	29948	151.0m	N10°E	-50°
	MJTC- 8	82726	30548	151.0m	S10°W	-50°
	MJTC- 9	82848	31059	151.0m	S10°W	-50°
	MJTC-10	82971	30796	151.1m	N10°E	-50°
	MJTC-11	83426	30694	151.0m	N10°E	-50°
	MJTC-12	83554	31037	151.0m	S10°W	-50°
	MJTC-13	83597	30497	151.0m	S10°W	-50°
	MJTC-14	83729	30465	151.0m	S10°W	-50°
Dikmen	MJTC-15	13062	41280	150.0m	-	-90°
Etili	MJTC-16	88338	20785	151.0m	N20°E	-50°
	MJTC-17	88500	20805	151.0m	N20°E	-50°

1-4 Members of the Third Phase Survey

(1) Survey Period. Geological and Geochemical Survey : June 24-October 24

Drill Survey : July 9-October 29

(2) Members participating in the Project

【MTA (MADEN TETKİK ve ARAMA GENEL MÜDÜRLÜĞÜ) at Ankara】

Head Office	General Director	Orhan BAYSAL
	Deputy General Director	Özer ÖLÇER
	Deputy General Director	Temel NEBİOĞLU
Metallic Minerals D.	Director	Ramiz ÖZOCAK
	Deputy Director	Asim GÖKTEPELİ
Drilling D.	Director	Abdullah GÜLGÖR
NW Anadolu Branch	General Manager	Rıfat BAYBÖRÜ
	Deputy Manager	Nizamettin ÇETİNKAYA
	Deputy Manager	Sinan ARSLAN

【Turkish Survey Members of MTA】

Coordinator	Necmi YÜCE
Geologist	Necip PEHLİVAN
Geologist	Abdullah TUFAN
Geologist	Ahmet ÇETİN
Mining Engineer	Muharrem DAĞLI
Mining Engineer	Mustafa CANTÜRK

【Metal Mining Agency of Japan】

Coordinator	Morihiro KURUSHIMA
Coordinator	Hiroshi SHIMOTORI

【Japanese Survey Members of NED】

Team leader	Hisashi MIZUMOTO
Geologist	Kazuyasu SUGAWARA
Drilling Engineer	Saichi ISHII
Driller	Tadateru SUGIBUCHI
Driller	Mitsuo NOMURA

CHAPTER 2 GEOGRAPHY

Çanakkale is the capital of the province and is the largest city on the Biga Peninsula. It is located approximately 550km west of Ankara and about 250km southwest of the largest city in Turkey, Istanbul. The population of Çanakkale is about 50,000. Çan is the second largest city of Çanakkale Province, and its population is more than 20,000.

By road, the distance from Ankara to Çanakkale is approximately 600km through Eskişehir and Bursa; long-distance bus takes 11 hours. The survey area is under the jurisdiction of the MTA Balıkesir Office (Kuzeybatı Anadolu Bölgesi). The major highway between Balıkesir and Çanakkale is paved and the approximately 250km can be covered by car in about three hours. The base camp of the geology section for the third phase survey was set in Çanakkale, and the drill section was in Çan and Etili. The field work for geological and geophysical surveys was conducted using jeeps for transport from Çanakkale. The travel time from Çanakkale to Arlık Stream and Piren Hill was one hour, and to Dikmen, two hours.

The area delineated for detailed survey in the third phase is located inland. It has relatively gentle topography with elevation ranging from 200-800m. There are many villages in the flat area below the 200m elevation, and vegetables and fruits are actively cultivated. Above 200m, in the higher lands, cultivation of wheat and raising various cattle are very prominent.

The annual precipitation of the survey area amounts to 567mm (average of 1988 and 1989), and there is a large area of fertile land where cultivation of vegetables, fruits and wheat, and breeding of cows, sheep, goats and other cattle are very active. The annual average temperature is warm (14.6℃), and climate is close to Mediterranean type.

At Çanakkale, the temperature rises above 30℃ during the four months from June to September, and during June to November when the field survey was carried out, the climate gradually shifted from the relatively dry season to relatively wet season, and the average monthly temperature dropped from 20.9℃ in September to 8.7℃ in November. The average monthly temperature and precipitation published by the Çanakkale Meteorological Station are as follows.

Table 1-4 Average Monthly Temperature of Çanakkale

Month(℃)	1	2	3	4	5	6	7	8	9	10	11	12	Annual
Max	16.7	15.2	18.1	20.7	28.8	32.0	38.8	34.2	30.0	24.2	18.8	17.6	1988
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
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	1989
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
Max	14.1	19.6	21.3	23.0	30.2	36.0	34.0	34.3	33.6				1990
Min	-4.1	-1.1	-1.3	3.8	3.4	8.6	16.7	15.8	8.7				
Average	4.8	7.3	9.6	13.4	17.0	21.6	25.4	24.6	19.5				

Table 1-5 Monthly Precipitation of Çanakkale

Precipitation	1	2	3	4	5	6	7	8	9	10	11	12	Annual
1988 (mm)	87	51	75	56	1	37	4	-	30	21	202	139	703
1989 (mm)	2	3	58	9	28	19	-	25	33	85	76	94	431
1990 (mm)	5	12	25	37	12	50	7	1	19				

CHAPTER 3 OUTLINE OF THE SURVEY AREA

3-1 Outline

The stratigraphy of the Çanakkale Area was compiled by Behçet AKYÜREK and Yılmaz SOYSAL of the Geology Division of MTA Ankara in 1980 (report of First Phase).

The basement of the area consists of pre-Triassic metamorphic rocks - the Kazdag Group. It is mainly composed of gneiss, metamorphic rocks derived from basic volcanic rocks and crystalline limestone. This basement is unconformably overlain by Mesozoic sedimentary formations and Miocene intermediate volcanic

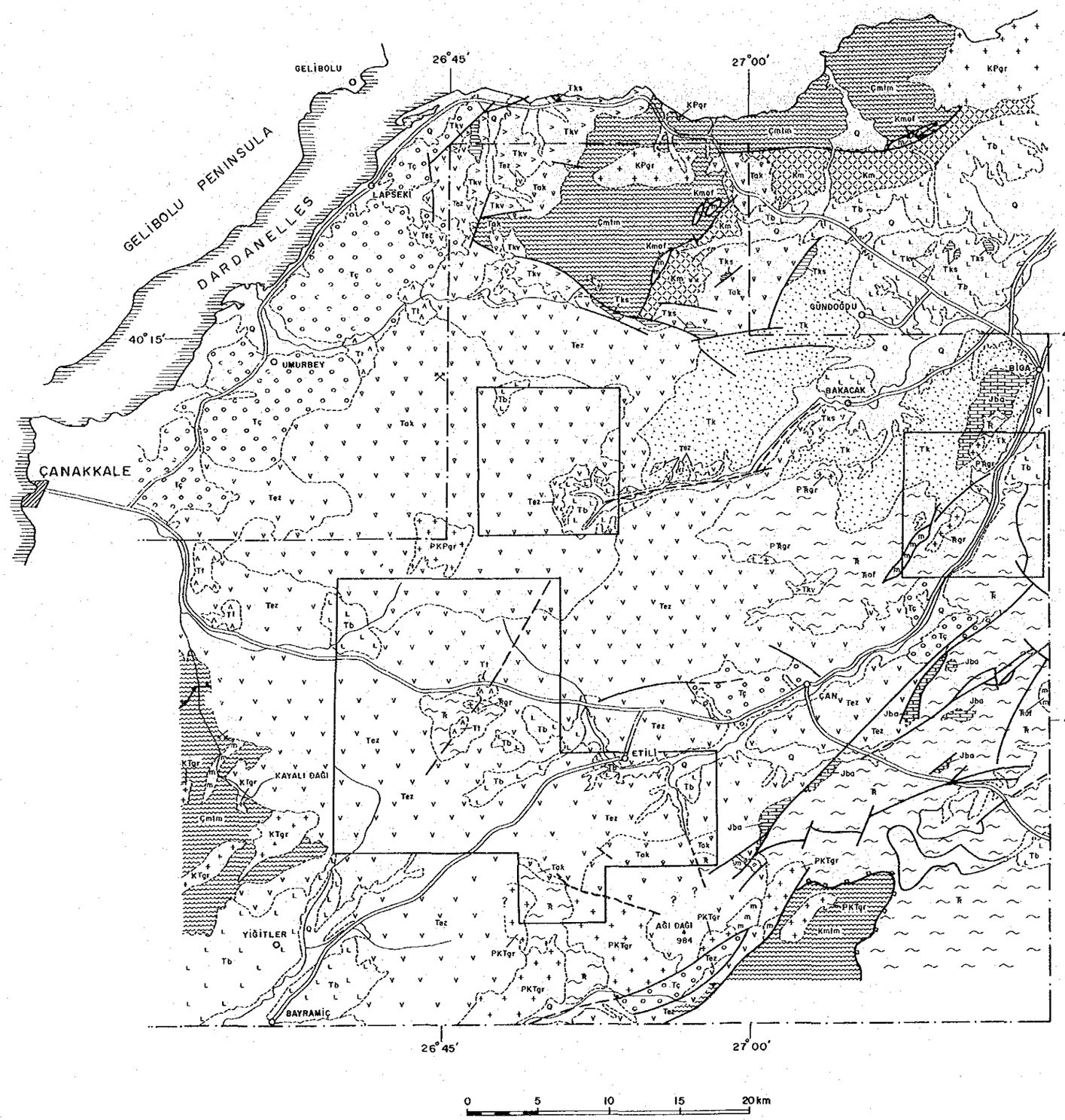
rocks. Silicified and argillized alteration zones were identified in some sections (Arlık Stream, Piren Hill and Etili) of the area where volcanism was active during the Eocene to Miocene, and andesite, dacite, rhyolite and pyroclastic rocks are developed. These are widely distributed in the central part of the survey area. During the beginning of this volcanic period, granodiorite intrusions occurred in many parts of the area, and iron, copper, lead and zinc mineralizations are found associated with this type of intrusion in the Dikmen.

In 1987, the exploration group of the Turkish Petroleum Co. conducted a geological survey of the entire Biga Peninsula prior to drilling for oil in Edremit Bay (bay at the southern part of the Biga Peninsula). It was shown by this work that the volcanic rock widely distributed in the central part of the area can be grouped as the product of three major volcanic activities aged Eocene, Miocene and post-Pliocene. Also, there are two stages of granite activity : Triassic and Cretaceous to Eocene. The ages were determined through the study of fossils in the vicinity.

The geology of Biga Peninsula, as mentioned above, has been investigated by MTA and the Turkish Petroleum Co. It is seen that the stratigraphy compiled during the first and third phase studies agrees with that prepared by the Turkish Petroleum Co. The geologic map of the Çanakkale Area and correlation list are shown in Figure 1-4 and Table 1-6.

The lowermost geologic unit of northwestern Biga is the pre-Triassic metamorphics (Kazdag Group) which consists mainly of metamorphic rocks of basic volcanic origin and is distributed to the north of Zone A and west of Zone B, both outside of the first phase survey area. In Zones B and C, the Triassic Karakaya Group and unconformably overlying Eocene and later intermediate volcanic rocks are widely distributed, while in Zone A, Eocene and later intermediate volcanic rocks occur widely. Most of the geologic units of these zones are Eocene to Miocene andesites and andesitic pyroclastics accompanied by a small amount of Late Tertiary to Quaternary dacite and basalt. The intrusive rocks are Triassic and Cretaceous to Eocene granodiorite, and they are distributed in Zones B and C.

The geology of the major part of the survey area consists of Eocene and younger volcanic rocks. The host rocks of the silicified and argillized zones are Miocene volcanics. These alteration zones have characteristics similar to those of the Madendagı and Kartaldagı mine areas. They extend into the survey area. The age of the alteration is inferred to be latest Tertiary, and the center of the Tertiary volcanic activity is very clearly identified.



LEGEND

QUATERNARY		Q	Alluvium	
TERTIARY	PLIOCENE	Taştepe Basalt	Tt	Basalt
	PLIOCENE	Bayramiç F.	Tb	Conglomerate/volcanics
	MIOCENE	Çan F. / Ezine Volcanics	Tç / Tez	Sandstone, siltstone, conglomerate etc. / Andesitic lava and pyroclastics
			Tk	Siltstone, sandstone
	EOCENE	Soğucak F.	Tks	Sandstone, siltstone, limestone
			Tkv	Andesite lava and pyroclastics
		Akçaalan Volcanics	Tok	Andesite lava and pyroclastics
CRETACEOUS			Km	Melange
JURASSIC		Bayırköy F.	Jba	Sandstone, siltstone, sandy limestone
TRIASIC		Karakaya Group.	Tr	Meta-sandstone, meta-volcanics marble
		Çamlıca Kazdağ Metamorphics	Çmlm / Kmlm	Mica schist, gneiss marble etc.

Intrusives

Rof Kmof Ophiolite
PTgr KPgr KPgr Granitic rocks
PKPgr (PKTgr)

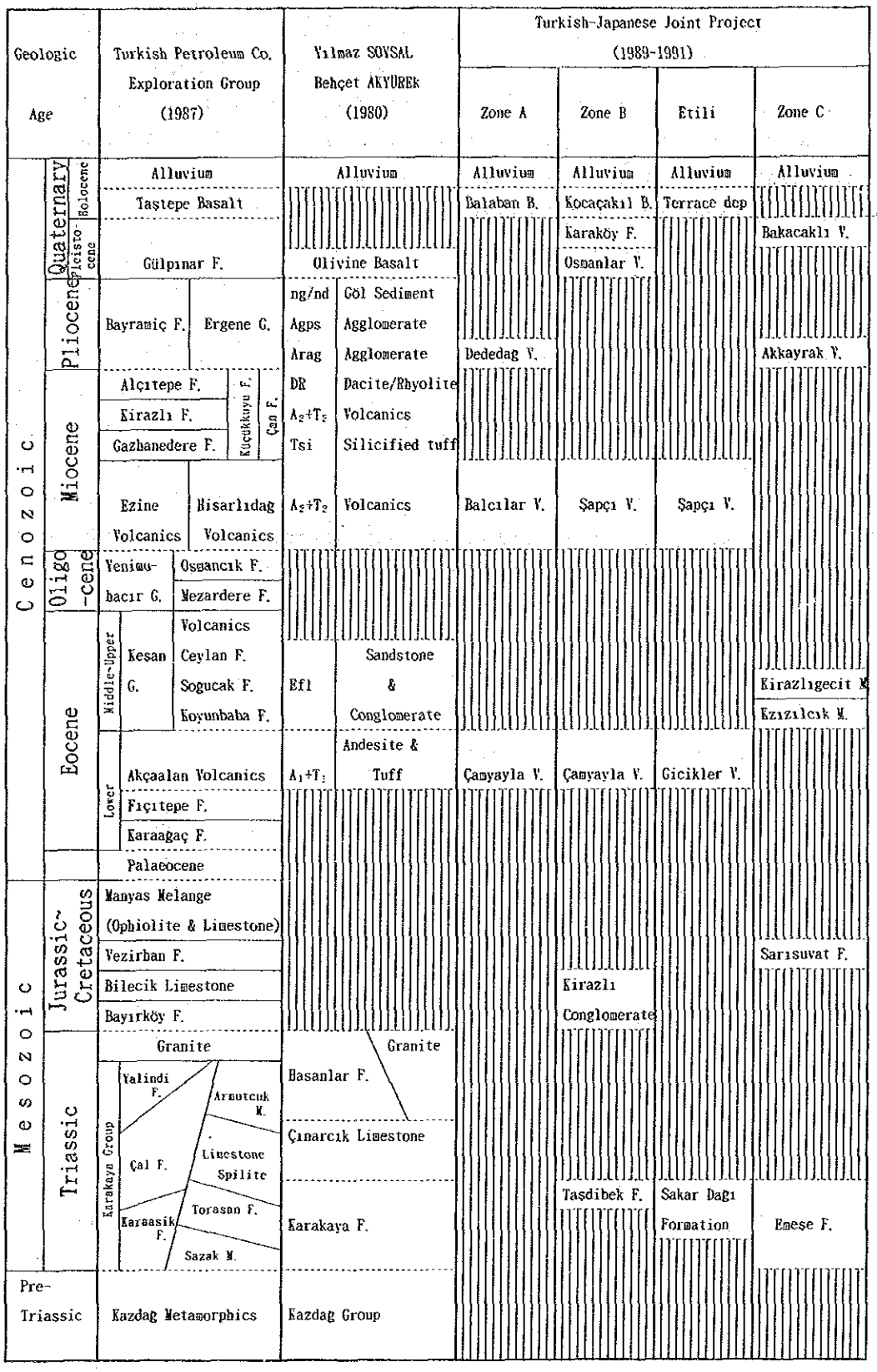
Igneous Activities

Ophiolite
- Kmof : Cretaceous ophiolite
- Rof : Triassic ophiolite

Granite
- KPgr : Cretaceous～Palaeogene granite
- PTgr : Paleozoic～Triassic granite
- PKPgr : Paleozoic～Palaeogene granite

Figure 1- 4 Geologic Map of the Çanakkale Area

Table 1-6 Correlation List of Biga Peninsula



3-2 Mining Activity in the Biga Peninsula

The Biga Peninsula, including the Çanakkale Area, is considered to be the most important lead-zinc metallogenic province of the Republic of Turkey. Also, antimony, gold, silver, mercury, iron and other metallic deposits as well as ceramic material resources have been found in the peninsula. Thus, this peninsula has been the target of geological surveys, geochemical prospecting, mining studies and various other MTA projects.

The area has been the site of the Turkey/Federal Republic of Germany Cooperative Project which resulted in the discovery of promising lead-zinc deposits of the Yenice-Kalkım.

Within the 3,400km^2 area analyzed by Landsat images, there are the well-known gold deposits of the Madendagı and Kartaldagı Mines. Also, although presently closed but previously operated on a very small scale, Çataltepe Mine (lead-zinc veins) is in the above area. In Zone C, a porphyry molybdenum deposit (Dikmen mineralized zone) was discovered during the first phase survey. Immediately outside of the Landsat image, there are the presently operating Koru Köyü Mine and the Yenice gold deposit which is now being explored.

CHAPTER 4 REVIEW OF THE SURVEY RESULTS

4-1 Geochemical Nature of Mineralization

Four hundred and fifty eight samples collected during the detailed survey of the Etili Area and 508 samples collected during the trench survey of Arlık Stream and Piren Hill in the third phase were analyzed. The analyzed elements are; gold, silver, fluorite, mercury, thallium, selenium, antimony, arsenic, copper, lead, zinc, molybdenum and barium. The samples were collected from the silicification zones in Zone B including Etili. The samples exceeding 100 ppb gold are listed in Table 1-7.

4-1-1 Mineralization of Arlık Stream Area

From this locality, 404 trench samples were analyzed. Of these, 29 samples collected from Sartaş and Güvemalanı silicified zones (the location are shown in Figure 2-1.) contained gold in excess of 100 ppb; this is gold associated with epithermal mineralization. It is noted that almost all of these samples contained small amounts of copper, lead, zinc and mercury, while the content of arsenic, molybdenum, and barium were somewhat higher when found with gold.

Gold-bearing massive silicified zones were detected in drill holes MJTC-4 (Güvemalanı Hill) and MJTC-10 (Sartaş Hill). These zones are considered to extend east-west because of accordance with the extent of silicified bodies. On the other hand, gold-bearing brecciated zones were detected in the drill holes MJTC-13 and MJTC-14 of the Inkaya Hill which is distributed in an area of talus deposits.

Silicified bodies are characterized by massive, brecciated and porous parts. The massive part generally locates in the center of the silicified zones, and silicified veins were observed in the periphery of silicified zones. It is thus considered that their shapes are "jellyfish-like" in geologic section.

4-1-2 Mineralization of Piren Hill Area

From this locality, 104 trench samples (in length 334m) were analyzed. Of these, two trench samples collected from drill site MJTC-2 of Davulgılı silicified zones contained gold in excess of 100 ppb, which is gold associated with epithermal mineralization. A gold-bearing limonitic zone occurs in the north side of periphery of the silicified zones which extend in an east-west direction, but auriferous parts are small-scale and low-grade.

4-1-3 Mineralization of Etili Area

From this locality, 458 rock samples were analyzed. Of these, 61 samples collected from Tepeköy and Halilaga silicified zones contained gold in excess of 100 ppb. This gold is associated with epithermal mineralization. It is noted that almost all of these samples from Tepeköy contained higher amounts of arsenic, barium and mercury, while in the Halilaga, the contents of lead and silver were somewhat higher when found with gold. Silicified zones are characterized by massive, brecciated and porous parts; the massive part generally locates in the center of the silicified zones. Silicified veins were not observed in the periphery of silicified zones. It is thus considered that their shapes are "mushroom-like" in geologic section.

4-1-4 Mineralization of Dikmen Area

There is porphyry molybdenum-copper mineralization in the quartz veinlets in and near the Dikmen Granite and porphyry. Elements of lower-temperature mineralization, such as gold, mercury, antimony and barium, were detected in the cores of MJTC-15, and it is noted that two different types of mineralization occurred in the same locality at different times.

Table 1-7 Significant Analytical Results of Rock and Trench Samples (1)

Etili Au > 100ppb (Rock)

Sample No.	Description	Au	Cu	Mo	Pb	Zn	Ag	As	Se	Hg	F	Ba	Tl
		ppb	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppb	ppm	ppm	ppm
Y640	94100 25190	2790	41	1	12	6	<0.5	1320	3.4	170	410	2750	<0.1
P665	88510 20890	2380	37	40	5040	30	3.0	1600	14.6	43000	80	3450	3.2
Y734	94015 24910	1810	22	4	148	8	<0.5	400	1.6	120	70	720	<0.1
Y611	93980 24910	1680	43	17	90	14	<0.5	3900	8.2	260	220	3200	0.5
Y639	94100 25190	1230	14	1	2	2	<0.5	340	2.4	50	300	680	<0.1
Y653	94125 25195	1060	29	2	4	4	<0.5	310	2.2	120	300	1300	<0.1
S705	86530 17890	1060	>10000	6	16	118	25.5	72	<0.2	10	110	200	<0.1
Y647	94085 25185	1050	12	1	6	<2	<0.5	76	0.4	240	60	1520	<0.1
Y638	94100 25190	1000	12	<1	6	<2	<0.5	260	1.6	40	160	700	<0.1
Y738	93960 24910	990	49	7	140	6	<0.5	3850	0.8	220	70	>10000	0.7
P660	88530 20950	960	9	3	334	6	3.0	234	2.2	19000	50	3800	0.4
P666	88505 20900	930	71	14	2870	122	<0.5	1000	6.6	14000	320	880	6.2
Y607	93965 24845	800	110	1	150	48	<0.5	3200	0.2	90	210	6900	0.3
Y733	94020 24925	790	26	7	260	8	<0.5	1450	1.6	600	70	2300	0.3
Y648	94085 25185	740	22	1	8	<2	<0.5	216	1.8	90	220	1000	<0.1
Y606	93970 24845	725	52	1	54	18	<0.5	940	1.6	150	120	2800	0.8
Y621	94035 25050	690	64	3	6	2	<0.5	1250	<0.2	260	170	400	0.3
Y732	94020 24930	655	21	13	162	22	<0.5	2700	2.8	220	200	2500	0.3
P668	88365 20825	620	59	12	204	16	60.0	300	6.6	61000	50	2250	0.2
Y652	94125 25195	590	50	2	8	2	<0.5	340	1.0	130	130	1080	<0.1
Y645	94085 25185	575	20	1	2	<2	<0.5	610	4.6	100	170	2000	<0.1
Y613	94030 24780	570	135	13	1300	38	<0.5	2920	1.2	150	150	5400	0.3
Y605	93985 24850	500	39	1	30	4	<0.5	340	1.0	490	120	2900	0.1
P653	88700 20930	440	23	7	140	2	17.5	52	1.2	42000	30	1560	0.1
Y737	93990 24915	430	6	1	148	2	<0.5	160	<0.2	510	50	8600	<0.1
Y651	94125 25195	400	18	3	2	2	<0.5	76	<0.2	50	60	4300	<0.1
P664	88515 20885	390	27	17	962	12	1.0	370	6.6	21000	110	960	1.0
Y634	94110 25175	385	9	1	2	<2	<0.5	60	<0.2	60	110	580	<0.1
Y666	94300 25230	380	15	1	24	18	<0.5	2510	0.6	710	560	3200	<0.1
Y642	94085 25185	375	5	1	<2	<2	<0.5	100	<0.2	90	60	700	<0.1
Y735	93990 24920	370	10	2	60	2	<0.5	176	<0.2	270	70	1700	0.4
Y646	94085 25185	340	8	1	2	<2	<0.5	44	0.2	150	160	1370	<0.1
Y643	94085 25185	340	12	1	2	<2	<0.5	300	0.8	50	160	1550	<0.1
Y635	94110 25175	340	2	<1	<2	<2	<0.5	23	<0.2	40	40	440	<0.1
Y636	94110 25175	335	5	1	2	<2	<0.5	50	<0.2	40	50	720	<0.1
P667	88310 20865	330	34	5	128	12	8.5	90	1.8	14000	40	2800	0.2
C626	88755 20795	320	7	9	296	12	1.5	880	2.4	4500	80	1700	<0.1
Y622	94035 25055	310	33	5	2	4	<0.5	1130	<0.2	320	70	170	0.1
Y637	94100 25190	305	6	1	4	<2	<0.5	90	0.6	50	200	2450	<0.1
P670	88395 20880	295	37	21	2870	34	8.5	610	5.0	8200	100	1200	0.9
Y608	93945 24845	280	23	1	60	12	<0.5	1000	11.2	170	120	2950	0.1
Y644	94085 25185	265	6	1	2	<2	<0.5	156	<0.2	160	160	1680	<0.1
P656	88120 20990	265	8	20	440	4	0.5	100	2.8	4800	50	1100	1.3
Y630	94110 25175	240	6	1	4	<2	<0.5	60	<0.2	30	100	390	<0.1
Y650	94125 25195	210	12	1	2	<2	<0.5	36	<0.2	40	70	440	<0.1

Table 1-7 Significant Analytical Results of Rock and Trench Samples (2)

Etili Au > 100ppb (Rock)

Sample No.	Description	Au ppb	Cu ppm	Mo ppm	Pb ppm	Zn ppm	Ag ppm	As ppm	Sc ppm	Hg ppb	F ppm	Ba ppm	Tl ppm
P659	88520 20965	205	14	13	542	8	<0.5	232	2.0	22000	40	2120	0.4
P663	88520 20885	200	30	11	776	12	3.0	270	2.6	6100	60	1920	0.9
Y632	94110 25175	185	23	2	26	<2	<0.5	100	<0.2	90	150	550	<0.1
P658	88580 20960	180	22	6	176	6	4.0	110	7.0	28000	70	430	<0.1
Y682	93980 25090	175	74	6	14	12	<0.5	1100	6.4	100	50	660	<0.1
Y686	94000 25050	175	2	<1	6	<2	<0.5	44	<0.2	50	60	500	<0.1
Y610	93945 24865	175	73	9	62	32	<0.5	3200	<0.2	90	400	870	0.2
P655	88610 21000	175	9	15	342	8	0.5	156	2.4	5700	60	1360	0.6
Y680	93940 25095	130	3	1	6	2	<0.5	14	<0.2	50	40	600	<0.1
T665	87850 18120	125	75	2	92	10	<0.5	200	17.6	1300	320	940	<0.1
Y678	93995 25110	110	3	1	2	<2	<0.5	18	<0.2	30	50	540	<0.1
Y631	94110 25175	110	5	<1	14	<2	<0.5	44	<0.2	50	80	450	<0.1
Y691	93925 24890	110	4	2	8	<2	<0.5	240	<0.2	20	50	260	<0.1
C631	89175 21200	105	24	12	632	18	1.5	500	4.2	5200	90	820	5.6
Y677	93980 25125	100	4	1	2	<2	<0.5	11	<0.2	60	50	300	<0.1
Y620	94045 24980	100	90	10	66	8	<0.5	4000	16.8	420	160	1900	1.9

Arlık Au > 100ppb (Trench)

Sample No.	Description	Au ppb	Cu ppm	Mo ppm	Pb ppm	Zn ppm	Ag ppm	As ppm	Sc ppm	Hg ppb	F ppm	Ba ppm	Tl ppm
AB30	Soil B	270	12	14	30	8	<0.5	12	1.2	30	520	260	1.3
AB31	Soil B	100	15	22	40	12	<0.5	22	1.6	40	470	220	1.5
AB33	Soil B	140	4	7	16	4	<0.5	8	0.2	30	190	200	0.2
AB38	Soil B	100	8	24	30	6	<0.5	26	2.0	40	550	320	0.7
AB43	Soil B	110	5	24	36	2	<0.5	18	3.4	30	540	460	1.9
AB48	Soil B	110	14	29	82	20	<0.5	38	4.2	20	160	360	1.2
AB50	Soil B	195	8	68	472	8	<0.5	13	3.4	20	130	480	3.2
AB51	Soil B	105	21	52	176	8	<0.5	25	4.0	10	190	420	1.9
A1005	Soil B	170	60	32	24	40	<0.5	40	1.0	40	230	100	0.1
A1006	Soil B	345	47	41	10	16	<0.5	154	7.2	20	370	120	0.2
A1007	Soil B	205	65	16	18	22	<0.5	32	4.0	20	850	560	0.4
A1029	Soil B	115	19	62	10	4	<0.5	31	2.0	20	250	120	0.4
A1141	Soil B	110	6	39	8	6	<0.5	23	1.2	30	100	160	0.3
A1145	Soil B	110	11	14	20	6	<0.5	16	5.0	40	290	180	1.1
A1149	Soil B	105	8	12	44	2	<0.5	8	6.8	50	270	440	1.5
A1256	Soil B	225	11	37	26	10	<0.5	26	2.6	50	190	400	0.3
A1306	Talus D	100	3	144	50	6	<0.5	25	0.6	20	200	480	0.2
A1309	Talus D	100	<1	22	6	<2	<0.5	4	<0.2	10	80	40	<0.1
A1320	Talus D	200	1	21	14	<2	<0.5	5	<0.2	20	90	50	<0.1
A1321	Talus D	220	3	20	10	2	<0.5	5	<0.2	10	120	50	<0.1
A1322	Talus D	200	2	18	8	2	<0.5	6	<0.2	10	100	60	<0.1
A1326	Talus D	100	<1	1	<2	<2	<0.5	1	<0.2	10	50	30	<0.1
A1330	Talus D	100	<1	2	4	<2	<0.5	1	<0.2	10	50	30	<0.1
A1332	Talus D	170	<1	4	8	<2	<0.5	1	<0.2	10	50	880	<0.1
A1333	Talus D	110	<1	3	14	<2	<0.5	2	<0.2	10	60	60	<0.1
A1342	Talus D	115	3	13	16	6	<0.5	6	<0.2	20	90	120	0.1
A1441	Talus D	125	4	18	34	<2	<0.5	10	0.2	20	240	520	0.3
A1445	Talus D	110	1	9	14	<2	<0.5	4	<0.2	20	120	60	0.1
A1450	Talus D	110	<1	6	8	<2	<0.5	2	<0.2	20	60	40	0.1

4-2 Results of X-ray Powder Diffraction

Fifty four samples collected from the Etili Area and forty six samples from drill cores were studied by X-ray powder diffraction. The samples of the Etili Area were collected from argillized and silicified zones; altered minerals mainly consist of montmorillonite, kaoline, alunite, cristobalite, and small amounts of sericite and chlorite. The minerals of alteration zones consist of kaoline and alunite in the Hamam and Seyret Hills, and kaoline in the Halilaga. Other areas consist of montmorillonite-kaoline or sericite-montmorillonite. The minerals of alteration zones of Arlık Stream, where gold was found, consists of alunite, pyrophyllite, kaoline and cristobalite. Thus most minerals were produced by acidic alteration, but montmorillonite and halloysite were produced by meteoric water and diagenesis. The Dikmen samples were collected from the core of drill hole MJTC-15. Altered minerals consist of mainly sericite and kaoline, minerals associated with porphyry-molybdenum mineralization, but kaoline is considered to be associated with gold mineralization in the Çanakkale.

4-3 Results of Whole Rock Analysis

A total of eighteen samples, two granites and sixteen volcanic rocks, were analyzed. The granite samples were upper Cretaceous～Eocene granite samples (Çavus Granite) collected from the south of Halilaga. The volcanic rocks consisting of Miocene Şapçı Volcanics were eleven andesite samples from Etili (including three drill core samples), and three drill core samples from the Emeşe Formation of the Dikmen Area. Thirteen elements were analyzed including BaO. The analytical method used was potassium permanganate titration for FeO, and ICP-AES for other elements. The results of the analysis, calculated norm, differentiation index (D.I.) and solidification index (S.I.) are shown in Table 1-8. The analyzed samples were also studied microscopically.

(1) Granitic rocks

The chemical composition of the upper Cretaceous-Eocene Çavus Granite was studied using the diagrams in Figures 1-5～1-11. The results are as follows.

① The granites of this survey area are between granodiorite and quartz monzonite of Bateman et al. (1963), namely, those with low normative orthoclase in the quartz-plagioclase-orthoclase diagram. The results of the Gümüşhane Project (1984-1987) show that the older granite (Devonian Gümüşhane Granite) is quartz monzonite while the younger (Upper Cretaceous-Eocene) is granodiorite. There was a significant difference between these granitoids, but in the Çanakkale Area, the difference in composition by age was not observed.

② Neither granite has a clear range of compositional variation in the D.I.-oxides chart.
③ A similar tendency exists for the CaO-alkali ratio, and the granites are in a high CaO zone (Figure 1-8).

Genetic classification of the granitoids has been proposed by Chappell and White (1974), Ishihara (1977) and others. In Chappell and White's classification, the $Al_2O_3/(Na_2O + K_2O + CaO)$ molar ratio, normative diopside and normative corundum values are used as the basis of the grouping. On this basis, both younger granites of the survey area belong to type I. Ishihara uses the mode of opaque minerals observed under the microscope and the Fe_2O_3/FeO^* ratio for his classification. Although microscopic study of polished sections has not been done in the third-phase work, the mode of opaque minerals and the Fe_2O_3-FeO^* diagram (Figure 1-9) indicate the granites of the survey area to be of the magnetite series.

(2) Volcanic rocks

Şapçı Volcanics is andesite. In the SiO_2-(Na_2O+K_2O) diagram (Figure 1-6), however, they are in the dacite range. The reason for these rocks being chemically in the dacite and rhyolite ranges is believed to be the increase of SiO_2 content by 5-6% through alteration. Also, the MFA diagram (Figure 1-7) and the SiO_2-FeO^*/MgO diagram (Figure 1-10) show that the volcanic rocks of this area belong to the calc-alkali series.

(3) Compositional variation in the alteration zones

The thirty two samples of Şapçı Volcanics were classified into three groups: thirteen unaltered (A), nine strongly silicified (B) and nine altered andesitic rocks (C). The averages of the chemical components are shown in Table 1-8.

Stable element	:Ti	
Increased component	:SiO_2	(high in center of silicified zones.)
Decreased element	:Al	(unchanged in alunite zones.)
	Fe	(low in strongly silicified zones.)
	Mg·Ca	(marked decrease.)
	Na+K	(marked decrease, but unchanged alunite zones.)

4-4 Resource Potential of Gold and Porphyry Molybdenum Deposits

4-4-1 Gold Potential

The geologic characteristic of this area is the predominance of Eocene to Miocene intermediate volcanic rocks. In Zone A, Eocene Çamyayla volcanics is developed and small-scale vein mineralization associated with the volcanism of this period is observed, while in Zone B including Etili Area, Miocene Şapçı

Table 1-8 Chemical Analysis and CIPW Norms for Granitic Rocks and Volcanics

	1 C679	2 P706	3 S663	4 S735	5 16135	12 P703	13 S699	14 D151	15 D152	16 D153	17 D154	18 D155
SiO_2%	51.26	59.03	55.32	62.35	58.07	66.59	65.48	73.06	69.38	70.62	69.17	70.95
TiO_2%	1.20	0.71	0.77	0.60	0.60	0.40	0.42	0.25	0.23	0.24	0.24	0.25
Al_2O_3%	18.99	16.81	17.45	17.29	16.55	15.53	15.15	12.12	11.49	12.27	12.19	12.45
Fe_2O_3%	5.78	3.83	3.87	5.00	3.58	1.98	1.84	1.38	2.46	2.51	0.87	1.30
FeO%	2.66	0.96	3.05	0.13	2.19	1.70	2.06	0.13	0.50	0.19	0.67	0.36
MnO%	0.16	0.07	0.20	0.04	0.38	0.07	0.04	0.01	0.02	0.02	0.03	0.02
MgO%	3.16	2.87	1.72	0.56	0.93	1.46	1.81	0.50	1.04	0.71	1.24	1.03
CaO%	8.45	5.51	7.92	3.93	4.15	3.60	3.31	3.25	2.21	1.86	3.70	2.68
Na_2O%	3.55	2.96	3.97	3.40	2.95	3.65	2.86	0.25	0.21	0.25	0.24	0.27
K_2O%	1.85	2.67	0.60	3.47	4.08	3.52	4.12	3.43	3.67	4.04	3.14	4.34
P_2O_5%	0.38	0.22	0.28	0.22	0.20	0.25	0.19	0.12	0.15	0.14	0.16	0.15
BaO%	0.07	0.09	0.05	0.08	0.07	0.05	0.12	0.05	0.04	0.08	0.03	0.05
LOI%	3.45	3.55	3.88	2.50	4.79	0.56	1.61	5.70	6.08	5.11	7.59	5.93
Total%	100.96	99.28	99.08	99.57	98.54	99.36	99.01	100.25	97.48	98.04	99.27	99.78
Q	3.75	16.40	12.56	20.98	15.24	22.42	23.09	51.18	48.25	49.06	46.35	45.92
C	0.00	0.00	0.00	1.85	0.21	0.00	0.42	2.49	3.51	4.44	2.05	2.79
or	10.93	15.78	3.55	20.51	24.11	20.80	24.35	20.27	21.69	23.88	18.56	25.65
ab	30.02	25.03	33.57	28.75	24.95	30.87	24.19	2.11	1.78	2.11	2.03	2.28
an	30.42	24.70	28.03	16.64	19.29	15.60	15.19	15.01	9.99	8.30	17.32	12.32
di-wo	3.77	0.50	3.94	0.00	0.00	0.27	0.00	0.00	0.00	0.00	0.00	0.00
di-en	3.26	0.43	2.69	0.00	0.00	0.19	0.00	0.00	0.00	0.00	0.00	0.00
di-fs	0.00	0.00	0.94	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00
hy-en	4.61	6.71	1.59	1.39	2.32	3.44	4.51	1.25	2.59	1.77	3.09	2.56
hy-fs	0.00	0.00	0.56	0.00	0.78	0.91	1.64	0.00	0.00	0.00	0.18	0.00
mt	5.62	1.26	5.61	0.00	5.19	2.87	2.67	0.00	1.01	0.00	1.25	0.50
hm	1.91	2.96	0.00	4.99	0.00	0.00	0.00	1.38	1.77	2.51	0.00	0.95
il	2.28	1.35	1.46	0.36	1.14	0.76	0.80	0.30	0.44	0.44	0.46	0.48
tn	0.00	0.00	0.00	1.01	0.00	0.00	0.00	0.23	0.00	0.02	0.00	0.00
ap	0.90	0.52	0.66	0.52	0.47	0.59	0.45	0.28	0.36	0.33	0.38	0.36
S. I.	18.59	21.60	13.02	4.46	6.78	11.86	14.26	8.79	13.20	9.22	20.13	14.11
D. I.	44.70	57.21	49.68	70.24	64.30	74.09	71.63	73.56	71.72	75.05	66.94	73.85

Area No.	Sample No.	Rock Name	Coordinates	Rock Unit	Location
1	C679	Basaltic andesite	90040 20630	Şapçı V.	Davulga Stream
2	P706	Andesite	90070 24240	Şapçı V.	Davulga Stream
3	S663	Basaltic andesite	96550 21710	Şapçı V.	Ardıç Stream
4	S735	Biotite andesite	97330 26100	Şapçı V.	Küçökpaşa
5	16135	Unaltered andesite	88338 20785	Şapçı V.	MJTC-16(135.00m)
12	P703	Granodiorite	89240 15300	Çavus Gr.	Bahçeler Stream
13	S699	Granodiorite	86870 17580	Çavus Gr.	Darı Stream
14	D151	Altered rock	13062 41280	Emeşe F.	MJTC-15(56.80m)
15	D152	Altered rock	13062 41280	Emeşe F.	MJTC-15(68.50m)
16	D153	Altered rock	13062 41280	Emeşe F.	MJTC-15(119.80m)
17	D154	Altered rock	13062 41280	Emeşe F.	MJTC-15(135.00m)
18	D155	Altered rock	13062 41280	Emeşe F.	MJTC-15(149.50m)

Table 1-8 Chemical Analysis and CIPW Norms for Granitic Rocks and Volcanics

	6	7	8	9	10	11	Average*		
	17694	16110	M605	M610	Y630	Y682	A	B	C
SiO_2%	60.23	94.43	97.17	96.61	96.70	98.29	56.86	96.39	64.41
TiO_2%	0.74	0.61	0.86	0.54	0.59	0.59	0.78	0.81	0.74
Al_2O_3%	20.34	0.40	0.26	0.15	0.15	0.47	17.52	0.29	15.02
Fe_2O_3%	3.38	2.48	0.01	0.05	0.03	0.13	4.61	0.61	3.69
FeO%	0.68	0.30	0.09	0.06	0.06	0.03	1.99	0.24	0.28
MnO%	<0.01	<0.01	0.01	0.01	0.01	0.01	0.16	0.01	0.01
MgO%	0.28	0.05	0.08	0.04	0.03	0.04	1.97	0.03	0.12
CaO%	0.46	0.19	0.22	0.19	0.19	0.25	5.51	0.15	0.22
Na_2O%	0.78	0.01	0.14	0.12	0.12	0.11	3.05	0.12	0.50
K_2O%	3.82	0.04	0.06	0.04	0.04	0.08	2.58	0.06	2.31
P_2O_5%	0.24	0.06	0.03	0.02	0.03	0.03	0.26	0.05	0.26
BaO%	0.06	0.08	0.03	0.11	0.09	0.02	0.09	0.05	0.10
LOI%	8.96	0.89	0.40	0.40	0.35	0.41	4.69	0.70	12.84
Total%	99.98	99.55	99.36	98.34	98.39	100.46	100.07	99.51	100.49

Area No.	Sample No.	Rock Name	Coordinates	Rock Unit	Location
6	17694	Altered andesite	88338 20785	Şapçı V.	MJTC-17(69.40m)
7	16110	Altered andesite	88338 20785	Şapçı V.	MJTC-16(11.00m)
8	M605	Massive sil rock	93850 24090	Şapçı V.	Baga Hill
9	M610	Massive sil rock	93835 24055	Şapçı V.	Baga Hill
10	Y630	Massive sil rock	94110 25175	Şapçı V.	Haman Hill
11	Y682	Massive sil rock	93980 25090	Şapçı V.	Haman Hill

* Average of Şapçı Volcanics (from first to third phases)

A 13 samples (unaltered andesite : TS078, TS093, S405, 559, S415, S373, 159, 259, C679, P706, S663, S735, 16135

B 9 samples (strongly silicified rock : M419, T485, M378, 258, M605, M610, Y630, Y682, 16110)

C 9 samples (altered andesite : 158, 358, 359, 460, S463, 558, 656, M460, 17694)

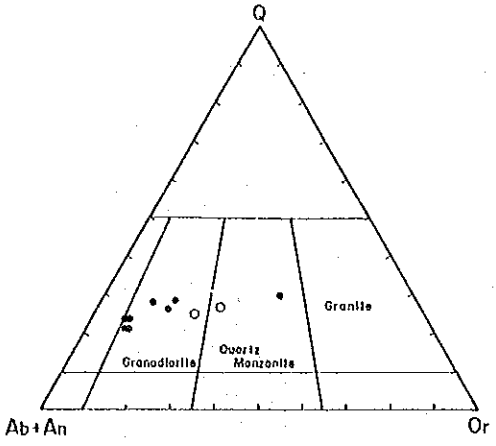


Figure 1- 5 Normalized Qz-(Ab+An) -Or Diagram for Granitic Rocks

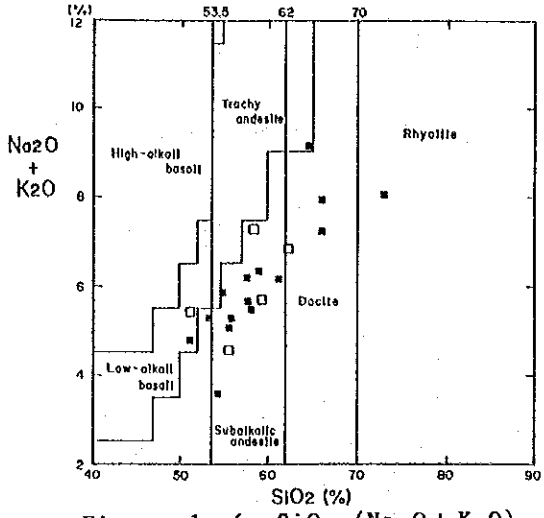


Figure 1- 6 SiO_2-(Na_2O+K_2O) Diagram for Volcanics

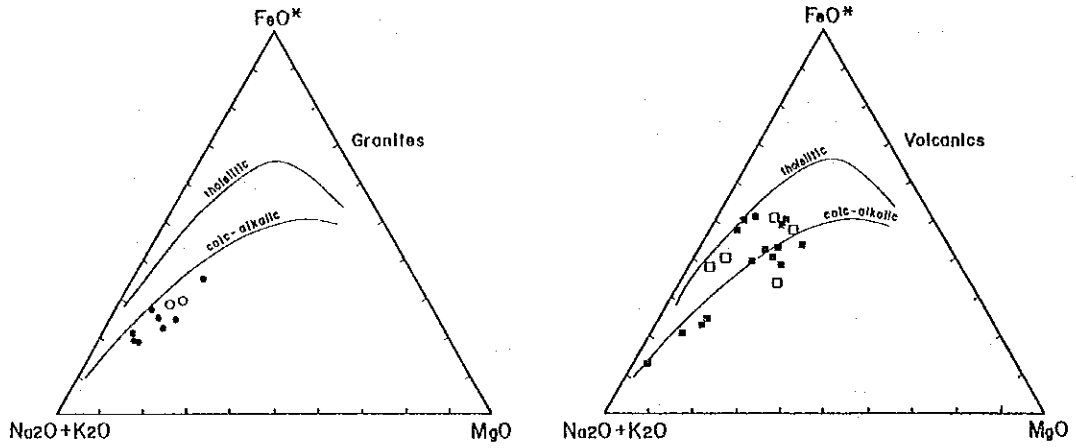


Figure 1- 7 MFA Diagrams

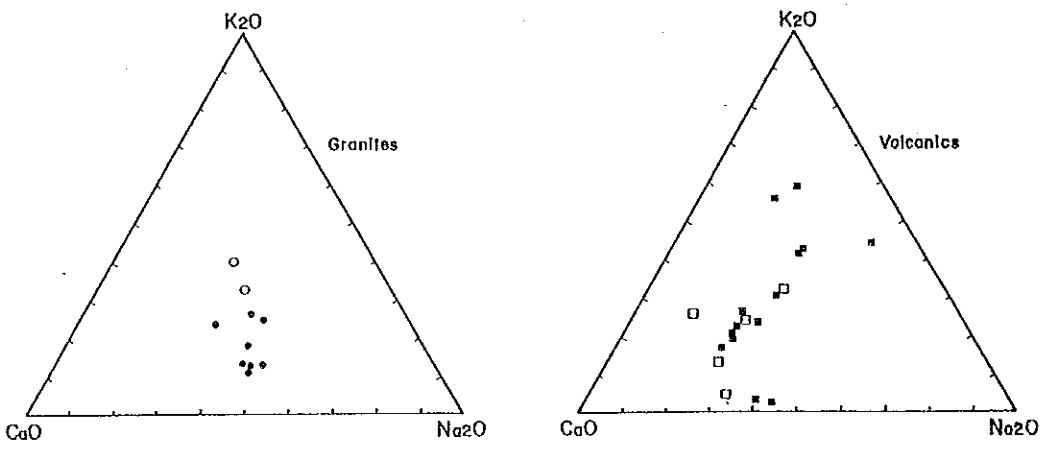


Figure 1- 8 CaO-Na_2O-K_2O Diagrams

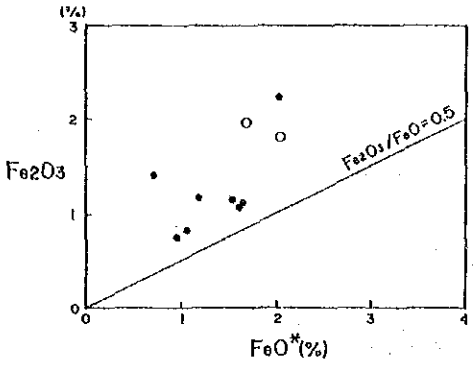


Figure 1- 9 Fe_2O_3-FeO* Diagram for Granitic Rocks

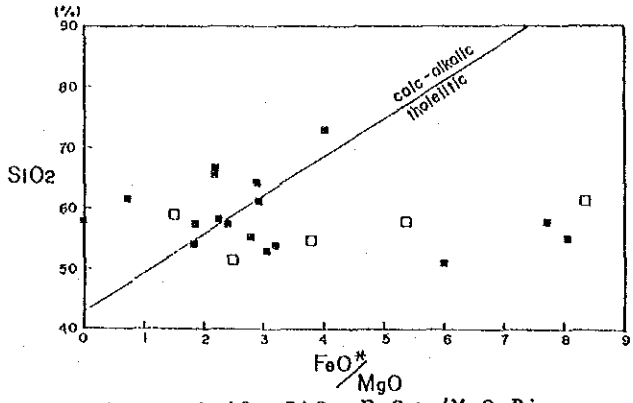


Figure 1-10 SiO_2-FeO*/MgO Diagram for Volcanics

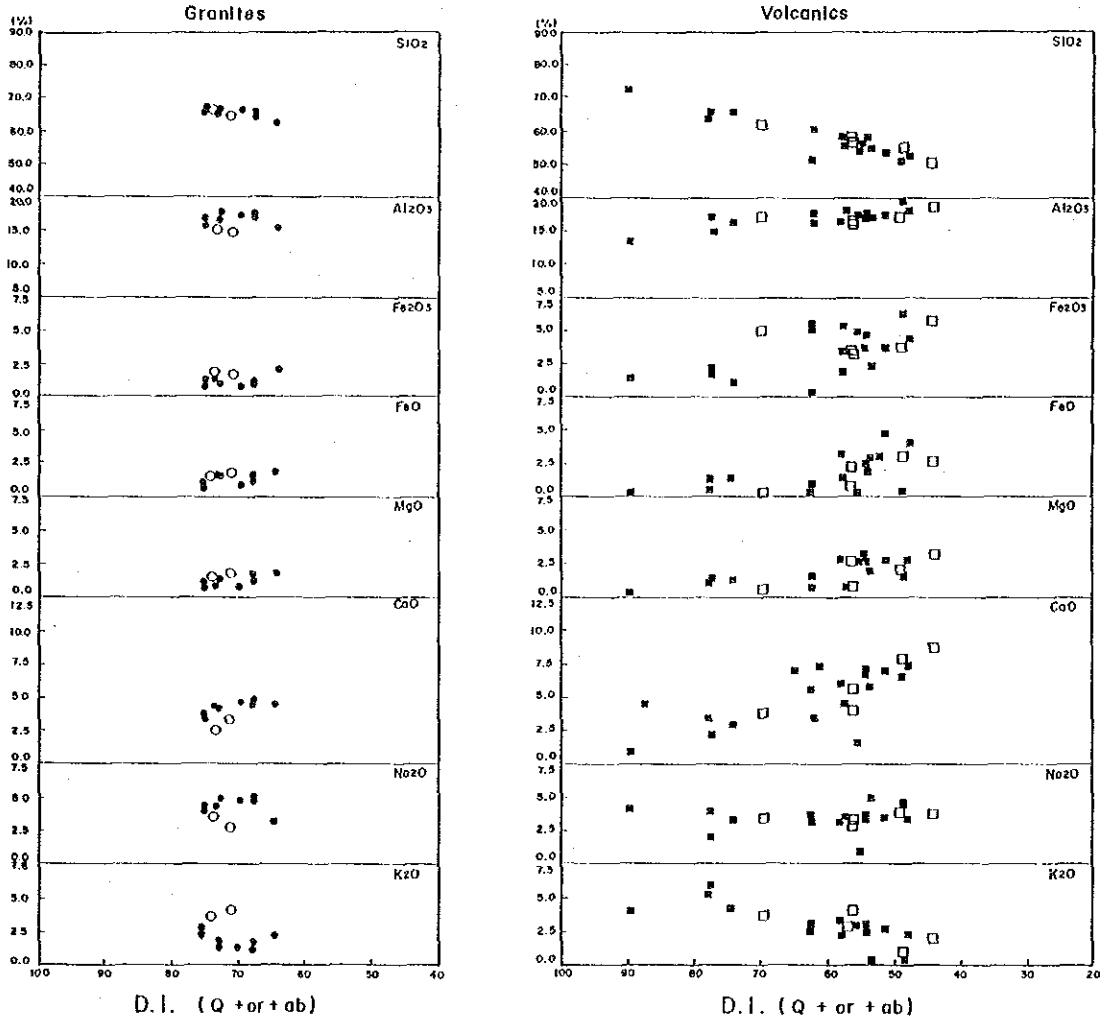


Figure 1-11 Variations Diagrams (D.I.~ Oxides)

Symbols (same as in Fig.1-5~Fig.1-11)

Granites

- ● Granodiorite (Triassic~Eeocene) Phase I~Phase II
- ○ Granodiorite (Triassic~Eeocene) Phase III

Volcanics

- ■ Andesite rocks (Eocene~Pliocene) Phase I~Phase II
- □ Andesite rocks (Eocene~Pliocene) Phase III

Table 1-9 Results of Microscopic Observation of the Thin Section

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	
C679	Basaltic andesite	Msa	Porphyritic			◎		□	□			○		◎					◎	◎		Ch. Ep
M605	Massive silicified rock	Msa	Granular	○									◎									vs Ser. Ch. Mf-relict
M610	Massive silicified rock	Msa	Granular	○	○							□	◎									vs Ser. Ch
P703	Granodiorite	Int	Holocrystalline	◎	◎	◎	○	○	□			□										
P706	Andesite	Msa	Porphyritic	□		◎	□	□				□		◎					○	◎		Ch. Mf-relict
S663	Basaltic andesite	Msa	Porphyritic			◎						○		◎					◎	○		Ch, Ep
S699	Granodiorite	Int	Holocrystalline	○	□	◎	○	○				○										Ch. Ep
S735	Biotite andesite	Msa	Porphyritic		□	◎	○	□?				○		◎					◎			Ch. Bi-relict
Y630	Massive silicified rock	Msa	Granular	□									◎						△			vs Ser. Ch. qz veinlet
Y682	Massive silicified rock	Msa	Granular	□									◎						□			vs Ser. Ch
16110	Altered andesite	Msa	Granular	□							△	△	◎						△	◎		vs Ser. Ch. Mf-relict
16135	Unaltered andesite	Msa	Porphyritic			◎		△	△					◎						□		Ch. Ep
17694	Altered andesite	Msa	Porphyritic	○		○		△	△			□	○							○		Ser. Ch
D151	Altered rock	Tev	Granular										◎						○			Ch. Mf-Ep veinlet
D152	Altered rock	Tev	Granular										◎						○	○		Ch. Ep. Op-pyrite?
D153	Altered rock	Tev	Granular										◎						○	○		Ch. Ep. Op-pyrite?
D154	Altered rock	Tev	Granular										◎						◎	○		Ch. Ep
D155	Altered rock	Tev	Granular										◎						◎	○		Ch. Ep. Op-pyrite?

Abbreviations

16110 : MJTC-16 11.0m
16135 : MJTC-16 135.0m
17694 : MJTC-17 69.4m
151 : MJTC-15 56.8m
152 : MJTC-15 68.5m
153 : MJTC-15 119.8m
154 : MJTC-15 135.0m
155 : MJTC-15 149.5m

◎:Abundant ○:Common □:Few △:Rare

Qz:Quartz, Kf:Potassium feldspar, Pl:Plagioclase, Bi:Biotite, Ho:Hornblende, Au:Augite, Hy:Hypersthene, Py:Pyroxene, Mf:Mafic mineral Op:Opaque minerals Ser:Sericite Ch:Chlorite Ep:Epidote C:Calcite Ah:Anhydrite G:Glass vs:very strong arg:argillization

volcanics is developed, and silicified and argillized zones related to epithermal gold mineralization is widely developed. In the Çanakkale area, there are the Madendağı and Kartaldağı gold mines, and the alteration zone extends from these mines to Zone B including the Etili Area.

It was shown by Landsat image analysis that there are many silicified and argillized alteration zones in the survey area, but the alteration zones are not necessarily accompanied by gold mineralization. Gold occurs only in limited localities. The major localities where gold mineralization was confirmed by geochemical samples (rock and trench) are shown in Table 1-7. The potential of these areas will be clarified by subsequent surveys. The characteristics known to date are as follows.

(1) In the central part of Zone B, the basement which consists of the Taşdibek Formation and Akpınar Granite forms an uplifted zone and gold mineralization is observed in the altered zone surrounding the basement complex. Similar characteristics are found in the Etili Area.

(2) The X-ray diffraction study of samples from the alteration zone showed that gold mineralization occurs in the acidic alteration whose products are kaoline, alunite and pyrophyllite with associated cristobalite.

(3) In the silicified zones, the gold content is low in the massive part, but is generally high along the fissures of the brecciated part with limonitic and hematitic clay associations.

(4) Aside from gold, the components with large absolute values of the eigenvector of the principal component analysis are copper, lead, zinc, silver, mercury, arsenic, and molybdenum; these elements are considered to be associated with gold.

From the above, it is anticipated that low-grade large-scale gold deposits occur in the silicified and argillized alteration zones near the basement rocks in Zone B including the Etili Area. Gold-bearing massive silicified bodies are expected from the Sartaş to Güvemalanı Hills in the Arlık Stream Area and Tepeköy in the Etili Area. Further gold-bearing brecciated zones are detected from Güvemalanı to İnkaya Hills.

4-4-2 Porphyry Molybdenum Potential

Porphyry molybdenum-copper deposits associated with the Dikmen Granite and porphyry intrusion were discovered in Zone C. The mineralization extends from the eastern side of the Dikmen Granite, which is elongated in the NEN-SWS direction to the Emeşe Formation of the Sığırirek Stream. The rocks are decoloured white at Sığırirek, and minor amounts of sulfide minerals such as molybdenite, chalcopyrite, sphalerite and pyrite occur in association with quartz veinlets. Although invisible under the microscope, analysis of drill

cores shows the existence of gold, silver, arsenic, mercury and antimony. Sericite and kaoline were identified by X-ray diffraction, indicating epithermal activity after the porphyry mineralization. The two mineralizations may be overlapping. The porphyry-type mineralization extends to the lower horizons and this is expected to be a low-grade large-scale deposit. This deposit locally contains gold. If gold can be found in significant amounts in the overlapped section, it would be an important future target.

4-5 Geologic Structure, Characteristics and Control of Mineralization.

The central part of Zone B consists of the Taşdibek Formation and Akpınar Granite which forms the geological basement. The basement is uplifted. Also, the south of the Etili Area consists of the Sakar Dağı Formation and Çavus Granite which forms the geological basement. The silicified and argillized zones of Şapçı Volcanics occur around the basement. The alteration zone extends further outward, but the gold mineralization is observed near the uplifted zone. In these localities, acidic alteration consisting of cristobalite, alunite, kaoline and pyrophyllite is observed. Analysis of rocks shows copper, lead, zinc, silver, mercury, arsenic and molybdenum together with gold. These elements are considered to have been associated with gold mineralization.

Quaternary Kocaçakıl Basalt lava intruded along the fault which extends through the uplifted zone of the basement. This is further evidence that conduits for hydrothermal fluids formed in the vicinity of the basement, and gold mineralization associated with the acidic alteration occurred.

Triassic Emeşe Formation is predominant in the southern part of Zone C. There are lineations trending NEN-SWS, parallel to the Dikmen Fault. *Serpentinite intruded along these latent faults, and Dikmen Granite and* porphyry also intruded in the same direction in latest Cretaceous to Eocene. Parts of the limestone and metavolcanics of the Emeşe Formation were skarnitized, argillized and silicified by the intrusion of the granitic rocks and porphyry. Molybdenite and other sulfide minerals occur in the quartz veinlets along the fissures formed by the intrusion of Dikmen Granite and porphyry. The intermediate volcanism became active in the Tertiary, and large amounts of lava and pyroclastic material were deposited during the Eocene to Miocene. The structure with the NEN-SWS trend clearly remained later into the time of silicification, argillization and associated gold mineralization (inferred to be latest Tertiary to Quaternary). Gold-bearing zones are locally observed along this direction, and the range of this mineralized zone is 4 km long and 2-3 km wide elongated in a NEN-SWS direction.

CHAPTER 5 CONCLUSIONS AND RECOMMENDATIONS

5-1 Conclusions

During the third phase, geological and geochemical surveys were conducted in the Etili Area. Further trench survey was carried out in the Arlık Stream and Piren Hill Areas, and drill survey in the Arlık Stream, Etili and Dikmen. Compiled maps of these areas are shown Figures 1-12, 1-13 and 1-14, the list of geological and geochemical characteristics in Table 1-10, and the summary of the four areas is below.

(1) Arlık Stream Area

Silicified and argillized zones occur in Şapçı Volcanics and part of Kirazlı Conglomerate. The Kocataş silicified zones occurring in Şapçı Volcanics were evident to 100m in MJTC-5, 6, 7 and 8, after which Kirazlı Conglomerate was intersected, but the Sartaş and Güvemalanı silicified zones continued for at least 150m in MJTC-3, 4, 9, 10, 11, 12, 13 and 14. Altered zones with limonite are predominant on the outcrops, but pyrites are not observed. Of the results of the drill survey, the following are significant: fine-grained pyrites are developed in the section underneath the surface; limonitic silicified zones with open spaces (caves) were found by drill hole MJTC-4 and 10; and the low-grade auriferous zones continued from near surface to bottom in holes MJTC-4, 13 and 14. Therefore, it is considered that the potential for gold deposits is high. Generally, auriferous mineralization in the silicified body did not extend further downward, and silicified veins were observed in the periphery of the silicified zones. Thus it is considered that their shapes are "jellyfish-like" in geologic section.

(2) Piren Hill Area

The geology consists of Şapçı Volcanics in this vicinity. The original rocks cannot be distinguished in the altered zones. The volcanic rocks become thicker with distance from the geologic basement. Altered zones with limonite and hematite are predominant on the outcrops, and pyrites are not observed because of oxidation.

Gold anomalies were detected in the silicified zones located in the southern part of the large alteration zone. The zones extend in an E-W direction in the vicinity of Piren Hill. The auriferous zones, which occur in limonitic clay such as those in fault zones, were detected by drill hole MJTC-2. As a result of the trench survey, gold-bearing zones on the surface were small-scale and the content of gold was low.

(3) Etili Area

Silicified and argillized zones occur in Şapçı Volcanics. The Halilaga silicified zones occurring in Şapçı Volcanics were evident as thin near the surface in MJTC-16 and 17, after which weakly altered andesites were intersected, but the Tepeköy silicified zones are inferred to continue for at least 150m because of large-scale silicified bodies. Altered zones with limonite are predominant on the outcrops, but pyrites are not observed.

Of the results of the drill survey, the following are significant: fine-grained pyrites are developed in the section underneath the surface, limonitic silicified-argillized zones were found by drill hole MJTC-16 and the low-grade auriferous zones continued from 2.80m to 16.65m in hole MJTC-16. Therefore, it is considered that the potential for gold deposits is low.

In Tepeköy alteration zones, auriferous mineralization in the silicified body extend further downward, and silicified veins are expected to be found in the central portion of the silicified zones. Thus it is considered that their shapes are "mushroom-like" in geologic section, as in the Kestane Mt. Area.

(4) Dikmen Area

Geophysical prospecting was carried out together with a detailed geological survey and geochemical prospecting. The detailed geological survey has clarified the distribution and conditions of gold occurrence, argillized zones and skarnization. The geochemical work has revealed two types of mineralization. By geophysical methods, the subsurface extent of mineralization from the outcrop downward was shown by delineating the low-resistivity zone and FE anomalies by IP.

A porphyry molybdenum-copper deposit associated with the intrusion of the Dikmen Granite and porphyry was discovered. The mineralization extends from the eastern side of the Dikmen Granite in a NW-SE direction to the Emeşe Formation in the Sığırirek Stream. The Emeşe Formation is altered, and minor amounts of sulfides such as molybdenite, chalcopyrite, wolframite, sphalerite and pyrite occur in the quartz veinlets. The analytical results show the existence of gold, arsenic, mercury and antimony. This shows that epithermal mineralization occurred after the porphyry molybdenum mineralization, and they now overlap spatially.

The porphyry molybdenum deposit mentioned above is expected to be a large-scale low-grade deposit as this type of mineralization is extensive at depth. It contains gold and antimony locally and may turn out to be a very important target.

The results of the third phase work summarized in (1)-(3) above, indicate the possibility of large-scale low-grade gold deposits in the alteration zone

near the basement rocks. The porphyry molybdenum deposit mentioned in (4) also is expected to be a large-scale low-grade deposit as this type of mineralization is extensive at depth. It locally contains gold and antimony, and significant gold is expected to be found in the overlapping portion.

5-2 Recommendations for Future Exploration

It is recommended that the following work be conducted in the promising areas delineated above (Figure 1-15). In the three localities of Zone B, epithermal gold mineralization is anticipated because of the gold showings of the alteration zones which were identified by geological and geochemical surveys. The hydrothermal gold mineralization is expected to extend both horizontally and vertically. Here, detailed geological survey clarified the distribution and extent of the alteration zone, and heavy mineral investigation in the vicinity located the position of the gold mineralization. On the basis of these findings, inclined drilling should be carried out in order to clarify the state of subsurface mineralization.

(1) Arlık Stream Area

The auriferous zones have been detected in Sartaş, Güvemalanı and İnkaya Hills; these localities belong to the concession of MTA. The drilling survey should be continued in these localities since auriferous zones were intersected by drill holes MJTC-4, 10, 13 and 14.

(2) Piren Hill Area

Gold anomalies were detected in the silicified zones located in the southern part of the large alteration zone which extends in an E-W direction in the vicinity of the Piren Tepe. The auriferous zone was detected by drill hole MJTC-2 in the Davulgılı silicified zones belonging to the concession of MTA. This zone was small and the content of gold was low on the surface. Further drilling survey should then be carried out in the southeastern part of the Piren silicified zones, which corresponds to west of Muratlar Village.

(3) Etili Area

The auriferous zones have been detected in Hamam Hill of southern Tepeköy Village. Although this locality does not belong to the concession of MTA, the drilling survey should be continued here because the auriferous zones were found through study of many rock samples.

(4) Dikmen Area

Geophysical prospecting was carried out along with detailed geological survey and geochemical prospecting. By geophysical methods, the subsurface extent of mineralization from the outcrop downward was shown by delineating the mineralization zones corresponding to geophysical anomalies, and was intersected by drill hole MJTC-15. Further drill survey should be conducted in the mineralized zone of the localities distributed in the Dikmen Granite and porphyry.

Table 1-10 Geological and Geochemical Characteristics

Characteristics of Geology and Geochemistry	Survey Area			
	Arlık Stream	Etili	Piren Hill	Dikmen
Type of Mineralization	Epithermal Type			Porphyry Mo
Country Rock of Ore Horizon	Şapçı Volcanics			Dikmen G. Porphyry
Clay Minerals	Kaoline, alunite, pyrophyllite			Sericite
Silicified Zone:Massive	○	○	○	-
Vein	×	×	×	○
Scale(km^2)	1.5	0.8	4.7	-
Number of Samples (N)	802	558	104	50
Au (max) ppb	3050	3660	2060	4600
Au > 100 ppb(Core & Trench)	103pcs	5pcs	-	-
Au > 100 ppb(Rock sample)	-	78pcs	-	-
Mo > 100 ppm(Core)	-	-	-	10pcs
Heavy Mineral Study	●	●	●	—
Detection of Gold Grains	common	abundant	few	—
Potential	high	high	low	high
Gold-bearing m sil ore	□	□	□	
Gold-bearing brecciated ore	□			
Gold-gearing quartz vein				□
Porphyry molybdenum				□

○ : predominant × : not observed ● : collected samples □ : expected ore m sil:massive silicified

Gold-bearing massive silicified ore : During the process of copper smelting, the iron component of the copper concentrates must be precipitated in the slag. Silicified ore is used for this purpose. The ratio of iron to silicified ore is 1.2. Kasuga Mine (Kyushu island) is operated as an open pit; ore grade is 2-3g/T Au and more than 88% SiO_2.

Gold-bearing brecciated ore : Gold extraction is easy with this type of ore because a sodium cyanide solution can be passed through the cracks to dissolve the gold. Gold extracted by the heap-leaching method is absorbed in active carbon. Generally, the location of the mine should be in a depopulated area with dry climate and a small amount of precipitation. Picacho Mine (California, USA) is operated as an open pit, ore grade is 0.9g/T Au, cut-off limit is 0.3g/T.

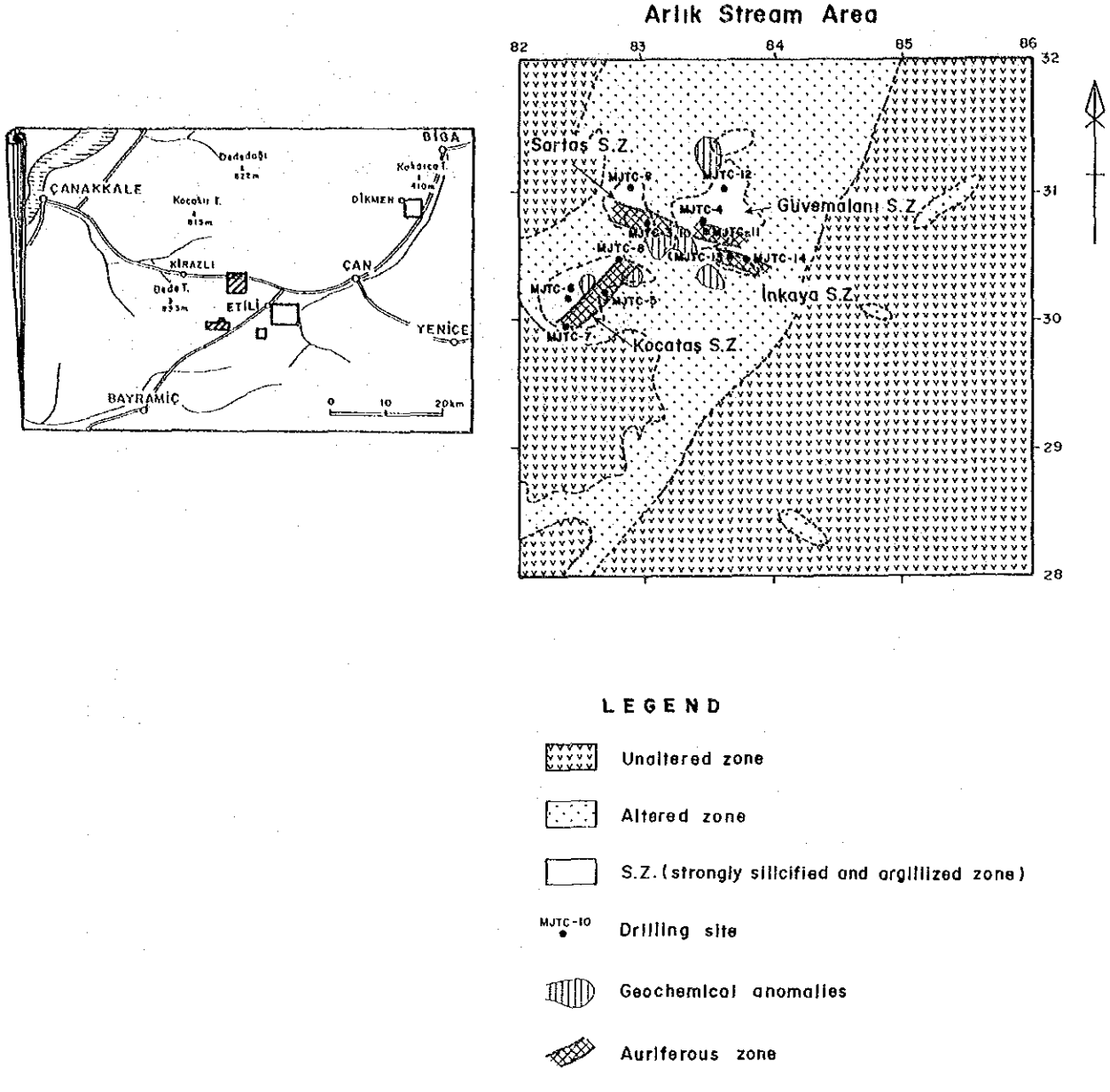
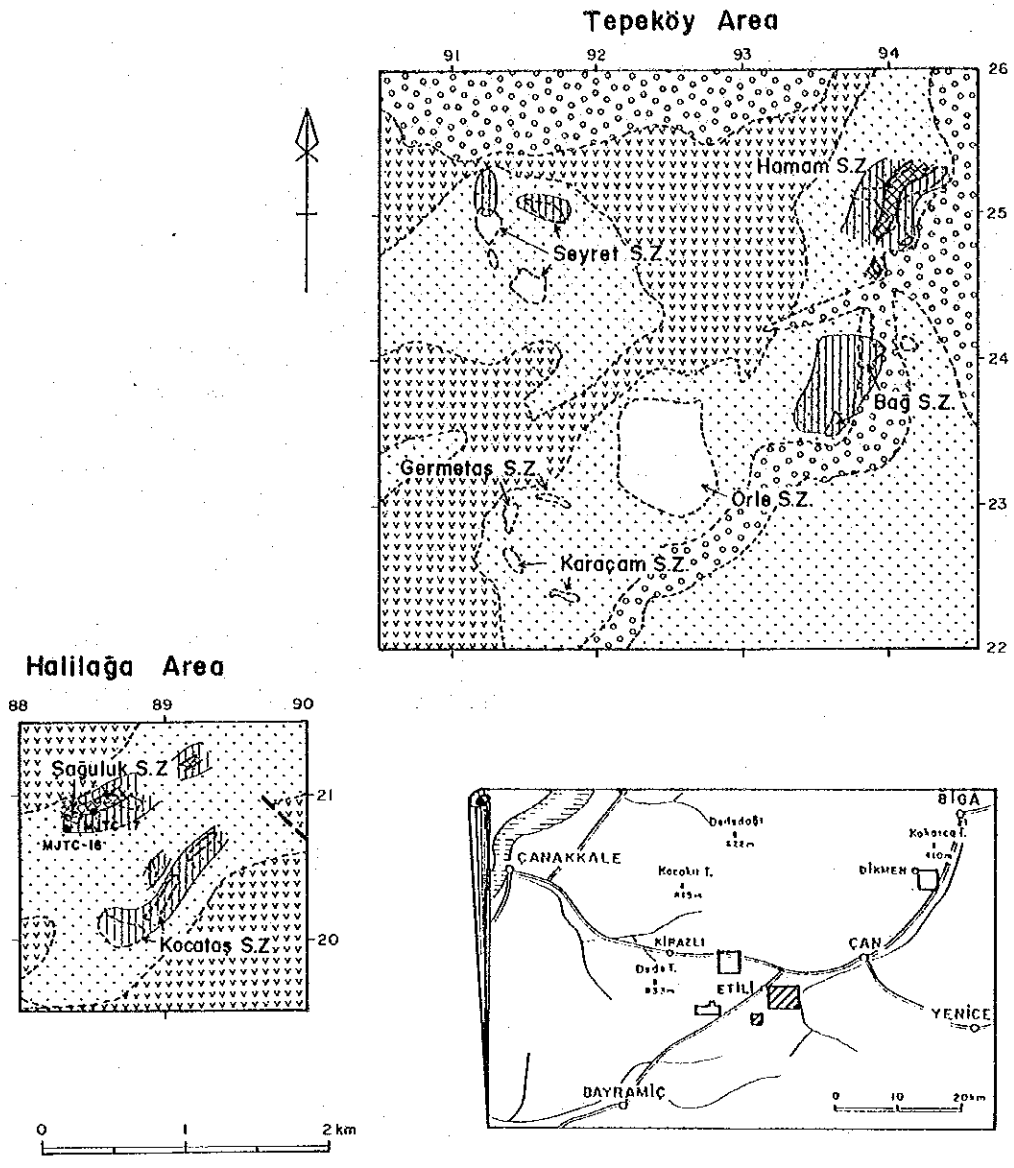


Figure 1-12 Compiled Map of the Arlık Stream and Piren Hill Areas



L E G E N D

- Silt, sand and gravel
- Unaltered zone
- Altered zone
- S.Z. (strongly silicified and argillized zone)
- Fault
- MJTC-16 Drilling site
- Geochemical anomalies
- Auriferous zone

Figure 1-13 Compiled Map of the Etili Area

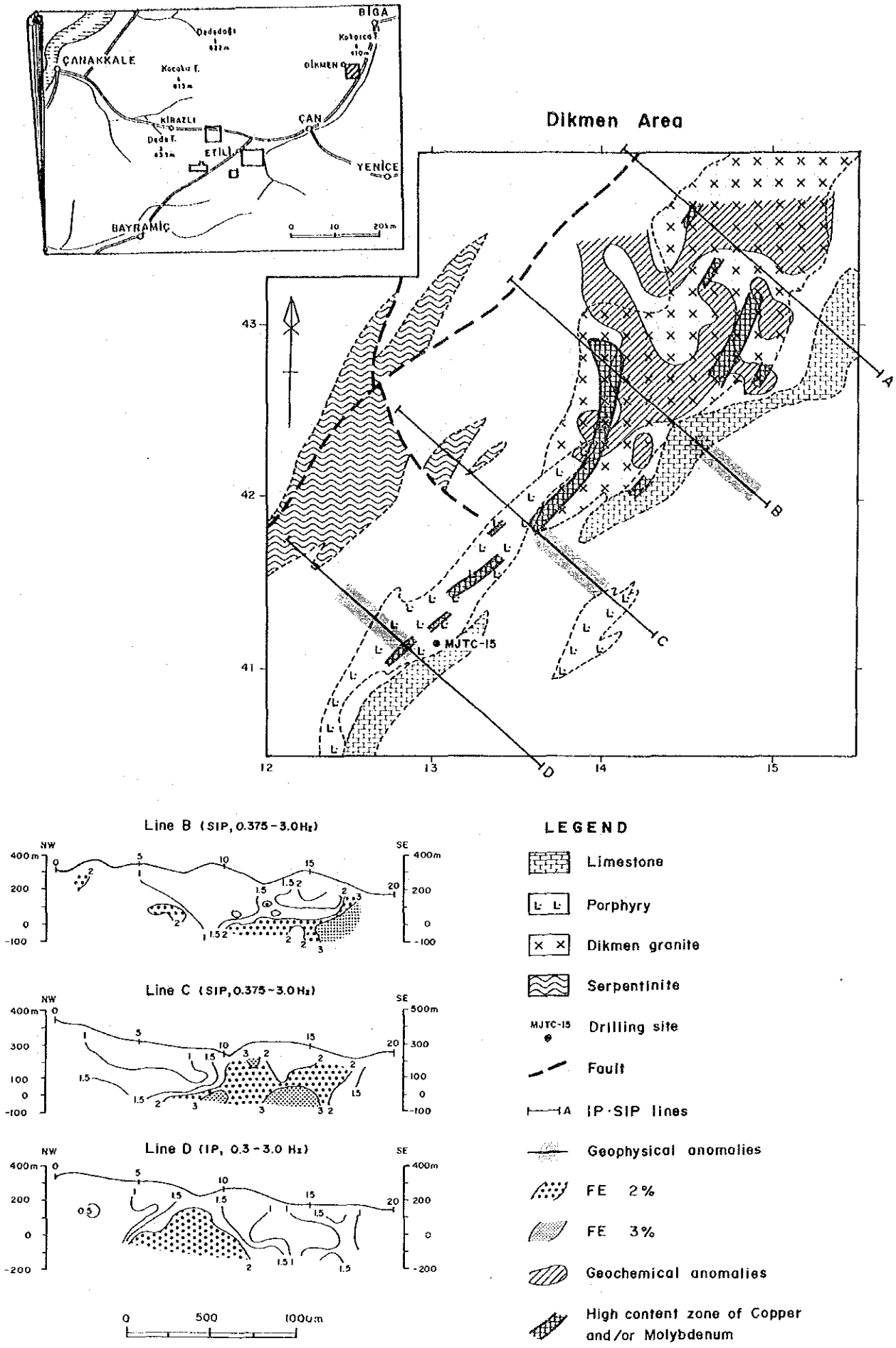


Figure 1-14 Compiled Map of the Dikmen Area

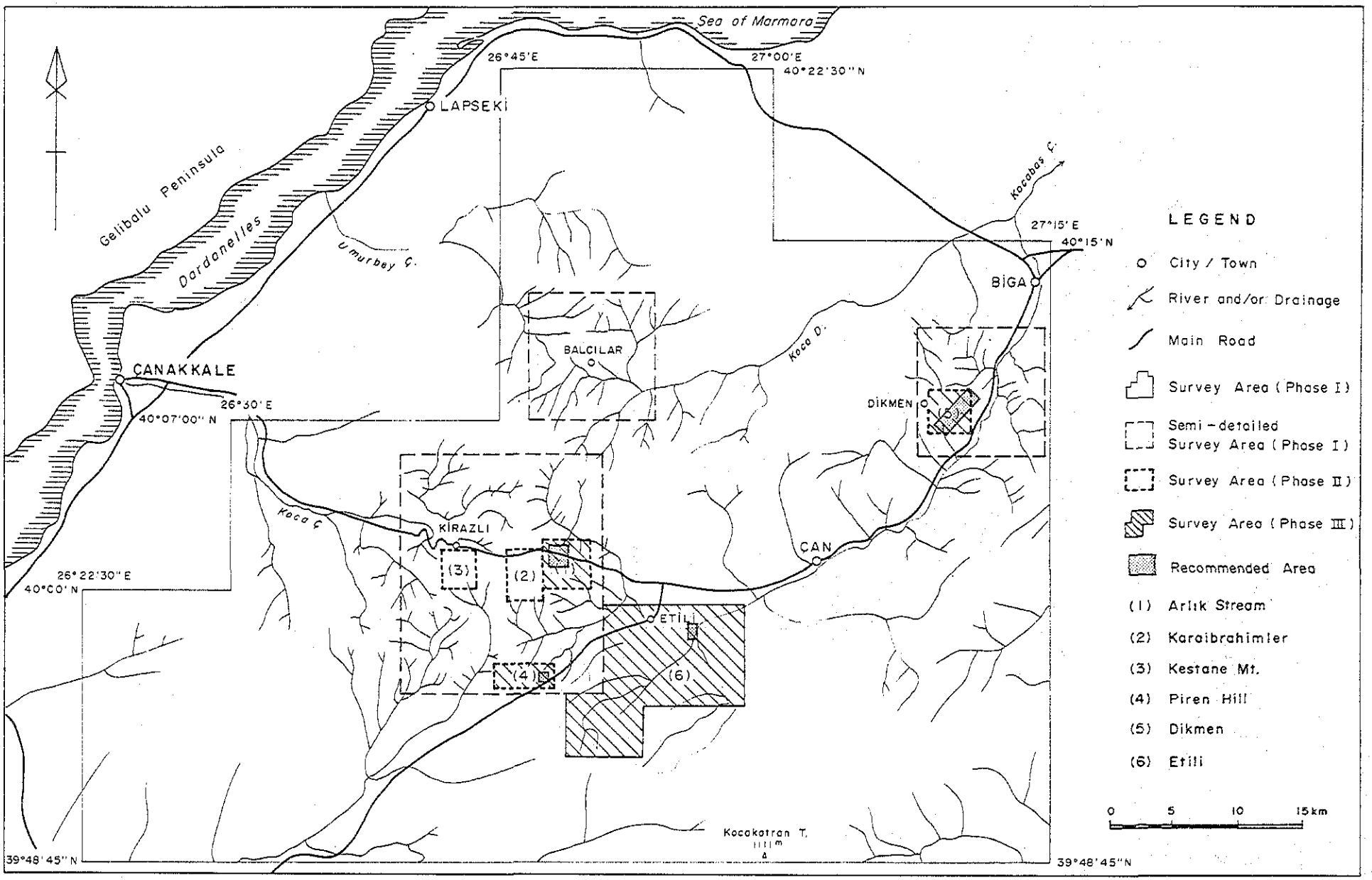


Figure 1-15 Recommendation Map of the Çanakkale Area

PART II ARLIK STREAM AREA

PART II ARLIK STREAM AREA

CHAPTER 1 SURVEY OF THE ARLIK STREAM AREA

1-1 Outline

The Arlık Stream Area locates in the eastern part of Zone B. The basement rocks of this zone are the Taşdibek Formation consisting of weakly metamorphosed green schist and crystalline limestone and the Akpınar Granite which intrudes into the Taşdibek Formation. The basement is correlated to the Triassic Karakaya Group because of the weakly metamorphosed lithology. The granite is not associated with mineralization, but the crystalline limestone in the vicinity has undergone contact metasomatism and has been skarnitized. Kirazlı Conglomerate, inferred to be Jurassic, unconformably covers these basement rocks. The intermediate volcanic activity began in the Eocene and the units progress from Çamyayla Volcanics to Şapçı Volcanics to Osmanlar Volcanics. The Karaköy Formation consisting of conglomerates were then deposited during the long volcanic interval. Quaternary volcanic rocks - Kocaçakıl Basalt - are observed as small outcrops where the Taşdibek Formation is distributed.

Geochemical anomalies of gold were discovered in the silicified and argillized zones in the Miocene Şapçı Volcanics, but the distribution of gold mineralization was gradually delineated by geological, geochemical and heavy mineral surveys of the first phase and detailed geological and drill surveys of the second phase.

1-2 Objective of the Survey

Gold grains were discovered at Arlık and İncirlık Streams. In the upstream section, there are the Sartaş, Güvemalanı and Kocataş Hill silicified zones. Almost all rock samples collected from these silicified zones contained gold in excess of 50 ppb, and hence geological and geochemical surveys were conducted in the Arlık alteration zones, and a drill survey was carried out in the concession of MTA. Then, trench and drill surveys were conducted in order to evaluate the auriferous zones in the third phase.

1-3 Contents of the Survey

The contents of the survey are shown in the following table:

Contents of Survey		Quantity	Components for Analysis
Trench S.	1,245m	404pcs	Au,Cu,Mo,Pb,Zn,Ag,As,Se,Hg,F,Ba,Tl
Drill S.	151mx8=1,208m	402pcs	Au,Ag,Cu,Pb,Zn,Sb,Hg,Mo

CHAPTER 2 GEOLOGY OF ARLIK STREAM AREA

The basement rocks of this zone are the Taşdibek Formation consisting of weakly metamorphosed green schist and crystalline limestone; Kirazlı Conglomerate covers these basement rocks unconformably. The intermediate volcanic activity continued from the Eocene to Pleistocene, and the units of Şapçı Volcanics are predominantly distributed. The Karaköy Formation consisting of conglomerates deposited during the long volcanic interval and Quaternary volcanic rocks -Kocaçakıl Basalt - are observed as small outcrops.

The stratigraphic column, geologic map, geologic cross section, gold occurrence and alteration map are shown in the report of the second phase (1990).

CHAPTER 3 TRENCH SURVEY OF SARTAŞ AND GÜVEMALANI ALTERATION ZONES

3-1 Trench Survey

Trench survey was carried out on the Sartaş and Güvemalanı Hills where the strongly silicified zones were intersected by drill survey in the second and third phases. These localities consist of drill sites of MJTC-4, 10, 11, 12, 13 and 14. The locations of trenches are shown in Fig.2-1. The interval of channel samples collected from the bottom of trenches is three meters, and the length of each trench and number of samples are as follows;

Location of Trench	Sample No.	Length	Quantity
Direction of MJTC-10	A1001～A1055	165m	55pcs
Direction of MJTC-11	A1101～A1170	210m	70pcs
Direction of MJTC-12	A1201～A1271	213m	71pcs
Direction of MJTC-13	A1301～A1355	165m	55pcs
Direction of MJTC-14	A1401～A1451	153m	51pcs
Parallel with MJTC-11	AA01～ AA48	144m	48pcs
Cross with MJTC-11	AB01～ AB63	195m	54pcs
Total		1,245m	404pcs

3-2 Sampling

After the stripping (depth of one meter) of overburden using a bulldozer,

further trenches were scooped out by a rock drill, and trench samples were collected from the B-C layer of soil. The depth of the trench is 1m to 1.5m. Sampling density was 404 samples from 1,224m of trench. The location of most samples vertically corresponds to strongly silicified zones.

3-3 Analytical Methods

All the samples were analyzed by Chemex Labs Ltd., of Canada. Gold was analyzed by the wet method and atomic absorption, fluorine by the SPECIFIC ION method, arsenic, selenium, mercury barium and thallium by atomic absorption spectrometry, and other elements by the ICP-AES method. The limits of detection of the elements are as below.

Table 2-1 Detection Limits and Analyzed Elements of Trench Samples

Element	Detection Limit	Element	Detection Limit
Cu	1ppm	Pb	1ppm
Zn	1ppm	Au	5ppb
Ag	0.2ppm	Mo	1ppm
Hg	10ppb	As	1ppm
F	20ppm	Ba	10ppm
Tl	0.1ppm	Se	0.2ppm

The results of analyses are shown in Table 6 of the Appendix.

3-4 Interpretation of the Chemical Results

(1) Outline of Method

The basic statistical values and correlation matrices of the chemical values of the trench samples were calculated, and the principal component analysis was carried out in the same manner as in the first and second phases, but only basic statistical values are shown in Table 2-2.

(2) Basic Statistical Values

Basic statistical values for 12 analyzed components with a population of 404 samples were calculated. Of the 12 components, gold content was, sometimes, below the detection limit, and thus, less than 2.5ppb was used for samples below 5ppb. The amounts of gold, molybdenum, fluorine and barium were high while those of copper, lead, zinc silver, arsenic, selenium. mercury and thallium were low. The basic statistical values are shown in Table 2-2.

Table 2-2 Basic Statistical Values of Arlık Stream Trenches

(Number of Samples:404)

Element	Mean	Dispersion	S.D.	Min.	Max.
Au(ppb)	24.271	0.271	0.520	2.50	345.0
Cu(ppm)	8.138	0.293	0.541	0.50	132.0
Mo(ppm)	12.430	0.122	0.350	1.00	144.0
Pb(ppm)	20.728	0.113	0.336	1.00	472.0
Zn(ppm)	5.776	0.201	0.448	1.00	224.0
Ag(ppm)	0.250	0.000	0.015	0.25	0.5
As(ppm)	13.545	0.148	0.385	0.50	154.0
Se(ppm)	0.573	0.371	0.609	0.10	17.0
Hg(ppb)	30.125	0.054	0.232	10.00	90.0
F (ppm)	273.490	0.088	0.297	50.00	1350.0
Ba(ppm)	276.525	0.102	0.320	20.00	1600.0
Tl(ppm)	0.469	0.200	0.447	0.05	4.0

(3) Interpretation

From the result of trench survey, the characteristics of mineralization are considered to be as follows:

Gold-bearing zones were clarified by the trench survey. These zones were divided into massive silicified and brecciated types. The former is inferred to ranges from drill hole MJTC-4 (Güvemalanı Hill) to MJTC-10 (Sartaş Hill), and locates in the limonitic parts of the massive silicified bodies which form the center of silicified zones. On the other hand, the latter ranges from MJTC-12 (Güvemalanı Hill) to MJTC-13 and 14 (İnkaya Hill), and locates in the limonitic-hematite parts of the brecciated zones which form the periphery of southeastern silicified zones.

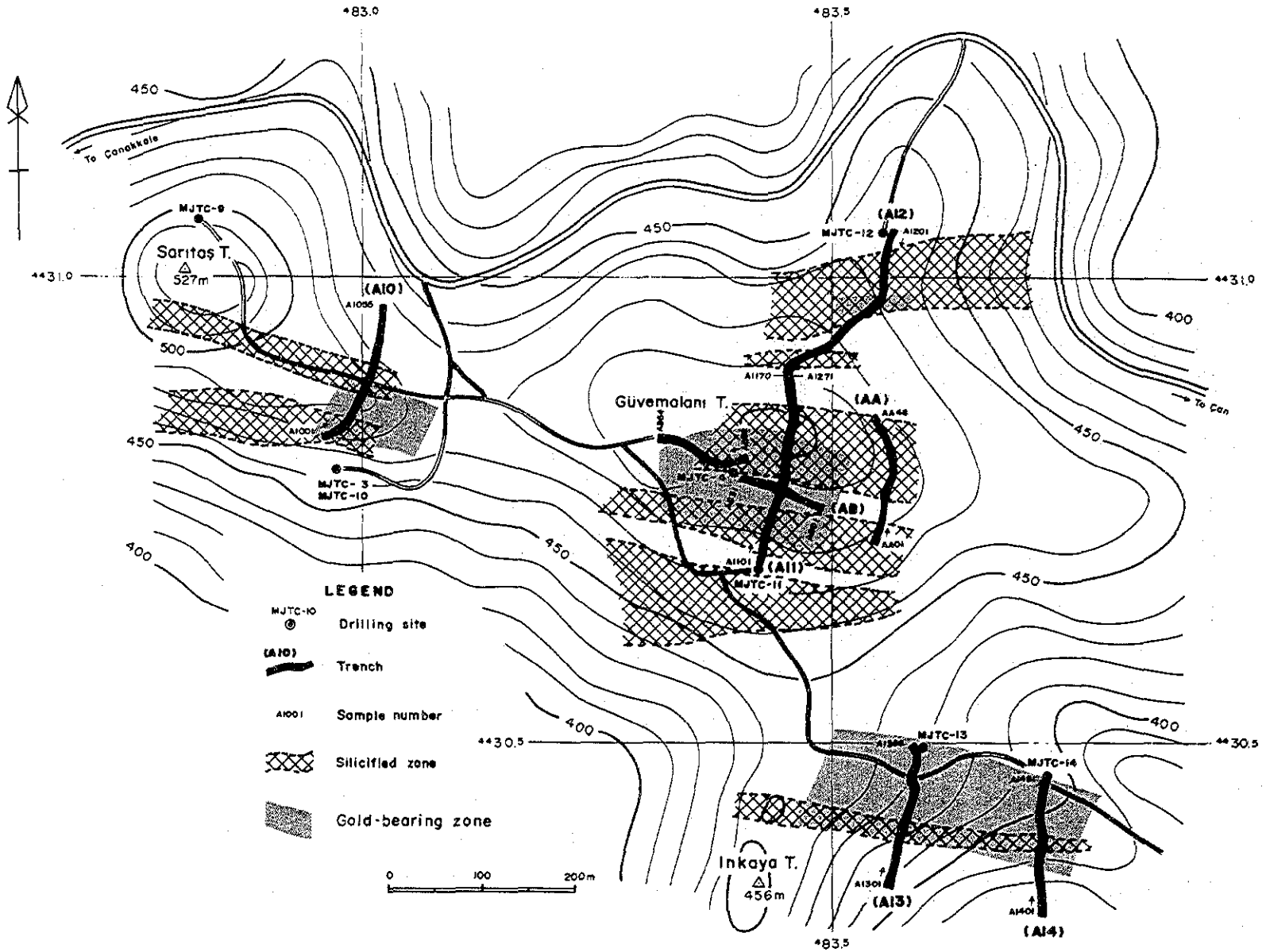


Figure 2-1 Location Map of Trenches of Arlık Stream Area

Table 2-3 Significant Analytical Results of Trench Samples (1)

Arlık (1) Au > 50ppb

Sample No.	Description	Au ppb	Cu ppm	Mo ppm	Pb ppm	Zn ppm	Ag ppm	As ppm	Se ppm	Hg ppb	F ppm	Ba ppm	Tl ppm
AA09	Soil B	55	3	10	12	4	<0.5	4	0.4	30	180	300	0.5
AA22	Soil B	50	2	5	16	2	<0.5	3	<0.2	40	320	480	0.5
AB04	Soil B	90	5	8	14	2	<0.5	8	<0.2	20	240	460	0.2
AB06	Soil B	50	15	15	20	8	<0.5	28	0.2	40	230	400	0.2
AB07	Soil B	50	10	10	26	8	<0.5	22	1.2	40	310	280	0.7
AB08	Soil B	60	12	19	30	6	<0.5	15	1.6	30	330	460	1.0
AB22	Soil B	55	12	19	32	14	<0.5	24	1.0	30	310	240	0.6
AB23	Soil B	75	20	28	36	18	<0.5	46	2.0	30	320	280	0.6
AB24	Soil B	70	12	18	34	14	<0.5	30	1.2	40	280	280	1.0
AB25	Soil B	80	14	20	48	16	<0.5	24	0.6	80	530	200	1.1
AB26	Soil B	75	11	14	44	14	<0.5	15	0.6	70	440	140	1.0
AB27	Soil B	80	13	17	56	18	<0.5	20	0.6	80	510	180	0.9
AB28	Soil B	75	11	17	30	10	<0.5	24	1.0	40	330	200	0.6
AB29	Soil B	80	15	12	52	14	<0.5	24	1.2	50	330	160	0.8
AB30	Soil B	270	12	14	30	8	<0.5	12	1.2	30	520	260	1.3
AB31	Soil B	100	15	22	40	12	<0.5	22	1.6	40	470	220	1.5
AB32	Soil B	55	3	8	18	2	<0.5	8	0.4	30	110	180	0.2
AB33	Soil B	140	4	7	16	4	<0.5	8	0.2	30	190	200	0.2
AB34	Soil B	60	4	9	16	4	<0.5	6	0.6	40	250	280	0.2
AB35	Soil B	50	5	15	40	4	<0.5	15	1.4	40	320	480	0.8
AB36	Soil B	70	7	31	28	6	<0.5	25	2.6	40	320	620	0.5
AB37	Soil B	85	12	28	26	8	<0.5	34	3.4	50	440	500	1.3
AB38	Soil B	100	8	24	30	6	<0.5	26	2.0	40	550	320	0.7
AB40	Soil B	55	1	10	24	<2	<0.5	4	<0.2	20	130	460	0.2
AB41	Soil B	80	1	7	18	<2	<0.5	3	<0.2	20	240	360	0.4
AB42	Soil B	90	4	44	32	4	<0.5	24	3.2	30	740	400	2.3
AB43	Soil B	110	5	24	36	2	<0.5	18	3.4	30	540	460	1.9
AB44	Soil B	85	16	24	30	6	<0.5	30	1.6	40	480	360	3.1
AB46	Soil B	60	18	40	114	10	<0.5	30	1.6	40	200	400	1.6
AB47	Soil B	50	22	30	58	8	<0.5	21	1.4	30	200	360	1.2
AB48	Soil B	110	14	29	82	20	<0.5	38	4.2	20	160	360	1.2
AB49	Soil B	60	9	25	176	8	<0.5	12	3.2	20	140	440	1.9
AB50	Soil B	195	8	68	472	8	<0.5	13	3.4	20	130	480	3.2
AB51	Soil B	105	21	52	176	8	<0.5	25	4.0	10	190	420	1.9
A1001	Soil B	80	28	16	8	8	<0.5	6	<0.2	20	330	100	0.3
A1002	Soil B	70	30	14	10	16	<0.5	17	0.4	20	500	140	0.2
A1003	Soil B	50	20	8	12	18	<0.5	10	1.0	20	460	180	0.4
A1004	Soil B	80	36	33	10	50	<0.5	48	0.8	20	430	220	0.2
A1005	Soil B	170	60	32	24	40	<0.5	40	1.0	40	230	100	0.1
A1006	Soil B	345	47	41	10	16	<0.5	154	7.2	20	370	120	0.2
A1007	Soil B	205	65	16	18	22	<0.5	32	4.0	20	850	560	0.4
A1009	Soil B	85	38	17	16	26	<0.5	38	1.4	30	980	820	0.3
A1010	Soil B	70	32	21	24	12	<0.5	20	2.8	30	820	660	0.4
A1011	Soil B	75	34	23	30	4	<0.5	17	1.8	30	910	520	1.3
A1022	Soil B	50	22	39	58	6	<0.5	11	1.0	10	450	420	1.5
A1024	Soil B	60	27	25	86	8	<0.5	20	2.4	20	740	1200	1.4
A1029	Soil B	115	19	62	10	4	<0.5	31	2.0	20	250	120	0.4
A1030	Soil B	65	28	67	18	8	<0.5	52	1.2	10	250	150	0.3
A1031	Soil B	65	38	69	6	4	<0.5	52	1.2	10	160	240	0.1
A1033	Soil B	50	25	11	20	4	<0.5	35	2.2	30	260	240	0.3

Table 2-3 Significant Analytical Results of Trench Samples (2)

Arlık (2) Au > 50ppb

Sample No.	Description	Au ppb	Cu ppm	Mo ppm	Pb ppm	Zn ppm	Ag ppm	As ppm	Se ppm	Hg ppb	F ppm	Ba ppm	Tl ppm
A1120	Soil B	55	19	11	70	34	<0.5	17	1.2	70	310	240	0.9
A1133	Soil B	70	25	27	42	8	<0.5	21	2.8	50	510	580	1.7
A1134	Soil B	55	28	28	24	8	<0.5	12	3.0	60	560	420	2.0
A1136	Soil B	70	15	26	24	8	<0.5	23	3.8	70	1350	340	3.7
A1140	Soil B	60	9	73	14	10	<0.5	56	5.0	40	210	240	0.4
A1141	Soil B	110	6	39	8	6	<0.5	23	1.2	30	100	160	0.3
A1145	Soil B	110	11	14	20	6	<0.5	16	5.0	40	290	180	1.1
A1146	Soil B	80	11	16	26	6	<0.5	14	17.0	50	360	320	1.3
A1147	Soil B	65	8	11	18	6	<0.5	13	1.2	50	250	380	0.5
A1149	Soil B	105	8	12	44	2	<0.5	8	6.8	50	270	440	1.5
A1156	Soil B	65	20	41	40	8	<0.5	60	1.4	40	610	220	0.7
A1168	Soil B	50	27	29	68	10	<0.5	18	2.0	50	240	360	0.9
A1256	Soil B	225	11	37	26	10	<0.5	26	2.6	50	190	400	0.3
A1270	Soil B	50	9	14	12	4	<0.5	8	0.2	50	140	400	1.0
A1301	Talus D	55	8	20	20	16	<0.5	15	<0.2	20	260	280	0.3
A1302	Talus D	50	1	9	10	2	<0.5	5	<0.2	10	100	80	0.1
A1303	Talus D	50	3	34	46	24	<0.5	8	0.2	20	100	90	0.1
A1304	Talus D	60	<1	18	18	<2	<0.5	5	0.2	10	100	100	0.1
A1305	Talus D	70	2	73	34	4	<0.5	14	0.6	10	190	320	0.2
A1306	Talus D	100	3	144	50	6	<0.5	25	0.6	20	200	480	0.2
A1307	Talus D	50	4	94	42	8	<0.5	24	0.6	20	180	560	0.3
A1308	Talus D	50	2	66	22	6	<0.5	13	<0.2	20	160	190	0.1
A1309	Talus D	100	<1	22	6	<2	<0.5	4	<0.2	10	80	40	<0.1
A1310	Talus D	90	1	12	8	2	<0.5	3	<0.2	20	80	80	0.1
A1311	Talus D	60	1	12	14	4	<0.5	5	<0.2	20	110	120	0.1
A1312	Talus D	60	3	7	12	2	<0.5	4	<0.2	10	90	100	0.1
A1313	Talus D	70	1	8	10	4	<0.5	4	<0.2	10	90	100	0.1
A1315	Talus D	60	5	18	16	10	<0.5	10	1.0	20	200	220	0.3
A1316	Talus D	65	3	17	16	6	<0.5	6	0.4	20	130	120	0.2
A1317	Talus D	75	1	5	6	2	<0.5	3	<0.2	20	80	60	0.1
A1319	Talus D	65	2	23	14	4	<0.5	6	0.6	20	120	60	0.1
A1320	Talus D	200	1	21	14	<2	<0.5	5	<0.2	20	90	50	<0.1
A1321	Talus D	220	3	20	10	2	<0.5	5	<0.2	10	120	50	<0.1
A1322	Talus D	200	2	18	8	2	<0.5	6	<0.2	10	100	60	<0.1
A1323	Talus D	80	3	16	28	4	<0.5	12	<0.2	20	160	160	0.2
A1324	Talus D	55	2	4	6	<2	<0.5	3	<0.2	20	80	40	<0.1
A1325	Talus D	70	1	1	2	<2	<0.5	1	<0.2	10	60	40	<0.1
A1326	Talus D	100	<1	1	<2	<2	<0.5	1	<0.2	10	50	30	<0.1
A1327	Talus D	60	<1	2	2	<2	<0.5	1	<0.2	10	70	30	<0.1
A1330	Talus D	100	<1	2	4	<2	<0.5	1	<0.2	10	50	30	<0.1
A1331	Talus D	95	<1	2	4	<2	<0.5	1	<0.2	20	50	30	<0.1
A1332	Talus D	170	<1	4	8	<2	<0.5	1	<0.2	10	50	880	<0.1
A1333	Talus D	110	<1	3	14	<2	<0.5	2	<0.2	10	60	60	<0.1
A1334	Talus D	90	<1	3	4	<2	<0.5	2	<0.2	10	60	30	<0.1
A1335	Talus D	90	1	3	6	<2	<0.5	1	<0.2	10	70	40	<0.1
A1336	Talus D	75	<1	3	6	<2	<0.5	1	<0.2	10	70	40	<0.1
A1337	Talus D	70	<1	5	4	<2	<0.5	2	<0.2	10	50	40	<0.1
A1338	Talus D	65	34	15	8	2	<0.5	6	<0.2	20	50	40	<0.1
A1339	Talus D	60	1	23	10	<2	<0.5	6	<0.2	10	50	50	<0.1
A1340	Talus D	55	6	15	22	4	<0.5	9	<0.2	10	100	140	<0.1
A1342	Talus D	115	3	13	16	6	<0.5	6	<0.2	20	90	120	0.1
A1343	Talus D	75	1	5	8	<2	<0.5	3	<0.2	10	60	30	<0.1
A1344	Talus D	90	2	11	10	4	<0.5	5	<0.2	20	70	50	0.1

Table 2-3 Significant Analytical Results of Trench Samples (3)

Arlık (3) Au > 50 ppb

Sample No.	Description	Au ppb	Cu ppm	Mo ppm	Pb ppm	Zn ppm	Ag ppm	As ppm	Se ppm	Hg ppb	F ppm	Ba ppm	Tl ppm
A1345	Talus D	90	6	9	8	<2	<0.5	3	<0.2	10	60	50	<0.1
A1346	Talus D	65	2	11	14	2	<0.5	5	<0.2	20	90	90	0.1
A1347	Talus D	65	3	9	14	<2	<0.5	5	<0.2	10	80	100	0.1
A1348	Talus D	85	2	32	42	<2	<0.5	13	<0.2	10	220	320	0.3
A1349	Talus D	90	2	24	46	<2	<0.5	10	<0.2	20	330	460	0.3
A1350	Talus D	75	3	88	38	2	<0.5	18	0.4	10	230	220	0.1
A1351	Talus D	70	2	28	32	<2	<0.5	15	<0.2	20	350	400	0.2
A1352	Talus D	80	1	88	30	<2	<0.5	15	<0.2	10	180	340	0.3
A1353	Talus D	95	3	81	32	<2	<0.5	16	<0.2	10	200	380	0.1
A1354	Talus D	90	2	33	10	2	<0.5	12	0.6	20	100	160	<0.1
A1355	Talus D	50	1	40	20	<2	<0.5	10	<0.2	10	220	340	<0.1
A1441	Talus D	125	4	18	34	<2	<0.5	10	0.2	20	240	520	0.3
A1442	Talus D	90	2	12	42	<2	<0.5	6	<0.2	10	200	580	0.4
A1443	Talus D	50	<1	6	10	<2	<0.5	3	<0.2	10	80	40	<0.1
A1444	Talus D	50	<1	7	22	<2	<0.5	2	<0.2	10	110	120	0.1
A1445	Talus D	110	1	9	14	<2	<0.5	4	<0.2	20	120	60	0.1
A1446	Talus D	55	1	6	12	<2	<0.5	3	<0.2	20	110	90	0.1
A1447	Talus D	70	<1	6	14	<2	<0.5	3	<0.2	20	100	820	0.1
A1448	Talus D	90	2	11	76	2	<0.5	6	<0.2	30	130	190	0.2
A1449	Talus D	85	2	9	38	<2	<0.5	2	<0.2	20	110	1600	0.1
A1450	Talus D	110	<1	6	8	<2	<0.5	2	<0.2	20	60	40	0.1
A1451	Talus D	60	2	7	12	2	<0.5	6	<0.2	20	100	120	0.1

CHAPTER 4 DRILLING SURVEY

4-1 Outline of the Drilling Survey

4-1-1 Objective of the Diamond Drilling

As a result of geological and geochemical surveys carried out in the first phase of the project, an epithermal-gold-type ore deposit is expected as a promising target for future exploration in the Arlık Stream area. In the second and third phases, a drilling survey consisting of twelve holes (total hole length: 1,800m) was planned and subsequently carried out in order to explore underground emplacement of the epithermal-gold-type ore deposit, and to investigate and unravel the relationship between the emplacement conditions of the ore deposit and the results of geological and geochemical surveys.

The purpose of the drill survey of the third phase is as follows:

MJTC- 7 & 8: exploration of gold mineralized area (Kocataş Hill) discovered by geochemical survey.

MJTC- 9 & 10: exploration of gold anomalous area (Sartaş Hill) found by geochemical survey.

MJTC-11 & 12: exploration of gold silicified zones (Güvemalanı Hill) found by drilling survey of the second phase.

MJTC-13 & 14: exploration of gold mineralized area (İnkaya Hill) and gold anomalies found by geochemical survey.

4-1-2 Outline of the Drilling Operation

(1) Location of drill holes

No.	Y	X	Z(m Sea level)	Direction	Dip
MJTC- 7	82325	29948	446	N10°E	-50°
MJTC- 8	82726	30548	412	S10°W	-50°
MJTC- 9	82848	31059	510	N10°E	-50°
MJTC-10	82971	30796	454	N10°E	-50°
MJTC-11	83426	30694	471	N10°E	-50°
MJTC-12	83554	31037	464	N10°E	-50°
MJTC-13	83597	30497	428	S10°W	-50°
MJTC-14	83729	30494	403	S10°W	-50°

(2) Drilling operation method

A wire line drilling method using the NQ- and BQ-type diamond bits as far as possible was applied. Drill holes were inclined.

(3) Core survey

A geological columnar section 1/200 in scale was compiled, and colour photographs of all drill cores collected were taken.

(4) Chemical assay of drill cores

Whole cores were split along the core extension, and half-pieces of the split core were chemically assayed to determine gold and silver content for the entrance section, while selected samples were analyzed for gold, silver, copper, lead, zinc, antimony, mercury and molybdenum content.

(5) Laboratory studies of the core

Detection of altered minerals by X-ray diffractometer were performed.

4-1-3 Holes Drilled

Drill Hole Data

No.	Length Drilled	Surface Soil	Core Length	Core Recovery	Period
MJTC- 7	151.00m	2.00m	145.75m	94.3%	28 Aug-15 Sep
MJTC- 8	151.00m	0.00m	150.80m	99.9%	23 Aug- 2 Sep
MJTC- 9	151.00m	0.00m	138.55m	91.8%	16 Sep- 8 Oct
MJTC-10	151.00m	19.20m	119.95m	84.9%	11 Jul- 2 Aug
MJTC-11	151.00m	0.00m	150.70m	99.8%	11 Jul- 7 Aug
MJTC-12	151.00m	0.70m	142.70m	94.9%	3 Sep-16 Sep
MJTC-13	151.00m	42.40m	126.50m	99.5%	8 Aug-27 Aug
MJTC-14	151.00m	47.00m	121.95m	80.8%	3 Aug-20 Aug

Table 2-4 Drilling Machine and Equipment Used

Drilling Machine Model "L-38"	2 set
Capacity	700m (BQ-WL)
Dimensions L x W x H	2,150mm x 1,170mm x 1,450
Hoisting Capacity	4,500kg
Spindle Speed	Forward 236,490,900,1,510rpm
Engine Model "F4L912"	18ps/1,800rpm
Drilling Pump Model "535 RQ"	1 set
Piston Diameter	70mm
Stroke	70mm
Capacity	Discharge Capacity 132 ℓ/min
	Max Pressure 56 kg/cm²
Dimensions L x W x H	1,905mm x 788mm x 940mm
Engine Model "WISCON"	18ps/2,000rpm
Wire Line Hoist	Attached to Drilling Machine
Derrick	Attached to Drilling Machine
Drilling Tools	
Drilling Rod	NQ-WL 3.05m 100 pcs
	BQ-WL 3.05m 100 pcs
Casing Pipe	HW 3.05m 20 pcs
	NW 3.05m 60 pcs
	BW 3.05m 100 pcs

4-2 Drilling Operation

4-2-1 Drilling Method

The drilling operation was performed by means of the wire line method using

a diamond drilling bit of NQ and BQ sizes not only at the MJTC-7, MJTC-10, MJTC-12, MJTC-13 and MJTC-14 sites covered by surface soil but also at the MJTC-8, MJTC-9 and MJTC-11 sites which had exposed bedrock at the surface.

Bentonite mud water was circulated during the drilling operation in order to reduce torque resistance caused by collapse in the hole.

Geology of the Arlık Stream area consists of silicified and argillized andesite. At the predominantly alterated sections of rocks in the hole, the rocks are soft and brittle and have many well-developed cracks and fissures which often cause loss of circulating mud water and much flash water. Meanwhile strong silicified rock is very hard to drill.

4-2-2 Drilling Machines, Equipment and Consumables

Two sets of Longyear L-38 were used for the drilling operation. The types and specifications of machines, engines, pumps and equipment, and amount of consumables are shown in Tables 2-4, and 2-5.

4-2-3 Operation Members and Shifts

The operation of move-in and move-out from site to site, and preparation work in the site were performed on a shift per day system, while the actual drilling operation was carried out by three shifts per day with eight working hours per shift. One drilling shift consisted of four members, a Japanese driller, a Turkish assistant driller (MTA) and two Turkish workers.

4-2-4 Transportation and Road Construction

The drilling machines, equipment and consumables were transported from the Northwest Anadol Regional Office of MTA located in Balıkesir, to a place near these drilling sites by a large truck, and then to the drilling sites by a small truck. As there was no access road, a new 0.75km road for MJTC-7 and MJTC-8, and a new 1.5km road for MJTC-9, MJTC-10, MJTC-11, MJTC-12, MJTC-13 and MJTC-14 were constructed by a bulldozer.

4-2-5 Water Supply

The necessary water for the drilling operation was transported by two tractors from a nearby well.

4-2-6 Withdrawal

After completion of the third-phase drilling survey, the drilling machines and equipment were stored in the storehouse of the MTA Office in Balıkesir.

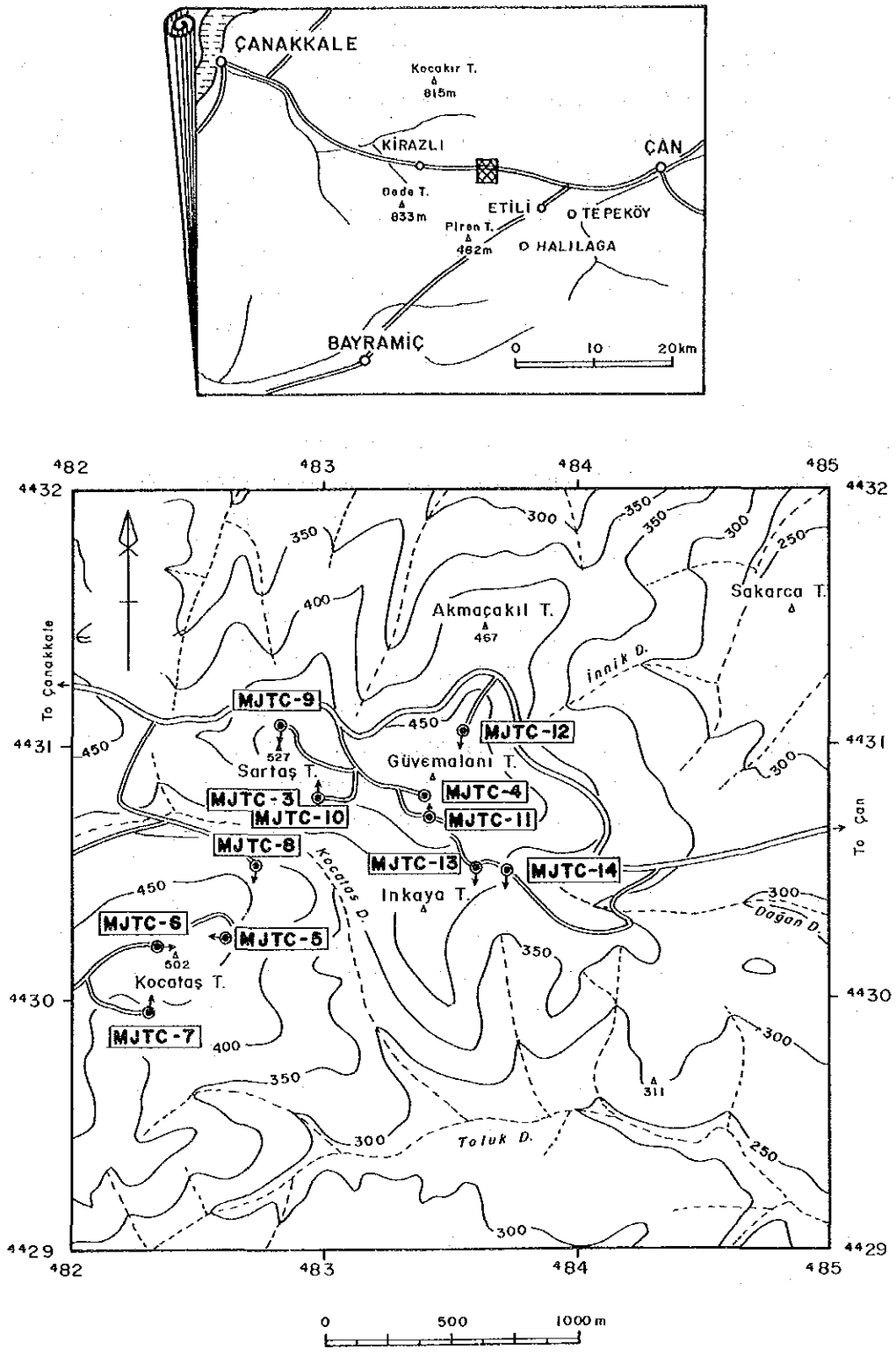


Figure 2- 2 Location Map of Drill Hole of the Arlık Stream Area

Table 2-5 Consumables Used(1)

Description	Specifi -cation	Unit	Quantity					
			MJTC-7	MJTC-8	MJTC-9	MJTC-10	MJTC-11	MJTC-12
Light oil		ℓ	3,700	1,900	4,020	3,700	4,660	3,700
Petrol		ℓ	1,290	720	1,560	1,530	1,920	930
Engine oil		ℓ	40	40	40	60	80	60
Hydraulic oil		ℓ	20	20	20	20	20	20
Grease		Kg	20	20	20	20	20	20
Cement		Kg	1,000	1,000	1,000	1,000	1,000	1,000
Bentonite		Kg	2,700	1,800	5,300	6,050	2,550	3,600
C.M.C		Kg	30	20	60	60	30	30
Telcoat-L		ℓ	-	-	10	-	-	-
Diamond bit	NQ/BQ	pcs	5/0	4/0	3/4	8/9	7/6	3/3
Diamond reamer	NQ/BQ	pcs	3/0	2/0	2/2	4/4	3/3	2/2
Casing diamond shoe	NX/BW	pcs	1/0	0/0	1/2	3/2	1/1	1/1
Casing metal shoe	HW/NW/BW	pcs	0/0/0	0/1/0	0/1/1	1/3/2	1/3/4	1/2/0
Core barrel Ass'y	NQ/BQ-WL	set	1/0	1/0	1/1	1/1	1/1	1/1
Inner tube	NQ/BQ-WL	pcs	2/0	2/0	2/2	2/2	2/2	2/2
Core lifter case	NQ/BQ-WL	pcs	4/0	4/0	4/4	6/4	4/4	4/4
Core lifter	NQ/BQ-WL	pcs	6/0	4/0	4/4	6/4	4/4	4/4
Thrust ball bearing	NQ/BQ-WL	pcs	4/0	2/0	4/4	4/4	4/4	4/4
Chuck piece	NQ/BQ-WL	set	1/0	1/0	1/1	1/1	1/1	1/1
Cylinder liner	535-RQ	pcs	3	3	3	6	6	3
Valve seat	535-RQ	pcs	3	3	3	6	6	3
Steel ball	535-RQ	pcs	3	3	6	6	6	3
Piston rubber	535-RQ	pcs	9	6	9	12	12	9
Core box	NQ & BQ	pcs	31	32	26	25	28	28

Table 2-5 Consumables Used(2)

Description	Specifi -cation	Unit	Quantity					Total
			MJTC-13	MJTC-14	MJTC-16	MJTC-17		
Light oil		ℓ	3,200	3,100	3,160	2,900		34,090
Petrol		ℓ	1,320	1,290	1,110	1,020		12,690
Engine oil		ℓ	40	40	40	40		480
Hydraulic oil		ℓ	20	20	20	20		200
Grease		Kg	20	20	20	20		200
Cement		Kg	1,000	1,000	1,000	1,000		10,000
Bentonite		Kg	2,600	2,500	2,300	4,600		34,000
C.M.C		Kg	60	60	30	50		290
Telcoat-L		ℓ	-	-	10	10		40
Diamond bit	NQ/BQ	pcs	8/0	8/0	4/1	3/2		53/25
Diamond reamer	NQ/BQ	pcs	4/0	4/0	2/1	2/1		28/13
Casing diamond shoe	NX/BW	pcs	3/0	3/0	1/1	1/1		15/ 8
Casing metal shoe	HW/NW/BW	pcs	1/3/0	1/3/0	1/1/0	1/0/0		7/14/7
Core barrel Ass'y	NQ/BQ-WL	set	1/0	1/0	1/1	1/1		10/6
Inner tube	NQ/BQ-WL	pcs	2/0	2/0	2/2	2/2		20/12
Core lifter case	NQ/BQ-WL	pcs	6/0	6/0	4/4	4/4		46/20
Core lifter	NQ/BQ-WL	pcs	6/0	6/0	4/4	4/4		48/24
Thrust ball bearing	NQ/BQ-WL	pcs	4/0	4/0	2/2	2/2		34/16
Chuck piece	NQ/BQ-WL	set	1/0	1/0	1/1	1/1		9/6
Cylinder liner	535-RQ	pcs	3	3	3	3		36
Valve seat	535-RQ	pcs	3	3	3	3		36
Steel ball	535-RQ	pcs	3	3	3	3		39
Piston rubber	535-RQ	pcs	9	9	9	9		93
Core box	NQ & BQ	pcs	31	27	27	25		280

Table 2-6 Drilling Meterage of Diamond Bit,
Reamer and Casing Shoe Bit Used(1)

Size	Drilling Meterage by Unit									
	MJTC-7		MJTC-8		MJTC-9		MJTC-10		MJTC-11	
	Diam.	m	Diam.	m	Diam.	m	Diam.	m	Diam.	m
NQ Bit	NT-35	31.80	NT-31	35.15	NT-43	31.80	NT- 1	17.15	NT- 2	21.10
	NT-36	31.75	NT-32	45.75	NT-44	25.90	NT- 3	22.90	NT- 4	10.95
	NT-37	33.50	NT-33	45.55	NT-45	18.95	NT- 5	21.20	NT- 6	9.20
	NT-38	27.45	NT-34	24.55			NT- 7	21.25	NT- 8	5.55
	NT-39	26.50					NT- 9	20.65	NT-10	9.70
							NT-11	2.90	NT-12	6.10
							NT-13	4.15	NT-14	8.80
							NT-15	6.20		
BQ Bit					BT-20	15.75	BT- 1	1.80	BT- 2	11.80
					BT-21	19.15	BT- 3	2.15	BT- 4	12.95
					BT-22	24.55	BT- 5	4.10	BT- 6	6.10
					BT-23	14.90	BT- 7	5.55	BT- 8	12.00
							BT- 9	2.55	BT-10	18.50
							BT-11	6.10	BT-12	18.25
							BT-13	2.35		
							BT-14	1.75		
							BT-15	8.25		
m/pc	5pcs	30.20	4pcs	37.75	7pcs	21.57	17pcs	8.88	13pcs	11.62
NQ Reamer	NR-18	63.55	NR-16	80.90	NR-23	31.80	NR- 1	40.05	NR- 2	32.05
	NR-19	60.95	NR-17	70.10	NR-25	44.85	NR- 3	42.45	NR- 4	24.45
	NR-20	26.50					NR- 5	23.50	NR- 6	14.90
							NR- 7	10.40		
BQ Reamer					BR-11	34.90	BR- 1	3.95	BR- 2	24.75
					BR-12	39.45	BR- 3	9.65	BR- 4	18.10
						BR- 5	11.00	BR- 7	36.75	
							BR- 6	10.00		
m/pc	3pcs	50.33	2pcs	75.50	4pcs	37.35	8pcs	18.88	6pcs	25.17
Casing shoe	NW	1pc	NW	1pc	NW	1pc	NW	3pcs	NW	1pc
					BW	2pcs	BW	2pcs	BW	1pc

Table 2-6 Drilling Meterage of Diamond Bit,
Reamer and Casing Shoe Bit Used(2)

Size	Drilling Meterage by Unit									
	MJTC-12		MJTC-13		MJTC-14		MJTC-16		MJTC-17	
	Diam.	m	Diam.	m	Diam.	m	Diam.	m	Diam.	m
NQ Bit	NT-40	31.65	NT-19	22.45	NT-15	8.50	NT-46	22.95	NT-50	24.40
	NT-41	26.55	NT-20	19.85	NT-16	17.25	NT-47	37.60	NT-51	29.05
	NT-42	21.25	NT-24	25.90	NT-17	17.40	NT-48	30.35	NT-53	31.95
			NT-25	25.40	NT-18	23.30	NT-49	21.05		
			NT-27	20.35	NT-21	18.90				
			NT-28	12.90	NT-22	25.40				
			NT-29	15.35	NT-23	17.65				
			NT-30	8.80	NT-26	22.60				
BQ Bit	BT-16	16.80					BT-19	39.05	BT-24	35.05
	BT-17	23.95							BT-25	30.55
	BT-18	30.80								
m/pc	6pcs	25.17	8pcs	18.90	8pcs	18.90	5pcs	30.20	5pcs	30.20
NQ Reamer	NR-21	31.65	NR-10	42.30	NR- 8	25.75	NR-24	60.55	NR-27	53.45
	NR-22	47.80	NR-11	51.30	NR- 9	40.70	NR-26	51.40	NR-28	31.95
			NR-14	33.25	NR-12	44.30				
			NR-15	24.15	NR-13	40.25				
BQ Reamer	BR- 8	40.75					BR-10	39.05	BR-13	65.60
	BR- 9	30.80								
m/pc	4pcs	37.75	4pcs	37.75	4pcs	37.75	3pcs	50.33	3pcs	50.33
Casing shoe	NW	1pc	NW	3pcs	NW	3pcs	NW	1pc	NW	1pc
	BW	1pc					BW	1pc	BW	1pc

Table 2-7 Working Time Breakdown of the Drilling Operation

Hole No.	Drilling			Shift		Men Working		Working Time						
	Bit size	Drilling length m	Core m	Drilling shift	Total shift	Engineer	Worker	Drilling h	Other work h	Recovery h	Total h	Removal h	Road construction and others h	G. Total h
						Number of men								
MJTC- 7	NQ	151.00	140.55	37	43	55	165	174	122	8	304	24	16	344
MJTC- 8	NQ	151.00	150.80	19	24	33	99	93	59	-	152	16	16	184
MJTC- 9	NQ/BQ	151.00	138.55	48	54	69	207	155	229	-	384	24	24	432
MJTC-10	NQ/BQ	151.10	119.95	44	51	68	204	180	188	-	368	16	24	408
MJTC-11	NQ/BQ	151.00	150.70	57	64	83	249	188	164	112	464	24	24	512
MJTC-12	NQ/BQ	151.00	142.70	26	32	42	126	141	75		216	24	16	256
MJTC-13	NQ	151.00	126.50	40	44	56	168	162	158	-	320	16	16	352
MJTC-14	NQ	151.00	121.95	38	43	54	162	134	178	-	312	16	16	344
Average	NQ/BQ	151.00	136.46	39	44	58	173	153	147	15	315	20	19	354
MJTC-16	NQ/BQ	151.00	136.45	32	37	48	144	154	101	-	255	24	16	295
MJTC-17	NQ/BQ	151.10	135.40	29	34	45	135	138	94	-	232	16	24	272
Average	NQ/BQ	151.00	818.90	189	239	267	1,072	973			1,662	128	216	2,006

4-3 Results of Diamond Drilling

4-3-1 MJTC-7

The hole reached massive bedrock at 2.00m after cutting through the surface with an NQ-size diamond bit with circulating dense bentonite mud water. After reaming with the HW and NW casing shoe bit, HW and NW casing pipes were inserted at 3.05m and 12.20m because of severe collapse of the hole wall. Below 12.20m, a NQ wire line method and bentonite mud water were used for the drilling operation. The rock consisted mainly of altered andesite rock with disseminated pyrite. The rock changed from altered andesite to alternations of black mudstone and fine tuffaceous sandstone below 84.75m. The drilling was completed at 151.00m. Mineralization accompanied by pyrite occurred in altered andesite of Şapçı Volcanics from 2.00m to 84.75m.

Depth (m)	0-6.10	6.10-151.00
Mud Water	BMW	BMW
Bit Exchange(pcs)	NQWL bit(1)	NQWL bit(4)
Pump Pres. (kg/cm^2)	0-5	5-10
Pump Feed (ℓ/min)	40	40
Pump Deli. (ℓ/min)	40	40
Bit Pres. (kg/cm^2)	1,000-1,500	1,000-1,500
Bit Rot. (rpm)	200	200
Core Recovery (%)	82	94

BMW:Bentonite Mud Water, Pres.:Pressures, Rot.:Rotation
Deli.:delivery

4-3-2 MJTC-8

As altered andesite of the Şapçı Volcanics was exposed at the surface of the site, the hole was drilled using an NQ diamond bit and circulating mud water, and was reamed with HW and NW casing shoe bits, HW and NW casing pipes were inserted at 3.05m and 6.10m. Below 6.1m, an NQ wire line method and mixed bentonite mud water were used for the drilling operation. The drilling was completed at 151.00m.

The lithology of this drill hole consists of altered andesite (0-94.00m), alternations of black mudstone and sandstone (94.00-126.00m) and altered conglomerate (126.00-151.00m). Mineralization accompanied by disseminated pyrite and native sulfur occurred in Şapçı Volcanics and Kirazlı Conglomerate.

Depth (m)	0-6.10	6.10-151.00
Mud Water	BMW	BMW
Bit Exchange(pcs)	NQWL bit(1)	NQWL bit(3)
Pump Pres. (kg/cm^2)	5-10	0-5
Pump Feed (ℓ/min)	40	40
Pump Deli. (ℓ/min)	40	40
Bit Pres. (kg/cm^2)	1,000-1,500	1,000-1,500
Bit Rot. (rpm)	200	200
Core Recovery (%)	100	99

4-3-3 MJTC-9

As altered andesite of the Şapçı Volcanics was exposed at the surface of the site, the hole was drilled using an NQ diamond bit and circulating mud water, and was reamed with an NX casing shoe bit. NX casing pipes were inserted through the andesite to 3.1m. Below 3.1m, an NQ wire line method and mixed bentonite mud water were used for the drilling operation. The loss of mud water commenced at 44.50m. NW casing pipes was extended to 45.75m after reaming with NW casing shoe bit. The hole was drilled using an NQ diamond bit, and BW casing pipes were inserted at 76.65m. Below 76.65m, a BQ wire line method, and bentonite mud water including TELCOAT-L were used for the drilling operation. The drilling was completed at 151.00m.

The lithology of this drill hole consists of altered andesite (0-49.65m), silicified fine tuff (49.65-132.00m), silicified andesite (132.00-142.30m) and strongly silicified rock (142.30-151.00m). Mineralization of pyrite and native sulfur did not occur in Şapçı Volcanics.

Depth (m)	0-76.65	76.65-151.00
Mud Water	BMW	BMW
Bit Exchange(pcs)	NQWL bit(3)	BQWL bit(4)
Pump Pres. (kg/cm^2)	0-5	5-10
Pump Feed (ℓ/min)	40	30
Pump Deli. (ℓ/min)	0-40	0
Bit Pres. (kg/cm^2)	1,000-1,500	1,000-1,500
Bit Rot. (rpm)	200	200
Core Recovery (%)	100	84

4-3-4 MJTC-10

The hole reached massive bedrock at 14.00m after cutting through the surface with an NQ-size diamond bit with circulating dense bentonite mud water. After reaming with the HW and NW casing shoe bits, HW and NX casing pipes were inserted at 3.00m and 39.75m. Below 39.75m, an NQ wire line method and bentonite mud water were used for the drilling operation. Below 103m, loss of mud water commenced in the cave parts of strongly silicified zones, and BW casing pipes were inserted at 116.40m because of severe collapse of the hole wall and loss of mud water. The drilling was completed at 151.00m.

The lithology of this drill hole consists of reddish brown soil (0-14m), strongly argillized rock (14-75.30m), silicified andesite (75.30-91.55m and 140.30-151.00m) and strongly silicified rock (91.55-140.30m). Mineralization accompanied by disseminated pyrite occurred in Şapçı Volcanics.

Depth (m)	0-116.40	116.40-151.00
Mud Water	BMW	BMW
Bit Exchange(pcs)	NQWL bit(8)	BQWL bit(9)
Pump Pres. (kg/cm^2)	0-5	5-10
Pump Feed (ℓ/min)	40	30
Pump Deli. (ℓ/min)	0-20	0
Bit Pres. (kg/cm^2)	1,000-1,500	1,000-1,500
Bit Rot. (rpm)	200	200
Core Recovery (%)	86	85

4-3-5 MJTC-11

As altered andesite of the Şapçı Volcanics was exposed at the surface of the site, the hole was drilled using an NQ diamond bit and circulating mud water, and was reamed with the HW and NW casing shoe bits. HW and NW casing pipes were inserted through the andesite to 3.0m and 9.15m. Below 9.15m, an NQ wire line method and bentonite mud water were used for the drilling operation and BW casing pipes were inserted at 116.40m because of severe collapse of the hole wall. Although the drill hole because jammed at 120.15m while retrieving an inner tube of the wire line, BQ rods and a core barrel were recovered by reaming, and the hole was completed at 151.00m.

The lithology of this drill hole consists of argillized andesite (0-32.10m and 110.60-150.00m), silicified andesite (32.10-38.00m and 107.85-110.60m) and strongly silicified rock (38.00-107.85m). Mineralization accompanied by disseminated pyrite did not occur in Şapçı Volcanics.

Depth (m)	0-71.40	71.40-151.00
Mud Water	BMW	BMW
Bit Exchange(pcs)	NQWL bit(7)	BQWL bit(6)
Pump Pres. (kg/cm^2)	0-5	5-10
Pump Feed (ℓ/min)	40	30
Pump Deli. (ℓ/min)	40	30
Bit Pres. (kg/cm^2)	1,000-1,500	1,000-1,500
Bit Rot. (rpm)	200	200
Core Recovery (%)	100	100

4-3-6 MJTC-12

The hole reached massive bedrock at 0.70m after cutting through the surface with an NQ-size diamond bit with circulating dense bentonite mud water. After reaming with the HW and NW casing shoe bits, HW and NW casing pipes were inserted at 6.10m. Below 6.10m, an NQ wire line method and bentonite mud water were used for the drilling operation. BW casing was inserted at 79.30m because of severe collapse of the hole wall. The drilling was completed at

151.00m.

The lithology of this drill hole consists of reddish brown soil (0-0.70m), strongly argillized rock (0.70-36.25m and 134.20-151.00m) and strongly silicified rock (36.25-134.20m). Mineralization accompanied by disseminated pyrite occurred between 144.90 and 151.00m.

Depth (m)	0-79.45	79.45-151.00
Mud Water	BMW	BMW
Bit Exchange(pcs)	NQWL bit(3)	BQWL bit(3)
Pump Pres. (kg/cm^2)	5-10	10-15
Pump Feed (ℓ/min)	40	30
Pump Deli. (ℓ/min)	40	20
Bit Pres. (kg/cm^2)	1,000-1,500	1,000-1,500
Bit Rot. (rpm)	200	200
Core Recovery (%)	99	90

4-3-7 MJTC-13

As the talus breccia was exposed at the surface of the site, the hole was drilled using an NQ diamond bit and circulating mud water, and was reamed with an HW casing shoe bit. An HW casing pipe was inserted at 3.05m. Below 3.05m, an NQ wire line method and mixed bentonite mud water were used for the drilling operation. The core recovery of unconsolidated limonitic talus breccia zones was low from the surface to 39.95m. After reaming of those zones with the NW casing shoe bits, NW casing pipes were inserted at 36.70m because of severe collapse of the hole. The drilling was completed at 151.00m.

The lithology of this drill hole consists of talus breccia (0-39.95m), and fractured argillized and strongly silicified rock (39.95-151.00m). Oxidization zones accompanied with hematite and limonite occurred in Şapçı Volcanics.

Depth (m)	0-39.95	39.95-151.00
Mud Water	BMW	BMW
Bit Exchange(pcs)	NQWL bit(3)	NQWL bit(5)
Pump Pres. (kg/cm^2)	5-10	0-5
Pump Feed (ℓ/min)	40	40
Pump Deli. (ℓ/min)	40	40
Bit Pres. (kg/cm^2)	1,000-2,000	1,000-1,500
Bit Rot. (rpm)	200	200
Core Recovery (%)	92	92

4-3-8 MJTC-14

As the talus breccia was exposed at the surface of the site, the hole was drilled using an NQ diamond bit and circulating mud water, and was reamed with

an HW casing shoe bit. An HW casing pipe was inserted at 3.05m. Below 3.05m, an NQ wire line method and mixed bentonite mud water were used for the drilling operation. The core recovery of unconsolidated limonitic talus breccia zones was low from the surface to 47.00m. After reaming of those zones with the NW casing shoe bits, NW casing pipes were inserted at 36.70m because of severe collapse of the hole. The drilling was completed at 151.00m.

The lithology of this drill hole consists of talus breccia (0-47.00m), and fractured argillized and strongly silicified rock (47.00-151.00m). Oxidization zones accompanied with hematite and limonite occurred in Şapçı Volcanics.

Depth (m)	0-47.00	47.00-151.00
Mud Water	BMW	BMW
Bit Exchange(pcs)	NQWL bit(3)	NQWL bit(5)
Pump Pres. (kg/cm^2)	1-5	5-10
Pump Feed (ℓ/min)	40	40
Pump Deli. (ℓ/min)	40	40
Bit Pres. (kg/cm^2)	1,000-1,500	1,000-1,500
Bit Rot. (rpm)	200	200
Core Recovery (%)	38	100

4-4 Alteration of Drill Holes

4-4-1 MJTC-7

An inclined hole (-50°) was drilled through the strongly argillized zones of Şapçı Volcanics until 100m and through Kirazlı Conglomerate from 100m to 151m. Argillized zones gradually decreased downward and the pyrite dissemination zones increased in the subsurface. The altered minerals consist of montmorillonite and kaoline in the Şapçı Volcanics, and montmorillonite and sericite in the Kirazlı Conglomerate. The drill hole did not intersect silicified zones distributed in the neighbourhood of the drill site.

4-4-2 MJTC-8

An inclined hole (-50°) was drilled through the argillized zones of Şapçı Volcanics until 126m and Kirazlı Conglomerate from 126m to 151m. Argillized zones gradually decreased downward and the pyrite dissemination zones and network of native sulfur increased in the subsurface. The altered minerals consist of montmorillonite and kaoline in the Şapçı Volcanics, and montmorillonite and sericite in the Kirazlı Conglomerate. The drill hole did not intersect silicified zones distributed in the neighbourhood of the drill site.

Table 2-8 Record of the Drilling Operation at MJTC-7

	Drilling length			Total		Shift		Working Men	
	Shift 1	Shift 2	Shift 3	Drilling Length	Core Length	Drilling Shift	Total Shift	Engi-neer	Worker
	m	m	m	m	m			men	men
28 Aug	PRDS						1	3	9
29 Aug	PRDS						2	3	9
30 Aug	PRDS						3	3	9
31 Aug	6.10			6.10	5.00	1	4	3	9
1 Sept	6.10	4.35	3.25	19.80	17.40	3	7	3	9
2 Sept	4.80	4.10	3.10	31.80	28.80	3	10	3	9
3 Sept	4.30	2.00	2.05	40.15	37.15	3	13	3	9
4 Sept	3.55	3.55	5.00	52.25	49.25	3	16	3	9
5 Sept	RECO						17	1	3
6 Sept	3.10	3.60	2.55	61.50	58.50	3	20	3	9
7 Sept	2.05	3.25	4.85	71.65	67.65	3	23	3	9
8 Sept	4.10	2.55	4.00	82.30	78.30	3	26	3	9
9 Sept	4.60	4.50	5.65	97.05	92.05	3	29	3	9
10 Sept	5.05	7.20	3.55	112.85	102.40	3	32	3	9
11 Sept	2.90	4.65	4.10	124.50	114.05	3	35	3	9
12 Sept	5.70	4.70	4.50	139.40	128.95	3	38	3	9
13 Sept	7.15	4.45	OUCP	151.00	140.55	3	41	3	9
14 Sept	DISM						42	3	9
15 Sept	DISM						43	3	9
Total	59.50	48.90	42.60	151.00	140.55	37	43	55	165

Abbreviations

ROCO;Road construction
PRDS;Preparation of drilling site
TRAN;Transportation
TRRE;Transportation and Reassembly
CIMW;Circulation of mud water
DISM;Dismantling
RECO;Recovery work
INCP;Inserting casing pipe
OUCP;Retrieving casing pipe

Table 2-9 Record of the Drilling Operation at MJTC-8

	Drilling Length			Total		Shift		Working Men	
	Shift 1	Shift 2	Shift 3	Drilling Length	Core Length	Drilling Shift	Total Shift	Engi-neer	Worker
	m	m	m	m	m			men	men
23 Aug	PRDS						1	3	9
24 Aug	PRDS						2	3	9
25 Aug	3.20			3.20	3.20	1	3	3	9
26 Aug	7.15	9.55	9.15	29.05	29.05	3	6	3	9
27 Aug	6.10	12.20	9.15	56.50	56.50	3	9	3	9
28 Aug	9.15	9.15	6.10	80.90	80.90	3	12	3	9
29 Aug	11.75	9.25	6.45	108.35	108.35	3	15	3	9
30 Aug	10.80	7.30	5.05	131.50	131.30	3	18	3	9
31 Aug	5.55	6.75	7.20	151.00	150.80	3	21	3	9
1 Sept	DISM						22	3	9
2 Sept	DISM						23	3	9
Total	53.70	54.20	43.10	151.00	150.80	19	24	33	99

Abbreviations

ROCO;Road construction
PRDS;Preparation of drilling site
TRAN;Transportation
TRRE;Transportation and Reassembly
DISM;Dismantling
RECO;Recovery work
INCP;Inserting casing pipe
OUCP;Retrieving casing pipe

Table 2-10 Record of the Drilling Operation at MJTC-9

	Drilling Length			Total		Shift		Working Men	
	Shift 1	Shift 2	Shift 3	Drilling Length	Core Length	Drilling Shift	Total Shift	Engi-neer	Worker
	m	m	m	m	m			men	men
16 Sept	PRDS						1	3	9
17 Sept	PRDS						2	3	9
18 Sept	PRDS						3	3	9
19 Sept	5.60			5.60	5.60	1	4	3	9
20 Sept	6.45	5.95		18.00	18.00	2	6	3	9
21 Sept	4.05	5.25	4.50	31.80	31.80	3	9	3	9
22 Sept	3.05	6.10	3.05	44.00	43.80	3	12	3	9
23 Sept	4.10	INCP	INCP	48.10	47.90	3	15	3	9
24 Sept	INCP	INCP	INCP	48.10	47.90	3	18	3	9
25 Sept	2.00	4.90	2.70	57.70	57.50	3	21	3	9
26 Sept	3.15	2.90	2.60	66.35	66.15	3	24	3	9
27 Sept	CIMW	2.05	5.10	73.50	73.30	3	27	3	9
28 Sept	2.20	0.95	1.90	78.55	78.35	3	30	3	9
29 Sept	5.70	INCP	INCP	84.25	84.05	3	33	3	9
30 Sept	INCP	2.75	1.90	88.90	88.70	3	36	3	9
1 Oct	3.50	3.95	5.60	101.95	101.75	3	39	3	9
2 Oct	6.10	3.50	4.00	115.55	111.25	3	42	3	9
3 Oct	CIMW	6.25	5.80	127.60	119.20	3	45	3	9
4 Oct	8.50	4.20	3.60	143.90	131.45	3	48	3	9
5 Oct	1.00	6.10	OUCP	151.00	138.55	3	51	3	9
6 Oct	DISM						52	3	9
7 Oct	DISM						53	3	9
8 Oct	DISM						54	3	9
Total	55.40	54.85	40.75	151.00	138.55	48	54	69	207

Abbreviations

ROCO;Road construction
PRDS;Preparation of drilling site
TRAN;Transportation
TRRE;Transportation and Reassembly
CIMW;Circulation of mud water
DISM;Dismantling
RECO;Recovery work
INCP;Inserting casing pipe
OUCP;Retrieving casing pipe

Table 2-11 Record of the Drilling Operation at MJTC-10

	Drilling Length			Total		Shift		Working Men	
	Shift 1	Shift 2	Shift 3	Drilling Length	Core Length	Drilling Shift	Total Shift	Engi-neer	Worker
	m	m	m	m	m			men	men
11 July	PRDS						1	3	9
12 July	PRDS						2	3	9
13 July	PRDS						3	3	9
14 July	3.00			3.00	1.50	1	4	3	9
15 July	5.65			8.65	4.75	1	5	3	9
16 July	3.95			12.60	7.15	1	6	3	9
17 July	2.85	1.60		17.05	10.55	2	8	3	9
18 July	2.25	4.60	5.05	28.95	19.90	3	11	3	9
19 July	5.50	4.00	1.65	40.10	29.45	3	14	3	9
20 July	INCP	1.05	6.20	47.35	36.10	3	17	3	9
21 July	8.90	5.05	8.65	69.95	58.70	3	20	3	9
22 July	8.25	4.35	6.40	88.95	77.70	3	23	3	9
23 July	7.55	2.55	1.70	100.75	89.25	3	26	3	9
24 July	2.45	1.55	1.30	106.05	90.95	3	29	3	9
25 July	3.05	1.10	2.15	112.35	93.20	3	32	3	9
26 July	3.55	0.50	BWCP	116.40	96.05	2	35	3	9
27 July	BWCP	1.80	2.15	120.35	98.40	2	38	3	9
28 July	4.10	5.55	2.55	132.55	106.55	3	41	3	9
29 July	PRMW	2.70	3.40	138.65	109.55	3	44	3	9
30 July	2.35	0.50	1.25	142.75	112.00	3	47	3	9
31 July	5.05	3.20		151.00	119.95	2	49	2	6
1 Aug	DISM						50	3	9
2 Aug	DISM						51	3	9
Total	68.45	40.10	42.45	151.00	119.95	44	51	68	204

Abbreviations

ROCO;Road construction
PRDS;Preparation of drilling site
TRAN;Transportation
TRRE;Transportation and Reassembly
PRMW;Preparation of mud water
DISM;Dismantling
RECO;Recovery work
INCP;Inserting casing pipe
OUCP;Retrieving casing pipe

Table 2-12 Record of the Drilling Operation at MJTC-11

	Drilling Length			Total		Shift		Working Men	
	Shift 1	Shift 2	Shift 3	Drilling Length	Core Length	Drilling Shift	Total Shift	Engi-neer	Worker
	m	m	m	m	m			men	men
11 July	PRDS						1	3	9
12 July	PRDS						2	3	9
13 July	PRDS						3	3	9
14 July	3.00			3.00	3.00	1	4	3	9
15 July	4.35			7.35	7.35	1	5	3	9
16 July	6.45			13.80	13.80	1	6	3	9
17 July	4.60	2.70		21.10	21.10	2	8	3	9
18 July	3.50	4.10	3.35	32.05	32.05	3	11	3	9
19 July	4.85	3.65	0.70	41.25	41.25	3	14	3	9
20 July	0.30	4.45	0.80	46.80	46.80	3	17	3	9
21 July	1.60	2.00	6.10	56.50	56.50	3	20	3	9
22 July	1.25	4.85	4.10	66.70	66.70	3	23	3	9
23 July	4.70	BWCP	2.60	74.00	73.70	3	26	3	9
24 July	3.85	5.35	3.80	87.00	86.70	3	29	3	9
25 July	3.05	6.10	2.65	98.80	98.50	3	32	3	9
26 July	3.45	8.15	3.85	114.25	113.95	3	35	3	9
27 July	3.25	PRMW	1.00	118.50	118.20	3	38	3	9
28 July	1.65	RECO	RECO	120.15	118.70	3	41	3	9
29 July	RECO	RECO	RECO	120.15	118.70	3	44	3	9
30 July	RECO	RECO	RECO	120.15	118.75	3	47	3	9
31 July	RECO	RECO	RECO	120.15	118.75	3	50	3	9
1 Aug	RECO	RECO	RECO	120.15	119.85	3	53	3	9
2 Aug	1.95	4.80	5.50	132.40	132.10	3	56	3	9
3 Aug	6.10	5.65	5.30	149.45	149.15	3	59	3	9
4 Aug	1.55	OUCP		151.00	150.70	1	61	2	6
5 Aug	DISM						62	3	9
6 Aug	DISM						63	3	9
7 Aug	DISM						64	3	9
Total	59.45	51.80	39.75	151.00	150.70	57	64	83	249

Abbreviations

ROCO;Road construction
PRDS;Preparation of drilling site
TRAN;Transportation
RREE;Transportation and Reassembly
PRMW;Preparation of mud water
DISM;Dismantling
RECO;Recovery work
INCP;Inserting casing pipe
OUCP;Retrieving casing pipe

Table 2-13 Record of the Drilling Operation at MJTC-12

	Drilling Length			Total		Shift		Working Men	
	Shift 1	Shift 2	Shift 3	Drilling Length	Core Length	Drilling Shift	Total Shift	Engi-neer	Worker
	m	m	m	m	m			men	men
3 Sept	PRDS						1	3	9
4 Sept	PRDS						2	3	9
5 Sept	PRDS						3	3	9
6 Sept	3.15	4.05	6.15	13.35	12.55	3	6	3	9
7 Sept	9.65	8.65	6.45	38.10	37.30	3	9	3	9
8 Sept	4.20	6.05	3.55	51.90	51.10	3	12	3	9
9 Sept	6.30	5.50	7.95	71.65	70.85	2	15	3	9
10 Sept	6.10	1.70	INCP	79.45	78.65	3	18	3	9
11 Sept	7.70	7.20	5.85	100.20	99.40	3	21	3	9
12 Sept	6.05	6.05	3.50	115.80	115.00	3	24	3	9
13 Sept	4.40	6.75	5.25	132.20	131.40	3	27	3	9
14 Sept	10.50	8.30	OUCP	151.00	142.70	3	30	3	9
15 Sept	DISM						31	3	9
16 Sept	DISM						32	3	9
Total	58.05	54.25	38.70	151.00	142.70	26	32	42	126

Abbreviations

ROCO;Road construction
PRDS;Preparation of drilling site
TRAN;Transportation
TRRE;Transportation and Reassembly
PRMW;Preparation of mud water
DISM;Dismantling
RECO;Recovery work
INCP;Inserting casing pipe
OUCP;Retrieving casing pipe

Table 2-14 Record of the Drilling Operation at MJTC-13

	Drilling Length			Total		Shift		Working Men	
	Shift 1	Shift 2	Shift 3	Drilling Length	Core Length	Drilling Shift	Total Shift	Engi-neer	Worker
	m	m	m	m	m			men	men
8 Aug	PRDS						1	3	9
9 Aug	PRDS						2	3	9
10 Aug	3.05			3.05	2.00	1	3	3	9
11 Aug	4.30			7.35	3.50	1	4	3	9
12 Aug	3.15	3.50		14.00	6.65	2	6	2	6
13 Aug	5.40	3.05	4.05	26.50	13.10	3	9	3	9
14 Aug	5.10	3.75	3.60	38.95	18.45	3	12	3	9
15 Aug	CIMW	1.40	1.95	42.30	20.25	3	15	3	9
16 Aug	3.35	3.45	3.85	52.95	30.90	3	18	3	9
17 Aug	6.10	7.10	2.05	68.20	46.15	3	21	3	9
18 Aug	3.55	4.00	4.65	80.40	58.35	3	24	3	9
19 Aug	5.60	4.15	3.45	93.60	71.55	3	27	3	9
20 Aug	2.50	5.30	5.15	106.55	84.50	3	30	3	9
21 Aug	6.40	4.85	4.10	121.90	99.85	3	33	3	9
22 Aug	Holiday								
23 Aug	CIMW	3.95	5.40	131.25	109.20	3	36	3	9
24 Aug	5.30	3.45	1.20	141.20	116.70	3	39	3	9
25 Aug	3.00	3.90	2.90	151.00	126.50	3	42	3	9
26 Aug	DISM						43	3	9
27 Aug	DISM						44	3	9
Total	56.80	51.85	42.35	151.00	126.50	40	44	56	168

Abbreviations

ROCO;Road construction
PRDS;Preparation of drilling site
TRAN;Transportation
TRRE;Transportation and Reassembly
CIMW;Circulation of mud water
DISM;Dismantling
RECO;Recovery work
INCP;Inserting casing pipe
OUCP;Retrieving casing pipe

Table 2-15 Record of the Drilling Operation at MJTC-14

	Drilling Length			Total		Shift		Working Men	
	Shift 1	Shift 2	Shift 3	Drilling Length	Core Length	Drilling Shift	Total Shift	Engi-neer	Worker
	m	m	m	m	m			men	men
3 Aug	PRDS						1	3	9
4 Aug	PRDS						2	3	9
5 Aug	5.20			5.20	4.25	1	3	3	9
6 Aug	4.05	4.05		13.30	5.15	2	5	3	9
7 Aug	3.95	1.65	1.80	20.70	6.55	3	8	3	9
8 Aug	3.85	1.20	2.15	27.90	11.00	3	11	3	9
9 Aug	5.25	1.75	0.90	35.80	12.40	3	14	3	9
10 Aug	2.90	1.20	2.55	42.45	15.45	3	17	3	9
11 Aug	0.70	2.45	1.40	47.00	17.95	3	20	3	9
12 Aug	2.95	6.55	7.45	63.95	34.90	3	23	3	9
13 Aug	2.50	5.70	3.85	76.00	46.95	3	26	3	9
14 Aug	5.20	4.15	7.20	92.55	63.50	3	29	3	9
15 Aug	6.45	4.15	5.55	108.70	79.65	3	32	3	9
16 Aug	2.05	3.45	9.15	123.35	94.30	3	35	3	9
17 Aug	5.05	6.85	7.90	143.15	114.10	3	38	3	9
18 Aug	4.95	2.90	OUCP	151.00	121.95	2	41	3	9
19 Aug	DISM						42	3	9
20 Aug	DISM						43	3	9
Total	55.05	46.05	49.90	151.00	121.95	38	43	54	162

Abbreviations

ROCO;Road construction
PRDS;Preparation of drilling site
TRAN;Transportation
TRRE;Transportation and Reassembly
DISM;Dismantling
RECO;Recovery work
INCP;Inserting casing pipe
OUCP;Retrieving casing pipe

Table 2-16 Summary of the Drilling Operation of MJTC-7

	Survey Period				Total Men	
	Period	Days	Work Day	Off Day	Engineer	Worker
Operation			Days	Days	Men	Men
Preparation	28 ～ 30 August	3	3	-	9	27
Drilling	31 Aug～13 Sept	14	Drilling 13	-	40	120
			Recovery 1	-		
Removal	14 ～ 15 September	2	2	-	6	18
Total	28 Aug～15 Sept	19	19	-	55	152

Drilling Length			
Length Planned	150.00m	Over-burden	2.00m
Increase or Decrease in Length	151.00m	Core Length	140.55m
Length Drilled	151.00m	Core Recovery	% 94.3

Core Recovery of 50 m hole		
Depth of Hole (m)	Core Recovery (%)	Core Recovery Cumulated (%)
0～ 50	98	98
50～100	88	92
100～151	100	94

Working Hours	h	%	%
Drilling	174	57	51
Other Work	122	40	35
Recovery	8	3	2
Total	304	100	88
Reassembly	24		7
Dismantling	16		5
Water Transportation			
Road Construction and Others			
G.Total	344		100

Efficiency of Drilling	
Total m/work Period(m/day)	151.00m/13 days (11.62m/day)
Total m/total Shift (m/shift)	151.00m/37 shifts (4.08m/shift)

Drilling Length/Bit(each size bit)

Bit Size	HW	NX	NQ
Drilled Length(m)			151.00
Core Length(m)			140.55

Casing Pipe Inserted

Size	Meterage (m)	Drilling Length x100 (%)	Meterage Recovery (%)
HW	3.05	2	100
NW	12.20	8	100

Direction: N10°E Incline:-50°

Table 2-17 Summary of the Drilling Operation of MJTC-8

Operation	Survey Period: Period	Days	Work day	Off day	Total Men: Engineer	Worker
			Days	Days	Men	Men
Preparation	23 ~ 24 August	2	2	-	6	18
Drilling	25 ~ 31 August	7	Drilling 7	-	21	63
			Recovery			
Removal	1 ~ 2 September	2	2	-	6	18
Total	23 Aug~2 Sept	11	11	-	33	99

Drilling Length			
Length Planned	150.00m	Over-burden	- m
Increase or Decrease in Length	151.00m	Core Length	150.80m
Length Drilled	151.00m	Core Recovery	% 99.9

Core Recovery of 50 m hole

Depth of Hole (m)	Core Recovery (%)	Core Recovery Cumulated (%)
0~ 50	100	100
50~100	100	100
100~151	99	99.9

Working Hours	h	%	%
Drilling	93	61	50
Other Work	59	39	32
Recovery			
Total	152	100	
Reassembly	16		9
Dismantling	16		9
Water Transportation			
Road Construction and Others			
G.Total	184		100

Efficiency of Drilling

Total m/work Period(m/day)	151.00m/ 7 days (21.57 m/day)
Total m/total Shift (m/shift)	151.00m/19 shifts (7.95 m/shift)

Drilling Length/Bit(each size bit)

Bit Size	HW	NW	NQ
Drilled Length(m)	-	-	151.00
Core Length(m)			150.80

Casing Pipe Inserted

Size	Meterage (m)	Drillingx100 Length (%)	Meterage Recovery (%)
HW	3.05	2.02	100
NW	6.10	4.04	100

Direction: S10°W Incline:-50°

Table 2-18 Summary of the Drilling Operation of MJTC-9

Operation	Survey Period: Period	Days	Work day	Off day	Total Men: Engineer	Worker
			Days	Days	Men	Men
Preparation	16 ~ 18 September	3	3	-	9	27
Drilling	19 Sept~ 7 Oct	17	Drilling 17	-	51	153
			Recovery			
Removal	6 ~ 8 October	3	3	-	9	27
Total	6 Sept~ 8 Oct	23	18	-	69	207

Drilling Length			
Length Planned	150.00m	Over-burden	0.00m
Increase or Decrease in Length	151.00m	Core Length	138.55m
Length Drilled	151.00m	Core Recovery	91.8 %

Core Recovery of 50 m hole		
Depth of Hole (m)	Core Recovery (%)	Core Recovery Cumulated (%)
0~ 50	99	99.6
50~100	100	99.8
100~151	75	91.8

Working Hours	h	%	%
Drilling	155	40	37
Other Work	229	60	53
Recovery			
Total	384	100	
Reassembly	24		5
Dismantling	24		5
Water Transportation			
Road Construction and Others			
G.Total	432		100

Efficiency of Drilling	
Total m/work Period(m/day)	151.00m/17 days (8.88 m/day)
Total m/total Shift (m/shift)	151.00m/48 shifts (3.15 m/shift)

Drilling Length/Bit(each size bit)

Bit Size	HW	NQ	BQ
Drilled Length(m)	-	76.65	74.35
Core Length(m)		76.45	62.10

Casing Pipe Inserted

Size	Meterage (m)	Drillingx100 Length (%)	Meterage Recovery (%)
NW	45.75	30.30	100
BW	82.25	54.47	100

Direction: S10°W Incline:-50°

Table 2-19 Summary of the Drilling Operation of MJTC-10

Operation	Survey Period: Period	Days	Work day	Off day	Total Men: Engineer	Worker
			Days	Days	Men	Men
Preparation	11 ~ 13 July	3	3	-	9	27
Drilling	14 ~ 31 July	18	Drilling 18	-	53	159
			Recovery		-	-
Removal	1 Aug ~ 2 Aug	2	2	-	6	18
Total	11 July~ 2 Aug	23	23	-	68	204

Drilling Length			
Length Planned	150.00m	Over-burden	14.00m
		Cave	5.20m
Increase or Decrease in Length	151.00m	Core Length	119.95m
Length Drilled	151.00m	Core Recovery	% 84.9※

Core Recovery of 50 m hole		
Depth of Hole (m)	Core Recovery (%)	Core Recovery Cumulated (%)
0~ 50	84	84
50~ 100	100	86
100~ 151	68	85

Working Hours	h	%	%
Drilling	180	49	44
Other Work	188	51	46
Recovery			
Total	368	100	90
Reassembly	24		6
Dismantling	16		4
Water Transportation			
Road Construction and Others			
G.Total	408		100

Efficiency of Drilling	
Total m/work Period(m/day)	151.00m/18 days (8.39m/day)
Total m/total Shift (m/shift)	151.00m/44 shifts (3.43m/shift)

Drilling Length/Bit(each size bit)

Bit Size	NQ	BQ	
Drilled Length(m)	116.4	34.6	
Core Length(m)	96.05	23.90	

Casing Pipe Inserted

Size	Meterage (m)	Drillingx100 Length (%)	Meterage Recovery (%)
HW	3.00	2	100
NW	39.75	27	100
BW	116.40	78	100

Direction: N10°E Incline:-50°

※ (119.95-8.00)/(151-14-5.2)=84.9

Table 2-20 Summary of the Drilling Operation of MJTC-11

	Survey Period				Total Men	
	Period	Days	Work day	Off day	Engineer	Worker
Operation			Days	Days	Men	Men
Preparation	11 ~ 13 July	3	3	-	9	27
Drilling	14 July~4 Aug	22	Drilling 18	-	53	159
			Recovery 4		12	36
Removal	5 ~ 7 Aug	3	3	-	9	27
Total	11 July~7 Aug	28	28	-	83	249

Drilling Length			
Length Planned	150.00m	Over-burden	- m
Increase or Decrease in Length	151.00m	Core Length	150.70m
Length Drilled	151.00m	Core Recovery	% 99.8

Core recovery of 50 m hole

Depth of Hole (m)	Core Recovery (%)	Core Recovery Cumulated (%)
0~ 50	100.0	100.0
50~100	99.4	99.7
100~151	100.0	99.8

Working Hours	h	%	%
Drilling	188	41	36
Other Work	164	35	32
Recovery	112	24	22
Total	464	100	
Reassembly	24		5
Dismantling	24		5
Water Transportation			
Road Construction and Others			
G.Total	512		100

Efficiency of Drilling

Total m/work Period(m/day)	151.00m/18 days (8.39 m/day)
Total m/total Shift (m/shift)	151.00m/57 shifts (2.65 m/shift)

Drilling Length/Bit(each size bit)

Bit Size	HW	NQ	BQ
Drilled Length(m)	-	71.4	79.6
Core Length(m)	-	71.4	70.0

Casing Pipe Inserted

Size	Meterage (m)	Drilling Length x100 (%)	Meterage Recovery (%)
HW	3.00	2.00	100
NW	9.15	6.10	100
BW	116.50	77.78	100

Direction: N10°E Incline:-50°

Table 2-21 Summary of the Drilling Operation of MJTC-12

Operation	Survey Period: Period	Days	Work day	Off day	Total Men: Engineer	Worker
			Days	Days	Men	Men
Preparation	3 ~ 5 September	3	3	-	9	27
Drilling	6 ~ 14 September	9	Drilling 9	-	27	80
			Recovery			
Removal	15 ~ 16 September	2	2	-	6	18
Total	3 ~ 16 September	14	14	-	42	126

Drilling Length				Core recovery of 50 m hole		
Length Planned	150.00m	Over-burden	0.70m	Depth of Hole (m)	Core Recovery (%)	Core Recovery Cumulated (%)
Increase or Decrease in Length	151.00m	Core Length	142.70m			
				0~ 50	98	98
Length Drilled	151.00m	Core Recovery	% 94.9	50~100	100	99
				100~151	85	95

Working Hours	h	%	%
Drilling	141	65	55
Other Work	75	35	29
Recovery			
Total	216	100	
Reassembly	24		9
Dismantling	16		7
Water Transportation			
Road Construction and Others			
G.Total	256		100

Efficiency of Drilling	
Total m/work Period(m/day)	151.00m/ 9 days (16.78 m/day)
Total m/total Shift (m/shift)	151.00m/26 shifts (5.81 m/shift)

Drilling Length/Bit(each size bit)			
Bit Size	HW	NQ	BQ
Drilled Length(m)		79.45	71.55
Core Length(m)		78.65	64.05

Casing Pipe Inserted			
Size	Meterage (m)	Drillingx100 Length (%)	Meterage Recovery (%)
HW	6.10	4.0	100
NW	6.10	4.0	100
BW	79.30	52.5	100

Direction: S10°W Incline:-50°

Table 2-22 Summary of the Drilling Operation of MJTC-13

	Survey Period				Total Men	
	Period	Days	Work day	Off day	Engineer	Worker
Operation			Days	Days	Men	Men
Preparation	8 ~ 9 August	2	2	-	6	18
Drilling	10 ~ 25 August	16	Drilling 15	1	44	132
			Recovery		-	-
Removal	26 ~ 27 August	2	2	-	6	18
Total	8 ~ 27 August	20	19	1	56	168

Drilling Length			
Length Planned	150.00m	Over-burden	39.95m
		Cave	2.45m
Increase or Decrease in Length	151.00m	Core Length	126.50m
Length Drilled	151.00m	Core Recovery	% 99.5※

Core recovery of 50 m hole

Depth of Hole (m)	Core Recovery (%)	Core Recovery Cumulated (%)
0~ 50	47	47
50~100	98	79
100~151	100	85

Working Hours	h	%	%
Drilling	162	51	46
Other Work	158	49	45
Recovery			
Total	320	100	91
Reassembly	16		5
Dismantling	16		4
Water Transportation			
Road Construction and Others			
G.Total	352		100

Efficiency of Drilling

Total m/work Period(m/day)	151.00m/19 days (7.95m/day)
Total m/total Shift (m/shift)	151.00m/40 shifts (3.78m/shift)

Drilling Length/Bit(each size bit)

Bit Size	NQ		
Drilled Length(m)	151.00		
Core Length(m)	126.50		

Casing Pipe Inserted

Size	Meterage (m)	Drilling Length x100 (%)	Meterage Recovery (%)
HW	3.05	2	100
NW	36.70	24	100

Direction: S10°W Incline:-50°

※ (126.50-18.45)/(151-39.95-2.45)