the eastern side of the Dikmen Granite which extends 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 results of the second phase work summarized above in (1)～(4), indicate the possibility of large-scale low-grade gold deposits in the alteration zone near the basement rocks. The porphyry molybdenum deposit mentioned in (5) 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 it may turn out to be a very important target if significant gold is found in the overlapping portion.

5-2 Recommendations for the Third Phase

It is recommended that the following work be conducted in the promising areas delineated above (Figure 1-17).

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.

Arlık Dere: The 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.

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 with the second phase.

Kestane Dağı: The concession of the Kestane Mountain area has been purchased by Tüprag Co. 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 with the second phase.

Piren Tepe: 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 Tepe. 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.

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.

Etili: Etili locates in the southeast area of Zone B. Silicified zones are predominant in the Şapçı Volcanics which are 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 (Table 6 of Appendix). Etili Area is considered to be a promising area, and a drill survey should be carried out after the geological survey and geochemical prospecting.

Table 1-13 List of Geological and Geochemical Characteristics

Characteristics of Geology and Geochemistry	Survey Area				
	Arlık Dere	Karaib-rahimler	Kestane Dağı	Piren Tepe	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)	282	98	140	207	269
Au (max) ppb	3050	490	3660	2060	4600
Au (average) ppb	14	7	13	7	6
Mo (average) ppm	4	2	3	5	7
Number of Samples more than 50 ppb(A)	68	14	35	32	56※
Frequency (A/N)%	24	14	25	15	21
Heavy Mineral Study	●	●	—	●	—
Detection of Gold Grains	common	abundant	—	few	—
Potential	high	low	high	high	high

※: Including sample more than 100ppm Mo

○ : predominant × : not observed ● : collected samples

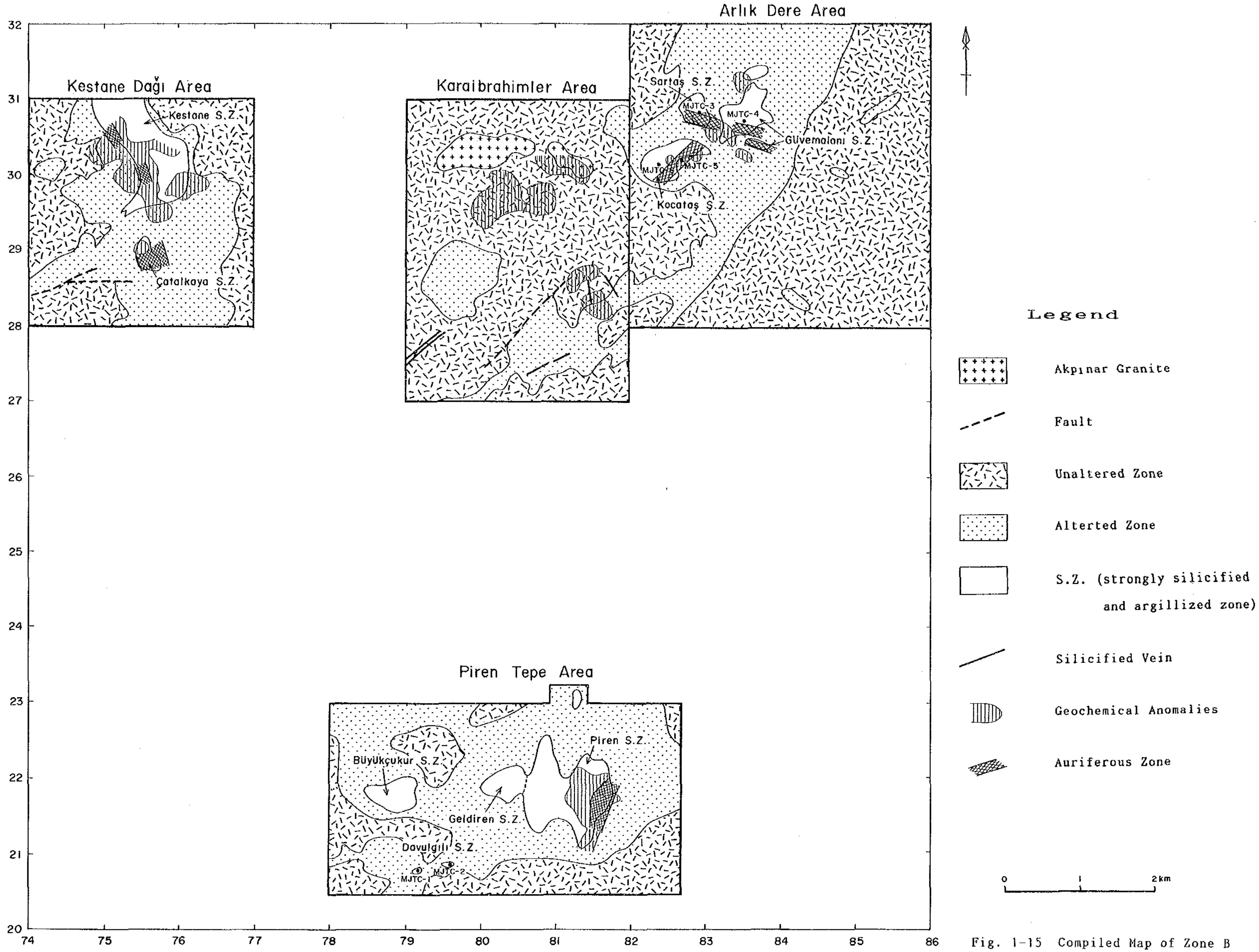
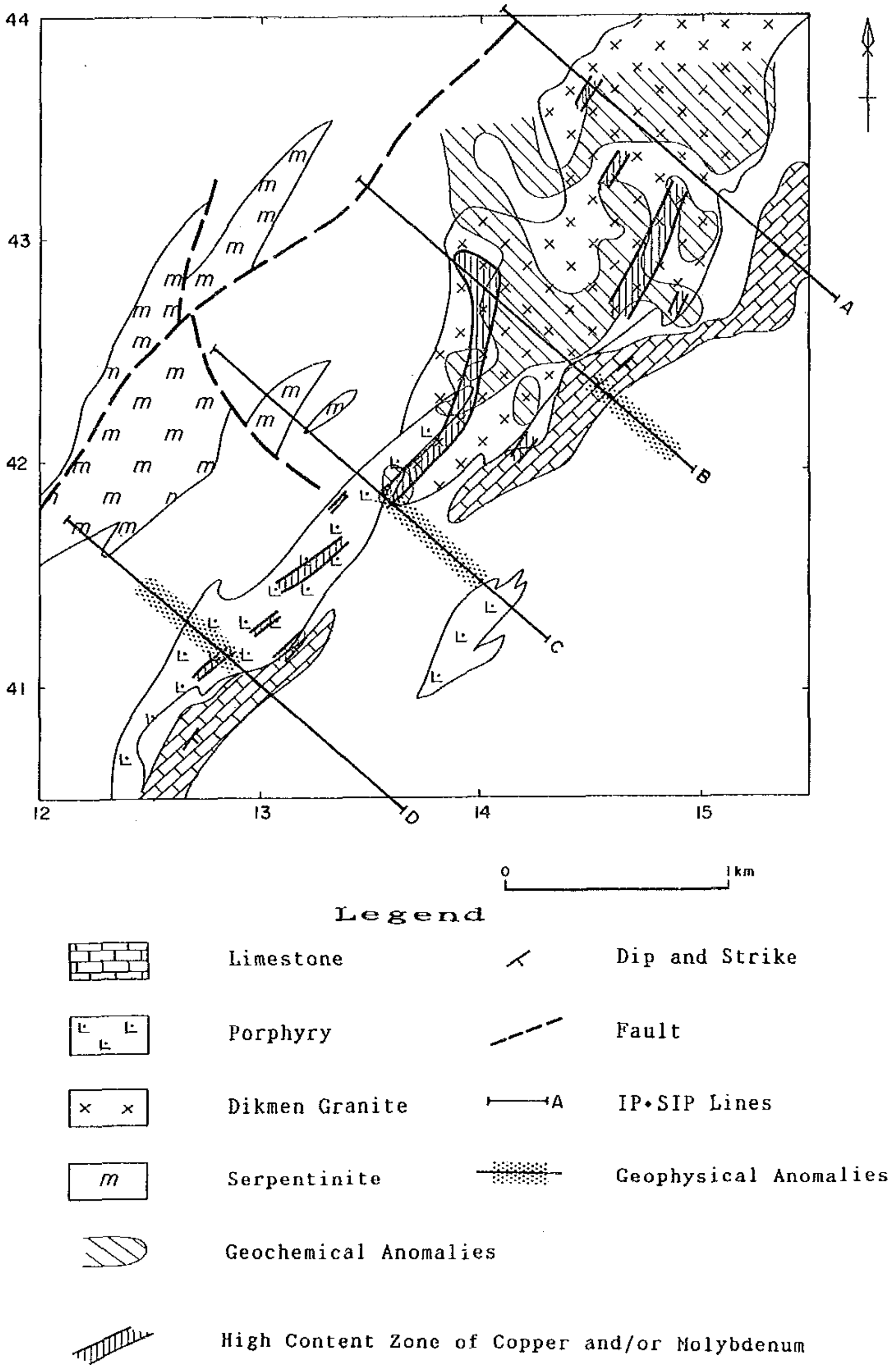


Fig. 1-15 Compiled Map of Zone B



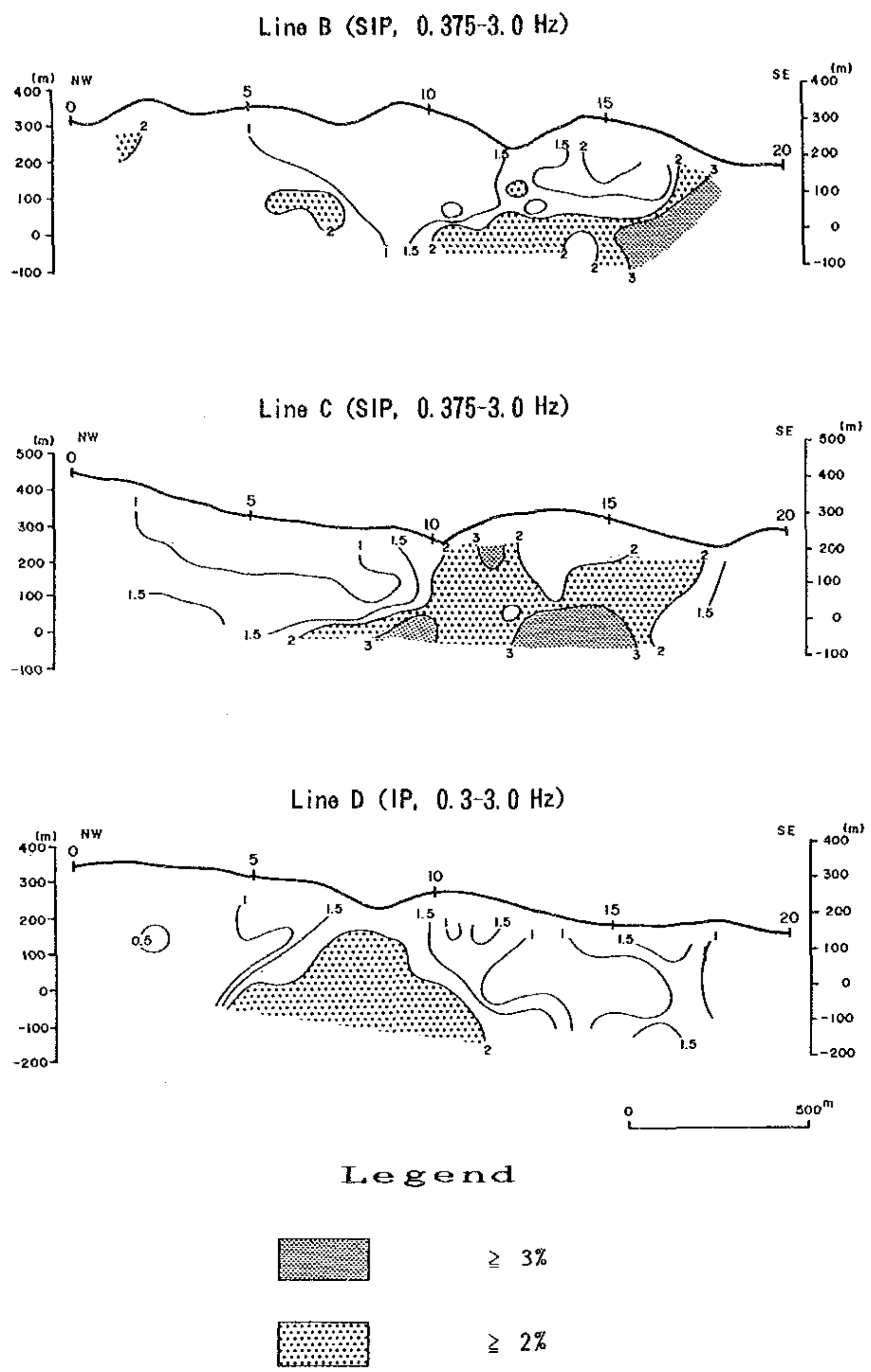


Fig. 1-16 Compiled Map of Dikmen Area

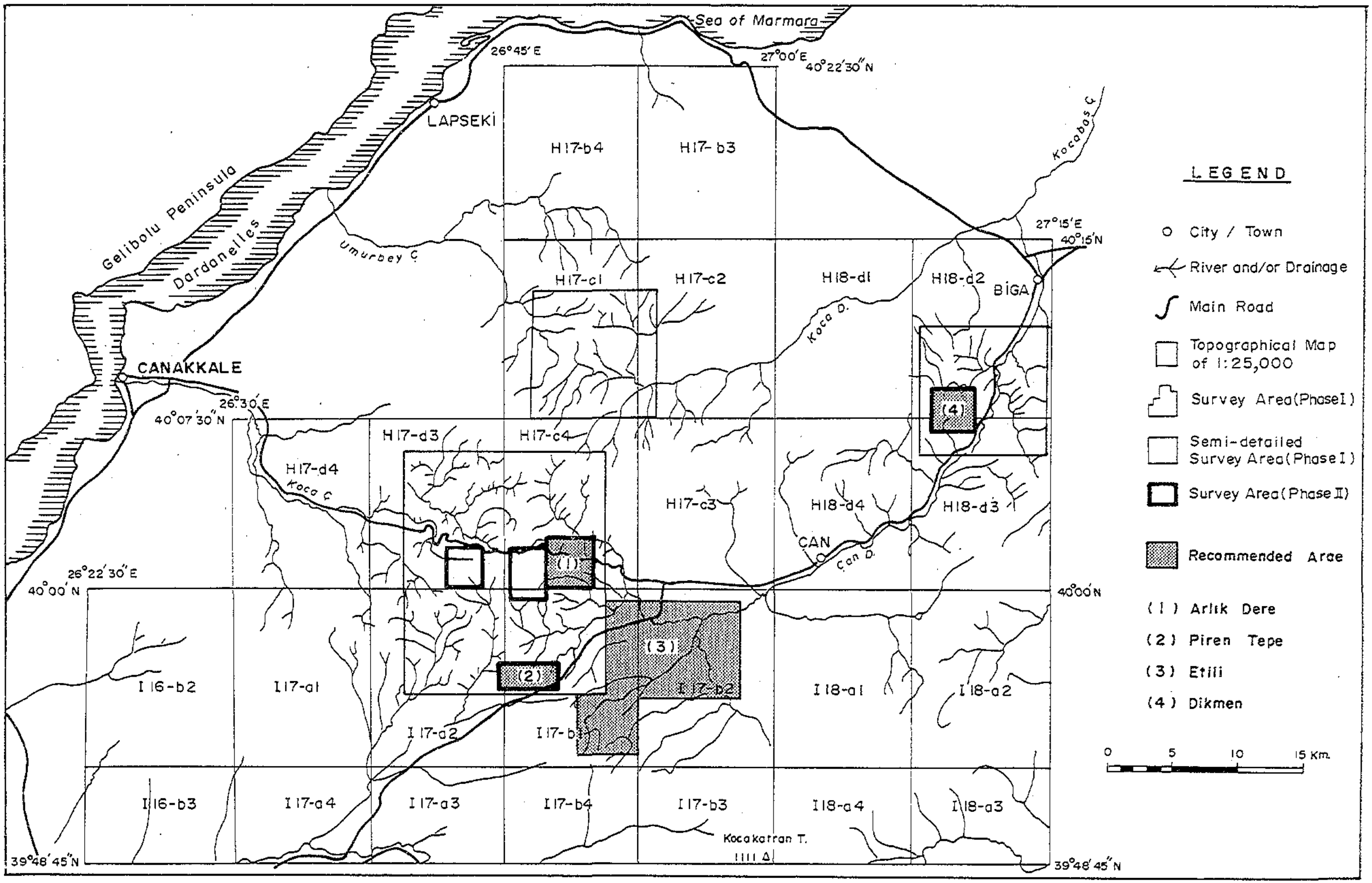


Fig. 1-17 Map of the Promising Area

PART II ARLIK DERE AREA

PART II ARLIK DERE AREA

CHAPTER 1 GEOLOGICAL SURVEY OF THE ARLIK DERE 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 not delineated in the first phase.

1-2 Objective of the Survey

Gold grains were discovered at Arlık and İncirlık Streams. In the upstream section of these streams, there are the Sartaş, Güvemalanı and Kocataş Hill silicified zones. Almost all chip 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.

1-3 Contents of the Survey

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

Survey	Laboratory Studies	Quantity	Components for Analysis
Geol. S. Geoch. S. ($16km^2$)	Chip Samples	221pcs	Cu, Pb, Zn, Au, Ag, Mo, Hg, As, F, Ba, Tl, Se
	Total Rock Analysis	2pcs	SiO_2, TiO_2, Al_2O_3, Fe_2O_3, MnO, MgO CaO, Na_2O, K_2O, P_2O_5, LOI, FeO
	Thin Section	2pcs	
	X-ray Diffractive M.	8pcs	
	Isotopic Age	2pcs	K-Ar Method
Heavy M. S.	Gold Grain	15pcs	
Drill S. (150m x4 hole)	Ore Analysis	201pcs	Au, Ag, Cu, Pb, Zn, Sb, Hg, Mo
	Thin Section	4pcs	
	EPMA Test	7pcs	
	Total Rock Analysis	6pcs	SiO_2, TiO_2, Al_2O_3, Fe_2O_3, MnO, MgO CaO, Na_2O, K_2O, P_2O_5, LOI, FeO
	X-ray Diffractive M.	20pcs	
	Liquid Inclusion	8pcs	

CHAPTER 2 GEOLOGY OF ARLIK DERE AREA

2-1 General Geology

The basement rocks of this zone are 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. 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 Figures 1-4, 2-1 and 2-2.

2-2 Stratigraphy

2-2-1 Taşdibek Formation

Distribution: It is distributed in the upstream part of the Oluk Stream.

Lithology and occurrence: Dark green-grey metavolcanics are predominant in the upstream part of Oluk Stream, while in the southeastern part where the Taşdibek Formation is distributed, green schist and creamy yellow to greyish white equigranular crystalline limestone is dominant.

In general, small-scale silicified zones along minute fractures (system NE-SW and NWN-SES) are developed in this formation, and rocks are altered into chlorite and disseminated with pyrite.

2-2-2 Kirazlı Conglomerate

Distribution: It is distributed from the Kocataş Hill to İncırlık Stream of the southwestern zone and surrounds the outcrop or directly overlies the

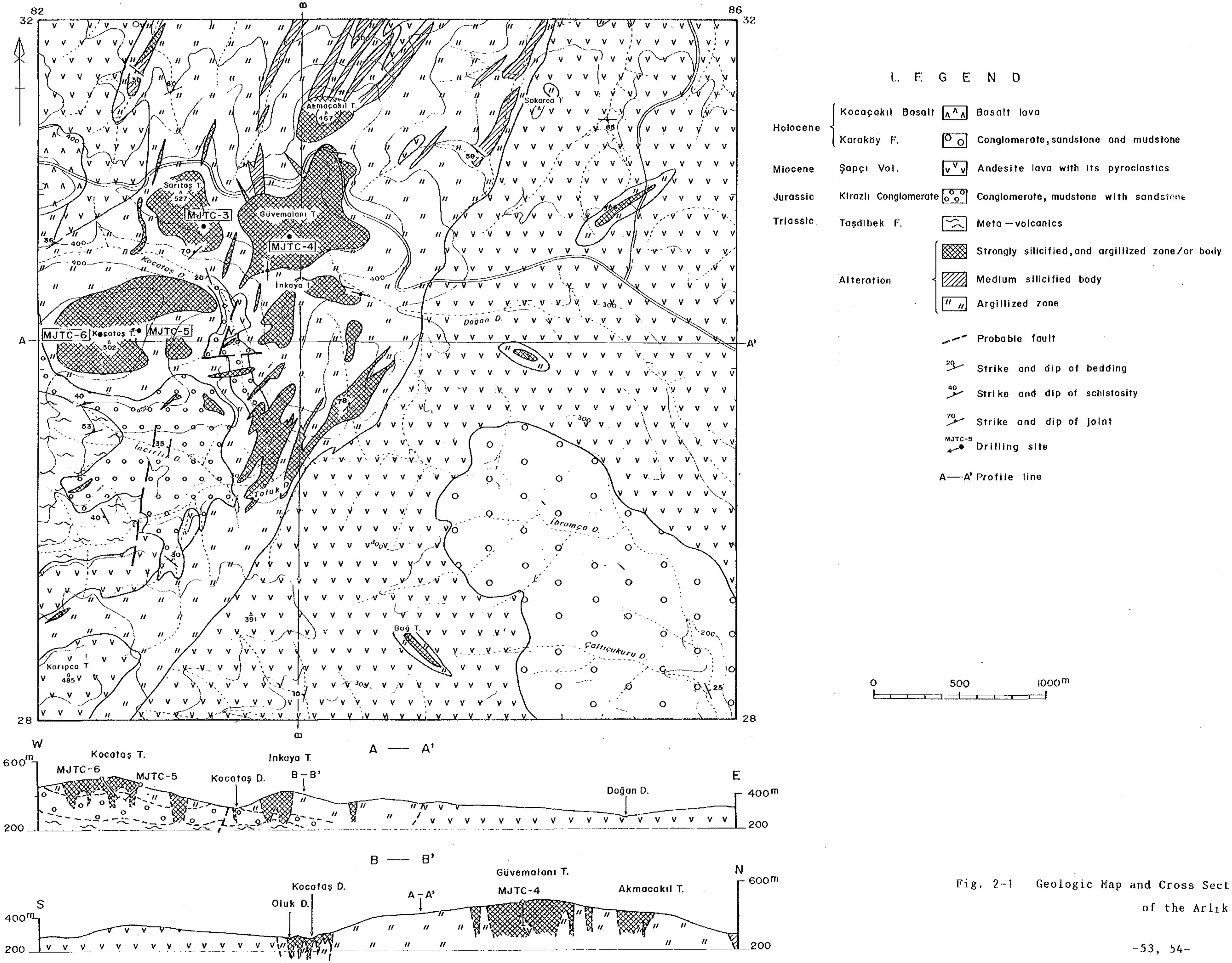
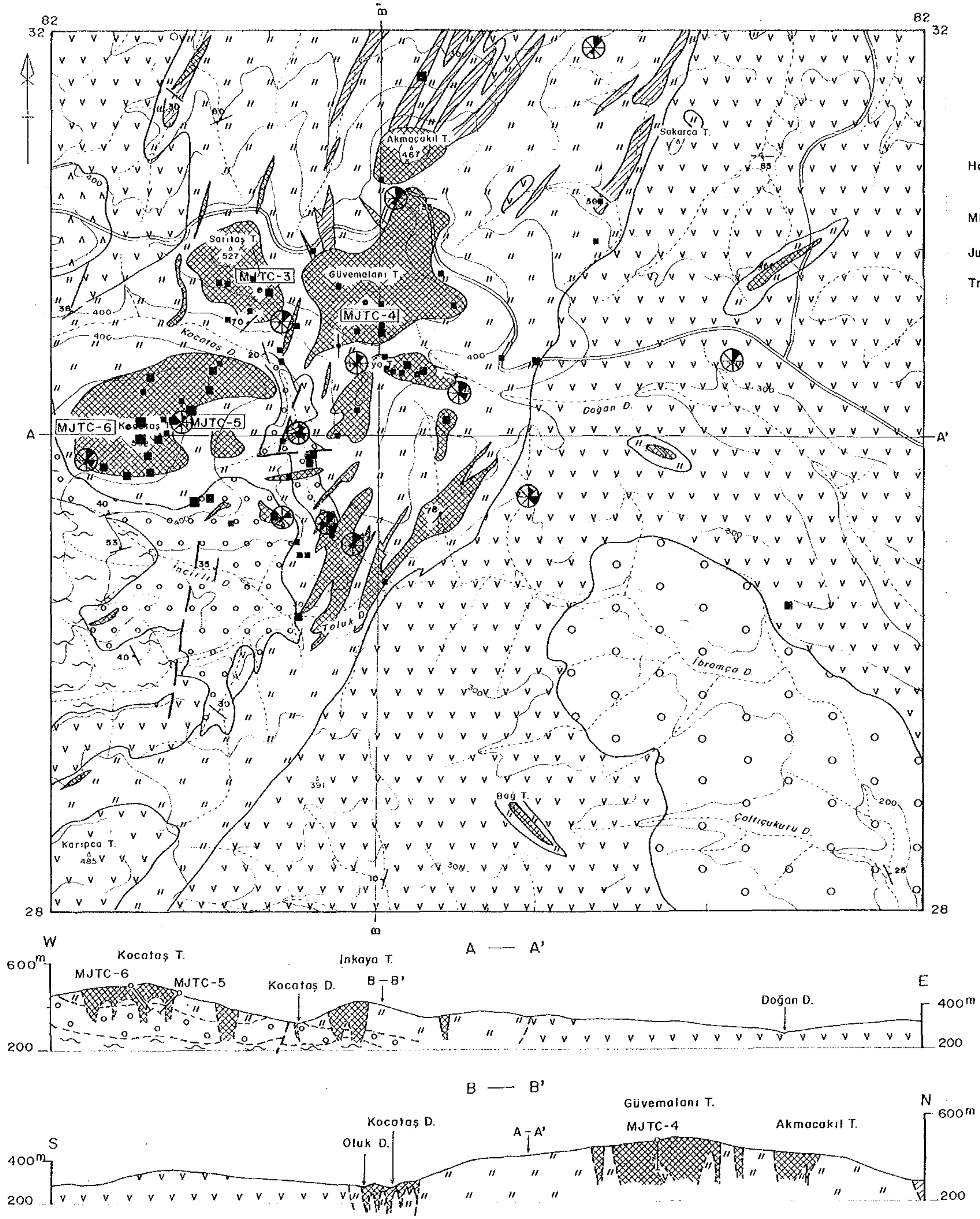


Fig. 2-1 Geologic Map and Cross Sections of the Arlık Area



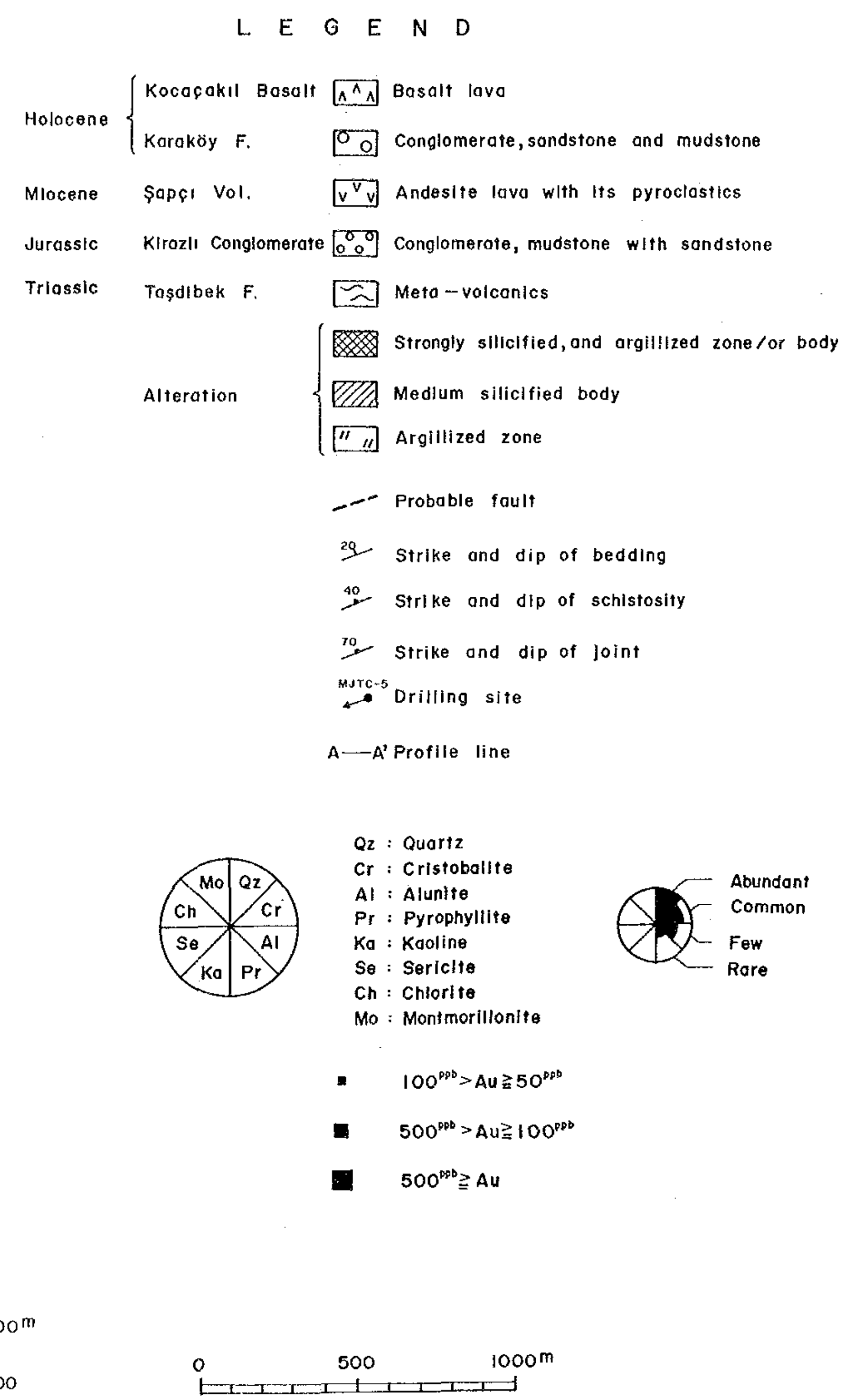


Fig. 2-2 Gold Occurrence and Alteration Map of the Arlık Area

underlying Taşdibek Formation.

Lithology and occurrence: This formation consists of pale green siltstone, fine-grained tuff and greyish white to dark grey conglomerate. The pebbles are mostly chert, green schist and quartzite, and they are in various shapes (from weakly angular to well rounded). They are mostly 1～3cm, but there are cobbles of 20～30cm. They are commonly fractured, locally well layered, and show silicification and limonitization. The rock is argillized and pyrite occurs scattered in the conglomerate. As well as bearing crosscutting irregular calcite veinlets which are sometimes a few mm in thickness, they also show iron stains as fracture fillings.

2-2-3 Şapçı Volcanics

Distribution: This is the largest unit and covers most of the area.

Lithology and occurrence: The major part of these rocks are andesite lava accompanied by andesitic pyroclastics, mainly tuff. The unaltered part of these rocks are dark grey, and generally, they are argillized and silicified from weak to medium intensity with strong alteration in some parts. Detailed lithological division is thus difficult.

It is clear, however, that pyroclastics are more abundant in the south than in the north and that lava is predominant in the west compared to the eastern part. These variations of lithology indicate the changes in the time and location of the centers of volcanic activities.

This volcanic unit has a general vertical trend of change from pumice tuff through biotite andesite to andesite with notable plagioclase phenocrysts in the ascending order. Some of the andesite has notable biotite phenocrysts while the biotite in others cannot be seen by the unaided eye. Also, in some localities, such as in the southeastern part of this zone, the area shows flow structure.

Argillization of these rocks can be grouped into unaltered to weakly altered parts and intermediate to strongly altered parts. Generally, the argillized parts are leucocratic, but hematitized or limonitized parts are reddish brown to brown. Native sulfur occurs in some localities.

Silicification zones often result in the formation of isolated mountains, and some examples are Sartaş , Güvemalanı , and Kocataş Hills. The original rocks of these localities are difficult to identify. Many of the joints and fissures in this zone trend NE-SW, although the strike is generally not discernible.

The structure of these volcanic rocks is mostly massive form, but the strike of the fine-grained tuff varies in many directions, N-S, NE-SW, E-W, and the dip is 20-35° near Akpınar Village in the central part of this zone.

It is shown microscopically that the most abundant phenocrysts are plagioclase with mainly hypersthene, hornblende and augite. The argillization is kaolinization; chlorite and epidote occur.

2-2-4 Karaköy Formation

Distribution: The formation is distributed in the vicinity of the İbramça Stream and Çaltçukuru Stream

Lithology and occurrence: Most of the formation is grey to greyish white, and locally yellowish brown with pale green parts. The formation is generally poorly consolidated and consists of tuffaceous conglomerate, sandstone and siltstone. It is generally unaltered. These beds form alternating dips of 10° ~ 20° and the dominant trend is NW. The pebbles of the conglomerate found in this zone are, in some cases, silicified and argillized.

2-2-5 Kocaçakıl Basalt

Distribution: The basalt occurs in limited parts on Kale Hill.

Lithology and occurrence: The rock is a black~dark green, fine-grained and compact basalt. Joints are developed, and the many pyroxene phenocrysts are unaltered. It forms blocks of 20~30cm in diameter and seems to have flowed to the depressions with structure in parallel with the topography.

2-3 Geologic Structure

In the central part of this zone, the basement, composed of the Taşdibek Formation and Akpınar Granite, is uplifted, and unconformably overlain by Tertiary volcanic rocks.. The Şapçı Volcanics are often massive, and it is not easily to understand the geologic structure, but it is assumed that the structure is gentle and wavy and that the thickness of this volcanic increases with distance from the basement rocks.

The fractures in this area occur in various directions, but the frequency is low. Lineaments in the NE-SW direction in the northwestern part of the area (the central part of the remote-sensing zone) were determined from Landsat data. Although it was not confirmed by surface study, fault direction was inferred as NEN-SWS and NW-SE in association with those lineaments.

The NEN-SWS faults transect through the western part of the area, and they cut through the Şapçı Volcanics, but are covered by Kocaçakıl Basalt.

The NW-SE faults are inferred to run through the Kirazlı Conglomerates to the east of Mt.Kestane and to the west of Dededağ (elevation 883m).

CHAPTER 3 ALTERATION ZONES

3-1 Outline

The Şapçı Volcanics have been silicified and argillized virtually throughout the area. The strongly altered parts are shown in Figure 2-1. The silicified zones often result in protruding topography, and they can be identified by Landsat images. The silicified zones which occur in slopes with thick vegetation and the relatively flat parts were newly identified during the geological survey. They are shown in Figure 2-2; the strongly silicified parts are shown separately. The strongly silicified zones are surrounded by silicified and argillized zones. The strongly silicified rocks are massive and stratified, but there are also brecciated parts which do not show the structure of the original rocks. They are all aggregates of fine-grained quartz with over 90% SiO_2, hard, compact and porous. The colour is mostly white, but becomes dark grey when containing pyrite, red with hematite and yellow to brown with limonite. Clay minerals (mainly kaoline) are sometimes contained in small amounts in the noncompact parts. Native sulfur, chrysocolla and other minerals occur in some druses.

Argillized zones occur surrounding the silicified zone. The clay zones consist of white parts and yellow-brown parts. The former consists mainly of quartz and clay minerals(kaoline, pyrophyllite, alunite, etc.), while the latter parts contain limonite and hematite in addition to the clay minerals. These are probably products of the oxidation of pyrite and other sulfides.

3-2 Kocataş Alteration Zones

The silicified zones on Kocataş Hill and north, northeast of it form great masses and lenses. The scale of silicification is 1,000m x 500m. The silicification observed around Kocataş Hill gives the impression that their formation was tectonic and structurally controlled. The massive silicified zones at the highest point of Kocataş Hill and towards its northeast corner formed with the associated tectonic directions N15°-30°E and N60°-70°E, where the slightly limonitized, brecciated and silicified zones might have followed the bedding. The silicification observed in the rocks, although exhibiting different setting and distribution, has a close relationship with the tectonic directions. The silicified rocks are generally grey or greyish-white; porous, brecciated and fractured parts are reddish or brownish-white in colour. There are thin secondary limonite and hematite veins in the rocks appearing as veinlets and stains. Disseminated and gelatinous pyrites are common in unoxidized silicified rocks although no pyrite was detected within the oxidized silicified zones. Gold has been found as small grains in soil samples P392, P393 and P394, which were collected from the southern corner of silicification at Kocataş Hill, on top of the hill and its northeastern ridge, respectively. There are slags of a disused mine on the hill and in the Kocataş Stream.

3-3 Sartaş Alteration Zones

These zones are distributed in the upstream section of Arlık Stream and locate along the southern part of the national road between Çanakkale and Çan. The scale of the silicified zone is 500m x 500m. The gold grains were detected by heavy mineral study. The weakly silicified zone is observed in at top of Sartaş Hill, but the pale-grey to brownish grey porous and massive silicified bodies accompanied with limonite occur on the south slope of the hill and are surrounded by silicified and argillized zones, which occur in massive and banded silicified forms, and further apart from Sartaş Hill, the zones have suffered weal alteration, and relict plagioclase. They are white in colour. Silicified veins in the NE-SW and NEN-SWS directions occur in the weakly altered zones. Those directions are considered to be mainly those of fractures in the silicified zones.

3-4 Güvemalanı Alteration Zones

The silicified zones observed in Pıkmaçakıl Hill at the northern part of the survey area are greyish-white and reddish-brown in colour, and are commonly massive-looking, partially porous and brecciated. The scale of silicified zones is 1,000m x 800m. Their fractures are, in some localities, limonitized and hematitized. Extensive silicified debris was also located towards the north of the hill. The silicified bodies in Güvemalanı Hill are massive and extend throughout a large area as big masses. They are brecciated and porous. Limonitization is observed, especially in the porous and some brecciated parts.

Silicified bodies are located on the İnkaya Hill as small caps, and they are mostly brecciated and limonitized. They are sometimes seen as large masses and blocks towards the south of İnkaya Hill. The blocks were partially brecciated with porous structure and also commonly limonitized. The primary rock southwest of İnkaya Hill is most probably a pyroclastic, which has been silicified to an intermediate degree. A second silica phase intruded into the fractures with a NE-SW direction forming silicified veins along these fractures with 1mm to 5cm thickness. The silicified sections are usually porous and limonitic, although they are highly limonitic and brecciated in some locations.

CHAPTER 4 GEOCHEMICAL PROSPECTING OF CHIP SAMPLES

4-1 Sampling

Chip samples were collected from the 16km² area for detailed survey and the vicinity of the MTA concession east of Zone B. Sampling density was fourteen samples per square kilometer. Mostly silicified zones were sampled in the Arlık Stream area.

4-2 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 SPECIFIC ION method, arsenic, selenium, mercury barium and thallium by atomic absorption spectrometry, and other elements by ICP-AES method. The limits of detection of the elements are as below.

Table 2-1 Detection Limits and Analyzed Elements of Chip 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

4-3 Statistical Analysis of the Chemical Results

(1) Outline of Method

The basic statistical values and correlation matrices of the chemical values of the chip samples were calculated, and principal component analysis was carried out in the same manner as in the first phase.

(2) Basic Statistical Values

Basic statistical values for 12 analyzed components with a population of 282* samples were calculated. Of the 12 components, gold content was at times below the detection limit, and thus less than 2.5ppb was used for samples below 5ppb. The amount of gold, molybdenum, fluorine and barium was high while that of copper, lead, zinc silver, arsenic, selenium. mercury and thallium was low. The basic statistical values are shown in Table 2-2. (*:61 samples from the first phase and 221 samples from the second phase)

Table 2-2 Basic Statistical Values of Chip Samples

(Number of Samples:282)

Element	Mean	Dispersion	S.D.	Min.	Max.
Au	14.190	0.470	0.686	2.50	3050.0
Cu	7.192	0.234	0.484	1.00	205.0
Mo	3.818	0.314	0.561	0.50	474.0
Pb	11.770	0.388	0.623	1.00	1900.0
Zn	4.182	0.314	0.560	1.00	560.0
Ag	0.218	0.041	0.203	0.10	3.7
As	12.256	0.307	0.554	1.00	320.0
Se	0.319	0.318	0.564	0.10	13.0
Hg	48.033	0.302	0.550	10.00	35000.0
F	144.617	0.148	0.385	20.00	950.0
Ba	146.425	0.268	0.518	10.00	8200.0
Tl	0.124	0.209	0.457	0.05	4.1

(3) Principal Component Analysis

The values for gold, many of which were below the detection limit, were processed by the same method as for the basic statistical values. Also as in the case for first phase, principal component analysis was carried out with all samples as the population. The correlation matrix is shown in Table 2-3.

It can be seen that when the elements up to an accumulated proportion of 68% are taken, the eigenvalue will generally 0.99 and the proportion 8.3%. Thus, those up to the fifth principal component express the major variations of this area.

First principal components: The components with large absolute eigenvector are copper, lead, zinc, arsenic, selenium and barium.

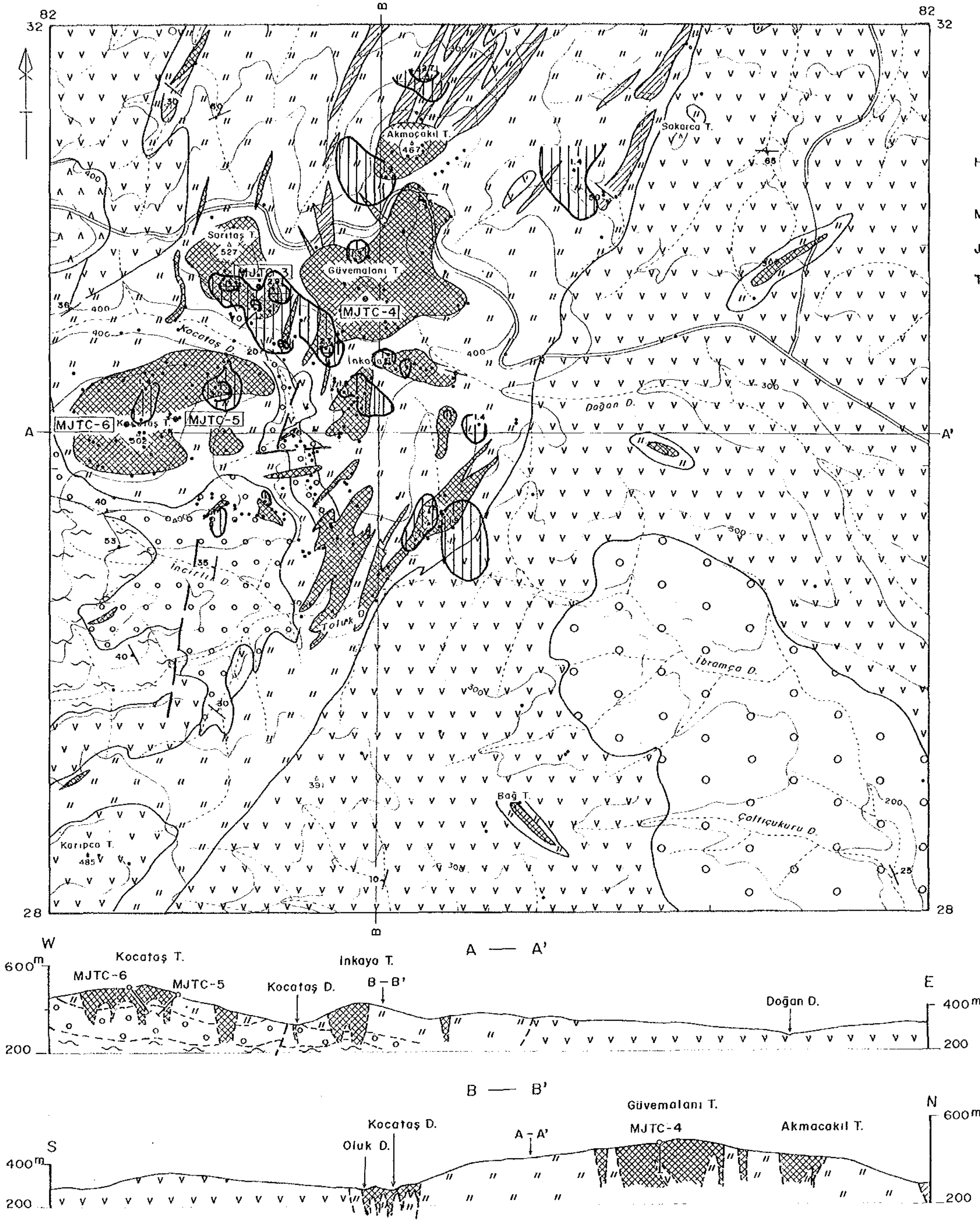
Second principal components: Gold, molybdenum and mercury show positive values while thallium negative ones.

Third principal components: Gold and fluorine show positive while silver and mercury show negative values.

Fourth principal components: Fluorine and barium show positive while copper and zinc show negative values.

Fifth principal components: Gold and lead show positive while molybdenum shows negative values.

The above are the components with high absolute eigenvectors. The first principal components are metallic elements, and they express the variation caused by epithermal mineralization. These are the elements with high



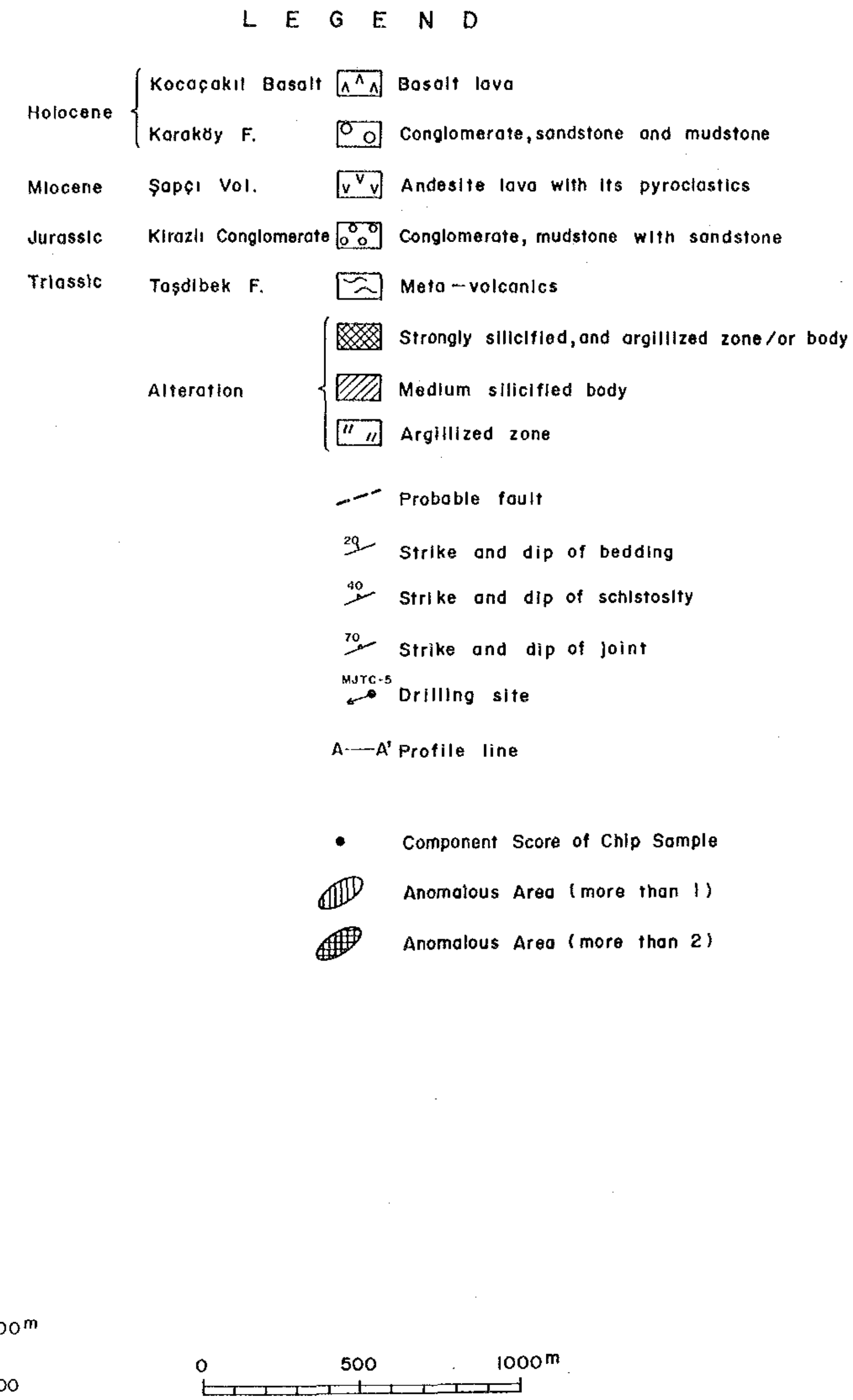


Fig. 2-3 Map of Component Scores of Chip Samples in the Arlık Area

content in the mineral showings in all five areas.

The proportion is somewhat low but the eigenvalues are high. The second and third principal components are mostly metallic with high scores in altered zones. Thus these are considered to express variations caused by epithermal mineralization as well as other factors. The fourth principal components are believed to show the variation of the silicified and argillized zones. The fifth principal components are believed to indicate a part of the mineralization because they contain metals although the proportion and the eigenvalues are low. The extent of the localities with the second principal component exceeding 1 on the map (Figure 2-3), they covers the known auriferous zones in the Arlık Stream area.

Table 2-3 Coefficients and the Covariance Matrix of Chip Samples

	Au	Cu	Mo	Pb	Zn	Ag	As	Se	Hg	F	Ba	Tl
Au	0.470	0.001	0.080	0.148	-0.037	0.083	0.014	0.033	-0.105	0.048	-0.095	-0.059
Cu	0.000	0.234	0.150	0.308	0.645	0.115	0.562	0.494	0.308	-0.009	0.342	0.326
Mo	0.031	0.041	0.314	0.091	0.051	0.235	0.213	0.152	-0.027	0.029	0.132	-0.096
Pb	0.063	0.093	0.032	0.388	0.312	0.178	0.483	0.319	0.268	0.060	0.360	0.211
Zn	-0.014	0.175	0.016	0.109	0.314	0.044	0.492	0.259	0.179	0.110	0.103	0.184
Ag	0.012	0.011	0.027	0.022	0.005	0.041	0.106	0.150	0.241	-0.013	0.140	-0.091
As	0.005	0.151	0.066	0.167	0.153	0.012	0.307	0.495	0.267	0.128	0.378	0.230
Se	0.013	0.135	0.048	0.112	0.082	0.017	0.155	0.318	0.323	0.147	0.354	0.277
Hg	-0.039	0.082	-0.008	0.092	0.055	0.027	0.081	0.100	0.302	-0.163	0.306	0.246
F	0.013	-0.002	0.006	0.014	0.024	-0.001	0.027	0.032	-0.035	0.148	0.190	0.108
Ba	-0.034	0.086	0.038	0.116	0.030	0.015	0.108	0.103	0.087	0.038	0.268	0.211
Tl	-0.019	0.072	-0.025	0.060	0.047	-0.008	0.058	0.071	0.062	0.019	0.050	0.209

Table 2-4 Eigenvectors and Eigenvalues of Chip Samples

	Z(1)	Z(2)	Z(3)	Z(4)	Z(5)	Z(6)	Z(7)	Z(8)	Z(9)	Z(10)	Z(11)	Z(12)
Au	0.00339	0.39976	0.28534	-0.22524	0.71801	-0.18556	-0.08947	-0.15619	-0.30099	0.14226	0.08252	-0.08947
Cu	0.42233	-0.10478	0.00658	-0.32810	-0.13180	-0.09738	-0.13824	-0.09948	-0.36112	-0.15889	-0.13598	0.68772
Mo	0.12339	0.55659	0.08602	-0.02944	-0.43509	-0.51414	0.06414	0.32157	0.04662	0.28721	-0.13911	-0.03929
Pb	0.33836	0.12812	0.02909	0.03799	0.36257	0.27357	0.48937	0.35100	0.35283	-0.07176	-0.36698	0.18308
Zn	0.33466	-0.15264	0.15927	-0.51444	-0.17922	0.34656	-0.12418	0.10990	-0.14610	0.15108	-0.21071	-0.55354
Ag	0.13760	0.53162	-0.35291	0.10907	-0.00197	0.36767	-0.49055	0.19281	-0.01723	-0.35950	0.13574	-0.03240
As	0.42374	0.03568	0.13452	-0.12043	-0.08501	0.02638	0.23506	-0.08007	0.24644	0.00416	0.81008	0.00012
Se	0.37599	0.02717	0.03644	0.13451	0.02055	-0.28709	-0.20798	-0.57765	0.42854	-0.24436	-0.29825	-0.21540
Hg	0.27658	-0.09404	-0.56521	0.14459	0.16224	0.03527	-0.13010	-0.10869	0.01761	0.71685	0.00866	0.06100
F	0.08698	0.02020	0.64562	0.45187	-0.09913	0.33157	-0.32643	-0.01167	0.04229	0.31365	-0.02856	0.20874
Ba	0.31479	0.03259	-0.04017	0.51909	-0.07649	0.00573	0.37243	-0.10593	-0.61984	-0.14757	-0.01964	-0.25808
Tl	0.23856	-0.42985	0.05521	0.18874	0.25408	-0.40902	-0.33546	0.57148	0.00286	-0.14510	0.10674	-0.12738
Eigenvalue	3.48125	1.36951	1.22841	1.10478	0.99404	0.77565	0.74836	0.63995	0.54849	0.50137	0.37857	0.22963
Proportion	0.29010	0.11413	0.10237	0.09207	0.08284	0.06464	0.06236	0.05333	0.04571	0.04178	0.03155	0.01914
Accum. Prop.	0.29010	0.40423	0.50660	0.59866	0.68150	0.74614	0.80850	0.86183	0.90754	0.94932	0.98086	1.00000

CHAPTER 5 DRILLING SURVEY

5-1 Outline of the Drilling Survey

5-1-1 Objective of the Diamond Drilling

As a result of geological and geochemical surveys carried out in the initial phase of the project, an epithermal-gold-type ore deposit is expected as a promising target for future exploration in the Arlık Dere area. In the second phase, a drilling survey consisting of four holes (total hole length: 600m) was planned and successively 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 is as follows:

MJTC-3 : exploration of gold mineralized area(Sartaş Hill) discovered on the surface.

MJTC-4 : exploration of gold mineralized area(Güvemalanı Hill) and gold anomalous area as found by geochemical survey on the surface.

MJTC-5 : exploration of gold anomalous area(Kocataş Hill) found by geochemical survey.

MJTC-6 : exploration of gold anomalous area(Kocataş Hill) found by geochemical survey.

5-1-2 Outline of Drilling Operation

(1) Location of drill holes

No.	Y	X	Z(m Sea level)	Direction	Dip
MJTC-3	82980	30790	454	-	-90°
MJTC-4	83400	30790	489	-	-90°
MJTC-5	82620	30220	452	N80°W	-50°
MJTC-6	82340	30170	491	S80°E	-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 inclinations were vertical and 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

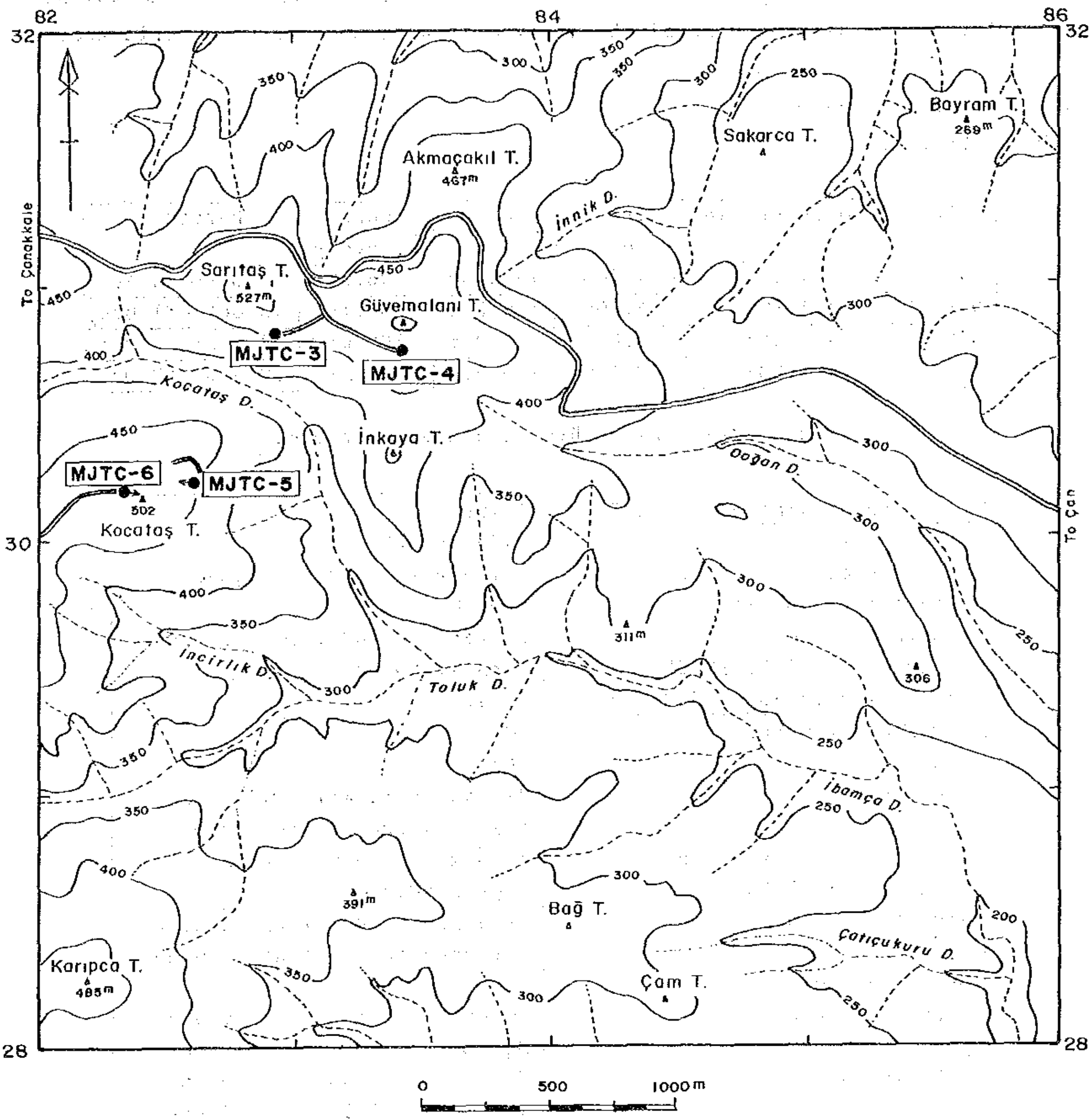


Fig. 2-4 Map of Drill Hole Locations in the Arlık Area

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

Microscope observations of rock thin sections and ore polished specimens, measurement of homogenization temperature and salinity of fluid inclusions, and detection of altered minerals by X-ray diffraction meter were performed.

5-1-3 Holes Drilled

Drill Holes Data

No.	Length Drilled	Surface Soil	Core Length	Core Recovery	Period
MJTC-3	151.00m	11.15m	145.75m	96.5%	23 Oct～ 6 Nov
MJTC-4	151.10m	3.00m	130.05m	86.1%	16 Oct～31 Oct
MJTC-5	151.00m	0.00m	151.00m	100.0%	27 Sep～ 7 Oct
MJTC-6	151.00m	3.15m	135.00m	94.5%	20 Sep～13 Oct

Table 2-5 Drilling Machine and Equipment Used

Drilling Machine Model "L-38"	1 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	3m	50 pcs
	BQ-WL	3m	50 pcs
Casing pipe	HX	1.5m	4 pcs
	NW	1.5m	1 pcs
	NW	3m	21 pcs
	BW	3m	50 pcs

5-2 Drilling Operation

5-2-1 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-3, MJTC-4 and MJTC-6 sites covered by surface soil but also at the MJTC-5 site which had exposed bed rock 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.

Table 2-6 Drilling Machine and Equipment Used

Drilling Machine Model "Acker"	1 set		
Capacity	800m (BQ-WL)		
Dimensions L x W x H	2,310mm x 1,070mm x 1,650		
Hoisting capacity	6,795kg		
Spindle speed	Forward 232,481,880,1,484rpm		
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/cm^2		
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	3m	60 pcs
	BQ-WL	3m	60 pcs
Casing pipe	HX	1.5m	4 pcs
	NW	1.5m	1 pcs
	NW	3m	30 pcs
	BW	3m	50 pcs

5-2-2 Drilling Machine, Equipment and Consumables

Longyear L-38 and Acker were used for the drilling operation. The types and specifications of machines, engines, pumps and equipment, and amount of consumables are shown in Tables 2-5, 2-6 and 2-7.

5-2-3 Operation Members and Shifts

The operation of move-in and move-out from site to site, and preparation work in the site were performed by 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 consists of five members, a Japanese driller, a Turkish assistant driller [MTA] and three Turkish workers.

5-2-4 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-3 and MJTC-4, and a new 1.75km road for MJTC-5 and MJTC-6 were constructed by bulldozer.

5-2-5 Water Supply

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

5-2-6 Withdrawal

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

5-3 Results of Diamond Drilling

5-3-1 MJTC-3

The hole reached massive bedrock at 11.15m after cutting through the surface with an NQ-size diamond bit with circulating dense bentonite mud water. After reaming with the HW casing shoe bit, HX casing pipes were inserted from 3.1m. Below 11.15m, a NQ wire line method, and bentonite mud water was used for the drilling operation.

The rock consisted mainly of strongly argillized rock with disseminated pyrite. Drilling was continued to 70.20m, with NX and BW casing pipes inserted at 31.0m and 70.20m because of severe collapse of the hole wall. Below 70.20m, the drilling operation was carried out with a BQ wire line method, and circulating bentonite mud water. The rock changed from argillized rocks to strongly silicified rocks below 82.00m. The drilling was completed at 151.00m. Mineralization accompanied by pyrite occurred in altered andesite of Şapçı Volcanics from 11.15m to the bottom of the hole.

Table 2-7 Consumables Used

Discription	Specifi -cation	Unit	Quantity						Total
			MJTC-1	MJTC-2	MJTC-3	MJTC-4	MJTC-5	MJTC-6	
Light oil		ℓ	2,800	3,020	2,680	2,280	2,120	3,080	15,980
Petrol		ℓ	950	1,280	680	660	510	690	4,770
Engine oil		ℓ	40	60	40	40	40	60	280
Hydraulic oil		ℓ	20	20	20	20	20	20	120
Grease		Kg	20	20	20	20	20	20	120
Cement		Kg	1,500	2,500	1,000	1,000	1,000	2,500	9,500
Bentonite		Kg	2,900	5,500	2,900	2,600	2,750	8,350	25,000
C.M.C		Kg	-	50	60	60	60	160	290
Cutting oil		ℓ	-	-	-	-	-	-	-
Telstop		Kg	-	-	-	-	-	-	-
Diamond bit	NQ/BQ	pcs	5/0	9/0	4/3	7/4	4/0	3/3	32/10
Diamond reamer	NQ/BQ	pcs	3/0	5/0	2/2	3/2	2/0	2/2	17/ 6
Diamond casing shoe	NX/BW	pcs	1/0	6/0	1/0	6/1	1/0	-	15/ 1
Metal casing shoe	HX/NW/BW	pcs	1/0/0	2/5/0	1/1/0	1/5/0	1/1/3	0/1/0	6/13/3
Core barrel Ass'y	NQ/BQ-WL	set	1/0	2/0	1/1	1/1	1/0	1/1	7/3
Inner tube	NQ/BQ-WL	pcs	2/0	2/0	2/2	2/2	2/0	2/2	12/6
Core lifter case	NQ/BQ-WL	pcs	4/0	6/0	4/4	4/4	4/0	4/4	26/12
Core lifter	NQ/BQ-WL	pcs	6/0	8/0	4/4	4/4	4/0	4/4	30/12
Thrust ball bearing	NQ/BQ-WL	pcs	4/0	6/0	4/4	4/4	4/0	4/4	26/12
Chuck piece	NQ/BQ-WL	set	1/0	1/0	1/0	1/0	1/0	1/1	6/1
Cylinder liner	535-RQ	pcs	3	6	3	3	3	6	24
Valve seat	535-RQ	pcs	3	6	3	3	3	6	24
Steel ball	535-RQ	pcs	6	12	6	6	6	6	42
Piston rubber	535-RQ	pcs	9	9	6	6	6	12	45
Core box	NQ & BQ	pcs	31	28	30	22	33	28	172

Table 2-8 Drilling Meterage of Diamond Bit, Reamer and Casing Shoe Bit Used

Item	Size	Drilling Meterage by Unit											
		MJTC-1		MJTC-2		MJTC-3		MJTC-4		MJTC-5		MJTC-6	
		Diamond	m	Diamond	m	Diamond	m	Diamond	m	Diamond	m	Diamond	m
Bit	NQ	NNT-1	10.95	NNT-2	4.40	NNT-23	11.40	NNT-22	9.50	NNT-13	33.65	NNT-18	32.75
		NNT-3	31.85	NNT-4	5.45	NNT-25	17.75	NNT-24	10.55	NNT-15	28.75	NNT-20	23.35
		NNT-5	29.15	NNT-6	6.10	NNT-30	28.25	NNT-25	12.60	NNT-17	39.65	NNT-21	13.95
		NNT-7	40.50	NNT-8	15.95	NNT-31	12.80	NNT-26	9.80	NNT-19	48.95		
		NNT-9	38.55	NNT-10	11.50			NNT-27	16.85				
				NNT-11	17.10			NNT-28	6.50				
				NNT-12	26.00			NNT-29	7.40				
				NNT-14	30.70								
				NNT-16	33.80								
	BQ					NBT- 8	23.05	NBT- 4	8.40			NBT- 1	26.15
						NBT- 9	30.15	NBT- 5	20.70			NBT- 2	28.55
						NBT-10	27.60	NBT- 6	19.35			NBT- 3	26.25
								NBT- 7	29.45				
	m/pc		30.20		16.78		21.57		13.74		37.75		25.17
Reamer	NQ	NNTR-1	42.80	NNTR-2	4.40	NNTR-15	29.15	NNTR-13	20.05	NNTR- 9	62.40	NNTR-10	56.10
		NNTR-3	69.65	NNTR-4	11.55	NNTR-17	41.05	NNTR-14	22.40	NNTR-11	88.60	NNTR-12	13.95
		NNTR-5	38.55	NNTR-6	27.45			NNTR-16	30.75				
				NNTR-7	43.10								
				NNTR-8	64.50								
						NBTR- 5	53.20	NBTR- 3	29.10			NBR- 1	54.70
						NBTR- 6	27.60	NBTR- 4	48.80			NBR- 2	26.70
	m/pc		50.33		30.20		37.75		30.22		75.59		37.75
Casing shoe		NX 1pc	9.30	NX 3pcs	61.00	NX 1pc	18.30	NX 3pcs	31.00	NX 1pc	3.00	NX 1pc	9.10
						BW 1pc	70.20	BW 1pc	73.20			BW 2pcs	94.55

Table 2-9 Working Time Breakdown of the Drilling Operation

Hole No.	Drilling			Shift		Men working		Working Time						
	Bit size	Drill-ing length	Core	Drill-ing	Total	Engi-neer	Worker	Drill-ing	Other work	Reco-vering	Total	Remo-val	Road con-struction and others	G.Total
		m	m	shift	shift	Number of men		h	h	h	h	h	h	h
MJTC-1	NQ	151.00	145.75	34	42	53	152	152	120	8	280	24	40	344
MJTC-2	NQ	151.00	130.05	54	58	63	244	202	190	40	432	16	16	464
MJTC-3	NQ/BQ	151.00	139.55	25	36	48	180	155	73	-	228	40	48	316
MJTC-4	NQ/BQ	151.10	113.80	25	32	32	156	148	76	-	224	16	16	256
MJTC-5	NQ	151.00	151.00	19	27	27	140	133	57	-	190	16	48	254
MJTC-6	NQ/BQ	151.00	138.75	32	44	44	200	183	125	-	308	16	48	372
Total	NQ/BQ	906.10	818.90	189	239	267	1,072	973	641	48	1,662	128	216	2,006

Depth (m)	0~70.20	70.20~151.00
Mud Water	BMW	BMW
Bit Exchange(pcs)	NQWL bit(4)	BQWL bit(3)
Pump Pre. (kg/cm²) Pump Feed (ℓ/min) Pump Deri (ℓ/min)	0~5 40 20~40	5~10 30 30
Bit Pre. (kg/cm²) Bit Rot. (rpm)	1,000~1,500 200	1,000~1,500 200
Core Recovery (%)	98	96

BMW: Bentonite mud water

5-3-2 MJTC-4

The hole reached massive bed rock at 9.10m after cutting through the surface with an NQ-size diamond bit with circulating dense bentonite mud water. After reaming with the HW and NX casing shoe bit, HW and NX casing pipes were inserted at 3.10m and 9.10m. Below 9.10m until 73.20m, an NQ wire line method and bentonite mud water were used for the drilling operation. Below 73.20m, a BQ wire line method, and bentonite mud water were used for the drilling operation. The drilling was completed at 151.10m.

The lithology of this drill hole consists of reddish soil (0~3.00m), strongly silicified rock (3.00~96.30m and 149.50~151.10m) and argillized rock (96.30~149.50m). Loss of mud water occurred at 32.25m and 35.50m in the open spaces of the silicified zones. Mineralization accompanied by disseminated pyrite occurred.

Depth (m)	0~73.20	73.20~151.10
Mud Water	BMW	BMW
Bit Exchange(pcs)	NQWL bit(7)	BQWL bit(4)
Pump Pre. (kg/cm²) Pump Feed (ℓ/min) Pump Deri (ℓ/min)	0~5 40 40	5~10 30 30
Bit Pre. (kg/cm²) Bit Rot. (rpm)	1,000~1,500 200	1,000~1,500 200
Core Recovery (%)	98	96

BMW: Bentonite mud water

5-3-3 MJTC-5

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 drilling was completed at 151.00m.

The lithology of this drill hole consists of limonitic rock (0~28.00m), argillized andesite (28.00~57.25m), silicified andesite (57.25~100.40m) and alternations of black mudstone and sandstone (100.40~151.00m). Mineralization accompanied by disseminated pyrite and native sulfur occurred in Şapçı Volcanics and Kirazlı Conglomerate.

Depth (m)	0~151.00
Mud Water	BMW
Bit Exchange(pcs)	NQWL bit(4)
Pump Pre. (kg/cm^2)	5~10
Pump Feed (ℓ/min)	40
Pump Deri (ℓ/min)	40
Bit Pre. (kg/cm^2)	1,000~1,500
Bit Rot. (rpm)	200
Core Recovery (%)	100

BMW: Bentonite mud water

5-3-4 MJTC-6

The hole reached massive bedrock at 9.10m after cutting through the surface with an NQ-size diamond bit with circulating dense bentonite mud water. After reaming with the HW and NX casing shoe bit, HW and NX casing pipes were inserted at 3.10m and 9.10m. Below 9.10m, an NQ wire line method and bentonite mud water were used for the drilling operation. Below 47.50m, loss of mud water commenced in the unconsolidated limonitic argillized zones, and BW casing was inserted at 94.55m because of severe collapse of the hole wall. The drilling was completed at 151.00m.

The lithology of this drill hole consists of reddish soil (0~3.15m), strongly argillized rock (3.15~77.15m and 102.00~117.50m), silicified andesite (77.15~102.00m) and alternations of black mudstone and sandstone (117.50~151.00m). Mineralization accompanied by disseminated pyrite and native sulfur occurred in Şapçı Volcanics and Kirazlı Conglomerate.

Depth (m)	0~70.05	70.05~151.00
Mud Water	BMW	BMW
Bit Exchange(pcs)	NQWL bit(3)	NQWL bit(3)
Pump Pre. (kg/cm^2)	5~10	0~5
Pump Feed (ℓ/min)	40	40
Pump Deri (ℓ/min)	40	0
Bit Pre. (kg/cm^2)	1,000~1,500	1,000~1,500
Bit Rot. (rpm)	200	200
Core Recovery (%)	92	92

BMW: Bentonite mud water

Table 2-10 Record of the Drilling Operation at MJTC-3

	Drilling length			Total		Shift		Working men	
	Shift 1	Shift 2	Shift 3	Drilling	Core length	Drilling	Total	Engineer	Worker
	m	m	m	m	m	shift	shift	man	man
17 Oct	Prds						1	1	8
18 Oct	Prds						2	1	8
19 Oct	Prds						3	1	8
20 Oct	Prds						4	1	8
21 Oct	Prds						5	1	8
22 Oct	Holiday								
23 Oct	3.20			3.20	-	1	6	1	4
24 Oct	5.35	2.85		11.40	0.25	2	8	2	8
25 Oct	3.55	2.20		17.15	6.00	2	10	2	8
26 Oct	5.00	6.65		28.80	17.65	2	12	2	8
27 Oct	5.10	6.15		40.05	28.60	2	14	2	8
28 Oct	9.15	8.20		57.40	45.95	2	16	2	8
29 Oct	5.85	6.95		70.20	58.75	2	18	2	8
30 Oct	INCP	7.05		77.25	65.80	2	20	2	8
31 Oct	7.45	8.55		93.25	81.80	2	22	2	8
1 Nov	6.80	7.70		107.75	96.30	2	24	2	8
2 Nov	7.55	8.10		123.40	111.95	2	26	2	8
3 Nov	9.15	7.70		140.25	128.80	2	28	2	8
4 Nov	4.80	5.95		151.00	139.55	2	30	2	8
5 Nov	Holiday								
6 Nov	Dism						31	3	8
7 Nov	Dism						32	3	8
8 Nov	Trans						33	3	8
9 Nov	Trans						34	3	4
10 Nov	Trans						35	3	4
11 Nov	Eqco						36	3	8
Total	72.95	78.05		151.00	139.55	25	36	48	180

Abbreviations

Prds ; Preparation for drilling site
Trans; Transportation
Trre ; Transportation and Reassemblage
Reco ; Recovering work
Dism ; Dismantlement
INCP ; Inserting casing pipe
OUCP ; Retrieving casing pipe
Eqco ; Equip completely

Table 2-11 Record of the Drilling Operation at MJTC-4

	Drilling length			Total		Shift		Working men	
	Shift 1	Shift 2	Shift 3	Drilling	Core length	Drilling	Total	Engineer	Worker
	m	m	m	m	m	shift	shift	man	man
11 Oct	Prds						1	1	8
12 Oct	Prds						2	1	8
13 Oct	Prds						3	1	8
14 Oct	Prds						4	1	8
15 Oct	Holiday								
16 Oct	3.55			3.55	3.55	1	5	1	4
17 Oct	2.75	3.20		9.50	4.95	2	7	2	8
18 Oct	4.75	5.80		20.05	8.20	2	9	2	8
19 Oct	6.10	6.50		32.65	16.95	2	11	2	8
20 Oct	INCP	INCP		32.65	16.95	2	13	2	8
21 Oct	2.65	7.15		42.45	20.80	2	15	2	8
22 Oct	Holiday								
23 Oct	11.15	5.70		59.30	31.80	2	17	2	8
24 Oct	6.50	4.65		70.45	39.30	2	19	2	8
25 Oct	2.75	8.40		81.60	45.45	2	21	2	8
26 Oct	11.95	8.75		102.30	64.95	2	23	2	8
27 Oct	10.90	8.45		121.65	84.30	2	25	2	8
28 Oct	9.85	8.45		139.95	102.60	2	27	2	8
29 Oct	5.05	6.10		151.10	113.80	2	29	2	8
30 Oct	Diam						30	1	8
31 Oct	Diam						31	1	8
1 Nov	Diam						32	1	8
Total	77.95	73.15		151.10	113.80	25	32	32	156

Abbreviations

Roco ; Road construction
Prds ; Preparation for drilling site
Tran ; Transportation
Trre ; Transportation and Reassemblage
Dism ; Dismantlement
Reco ; Recovering work
INCP ; Inserting casing pipe
OUCP ; Retrieving casing pipe

Table 2-12 Record of the Drilling Operation at MJTC-5

	Drilling length			Total		Shift		Working men	
	Shift 1	Shift 2	Shift 3	Drilling	Core length	Drilling	Total	Engineer	Worker
	m	m	m	m	m	shift	shift	man	man
20 Sep	Prds						1	1	8
21 Sep	Prds						2	1	8
22 Sep	Prds						3	1	8
23 Sep	Prds						4	1	8
24 Sep	Holiday								
25 Sep	Prds						5	1	8
26 Sep	Prds						6	1	8
27 Sep	9.25	6.25		15.50	15.50	2	8	2	8
28 Sep	10.95	7.20		33.65	33.65	2	10	2	8
29 Sep	7.00	6.50		47.15	47.15	2	12	2	8
30 Sep	8.25	7.00		62.40	62.40	2	14	2	8
1 Oct	Holiday								
2 Oct	11.95	9.15		83.50	83.50	2	16	2	8
3 Oct	8.45	10.10		102.05	102.05	2	18	2	8
4 Oct	7.80	4.40		114.25	114.25	2	20	2	8
5 Oct	5.10	9.05		128.40	128.40	2	22	2	8
6 Oct	8.85	8.75		146.00	146.00	2	24	2	8
7 Oct	5.00			151.00	151.00	1	25	1	4
8 Oct	Holiday								
9 Oct	Disma							1	8
10 Oct	Disma							1	8
11 Oct									
12 Oct									
13 Oct									
Total	82.60	68.40		151.00	151.00	19	27	27	140

Abbreviations

Roco ; Road construction

Prds ; Preparation for drilling site

Tran ; Transportation

TRRE ; Transportation and Reassemblage

Disma ; Dismantlement

Reco ; Recovering work

INCP ; Inserting casing pipe

OUCP ; Retrieving casing pipe

Table 2-13 Record of the Drilling Operation at MJTC-6

	Drilling length			Total		Shift		Working men	
	Shift 1	Shift 2	Shift 3	Drilling	Core length	Drilling	Total	Engineer	Worker
	m	m	m	m	m	shift	shift	man	man
13 Sep	Prds						1	1	8
14 Sep	Prds						2	1	8
15 Sep	Prds						3	1	8
16 Sep	Prds						4	1	8
17 Sep	Holiday								
18 Sep	Prds						5	1	4
19 Sep	Prds						6	1	4
20 Sep	3.10			3.10	3.10	1	7	1	4
21 Sep	2.75	4.65		10.50	10.50	2	8	2	8
22 Sep	3.35			13.85	13.85	1	10	1	4
23 Sep	3.25			17.40	17.40	1	11	1	4
24 Sep	Holiday								
25 Sep	3.05	5.15		25.60	24.90	2	13	2	8
26 Sep	4.50	2.65		32.75	32.05	2	15	2	8
27 Sep	7.10	5.70		45.55	44.55	2	17	2	8
28 Sep	7.50	3.05		56.10	53.70	2	19	2	8
29 Sep	Cmnt	–					20	1	4
30 Sep	–	Cmct					21	1	4
1 Oct	Holiday								
2 Oct	Cmnt						22	1	4
3 Oct	3.50	5.30		64.90	59.80	2	24	2	8
4 Oct	2.55	2.60		70.05	64.40	2	26	2	8
5 Oct	2.65	3.45		76.15	69.50	2	28	2	8
6 Oct	INCP	1.00		77.15	69.70	1	30	2	8
7 Oct	3.60	2.10		82.85	73.90	2	32	2	8
8 Oct	Holiday								
9 Oct	7.25	6.10		96.20	86.55	2	34	2	8
10 Oct	3.65	8.55		108.40	97.35	2	36	2	8
11 Oct	10.15	6.20		124.75	113.70	2	38	2	8
12 Oct	10.45	6.75		141.95	130.90	2	40	2	8
13 Oct	7.40	1.65		151.00	138.75	2	42	2	8
14 Oct	Dism						43	1	8
15 Oct	Holiday								
16 Oct	Dism						44	1	8
17 Oct									
Total	86.10	64.90		151.00	138.75	32	44	44	200

Abbreviations

Roco ; Road construction
Prds ; Preparation for drilling site
INCP ; Inserting casing pipe
Cmnt ; Cementation
Dism ; Dismantlement
Reco ; Recovering work
OUCP ; Retrieving casing pipe
Cmct ; Cutting cement

Table 2-14 Summary of the Drilling Operation of MJTC-3

Operation	Survey period: Period	Days	Work day (days)	Off day (days)	Total men: Engineer (man)	Worker (man)
Preparation	17 ~ 21 October	6	5	1	5	40
Drilling	23 Oct~ 4 Nov	13	Drilling 13	-	25	100
			Recovering			
Removing	5 ~ 10 November	6	5	1	18	40
Total	17 Oct~ 10 Nov	25	23	2	48	180

Drilling length			
Length planned	150.00m	Over-burden	11.15m
Increase or Decrease in length	151.00m	Core length	139.55m
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	99	99.3
50~ 100	100	99.7
100~ 151	100	99.8

Working hours	h	%	%
Drilling	155	68	51
Other work	73	32	24
Recovering			
Total	228	100	
Reassemblage	40		12
Dismantlement	48		13
Water transportation			
Road construction and others			
G.Total	316		100

Efficiency of drilling

Total m/work period (m/day)	151.00m/13 days (11.62 m/day)
Total m/total shift (m/shift)	151.00m/25 shifts (6.04 m/shift)

Drilling length/bit (each sized bit)

Bit size	NX	NQ	BQ
Drilled length (m)	-	70.20	80.80
Core length (m)		58.75	80.80

Casing pipe inserted

Size	Meterage (m)	Drilling length X100 (%)	Meterage recovery (%)
HW	3.10	2.00	100
NX	61.00	40.00	100
BW	70.20	46.00	100

Table 2-15 Summary of the Drilling Operation of MJTC-4

	Survey period				Total men	
	Period	Days	Work day	Off day	Engineer	Worker
Operation			days	days	man	man
Preparation	11 ~ 15 October	5	4	1	4	32
Drilling	16 ~ 29 October	14	Drilling 13 Recovering	1	25	100
Removing	30 Ovt ~ 1 Nov	3	3	–	3	24
Total	11 Oct ~ 1 Nov	22	20	2	32	156

Drilling length			
Length planed	150.00m	Over-burden Cnave	3.00m 19.35m
Increase or Decrease in length	151.10m	Core length	113.75m
Length drilled	151.10m	Core recovery	% 88.3

Core recovery of 50 m hole		
Depth of hole (m)	Core recovery (%)	Core recovery cumulated (%)
0~ 50	90	83
50~ 100	100	80
100~ 151	99	100

Working hours	h	%	%
Drilling	148	66	53
Other work	76	34	27
Recovering			
Total	224	100	80
Reassemblage	32		11
Dismantlement	24		9
Water transportation			
Road construction and others			
G.Total	280		100

Efficiency of drilling	
Total m/work period (m/day)	151.10m/13 days (11.62m/day)
Total m/total shift (m/shift)	151.10m/25 shifts (6.04m/shift)

Drilling length/bit (each sized bit)			
Bit size	NX	NQ	BQ
Drilled length (m)	31.0	73.2	77.9
Core length (m)		39.8	74.0

Casing pipe inserted			
Size	Meterage (m)	Drilling length X100 (%)	Meterage recovery (%)
HW	3.10	2	100
NW	31.00	20	100
BW	73.20	48	100

Table 2-16 Summary of the Drilling Operation of MJTC-5

Operation	Survey period: Period	Days	Work day (days)	Off day (days)	Total men: Engineer (man)	Total men: Worker (man)
Preparation	20 ~ 26 September	7	6	1	6	48
Drilling	27 Sep~ 7 October	11	Drilling 10	1	19	76
			Recovering			
Removing	8 ~ 9 October	3	2	1	2	16
Total	20 Sep~ 9 October	21	18	3	27	140

Drilling length			
Length planned	150.00m	Over-burden	– m
Increase or Decrease in length	151.00m	Core length	151.00m
Length drilled	151.00m	Core recovery	% 100

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	100	100

Working hours	h	%	%
Drilling	133	70	52
Other work	57	30	23
Recovering	–	–	–
Total	190	100	
Reassemblage	48		19
Dismantlement	16		6
Water transportation			
Road construction and others			
G.Total	254		100

Efficiency of drilling	
Total m/work period (m/day)	151.00m/10 days (15.10 m/day)
Total m/total shift (m/shift)	151.00m/19 shifts (7.95 m/shift)

Drilling length/bit (each sized bit): Bit size	HW	NX	NQ
Drilled length (m)	–	3.1	151.00
Core length (m)			151.00

Casing pipe inserted: Size	Meterage (m)	Drilling length x100 (%)	Meterage recovery (%)
HW			
NX	3.00	2.00	100
BQ			

Direction: N80° W Incline: -50°

Table 2-17 Summary of the Drilling Operation of MJTC-6

Operation	Survey period: Period	Days	Work day (days)	Off day (days)	Total men: Engineer (man)	Total men: Worker (man)
Preparation	13 ~ 19 September	7	6	1	6	40
Drilling	20 Sep~ 13 Oct	24	Drilling 21	3	36	144
			Recovering			
Removing	14 ~ 16 October	3	2	1	2	16
Total	13 Sep~ 16 Oct	34	29	5	44	200

Drilling length			
Length planned	150.00m	Over-burden	3.15m
Increase or Decrease in length	151.00m	Core length	138.75m
Length drilled	151.00m	Core recovery	% 94.5

Core recovery of 50 m hole: Depth of hole (m)	Core recovery (%)	Core recovery cumulated (%)
0~ 50	90	90
50~ 100	83	87
100~ 151	95	94

Working hours	h	%	%
Drilling	183	59	49
Other work	125	41	34
Recovering			
Total	308	100	
Reassemblage	48		13
Dismantlement	16		4
Water transportation			
Road construction and others			
G.Total	372		100

Efficiency of drilling	
Total m/work period(m/day)	151.00m/21 days (7.19 m/day)
Total m/total shift (m/shift)	151.00m/32 shifts (4.72 m/shift)

Drilling length/bit(each sized bit): Bit size	HW	NX	NQ
Drilled length(m)		70.05	80.95
Core length(m)		64.40	74.35

Casing pipe inserted: Size	Meterage (m)	Meterage / Drilling length X100 (%)	Meterage recovery (%)
HW	3.10	2.1	100
NX	9.10	6.0	100
BW	94.55	62.6	100

Direction: S80°W Incline:-50°

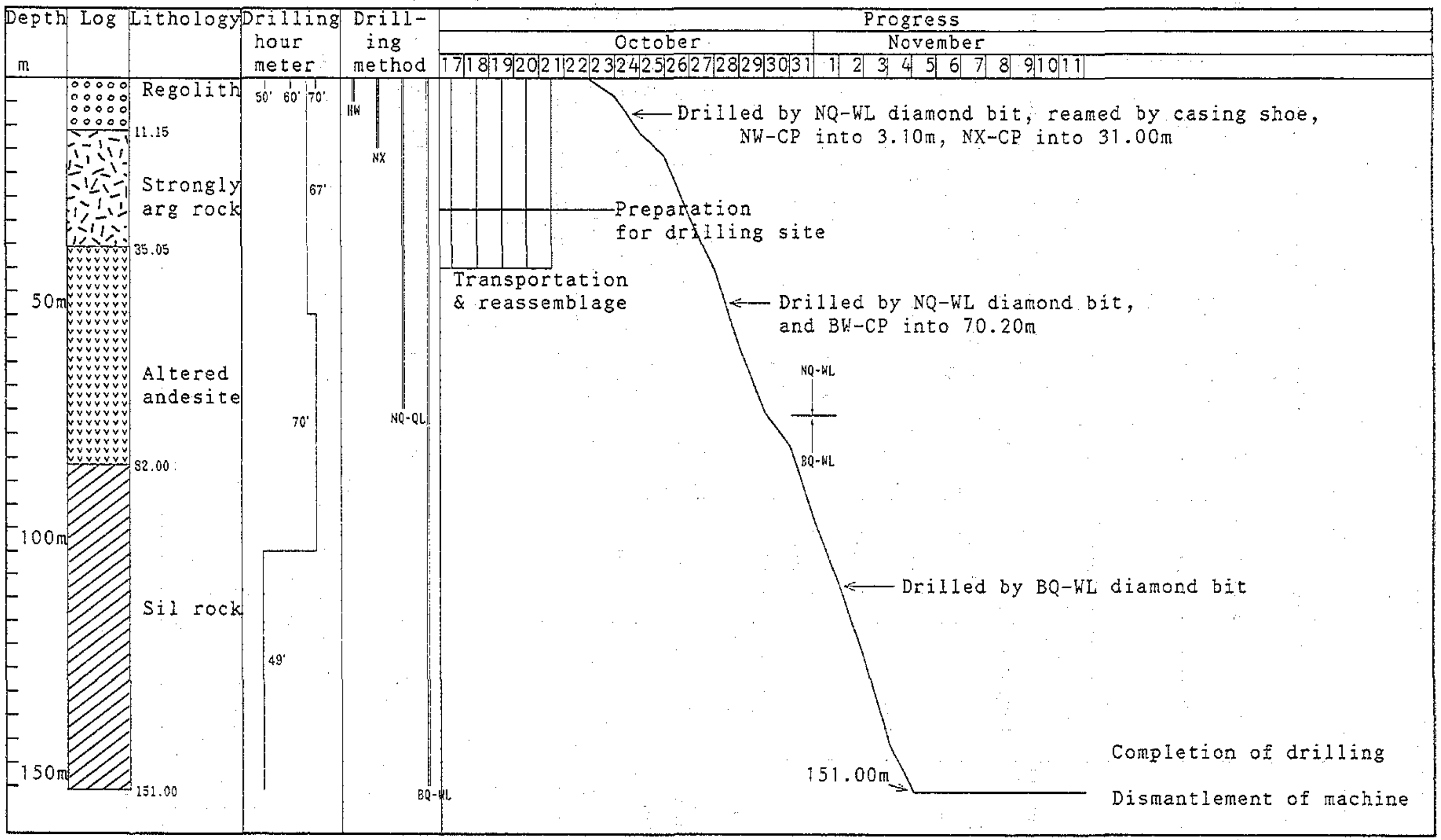


Fig. 2-5 Drilling Progress of MJTC-3

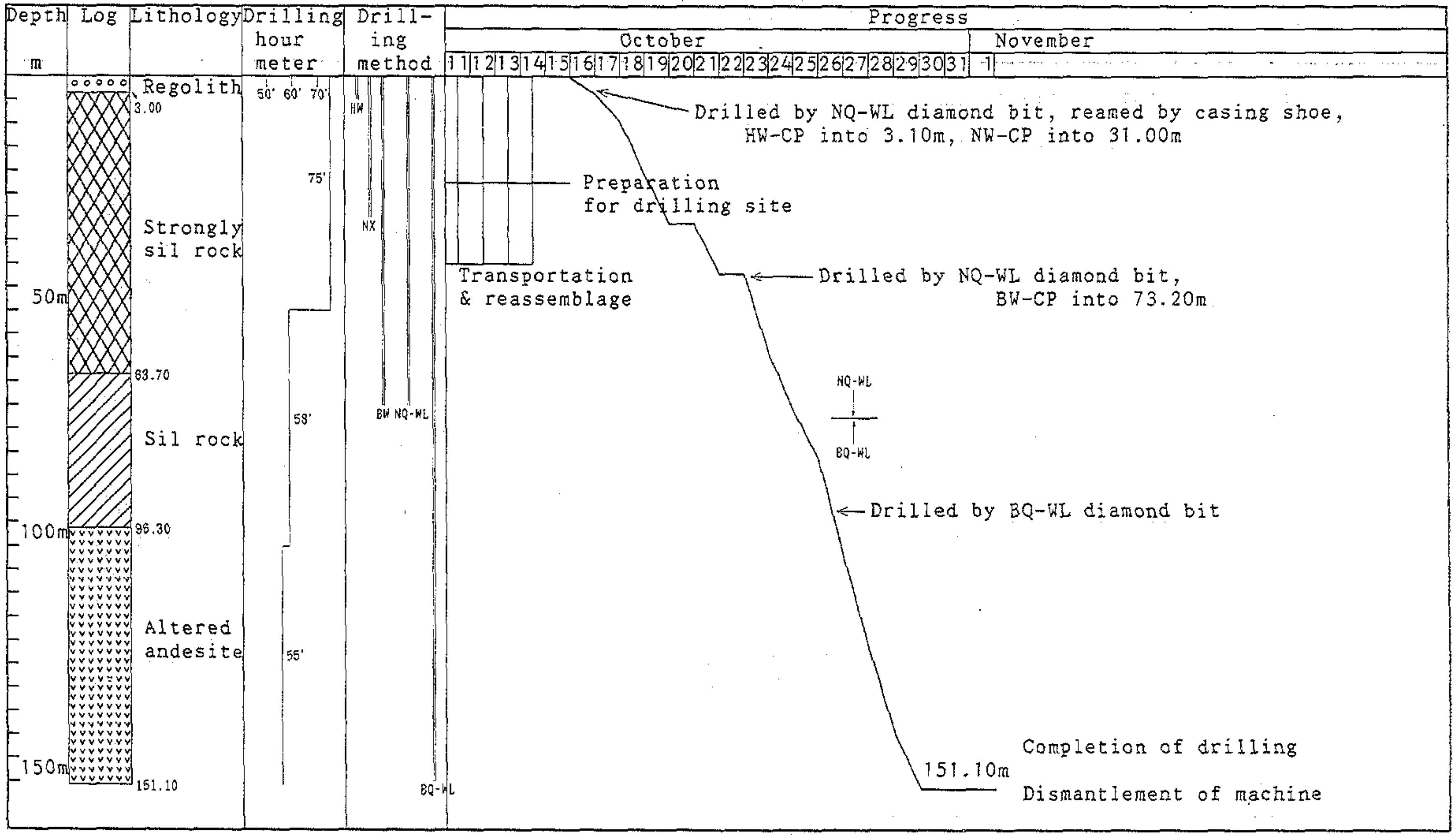


Fig. 2-6 Drilling Progress of MJTC-4

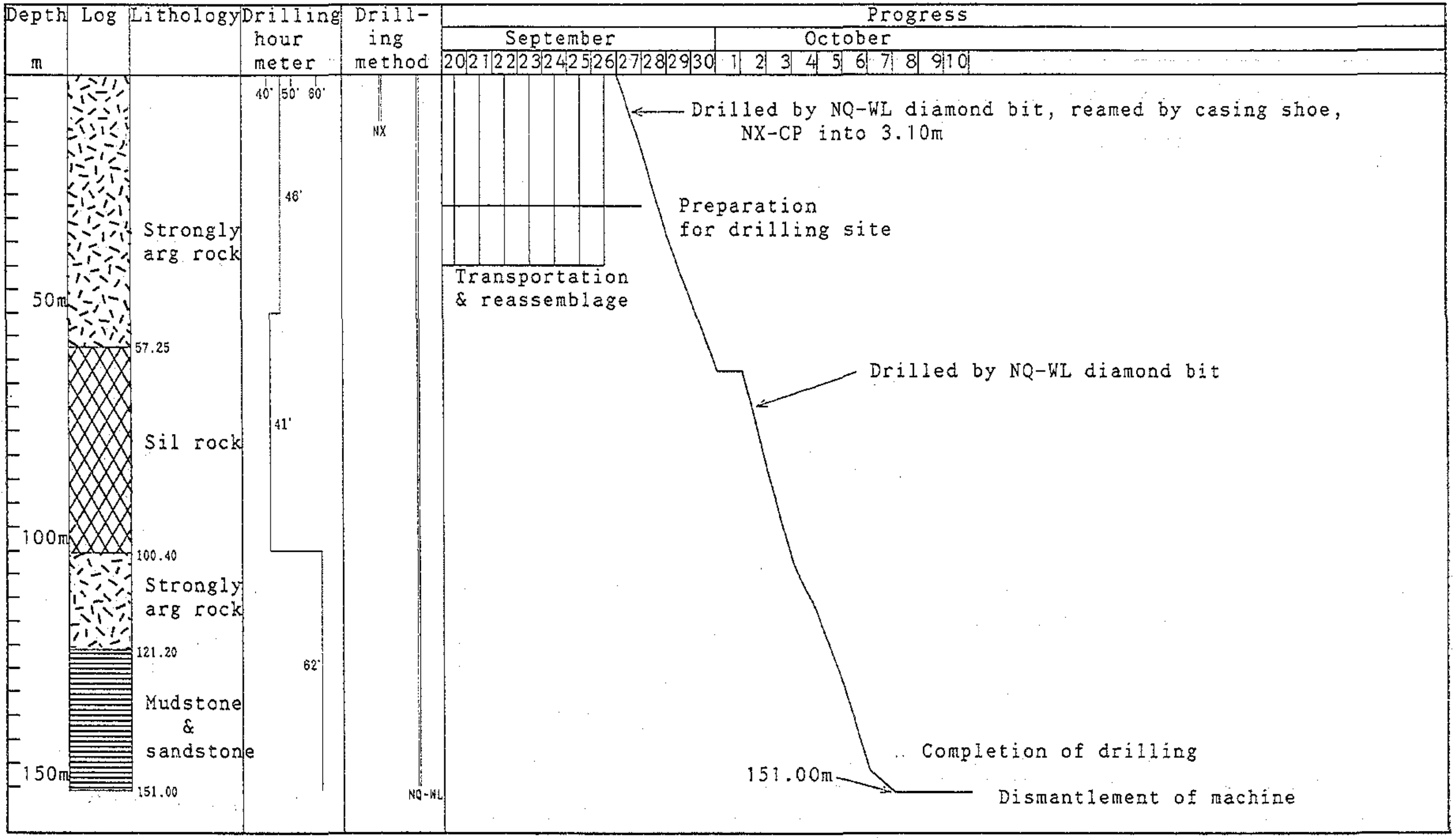


Fig. 2-7 Drilling Progress of MJTC-5

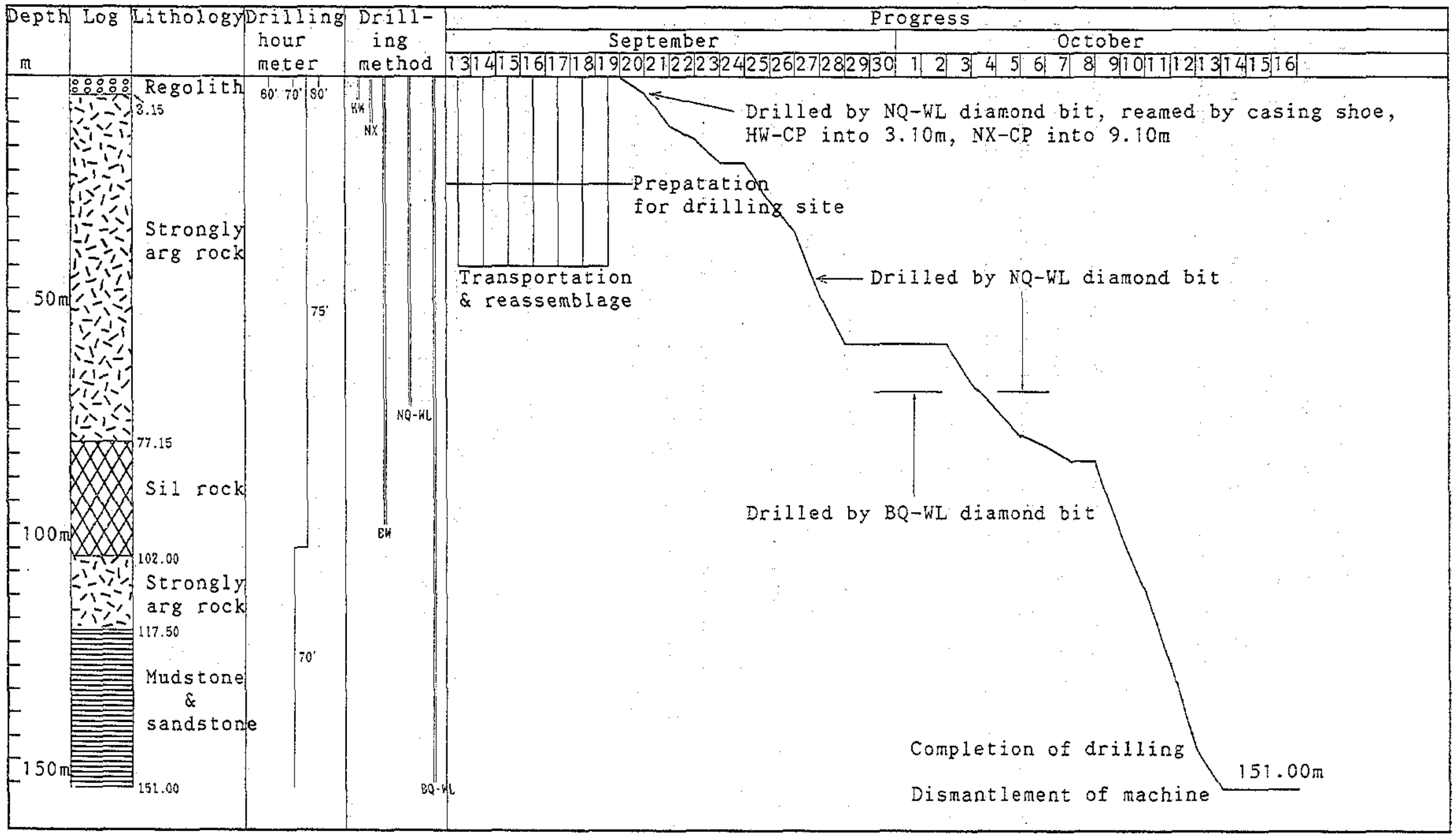


Fig.2-8 Drilling Progress of MJTC-6

5-4 Alteration of Drill Holes

5-4-1 MJTC-3

Silicified zones are distributed in the neighbourhood of the drill site, but a vertical drill hole drilled through argillized zones with limonite and intersected with the silicified zones accompanied by disseminated pyrite at 82.00m. Below 113.00m, dissemination of pyrite become stronger, and a small amount of sphalerite and chalcopyrite were observed under the microscope.

5-4-2 MJTC-4

The strongly silicified zones accompanied by limonite exist to 96.00m, and they have parts with open spaces. Below 96.00m, there were silicified and argillized zones accompanied by disseminated pyrite from 96.00m to 151.10m. The altered minerals consist of alunite, kaoline and pyrophyllite in the silicified zones and mainly kaoline in the argillized zones.

5-4-3 MJTC-5

An inclined hole (-50°) was drilled through the argillized and silicified zones of Şapçı Volcanics until 121.20m. Silicified zones gradually decreased downward and argillized zones increased in the subsurface. The alternation zones of black mudstone and sandstone of Kirazlı Conglomerate accompanied with a network of native sulfur occur from 121.20m to 151.00m. The altered minerals consist of montmorillonite, kaoline, pyrophyllite and alunite in the Şapçı Volcanics, and montmorillonite and sericite in the Kirazlı Conglomerate.

5-4-4 MJTC-6

A inclined hole (-50°) was drilled through argillized and silicified zones of Şapçı Volcanics until 117.50m, in which weakly altered zones from surface to 44.00m, unconsolidated limonitic zone from 44.00m to 54.00m and strongly altered zones accompanied with disseminations of fine-grained pyrite were identified. Silicified zones gradually decreased downward and argillized zones increased in the subsurface. The zones of alternating black mudstone and sandstone of the Kirazlı Conglomerate accompanied with a network of native sulfur occur from 117.50m to 151.00m. The altered minerals consist of montmorillonite and kaoline, and kaoline in the Şapçı Volcanics.

5-5 Assay Results of Cores

5-5-1 MJTC-3

Expected gold mineralization was not detected by any drill hole, but a zone

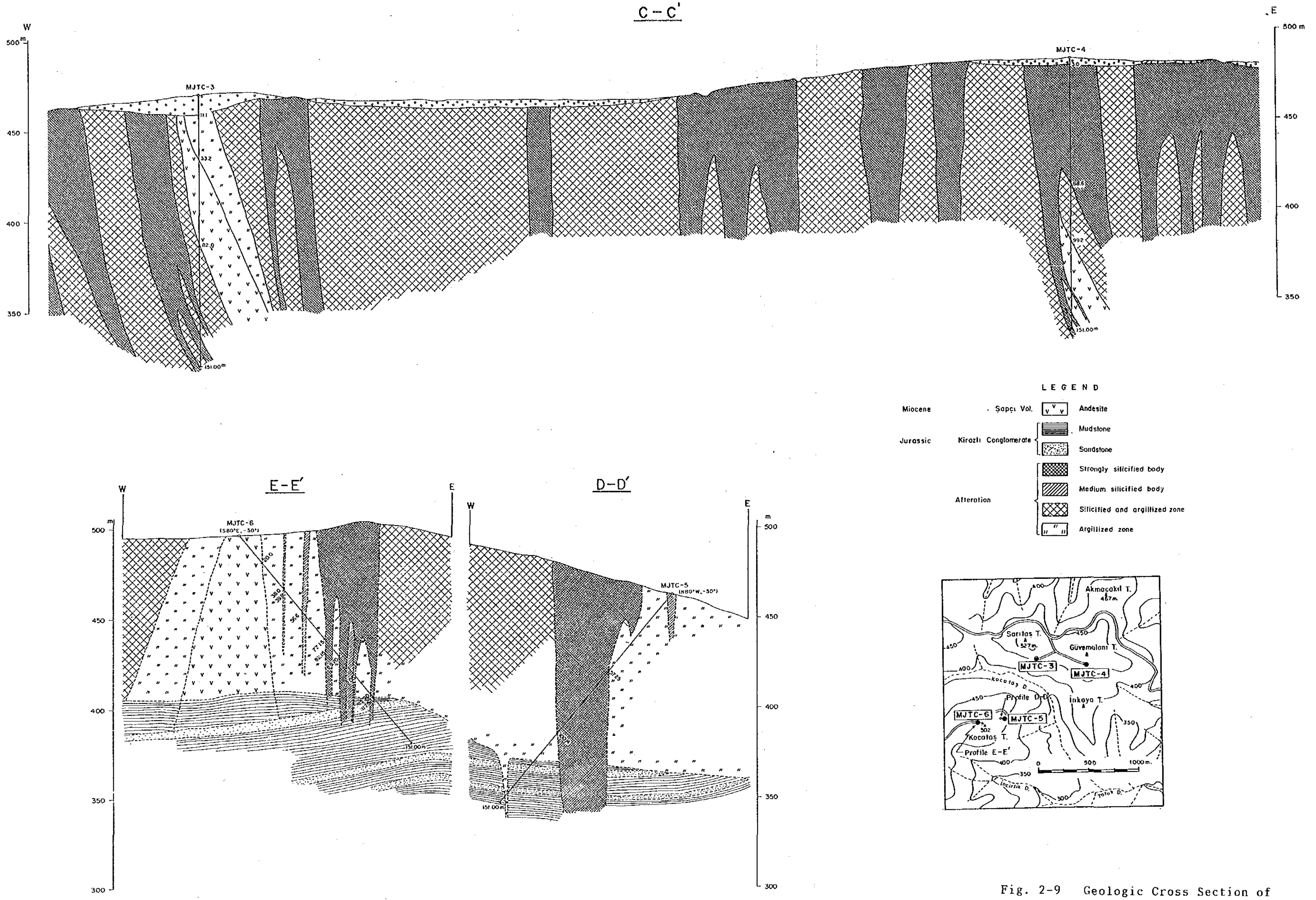


Fig. 2-9 Geologic Cross Section of Drilling Holes (MJTC-3～MJTC-6)

containing gold and copper was found in the silicified body in the range from 120.00m to 144.00m. The grades are 53ppb Au and 290ppm Cu. It is significant that the components related to gold mineralization were detected in the lower section.

5-5-2 MJTC-4

Low-grade mineralization continued from surface to 151.10m at the bottom of the hole; average grade of gold is 134 ppb. It is significant that the content of gold and molybdenum in the strongly silicified zones is higher than that in the other zones.

5-5-3 MJTC-5

Gold mineralization was not detected by this drill hole.

5-5-4 MJTC-6

Mineralization containing gold in excess of 50 ppb was detected in the silicified and argillized zones from 57.00m to 99.00m. These zones corresponded to the descending silicified body seen at the surface, and the content of silver is high.

CHAPTER 6 DISCUSSION

6-1 Alteration Zones

The silicified and argillized zones of the Arlık Stream area are distributed in the Kocataş, Sartaş and Güvemalanı Hills. Kocataş alteration zones are the biggest in the vicinity, its dimensions being 2km long east-west and 1km wide north-south. The gold content was detected from chip samples collected during two years. The auriferous samples were significant in the Kocataş alteration zones. The silicified bodies consist of massive, brecciated and porous parts, which gradually change into each other. Generally, the massive part is centered in the silicified body; the porous and brecciated parts occur at the margin. The silicified zones often result in protruding topography and they can be identified on air photographs, the silicified zones are accompanied by limonite and hematite due to oxidation. The quantity of limonite is low in the massive part, and high in the porous part.

6-2 Alteration of the Deeper Zone

Two drill holes, MJTC-3 and 4 were vertical. The lithology of MJTC-3 was mainly argillized rocks, and that of MJTC-4 was mainly silicified rocks.

The two drill holes of MJTC-5 and 6 were inclined -50°. The lithology of two drill holes were argillized rocks, and the thickness of silicified zones became thin in the subsurface. However, the auriferous silicified zones continued from surface to bottom in MJTC-4; argillized zones accompanied by *pyrite disseminations occur surrounding the silicified zone.* Native sulfur occurs in the lower parts of MJTC-5 and 6.

6-3 Mineralization

It is significant that gold was detected in the chip samples collected from the Kocataş alteration zones, in soil for heavy mineral study and in MJTC-4. The results of the second phase indicate the possibility of large-scale low-grade gold deposits in the alteration zones

CHAPTER 7 CONCLUSIONS AND RECOMMENDATIONS

7-1 Conclusions

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 of 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.

7-2 Recommendations for the Third Phase

The 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.

PART Ⅲ KARAIBRAHIMLER AREA

PART III KARAİBRAHİMLER AREA

CHAPTER 1 GEOLOGICAL SURVEY OF THE KARAIBRAHIMLER AREA

1-1 Outline

The Karaibrahimler area locates in the central part of Zone B. The basement rocks of this area are the Taşdibek Formation consisting of weakly metamorphosed green schist and crystalline limestone, and the Akpınar Granite which intrude into the Taşdibek Formation. The granite is not associated with mineralization, but the crystalline limestone in the vicinity has undergone contact metasomatism and has been skarnized. Kirazlı Conglomerate covers these basement rocks unconformably. The intermediate volcanic activity began in the Eocene and the units progress from Çamyayla Volcanics, Şapçı Volcanics to Osmanlar Volcanics, then the Karaköy Formation consisting of conglomerates deposited during the interval after the long volcanic activity. Quaternary volcanic rocks - Kocaçakıl Basalt - is observed as small outcrops where the Taşdibek Formation is distributed.

As a result of the heavy mineral study, it is inferred that gold mineralization occurs in the silicified and argillized zones of Şapçı Volcanics.

1-2 Objective of the Survey

A significant amount of gold grains was detected in samples collected from the section downstream of Karaibrahimler Village. Therefore, detailed geological and geochemical surveys were conducted in the Karaibrahimler alteration zones.

1-3 Contents of the Survey

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

Survey	Laboratory Studies	Quantity	Components for Analysis
Geoch. S ($12 km^2$)	Chip Samples	64pcs	Cu, Pb, Zn, Au, Ag, Mo, Hg, As, F, Ba, Tl, Se
	Total Rock Analysis	2pcs	SiO_2, TiO_2, Al_2O_3, Fe_2O_3, MnO, MgO CaO, Na_2O, K_2O, P_2O_5, LOI, FeO
	Thin Section	2pcs	
	X-ray Diffractive M.	4pcs	
Heavy M. S.	Gold Grain	22pcs	

CHAPTER 2 GEOLOGY OF KARAIBRAHIMLER AREA

2-1 General Geology

The Karaibrahimler area locates in the center of Zone B. The geology of this area consists of the Taşdibek Formation, Kirazlı Conglomerate, Şapçı Volcanics and Kocaçakıl Basalt. The stratigraphic column, geologic map, geologic cross sections, gold occurrence and alteration map are shown in Figures 1-4, 3-1 and 3-2.

2-2 Stratigraphy

2-2-1 Taşdibek Formation

Distribution: It is distributed along the Köşerelik Stream and Çap Stream.

Lithology and occurrence: Green schist is predominant in the northern part of Karaibrahimler Village, while in the southeastern part where the Taşdibek Formation is distributed, green schist and creamy yellow to greyish-white equigranular crystalline limestone is dominant. Akpınar Granite intrudes into the limestone. In general, minute fractures are developed in this formation. Skarns are observed near the contact of the limestone with the granite and there are hematite concentrations. There are quartz-limonite veins (strike N10°W, dip 55°E, 46cm thick) in the granitic body.

Metamorphosed volcanics and sedimentary rocks are usually greyish-green in colour, intensively fractured and locally display schistosity. They are highly rigid in places and having intensive hematitization, limonitization and silicification along some fractures. Quartz veinlets occur in a widespread area as parallel to schistosity, although they occasionally intersect the schistosity.

Crystallized limestone outcrops occur in the vicinity of Akpınar Village, and are grey, greyish-white coloured, intensively fractured, locally very hard to break down and bear dissolution cavities. A saccharoidal texture is developed in some sections of the limestone due to the effect of the granitic intrusion in skarnization of some parts.

2-2-2 Kirazlı Conglomerate

Distribution: Small-scale distribution surrounding the outcrop or directly overlying the Taşdibek Formation was observed in the downstream section of Köserelik Stream.

Lithology and occurrence: This formation consists of pàle green siltstone, fine-grained tuff and greyish-white to dark grey conglomerate. The pebbles are mostly chert, green schist, and quartzite, and they are well rounded.

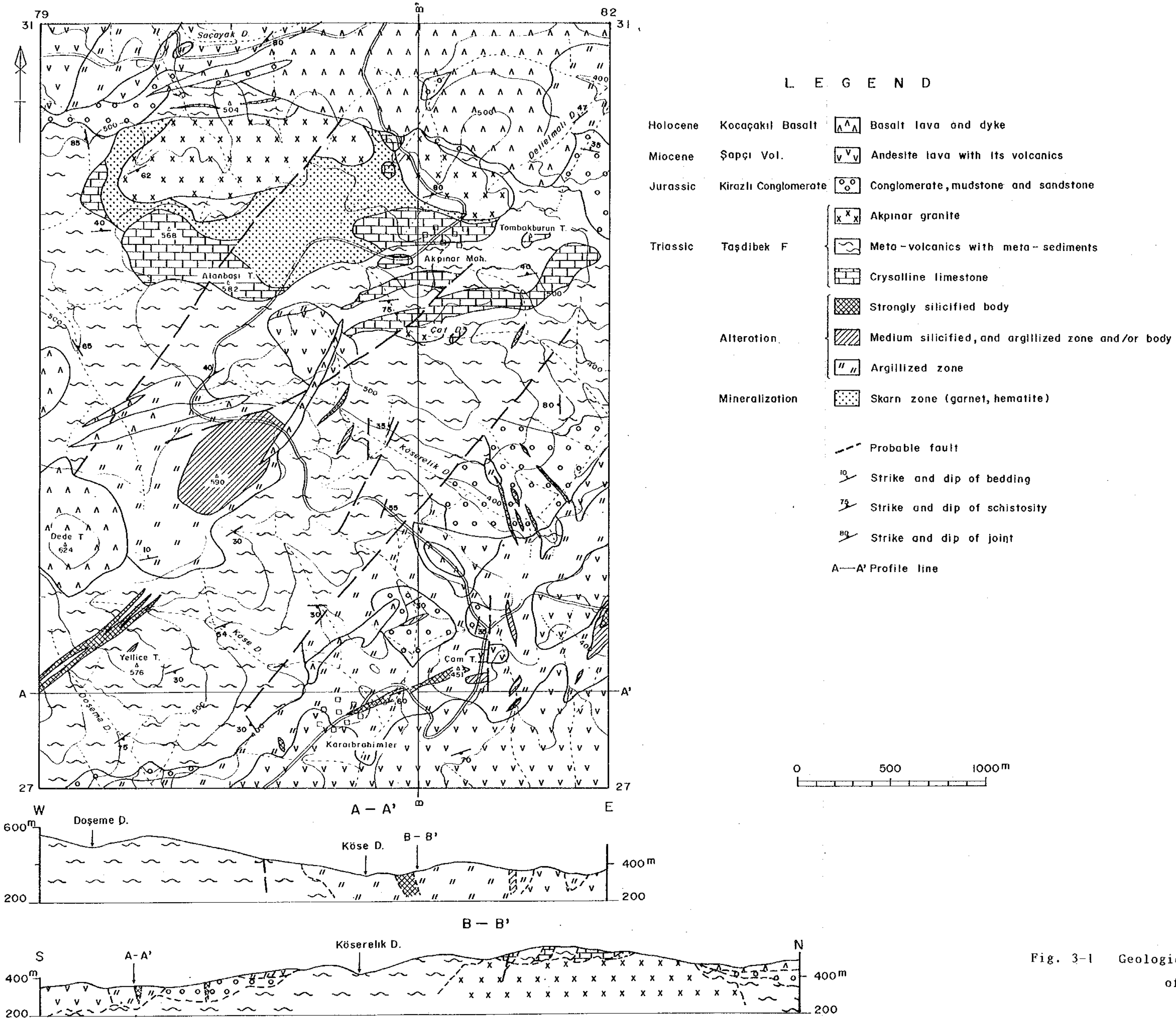
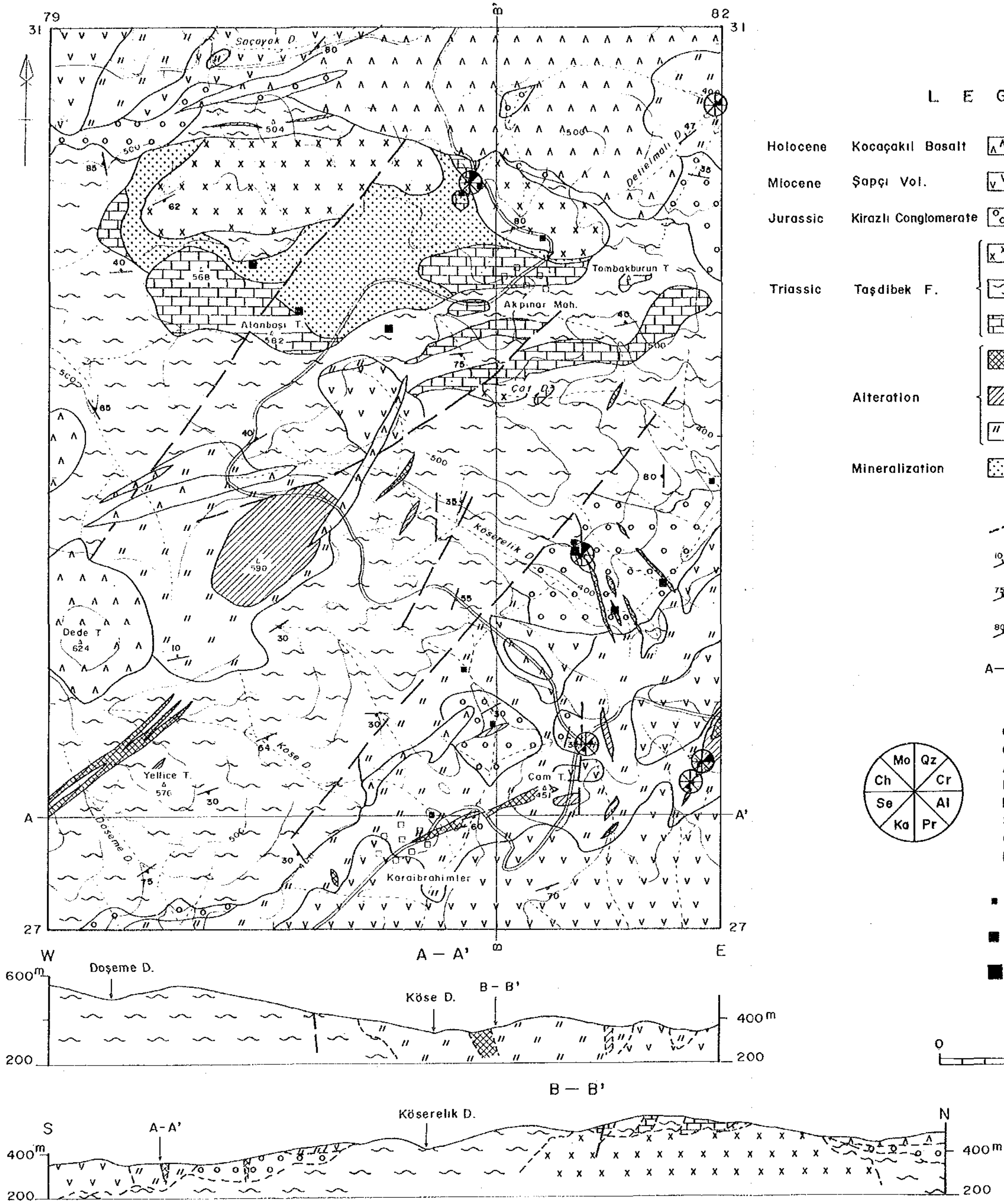


Fig. 3-1 Geologic Map and Cross Section of the Karaibrahimler Area



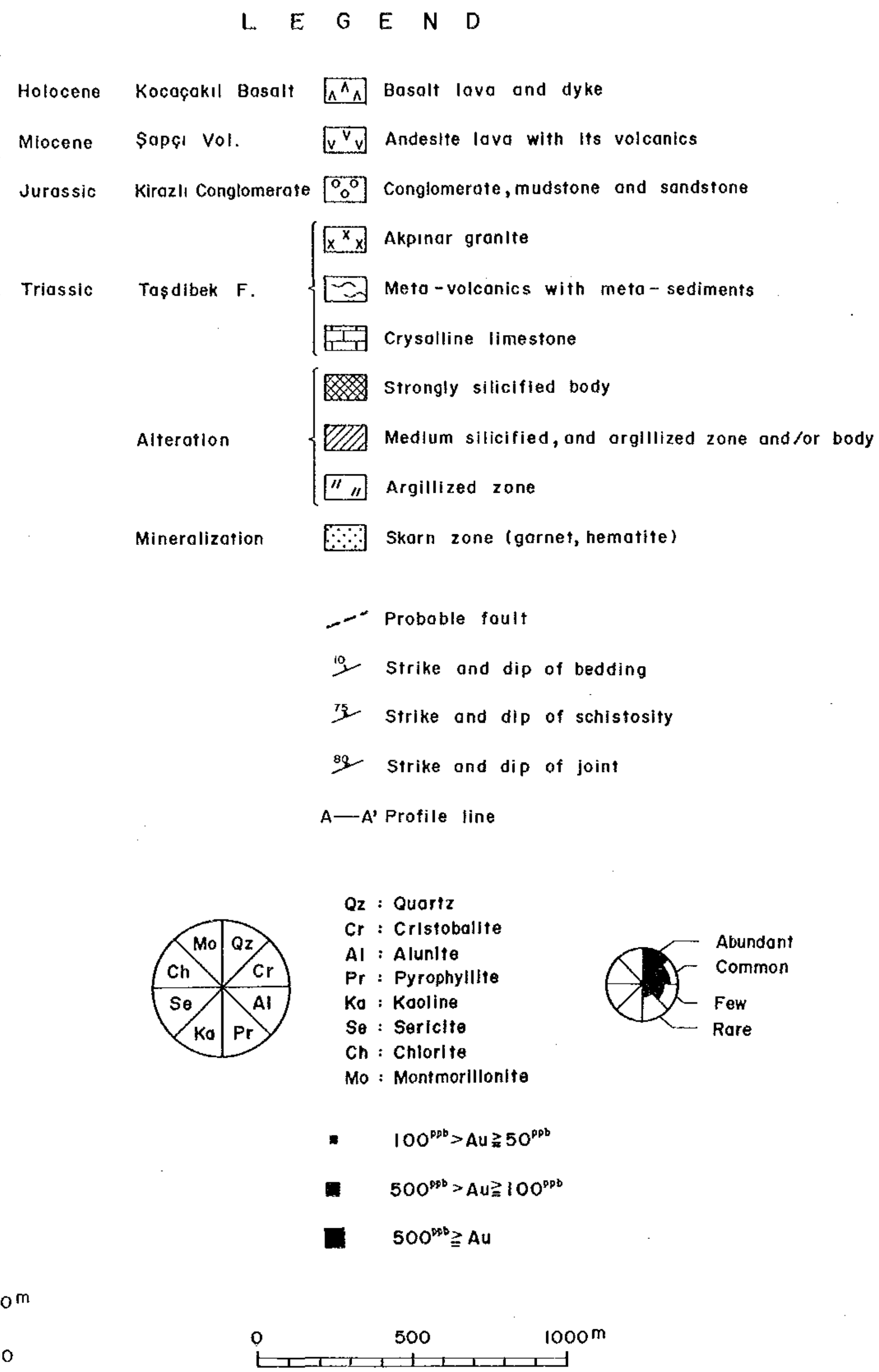


Fig. 3-2 Gold Occurrence and Alteration Map of the Karaibrahimler Area

They are mostly 1～3cm, but there are cobbles of 20～30cm. The rock is argillized, and pyrite occurs scattered in the conglomerate. The formation is without bedding throughout most of the zone. From the pebbles and the relationship with the overlying Tertiary system, this is inferred to be a Jurassic formation.

2-2-3 Şapçı Volcanics

Distribution: This is distributed from Karaibrahimler Village to Köşerelik Stream.

Lithology and occurrence: The major part of these rocks are andesite lava accompanied by andesitic pyroclastics, mainly tuff. The unaltered part of these rocks are dark grey and purple and locally blackish in colour, and generally they are argillized and silicified to weak to medium intensity with strong alteration in some parts.

Generally, the argillized parts are cream yellow, but hematitized or limonitized parts are reddish brown to brown. Altered minerals consists of mainly kaoline and a small amount of montmorillonite and sericite.

Silicification zones often result in the formation of isolated mountains. The original rocks of these localities are difficult to identify. Many of the joints and fissures in the southwestern part of the zone trend E-W, although the strike is generally not discernible. The structure of these volcanic rocks is mostly massive form, but the strike of the fine-grained tuff varies in many directions, N-S, NE-SW, E-W, and the dip is 20-30° near Akpınar Village in the central part of this zone.

It is shown microscopically that the most abundant phenocrysts are plagioclase with mainly hypersthene, hornblende and augite. The argillization is kaolinization; chlorite and epidote occur.

2-2-4 Kocaçakıl Basalt

Distribution: This basalt lava occurs in limited parts at Dededağ (elevation: 624m) in the western part and also to the north of Tombakburun Hill. The basaltic dykes striking NE-SW are distributed in the center of the survey area.

Lithology and occurrence: The rock is a black～dark green, fine-grained compact basalt. Joints are developed and the many pyroxene phenocrysts are unaltered. It forms blocks of 20～30cm in diameter and seems to have flowed to the depressions with a structure that follows the topography.

2-3 Akpınar Granite

Akpınar Granite is observed in the northern part of Akpınar Village stretching in an east-west direction. A small outcrop of Cemiyetalanı and Çap Stream shows the microcrystalline texture, although microcrystalline-texture-showing granites are traced in the vicinity. The granite is hard and tough in general and arenitized along its contact with the limestone. The jointing and fracturing system are conspicuous. Skarnization is observed over a extensive area along the contact between limestone and granite, exhibiting garnet, quartz, calcite and ore minerals, galena, hematite, malachite and azurite particularly south of Dabanlı Çeşme.

Chemically, this granitoid has granodiorite composition. It is hornblende diorite in the northern part of Alanbaş Hill. It is relatively fine-grained and holocrystalline. Weak chloritization is observed microscopically.

2-4 Geologic Structure

In the central part of this zone, the basement composed of the Taşdibek Formation and Akpınar Granite has been uplifted and is unconformably overlain by Tertiary volcanic rocks. The volcanic rocks are often massive, and it is not easy to understand the geologic structure. Although the Şapçı Volcanics do not have bedding and the structure is unclear, it is assumed that the structure is gentle and wavy.

An anticlinal structure is not clearly observed except in the above uplifted area, and synclinal structures are observed in the Karaköy Formation.

The fractures in this zone occur in various directions, but the frequencies are low. Lineaments in the NE-SW direction in the central part of the zone determined from Landsat data. Although it was not confirmed by surface study, faults with NE-SW and NWN-SES directions were inferred to be associated with those lineaments, as well as Kocaçakıl basalt dykes with these directions.

CHAPTER 3 ALTERATION ZONES

The Şapçı Volcanics have been silicified and argillized near the Taşdibek Formation. Unaltered andesites are observed further from the basement rocks. The strongly altered parts are shown in Figure 3-1.

The silicified zones which occur on slopes with thick vegetation and relatively flat areas were newly found during the geological survey. The strongly silicified zones are surrounded by silicified and argillized zones. The strongly silicified rocks are massive and stratified, but there are also brecciated sections which do not show the structure of the original rocks. They are hard, compact and porous. The colour is mostly white, but it becomes dark grey when containing pyrite, red with hematite and yellow to brown with limonite. Clay minerals (mainly kaoline) are sometimes contained in small amounts in the noncompact parts. Native sulfur, chrysocolla and other minerals occur in some druses.

Argillized zones occur surrounding the silicified zone. The clay zones consist of white parts and yellow-brown parts. The former consists mainly of quartz and clay minerals (kaoline, pyrophyllite, alunite etc.) while the latter parts contain limonite and hematite aside from the clay minerals. These are probably products of oxidation of pyrite and other sulfides.

CHAPTER 4 GEOCHEMICAL PROSPECTING OF CHIP SAMPLES

4-1 Sampling

Chip samples were collected from the $12km^2$ geological survey area and the vicinity of the MTA concession in the center of Zone B. Sampling density was five samples per square kilometer. Mostly silicified and argillized zones were sampled because of the expected epithermal gold mineralization.

4-2 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 SPECIFIC ION method, arsenic, selenium, mercury barium and thallium by atomic absorption spectrometry, and other elements by ICP-AES method. The limits of detection of the elements are shown in Table 2-1.

4-3 Statistical Analysis of the Chemical Results

(1) Outline of Method

The basic statistical values and correlation matrices of the chemical values of the chip samples were calculated, and principal component analysis was carried out in the same manner as in the first phase.

(2) Basic Statistical Values

The basic statistical values for the 12 analyzed components with a population of 98* samples were calculated. Of the 12 components, gold content was at times below the detection limit, and thus less than 2.5ppb was used for samples below 5ppb. The amount of arsenic, barium and thallium was high while that of copper, molybdenum, lead, zinc, silver, selenium and mercury was low.

The basic statistical values are shown in Table 3-1 (* 34 samples from the first phase and 64 samples from the second phase).

Table 3-1 Basic Statistical Values of Chip Samples
(Number of Samples:98)

Element	Mean	Dispersion	S.D.	Min.	Max.
Au	6.971	0.396	0.629	2.50	490.0
Cu	25.709	0.386	0.622	1.00	6800.0
Mo	2.317	0.326	0.571	0.50	404.0
Pb	22.370	0.817	0.904	1.00	10000.0
Zn	37.205	0.667	0.817	1.00	9000.0
Ag	0.279	0.279	0.528	0.10	100.0
As	41.113	0.611	0.782	1.00	7200.0
Se	0.291	0.277	0.526	0.10	12.0
Hg	92.358	0.416	0.645	10.00	3700.0
F	126.089	0.147	0.383	20.00	1650.0
Ba	131.334	0.265	0.515	20.00	2600.0
Tl	0.347	0.238	0.488	0.05	5.8

(3) Principal Component Analysis

The values for gold, many of which were below the detection limit, were processed by the same method as for the basic statistical values. Also as in the case for the first phase, principal component analysis was carried out with all samples as the population. The correlation matrix is shown in Table 3-2. It can be seen that when the elements up to an accumulated proportion of 77% are taken, the eigenvalue will generally 0.85 and the proportion 7.1%. Thus, those up to the fifth principal component express the major variations of this area.

First principal components: The components with large absolute eigenvector are copper, molybdenum, lead, zinc, arsenic, silver and mercury.

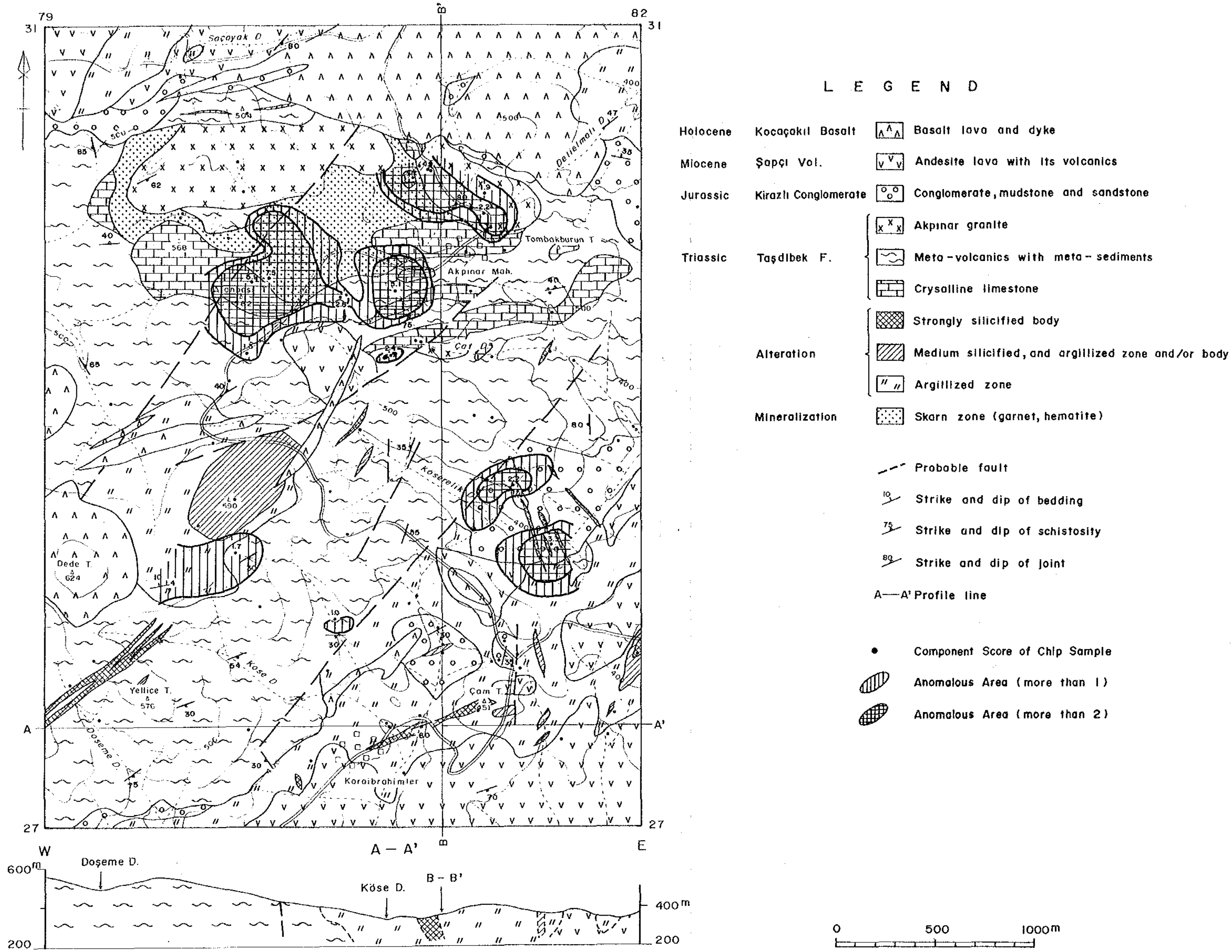
Second principal components: Fluorine, barium and thallium show positive values.

Third principal components: Mercury shows positive while copper and zinc show negative values.

Fourth principal components: Gold and selenium show positive while lead and barium show negative values.

Fifth principal components: Molybdenum shows positive while arsenic and mercury show negative values.

The above are the components with high absolute eigenvectors. The first principal components are metallic elements, and they express the variation caused by epithermal mineralization. These are the elements with high concentration in the mineral showings in all five areas. The proportion is somewhat low but the eigenvalues are high. The second principal components are mostly nonmetallic with high scores in areas excepting alteration zones. Thus these are considered to express variations caused by igneous activity and



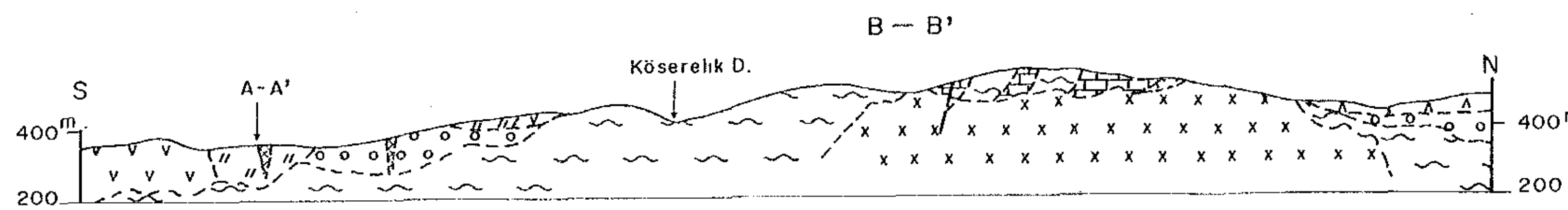


Fig. 3-3 Map of Component Scores of Chip Samples in the Karaibrahimler Area

other factors. The third, fourth and fifth principal components are believed to indicate a part of the mineralization because they contain metals although the proportion and the eigenvalues are low. By showing the localities with the first principal component exceeding 1 on the map (Figure 3-3), it is shown to cover most of the localities where gold was detected.

Table 3-2 Coefficients and Covariance Matrix of Chip Samples

	Au	Cu	Mo	Pb	Zn	Ag	As	Se	Hg	F	Ba	Tl
Au	0.396	0.315	0.261	0.372	0.177	0.452	0.307	0.379	0.449	0.020	-0.118	0.160
Cu	0.123	0.386	0.203	0.375	0.701	0.519	0.411	0.215	0.274	0.134	-0.096	0.105
Mo	0.094	0.072	0.326	0.598	0.286	0.540	0.386	0.443	0.443	-0.006	0.056	-0.034
Pb	0.212	0.211	0.309	0.817	0.500	0.672	0.535	0.287	0.479	-0.189	0.046	0.094
Zn	0.091	0.356	0.133	0.369	0.667	0.483	0.411	0.167	0.116	0.192	-0.019	0.143
Ag	0.150	0.170	0.163	0.321	0.208	0.279	0.323	0.341	0.387	-0.134	-0.032	-0.014
As	0.151	0.200	0.172	0.378	0.263	0.133	0.611	0.424	0.558	-0.096	-0.018	0.173
Se	0.125	0.070	0.133	0.137	0.072	0.095	0.174	0.277	0.368	0.090	-0.035	0.189
Hg	0.182	0.110	0.163	0.279	0.061	0.132	0.282	0.125	0.416	-0.111	0.016	0.190
F	0.005	0.032	-0.001	-0.065	0.060	-0.027	-0.029	0.018	-0.027	0.147	0.247	0.402
Ba	-0.038	-0.031	0.016	0.022	-0.008	-0.009	-0.007	-0.010	0.005	0.049	0.265	0.434
Tl	0.049	0.032	-0.010	0.041	0.057	-0.004	0.066	0.049	0.060	0.075	0.109	0.238

Table 3-3 Eigenvectors and Eigenvalues of Chip Samples

	Z(1)	Z(2)	Z(3)	Z(4)	Z(5)	Z(6)	Z(7)	Z(8)	Z(9)	Z(10)	Z(11)	Z(12)
Au	0.28950	-0.01686	0.15639	0.46401	0.01046	0.60696	0.01814	0.08139	0.50230	-0.20848	0.05466	0.04390
Cu	0.31619	0.07602	-0.50334	0.14611	-0.16535	0.01898	0.00840	-0.47769	-0.16088	-0.28300	-0.12880	-0.49094
Mo	0.33078	-0.08456	0.19741	-0.28378	0.51124	-0.18685	0.30069	0.10433	-0.02927	-0.57901	-0.17201	0.02578
Pb	0.39261	-0.10108	0.02032	-0.35659	-0.04736	0.10011	-0.01910	0.45134	0.05759	0.31879	0.23815	-0.57453
Zn	0.30619	0.13243	-0.55976	-0.10648	-0.04042	-0.13872	-0.07139	0.17168	0.10270	-0.10730	0.48564	0.50069
Ag	0.37835	-0.13817	-0.12559	-0.17352	0.22417	0.37919	-0.17702	-0.13521	-0.27427	0.39857	-0.44294	0.34343
As	0.34853	0.00079	0.10462	0.04409	-0.42860	-0.49965	0.01650	0.04217	0.42676	0.13382	-0.46464	0.11966
Se	0.28010	0.06972	0.28856	0.35232	0.37578	-0.35543	-0.56233	-0.18443	-0.07266	0.12121	0.25428	-0.08304
Hg	0.32600	-0.03317	0.38507	0.09256	-0.30577	0.00692	0.50948	-0.27692	-0.36496	0.13978	0.35505	0.16486
F	-0.00825	0.57199	-0.18047	0.24790	0.40300	-0.08821	0.47386	0.06860	0.10110	0.39027	-0.09388	-0.08919
Ba	-0.00520	0.49427	0.22427	-0.56004	-0.02746	0.16078	-0.14033	-0.46745	0.33854	-0.00699	0.11046	0.00859
Tl	0.09720	0.60209	0.16837	0.06691	-0.27476	0.11670	-0.22826	0.40884	-0.43180	-0.25437	-0.18563	0.03530
Eigenvalue	4.22217	1.78194	1.35448	1.02700	0.84605	0.76002	0.53164	0.44404	0.38251	0.24545	0.21999	0.18473
Proportion	0.35185	0.14850	0.11287	0.08558	0.07050	0.06333	0.04430	0.03700	0.03188	0.02045	0.01833	0.01539
Accum. Prop.	0.35185	0.50034	0.61322	0.69880	0.76930	0.83264	0.87694	0.91394	0.94582	0.96627	0.98461	1.00000

CHAPTER 5 DISCUSSION

5-1 Alteration Zones

The silicified and argillized zones of the Karaibrahimler area are mainly distributed in the vicinity of Karaibrahimler Village. Small-scale silicified veins occur along the Köserelik Stream and in the upstream part of Doşeme Stream. The gold content was determined from a few chip samples collected during two years. These auriferous samples were mainly found in the silicified veins of Köserelik Stream. The silicified veins consist of massive, brecciated and porous parts which gradually change into each other. Generally, the massive part is in the center of the silicified zones; porous and brecciated parts occur in the margin, and the silicified zones are accompanied by limonite and hematite due to oxidation. The quantity of limonite is low in the massive part and high in the porous part.

5-2 Alteration of the Deeper Zone

Only a geological survey only was carried out in the area during the two years. It is inferred that silicified veins correspond to the lower parts of the silicified zone in consideration of geological and drill surveys of the Arlık area and the thinning of silicified zones in the subsurface, and argillized zones accompanied by pyrite dissemination occur surrounding the silicified zone.

5-3 Mineralization

As auriferous samples were found in the Köserelik Stream and gold grains were detected in the vicinity of Karaibrahimler Village, the results of the second phase indicate the possibility of small-scale low-grade gold mineralization in the alteration zones.

CHAPTER 6 CONCLUSIONS AND RECOMMENDATIONS

6-1 Conclusions

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.

6-2 Recommendations for the Third Phase

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 with the second phase.

PART IV KESTANE DAGI AREA

PART IV KESTANE DAGI AREA

CHAPTER 1 GEOLOGICAL SURVEY OF THE KESTAN DAĞI AREA

1-1 Outline

The Kestane Mountains area locates in the western part of Zone B. The basement rocks of this zone are the Taşdibek Formation consisting of weakly metamorphosed green schist. This formation is distributed in the marginal part of the northeast area. Kirazlı Conglomerate, distributed in a north-west direction in the eastern part, covers this basement rock unconformably.

The intermediate volcanic activity began in the Eocene and the units progress from Çamyayla Volcanics, Şapçı Volcanics to Osmanlar Volcanics; then the Karaköy Formation consisting of conglomerates deposited during the long quiescent interval. Şapçı Volcanics are extensively distributed in the area.

Kestane Mountain and Çatalkaya Hill consisting of silicified zones form the protruding topography, and argillized zones are extensively distributed on the slope of the hill, the unaltered andesitic rocks are observed far from the hill.

As a result of the heavy mineral study, it is inferred that gold mineralization occurs in the silicified and argillized zones of Şapçı Volcanics.

1-2 Objective of the Survey

A significant amount of gold grains was detected in the samples collected from the upstream section of Hacıkar Stream, and auriferous rocks were found in the vicinity of Kestane Mountain and Çatalkaya Hill. Thus geological and geochemical surveys were conducted in the Kestane Mountain area.

1-3 Contents of the Survey

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

Survey	Laboratory Studies	Quantity	Components for Analysis
Geol. S. Geoch. S ($9km^2$)	Chip Samples	74pcs	Cu, Pb, Zn, Au, Ag, Mo, Hg, As, F, Ba, Tl, Se
	Total Rock Analysis	2pcs	SiO_2, TiO_2, Al_2O_3, Fe_2O_3, MnO, MgO CaO, Na_2O, K_2O, P_2O_5, LOI, FeO
	Thin Section	2pcs	
	X-ray Diffractive M.	3pcs	
	Isotopic Age	1pcs	K-Ar Method

CHAPTER 2 GEOLOGY OF KESTAN DAĞI AREA

2-1 General Geology

The Kestane Mountain area locates in the western part of Zone B. The geology of this area mainly consists of Kirazlı Conglomerate, Şapçı Volcanics and talus deposits. The stratigraphic column, geologic map, geologic cross sections, gold occurrence and alteration map are shown in Figures 1-4, 4-1 and 4-2.

2-2 Stratigraphy

2-2-1 Kirazlı Conglomerate

Distribution: Pekmez Stream and the south slope of Kök Hill.

Lithology and occurrence: This conglomerate is observed along the eastern part of the area as well as southwest of the area. In the eastern part, their colours are in light greyish-brown, green and greenish-grey. Locally they are a conglomerate and sandstone, respectively. Bedding is sometimes distinctive. They are well packed and rather rigid, bearing hematite, limonite and sometimes, pyrite along the fractures. Argillization, silicification and pyritization are locally observed, but not intensely. They are generally dark green in colour and show alteration of sandstone and siltstone in the southwestern part of the area. They are highly fractured and bear quartz veins with thicknesses of a few cm to 20 cm, especially within the moderately silicified sections. The quartz veins also bear pyrite. Fine-grained sections of the formation have been silicified. Where silicification has taken place, the colours are greyish-white and light brown. Disseminated pyrite, which is mostly limonitized, is also observed in these silicified parts.

2-2-2 Şapçı Volcanics

Distribution: This is extensively distributed in the vicinity of Kirazlı Mountain, Kestane Mountain and Çatalkaya Hill, and the western parts of the area.

Lithology and occurrence: The major part of these rocks are andesite lava accompanied by andesitic pyroclastics, mainly tuff. The unaltered part of these rocks are dark greyish-purple and locally blackish, and generally they are argillized and silicified to weak to medium intensity with strong alteration in some parts.

Argillization of these rocks can be grouped into unaltered to weakly altered parts and intermediate to strongly altered parts. There are parts to the west

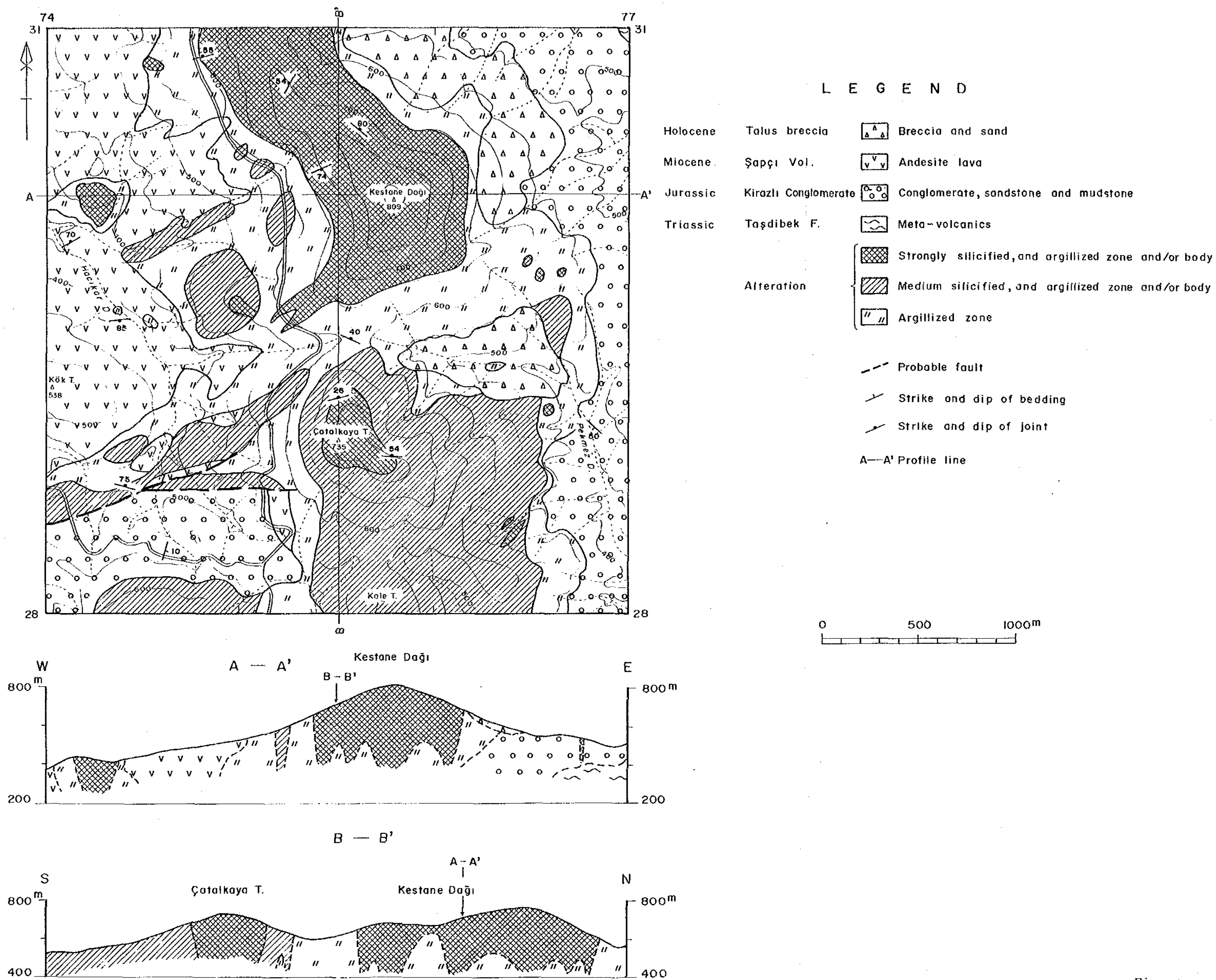
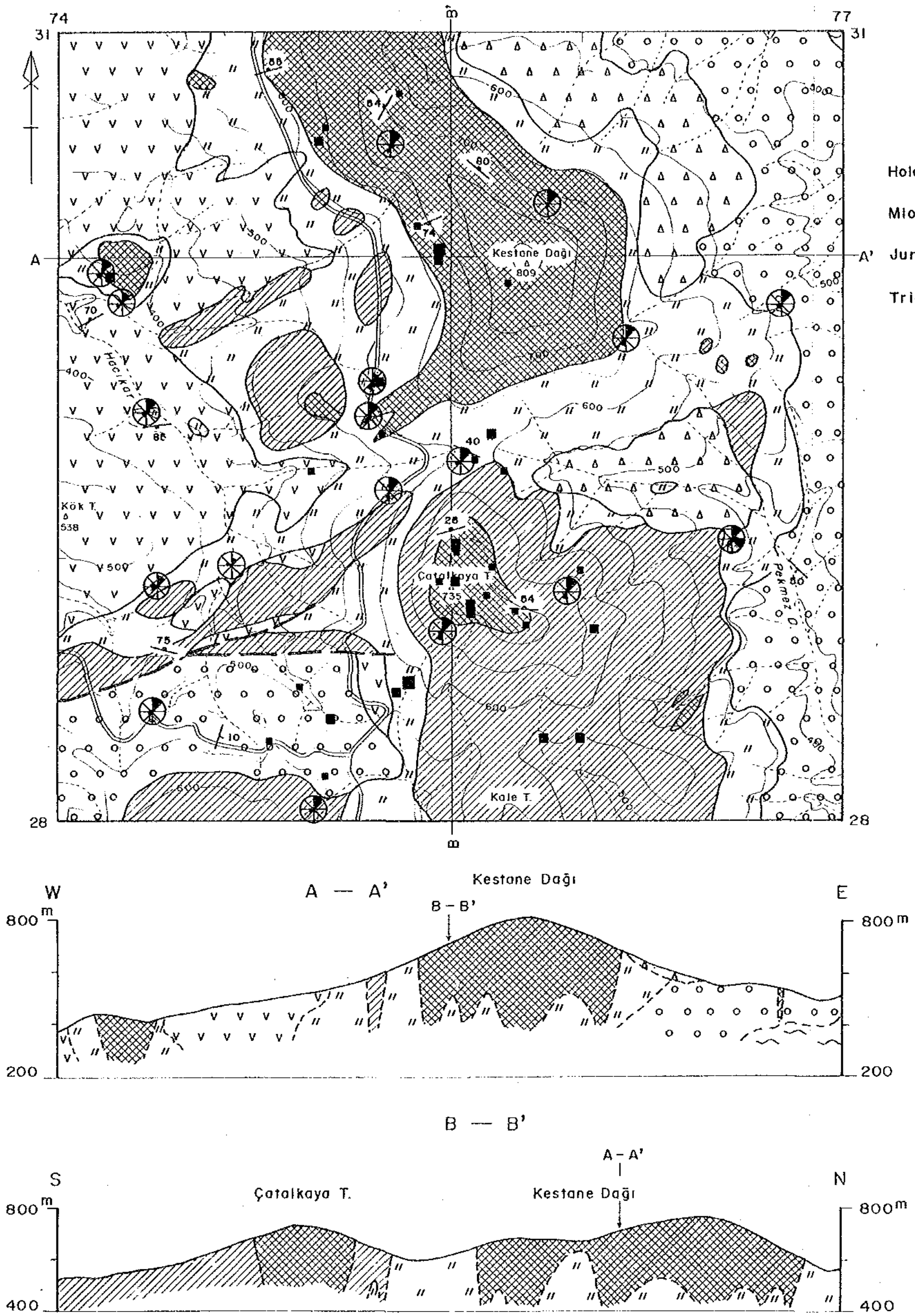


Fig. 4-1 Geologic Map of the Kestane Dagı Area



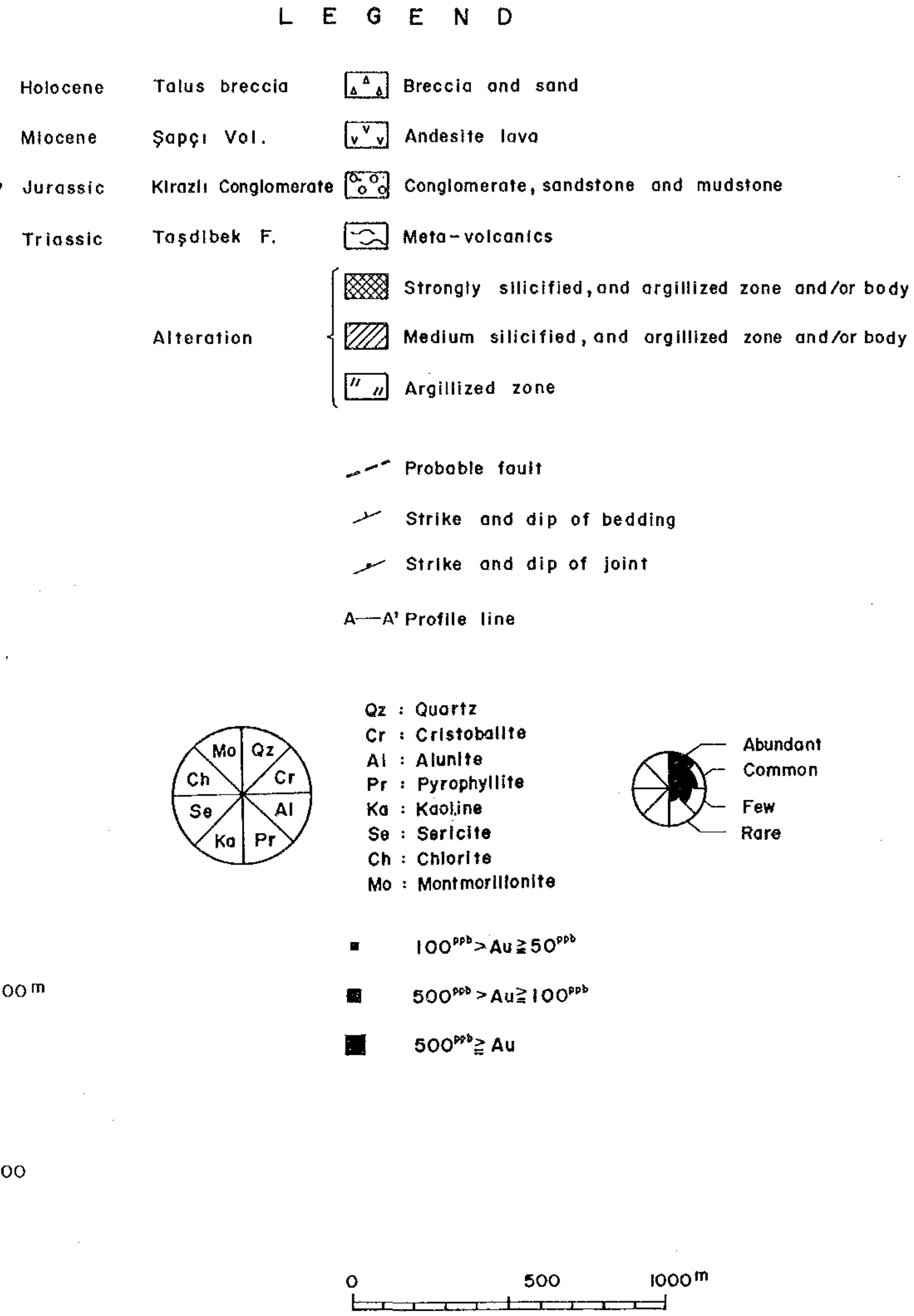


Fig. 4-2 Gold Occurrence and Alteration Map of the Kestane Dağı Area

of Kestane Mt. where the two types of alteration occur mixed. Generally, the argillized parts are creamy yellow to white, but hematitized or limonitized parts are reddish brown to brown.

Silicification zones often result in the formation of isolated mountains and examples are, among others, Kirazlı Mountain, Kestane Mountain and Çatalkaya Hill. The original rocks of these localities are difficult to identify. Many of the joints and fissures in the southern and southwestern parts of the area trend E-W, although the strike is generally not discernible.

The structure of these volcanic rocks is mostly the massive form, but the strike of the Kirazlı Conglomerate is, in general, a N-S direction, and the dip is 20-30° west in the vicinity of Pekmez Stream into eastern part of this area. Hence it is inferred that the thickness of Şapçı Volcanics increases westward.

It is shown microscopically that the most abundant phenocrysts are plagioclase with mainly hornblende and augite. The argillization is kaolinization, and chlorite and epidote occur.

2-2-3 Talus Deposits

Distribution: These deposits are found around Pekmez Stream and the northeastern slope of Kestane Mountain.

Lithology and occurrence: The deposits consist of limonitic brownish silicified rock and massive grey silicified rock. The shape of these rocks is angular, and the matrix material is limonitic sand. Talus deposits are consolidated but not hard.

2-3 Geologic Structure

In the central part of Zone B, the basement composed of the Taşdibek Formation and Akpınar Granite is uplifted and are unconformably overlain by Tertiary volcanic rocks. The volcanic rocks are often massive and it is not easy to understand the geologic structure, but the Çamyayla Volcanics in the northern part of the zone dip gently southward. Although the Şapçı Volcanics do not have bedding and the structure is not clear, it is assumed that the dip of Şapçı Volcanics is 20-30° west due to the structure of Kirazlı Conglomerate. The fractures in this area occur in various directions, but the frequencies are low. Lineaments in a NE-SW direction in the southeastern part of the zone (the central part of the remote-sensing zone) were determined from Landsat data. Although it was not confirmed by surface study, faults were inferred in the NE-SW and N-S directions associated with those lineaments.

CHAPTER 3 ALTERATION ZONES

3-1 Outline of Alteration Zones

The Şapçı Volcanics have been silicified and argillized almost throughout the area. The strongly altered parts are shown in Figure 4-1. The silicified zones often result in protruding topography. They can be identified by Landsat images and were observed as widespread along the north to south direction of Kestane and Kirazlı Mountains, and on Çatalkaya Hill as huge bodies. They are usually greyish-white, brownish-grey and reddish brown, have rigid and massive structure, and are also highly fractured. The fractures have been filled by limonite and hematite. Intensive argillization is observed between the silicified blocks as well as surrounding the blocks. There is a working kaoline mine site near the Kirazlı Conglomerate contact on the eastern slope of Kestane Mountain.

3-2 Kestane Alteration Zones

The alteration zones are distributed from Kestane Mountain to Kirazlı Mountain. The scale of alteration zones is 21,000m X 1,000m; one of the strongly silicified bodies is 1,500m X 500m. The outcrops of silicified bodies mainly occur from the top of Kestane Mountain to the western slope, and consist of massive and porous parts. The colours are white to creamy yellow. The silicification of the Kestane alteration zones is stronger than that of other bodies. The quantity of limonite is high in this locality.

The fractures in the silicified zones trend NE-SW and NW-SE; the former is very common. It is considered to be the main fracture.

Gold was detected in two chip samples and heavy mineral samples collected from the upstream section of Hacıkar Stream.

3-3 Çatalkaya Alteration Zones

The silicified zones occur in the vicinity of Çatalkaya Hill. Alteration zones are distributed from the top of the hill to the western slope. The scale of the alteration zones is 1,000m X 1,000m. The silicified zones are the same as those of Kestane Mountain. Gold was detected in nine chip samples.

CHAPTER 4 GEOCHEMICAL PROSPECTING OF CHIP SAMPLES

4-1 Sampling

Chip samples were collected from the 9km^2 geological survey area and the vicinity of the MTA concession in the center of Zone B. Sampling density was nine samples per square kilometer. Mostly silicified and argillized zones were sampled because of the expected epithermal gold mineralization.

4-2 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 SPECIFIC ION method, arsenic, selenium, mercury barium and thallium by atomic absorption spectrometry, and other elements by ICP-AES method. The limits of detection of the elements are shown in the Table 2-1.

4-3 Statistical Analysis of the Chemical Results

(1) Outline of Method

Basic statistical values and correlation matrices of the chemical values of the chip samples were calculated and principal component analysis was carried out in the same manner as in the first phase.

(2) Basic Statistical Values

Basic statistical values for the 12 analyzed components with a population of 140* samples were calculated. Of the 12 components, gold content was at times below the detection limit and thus less than 2.5ppb was used for samples below 5ppb. The amount of gold, lead, arsenic, selenium, mercury, fluorine, barium and thallium was high while that of copper, molybdenum, zinc and silver was low. The basic statistical values are shown in Table 4-1 (*: 66 samples from the first phase and 74 samples from the second phase).

Table 4-1 Basic Statistical Values of Chip Samples
(Number of Samples:140)

Element	Mean	Dispersion	S.D.	Min.	Max.
Au	12.590	0.534	0.731	2.50	3660.0
Cu	15.561	0.334	0.578	1.00	482.0
Mo	2.669	0.258	0.508	0.50	573.0
Pb	74.790	0.677	0.823	1.00	4840.0
Zn	8.057	0.500	0.707	1.00	7000.0
Ag	0.312	0.354	0.595	0.10	100.0
As	42.631	0.459	0.677	1.00	3400.0
Se	1.440	0.420	0.648	0.10	30.0
Hg	143.888	0.657	0.810	10.00	46000.0
F	211.253	0.220	0.469	30.00	2300.0
Ba	206.098	0.205	0.452	20.00	8600.0
Tl	0.304	0.312	0.559	0.05	7.3

(3) Principal Component Analysis

The values for gold, many of which were below the detection limit, were processed by the same method as for the basic statistical values. Also as in the first phase, principal component analysis was carried out with all samples as the population. The correlation matrix is shown in Table 4-2. It can be seen that when the elements up to an accumulated proportion of 74% are taken, the eigenvalue will generally 0.88 and the proportion 7.3%. Thus, those up to the fifth principal component express the major variations of this area.

First principal component: The components with large absolute eigenvector are lead, silver, arsenic, selenium and mercury.

Second principal components: Copper, zinc, fluorine and thallium show positive values.

Third principal components: Gold, molybdenum and fluorine show positive values.

Fourth principal components: Silver and barium show positive while molybdenum show negative values.

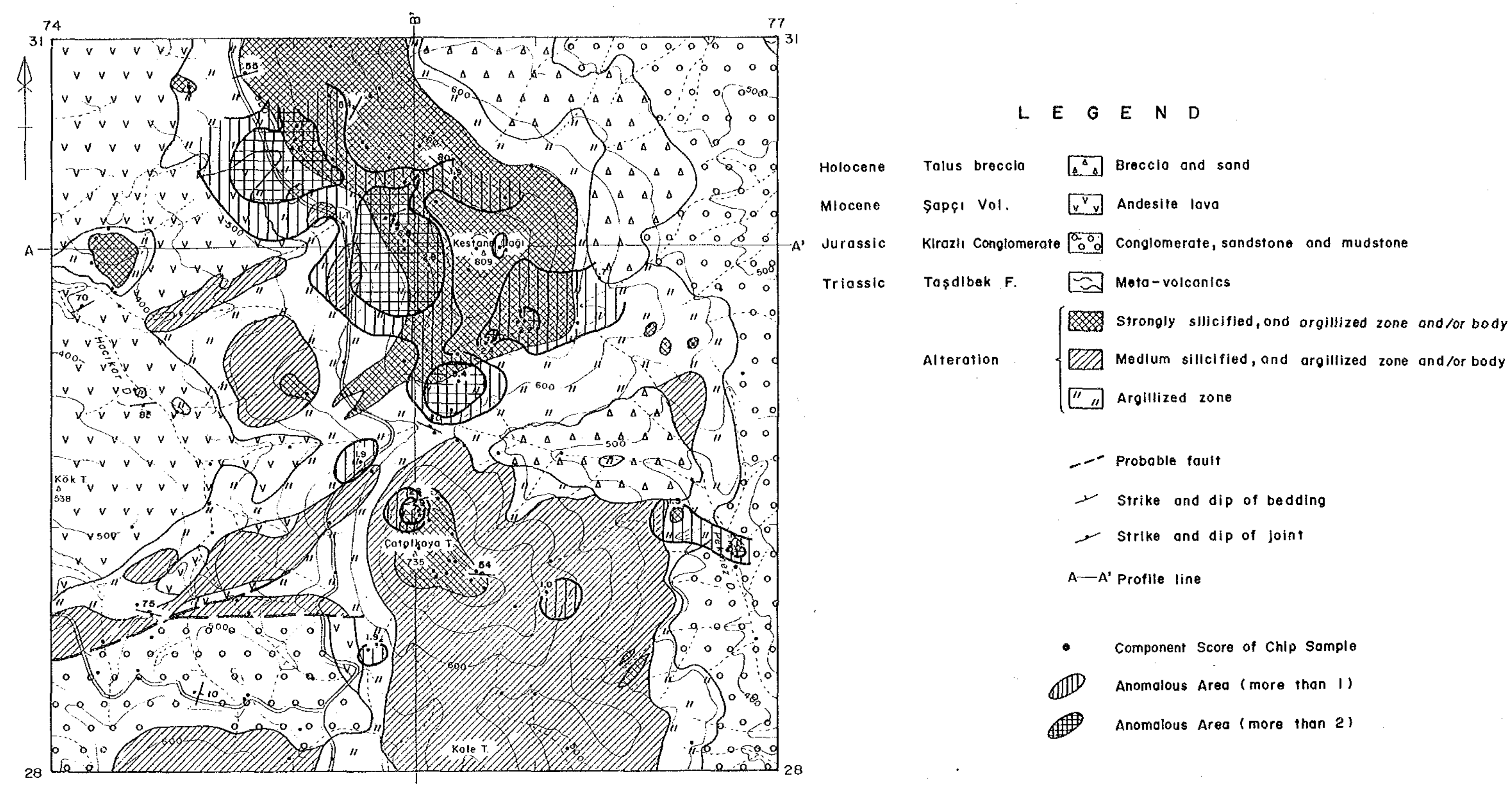
Fifth principal components: Molybdenum, lead and thallium show positive while gold show negative values.

Table 4-2 Coefficients and Covariance Matrix of Chip Samples

	Au	Cu	Mo	Pb	Zn	Ag	As	Se	Hg	F	Ba	Tl
Au	0.534	0.258	0.372	0.126	-0.043	0.192	0.020	0.087	0.176	0.194	0.089	-0.155
Cu	0.109	0.334	0.058	0.225	0.554	0.154	0.473	0.436	0.129	0.036	0.206	0.113
Mo	0.138	0.017	0.258	0.272	-0.212	0.010	0.098	0.146	0.184	0.036	-0.072	-0.151
Pb	0.076	0.107	0.114	0.677	0.115	0.315	0.574	0.328	0.548	-0.191	0.112	-0.179
Zn	-0.022	0.226	-0.076	0.067	0.500	0.057	0.389	0.178	-0.056	0.044	0.106	0.204
Ag	0.084	0.053	0.003	0.154	0.024	0.354	0.237	0.259	0.633	-0.316	0.199	-0.192
As	0.010	0.185	0.034	0.320	0.186	0.095	0.459	0.517	0.331	-0.392	0.022	-0.055
Se	0.041	0.163	0.048	0.175	0.082	0.100	0.227	0.420	0.366	-0.074	0.116	-0.135
Hg	0.104	0.060	0.076	0.365	-0.032	0.305	0.182	0.192	0.657	-0.407	0.121	-0.296
F	0.067	0.010	0.009	-0.074	0.015	-0.088	-0.125	-0.022	-0.155	0.220	0.227	0.286
Ba	0.029	0.054	-0.017	0.042	0.034	0.054	0.007	0.034	0.045	0.048	0.205	0.215
Tl	-0.063	0.036	-0.043	-0.082	0.081	-0.064	-0.021	-0.049	-0.134	0.075	0.054	0.312

The above are the components with high absolute eigenvectors. The first principal components are metallic elements, and they express the variation caused by epithermal mineralization. These are the elements with high content in the mineral showings in all five areas.

The proportion is somewhat low but the eigenvalues are high. The second principal components are mostly nonmetallic with high scores in areas excepting alteration zones. Thus these are considered to express variations caused by igneous activity and other factors. The third principal components are believed to show the variation of the silicified and argillized zones.



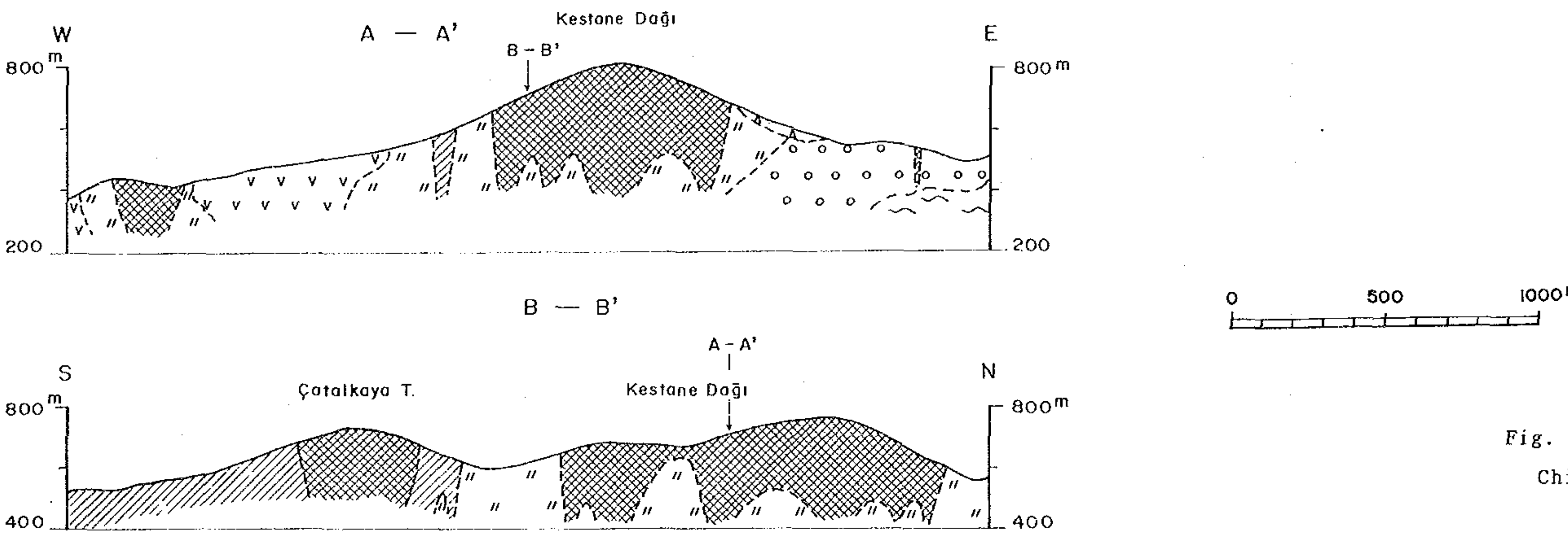


Fig. 4-3 Map of Component Scores of Chip Samples in the Kestane Dagı Area

The fourth and fifth principal components are believed to indicate a portion of the mineralization because they contain metals, although the proportion and the eigenvalues are low. By showing the localities with the first principal components exceeding 1 on maps, Figure 4-3 is shown to cover most of the localities where gold was detected.

Table 4-3 Eigenvectors and Eigenvalues of Chip Samples

	Z(1)	Z(2)	Z(3)	Z(4)	Z(5)	Z(6)	Z(7)	Z(8)	Z(9)	Z(10)	Z(11)	Z(12)
Au	0. 14963	-0. 03504	0. 60757	-0. 05708	-0. 43403	-0. 24881	0. 01302	-0. 05850	0. 49386	0. 14292	-0. 26548	-0. 12366
Cu	0. 29886	0. 44597	0. 10019	-0. 15491	-0. 26918	-0. 00856	0. 12567	-0. 19726	-0. 04830	-0. 57318	0. 46864	0. 00613
Mo	0. 14466	-0. 20300	0. 49221	-0. 36606	0. 32264	-0. 18625	0. 22815	-0. 18063	-0. 56897	0. 11693	0. 00345	0. 02713
Pb	0. 40234	-0. 06207	0. 03882	-0. 05061	0. 43768	-0. 18922	-0. 52202	0. 26147	0. 16804	-0. 09964	0. 17664	-0. 43887
Zn	0. 16081	0. 51264	-0. 19669	-0. 11530	-0. 28688	-0. 22089	-0. 26077	0. 13604	-0. 44528	0. 19068	-0. 43918	-0. 11937
Ag	0. 34428	-0. 15186	-0. 02294	0. 48324	-0. 28286	-0. 14651	0. 22244	0. 26765	-0. 21465	0. 39792	0. 44253	-0. 03912
As	0. 41903	0. 16274	-0. 22067	-0. 26746	0. 18899	-0. 07135	-0. 03218	-0. 17786	0. 31291	0. 39244	0. 08224	0. 58783
Se	0. 36321	0. 13262	0. 03225	-0. 12563	0. 08385	0. 71697	0. 35949	0. 16771	0. 06851	0. 13032	-0. 20036	-0. 30563
Hg	0. 41220	-0. 26452	-0. 00073	0. 28464	0. 03544	-0. 05852	0. 07075	0. 23061	-0. 07669	-0. 50094	-0. 44535	0. 40135
F	-0. 22575	0. 30630	0. 48516	0. 04921	0. 07625	0. 25945	-0. 26431	0. 52584	-0. 06187	0. 05349	0. 15948	0. 40718
Ba	0. 09265	0. 27189	0. 22946	0. 62485	0. 24890	0. 15787	-0. 19611	-0. 57062	-0. 06919	0. 08456	-0. 10553	-0. 01998
Tl	-0. 15537	0. 43265	-0. 00756	0. 16790	0. 41162	-0. 42717	0. 54627	0. 22690	0. 20089	-0. 02814	-0. 09032	-0. 09661
Eigenvalue	3. 28358	1. 99125	1. 54686	1. 20738	0. 87606	0. 73029	0. 61541	0. 51566	0. 44059	0. 33310	0. 28415	0. 17568
Proportion	0. 27363	0. 16594	0. 12891	0. 10062	0. 07300	0. 06086	0. 05128	0. 04297	0. 03672	0. 02776	0. 02368	0. 01464
Accum. Prop.	0. 27363	0. 43957	0. 56847	0. 66909	0. 74209	0. 80295	0. 85424	0. 89721	0. 93392	0. 96168	0. 98536	1. 00000

CHAPTER 5 DISCUSSION

5-1 Alteration Zones

The silicified and argillized zones of the Kestane Mountain area are extensively distributed in the vicinity of mountains and hills. Silicified zones occur in the 1km-east-west and 2km-north-south directions. Gold was found in a few chip samples collected during two years, and auriferous samples were mainly detected in the silicified zones. The silicified zones consist of massive, brecciated and porous parts, which gradually change into each other. Generally, massive part is the center of the silicified zones, and porous and brecciated parts occur in the margin. The silicified zones are accompanied by limonite and hematite due to oxidation. The quantity of limonite is low in the massive part and high in the porous part.

5-2 Alteration of the Deeper Zone

Only the geological survey was carried out in the area during the two years. It is inferred that silicified zones extend to the lower parts of alteration zones in consideration of the geological and drill surveys of the Arlık Area, and the thinning of silicified zones in the subsurface. Argillized zones accompanied by pyrite dissemination occur surrounding the silicified zones.

5-3 Mineralization

The auriferous samples were found in alteration zones of Kestane Mountain and Çatalkaya Hill. Gold grains were also detected in the upstream section of Hacıkar Stream. The amount of arsenic, lead and barium is high in comparison with other areas. The results of the second phase indicate the possibility of large-scale low-grade gold mineralization in the alteration zones.

CHAPTER 6 CONCLUSIONS AND RECOMMENDATIONS

6-1 Conclusions

The Şapçı Volcanics and Kirazlı Conglomerate have suffered hydrothermal alteration in this vicinity. In particular, the Şapçı Volcanics have 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 hills consist of massive, porous and brecciated parts. Silicified veins were not observed in the periphery of silicified bodies. Thus it is considered that their shapes are "mushroom-like" in geologic section.

6-2 Recommendations for the Third Phase

The concession of the Kestane Mountain. area has been purchased by Tüprag Co. 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 with the second phase.

PART V PIREN TEPE AREA

PART V PİREN TEPE AREA

CHAPTER 1 GEOLOGICAL SURVEY OF THE PIREN TEPE AREA

1-1 Outline

The Piren Hill area locates in the southern part of Zone B. The basement rocks of Zone B are not distributed in this area. The geology of the area consists only of Şapçı Volcanics. The silicified zones form the protrudent topography of Büyükçukur Mountain, Geldiren Hill and Piren Hill extending east to west. Argillized zones occur on the slopes of hills and gradually change into unaltered volcanics far from the alteration zones. Gold mineralization was detected in the alteration zones of Şapçı Volcanics.

1-2 Objective of the Survey

The significant result of the first-phase survey, is that the auriferous rocks were found from the chip samples collected on the western slope of Davulgılı Hill and western part of Muratlar Village. Geological and geochemical surveys were conducted in the Piren Hill Area, as well as drill survey in the concession of MTA.

1-3 Contents of the Survey

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

Survey	Laboratory Studies	Quantity	Components for Analysis
Geol. S. Geoch. S ($12km^2$)	Chip Samples	134pcs	Cu, Pb, Zn, Au, Ag, Mo, Hg, As, F, Ba, Tl, Se
	Total Rock Analysis	2pcs	SiO_2, TiO_2, Al_2O_3, Fe_2O_3, MnO, MgO CaO, Na_2O, K_2O, P_2O_5, LOI, FeO
	Thin Section	2pcs	
	X-ray Diffractive M.	7pcs	
Heavy M. S.	Gold Grain	15pcs	
Drill S. (150m X2 hole)	Ore Analysis	100pcs	Au, Ag, Cu, Pb, Zn, Sb, Hg, Mo
	Thin Section	2pcs	
	EPMA Test	2pcs	
	Total Rock Analysis	4pcs	SiO_2, TiO_2, Al_2O_3, Fe_2O_3, MnO, MgO CaO, Na_2O, K_2O, P_2O_5, LOI, FeO
	X-ray diffractive M.	10pcs	
	Liquid Inclusion	4pcs	

CHAPTER 2 GEOLOGY OF PIREN TEPE AREA

2-1 General Geology

The intermediate volcanic activity began in the Eocene and the units progress from Çamyayla Volcanics, Şapçı Volcanics to Osmanlar Volcanics. Only Şapçı Volcanics are distributed in the area. The stratigraphic column, geologic map, geologic cross sections, and the gold occurrence and alteration map are shown in Figures 1-4, 5-1 and 5-2.

2-2 Stratigraphy (Şapçı Volcanics)

Distribution: The Şapçı Volcanics are extensively distributed in the area.

Lithology and occurrence: Şapçı Volcanics consist mainly of andesite, andesitic agglomerate and tuff, and outcrop in a large area. They show grey and purplish grey colours, while their argillized parts show white, and creamy yellow, and tuffaceous parts greyish colour.

The andesites are generally coarsely crystallized and locally arenaceous and appearing like granite, especially in a small area southwest of Geldiren Hill. Exfoliated agglomerates and lavas of andesites also were observed in the area. The unaltered part of these rocks is dark grey and generally argillized and silicified to weak to medium intensity with strong alteration in some parts. The unaltered andesites are rather hard to break down and partly fractured. However, their tuffs locally have distinctive bedding and also show argillization. The tuffaceous layers which were observed in the southwestern part of Geldiren Hill and southeastern part of Hacıdervişler district are used as building stones.

Silicification zones often result in the formation of isolated mountains and examples are, among others, Büyükçukur Mountain, Geldiren Hill and Piren Hill.

The original rocks of these localities are difficult to identify. Many of the joints and fissures in the alteration zones trend NE-SW, although the strike is generally not discernible.

It is shown microscopically that phenocrysts are mostly plagioclase with mainly biotite, hornblende and augite. The argillization is kaolinization and chloritization, and epidote does not occur.

2-3 Geologic Structure

In the central part of Zone B, the basement composed of the Taşdibek Formation and Akpınar Granite is distributed and are unconformably overlain by Tertiary volcanic rocks. The volcanic rocks are often massive and it is not easy to understand the geologic structure, but the Çamyayla Volcanics in the northern part of the zone gently dip southward. Although the Şapçı Volcanics

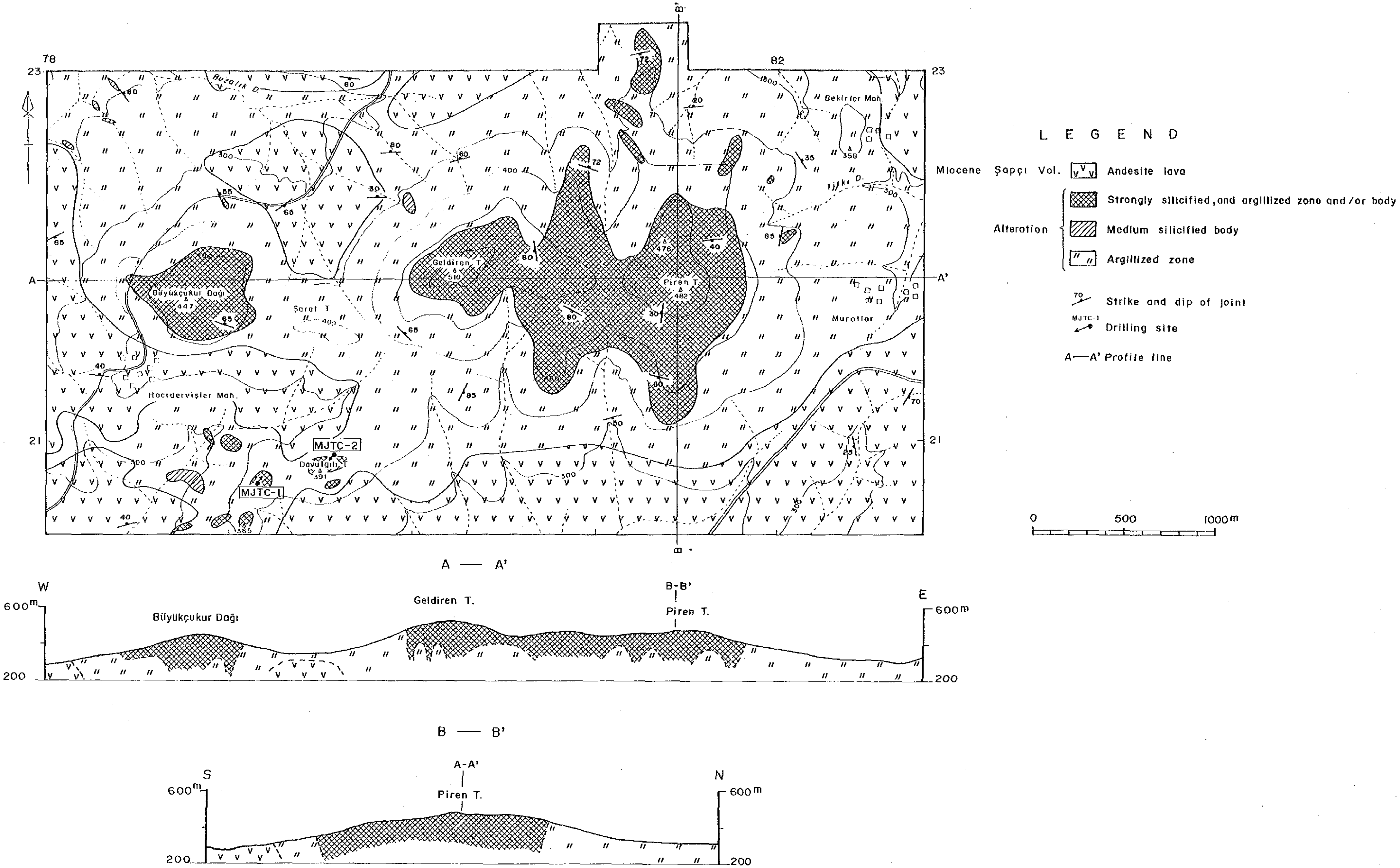


Fig. 5-1 Geologic Map and Cross Sections of the Piren Tepe Area

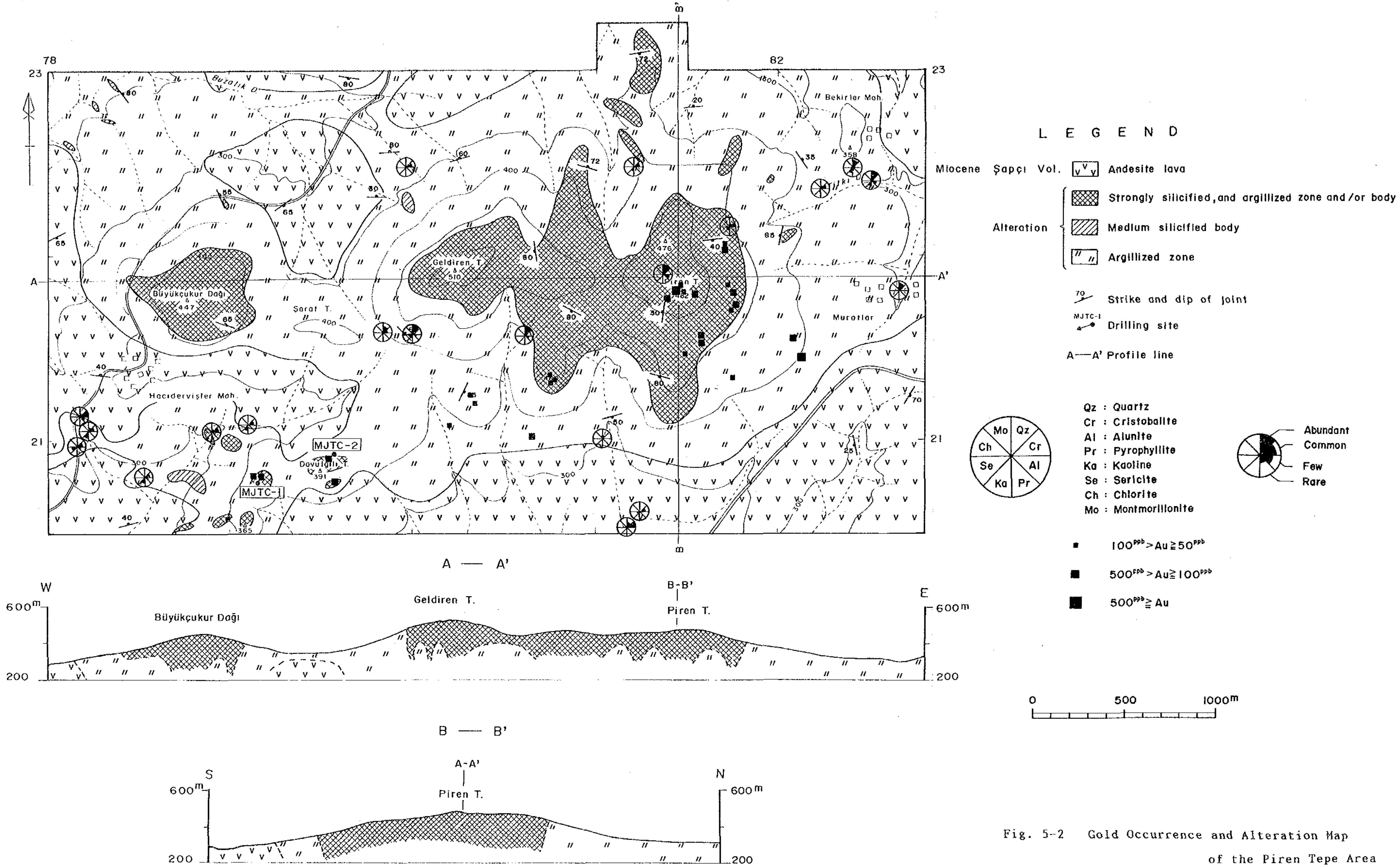


Fig. 5-2 Gold Occurrence and Alteration Map of the Piren Tepe Area

do not have bedding and the structure is not clear, it is assumed that the structure is gentle and wavy.

In the Piren Hill area in the southern part of Zone B, geologic structure is not distinct because of the extensive distribution of Şapçı Volcanics.

The anticlinal structure is not clearly observed except in the above uplifted part, and the synclinal structures are only observed in the Osmanlar Volcanics and the Karaköy Formation.

The fractures in this area occur in various directions, but the frequencies are low. Lineaments in the NE-SW direction in the southeastern part of the area (the central part of the remote-sensing zone) were taken from Landsat data. Although it was not confirmed by surface study, faults were inferred in the NEN-SWS and NW-SE directions associated with those lineaments.

CHAPTER 3 ALTERATION ZONES

3-1 Outline

The Şapçı Volcanics have been silicified and argillized virtually throughout the area. The strongly altered parts are shown in Figure 5-1. The silicified zones often result in protruding topography, which can be identified by Landsat images because of the thin vegetation. The silicified zones occur at the tops and slopes of hills.

The strongly silicified rocks are massive and stratified, but there are also brecciated parts which do not show the structure of the original rocks. They are all aggregates of fine-grained quartz with over 90% SiO_2. They are hard, compact and porous. The colour is mostly white, but it becomes dark grey when containing pyrite, red with hematite and yellow to brown with limonite. Clay minerals (mainly kaoline) are sometimes contained in small amounts in the noncompact parts. Native sulfur, chrysocolla and other minerals occur in some druses.

Argillized zones generally surround the silicified sections as halos and decrease outwards the original unaltered rocks appear. Unaltered blocks are locally located within the argillized zone which have argillized veins and veinlets along fractures and joints. Widespread, intensively argillized sections are observed at eastern Piren Hill which show white colour as well as limonitic colouring in places. Kaoline and alunitic argillized parts are observed south-southwest of Söğütgediği Village.

Sulfur-bearing andesite sections are traced in the stream south of the Söğütgediği District. Additionally, pyrite occurs in a very restricted locality west of the village.

3-2 Büyükçukur Alteration Zones

These zones locate northeast of Hacıdervişler Village and are mainly distributed in the southern slope of Hacıdervişler Mountain. The scale of the alteration zone is 1,000m X 1,000m, and the scale of silicified bodies is 500m X500m at the center of the top of Büyükçukur Hill. The silicified zones are usually greyish white, grey, light brown or reddish brown colours. They consist of massive and brecciated parts, and have undergone moderate silicification. The fractures in this area occur as NE-SW and NW-SE systems. The latter has high frequency and is inferred to be the main system.

Argillized zones generally surround the silicified sections as halos and decrease outwards where the original unaltered rocks appear. Few outcrops are distributed in the argillized zones.

Gold has not been detected in the twelve chip samples or the heavy mineral samples.

3-3 Geldiren Alteration Zones

These zones are distributed from Geldiren Hill to Piren Hill. The scale of the alteration zones is 2,000m X 1,000m, and the scale of silicified zones is 500m X 500m at the center of the top of Geldiren Hill. The silicified zones are observed N-NE and S-SE of Seldiren Hill landmark with white and grey-white colours. They are massive, occasionally porous and also partly fractured. However, the silicified rocks observed at the eastern part of the landmark are of grey, whitish grey, greyish brown and reddish brown colours. They show intensive limonite and hematite veins and stains and are usually porous although sometimes brecciated. The silicification observed at the western part of the hill appear to be at a certain elevation. Additionally, pyrite which is fine grained is traced in some parts of the silicified rocks.

Gold has not been detected in the chip samples.

3-4 Piren Alteration Zones

These zones are distributed in the vicinity of Piren Hill. The scale of the alteration zone is 2,000m X 2,000m, and the scale of silicified zones is 1,300m X 1,300m at the center of the top of Piren Hill. The silicified parts are usually of greyish white, grey, light brown and reddish brown colours. They are to a great extent, massive and to a lesser extent, porous and brecciated, and have vugs and are generally weakly limonitized. Two main fracture systems are identified generally trending in the E-W and N-S directions. The E-W directed fractures are the most dominant ones and are in the form of large fractures and cracks.

Gold was detected in the chip samples collected south of Piren Hill and west of Muratlar Village, and heavy mineral samples were collected from the stream north of Piren Hill.

3-5 Davulgılı Alteration Zones

These zones locate in the southeast of Hacıdervişler Village and are distributed in the eastern slope of Davulgılı Hill. The scale of the silicified zones is 100m x 100m at the drill site of MJTC-1, and 200m x 100m at the drill site of MJTC-2. Two holes were drilled because auriferous rocks were detected in the silicified zones.

Intensively silicified zones and debris are observed at the western slope of the hill as well as at the top of it. They are white and grey-white at the massive parts, while brecciated and fractured parts show reddish-brown and grey colours. They sometimes bear fine-grained pyrite. They are also highly fractured and have joints. Advanced argillization has taken place between the silicified blocks. Limonitization and hematitization are widespread in the brecciated, reddish-brown coloured silicified rocks. The silicified bodies generally locate in the strongly silicified zones and are surrounded by silicified and argillized zones.

CHAPTER 4 GEOCHEMICAL PROSPECTING OF CHIP SAMPLES

4-1 Sampling

Chip samples were collected from the 12km^2 geological survey area and the vicinity of the MTA concession in the southern part of Zone B. Sampling density was seventeen samples per square kilometer. Mostly silicified and argillized zones were sampled because of the expected epithermal gold mineralization.

4-2 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 SPECIFIC ION method, arsenic, selenium, mercury barium and thallium by atomic absorption spectrometry, and other elements by ICP-AES method. The limits of detection of the elements and results of chemical analysis are shown in the Table 2-1 and Table 4 of the Appendix.

4-3 Statistical Analysis of the Chemical Results

(1) Outline of Method

Basic statistical values and correlation matrices of the chemical values of the chip samples were calculated, and principal component analysis was carried out in the same manner as in the first phase.

(2) Basic Statistical Values

Basic statistical values for 12 components using a population of all 207* samples were calculated. Of the 12 components, gold content was at times below the detection limit and thus less than 2.5ppb was used for samples below 5ppb. Arsenic, antimony and selenium content was high while that of fluorine, copper, zinc and barium was low. The basic statistical values are shown in Table 5-1 (*: 73 samples from the first phase and 134 samples from the second phase).

Table 5-1 Basic Statistical Values of Chip Samples

(Number of Samples:207)

Element	Mean	Dispersion	S.D.	Min.	Max.
Au	6.515	0.459	0.677	2.50	2060.0
Cu	7.954	0.272	0.521	1.00	425.0
Mo	4.469	0.297	0.545	0.50	220.0
Pb	7.746	0.353	0.594	1.00	855.0
Zn	2.869	0.179	0.423	1.00	46.0
Ag	0.207	0.057	0.238	0.10	3.0
As	35.049	0.431	0.656	2.00	10000.0
Se	0.338	0.356	0.597	0.10	100.0
Hg	132.563	0.451	0.671	10.00	33000.0
F	74.326	0.155	0.393	20.00	1600.0
Ba	180.011	0.281	0.530	10.00	3700.0
Tl	0.130	0.231	0.481	0.05	11.0

(3) Principal Component Analysis

The values for gold, many of which were below the detection limit, were processed by the same method as for the basic statistical values. Also as in the first phase, principal component analysis was carried out with all samples as the population. The correlation matrix is shown in Table 5-2. It can be seen that when the elements up to an accumulated proportion of 75% are taken, the eigenvalue will generally 0.75 and the proportion 6.2%. Thus, those up to

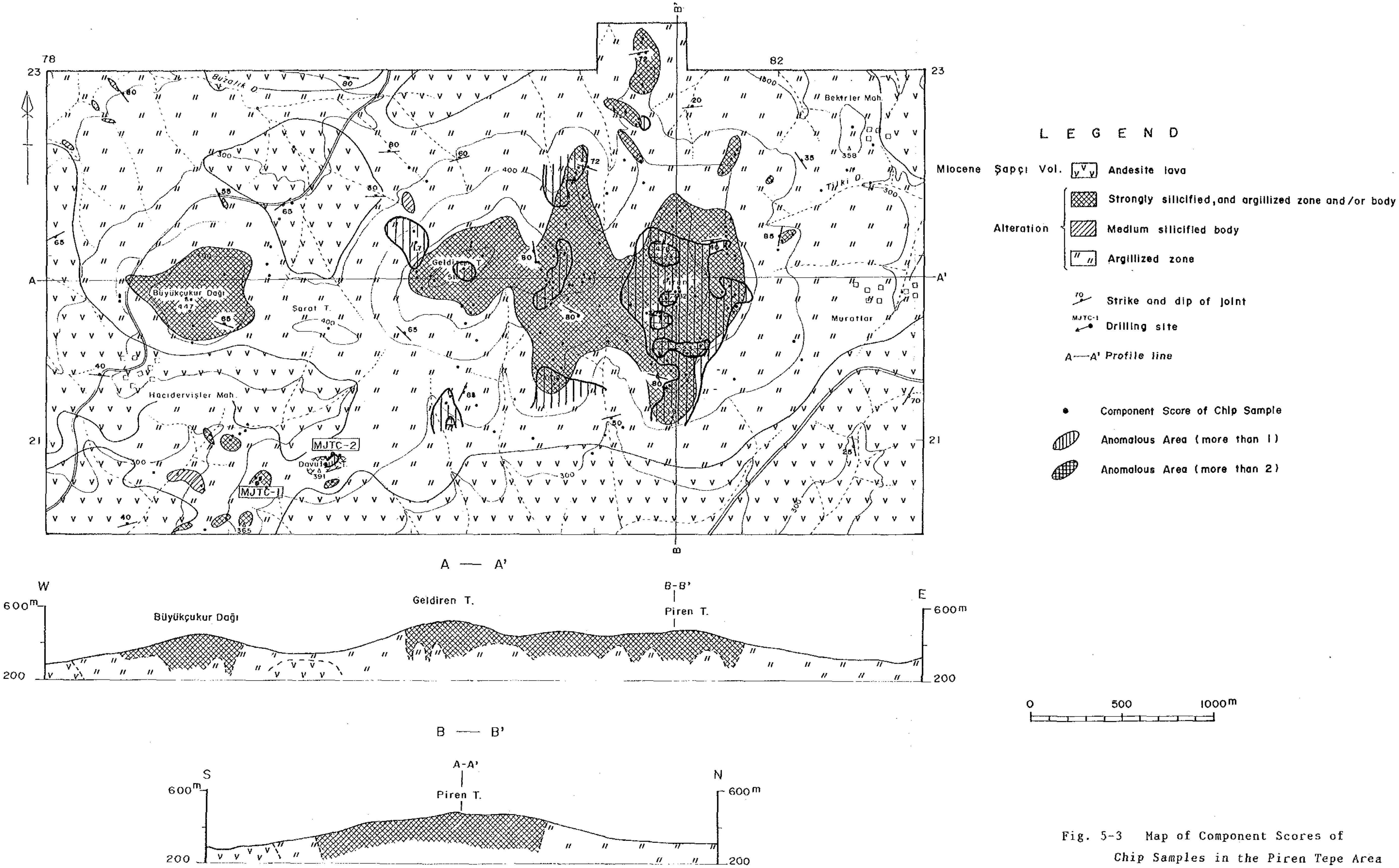


Fig. 5-3 Map of Component Scores of Chip Samples in the Piren Tepe Area

the fifth principal component express the major variations of this area.

First principal components: The components with large absolute eigenvector are copper, lead, zinc, arsenic, selenium and thallium.

Second principal components: Molybdenum, lead and silver show positive values.

Third principal components: Mercury and barium show positive while gold and arsenic show negative values.

Fourth principal components: Gold and barium show positive while molybdenum and zinc show negative values.

Fifth principal components: Molybdenum and fluorine show positive while silver and thallium show negative values.

The above are the components with high absolute eigenvectors. The first principal components are metallic elements, and they express the variation caused by epithermal mineralization. They are the elements with high content in the mineral showings in all five areas. The proportion is somewhat low but the eigenvalues are high. The second and third principal components are mostly metallic with high scores in alteration zones. Thus these are considered to show the variations of the silicified and argillized zones.

The fourth and fifth principal components are believed to indicate a portion of the mineralization because they contain metals although the proportion and the eigenvalues are low. By showing the localities with the second principal component exceeding 1 on the map (Figure 5-3), they are shown to cover most of the localities where gold was detected.

Table 5-2 Coefficients and Covariance Matrix of Chip Samples

	Au	Cu	Mo	Pb	Zn	Ag	As	Se	Hg	F	Ba	Tl
Au	0.459	0.068	0.082	0.353	0.031	0.147	0.342	0.124	0.107	0.025	0.105	0.005
Cu	0.024	0.272	0.148	0.257	0.682	0.039	0.519	0.514	0.330	0.369	0.349	0.535
Mo	0.030	0.042	0.297	0.340	0.083	0.297	0.374	0.146	0.231	-0.171	-0.027	-0.181
Pb	0.142	0.080	0.110	0.353	0.184	0.299	0.521	0.224	0.206	0.099	0.304	0.234
Zn	0.009	0.151	0.019	0.046	0.179	-0.162	0.536	0.421	0.085	0.366	0.246	0.490
Ag	0.024	0.005	0.039	0.042	-0.016	0.057	0.139	0.014	0.284	-0.404	-0.004	-0.180
As	0.152	0.178	0.134	0.203	0.149	0.022	0.431	0.400	0.238	0.236	0.264	0.295
Se	0.050	0.160	0.047	0.080	0.103	0.002	0.157	0.356	0.414	0.292	0.411	0.386
Hg	0.048	0.116	0.084	0.082	0.024	0.045	0.105	0.166	0.451	-0.033	0.381	0.168
F	0.007	0.076	-0.037	0.023	0.061	-0.038	0.061	0.069	-0.009	0.155	0.339	0.445
Ba	0.038	0.097	-0.008	0.096	0.055	-0.000	0.092	0.130	0.136	0.071	0.281	0.317
Tl	0.002	0.134	-0.047	0.067	0.100	-0.021	0.093	0.111	0.054	0.084	0.081	0.231