

plagioclase, augite, and olivine. The groundmass appears intergranular texture, consisting of plagioclase, augite, and others. Gas cavities are filled with chlorite and calcite.

## (2) Geological Structure

The dacite lava (Adcl) of the Alemağaç Formation is distributed mainly centering Muskale Mountain (height: 903 m) to the south of the Tunca area, and forms a lava dome. For this reason, the upper formation has changing its strikes that surrounds the lava dome. The strikes in this area are dominant in northeast to southwest ~ northwest to southeast direction and dips range 10 to 30° N.

Intrusive rocks in the northeast to southwest directions are dominate, reflecting geological structure in this area. Small-scale faults in north-northwest to south-southeast direction are observed to the west of Tunca.

There is much landslide topography around the area. Tunca village is on the "Tunca Landslide" (tentative name), which has slipped down from the cliff just behind the village. The landslide extends about 600 m long from the top toward the Tunca River in the north-northwest to south-southeast with about 500 m in width. The Tunca Deposit, consisting of massive sulphide blocks, is situated on the northern bank of the Tunca River, where is the edge of the "Tunca Landslide". It is presumed that the ore has been transferred from its assumptive source ore body, and its source would be to the north-northwest direction.

## (3) Mineralization and Alteration

### (a) Ore Horizon

The volcanogenic massive sulphide deposits in the Tunca area exist in the upper part of Alemağaç Formation. The main mineralization has occurred in dacite lava (Adcl) and dacitic pyroclastic rocks (Atf). On the other hand, the Şenyuva and Tunca South Occurrences, consisting of pyrite, chalcopyrite, sphalerite and barite disseminations, is in the green dacitic pyroclastic rocks (Attf) which is stratigraphically higher position. The purple dacite (i.e. green dacitic pyroclastic rocks) is presumed to have intruded during the decaying stage of the hydrothermal activity right after the massive sulphide deposit has formed. Accordingly, the ore horizon ranges from the upper part of the dacitic pyroclastic rocks (Aft) to below the reddish

calcareous mudstone of the bottom of the Çağlayan Formation.

#### (4) Alteration

##### ( i ) Alteration Zonation

Table II-1-1 shows the results of the X-ray diffraction, and Fig. II-1-4 shows the distribution map of the alteration zones. The assemblage of alteration minerals classified in the area are as follows,

- 1) quartz-sericite-chlorite-sericite/smectite mixed layer mineral
- 2) quartz-(chlorite)-sericite/smectite mixed layer mineral-(smectite)
- 3) quartz-kaolinite-sericite

The quartz-sericite-chlorite-sericite/smectite mixed layer mineral zone is distributed in the Tunca Deposit, around the Tunca West and Şenyuva Occurrences, and the east of Kirazlık. This alteration zone is estimated to have formed as a result of volcanogenic massive sulphide mineralization. The continuity of the zone is poor except for from the Tunca Deposit to the Tunca West Occurrence. The alteration zone is surrounded by the quartz-(chlorite)-sericite/smectite mixed layer mineral-(smectite) zone. Since the poor continuity is due to the dominant intrusive bodies of the Purple dacite. The quartz-kaolinite-sericite zone appears around the dolerite intrusive body in the south of the Şenyuva Occurrence.

##### ( ii ) Alteration Index

The alteration indexes (AI) of the dacitic rocks of the Alemağaç Formation were calculated to determine the mineralization intensity. Table II-1-2 and Fig. II-1-5 show the results. The alteration intensity areas,  $90 \% < AI$ , are distributed around the Tunca Deposit, the Tunca West and Şenyuva Occurrences. Their continuities are poor. It is thought that the poor continuities are due to weak mineralization activity or far from the activity center, in addition to the dominant intrusive bodies of the Purple dacite.

#### (4) Deposit and Occurrence

From the survey results in fiscal year 2002 and fiscal year 2003, it has been cleared that the deposit and occurrences in the area are all of the volcanogenic massive sulphide type.

Table II -1-1 Results of X-ray Diffraction (Tunca Area)

No.	Sample	Location	Coordinates		ROCK TYPE	Alteration zone	MINERALS														Remarks								
			UTM-E	UTM-N			Quartz	Plagioclase	K-Feldspar	Biotite	Hornblende	Hyperthene	Albite	Smectite	Sericite/Smectite	Sericite	Kaolin Minerals	Chlorite	Hematite	Laumontite		Jarosite	Barite	Pyrite	Chalcopyrite	Sphalerite	Siderite	Magnetite	Ankerite
1	E007	Şenyuva	76577	56001	Attf	S/Sm	39					4	<1	1														2	
2	E009	Şenyuva	76526	55880	Attf	Ser-Ch	58							<1							2								
3	E011	Tunca	78185	54725	Atf	Ser-Ch	58							2							<1								
4	E017	Tunca W.	77798	54622	Atf	Ser-Ch	42							1	<1						<1				?				
5	E018	Kirazlık E.	77008	54629	Adcg	S/Sm	32					11	<1	1														6	
6	E019	Şenyuva	76514	55725	Attf	Ser-Ch	13							2						2	6	2	8						
7	E020	Şenyuva	76426	55676	Attf	—	27					21		<1							1								
8	E022	Şenyuva	76350	55695	Attf	S/Sm	58					3	<1	1														1	
9	E023	Şenyuva	76445	55500	Attf	—	38					18	<1	1															
10	E026	Şenyuva	76237	55560	Attf	—	30					40									<1							4	
11	E031	Şenyuva	76160	55500	Cms	—	55													2									
12	E034	Esentepe SW.	76935	55046	Adcp	S/Sm	53					1	<1	1															
13	F011	Esentepe SW.	76883	55210	Attf	S/Sm	33					1	<1	1												8	6		
14	F021	Kirazlık	75945	54435	Attf	Kl	38						<1	3							<1							8	
15	F023	Kirazlık	75738	54718	Adcg	S/Sm	31					<1	1	<1							1						7		
16	F030	Tunca	78433	54923	Atf	Ser-Ch	32					10		1						2								4	
17	F036	Şenyuva	76248	55538	Adcg	Kl	39					1	<1	1	3														
18	G004	Şenyuva	76520	55770	Attf	Ser-Ch	54							<1							3								
19	G008	Şenyuva	76525	56115	Attf	S/Sm	14						1		?						<1							3	
20	G034	Tunca S.	78220	54580	Attf	S/Sm	32							<1						4	2		6						
21	G037	Tunca S.	77865	54310	Attf	—	34					20			?														
22	G040	Kirazlık E.	76950	54270	Adcl	—	25					49		<1															
23	G041	Kirazlık E.	76910	54295	Adcl	—	17					44		<1							<1						4		
24	G042	Kirazlık E.	76800	54365	Atf	Ser-Ch	32					9		1							<1							4	
25	G043	Kirazlık E.	76680	54375	Adcg	Ser-Ch	14					4		3															
26	G044	Kirazlık E.	76680	54400	Adcg	S/Sm	33					3	1	1							<1							9	
27	G045	Kirazlık E.	76555	54570	Attf	S/Sm	42						1								1								
28	H006	Tunca	78050	54805	Atf	—	27					39									<1								
29	H007	Esentepe	77555	55075	Adcp	Ser-Ch	20					12		1		1											2		
30	H015	Esentepe	77440	55455	Adcg	S/Sm	22					1	1	1							1								

Ser-Ch : Quartz-Sericite-Chlorite-(Sericite/Smectite mixed layer), S/Sm : Quartz-(Chlorite)-Sericite/Smectite mixed layer-(Smectite)  
 Kl : Quartz-Kaolin-Sericite

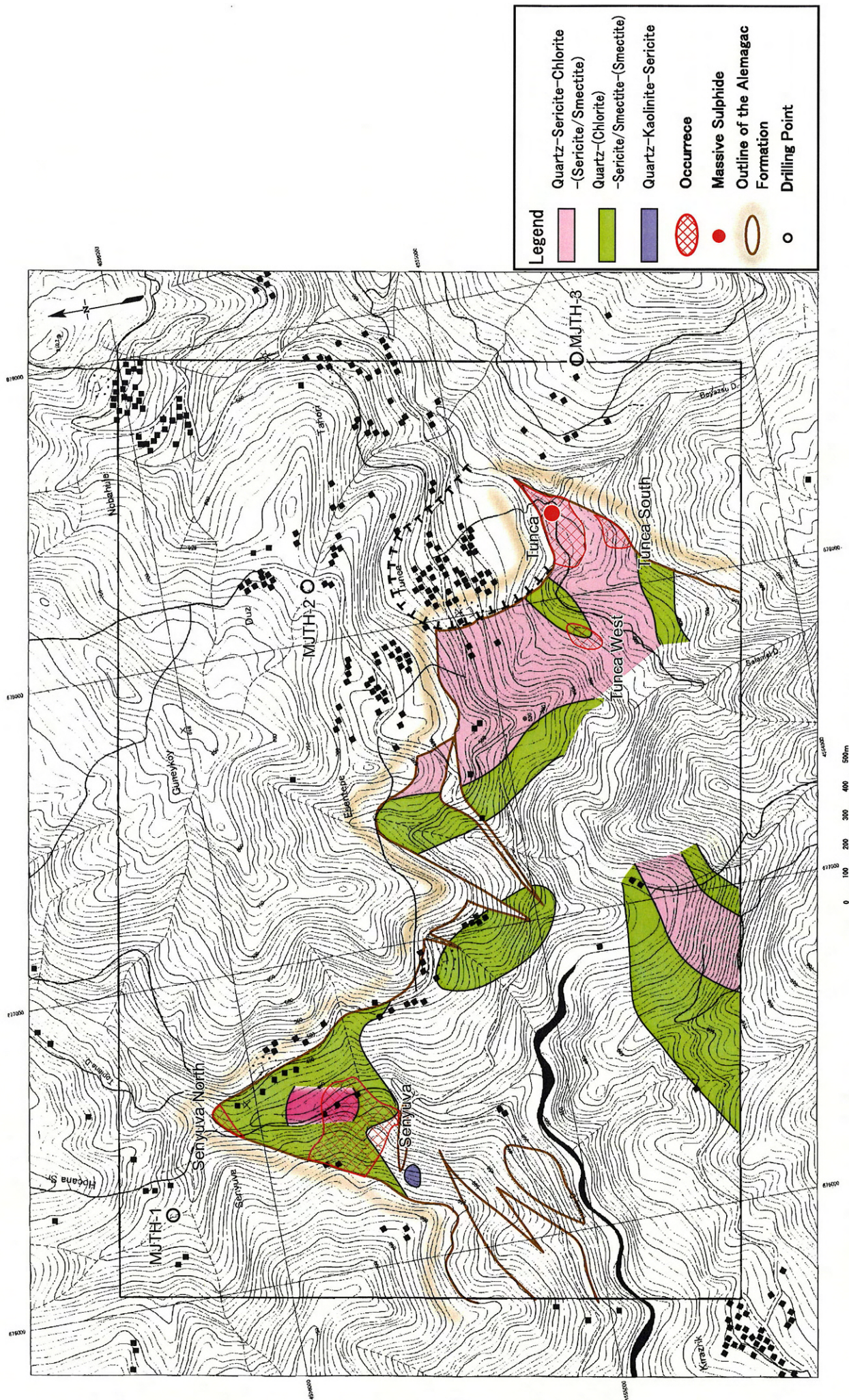


Fig. II -1-4 Distribution Map of Alteration Zones of the Tunca Area

Table II -1-2 Alteration Index of the Tunca Area

Sample	Coordinates		Rock Type	Alteration Index(AI)	Ca %	K %	Mg %	Na %	Sample	Coordinates		Rock Type	Alteration Index(AI)	Ca %	K %	Mg %	Na %	
	UTM-E	UTM-N								UTM-E	UTM-N							
E003	75926	54905	Adcp	21	0.21	0.77	0.06	2.63	G008	76525	56115	Attf	48	2.73	2.49	0.54	0.27	
E006	76544	56054	Attf	23	2.44	0.61	0.48	1.20	G012	76720	55773	Attf	84	0.18	2.31	0.47	0.30	
E007	76577	56001	Attf	35	2.42	1.52	0.34	0.84	G021	77380	55395	Adcg	56	1.80	2.39	0.39	0.18	
E008	76525	55935	Attf	25	2.51	1.04	0.35	1.41	G037	77865	54310	Attf	11	0.11	0.43	0.06	3.47	
E009	76526	55880	Attf	91	0.10	1.46	0.21	0.06	G038	77035	54180	Adcp	95	0.07	4.75	0.72	0.22	
E010	76480	55650	Attf	43	0.11	1.58	0.17	2.06	G040	76950	54270	Adcl	9	0.58	0.35	0.18	4.72	
E011	78185	54725	Atf	93	0.03	1.64	0.07	0.09	G041	76910	54295	Adcl	9	0.93	0.34	0.30	5.48	
E013	77935	54740	Atf	55	1.20	2.08	1.10	1.39	G042	76800	54365	Atf	31	1.40	1.30	0.48	2.39	
E017	77798	54622	Atf	93	0.21	1.90	1.70	0.05	G043	76680	54375	Adcg	89	0.21	4.70	0.31	0.35	
E018	77008	54629	Adcg	27	2.98	1.66	0.21	1.73	G044	76660	54400	Adcg	47	2.30	1.95	0.59	0.39	
E020	76426	55676	Attf	17	0.14	0.69	0.05	3.27	G045	76555	54570	Attf	82	0.11	1.56	0.25	0.27	
E021	76370	55663	Attf	25	3.77	1.56	0.10	0.60	G049	77590	55250	Adcg	59	0.08	1.72	0.35	1.26	
E022	76350	55695	Attf	34	0.55	1.20	0.12	1.85	G051	77280	55335	Adcg	79	0.11	1.68	0.32	0.39	
E023	76445	55500	Attf	60	0.18	1.82	0.24	1.07	G053	76215	55360	Attf	89	0.04	2.60	0.12	0.25	
E024	76297	55183	Attf	74	0.11	1.23	0.22	0.36	G054	76060	55335	Attf	88	0.07	2.56	0.36	0.29	
E026	76237	55560	Attf	4	0.71	0.16	0.05	3.67	G056	77220	55265	Adcg	32	0.06	1.10	0.15	2.46	
E027	75660	55068	Attf	36	2.47	0.02	1.38	0.52	H006	78050	54805	Atf	22	1.18	0.21	1.04	4.00	
E028	76004	55125	Attf	33	0.48	0.41	1.89	4.41	H007	77555	55075	Adcp	42	1.70	1.88	1.02	2.26	
E029	76263	55524	Attf	13	0.08	0.45	0.03	2.90	H015	77440	55455	Adcg	91	0.16	3.49	0.97	0.24	
E030	76167	55516	Attf	45	0.11	0.88	0.12	1.04										
E032	75661	55204	Attf	86	0.04	2.17	0.34	0.34										
E034	76935	55046	Adcp	83	0.20	2.60	0.32	0.33										
E035	77093	55036	Adcp	43	0.16	0.93	0.42	1.64										
E037	77088	55125	Attf	62	0.56	3.00	1.10	1.87										
E039	77015	55385	Attf	7	6.85	0.41	0.27	2.00										
F001	76470	55200	Adcp	10	0.11	0.49	0.03	4.23										
F002	76700	55023	Adcp	17	0.13	0.78	0.06	3.57										
F011	76883	55210	Attf	35	3.97	1.96	0.54	0.31										
F021	75945	54435	Attf	19	3.79	0.96	0.22	0.84										
F022	75768	54592	Adcg	21	0.29	1.12	0.14	4.15										
F023	75738	54718	Adcg	43	1.28	1.24	0.55	1.07										
F026	78405	54810	Atf	34	1.36	0.94	1.02	2.71										
F030	78433	54923	Atf	30	2.52	1.04	0.58	1.28										
F036	76248	55538	Attf	82	0.10	1.64	0.21	0.27										
F037	76325	55498	Attf	38	5.57	0.51	3.51	2.01										
F038	77304	55128	Adcp	22	0.16	0.60	0.17	2.51										
G002	76555	55660	Attf	36	1.62	1.11	0.54	1.24										
G004	76520	55770	Attf	90	0.09	1.52	0.25	0.09										
G006	76560	56020	Attf	20	1.89	0.69	0.39	2.35										