

1-4 地化学探査

地化学調査は、下記2点を目的に実施した。

- ① 異常値の分布を明らかにすること。
- ② 各岩層・各層準ごとの金属成分の濃集度を明らかにすること。

試料は岩石とし、指示元素はAg・Cu・Pb・Znとした。第1年次は全域を均等にカバーするグリット・サンプリングとし、第2年次は地層に直交する方向のライン・サンプリングとした。

(1) 相関関係

4成分の間で、Pb・Zn間に強い正の相関を認め ($cc=0.70\sim0.82$)、Cu・Zn間に弱い正の相関を認めた ($cc=0.38\sim0.55$)。Agは他成分との相関関係を有しない。

(2) 異常値の分布

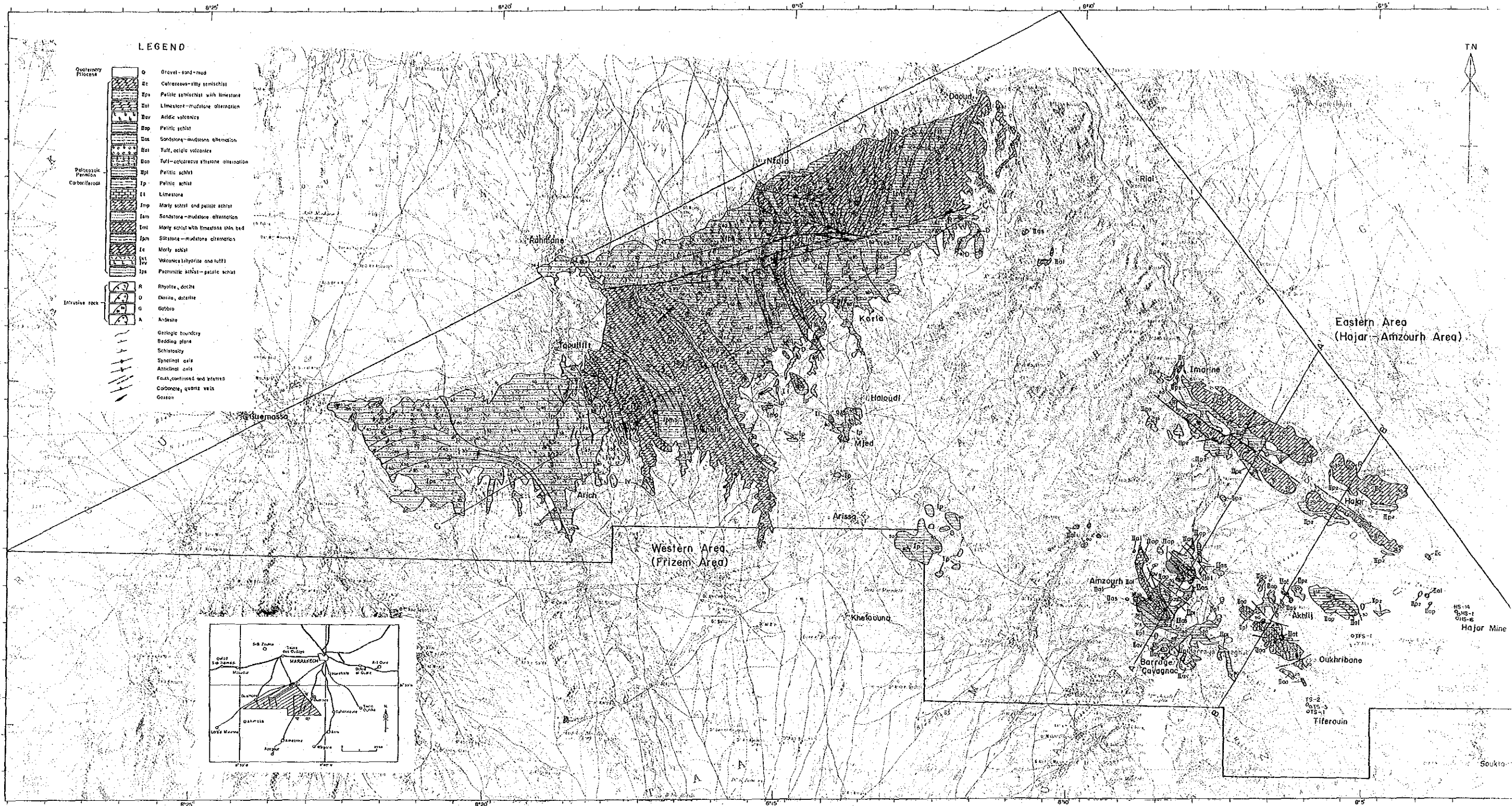
($M+2\sigma$) 値を参考にしてしきい値を決め、異常値を抽出した (Tab. 3)。その結果次ぎの事実が明らかとなった (Fig. 16)。

- ① 異常値はHajar 層準及びFrizen地区に集中すること。
- ② 断層破砕帯の近辺で、Zn・Agが濃集すること。

(3) 岩層別金属成分

- ① 本地域のバックグラウンド値 (幾何平均値) は、Ag 1.3 ppm, Cu 27ppm, Pb 36ppm, Zn 120ppmを示す。
- ② Frizen地区の酸性火山岩類の3試料の幾何平均値は、Cu 110 ppm, Zn 374 ppmでバックグラウンド値の3倍以上の値である。
- ③ Hajar層準の18試料の幾何平均値は、Zn 180 ppmを示す。
- ④ 貫入岩4試料の幾何平均値は、Ag 0.2 ppm, Cu 7 ppm, Pb 11ppm, Zn 39ppmで、低い値を示す。
- ⑤ Hajar鉱床の上位層では、Zn 74 ~80 ppmであり貫入岩に次いで低い値を示す。

以上の諸事実より、本地域の鉱化作用は火山岩類又は火砕岩類に関係し、特定の層準に金属成分を濃集するが、上位の地層には影響を与えていないことが推察された。これは本地域の鉱床が同生鉱床であることを裏付ける事実である。



0 5000m
Scale 1 : 100,000

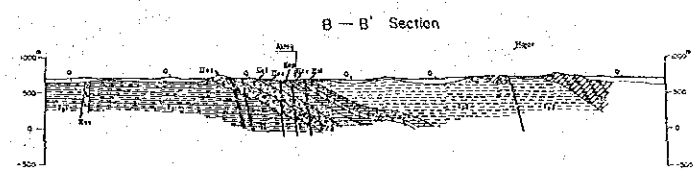
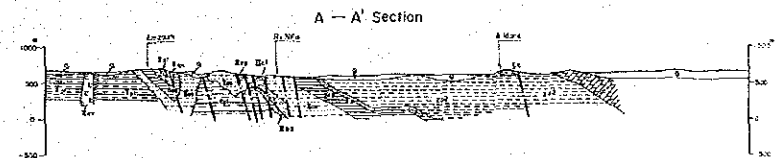
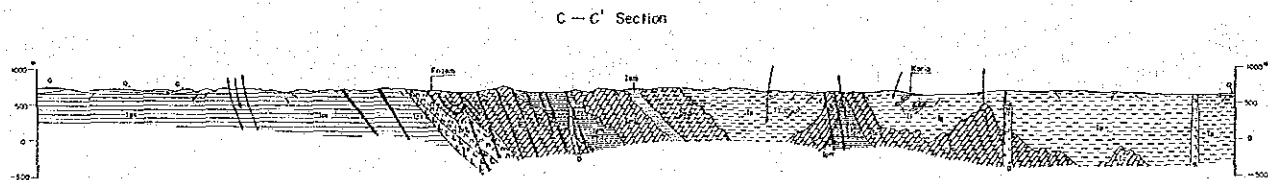


Fig. 6 Geological Map of the Haouz Central Area

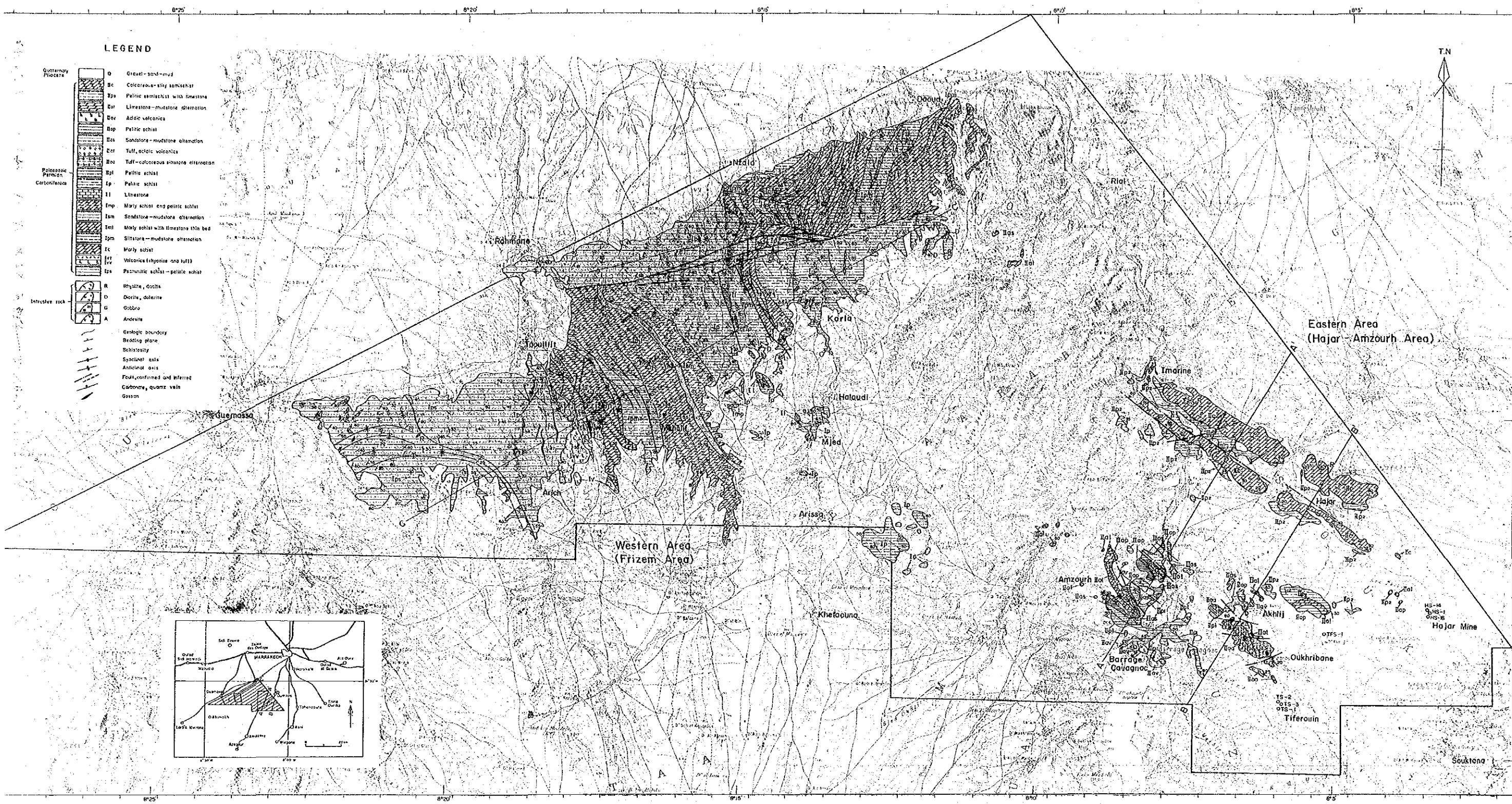


Fig. 6 Geological Map of the Haouz Central Area




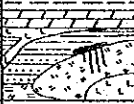
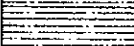
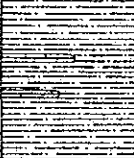


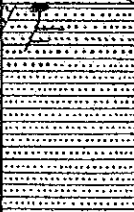
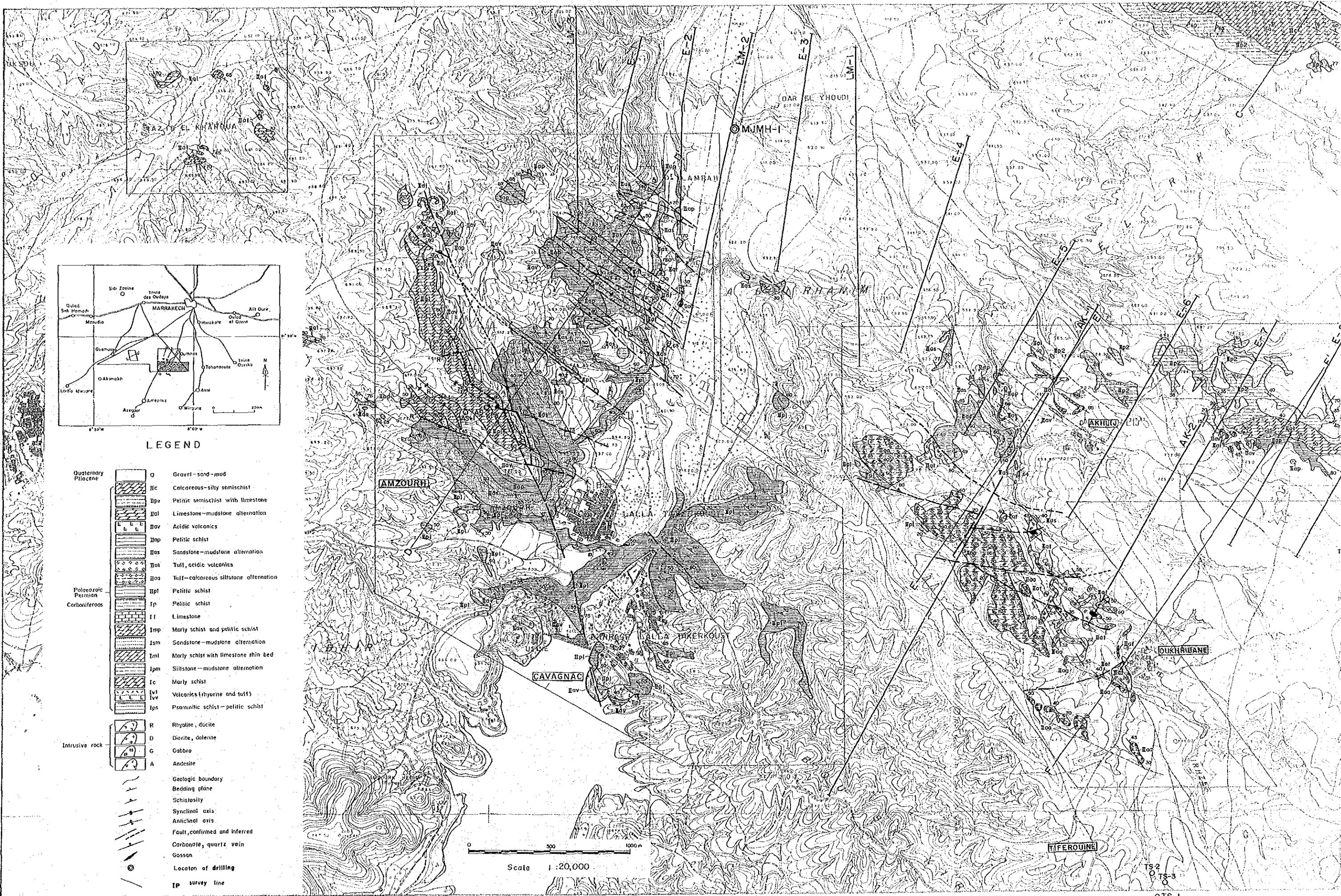
Geological Age	Fm	Stratigraphic Column	Lithology	Thick-ness	Area	Tectonic Move-ment	Igneous Activity	Minerali-zation
Quaternary	Q		Gravel-sand-mud	+120	Eastern Area	Alpine	Rhyolite Diorite-Dacite Gabbro	Massive sedimentary type
Tertiary								
Cretaceous								
Jurassic								
Triassic								
Permian	IIc		Calcareous-silty-semischist	+400	Hercynian	Dacite Rhyolite		
	IIp2		Pelitic semischist (slate-limestone-siltstone)	±900				
Carboniferous	IIa		Volcanics and alternation zone (limestone-rhyolite-tuff-sandstone-slate)	±500	Hajar Hz	294 Ma 303 Ma		
	IIpl		Pelitic semischist (slate)	+1500				
	Ip		Pelitic schist (slate-limestone)					
	Ic		Marly schist with sandstone and limestone	+1500			Western Area	Frizem Hz
Iv		Volcanics (rhyolite-tuff-slate)	±200					
Ips		Pelitic schist (slate-siltstone)	+1500					

Fig 7 Schematic Geological Column of the Haouz Central Area



LEGEND

- | | | |
|----------------|------|---------------------------------------|
| Quaternary | Q | Gravel-sand-mud |
| Pliocene | IIc | Calcareous-silty semischist |
| | IIp2 | Pelitic semischist with limestone |
| | IIal | Limestone-mudstone alternation |
| | IIav | Acidic volcanics |
| | IIap | Pelitic schist |
| | IIas | Sandstone-mudstone alternation |
| | IIat | Tuff, acidic volcanics |
| | IIaa | Tuff-calcareous siltstone alternation |
| Palaeozoic | IIpl | Pelitic schist |
| Permian | Ip | Pelitic schist |
| Carboniferous | Il | Limestone |
| | Imp | Marly schist and pelitic schist |
| | Ism | Sandstone-mudstone alternation |
| | Iml | Marly schist with limestone thin bed |
| | Ipm | Siltstone-mudstone alternation |
| | Ic | Marly schist |
| | Ivt | Volcanics (rhyolite and tuff) |
| | Isv | Psammitic schist-pelitic schist |
| | Ips | Psammitic schist-pelitic schist |
| Intrusive rock | R | Rhyolite, dacite |
| | D | Diorite, dolerite |
| | G | Gabbro |
| | A | Andesite |
| | | Geologic boundary |
| | | Bedding plane |
| | | Schistosity |
| | | Synclinal axis |
| | | Anticlinal axis |
| | | Fault, confirmed and inferred |
| | | Carbonate, quartz vein |
| | | Gosson |
| | | Location of drilling |
| | | lp survey line |

Scale 1:20,000

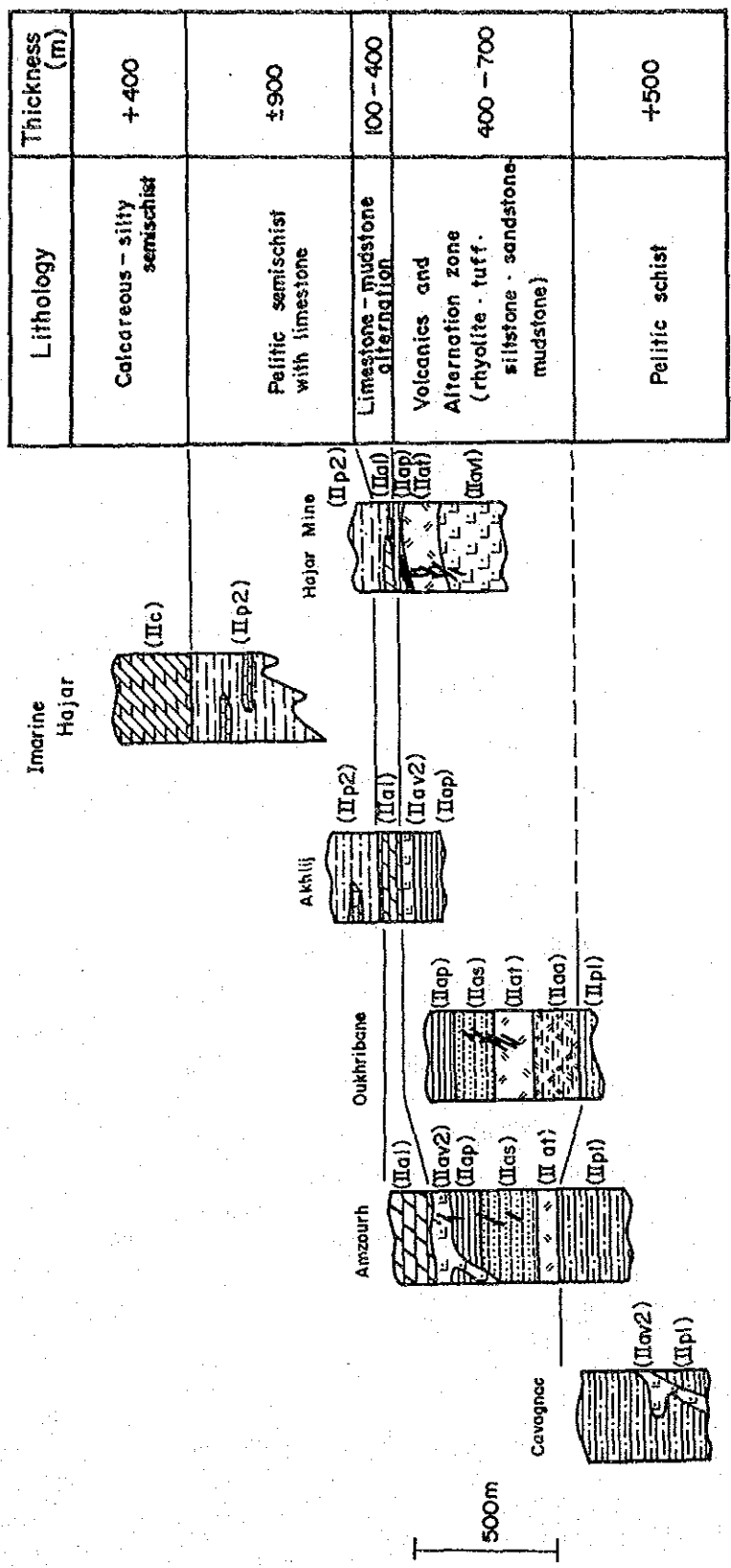


Fig. 9 Schematic Geological Column of the Hajar-Amzourh Area

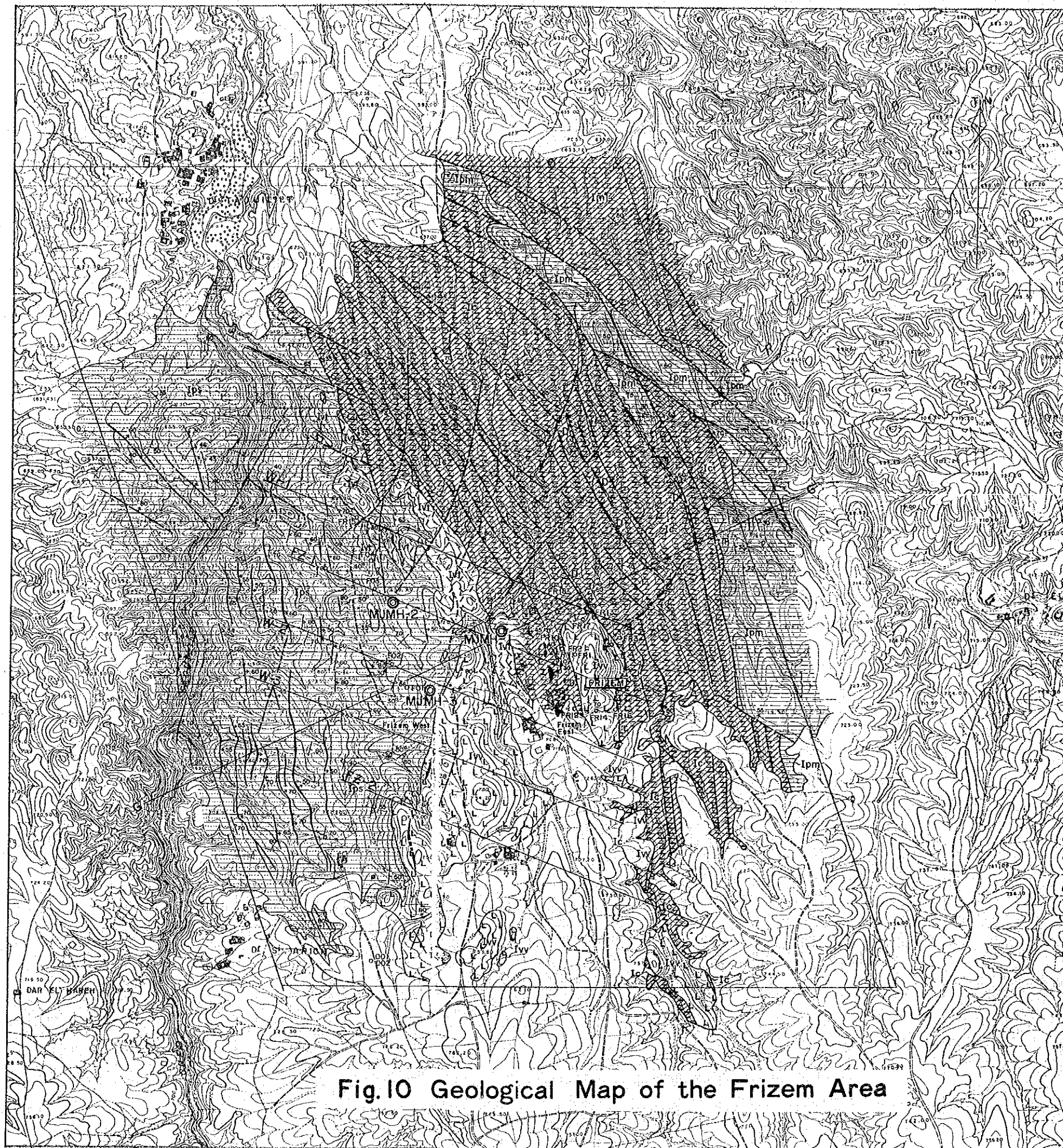
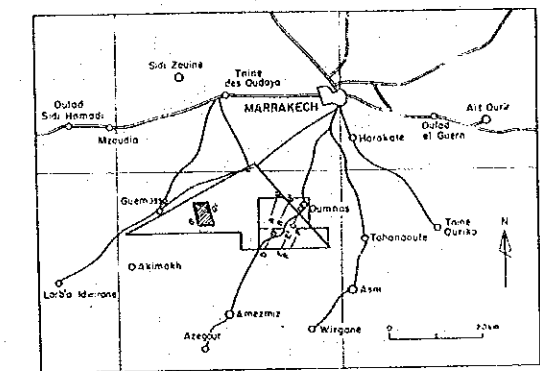


Fig.10 Geological Map of the Frizem Area



Scale 1 : 20,000

LEGEND

Quaternary	Q	Gravel-sand-mud
Pliocene	Iic	Calcareous-silty semischist
	Ipa	Pelitic semischist with limestone
	Ial	Limestone-mudstone alternation
	Iav	Acidic volcanics
	Iap	Pelitic schist
	Ias	Sandstone-mudstone alternation
	Iat	Tuff, acidic volcanics
	Iaa	Tuff-calcareous siltstone alternation
Palaeozoic	Ipl	Pelitic schist
Permian	Ip	Pelitic schist
Carboniferous	Il	Limestone
	Imp	Marly schist and pelitic schist
	Ism	Sandstone-mudstone alternation
	Iml	Marly schist with limestone thin bed
	Ipm	Siltstone-mudstone alternation
	Ic	Marly schist
	Ivt	Volcanics (rhyolite and tuff)
	Ivv	
	Ips	Psammitic schist-pelitic schist
Intrusive rock	R	Rhyolite, dacite
	D	Diorite, dolerite
	G	Gabbro
	A	Andesite
		Geologic boundary
		Bedding plane
		Schistosity
		Synclinal axis
		Anticlinal axis
		Fault, confirmed and inferred
		Carbonate, quartz vein
		Gossan
	o	Survey line by IP method
	⊙	Location of short drilling
	⊙	Location of drilling
	—	Ip survey line

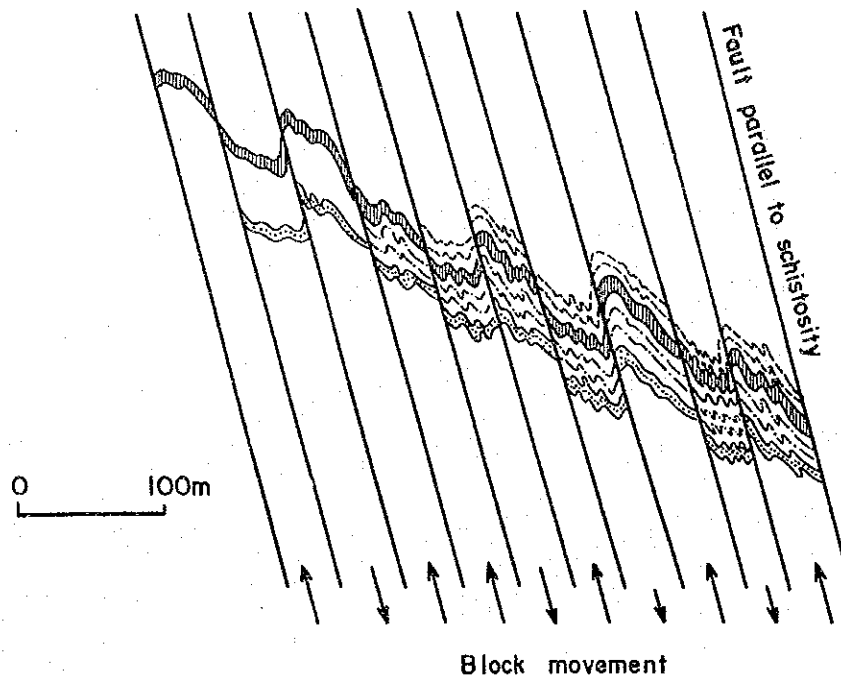
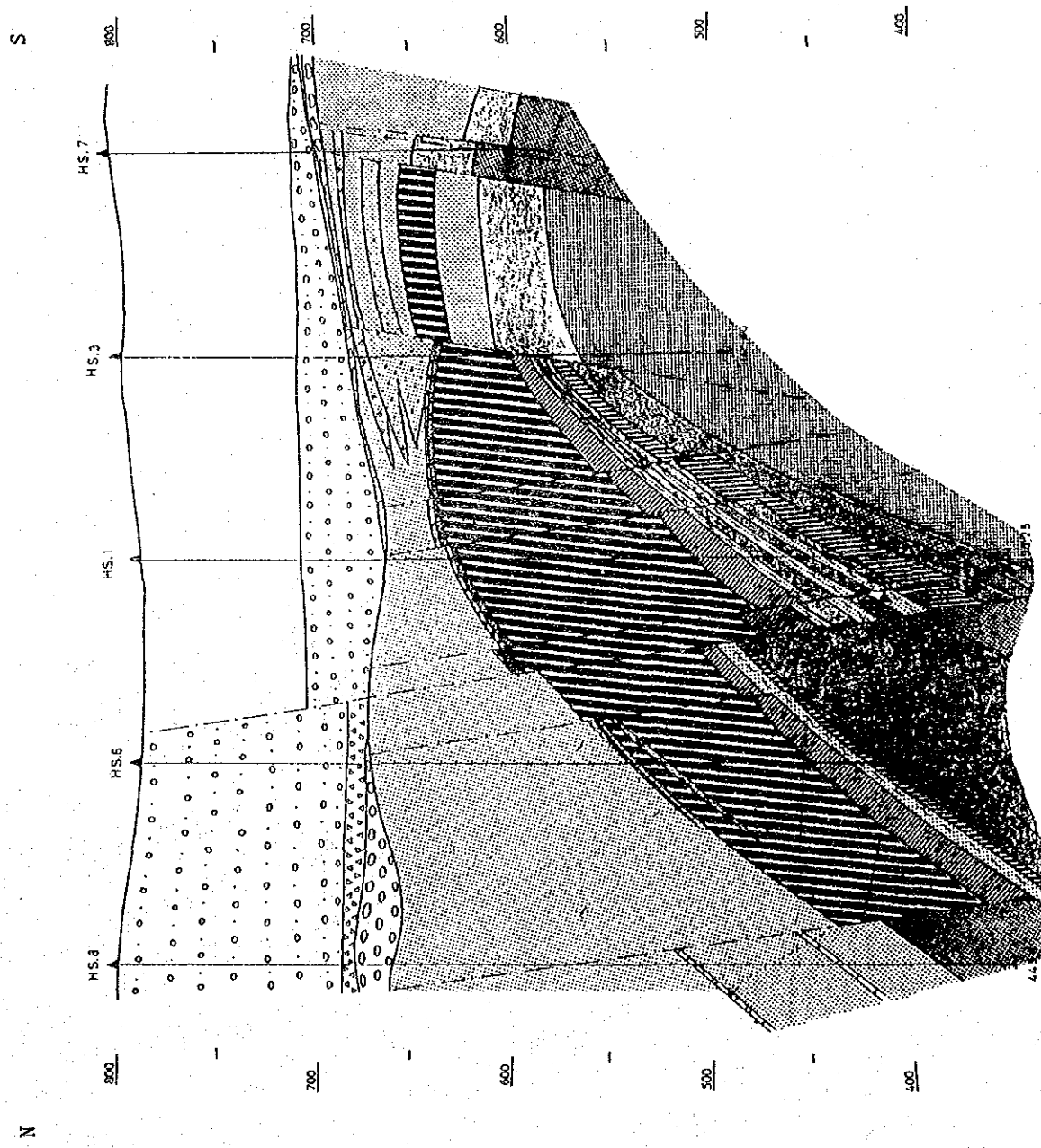


Fig. II Schematic Model of Drag Fold (Section)

Tab. 2 List of Mineralized Zones

No	Name	Type of Indication	Location	Com- modi- ty	Shape of Ore body	Type of Minerali- zation	Host Rock		Scale of Ore body (m)	Scale of Zone (m)	Strike and Dip	Grade of Ore	Ore Mineral	Gangue Mineral	Remarks
							Fa. t	Rock							
1	Hajar Deposit	Magnetic Anomaly	Hajar	Cu Pb Zn Ag	massive	sedimentary	lat	Tuff	100x400 x500	+500	NW-SE, 50° NE	Ag* 74ppm Cu* 0.86 % Pb* 2.78 % Zn* 9.45 %	Cp-Gl Sp-Po Py	Qt-Talc Chl-Ser Cal	DDH = 27holes Shaft* 235 m Adit = 233 m
2	Outhrbane-E	Gossan	Outhrbane	Cu Zn	network	fracture filling	lat	Tuff	20x60	+100	NW-SE, 80° NE	Ag* 0.3ppm Cu* 0.06 % Pb* tr Zn* 0.01 %	Ilm-Ge	Qt	
3	Outhrbane-W	Gossan	Akhilj	Cu Zn	network	fracture filling	lat	Tuff	20x70	+100	NW-SE, 80° NE	Ag* 0.3ppm Cu* 0.05 % Pb* tr Zn* 0.01 %	Ilm-Ge	Qt	
4	Tiferouine	Magnetic Anomaly	3km S from Akhilj	Cu	dissemi- nation	replace	lps	Slate	20				Cp-Py Mg-Po	Qt	DDH = 3holes
5	Tifratine		Akhilj	Pb Zn	dissemi- nation	sedimentary	lat	Tuff	7			Ag* 7ppm Cu* 0.01 % Pb* 0.2 % Zn* 0.8 %	Sp-Po	Qt	DDH = 1hole
6	Amzourh	Gossan	Amzourh	Cu Pb Zn	dissemi- nation	fracture filling	lav	Vol- canic Rock	2x20	+500	NW-SW 80° NE	Ag* 8ppm Cu* 0.85 % Pb* 1.77 % Zn* 1.17 %	Ilm-Ge Cu-Ox	Qt-Cal	DDH = 2holes
7	Frizez-E	Gossan	Frizez	Cu Pb Zn	dissemi- nation	sedimentary replace	lc	Marl Slate	10x40	+500	NW-SSE 30° E	Ag* 15ppm Cu* 0.36 % Pb* 0.63 % Zn* 1.76 %	Cp-Gl Sp-Py Po	Sid-Qt Cal	DDH = 9holes
8	Frizez-W	Gossan	Frizez	Cu Pb Zn	dissemi- nation	fracture filling	lps	Slate	2x50	+700	NW-SSE 50° E	Ag* 5ppm Cu* 2.25 % Pb* 0.61 % Zn* 1.63 %	Ilm-Ge Cu-Ox	Qt-Sid Cal	DDH = 1hole
9	Mied	Gossan	4km E from Frizez		dissemi- nation	replace	ll	Lime- stone	2x50	+300	NW- SS 80° E	Ag* 1ppm Cu* tr Pb* tr Zn* 0.01 %	Ilm-Ge Po	Sid-Qt	DDH = 1hole

Cp : Chalcopyrite
 Gl : Galena
 Sp : Sphalerite
 Po : Pyrrhotite
 Py : Pyrite
 Mg : Magnetite
 Ilm : Hematite
 Ge : Goethite
 Ox : Oxide
 Qt : Quartz
 Chl: Chlorite
 Ser: Sericite
 Cal: Calcite
 Sid: Siderite



LEGEND

- PLIOCENE-QUATERNARY SEDIMENT**
- Alluvium
 - Reddish grey sandstone
 - Breccia cemented with carbonate
 - Conglomerate
- VOLCANO-SEDIMENTARY FORMATION**
- Horizon of pelitic-psammitic schist with acidic tuff
 - Pelitic-psammitic schist with acidic tuff
 - acidic tuff with kaolinization
 - Limestone bed
- Mineralized horizon**
- Massive and banded ore of Cu, Pb, Zn, Pyrrhotite
 - Brecciated ore
 - Chloritized rock
- Horizon of chloritized tuff**
- Chloritized tuff
 - Stockwork of Zn-Pyrrothite
 - Stockwork of Pyrrhotite
- Horizon of acidic volcanic rock**
- Quartz karatophyre with tuffaceous rock
 - Brecciated lava
- Volcanic rocks**
- (a) Microcrystalline, (b) Glassy, (c) Brecciated
- Hydrothermal alteration**
- Kaolinization
 - Chloritization
 - Silicification (cherty bed)
- Other symbols:**
- Fault
 - Vertical drilling
 - Inclined drilling

Fig. 12 Geological Section of Hajjar Orebody (N-S)

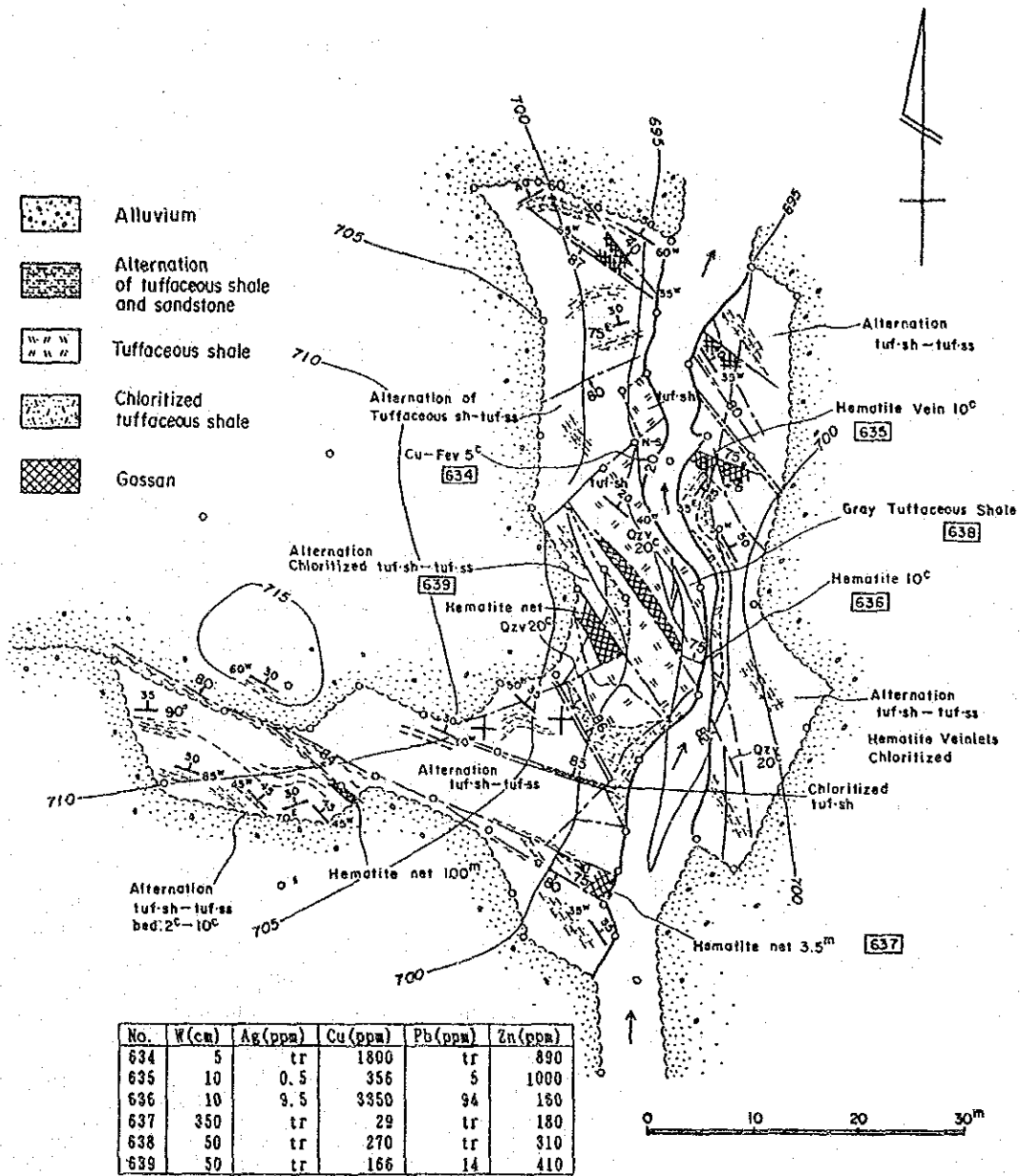


Fig. 13 Mineral Indication of the East Oukhribane

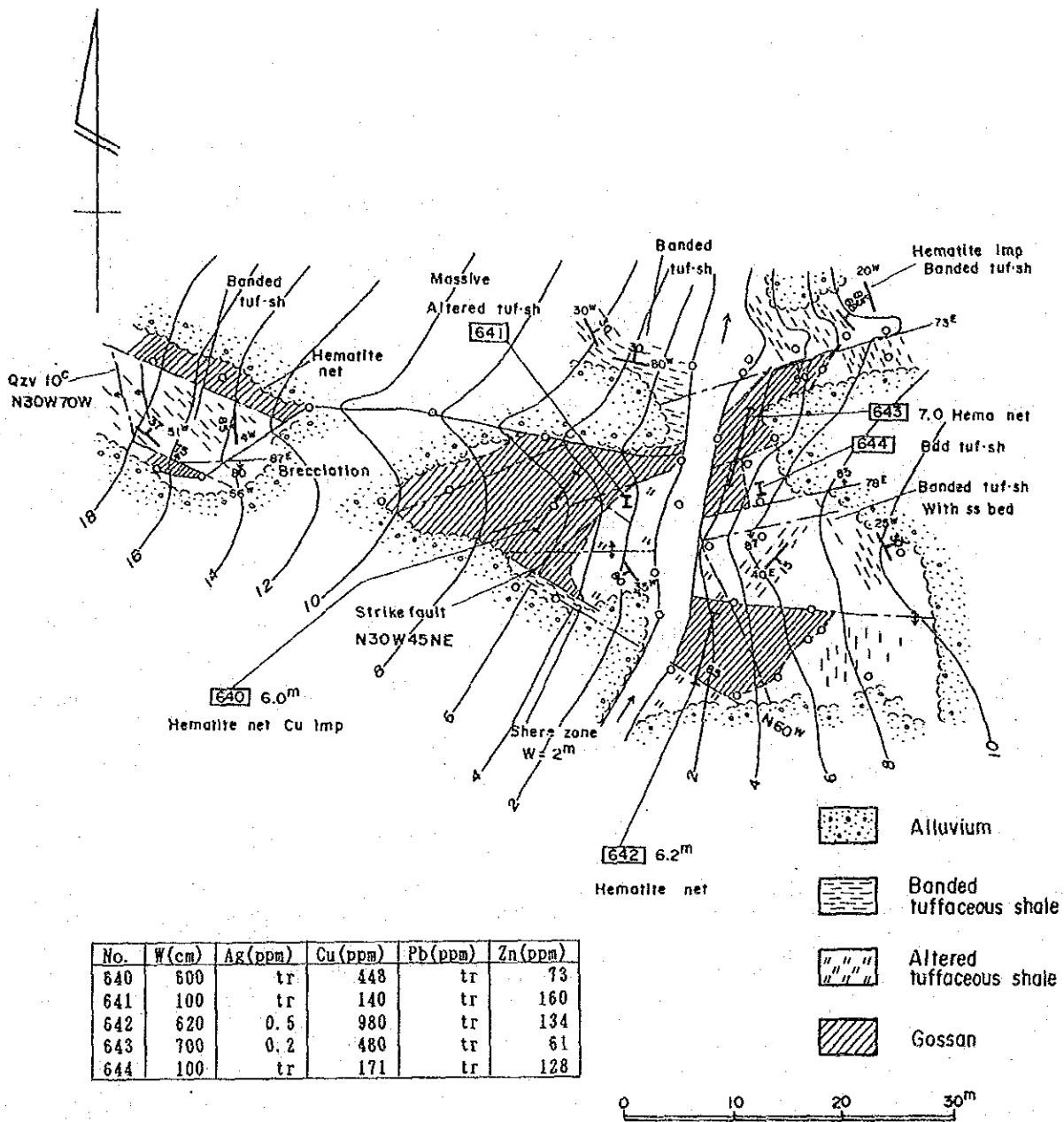


Fig. 14 Mineral Indication of the West Oukhribane

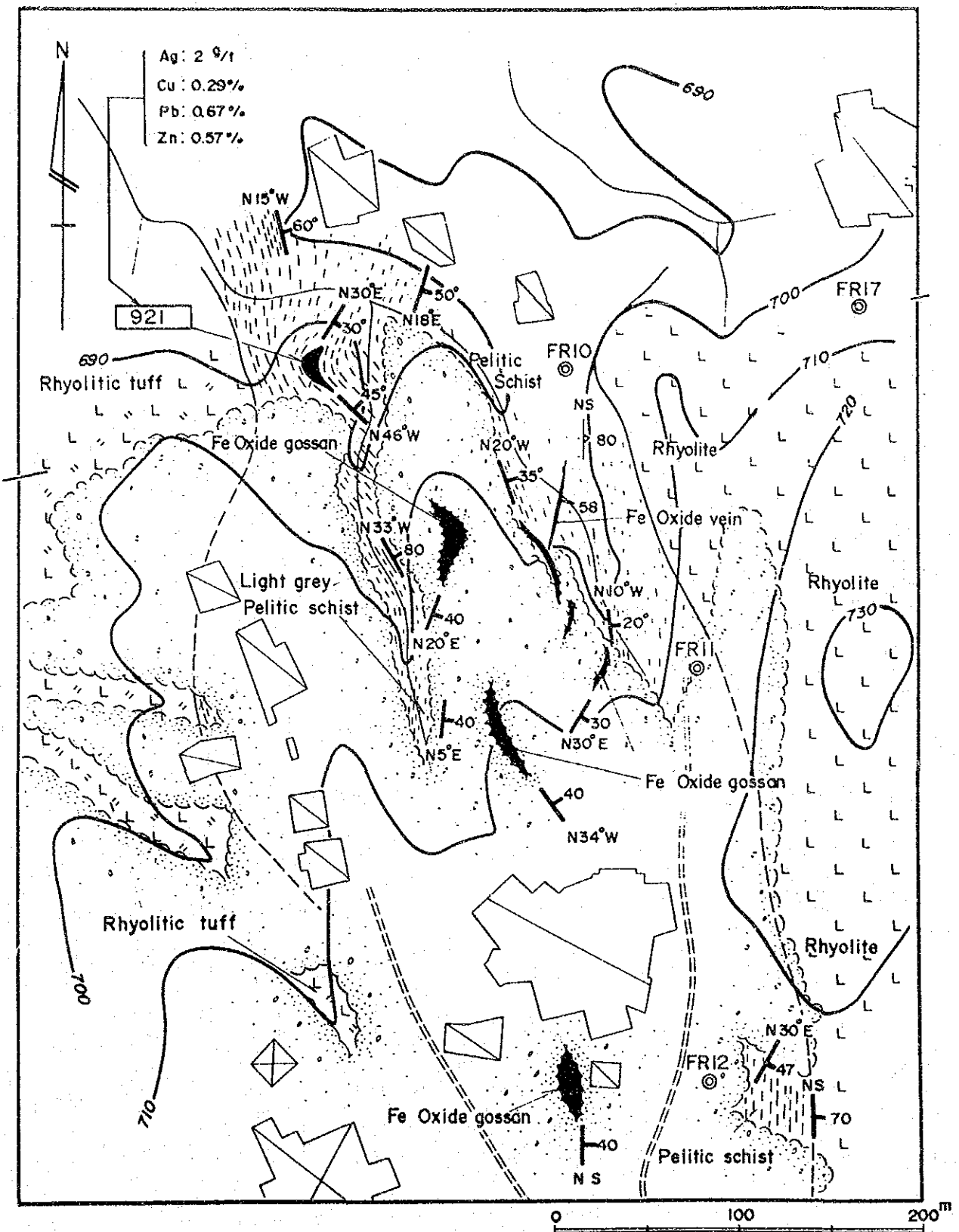


Fig. 15 Mineral Indication of the East Frizem Area

Tab. 3 Statistical Values of Geochemical Assay Results

(Phase I)

Classification	No.	Ag (ppm)			Cu (ppm)			Pb (ppm)			Zn (ppm)		
		Mean	M + σ	M + 2 σ	Mean	M + σ	M + 2 σ	Mean	M + σ	M + 2 σ	Mean	M + σ	M + 2 σ
Total	202	1.32	2.81	5.96	26.8	67	170	36.0	91	229	120	292	713
0 Intrusive rock	4	0.28	0.57	1.13	7.0	11	17	11.3	17	25	40	91	211
1 Ips (Pelitic schist)	48	1.16	2.66	6.12	27.5	78	223	21.0	41	79	117	316	854
2 Iv (Volcanics)	3	1.37	4.26	13.90	110.5	524	2490	217.5	313	451	374	1519	6167
3 Ic (Carbonatic schist)	54	1.67	3.30	6.53	30.8	87	243	41.0	100	244	142	339	805
4 Ip (Pelitic schist)	37	1.27	2.34	4.33	28.5	48	82	34.9	58	98	125	175	245
5 IIP ₁ (Pelitic semischist)	2	0.57	0.92	1.51	11.0	12	14	25.3	48	92	127	283	632
6 IIA1 (Alternate semischist)	18	1.44	2.59	4.65	30.4	89	263	38.6	169	737	180	580	1869
7 IIAv (Volcanics)	2	1.13	1.85	3.02	11.3	18	30	27.7	34	42	83	272	887
8 IIP ₂ (Pelitic semischist)	15	1.08	2.57	6.10	25.3	40	63	63.1	147	341	80	179	402
9 IIC (Carbonatic semischist)	19	1.76	2.91	4.81	17.7	28	43	63.5	133	280	74	145	283

M (Mean) = Geometric mean

σ = Standard deviation

Phase II)

Geologic Unit	No. of Samples	Cu (ppm)				Pb (ppm)				Zn (ppm)				Ag (ppm)			
		Mean	Std	Min	Max	Mean	Std	Min	Max	Mean	Std	Min	Max	Mean	Std	Min	Max
Total	268	40.15	62.74	6	560	26.49	51.87	1	400	157.11	184.88	28	1400	0.11	0.05	0.1	0.6
Intrusive	6	15.33	7.92	10	31	69.33	141.63	3	358	128.67	168.51	37	470	0.10	0.00	0.1	0.1
IIC	38	17.68	4.75	9	31	18.00	15.88	4	90	111.58	144.11	44	880	0.11	0.04	0.1	0.3
IIP ₂	37	29.70	18.25	8	112	19.19	22.84	4	144	111.62	79.08	28	460	0.10	0.00	0.1	0.1
IIA1	22	27.64	14.36	9	76	17.18	16.69	1	71	152.59	119.74	41	470	0.10	0.02	0.1	0.2
IIAv	7	19.86	9.86	10	37	15.29	8.88	4	28	97.43	37.35	60	160	0.11	0.04	0.1	0.2
IIP ₁	11	69.27	85.61	9	288	21.82	15.18	6	56	258.09	384.18	57	1400	0.12	0.06	0.1	0.3
IIAs	24	28.00	30.50	6	128	15.04	22.06	1	94	108.54	95.14	28	410	0.11	0.03	0.1	0.2
IIAt	16	162.31	160.12	8	560	24.06	51.63	1	198	278.88	304.40	76	1150	0.10	0.00	0.1	0.1
IIAa	23	48.78	67.32	10	307	2.83	3.88	1	17	100.30	34.31	53	183	0.12	0.08	0.1	0.5
IIP ₁	15	19.33	9.69	6	36	13.33	9.24	2	38	101.87	38.49	46	173	0.10	0.00	0.1	0.1
IIA1	1	209.00	0.00	209	209	30.00	0.00	30	30	165.00	0.00	165	165	0.20	0.00	0.2	0.2
IIP ₁	4	22.00	6.68	16	31	6.75	6.29	2	16	64.50	9.26	57	77	0.10	0.00	0.1	0.1
Ic	24	39.46	51.35	13	264	50.88	89.20	8	400	229.58	288.38	49	1250	0.15	0.12	0.1	0.6
Iv+IvV	15	24.80	13.62	11	61	99.20	92.57	8	334	243.27	144.31	72	630	0.14	0.08	0.1	0.4
Ips	25	43.64	50.98	11	238	31.52	61.98	1	278	224.08	229.17	50	900	0.11	9.03	0.1	0.2

Mean : Geometric Mean

Std : Standard Deviation

Min : Minimum

Max : Maximum

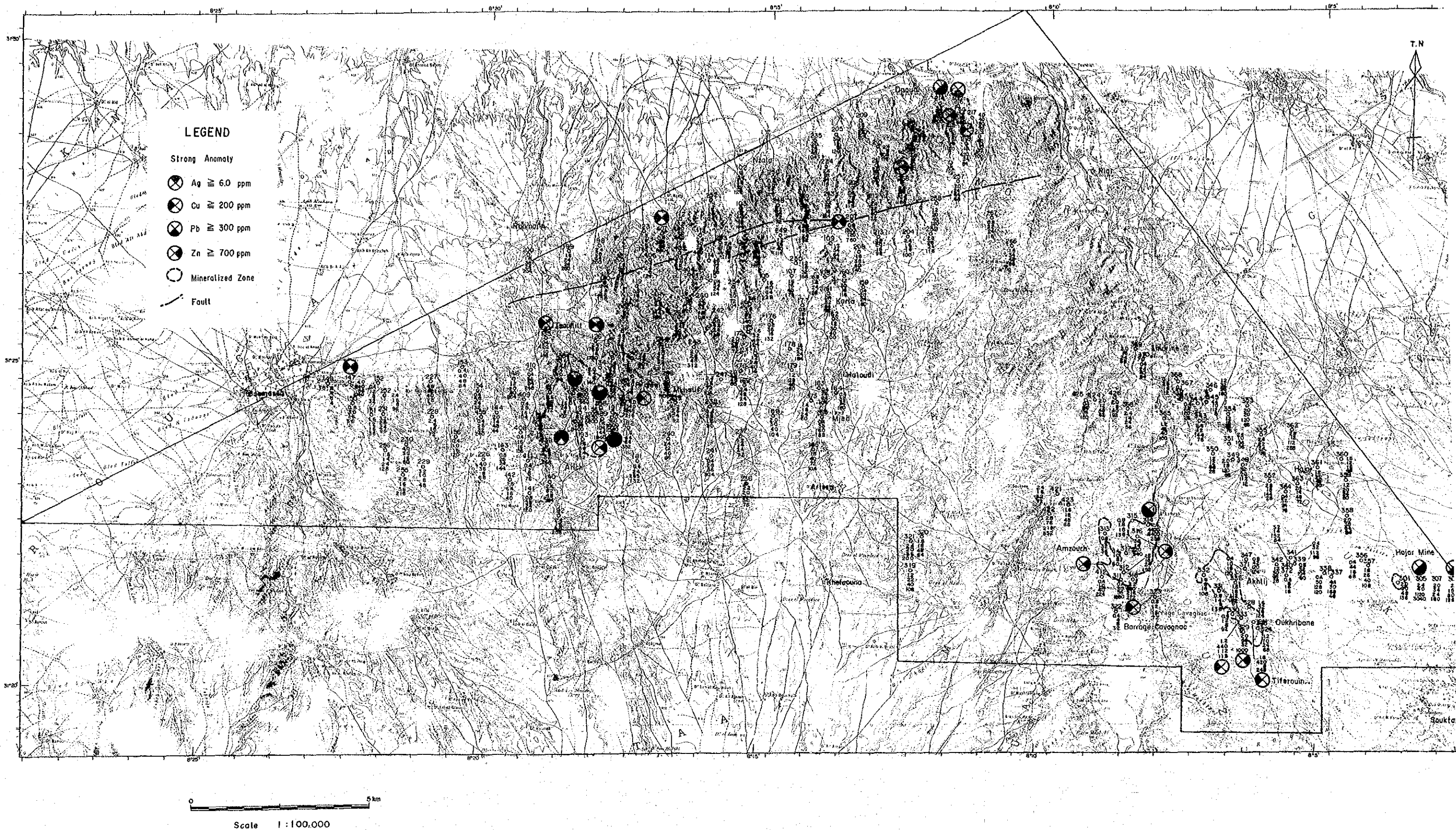


Fig. 16 Distribution of Geochemical Anomalies

