(3) Copper ore collected from 920ML of Aşıköy Orebody

Table 1-18 Analytical Results of the Ore Samples (3)

Sample No.	Au g/T	Ag g/T	Cu %	Pb %	Zn %	Co %	S %	Remarks
M058	3.2	5	4.00	0.02	0.28	0.63	48.19	
M059	3.6	15	3.00	0.05	0.04	0.44	48.74	

(4) Cores of Toykondu Ore Zones intersected by Drilled Holes

Table 1-18 Analytical Results of the Ore Samples (4)

Sample No.	Au g/T	Ag g/T	Cu %	Pb %	Zn %	Co %	S %	Remarks
A041	1.8	< 5	4.31	0.11	0.05	0.02	44.20	No.163 22-24m
A042	2.2	< 5	4.38	0.11	0.04	<0.006	45.19	No.163 24-25.7m
A043	4.1	25	9.88	0.15	0.07	<0.006	41.86	No.164 39.2-40.5m
A044	0.2	5	5.13	0.11	0.03	0.03	44.74	No.164 40.5-43m
A045	0.2	10	7.38	0.08	0.04	<0.006	46.98	No.164 43-45.2m
A046	2.2	< 5	6.75	0.10	0.03	0.03	46.44	No.164 45.2-47.5m

(5) Ore Samples collected from Bakibaba Orebody

Table 1-18 Analytical Results of the Ore Samples (5)

Sample No.	Au g/T	Ag g/T	Cu %	Pb %	Zn %	Co %	S %	Remarks
A013	<0.1	< 5	<0.006	0.06	0.06	0.01	0.42	
A034	5.6	5	4.63	0.06	0.18	0.20	29.45	EPMA
A035	7.6	10	9.25	0.10	2.48	0.06	44.60	EPMA, S-isotope
K064	0.4	< 5	0.05	0.02	0.08	<0.006	< 0.01	
M060	0.3	< 5	0.15	0.01	0.05	0.04	27.27	
M061	2.5	5	15.25	<0.01	3.75	0.02	44.47	1,014ML
M062	0.2	< 5	5.38	<0.01	0.09	0.16	49.04	1,014ML
M063	2.6	30	6.13	<0.01	0.03	0.21	43.50	1,080ML
M064	0.9	10	4.69	<0.01	0.10	0.44	46.37	1,080ML

(6) Gossan in the Surface of Bakibaba Mineralized Zones

Table 1-18 Analytical Results of the Ore Samples (6)

Sample No.	Au g/T	Ag g/T	Cu %	Pb %	Zn %	Co %	S %	Remarks
N083	0.4	< 5	0.03	0.01	0.05	<0.006	< 0.01	
N084	<0.1	< 5	0.04	<0.01	0.05	0.006	< 0.01	
N085	<0.1	< 5	0.03	<0.01	0.06	0.07	0.23	
N086	<0.1	< 5	0.26	0.01	0.08	0.04	< 0.01	
N087	<0.1	< 5	0.04	<0.01	0.03	<0.006	< 0.01	
N088	<0.1	< 5	0.09	<0.01	0.05	0.04	< 0.01	
N089	<0.1	< 5	0.12	<0.01	0.09	<0.006	< 0.01	
N090	<0.1	10	0.44	<0.01	0.09	0.12	15.30	

(7) Slag of Bakibaba

Table 1-18 Analytical Results of the Ore Samples (7)

Sample No.	Au g/T	Ag g/T	Cu %	Pb %	Zn %	Co %	S %	Remarks
A017	<0.1	< 5	2.19	0.02	0.08	0.19	2.16	
H025	<0.1	< 5	0.60	0.12	0.17	0.43	1.16	
N091	<0.1	< 5	0.69	<0.01	0.12	0.29	1.07	
N092	3.6	10	4.06	0.02	0.25	0.46	1.21	
N093	<0.1	< 5	0.48	0.04	0.31	0.29	0.74	
N094	<0.1	5	1.76	0.01	0.17	0.37	1.33	
N095	<0.1	< 5	0.54	0.01	0.21	0.41	1.14	
N096	0.1	5	1.50	0.15	0.17	0.46	1.04	
N097	0.5	5	2.50	0.04	0.32	3.31	0.71	

(8) Core, Gossan and Slag of Kızılsu Mineralized Zones

Table 1-18 Analytical Results of the Ore Samples (8)

Sample No.	Au g/T	Ag g/T	Cu %	Pb %	Zn %	Co %	S %	Remarks
A050	0.2	< 5	0.51	0.04	0.02	0.01	1.75	gossan
A051	<0.1	< 5	0.44	<0.01	0.02	0.02	0.24	gossan
A052	<0.1	< 5	0.63	<0.01	0.15	0.33	1.26	slag
A053	<0.1	< 5	0.04	0.09	0.01	<0.006	< 0.01	gossan
A054	1.7	< 5	0.12	0.01	0.03	<0.006	< 0.01	gossan
A055	<0.1	< 5	0.03	0.05	0.02	0.04	< 0.01	gossan
A056	0.9	5	3.81	0.05	0.02	0.33	40.41	core

(9) Concentrates of Copper and Pyrite

Table 1-18 Analytical Results of the Ore Samples (9)

Sample No.	Au g/T	Ag g/T	Cu %	Pb %	Zn %	Co %	S %	Remarks
A079	5.2	25	12.88	0.06	1.31	0.20	42.58	Cu concentrate
A080	4.1	25	13.88	0.06	1.28	0.21	42.03	
A081	4.4	25	11.75	0.06	1.08	0.14	43.01	
A076	2.0	5	1.13	0.03	0.42	0.14	43.50	S concentrate
A077	0.08	< 5	0.63	0.02	0.30	0.16	45.80	
A078	1.8	< 5	1.09	0.06	0.42	0.15	42.46	

(10) Collected Samples of Mineralized Zones in the Küre Mining Zone

Table 1-18 Analytical Results of the Ore Samples (10)

Sample No.	Au g/T	Ag g/T	Cu %	Pb %	Zn %	Co %	S %	Remarks
K009	<0.1	< 5	0.006	0.02	0.02	<0.006	< 0.01	Ersizler
K018	<0.1	< 5	< 0.006	0.02	0.01	<0.006	17.26	İpsinler
L028	<0.1	< 5	0.006	<0.01	0.02	0.06	< 0.01	SE of İpsinler
L013	<0.1	< 5	< 0.006	0.04	0.01	<0.006	0.53	North of Zemberekler
L014	<0.1	< 5	< 0.006	<0.01	0.02	0.03	0.64	
L015	<0.1	< 5	< 0.006	<0.01	0.03	0.006	0.06	
L019	<0.1	< 5	< 0.006	<0.01	0.02	<0.006	0.24	Northeast of Bakibaba
M044	<0.1	< 5	< 0.006	0.05	0.01	0.03	4.87	
N029	<0.1	< 5	< 0.006	<0.01	0.01	<0.006	0.82	Northeast of K.
N039	<0.1	< 5	0.02	<0.01	0.01	<0.006	< 0.01	South of K.
Y019	<0.1	< 5	< 0.006	<0.01	0.01	<0.006	7.26	West of K.
Y012	<0.1	< 5	< 0.006	<0.01	0.01	<0.006	3.73	Zemberekler Dere
Y024	<0.1	< 5	< 0.006	<0.01	0.01	<0.006	0.72	

SE:Southeast, K.:Katıruçtuğu St.

(11) Collected Samples of Taşköprü Zone

Table 1-18 Analytical Results of the Ore Samples (11)

Sample No.	Au g/T	Ag g/T	Cu %	Pb %	Zn %	Co %	S %	Remarks
A122	<0.1	< 5	1.19	0.07	0.19	0.17	0.35	Cozoğlu
A123	<0.1	< 5	0.78	0.01	0.04	<0.006	1.81	
Y200	<0.1	5	2.50	<0.01	0.75	0.01	0.18	
Y203	<0.1	5	0.91	<0.01	0.16	0.01	1.22	
Y204	<0.1	5	4.81	<0.01	0.01	<0.006	0.49	
Y207	<0.1	5	1.05	<0.01	0.18	0.11	0.83	
N057	1.9	115	0.30	0.10	0.15	<0.006	40.26	Cünür
Y165	<0.1	5	4.31	<0.01	1.44	0.01	0.29	
K422	<0.1	< 5	0.02	<0.01	0.01	<0.006	4.22	Alayürek
N108	0.2	< 5	0.91	<0.01	0.03	<0.006	12.81	
N111	1.5	100	0.17	0.39	0.03	<0.006	1.75	
S076	<0.1	15	1.02	0.04	1.56	<0.006	1.39	
S077	<0.1	< 5	0.04	<0.01	0.03	<0.006	< 0.01	
A075	<0.1	5	< 0.006	0.02	0.01	<0.006	31.24	SE of Karakus
H032	<0.1	5	0.01	0.06	0.01	<0.006	35.01	Sey Yayla
H036	<0.1	5	0.07	<0.01	0.14	<0.006	< 0.01	Boyalı
H037	<0.1	< 5	0.04	<0.01	0.08	<0.006	25.14	Boyalı
H038	<0.1	< 5	0.03	0.02	0.05	0.01	< 0.01	Boyalı
K224	<0.1	< 5	0.01	0.02	0.01	0.02	0.90	North of Sökü
K228	<0.1	< 5	0.08	<0.01	0.01	<0.006	0.14	North of Sökü
Y067	<0.1	< 5	0.63	<0.01	0.44	<0.006	< 0.01	North of Sökü
L051	<0.1	< 5	0.006	<0.01	0.04	<0.006	1.18	Suleymanköy
L052	<0.1	< 5	0.006	0.05	0.01	<0.006	1.86	Suleymanköy
M234	<0.1	< 5	0.07	0.04	0.01	<0.006	< 0.01	SE of Deliimam
M257	<0.1	< 5	0.08	0.04	0.02	<0.006	1.25	NE of Gano M.
N063	<0.1	< 5	0.006	0.01	0.01	0.04	19.00	S of Dikmen
N066	<0.1	< 5	0.03	<0.01	0.004	<0.006	7.01	Kepez
N072	<0.1	< 5	0.006	<0.01	0.02	<0.006	2.84	NW of Sarpın
S095	<0.1	< 5	0.006	<0.01	0.01	0.01	1.52	S of Alayürek
S097	<0.1	< 5	0.47	<0.01	0.01	0.03	16.99	S of Alayürek

(12) Collected samples of Dikmendağ Zone

Table 1-18 Analytical Results of the Ore Samples (12)

Sample No.	Au g/T	Ag g/T	Cu %	Pb %	Zn %	Co %	S %	Remarks
S261	<0.1	5	< 0.006	<0.01	0.01	<0.006	3.58	South of Masköy
S262	<0.1	< 5	< 0.006	0.01	0.01	<0.006	4.48	
K111	<0.1	< 5	< 0.006	<0.01	0.01	<0.006	1.93	Southwest of Kale T.
S111	<0.1	< 5	0.80	0.06	0.03	1.63	< 0.01	
K405	<0.1	5	3.25	<0.01	0.02	0.21	0.50	

Note: Detection Limit
Au: 0.1 g/T, Ag: 5 g/T, Cu and Co: 0.006%, S: 0.05%, Pb: 0.01%

4-1-5 X-ray Diffraction

Twelve samples were selected for significant alteration and studied by X-ray diffraction. Nine samples from Küre and three from Taşköprü. The sampling locations are shown in Table 1-19.

There are secondary minerals formed in the basalts such as chlorite, epidote, prehnite and actinolite. These were formed on the sea floor. The marine alteration is characterized by silicification and carbonitization. Also anatase is found in Küre and analcine in Taşköprü. The results of the X-ray work is laid out in Table 1-20.

Table 1-19 X-ray Diffractive Samples

Zone	No.	Description	Locality	Y	X
Küre Mining	A030	Altered basalt	Aşıköy	2557410	4630840
	S057	Altered basalt	Katıruçtuğu Sr.	2560120	4631510
	A009	Altered basalt	Kızılsu	2558580	4628965
	A024	Altered basalt	Aşıköy	2557517	4630803
	M034	Altered basalt	W.Katıruçtuğu S	2559000	4632250
	Y010	Altered basalt	Anayol Küre	2559650	4630280
	Y037	Altered basalt	Aşıköy	2557325	4631182
	Y043	Altered basalt	Aşıköy	2557515	4631080
	Y048	Altered basalt	Aşıköy	2557445	4630937
Taşköprü	K218	Gossan with py	N.Büyükkan Sr.	2579720	4602170
	S078	Altered rock	N.Ortadoruk T.	2575600	4599900
	Y059	Altered basalt	NE.Ketendoruğu	2584940	4603000

Table 1-20 X-Ray Diffractive Analysis

	A009	A024	A030	M034	S057	Y010	Y037	Y043	Y048	K218	S078	Y059
Mo						・?						
Ch		・		△	△		・?	○			△	△
Se	△	○		○			・			◎	○	△
Ca								◎				
Qz	◎	◎	◎	◎	◎	◎	◎	○	◎	◎	◎	◎
Pl	△				○	◎		◎				
Py		△							○	○		△
He							・					
Ana		△	・?						・?	・?		
Anl											○	

Abbreviation

◎:abundant, ○:common, △:few, ・:rare

Mo:montomorillonite, Ch:chlorite, Se:sericite, Ca:calcite, Qz:quartz, Pl:plagioclase, Py:pyrite, He:hematite, Ana:anatase, Anl:analcine

4-1-6 EPMA

Four representative ore samples were selected from Aşköy Orebody and three from Bakibaba for qualitative analysis of minor elements by EPMA. Analysis was made at 21 points for 17 elements. Chalcopyrite and pyrite are the major constituents of Küre with minor content of sphalerite and galena. Also minute amount of cobalt minerals exist. The minor element content of chalcopyrite, pyrite, and sphalerite was annualized. The results are shown in Table 1-21. The following is the description.

Gold:Microscopic studies failed to identify electrum and native gold. Gold was not detected by EPMA analysis. It is generally below the detection limit. The content in chalcopyrite is 0.08% (max), 0.09% (max) in pyrite, and 0.06% in sphalerite.

Silver:Copper-silver minerals occur together with pyrite. Generally the content is below the limit of detection. Content is 0.03% in chalcopyrite and 0.02% in pyrite.

Manganese:Very minor content is detected in chalcopyrite and pyrite (0.02-0.03%).

Arsenic:Minor content is detected 0.28% in pyrite, 0.10% in undecided minerals existing between chalcopyrite and pyrite, and 0.04% in chalcopyrite.

Antimony:Content is 0.02% in chalcopyrite and pyrite.

Bismuth:content is 0.15%(max) in pyrite, 0.06% in chalcopyrite and 0.03% in sphalerite.

Selenium:Content is 0.08% in undecided minerals existing between chalcopyrite and pyrite, 0.07% in chalcopyrite and sphalerite, and 0.02% in pyrite.

Cobalt:Content is 0.75%(max) in pyrite, 0.41% in undecided minerals existing between chalcopyrite and pyrite, and 0.06% in chalcopyrite.

Nickel:Very minor content is 0.01% in chalcopyrite and 0.1% in pyrite.

Representative BEI images and silver, cobalt X-ray images are shown in Photo 3. The polished sections analyzed by EPMA were also studied microscopically and assayed. Ore samples of qualitative analysis by means of EPMA method are as follows:

Sample No.	Au g/T	Ag g/T	Cu %	Pb %	Zn %	Co %	S %	Location
A023	0.3	15	8.38	0.06	1.56	0.10	46.21	Aşıköy O/P
A025	<0.1	5	2.66	0.04	0.05	0.24	44.01	Aşıköy O/P
A027	1.6	5	1.30	0.06	0.05	0.04	45.55	Aşıköy O/P
A032	<0.1	5	1.45	0.06	0.12	0.11	44.93	Aşıköy O/P
A034	5.6	5	4.63	0.06	0.18	0.20	29.45	Bakibaba U/G
A035	7.6	10	9.25	0.10	2.48	0.06	44.60	Bakibaba U/G
M064	0.9	10	4.69	<0.01	0.10	0.44	46.37	Bakibaba U/G

Table 1-21 Analytical Results of EPMA (1)

wt%	A023 Cp	A023 Cp	A025 Cp	A027 Cp	A032 Cp	A034 Cp	A035 Cp
Cu	34.12	34.09	34.33	34.16	34.43	34.51	34.79
Ag	0.03	0.01	0.01	0.03	0.03	0.01	
Au		0.05		0.06			0.08
Fe	30.44	30.87	30.70	30.95	30.44	30.51	30.64
Zn							
Mn		0.02					0.01
Cd							
Te							
As			0.01	0.02			0.04
Sb				0.01	0.01		
Bi	0.02	0.06	0.00	0.03			
Sn							
S	34.86	34.79	34.45	34.76	35.02	34.87	35.03
Se	0.07		0.00	0.05			
Co	0.02	0.06	0.02	0.03	0.03	0.05	0.04
Ni	0.01		0.01				
In							
Total	99.57	99.95	99.53	100.10	99.96	99.95	100.63

Cp:chalcopyrite

wt%	A023 Py	A023 Py	A023 Py	A023 Py	A025 Py	A027 Py	A032 Py	A034 Py	A035 Py
Cu									
Ag			0.01						
Au		0.09		0.01	0.02		0.02		
Fe	46.71	46.33	46.84	46.77	47.03	46.50	46.68	45.36	46.66
Zn									
Mn						0.01	0.01	0.01	0.01
Cd				0.03		0.04	0.04		0.04
Te									
As	0.09	0.02	0.19	0.04	0.06	0.09	0.05	0.28	0.17
Sb									0.02
Bi	0.15					0.03		0.03	
Sn									
S	52.49	52.91	52.88	53.02	52.93	52.74	53.63	52.60	53.27
Se	0.05	0.02	0.01	0.01	0.01		0.02	0.02	
Co	0.08	0.04	0.06	0.05	0.06	0.04	0.04	0.75	0.05
Ni		0.01		0.02		0.10	0.02		
In									
Total	99.57	99.42	99.99	99.95	100.11	99.55	100.51	99.05	100.22

Py:pyrite

Table 1-21 Analytical Results of EPMA (2)

wt%	A023 Sp	A025 *1	A034 *2	A027 Pyrim	A027 Pycore
Cu	1.91	13.52	23.15		
Ag				0.02	0.01
Au	0.06	0.05			0.03
Fe	3.61	40.07	36.29	46.37	47.00
Zn	60.76				
Mn			0.02	0.01	0.03
Cd	0.13	0.02			0.03
Te					
As	0.02	0.17	0.10		0.22
Sb		0.01			
Bi	0.03			0.06	0.02
Sn					
S	32.87	46.07	40.91	52.52	52.78
Se	0.07		0.08	0.02	0.02
Co	0.01	0.28	0.41	0.05	0.04
Ni					
In					
Total	99.47	100.19	100.96	99.05	100.18

Sp:sphalerite
Pyrim:Rim of colloform pyrite
Pycore:Core of colloform pyrite
*1:pyrite contained with the dotted chalcopyrites
*2:undecided minerals existing between chalcopyrite and pyrite

4-1-7 Sulfur Isotope Studies

Six samples from Aşiköy Orebody and one from Bakibaba were selected for sulfur isotope studies. Samples with large amount of chalcopyrite, those with only pyrite were chosen from both massive and vein ores. Sulfur was extract by Sn-strong phosphoric acid method and Finuigan mat delta-E equipment was used. The result is shown in permil deviation to the CDT values. The accuracy is ± 0.1‰.

The $\delta^{34}S$ values range within +5.43 ~ +12.72 ‰ and significant difference does not exist between the chalcopyrite and pyrite dominant parts of the massive ores, but the veins have high values of +8 ~ +12 ‰.

Although the number of measurements are limited in the present case, the $\delta^{34}S$ values obtained are similar to those of ophiolite. Thus it is inferred that these ores were formed syngenetically without being affected by the deep sea water. The results are compared to those of the published reports in Figure 1-14.

Table 1-22 $\delta^{34}S$ Value of Sulfur Isotope

No.	Description	$\delta^{34}S$ CDT
A023	Massive cp-py ore of Aşıköy	+5.56
A026	Vein-type cp ore of Aşıköy	+8.45
A027	Massive colloform py ore of Aşıköy	+5.75
A029	Crystallized py ore of Aşıköy	+5.64
A031	Py vein in basalt of Aşıköy	+12.45
A033	Massive py ore of Aşıköy	+12.72
A035	Massive cp-py ore of Bakibaba	+5.43

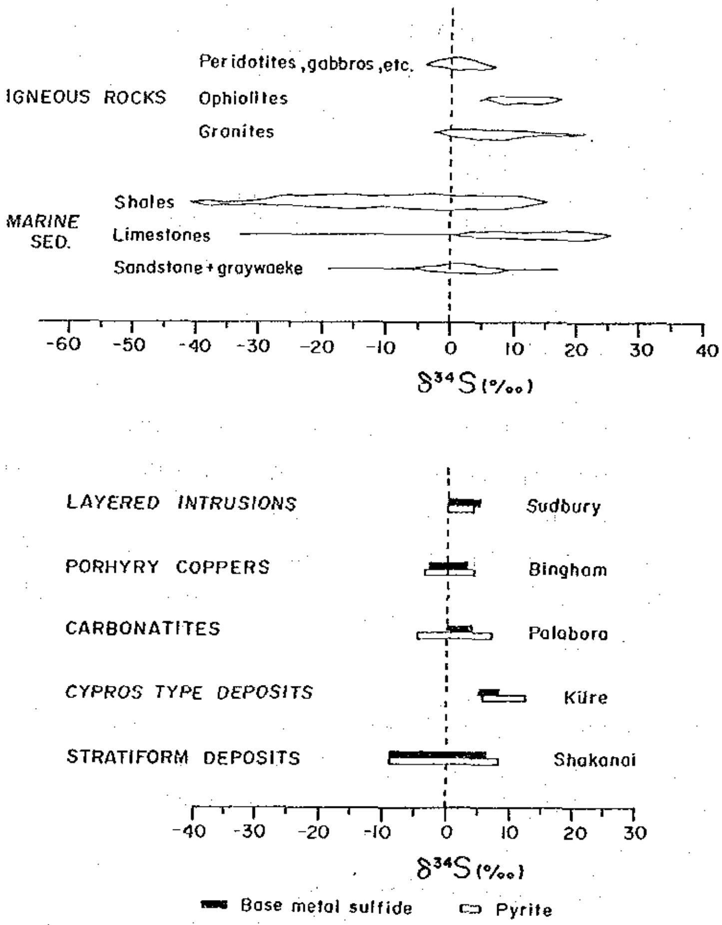


Figure 1-14 Sulfur Isotopic Variation in Nature and Ore Deposits

4-2 Geologic Structure

Turkey is located at the collision of the African Plate in the south and the Eurasian Plate in the north. Thus the geological units are elongated in the east-west direction and they are zoned in the north-south direction. The area along the coast of the Black Sea, north of the Küre Area, belongs to the Central Pontidos Zone and is characterized by Mesozoic and Cenozoic flysch-type sediments (shallow and deep marine origin). The southern side of Küre is composed of basement metamorphic rocks and is the northern end of the Anatolia Microcontinent.

There are many thrust faults in this area as a result of the Alpine Orogeny which began in the late Mesozoic. The thrusts which were identified from satellite images are, *inter alia*:

(1) The fault which thrusts the basement to the south of Gokirmak River northward. The basement rocks occur widely in the east-west direction. The southern side of the basement is bounded by the Anatolia fault.

(2) The fault which thrusts the basement southward from north of Kastamonu. The basement rocks extend in the east-west direction.

(3) The fault which thrusts the Jurassic to Lower Cretaceous sedimentary rocks northward from Cide to the Küre Mine area.

These thrust faults are pushed at low angles and those described in items (2) and (3) were the main factors in forming the Küre Range extending in the east-west direction within the Pontidos mountain system in the north.

In this area which is strongly affected by the orogenesis, faults of E-W and N-S systems are predominant with NE-SW and NW-SE trending branches. From the dynamics of the area, many of the fold axes trend in the E-W direction.

The Taşköprü Zone corresponds to the (2) above and the Küre-Dikmendağ Zones to the (3) areas. The stratigraphic correlation from the results of the first year survey is shown in Table 1-23.

Table 1-23 Correlation in the Küre Area

Geologic Age			Küre	Dikmendag	Taşköprü	Type Locality
Cenozoic	Tertiary				Çayköy F. Çtl:limestone Çtl:andesite lava Çts:sanstone	Gökçeagaç F.
Mesozoic	Cretaceous	Upper	Göynük F.	Satıköy F.	Alaçam F. Acs:sandstone marl, mudstone	Çaglayan F.
		Lower	Karadana F. Kcl:ls	Köstekciler F. Kcl:limestone	Kızacık F. Kcl:limestone	İnaltı F.
	Jurassic	Malm			Muzrup F. Mmc:conglomerate	Bürnük F.
		Dogger	Did,Dad:Diorite/dacite		Çangal Granitoids(Çg)	
		Lias	Küre F. Bls:Bediroglu Facies Klbb,Klbm,Klbl:Küre lava Facies		Kayadibi F. Kls:sandstone Klb:basic rocks	Akgöl F.
	Pre-Jurassic		Intrusives Sl:serpentinite Gl:gabbro		Çangal metaophiolites Çlp:pelitic schist Çlb:meta-basic rocks Çls:serpentinite	
? Paleozoic					Devrekani metamorphics(Dpg)	

4-3 Mineralization Inferred from the Results of the Geological Survey

It is considered from the results of the geological and geochemical (stream sediments) surveys carried out by MTA and Etibank, and the history of mining of the area, that:

(1) Cyprus-type mineralization can be expected to the east and west of the Küre Mine. This is in association with the Lias mafic rocks.

(2) Pre-Jurassic metamorphic rocks are widely distributed in the Kastamonu area and copper and zinc mineral showings occur extending in the east-west direction and slag dumps are found sporadically. Although there is no record of mining operation in the area, the occurrence of metamorphosed Besshi-type mineralization appears promising.

(3) Granite to granodiorite bodies occur in the western part of the Küre Mine and pyrite dissemination is found. The time of intrusion is inferred to be latest Cretaceous to Eocene. Dissemination mineralization will be the target of exploration in this zone.

4-4 Results of Geophysical Prospecting

4-4-1 CSAMT Results

A total of CSAMT 513 stations, namely 400 stations by array and 113 stations by random points, were measured during the course of this survey. Maps and pseudosections of apparent resistivity were made from field data, maps and cross sections of resistivity structure were prepared from one- and two-dimensional analysis of the results. The resistivity structure and the low resistivity anomalies have the following characteristics.

(1) As a whole, resistivity values in the range of 100-300ohm-m are prevalent in the Küre Area. Medium resistivity zone is widely distributed in the vicinity of the survey area. High resistivity zone exceeding 1000ohm-m is mainly concentrated in the central part of the area and extends in the NW-SE direction. This high resistivity has a tendency to extend into the deeper zones.

(2) Low resistivity anomalies associated with the Aşiköy, Bakibaba, and Kizılsu Deposits are notable. In the southeastern part of the Aşiköy Orebody, small anomalies are detected. Also small but significant low resistivity anomalies were confirmed in the northern and southern part of the Baki-

baba Deposit.

(3) There are weak anomalies associated with the mineral showings to the northeast of Bakibaba. Slag of the old Bakibaba Mine is widely deposited to the south of the weak anomalies. Although it is not recorded as mineral showing, eastern Bakibaba anomalies extending in the NNW-SSE direction were analyzed under the slag heap. This anomalous zone continues for four traverse lines from line C to E2, and the Zemberekler Stream Mineralized Zone is located at the southern extension of this anomalous zone.

(4) From the results of the random point CSAMT measurements of the vicinity, notable low resistivity anomalies were detected at 1km south of Ipsinler and at about 400m north of the Ersizler mineral showings. Array measurements were carried out and a very significant low resistivity zone was confirmed.

4-4-2 Results of IP Prospecting

Significant FE anomalies were not detected by IP measurements over three lines. The low resistivity detected by CSAMT in Line II is considered to be caused by groundwater as the anomaly occurs in the limestone talus deposits. The reason for not detecting the shallow anomalies below Line DD is believed to be the long electrode interval of a=100m. With IP, shorter interval of 25-50m would be suitable for this type of work.

4-4-3 Results of Laboratory Tests

A total of 43 rock samples were collected. Resistivity and FE values were measured. The results are as follows.

(1) The general trend of the resistivity is; mafic rocks such as serpentine, diorite, basalt have high values while sedimentary rocks, namely shale and sandstone have relatively low values of 300 - 600 ohm-m. Limestone has the highest resistivity followed by serpentine, hyaloclastite, then in the order of decreasing value, pillow lava > massive lava > sandstone > black shale (302ohm-m).

(2) FE values do not vary as much as the resistivity. Serpentine has the highest FE of 12.2%, followed by black shale and hyaloclastite, and then they are, in the decreasing order, sandstone > diorite > massive basalt > pillow lava > limestone. The value of the lowest limestone is 0.4%.

(3) The ores of the Aşıköy and Bakibaba Deposits have FE of around 40% and extremely low resistivity in the order of 7.5ohm-m. There is a significant difference of these values with the host rocks.

From the above, it is concluded that massive sulfide orebodies of a certain size can be detected by FE. Some of the black shale and sandstone have similar resistivity and it is difficult to determine ore deposits by resistivity alone. It is difficult to identify rocks of the area by resistivity, but igneous rocks and sedimentary rocks can be distinguished.

4-5 Mineral Potential of Küre Area

4-5-1 Küre Mining Zone

There is a presently operating mine in this zone. Its deposits occur in the Küre Formation of the Lias Series. The Aşıköy-Toykondu and the Bakibaba Deposit are the presently working bodies. Aside from the above, ore reserves have been confirmed from both Toykondu and Kızılsu Orebodies. The total of the past recorded production and the present reserves would amount to 20 million tons containing 600 thousand tons of copper metal. This mine has been operating intermittently from the Roman Period and there are slags amounting to two million tons. The amount of ores mined, calculated from the existing slag would be higher than the recorded values.

Previous exploration of the above deposits included geophysical prospecting for shallow subsurface zones and drilling for all the areas of detailed geological survey and the mineral showings.

Integrated exploration had not been carried out recently. The present work starting from this year, carried out jointly with Etibank, is an attempt at exploration utilizing all phases of integrated modern technology. Analysis of the results of previous work, semi-detailed geological survey, and geophysical prospecting were carried out during the first year. The findings of the work are as follows.

Existing geoscientific data and information:

(1) The reserves and grade of the known deposits have been calculated by drilling.

(2) Shallow subsurface zones below the mineral showings near the deposits

have been explored in almost all cases.

(3) Exploration for new deposits has not been carried out. For example, tunneling for exploring the vicinity of the known deposits, drilling for clarifying the geologic structure, regional geochemical survey for clarifying the behavior of indicating elements, and extracting new exploration targets from these data.

Results of the first year survey:

(1) Anomalies were detected in the vicinity of the known deposits by CSAMT survey.

(2) The above anomalies occur in zones where blind deposits are expected to occur geologically.

From the above results, this is concluded to be an area with considerably high potential for finding new ore deposits by future exploration.

4-5-2 Other zones

Notable mineralization in other areas are; copper in pre-Jurassic Çangal Meta-ophiolite in Taşköprü Zone and also copper in the Lias Küre Formation in Dikmendağ Zone. The latter mineralization is similar to that of the Küre Mining Zone. These are all associated with mafic igneous activity. The surface manifestations of these deposits are weak, characteristics of the Cyprus-type mineralization. Geological survey, geochemical survey, and in some parts geophysical prospecting in Taşköprü, and in Dikmendağ, have been carried out. These are all in the initial stages. Promising zones have been extracted by the present first year survey. The mineral potential of these zones will be considered after the progress of these work.

CHAPTER 5 CONCLUSIONS AND RECOMMENDATIONS

5-1 Conclusions

Prior to the field survey, all existing geoscientific data and information regarding the Küre Area were analyzed and interpreted. Field survey was planned and implemented with the knowledge of the previous surveys. Geological reconnaissance covering 559km^2 of the Küre Zone and 66km^2 of the

Dikmendağ Zone were carried out and the results are expressed in 1/50,000 scale geological maps. The extracted promising zones were geologically surveyed in semi-detail as follows. A total of $4km^2$ in Cozoğlu, Cünür, and Alayürek of Taşköprü Zone and $2km^2$ in Masköy of Dikmendağ Zone. The results are shown in 1/5,000 scale geological maps. Küre Mining Zone is important as a mine is presently in operation, and $22km^2$ was surveyed in semi-detail.

The geology of the Taşköprü Zone predominantly consists of pre-Lias Çangal Meta-ophiolite. The mineralized zone is accompanied by silicification and argillization in the metabasalts and green schist.

In the Küre and Dikmendağ Zones, the deposits and mineral showings occur in the Lias basalt. Although different in age, these mineralization and that of the Taşköprü are related to ophiolite. The geological environment indicate metamorphosed Besshi-type mineralization in Taşköprü and Cyprus-type in Küre and Dikmendağ.

The following localities were extracted as targets for future exploration. In Küre Mining Zone; southern part of Aşıköy deposit, northern and southern parts of Bakibaba deposit, vicinity of entrance to Gallery 920ML, southern part of Ipsinler mineralized zone, and Zemberekler and Kızılsu deposits. In Taşköprü Zone; Cozoğlu, Cünür and Alayürek.

The descriptions of the individual localities are in the following section.

5-1-1 Southern Part of Aşıköy Orebody

Clear CSAMT anomalies were obtained. The surface is covered by sandstone-shale alternation of the Küre Formation. It is south of the Aşıköy Orebody which is presently mined by open pit. This corresponds to the southern extension of the deposit. There are three N-S trending tectonic lines parallel to each other near the Küre Mine and this location is near the western line.

5-1-2 Vicinity of Entrance to Gallery 920ML

CSAMT anomalies were obtained with values second to southern part of Aşıköy. Pyrite dissemination was found in the 920ML gallery, but further exp;oration has not been conducted. This location corresponds to the northern extension of the Zemberekler. Basalts occur on the surface.

5-1-3 North and South of Bakibaba Deposit

CSAMT anomalies with values after 1-1 and 1-2. At the surface basalts and minor amount of sandstone-shale alternation are observed. These anomalies are located to the north and south of the Bakibaba Deposit with high copper grade and the existence of the N-S tectonic lines in the vicinity enhances the need for further exploratory work in the area.

5-1-4 South of İpsinler Mineralized Zones

Very strong CSAMT anomalies occur in this locality. The surface is covered by limestone talus deposits of Karadana Formation and manifestation of mineralization is not observed on the surface. IP anomalies were not obtained and this could be due to flow of subsurface water or to CSAMT anomalies due to targets deeper than 200m depth. Further geophysical investigation is warranted.

5-1-5 Zemberekler and Kızılsu Deposit

Küre Mine is located in a topographically steep area and there are high tension electric transmission lines in the general area. Also there are large amounts of overburden from the open pit covering the vicinity. Therefore, geophysical work can be carried out only in limited parts. This locality can only be further explored by drilling from the above reasons.

5-1-6 Cozoğlu Mineralized Zone

Two openings to old adits and waste dumps were found in an area of 350 x 350m in metabasalt. In one of the old adits, there is a 10cm thick quartz vein with copper oxide stains and 3m wide gossan, but the exposure is not good. Geophysical prospecting is necessary for confirming the state of mineralization.

Geophysical prospecting in the Cozoğlu Mineralized Zone. This will provide knowledge regarding the mineralization in deeper zones.

5-1-7 Cünür Mineralized Zone

The zone is located in metabasalt and green schist. There are extensive gossan occurrences (500 x 60m - 100 x 10m) in eight localities of this zone. Pyrite veinlets were found at one of the gossan outcrops and copper oxide smears on the host rock at another. There are wide silicified zones around these gossan occurrences and further geochemical and geophysical exploration are warranted.

Geochemical and geophysical prospecting in both the Cünür and Alayürek Mineralized Zones. Delineate the strong mineral showings by geochemical work and delineate the low resistivity zone and FE anomalies by geophysics.

5-1-8 Alayürek Mineralized Zone

This zone is developed in the green schist and metabasalt. Pyrite dissemination occurs over 600x50m and chalcopyrite was found in some parts of the mineralized zone. High-grade copper ore samples were collected during previous surveys, but during the present work, such samples were not found. Although the metamorphism of the host rocks is not strong, further geochemical and geophysical exploration are warranted.

From the above results, it is believed that the green schist and metabasalt extend in the NEE-SWW direction with fairly steep dip. And the mineralized zones are expected to extend further downward. Although the surface manifestation of mineralization is relatively weak, the Besshi-type mineralization becomes stronger downward. In order to confirm the subsurface conditions of mineralization, further geochemical and geophysical exploration are warranted in these mineralized zones.

5-1-9 Basic Rock Area of the Dikmendağ Zone

The results of the first year survey reveals that basaltic rocks are intercalated in sandstone-shale alternations and in some parts pyrite mineralization occurs in the basalt. Although surface manifestation of the mineralization is weak, there are possibilities of this type of mineralization becoming stronger in the lower subsurface zones. Geophysical exploration is necessary to confirm the possibility.

5-1-10 Ophiolite Area

Küre Formation is widely distributed to the east and west of the Küre Mine. This is called Akgöl Formation in the regional geology of İnebolu-Kastamonu area and is described as consisting of ophiolite and alternation of sandstone and shale. It is treated as a single unit in the field. But geochemically, the minor element content differs by occurrence, and those accompanied by mineralization can most probably can be distinguished from those not. The distribution of the mafic volcanic rocks have been clarified by the past surveys at; east of Küre Mine and the western part of Dikmendağ Zone. Geological investigation in these areas is expected to yield useful results.

5-2 Recommendations for the Second Phase Survey

It is recommended that the following be carried out during the second phase of this project. It is anticipated that promising localities will be delineated as a result of the work listed below.

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

Reco:recommendation

PART 2 COMPILE OF PREVIOUS SURVEY

PART 2 COMPILE OF PREVIOUS SURVEY

Chapter 1 Previous Survey of the Küre Area

1-1 Outline

The objective of the present survey was to clarify the mode of occurrence of Cyprus type deposits of Küre Area. Prior to the survey, Landsat images, totaling 7,700km^2 in areal extent were analyzed and interpreted, available data regarding previous work on geology and ore deposits, geochemical and geophysical prospectings were acquired and studied. The previous reports acquired and compiled data are listed in Table 2-1.

Table 2-1 Report List of Compiled Data

	No.	Year	Name of Previous Works
Geology	1	1986	Kastamonu Granitoid of Northern Turkey
	2	1986	Geology of Kastamonu
	3	1977	Geological Exploration of Küre Mine
	4	1980	Geology and Massive Sulfide Ores of the Küre Area
	5	1989	Mineralized Zones of Ersizlerdere and Ipsinler
	6	1986	Litho-stratigraphy of Daday-Devrekani Area
	7	1969	Geology and Mineralization of Dikmendağ
	8	1976	Geology and Mineralization in the Western Part of Küre
	9	1974	Geology and Mineralization of Kepez
	10	1991	Mineralized Zones of Sey Yayla
Geochemical Prospecting	1	1973	Geochemical Prospecting of Northward Küre Area
	2	1987	Geochemical Prospecting of Çangal Meta-ophiolites
	3	1988	Geology and Geochemical Prospecting of Devrekani Area
Geophysical Prospecting	1	1989	GP of Ersizlerdere and İpsinler (IP method)
	2	1978	GP of Toykondu Orebody (IP method)
	3-1	1964	GP of Aşıköy-Bakibaba Deposits (SP & EM methods
	3-2	1976	GP of Aşıköy-Bakibaba Deposits (IP method)
	4	1981	GP of Northeast of Bakibaba Deposit (IP method)
	5	1985	GP of Zemberekler (IP method)
	6-1	1964	GP of Kızılsu Deposit (SP and EM method)
	6-2	1988	GP of Kızılsu Deposit (IP method)
	6-3	1989	GP of Kızılsu Deposit (IP method)
	7	1991	GP of Sey Yayla (SP and IP methods)
Küre Mine	1	1944	Discovery of Aşıköy Orebody
	2	1985	On the Ore Deposits of Küre
	3	1986	Geology and Reserves of Küre Mine
	4	1987	Aşıköy-Toykondu and Bakibaba Deposits
	5	1990	Bakibaba Deposit
	6	1980	Gold and Cobalt Minerals of Küre Mine

GP:Geophysical Prospecting

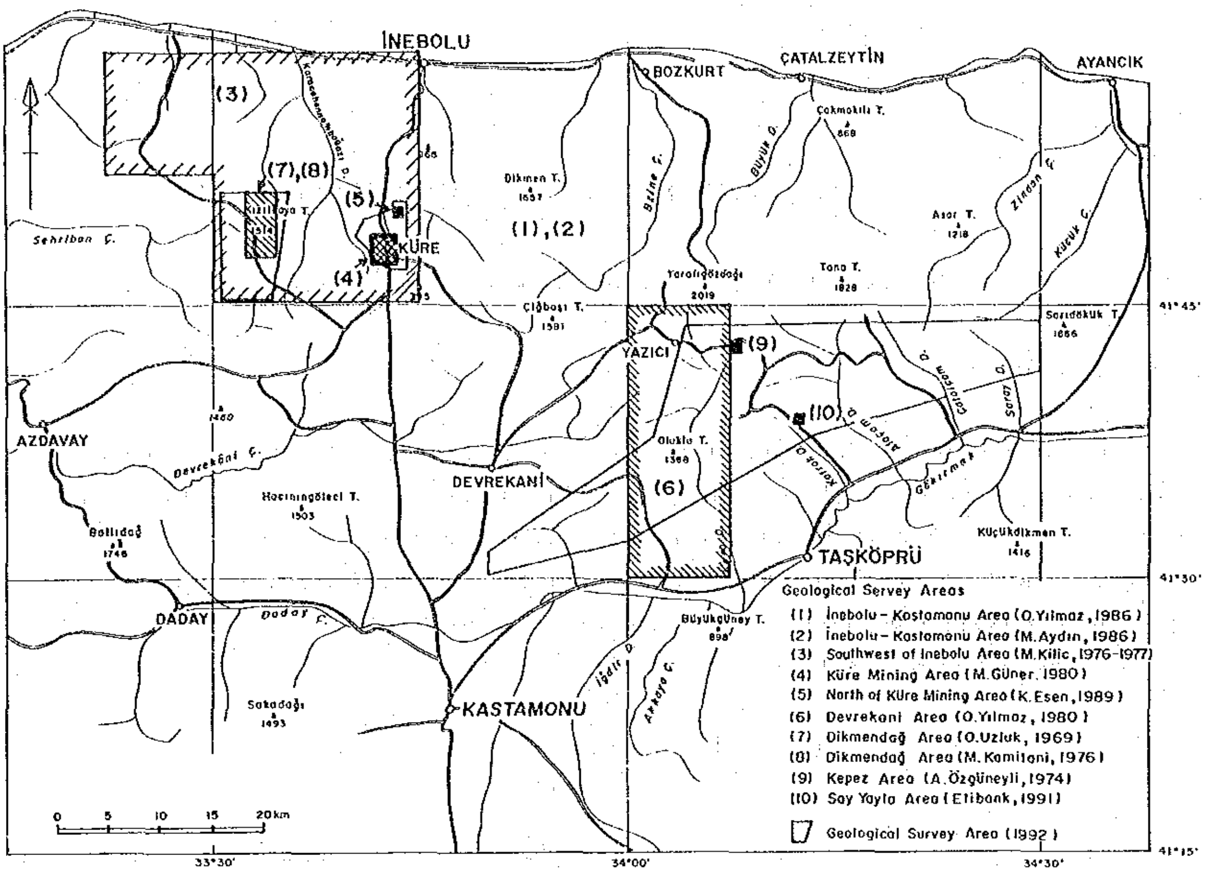


Figure 2-1 Index Map of Previous Work related to Geology Survey

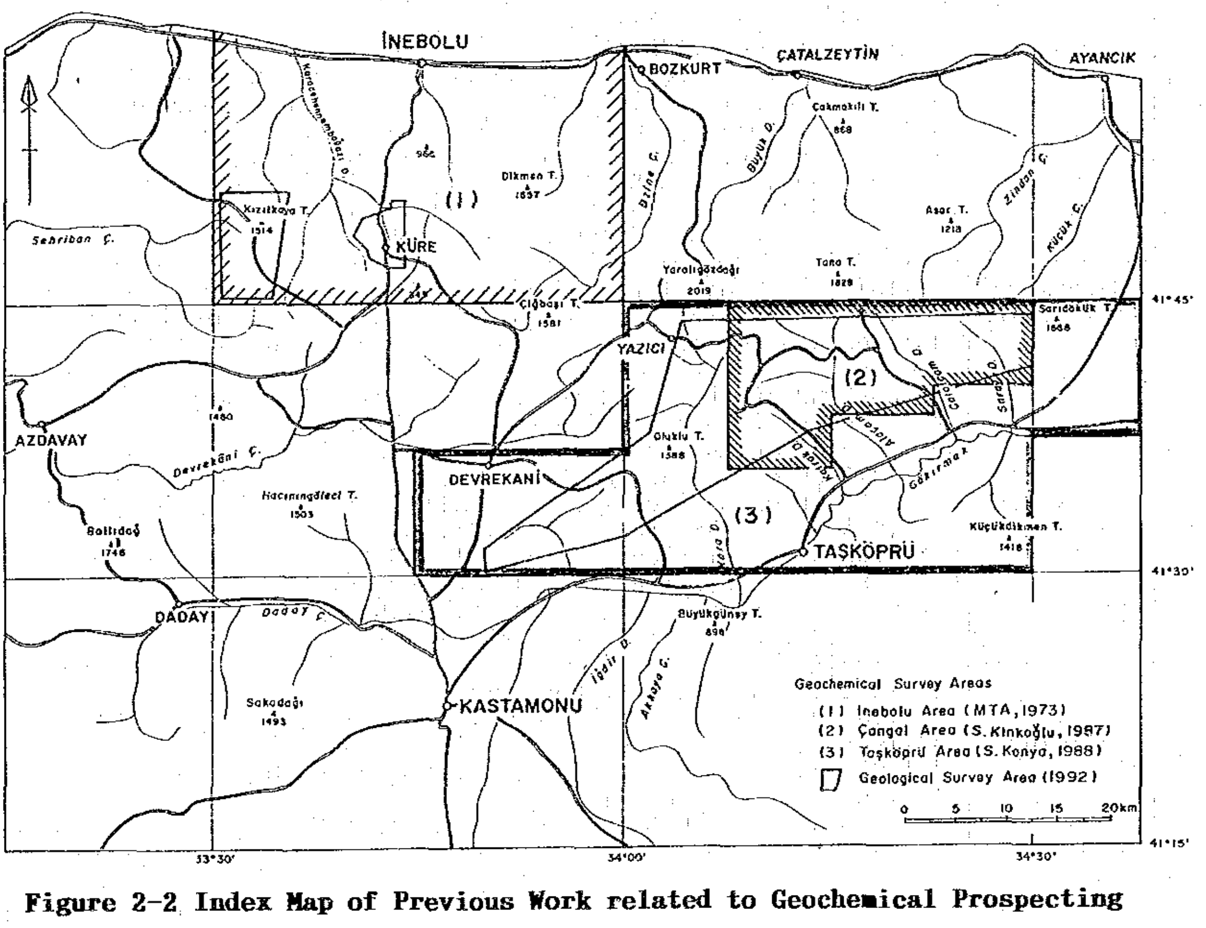


Figure 2-2 Index Map of Previous Work related to Geochemical Prospecting

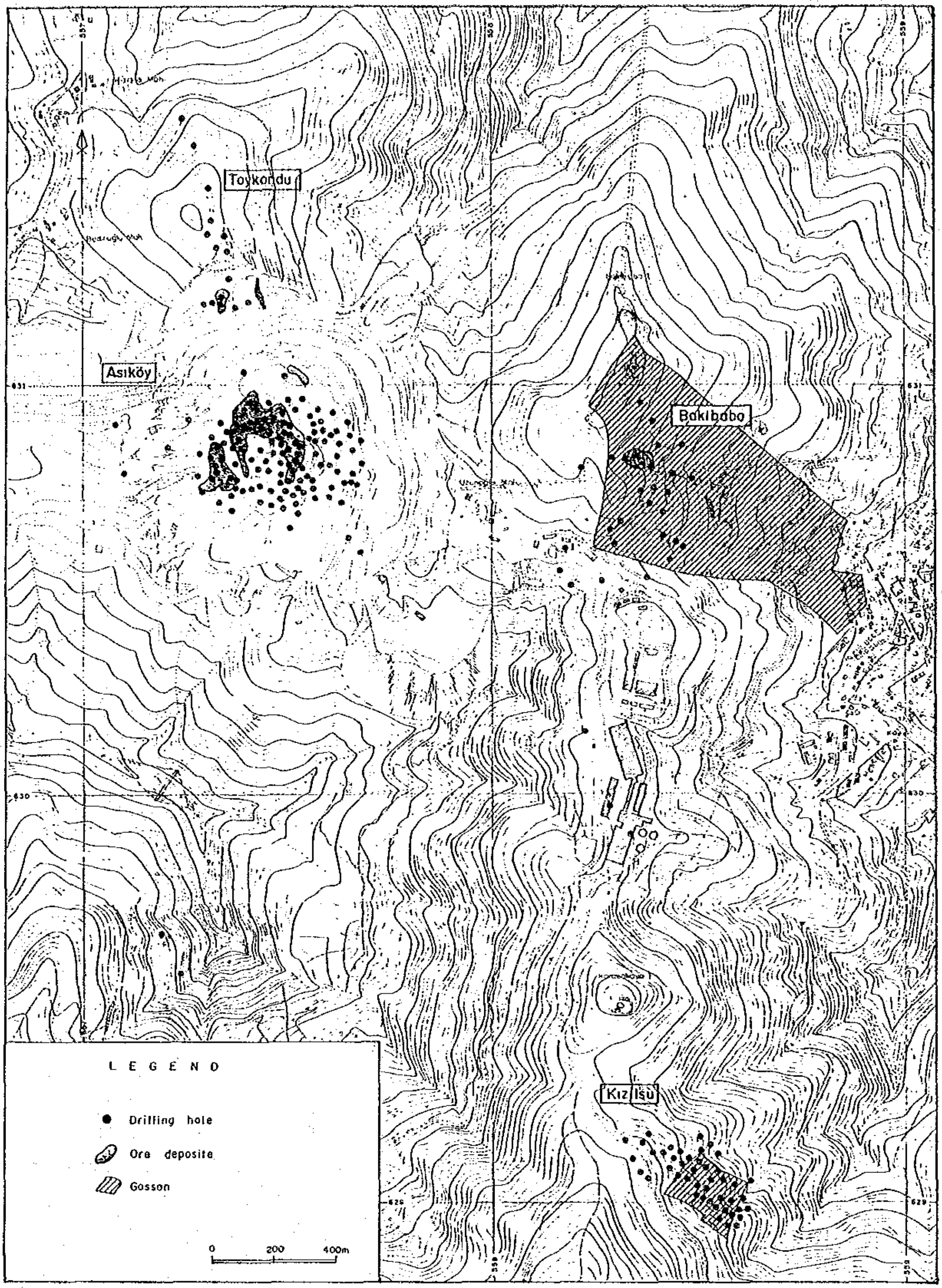


Figure 2-3 Location of Drilled Holes

1-2 Data of Drilled Holes

The drilling survey is carried out in the mineralized zones of Küre Mine since 1971, and now drilling operation is continued by four drilling machines. During this year, the locations of drill holes are panning in the Bakibaba, Toykondu, and 920 ML gallery. The contents of previous drilling survey (from 1971 to 1990) are summarized in Table 2-2, and the locations of drill holes are shown in Figure 2-3.

Table 2-2 Classification of the Drilled Holes

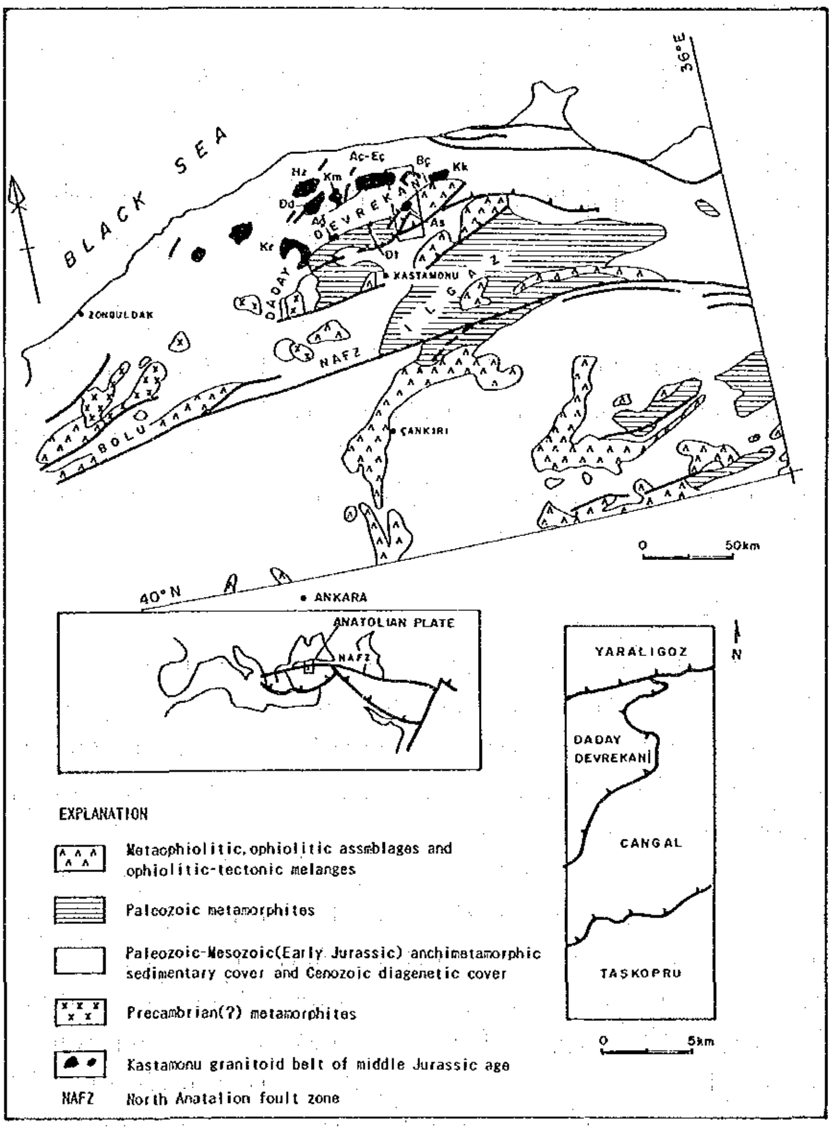
	Unit	Aşıköy (Total)	Aşıköy (Eval.)	Toykondu (Total)	Toykondu (Eval.)	Bakibaba (Total)	Bakibaba (Eval.)	Karacakaya (Total)	Sapdere (Total)	Kızılsu (Total)
Drill number	holes	154	134	15	5	25	19	3	1	55
Total drill length	m	28,206	27,406	1,541	290	3,817	2,986	770	209	5,003
Amount of drills that cut the ore	holes	117	101	10	2	11	10	-	-	
Amount of drills that doesn't	holes	37	33	5	3	14	9	3	1	
Total length of intersected ore	m	5721	5302	138	17	438	422	-	-	
Total length of the wall rock	m	22,485	22,104	1,403	273	3,380	2,565	770	209	
Core Recovery (whole)	%	47	47	61	88	no inf.	no inf.	71	68	
Core Recovery (ore zones)	%	52	52	76	86	no inf.	-	-	-	
Drill amount with ore	%	73	73	-	-	2	2	-	-	
Drill amount without ore	%	14	14	-	-	2	2	-	-	

Eval.:Evaluation, no inf.:No information

A drilling survey consisting of 253 holes (total hole length:39,545m) was planned and successively carried out in order to delineate the extent of mineralization from the outcrop downward and to do calculation of ore reserves, but it was not used to clarify the geologic structure of Küre Mine.

includes the Dibekdere meta-ultramafic rocks, consisting of serpentinite and anthophyllite schist and the Karadere metabasic rock, consisting of metaabbro, metadiabase, metaspilite and metaporphyrite. The mineral assemblages, represented in facies ranging from green schist to epidote-amphibo-

As seen from all these data, the Çangal metaophiolite, which is remnant of the Paleo-Tethys, is to the south of continental crust assemblages. The Kastamonu granitoid belt, which is arc plutonic in character, clearly crops out to the north of the Çangal Metaophiolite(Figure 2-4). Time and the space relationships between the Kastamonu Granitoid Belt and the Çangal Metaophiolite, which is a suture zone product of paleo-Tethys, indicate that paleo-Tethyan oceanic crust should be consumed in a northward subduction zone. Thus, the geologic setting of the Kastamonu Granitoid Belt supports suggestions of a northward subduction of a southerly situated Paleo-Tethyan oceanic crust.



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

Figure 2-4 Structural-Geologic Map of Kastamonu Granitoid Belt and Surrounding Areas

(2) Ballıdağ-Çangal Daği (Kastamonu) Arasındaki Bölgenin Jeolojisi (1986)
The Geology Between Ballıdağ and Çangaldağı (Kastamonu).
M.Aydın, O.Şahintürk, H.S.Serdar, Y.Özçelik, I.Akarsu, A.Ungur, R.Çokuğraş and S.Kaşar

Oceanic deep marine units:

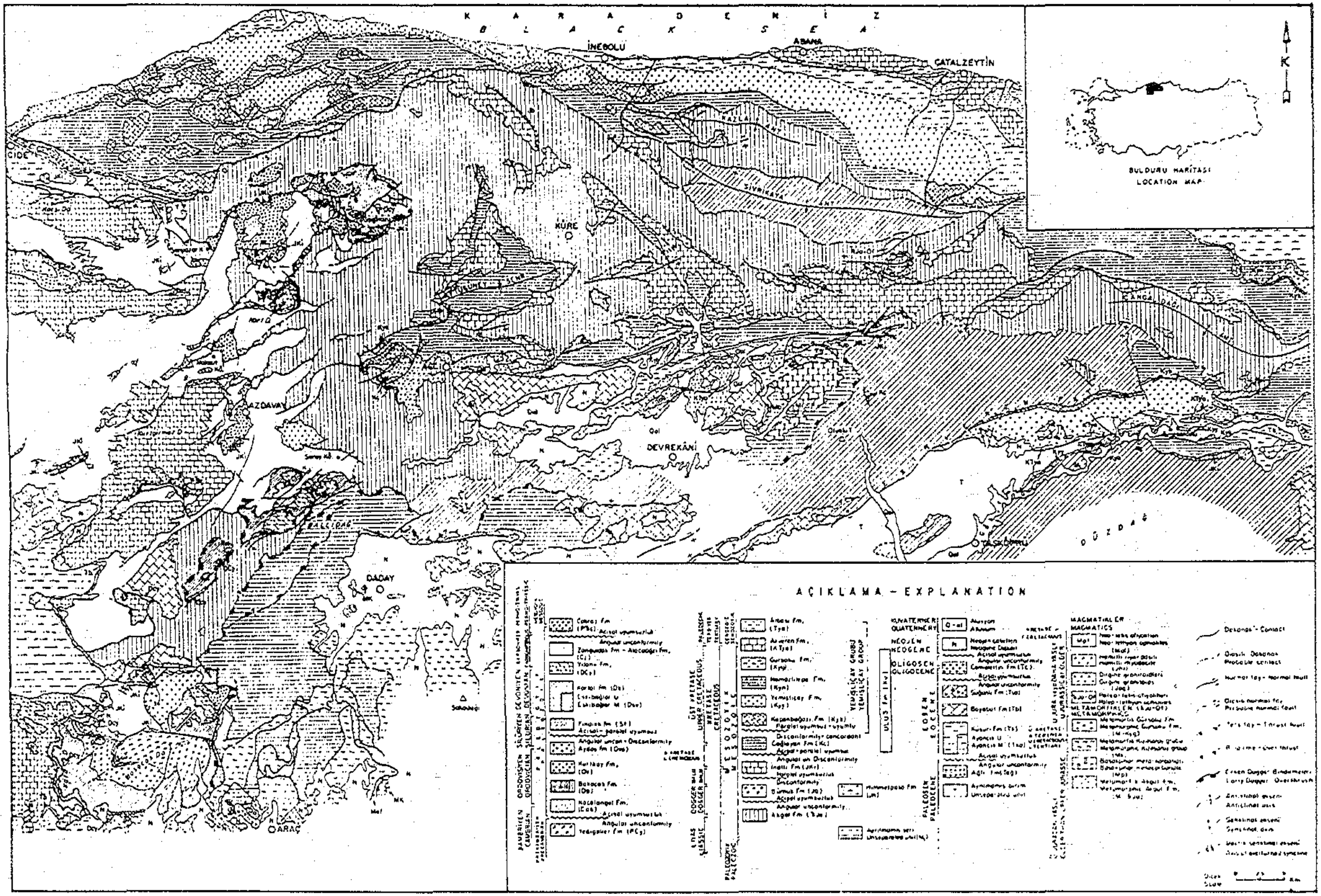
These are the Paleo-Tethyan deposits which were named as "Küre Nappe Units " by Şengör and others (1980). Under this title, four main units in which some lithological and facies differences observed and deposited in different places of the same ocean, will be explained.

Akgöl Formation:
The unit which was named by Ketin and Gümüş (1962) in the Sinop-Ayancik work;makes up the base for Upper Jura or younger units (Figure 2-5, 2-6 and 2-7).

The units containing shale having dark gray -black, generally non fossiliferous and manganese dendrites ;siltstone, fine-grained sandstone;thin limestone bands, spilite, diabase, gabbro, serpentinite (Küre) like lithologies have been formed deep marine environments (Aydın and others; 1980, 1982).

Metamorphic-Akgöl Formation:
Akgöl Formation has gained slate; phyllite and metaophiolite character due to the Early Dogger tectonics and Dogger intrusions in some localities(N-NS of Yaralıgözdağı). The unit is overlain by angular unconformities in North of Düzdağ by İnaltı Formation and in South of Yaralıgözdağı by Bürnük and Inalti Formations (Figure 2-6).

By determining the metamorphism degree by applying illite-crystallinity degree method around Early Dogger intrusions; some rocks having 3.75-5.50 mm illite crystallinity degrees in some places fell into anchi-metamorphic zone. These rocks having typical illite- chlorite paragenesis were called slate. In some other places, illite crystallinity degrees of the lithologies made of quartz, tourmaline, apatite in a matrix composed of chlorite-sericite, enter into the "epizone" with 3.05 mm crystallinity values. The clay mineral paragenesis in these rocks were determined as being muscovite and chlorite (Yılmaz and Boztuğ, 1984).



Şekil 1 : İnceleme Alanının Jeoloji Haritası
Figure 1 . Geological Map of Investigated Area

Figure 2-5 Geologic Map of the İnebolu-Kastamonu Area

The metamorphism determinations of the 9 samples from metamorphic Akgöl Formation taken from South of Küre; Çangal mountain and Sinop-Boyabat Road are as follows; especially illite, kaolinite and chlorite were recognized within the clay assemblage. Both, width of the half length (10 A° 001 peak) and crystallinity as 2θ value of illite were measured. According to Kubler (1980); 6, 7, 9 th samples with 0.35, 0.35 and 0.40 2θ values take place in the anchi-metamorphic zone. Other 6 samples are in the advanced stages of diagenesis (Ertürk, 1984; personnel communication).

Except the burial metamorphism, we think that the dislocation metamorphism was also effective in Düzdağ and South of Çangal mountain.

Bürnük Formation:

This formation which deposited in generally intermountain alluvial fan environment contains lithologies such as red colored conglomerate, sandstone, siltstone and sandy limestone.

Within the conglomerates, there are shale, sandstone, diabase, gabbro, granite, granodiorite, metamorphic dolomite and marble belonging to the older units.

It begins with the fossiliferous sandy limestone in the North of Yaraligözdağı. This unit is expected to have Upper Dogger-Lower Malm age according to the lower and upper boundary relationships.

İnaltı Formation:

During Dogger and Early Malm, except the deposition of Himmetpaşa formation, with a regional transgression which was from S to N a shallow marine units deposited in Malm.

The bottom contact of the unit which contains gray, blue-gray, thin-medium bedded, locally reefal calcareous rocks and sandstone beds, is either parallel to or show angular unconformity with the Himmetpaşa and Bürnük Formations.

It is mostly unconformable with the overlying Cretaceous units in most of the area. In some locations, especially in the places where the micritic levels of the İnaltı Formation are observed, a nonconformity is suggested. The observations of hard surfaces and basal conglomerates (West of Şenpazar) are the evidences of the unconformity between İnaltı Formation and the Cretaceous units. Moreover, by the paleo-current direction determinations done; the turbiditic sandstones were determined to be fed from the NW. The feeding of the turbidites which overlies the İnaltı Formation that deposited due to a S-N trending transgression, should be counted as the evidence of the unconformity. Because according to Aydın, Şentürk, Serdar and others (1986) Paleo-tethys convergence had started.

Due to the following fossil content, the unit is suggested to have Upper Jurassic-Lower Cretaceous age: *Anchispirocyclina* sp., *Trocholina alpina*, *Nautiloculina oolithica*, *Protopeneroplis* sp., *Haurania amiji*, *Pseudocyclammina* sp., *Textularidae*, *Macroporella* sp., *Thaumotoporella* sp., *Likanella* sp.

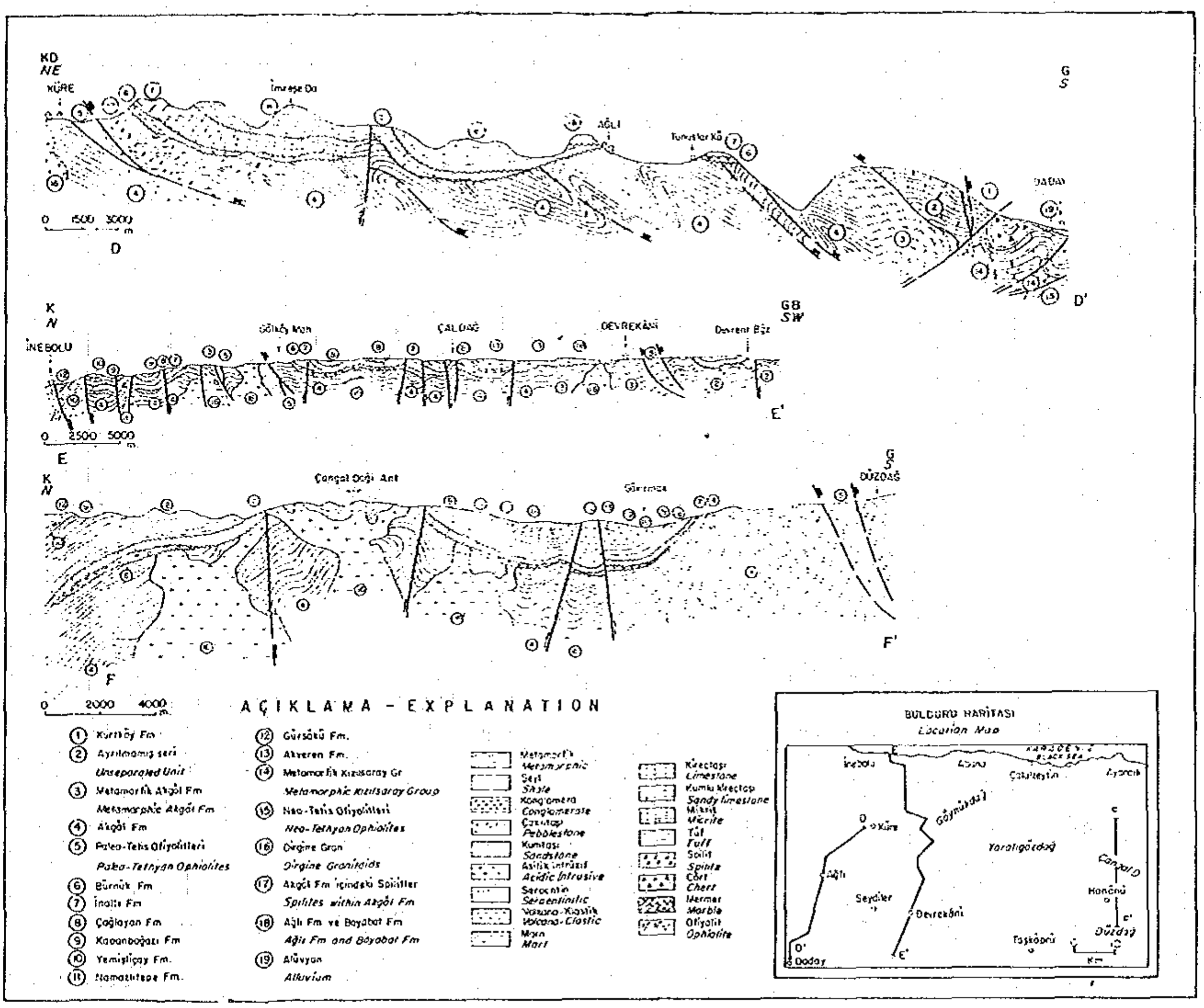


Figure 2-6 Geologic Cross Sections of the İnebolu-Kastamonu Area

Çağlayan Formation:

The unit which contains yellow-gray colored turbiditic sandstone, conglomerate, dark gray shale carbonaceous shale, turbiditic character; shows angular to parallel unconformity with the İnaltı Formation. Because of irregularity of the bottom topography during its deposition, it shows local facies changes. It contains shallow marine carbonates around Ağlı and olistostromal conglomerate lithologies in the North. Gray- light gray colored marl and silty marl take the place of dark gray colored shales in the north of Devrekani.

According to *Rotalipora subticiensis* GADOLFI, *Praeglobotruncaana* sp., *Calcisphaerula* sp., *Lituolidae, Textularidae, Dictyomitra* sp., which were found in the shales and marls; the unit has Aptian-Cenomanian age.

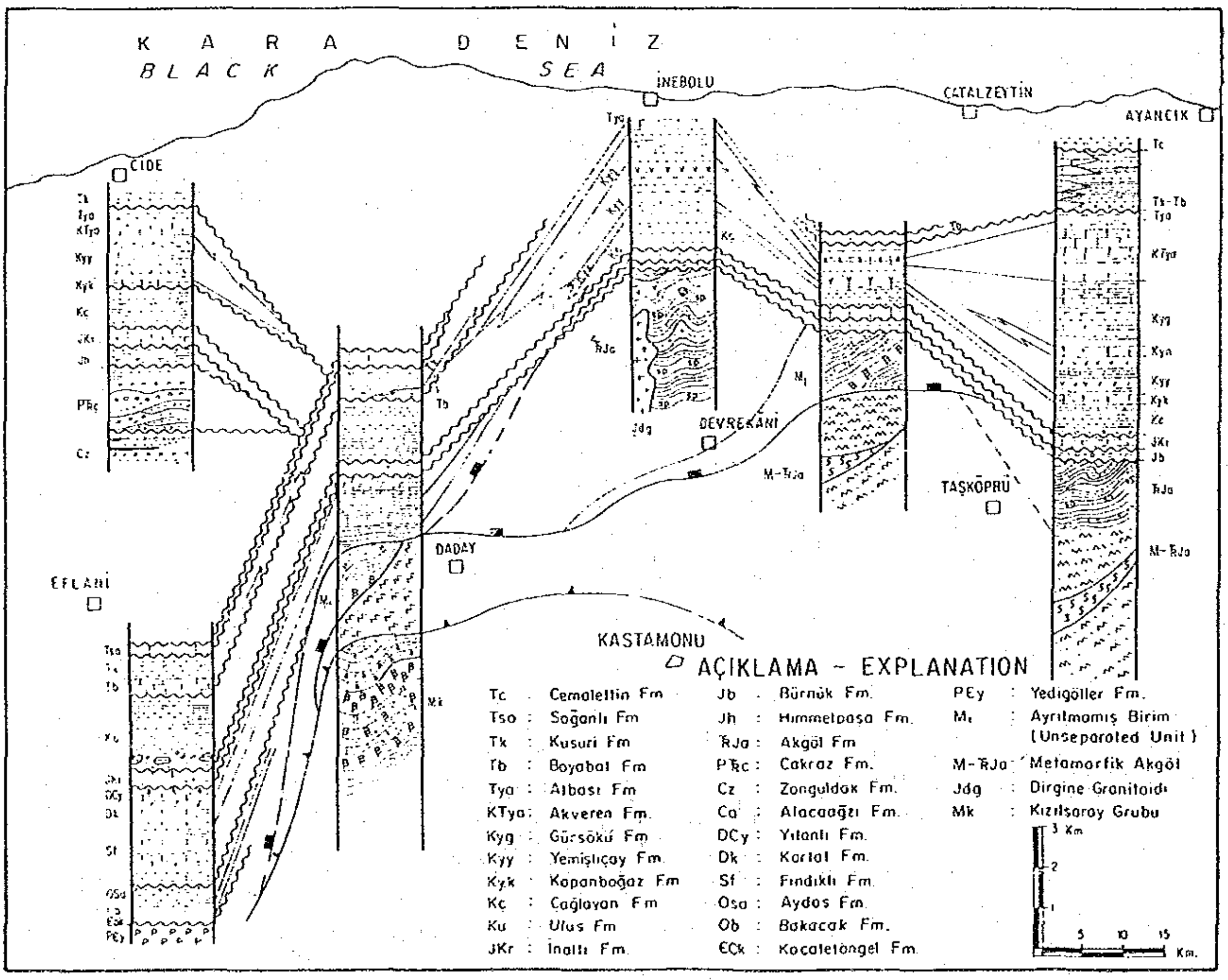


Figure 2-7 Facies Map of the İnebolu-Kastamonu Area

(3) Kastamonu-Küre Bakırlı Pirit Aramaları, Jeoloji ön Rapor (1976-1977)
(Geological Exploration of Pyritic Copper Deposits in Küre)
M. Kılıç, S. Tüfekçi, A. Camaşırcıoğlu, N. Tekel, N. Çetinkaya, Z. Biçer.

Around Küre, Kastamonu, İnebolu areas covering copper-pyrite formations of Küre, Aşıköy, Bakibaba, Kızılsu; detailed geological and geochemical works were carried out in 1/25,000, 1/10,000, 1/500 scales.

Paleozoic metamorphics, Lias eugeosynclinal sedimentary rocks, submarine volcanic rocks, intrusive magmatic rocks and serpentinites crop out in the area. Furthermore, massive limestones beginning with Upper Jurassic-Lower Cretaceous red basal conglomerate area observed.

The youngest unit in the area is the Upper Jurassic flysch composed of sandstone, mudstone, argillaceous limestone of agglomerate, tuff and lava intercalations with andesitic and dacitic concentrations cropping out on the Black Sea coast.

The important copper-pyrite deposits of the study area which are the Küre, Aşiköy, Kizilsu and Bakibaba deposits have quite similar mineralogical properties. Ore minerals are chalcopyrite and sphalerite. Furthermore, cobalt, gold and silver elements were found to be present in the trace element concentrations in the chemical analyses. Secondary minerals consisting of limonite, malachite, azurite, covelline and chalcosine are present.

The anomaly fields, previously determined by the MTA were checked by the geochemistry studies, but no mineralizations were recognized.

(4) Küre civarının masif sülfid yatakları ve jeolojisi, Pontidler (Kuzey Türkiye), 1980
(Geology and Massive Sulfide Ores of the Küre Area, the Pontic Ranges, Northern Turkey)
M. Güner (MTA)

This study deals with the geology and massive sulfide deposits of the Küre district which is in 50 km North of Kastamonu and in 20 km South of Black Sea in Northern Turkey

More than half of the study area is covered by the sedimentary rocks. These formations make up the eugeosynclinal sedimentary rocks subgraywacke and black shale character and non-eugeosynclinal sequence of mudstone, conglomerate and limestone. The oldest rock unit is the Permian subgraywacke and the youngest unit is the Upper Jurassic limestone in Küre. Subgraywacke-black shale unit seems to be folded isoclinally before the extrusions of extrusive rocks. Possibly, most of the rocks belonging to the Permian-Triassic submarine basalt sequence are interconnected with the eugeosynclinal accumulations. Formation of dykes with varying compositions take place in the basaltic rocks. Toward the top, pillow breccias and tulle like chlorite masses follow these. In the transition zone of the pillows to the breccias, matrix content gradationally increases. At the same time the pillows become upside-down and poorly sorted. The broken pillows and their pieces mostly cover the uppermost part of the basalt sequence. Basaltoids and related diabase dykes have basaltic chemical concentrations of tholeiitic ocean base.

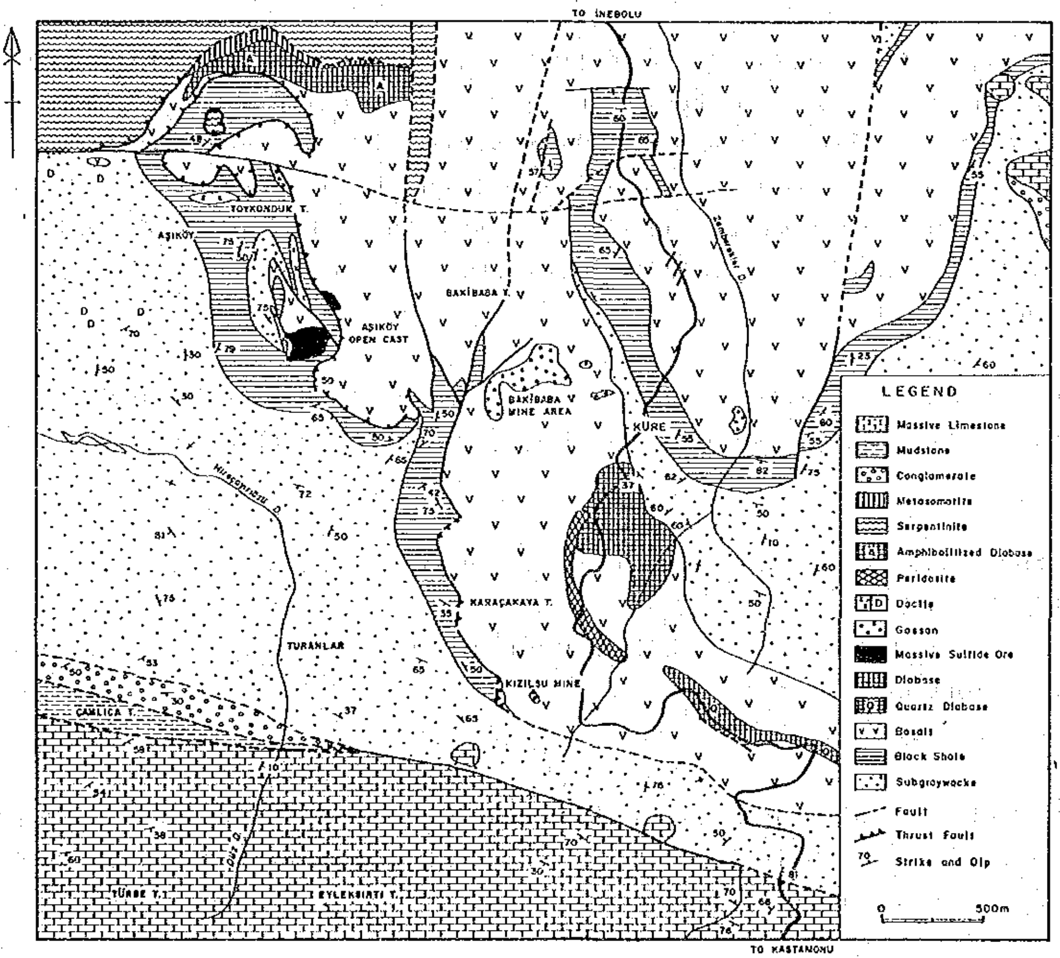


Figure 2-8 Geologic Map of the Küre Mine Area

Pyrite-copper deposit of Bakibaba, Aşıköy and Kızılsu in Küre area have many common properties. All of these, actually. are made of sulfides which substitute with basaltic sulfides. Aşıköy mine being the greatest ore mass, has 170 x 300 m^2 area and is followed up to 900 m(sea level) deep from the surface. Massive ores contain more than 90 % sulfide minerals in volume. Chalcopyrite content varies from 1.5 % to 99 %. Disseminated ores have small amount of sulfide and do not have or have very small amount of chalcopyrite or iron-oxide. Massive ores in Bakibaba have an average copper grade of 6 %. This is 3 % percent in Aşıköy mine. Textural studies showed the presence of brecciated, colloform and framboidal pyrites. But beside the unaffected chrome spinells, approximately no silicate minerals which were previously replaced by sulfides are not observed.

Almost all ore masses are near contact black shale and basalt. Their formation places are fault controlled. These faults ensure ore carrying fluids to move up along the weak zones within the basalt sequence. The ores are placed by periodic intrusions. Raising ore solutions causes widespread hydrothermal alteration within the basalt complex. But it does not affect the sedimentary rocks. Hydrothermal takes place within the breccia formations and in some rock types rich in chlorite. During the metasomatism, large amount of alkalies, silicates, magnesium and iron were taken from these mineralized areas and probably accumulated in the upper levels of the altered wall rock columns. Some chloritic rocks display addition of FeO, MgO and Al_2O_3 and continuous loss of large amounts of Na_2O, CaO and some SiO_2.

In some places the iron hats which slided from the higher places are generally found on the surfaces of massive or disseminated ores. these are certainly formed due to the oxidation of sulfides.

(5) Küre Bakırlı Pirit İşletmesi Müessesesi Ar: 31961 Numaralı Sahada Ersizlerdere ve İpsinler Köyü Civarında Yapılan Jeolojik Etüd Hakkında Rapor (1989)

(Report of Ersizlerdere and İpsinler Mineralized Zones)

Kenan Esen (Etibank)

1/1,000 scale geological mapping of 10 Ha area situated in the west of Ersizlerdere-Değirmenönü and of 10 Ha area situated in the north of İpsinler village were done within the circumstances of 1988 prospecting program in the K.B.P.İ. license fields.

Within the diabase unit which shows distribution in the area west of

Ersizler village, poor pyrite dissemination and rare malachite-chalcopyrite were observed and it was proved that this mineralization depending on NW-SE directed fracture systems did not continue downward by the geological and geophysical surveys.

In the study area, north of İpsinler village, limonitized and kaolinized outcrops were observed in the highly altered diabase and in the areas where there are malachite three point samples were taken Cu, S, Fe contents of these three samples are as follows.

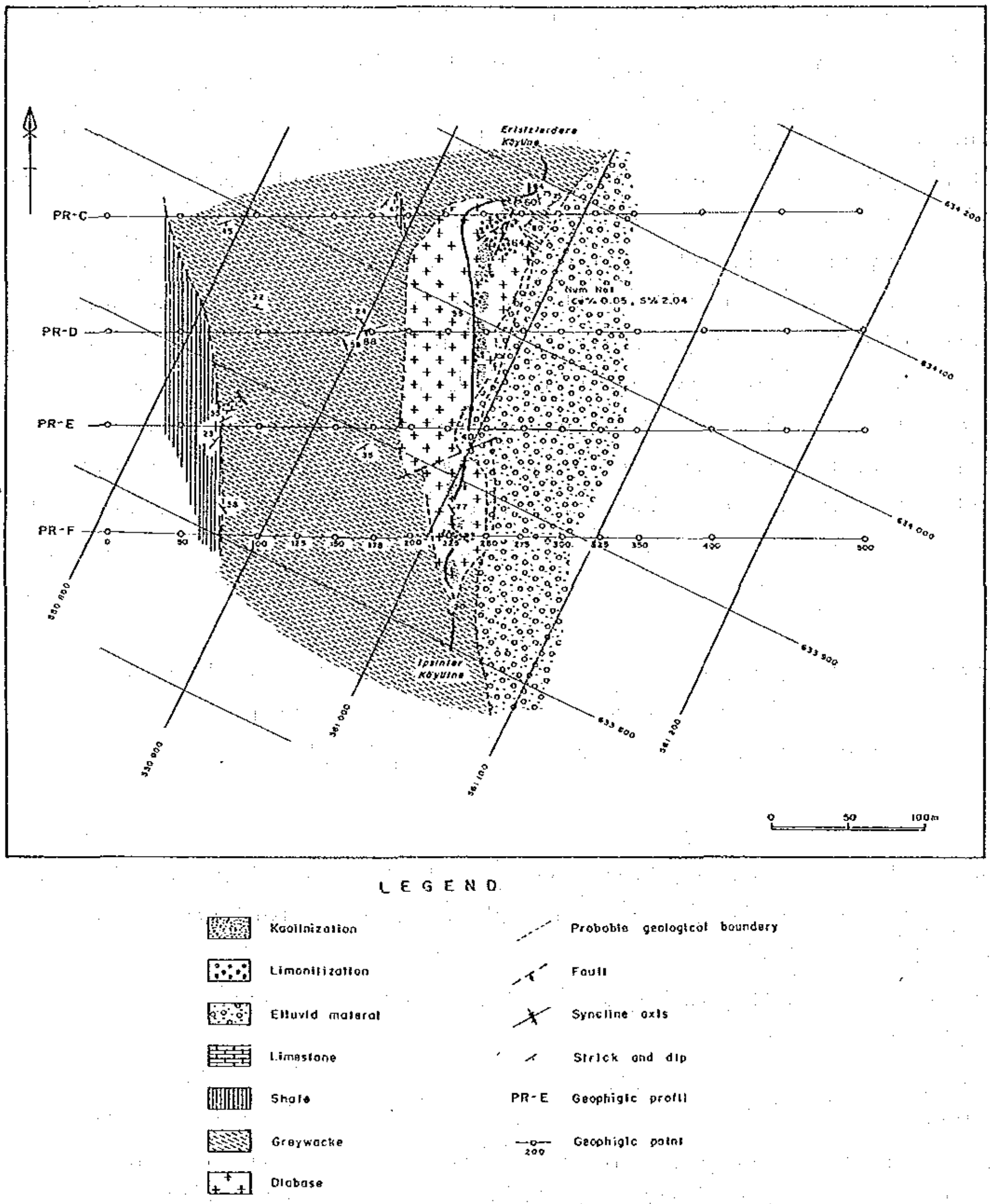


Figure 2-9 Geologic Map of the İpsinler

Sample	Cu %	S %	Fe %
1	0.47	1.88	---
2	0.62	13.28	---
3	0.05	1.45	11.12

In this area any evidence showing a deeper mineralization could not be obtained by the geophysical surveys. Therefore, as the result of geophysical and geological surveys it was concluded that no economical mineralization could be found in the two regions.

As a conclusion, if a widespread prospecting is done in this region, this area, also, is advised to be added to the prospecting program circumstance and be evaluated. The mid point of "0" point of E_2 and F_4 profiles was found to be suitable for the drilling.

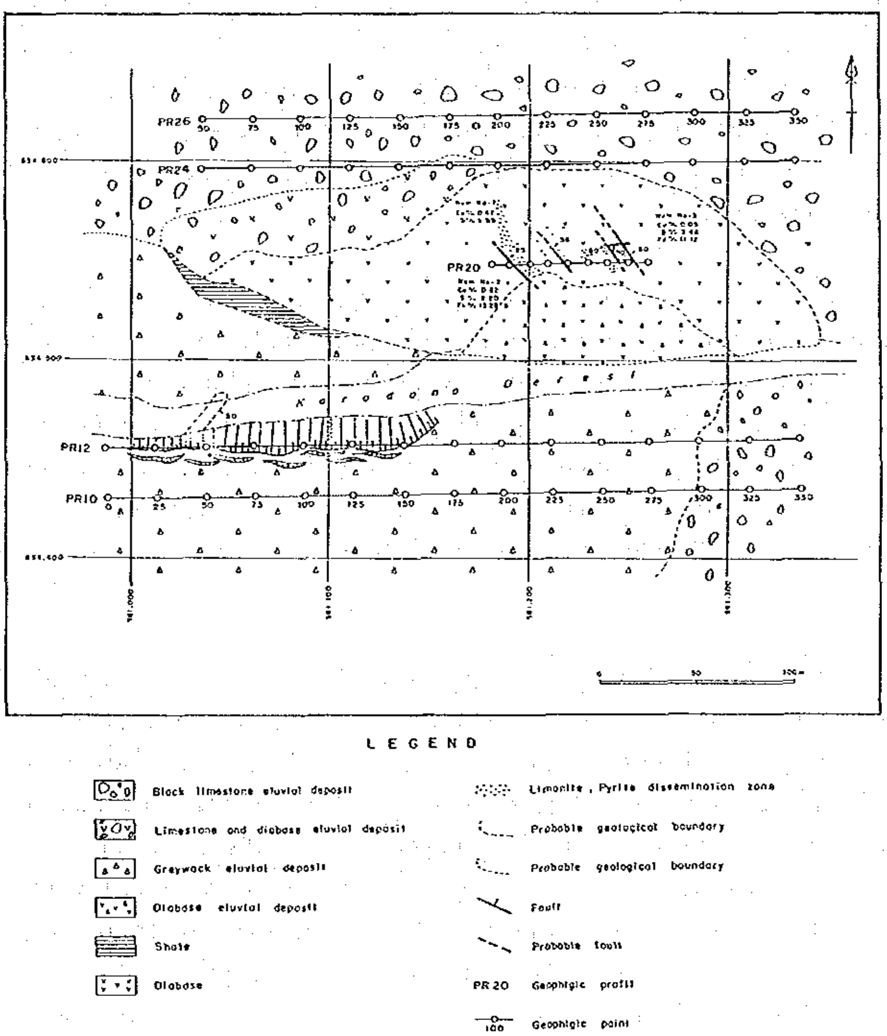


Figure 2-10 Geologic Map of the Ersizlerdere

(6) Daday-Devrekani Masifi, Kuzeydoğu Kesimi Litostratigrafi Birimleri ve Tektoniği (1980)
(Litho-stratigraphic Units and Tectonics of Northeastern Part of the *Daday-Devrekani Masif, Western Pontides, Turkey)*
Osman YILMAZ

Abstract

The metamorphics of northeastern part of the Daday-Devrekani massif and their surrounding rocks have been distinguished into lithospheric units and grouped according to their tectono-stratigraphic relations.

The group of Ebrek Metamorphics, composed of medium-high graded gneisses and meta-carbonates, divided into a pair of mappable litho-stratigraphic units; Gürleyik gneiss and Başakpınar meta-carbonate and also, the assemblage of Çangal Metaophiolite, consisting essentially of low graded serpentinite, metagabbro, meta-serpentinite, metadiabase, metaspilite and metaporphyrite have been divided as Dibekdere metaultramafic rock and Karadere metabasic rocks. Age of the metamorphics is determined as Pre-Lower Jurassic. However, Ebrek Metamorphics can be Precambrian and, generation and primary (*in situ*) metamorphism ages of Çangal Metaophiolite have been presumed as Paleozoic.

Mesozoic-Cenozoic aged rocks are distinguished from old to young as follows;Börümce Formation (Lower Jurassic); Asarcik diorite (Middle Jurassic); Yaralıgöz Group consisting of Muzrup Formation (Middle-Upper Jurassic); Yukarıköy Formation (Upper Jurassic-Lower Cretaceous) and Çatak Formation (Lower Cretaceous); Kirensökü Formation (Upper Cretaceous); Germeç Group *consisting of Kaygunca Formation (Palaeocene-Eocene) and formations of* Eocene age from outside of studied area and lastly, Cünür Formation (Miocene-Pliocene).

By means of tectonically investigation, it's been established that Ebrek Metamorphics and Çangal Metaophiolite have been juxtaposed along Musaderesi thrust zone during Kimmerian phase; characteristics of Börümce Formation differed from those of Yaralıgöz Group; calc-alkaline intrusions such as Asarcık diorite of Kimmerian phase emplaced into the Ebrek metamorphics and Börümce Formation; Yaralıgöz Group overlaid on Ebrek Metamorphics, Çangal Metaophiolite and Börümce Formation with angular unconformity and also during the Lower-Upper Cretaceous and other unconformity take place and in this region NE-SW trended thrust of Pyrenean phase.

As a result litho-stratigraphic units established in the typical region of the northeastern part of the Daday-Devrekani Massif are proposed as *official litho-stratigraphic units for Daday-Devrekani Massif and surrounding* ing massif.

Çangal Metaophiolite:

Metamorphosed mafic-ultramafic rocks and leucocratic metaporphyrites cutting these as dykes within the study area are collected under the name of Çangal Metaophiolite. Even though metamorphic equivalent of lithologies defined for an ophiolitic group in Penrose Conference (Geotimes, 19729 were found in Çangal Metaophiolite in different proportions; together with these (meta-) sedimentary is observed. The main lithologic units of serpentinite and metadiabase, metaspilite, metaporphyrite making the metaophiolite are collected in two mappable units as Dibekdere metaultramafic rocks and Karadere metabasic rocks, respectively. Fault contacts are common between Dibekdere and Karadere units as observed in the ophiolite groups (Coleman, 1977).

Muzrup Formation:

The place in which this unit that is composed of conglomerate is best observed is Muzrup and vicinity. The red colored polygenic conglomerates which unconformably overly the Börümce Formation continues in the same facies up to the base of Yukarıköy Formation. Its thickness is approximately 500 m. The granite, diorite, green schist, gneiss, marble, calc-silica gneiss, black shale gravels, coarse grained sandstone within the conglomerate and cemented by calcite and red colored iron oxide. This unit passing into red colored sandstone towards upper levels is conformably overlain Yukariköy in the Uppermost part of the unit preserving their original situation gives Middle-Upper Jurassic age for the Muzrup Formation. In the samples of the unites taken from the upper sandstone levels, calcite cement amount varies between 0 and 70 %..

(7) Küre kazası, Fırıncık(Köselik) civarında yapılan Jeolojik Etüd Raporu (1969)

(Report of Mineralized Zones of Dikmendağ Area)
Orhan Uzluk

The survey areas with

G.M.D. No	Ar. No
36269	6392

36270	6450
26271	6339
26272	6397

License numbers which belong to Etibank General Directorate, were done between the dates 19 July-30 August and this was prepared following the 1/5,000 geological mapping and geological surveying works.

The two areas labeled above of each was closed depending on the old dump slags of 5,000 tons in three different places were later studied by geologist Yüksel Arda. He made general geological surveys in these areas and summarized the results in a report with 15.07.1968 date. The areas which can be important for the mineralization were divided into three units.

The presence of three different slags in the area brought about the conclusion that there were old mining works around. But since these works are very old neither the villagers nor the surveying works gave any evidence about them. The only known one is the drilling made by Sonar Mining, being 100 m away from the slag no. 1 on the border of our field. It is known that this drill went down to 128 m but there is no information about the drilling cores.

Generally magmatic and sedimentary rocks make the lithology in the area. Moreover the metamorphic rocks caused by the metamorphism of the sedimentary rocks cover a wide area.

The geologists worked in this district, assume that the sedimentary rocks and the submarine flows in the area formed in a eugeosyncline and they collected them under the name of " Eugeosynclinal Rocks". According to this rocks are divided into three as;

a) Eugeosynclinal rocks
b) Acidic and basic intrusives
c) Calcareous rocks and conglomerates

Eugeosynclinal Rocks:

Submarine volcanic eruptions and sedimentary rock assemblages enter into this group and sedimentary rocks are represented by the argillites and graywackes in the area.

-Argillite:Argillites are mainly mudstones and show fine grained, fine layering and sometimes limonitization.

-Graywacke: The graywacke which generally show sandstone properties, are fine to medium grained and poorly sorted. They are brown-gray colored and contain quartz, feldspar and mica (mostly biotite) which generally turned into sericite. Local mineralization is also observed.

Age of the graywacke-argillite assemblages was shown to be Jurassic-Cretaceous.

Mineralization:

According to the Yüksel Arda's report, there are three unites that can be hopeful for the mineralization. In the unit no. 1 there is no sign of mineralization. In the unit no. 2,(in the South of the map, around Öcür) only a very narrow part within the village has traces of pyrite. But on the unit no. 2 and around, there are pyrite disseminations, therefore the works were shifted to the upper part of the 1/5,000 scale map.

Ascendant-primary Mineralization:

Mineralization seems to depend upon the rocks with fresh green colored and named as diabases. The diabases (shown in the map) have very fine grained pyrite disseminations and in some samples these grains become more intense. This situation is mostly seen in the diabases which are 140 m South of Ornu village road. The volcanic sequence contain mild kaolinization, diabases with pillow structure and mild pyrite mineralization.

A similar structure continues on the road to the slag no. 2. They are originally same units but parted due to the erosion of the stream flowing between them.

Secondly, N-S directed poor pyrite disseminations which is on the S-E down-slope Karafındık Tepe can be shown. This area is both a contact and a probable fault line with mild pyrite disseminations.

Conclusion:

The most important parts of the area for us, are the diabases and poor pyrite mineralization near the contact, South of Mt.Karafındık.

If there will be geophysical work in the area, it is suggested to be on the referred poor mineralizations and diabases.

As for the mineralized diabases, the kaolinized part on the road to Ornu village and diabases with pillow structure are suggested to be chosen and worked.

Even though these pyrite disseminations and kaolinizations are out of Etibank's license field, since the strongest mineralization appears there, the geophysical profiles are suggested to pass through the mineralized diabases which are closest to or within our license field.

(8) Kastamonu, Küre'nin Bati Kısımlarındaki Cevherleşme ve Jeoloji (1976)
(The Geology and Mineralization in the Western Part of Küre, Kastamonu)
M. Kamitani, A. Çamaşırcıoğlu

Introduction

This study is based on the proposal of the M.T.A. Institute, two concession areas were examined; the first one is around Kara Tepe-Ornu-Abuda and the other one is in Satıköy-Çamlık Tepe-Öcür-Domuzalanı-Alacık. The concession areas of Ar. 18159 and 18344, are located at the western part of Küre town where western Black Sea mountains have an altitude range of 900m to 1,500m and whole area are almost covered by various kinds of pine trees. In the concession areas there are no large towns or villages but scattered hamlets.

Geological Setting

The two concession areas are made up mainly of Jurassic-Lower Cretaceous formations and dacitic dykes intruded into them (Figure 2-11). According to Ketin (1962), in this area the oldest formation is Liassic and it gradually passes into the Jurassic-Cretaceous formations.

The Liassic formation in this area consists of mainly basic volcanic rocks and alternating argillite and sandstone beds. The basic volcanic rocks extend in the direction of N-S to NE-SW and are composed mainly of diabase, andesitic lavas and their pyroclastic rocks. They are exposed along the road cuts between Yayla and Masköy hamlets. The relation between the basic rocks and argillites, is shown in Figure 2-11, there seems to be an unconformity apparent therefore, there is no thermal effect. Andesitic rocks consisting of essentially tuff, breccias and lapilli tuffs and they are located between the upper and middle horizons of the basic volcanics.

Intimately alternating argillites and sandstones are exposed at the west of the basic volcanics. This formation has a synclinal structure in the northern part while in the southern part this structure gradationally obscured.

The Jurassic-Cretaceous formation comprising of limestone-calcirudite, calcarenite, sandstone, argillite, mudstone and basic tuffs are exposed to the southern part of the basic volcanics of the Liassic age. Although unconformity between Liassic and Jurassic-Cretaceous formations was not directly observed, many rounded and subrounded of the basic volcanic rocks, argillites and sandstones are found in the calcirudites. This clearly shows that there is an unconformity between them. Jurassic-Cretaceous formation has an obscured synclinal structure of which axis shows NE-SW direction which is plunging into the SE.

Argillite, mudstone and mudstone become gradually disappeared in the north eastern part, while in the south western part calcareous rocks such as limestone, calcirudite and calcarenite are seen a little exposed. Limestone, calcirudite and calcarenite predominate in the north eastern part of this area.

The basic volcanic rocks consisting mainly of diabasic and acidic tuffs are concordantly intercalated with each other. It is very difficult to differ the rocks between Liassic basic volcanics and the younger ones by the field observation.

Dacite dykes have varying textures from porphyritic phenocrystalline to aphanitic. There are no remarkable contact effect and hydrothermal alteration against the wall rocks.

Mineralization and Hydrothermal Alteration

In the two concession areas some weak mineralizations were observed; Yaylabeli mineralization is found in 1 km south of Masköy, between Kızılkaya tepe, Yayla and Öcür hamlets. Hydrothermal alteration such as silicification, kaolinization and sericitization are found in Yaylabeli and its western slope.

The largest impregnated zone of pyrite is located in the western slope of Yaylabeli. It is estimated that the zone extend to NE-SW direction, and has a maximum width of about 50 meters, In this zone, very fine grained pyrite ore disseminated in and around quartz veinlets. Other sulfide minerals, however, except pyrite and their secondary minerals are not found. Hydrothermally altered minerals are quartz, kaoline mineral and sericite.

The other mineral occurrences of impregnated pyrite are observed at forest road cuts between Kızılkaya tepe (1,514 m) and Yayla hamlet. There are no remarkable mineralization and hydrothermal alteration. The occurrences are seen to be controlled by fractures in the basic volcanic rocks.

Several barren quartz veins with useful sulfide mineral, except pyrite, are seen in the basic volcanics of the Jurassic-Cretaceous formation at Öcür hamlet. The maximum width of the vein is about 10 cm. The quartz veins have two directions; one strikes NE-SW and dips steeply towards south, the other one NW-SE and steeply towards north. The quartz veins are not seen cutting through the calcirudite bed covering the basic volcanic rocks.

Conclusions and Recommendations

Although the authors made the reconnaissance geologic survey based on 1/25,000 topographic maps in and around two concession areas; they couldn't find any remarkable mineralization. Basic volcanic rocks, however, are widely distributed from the east to the south of Ar.18344 and small scale ones scattered in Ar.18159.

Pyritization and hydrothermal alteration are found here and there in the basic bodies, but no mineralization in the clastic sediments of Liassic and Jurassic-Cretaceous formations.

The copper contents in the largest pyrite-disseminated zone in the western slope of Yaylabeli are very low. Öner(1971) and Takashima and Kılıç(1975), also state that there are no important copper mineralization. Four localities of slug dumps containing considerable amount of copper were found by their reconnaissance surveys. It is supposed that the melting of cupriferous sulfide ores were conducted in many places of which were midway areas coal producing area and the Küre mine.

Submarine basic volcanic complexes are distributed around the Küre mine and many gossans have been acquainted in the complex. It is important to study whether these gossans occur the same volcanic sequence of the complexes or not. There are serious problems on the genesis of the ore deposits; that is, submarine exhalative-sedimentary or hydrothermal replacement deposit at the post-Alpine orogenic stage.

To investigate the genesis and explore the same type of ore deposits as the Aşiköy deposit, further volcano-stratigraphic, petrographic and petrochemical studies as described below are necessary;

1) Distribution and structure of the basic complexes (based on 1/10,000 topographic map).

2) Volcano-stratigraphic sequence and petro-chemistry of the basic complexes.

3) Stage of mineralization and related igneous activity.

Fortunately, there are many drilling data in and around Aşiköy Bakibaba and Kızılsu ore deposit. Detailed geologic survey based on 1/10,000 topographic map is desirable to extend from the developed and underdeveloping deposits to the peripheries.

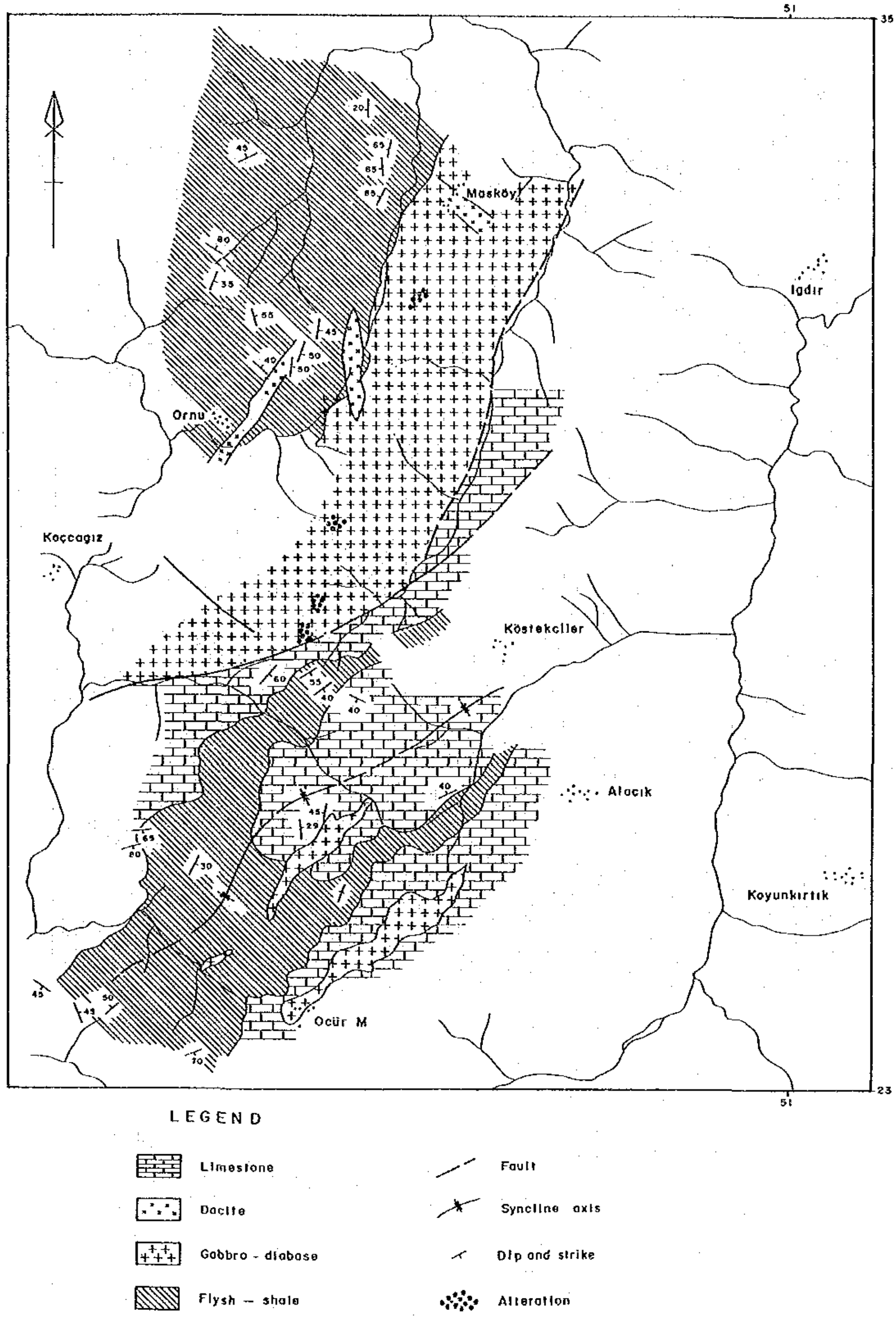


Figure 2-11 Geologic Map of the Dikmendağ Zone (Kamitani)

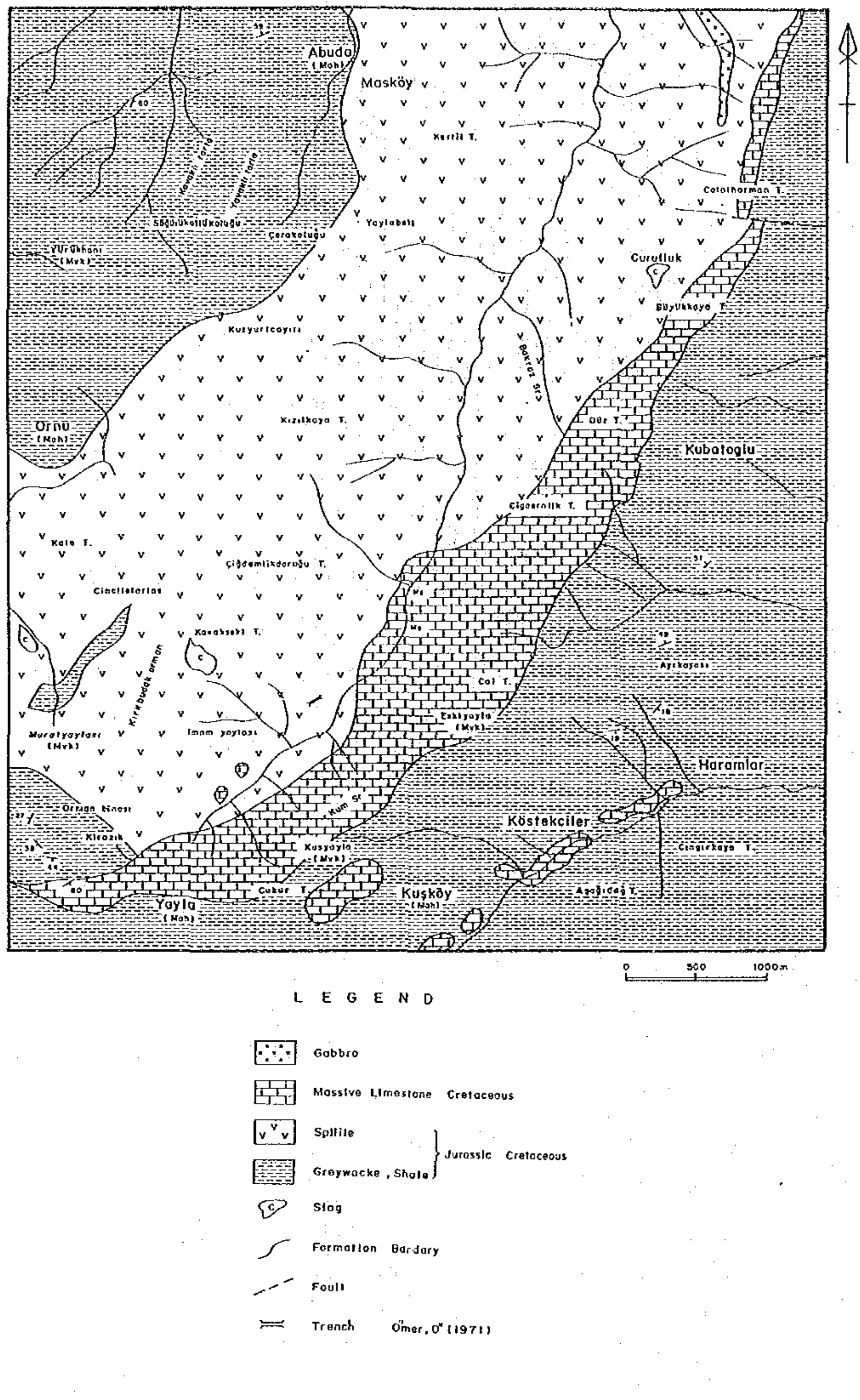


Figure 2-12 Geologic Map of the Dikmendağ Zone (Ömer)

(9) K.B.I. E32-d1 Paftasına Ait Kepez Köyü Bakır Anomalisinin Detay Jeolojisi (1974)

(Detailed Geology of Kepez village Copper Anomaly of E32-d1 section, Kastamonu, of K.B.I.)

Atilla Özgüneyli (MTA)

The metamorphics composed of green schist, serpentinite-schist, chlorite-schist, epidote-schist, graphite-schist, sericite-muscovite-schist and quartz-schist show a wide distribution within the region in which there is Devrekani-Kepez anomaly. Furthermore, there are phyllites, metamorphosed-calcareous rocks, red-radiolarite-schists, large serpentinite, gabbro bodies of diabasic origin and spilites. The grayish calcareous rocks overly these with a Palaeocene transgression. The region was effected by NW-SE directed tectonic regime. These are generally left-lateral strike-slip faults which developed in the referred direction. In the northern part of the area, calcareous rocks are separated from the other formations by the gravity faults (N60°W).

There are not important alterations except the unimportant limonitizations on the contacts of acidic and diabasic/dacitic rocks outcropping as small head in the northern parts of the magmatic complex and unimportant and local pyritic and limonitic formations on the contacts/within the schists in the southern margin of the area.

(10) Kastamonu-Taşköprü-Musabozarmut Sahası Jeoloji ve Jeofizik Etüdleri Raporu (1991)

(Geologic and Geophysical Exploration of Musabozarmut Area, Taşköprü, Kastamonu)

Tayfun AKKUŞ and Sari Dirim (Etibank Maden Arama Dairesi Başkanlığı)

Sey Yaylası Mineral Occurrence

The study area which belongs to the northern part of the Taşköprü town of Kastamonu city, is represented by the rocks called Çangal Meta-ophiolite is in the middle part of the North Anatolian Fold Belt. The abundant rock types are Pre-Jurassic metadiabases which make up the lowermost lithology of the Karadere metabasic rocks.

No distinctive mineralization is observed in the area some intense alteration zones are followed. The most effective alteration zone starts at the junction of Ağulu Stream and Kurtaran Stream and laterally continues 300m in the E-W direction and it is about 150m wide. There is an intense pyritization along the road slope of the Kurtaran Stream.

There is no other sulfur mineral constituent within this area. But secondary minerals like malachite and azurite are observed in the slags. The dump slags around this alteration zone are thought to belong to the old mining activities. Moreover the limonitic formations are also widespread in the area. There is no important metal concentration. 1/5,000 scale geophysical map of 150 Ha area and 1/1,000 scale geophysical map of 40Ha area completed and geophysical survey of 35 Ha area was carried out in the study area.

Geophysical surveys were done by the applications of IP and SP methods which are the most effective methods in the sulfur mineral prospecting. The anomalies which can be due to probable sulfur mineralizations of the two methods overlapped.

2-2 Geochemical Prospecting

(1) Kastamonu-Küre Sahasının Genel Jeoşimik Etüdü, MTA Maden Etüd Dairesi Rapor No.1400 (1973)

(Geochemical Prospecting of Kastamonu-Küre Area)
M.Köksoy ve Y.Turan

Introduction

A geochemical prospecting for the copper and related mineralization was programmed for the area including Küre -Kastamonu by the MTA in 1967-1968. According to this program from a 1,150km^2 area covering E31 a1, a2, a3, a4, b1, b2, b3, b4, sections 1,058 stream sediment samples were collected. But the analyses of these samples could not be done due to the laboratory impossibilities.

The registered samples could be analyzed in 1972. By the first evaluations of the obtained data; some dispersed high values were observed and by picking up new sediment samples, a control study was done.

The 1967-1968 field works were conducted by Nail Kaynak, Enver Telek and Işik Kongur and 1972 control study was conducted by Kamil Kara.

80-mesh size fractions of dry samples were analyzed in Atomic Absorption Instrument for their Cu, Zn, Co, Ni values. Due to the high values obtained from the samples taken from E31 a1, a2 sections; 525 sedimentary samples were again collected in 1972 field season. 35 mesh size samples were analyzed for Cu and Zn.

During this study, regional geology was tried to be studied but the samples collected from pyritic and altered rocks didn't give good results.

The statistical evaluations of the analyses results of each element were done by using computer and drawing % cumulative frequency-probability curves. By plotting the obtained values on the maps and anomaly fields were determined (Figure 2-13).

Geochemical Anomalies

Anomaly Field "A"(Figure 2-13):This field which is situated 3-5 km in the northwest of Küre; covers approximately 16 km^2 area. All the elements; Cu, Zn, Co, Ni here gave values at anomaly fields.

Because Hiraçayırözü stream, flows around Aşıköy ore deposit; it may be thought that these anomalies could be driven from this contamination. However the tributaries of Hiraçayırözü stream gave high values. Thus, it's strongly possible that the anomalies can be related to a mineralization in the field. Therefore, a detailed geological survey has to be done in the field and detailed geophysical and geochemical methods have to be applied where necessary.

Anomaly Field "B" (Figure 2-13):This field which is situated 20 km in the east of Küre; covers 60-70 km^2 area. Co and Ni anomalies are present here. Only one sample gave both Cu and Zn anomalies. Co and Ni anomalies are parallel to the tectonic lines trending NE and NW. A detailed geological survey has to be done where the Isırganlı stream joins with the Tahtaköprü stream.

The probable causes of the geochemical anomalies should be searched for. Because only Co and Ni elements give anomalies;the high values may be due to basic and ultrabasic rocks. Actually a small diorite outcrop is seen in the geological map. Even though the Cu and Zn elements support that the Co-Ni anomalies can be related to a Cu mineralization; before making a decision, it is good to wait for the result of the surveying that is suggested to be done where there was the strongest anomaly. If the survey result is positive, geological surveying has to be extended to cover all the anomaly field. Otherwise, a further work is not necessary on this anomaly.

Anomaly Field "C" (Figure 2-13):This field is situated 10 km in the north-east of Küre and on the continuation of the anomaly "B". When the geological surveying that is suggested to be done in on the anomaly "B" gave a positive result, this area can also be studied. Otherwise a further anomaly is not necessary on this anomaly, either.

The other anomalies (Figure 2-13):In the end of 1972 general control works, in the sections of Kastamonu E31 a1 and a2; different geochemical anomalies were obtained.

Of these, the Cu anomalies situated in Umba (in the north) and Çaydüzü (in the middle) villages were generally determined from river bed samples and this main river comes from the Küre-Aşıköy ore field, 20-25 km South. Therefore it is possible to relate these anomalies to the contamination caused by the ore carrying stream waters. But, there arise two questions at this point; a- Can the contamination area caused by Küre-Aşıköy fields can be as large as 20-25 km^2? b- If yes; why did not the other parts of the main river give anomaly values? What is the reason of being the high values in these two places?

If contamination is not possible, these anomalies can be related to a Cu mineralization present around. It is going to be very useful to check these points. Quite a big Zn anomaly was obtained in the middle of E31 a2 section. It is very difficult to explain the reasons of these anomalies with the present data. The field can not be evaluated as positive for the Cu mineralization because Cu and ore values can not reach the anomaly level. Thus it can be thought that the anomaly can be related to a Pb-Zn mineralization.

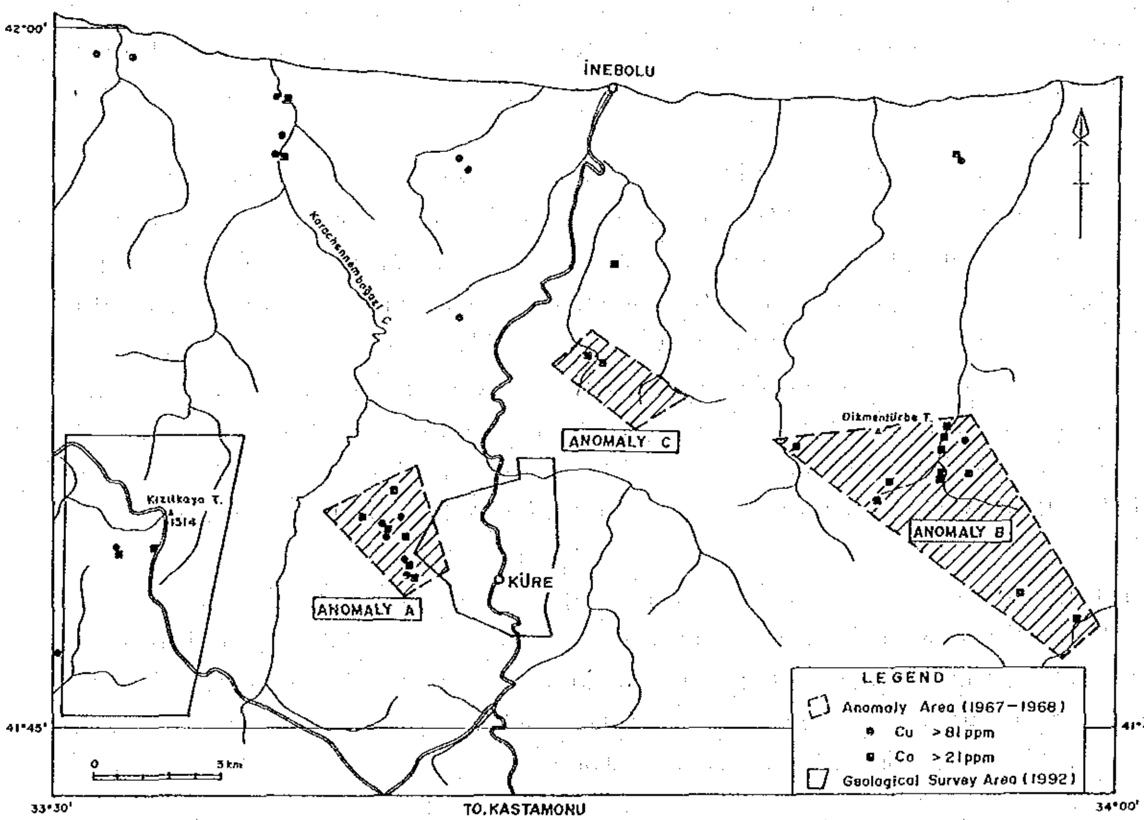


Figure 2-13 Anomaly Map of the North of Küre Mine

Results and Suggestions

1) The most important of the obtained anomalies is in the "A" anomaly and needs to be controlled.

2) "B" and "C" anomalies are of secondary importance and need to be surveyed when necessary.

3) The other anomalies are third degree anomalies and their surveying can be left to another time till the supporting geological data obtained.

(2) Çangal Metaofiyolitinin Jeokimyasal Prospeksiyonu (1987)
(Geochemical prospecting of the Çangal Meta-ophiolite)
M.Sezai KIRIKOGLU
Etibank Maden Arama Dairesi Rapor

In this study the geochemical prospecting of the Çangal Meta-ophiolite covering an area of approximately 600 km^2 to the east of the Küre copper-bearing pyrite deposits, one of the major ore deposits of Turkey, is discussed. The study included the preparation of 1:25,000 scale geochemical prospecting (anomaly) maps of an area of approximately 400 km^2, the structural, mineralogical and petrographical characterization of ophiolitic units and their whole rock chemistry and preliminary investigation of the alteration and mineralization zones determined during the field work.

The rock types in the area all belong to the ophiolite suite and are serpentinite, metagabbro, metadiabase, metaspilite, metalavas. The meta-ophiolite is cut by acidic veins and plutonic rocks. These hypabyssal rocks called as metaporphyroids are metamorphosed together with the ophiolitic rocks. The Çangal Meta-ophiolite rests with a tectonic contact on Precambrian metasediments and is cut by Dogger granites. The age of the Çangal Meta-ophiolite is given as Pre-Liassic.

The studied area is investigated especially for copper and 500 stream sand samples are collected from all the streams in the investigated area. The samples were analyzed for their Cu, Co, Zn, Pb and Ni contents. In all analyzed samples the contents of Co, Pb, and Ni are below 10 ppm. The highest and lowest values for Cu are 0 and 1,800 ppm, and Zn 9 and 4,600 ppm. Geo-statistical evaluation of the analytical results indicate that the base value for Cu are 80 ppm and 101 ppm respectively, the thresholds values for Cu and Zn are 111 ppm and 130 ppm, and the anomaly values for Cu and Zn are 141 ppm and 160 ppm respectively. Thus areas for Cu and Zn, which can signify economic ore deposits, are determined.

Chalcopyrite is found as the primary copper mineral in samples taken from the anomaly regions and surrounding area. Malachite, azurite and cuprite are the other copper mineral. From the Zn minerals only sphalerite is determined under the microscope. In the whole of the studied area abundant pyrite accompanies these minerals. Especially in regions rock in chalcopyrite, a widespread manganese formation is observed. Limonite and goethite are also frequent. Hematite and magnetite are observed as trace minerals in the rocks. Magnetite enrichment is conspicuous in the gabbros.

Gold and silver analysis carried out in samples taken from pyrite-rich zones gave low values.

The geochemical prospecting of Çangal Meta-ophiolite has brought to light the presence of anomaly regions which may signify to the presence of economic ore deposits. Detailed ore geological studies for the determination of possible copper and zinc potentials of the anomaly regions should be started as soon as possible.

Metaophiolitic assemblage(Çangal Meta-ophiolite):

This assemblage which shows widespread distribution in the study area is composed of metamorphosed ultrabasic and alternating pelitic rocks. Moreover the light colored metaporphyrites cutting these units are also added to this group. The lithological units which make up the assemblage are shortly serpentinite, metagabbro, metadiabase, metaspilite, metaphyllite, metaporphyrite.

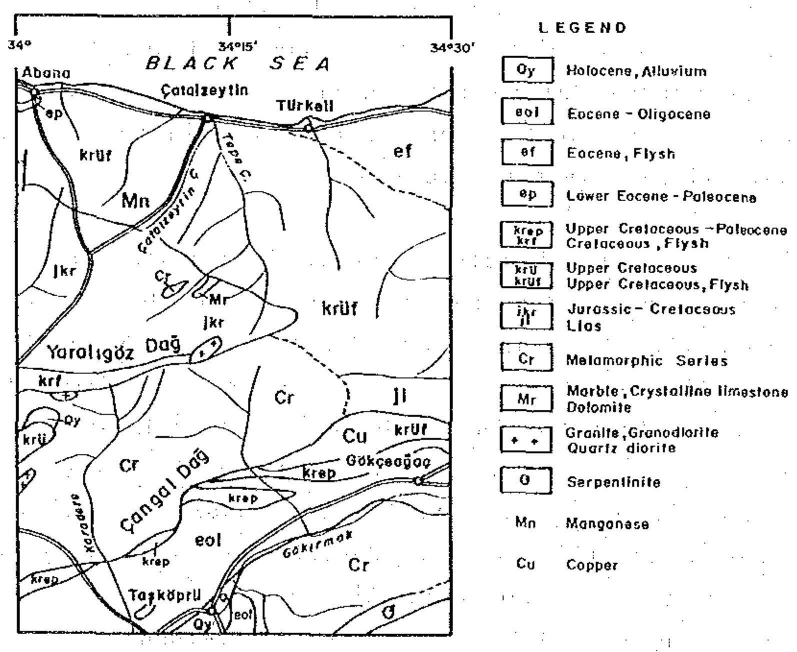


Figure 2-14 Geologic Map of the Çangal Mountains

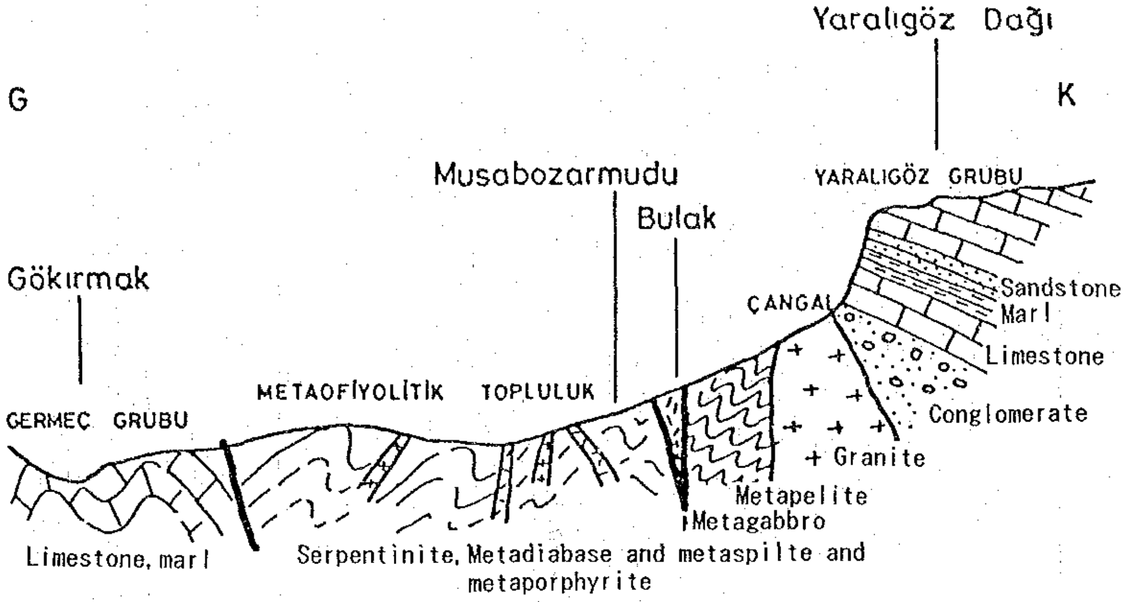


Figure 2-15 Geologic Cross Section of the Çangal Mountains

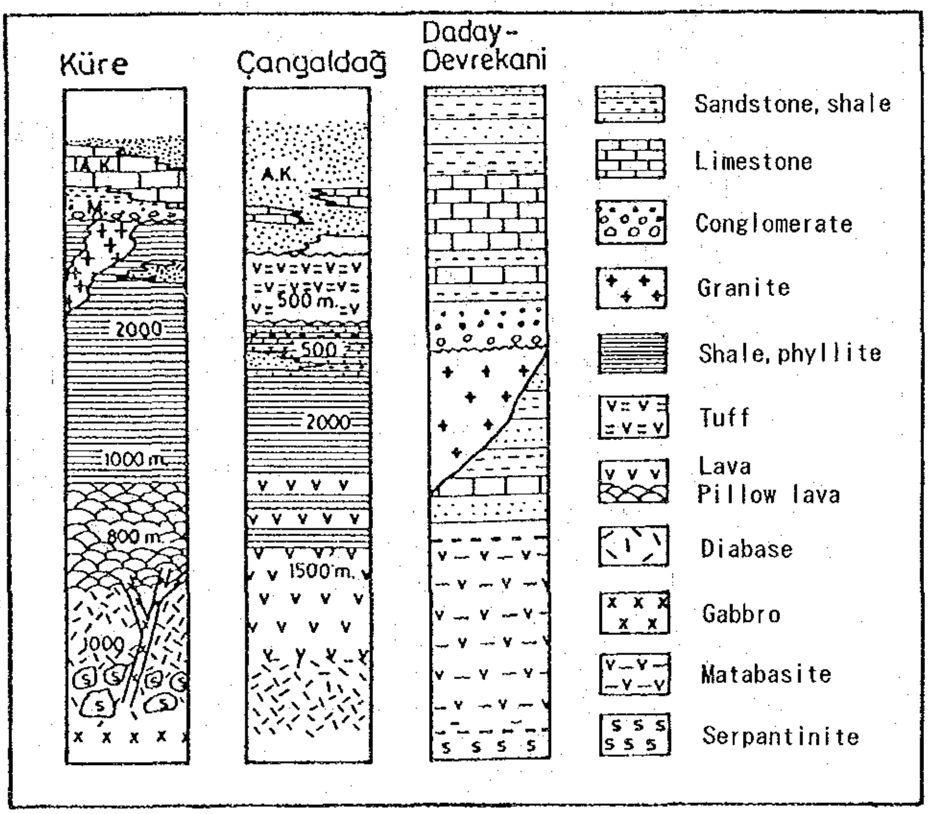
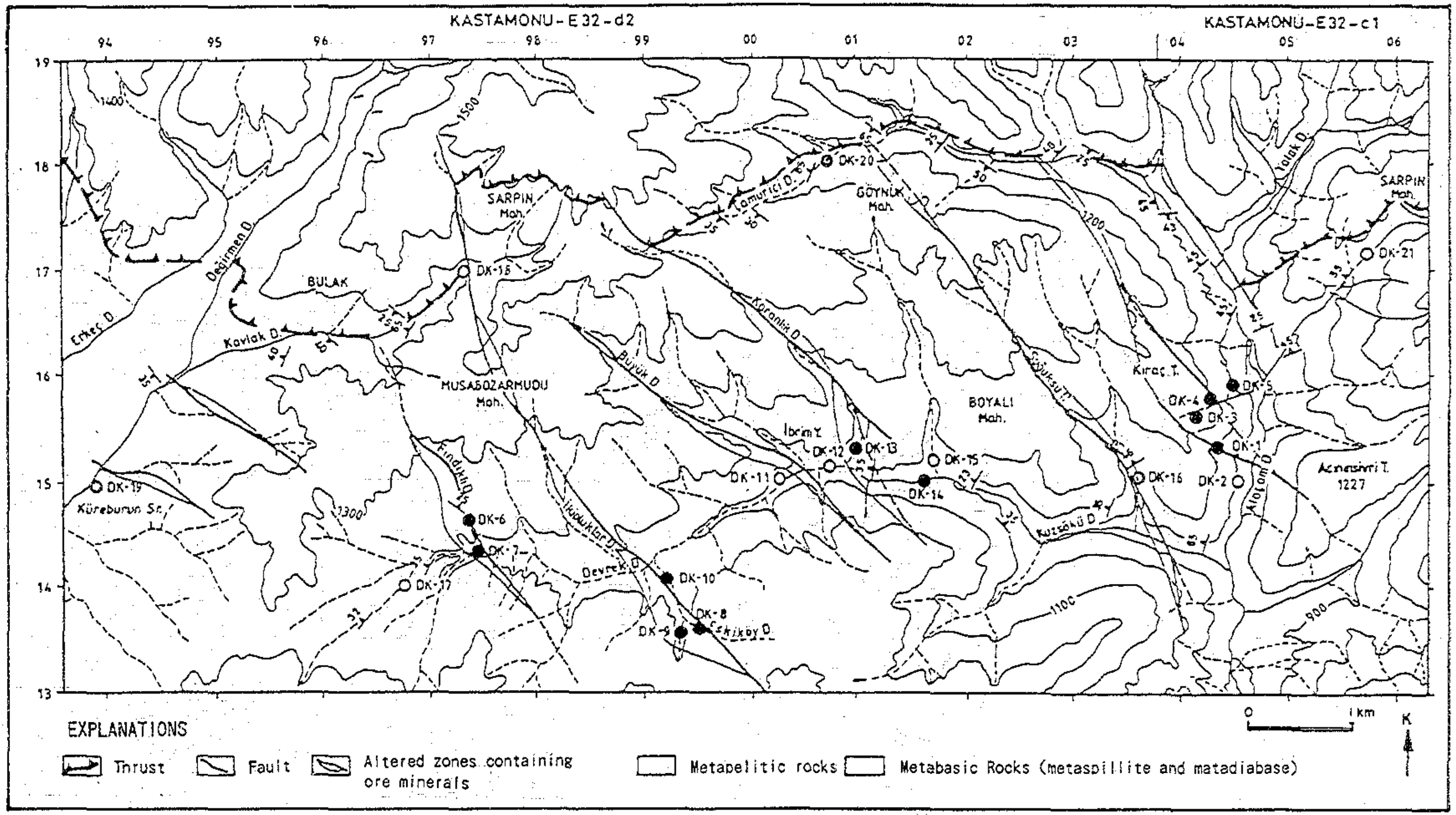


Figure 2-16 Correlation Map in the Küre-Devrekani Area



Total 21 stream sediments which were taken from Devrek, Alaçam and other streams in which Cu and Zn anomalies intensities increases within the study area, were plotted. Metaspillite and metadiabase forming the metabasic assemblage were altered intensely. The so-called hydrothermal alteration is associated with a widespread pyrite mineralization. black colored samples contain Cu and Zn values above the anomaly values.

Figure 2-17 Mineralized Map

Yılmaz (1979), recorded that the Çangal Meta-ophiolite underwent to the *in situ* low grade metamorphism within the oceanic crust. According to the author, it is possible to separate two different metamorphism zone. These can be give as mafic green schist (clinozoisite-albite-tremolite/actinolite-chlorite) and low grade amphibolite (albite/oligoclase-hornblende-chlorite).

The so called lithological units which make up the metaophiolitic assemblage, are named according to their structural/textural and mineralogical composition. However, each of these units were not mapped during the field studies. But the detailed geological studies and maps of the anomaly fields which will be determined after the studies, are suggested to be done.
The most common rock units making up the metaophiolitic assemblage are *metadiabase and metaphyllites.*

These are frequently cut by the light colored metapophyrites. The pillow structure is quite obscure in the metaspilites due to the tectonic deformation. Metagabbros form the small intrusive bodies in the Çangal Metaophiolite. On the other hand, no serpentine body was determined within the study area of the Çangal Metaophiolite. But the hornblends within the diabases, are known to turn into chrysotile from their crystal edges and fractures. Furthermore, within the olivine gabbros which are situated in the north of the study area; local serpentinization was observed.

(3) Kastamonu-Taşköprü-Devrekani Yöresi Jeokimya Raporu (1988)
(Kastamonu-Taşköprü-Devrekani Geochemistry Report)
S.KONYA ve Diğerleri (MTA)

This study was done due to the possibility of finding the massif sulfide type deposits of Küre district in Kastamonu-Taşköprü province.

The oldest unit in the district is the Paleozoic/Pre-Cambrian Devrekani Metamorphics. This unit is made of metamorphosed sedimentary rocks. It was thrusted over the Pre-Liassic Elekdağ Metamorphics of oceanic crust character. Thrusting is the product of N-S directed tensional regime.

The upper parts of the Elekdağ Meta-ophiolite is composed of a unit which is composed of sandstone-shale and called Akgöl Formation. It covers the Elekdağ Meta-ophiolite concordantly.

The granitoides produced by the subduction of Elekdağ Meta-ophiolite under the lithospheric crust (to the North) cut all the older units and have epizone character. According to its relation with the surrounding rocks, its age is Dogger.

Malm-Lower Cretaceous deposition is continuous. Bürnük Formation which has a basal conglomerate character and Malm age is followed by; İnaltı Limestone Formation and Lower Cretaceous Çağlayan Formation composed of olistholithcal shale, sandstone, carbonates, shale and sandstone.

Upper Cretaceous deposits are microtic limestone, siltstone, sandstone, agglomerate, tuff, lava, conglomerate, shale and reefal limestone. It is named as Gökçeağaç Formation. This unit is transitional with the Palaeocene-Eeocene sediments.

Tertiary deposits are composed of limestone, marl, claystone, sandstone and conglomerates and called Taşköprü-Boyabat Basin sediments and cover Palaeocene-Eocene-Oligocene-Miocene.

Intrusion of the Dogger granitoides caused weak contact metamorphism in the wall rocks that they cut. Along the E-W and NE-SW directed widespread fractures, hydrothermal activities are observed. Size of the fractures and uniformity of the hydrothermal activities control the pyritic mineralization. In the end of the geochemical prospecting being completed between 1985 and 1986, two important geochemical anomaly (Cu,Zn) fields were determined around Boyalı and Cünür and detailed geochemistry surveys were completed.

As a result, it's determined that in Cünür anomaly field Cu and Zn element behaviors are directly proportional and that of Co elements are inversely proportional to the intensity of the alteration and in Boyalı anomaly field, Cu, Zn, Co and As elements are related to the mineralization.

Previous Works:

Hoore (1913) reported the collapsed holes and around 40,000-60,000 ton in "Cozoğlu Köyü Bakır Madeni Raporu" and emphasizing the importance of the mineralization he suggested two galleries.

Pilz (1937) reported his idea on "Hoca Vakıf" (Cozoğlu) mineralization as "It is possible to find the places having compact ore as copper-pyrite lenses in mineralized areas, but he effect of general commission is about the lack of enough ore potential necessary for a profitable production." in his "Sinop ve Kastamonu vilayetlerindeki Muteaddid Mineral Yataklarının Tetkiki Hakkında Rapor"

Coronini (1964) reports normal fault related vein type mineralization for the Cozoğlu Mineralization in "D15 No'lu Bakır Ruhsat Sahası Hakkında Rapor (Kastamonu-Taşköprü)".

Özgüneyli (1974) suggests that the area is negative from the mineralization point of view, in the "Karadeniz Bakır İşletmelerinin Kastamonu E31-d1 Paftasına Ait Kepez Köyü Bakır Anomalisinin Detay Jeolojisi" report.

Şenocak (1974) recorded that the area is negative for the mineralization in the "Karadeniz Bakır İşletmelerine Ait Doğan Deresi Sahası Anomalisinin Jeolojisi Raporu" which covers the southern continuity of the area studied by Özgüneyli (1974).

Takashima (1975) reported that the Kepez mineralization field, south of Devrekani, is very weak; different than Küre and that of pyritization is due to the replacement of mafic rocks like diorite-diabase in "Küre-Çorum Bölgesindeki Bakırlı Pirit Yataklarının Jeolojisi" report.

Regional Geology

In the previously done regional studies, the base of the Paleozoic sequence in western Black Sea was reported to be observed in Karadere (between Safranbolu and Iğdır) and in eastern Black Sea (among Gümüşhane, Bayburt and Reşadiye) (Ketin, 1951; Yilmaz, 1984).

The basement of Paleozoic assemblage in Safranbolu-Iğdır and Karadere is composed of migmatitic rocks of metapelitic origin and amphibolites of metabasic origin. This basement which is metamorphosed in amphibolite facies has either Cambrian or Pre-Cambrian age and overlain by a sedimentary sequence of Cambrian(?) to Permian age.

The Paleozoic basement in Gümüşhane-Bayburt-Reşadiye consists of metamorphics such as phyllites and slates. The first sedimentary cover unit above the metamorphic basement is Permian sequence recognized in Bayburt.

Both of the two basements are cut by the post-tectonic granites. However, the age of the post-tectonic epizonal granite cutting the basement of the western Black Sea Paleozoic sequence is Cambrian/Pre-Cambrian, but that of granite cutting eastern Black Sea basement is Permian (Çoğulu, 1975).

Within the İlgaz Massif called Kargi Massif, there said to be Pre-Cambrian metamorphics (Bingöl, 1975).