

# Appendix 16

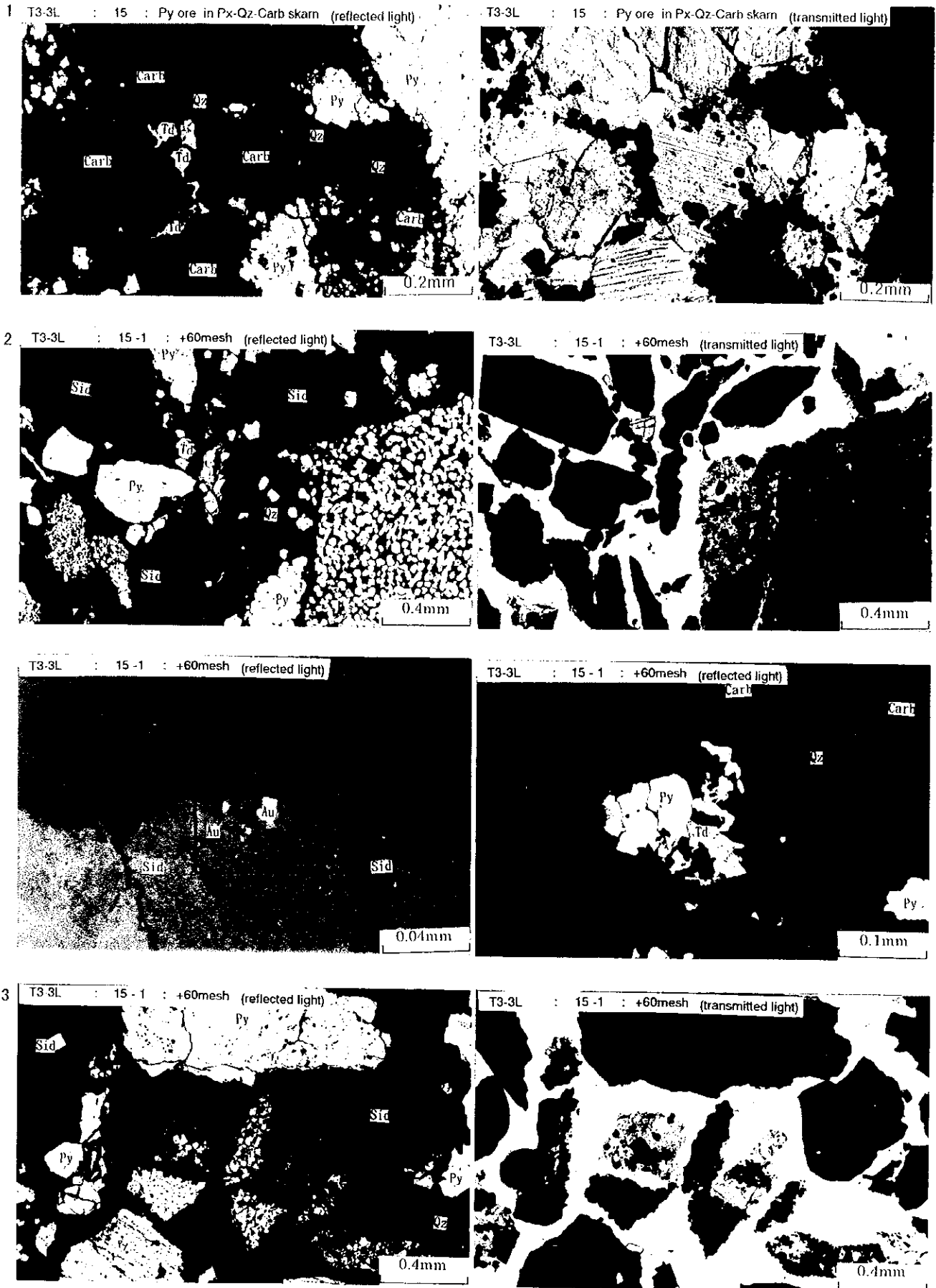
## Photomicrographs of the Polished Thin Sections for Mineral Separation Test

### Abbreviations

Asp	: Arsenopyrite
Au	: Native gold
Bn	: Bornite
Bt	: Biotite
Carb	: Carbonate
Cp	: Chalcopyrite
Cpx	: Clinopyroxene
Cu	: Native copper
Cv	: Covellite
El	: Electrum
En	: Enargite
Ga	: Garnet
Ms	: Marcasite
Mt	: Magnetite
Py	: Pyrite
Qz	: Quartz
Se	: Sericite
Sid	: Siderite
Sp	: Sphalerite
Stan	: Stannite
Td	: Tetrahedrite
X	: unidentified minerals

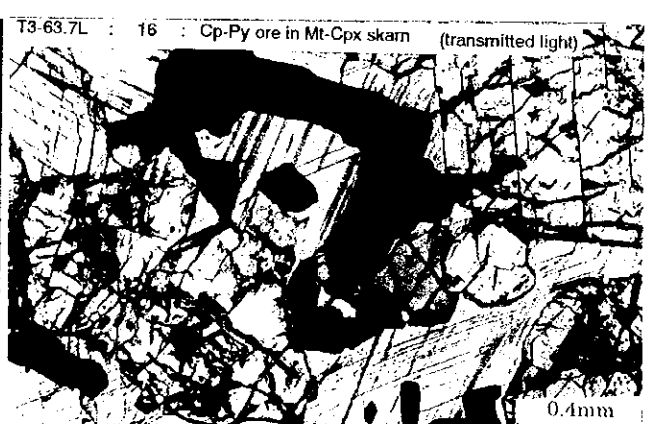
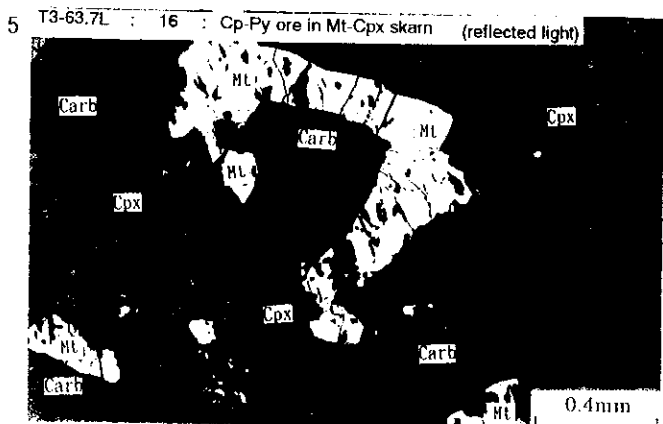
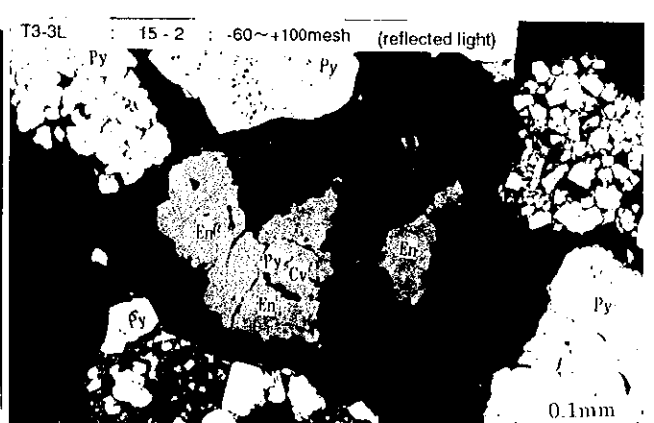
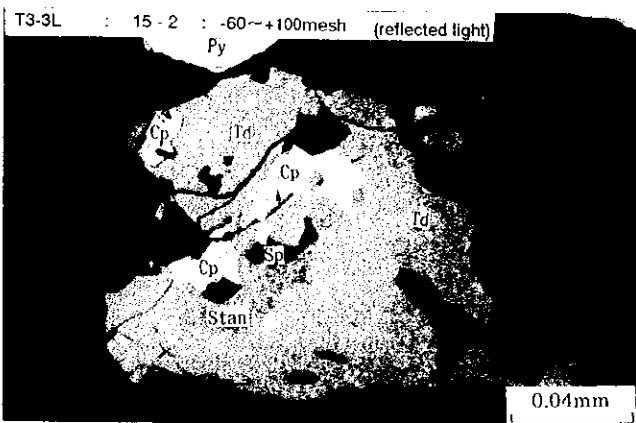
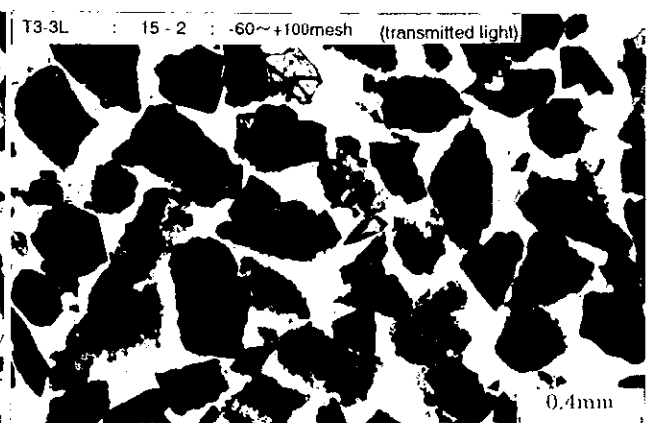
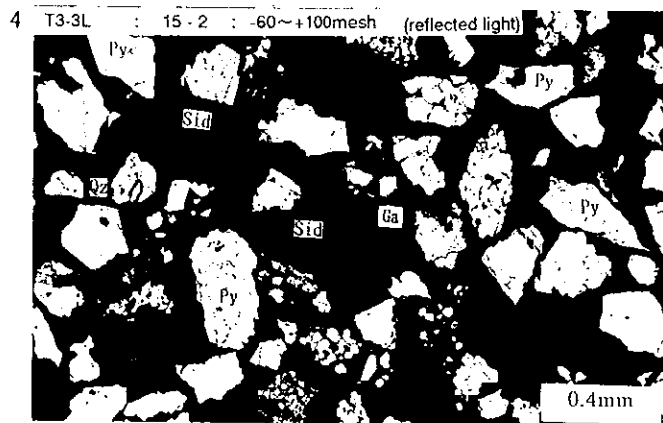
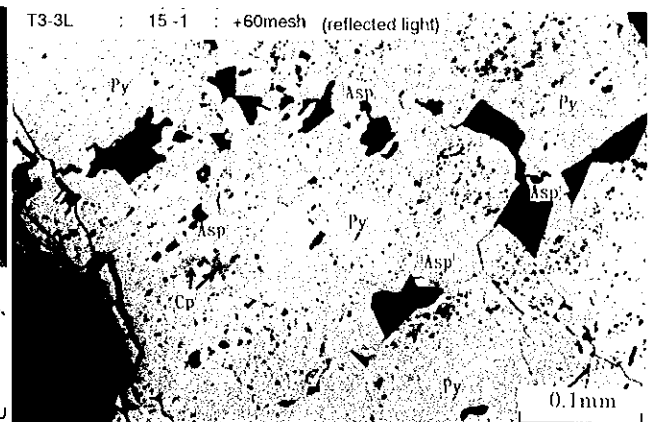
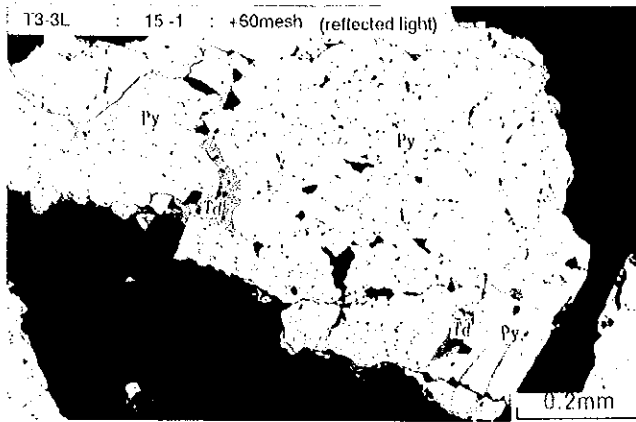


Appendix 16 Photomicrographs of the Polished Thin Sections(Au grain distribution test)



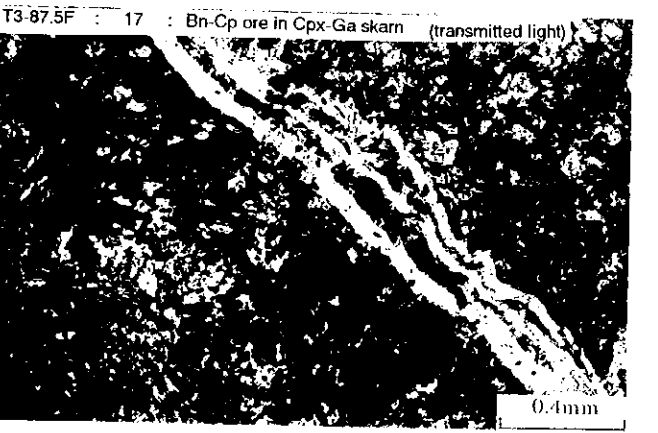
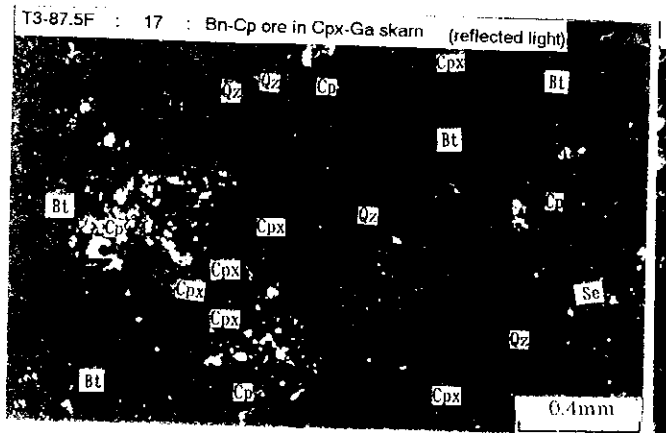
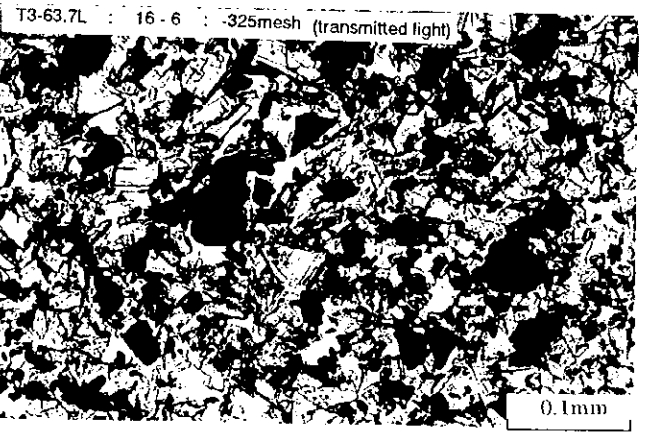
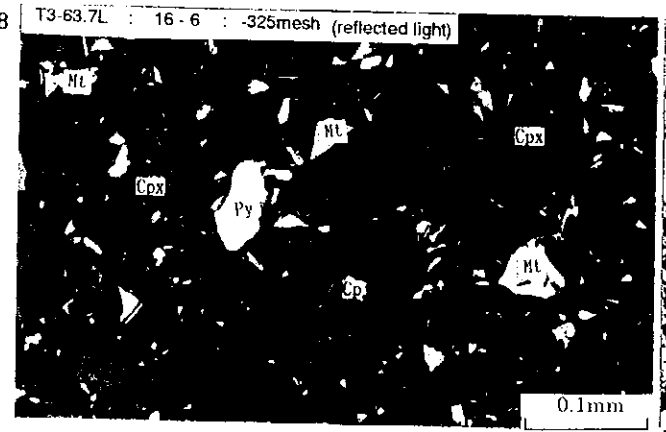
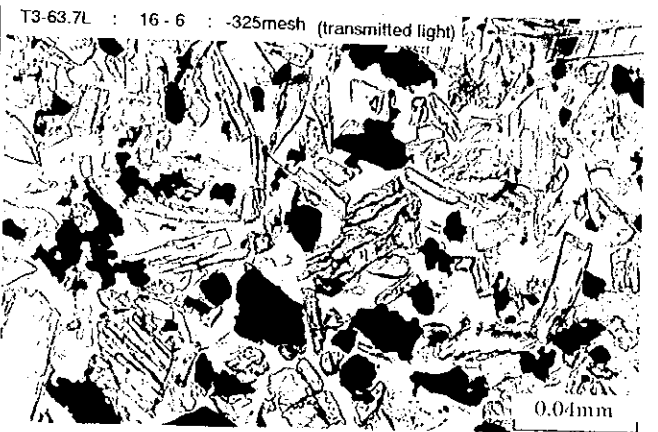
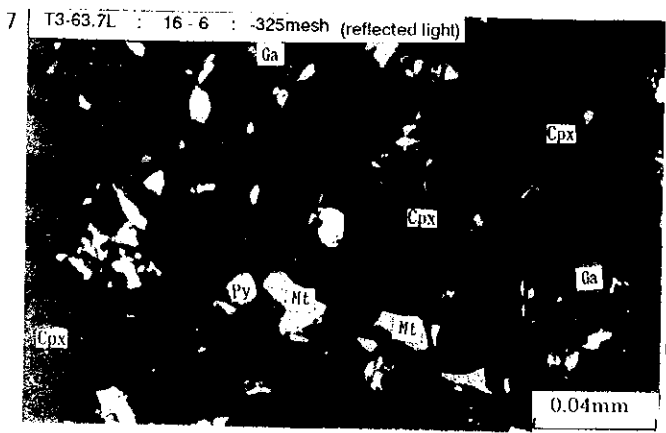
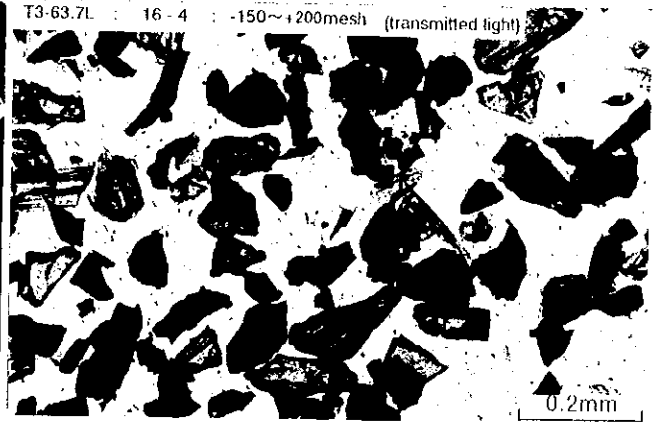
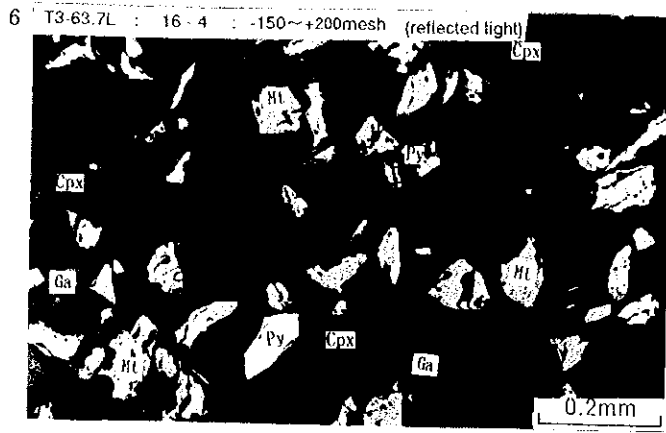


Appendix 16 Photomicrographs of the Polished Thin Sections(Au grain distribution test)





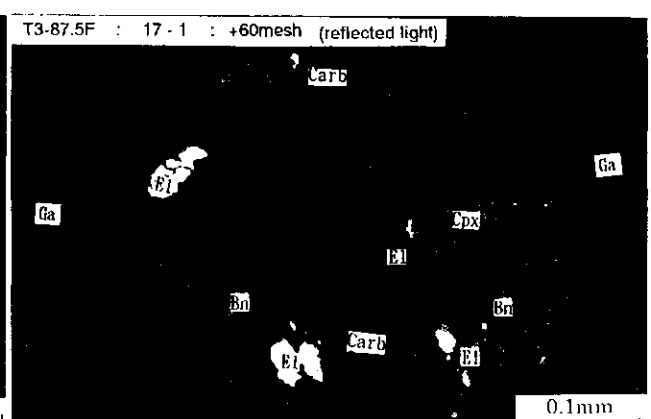
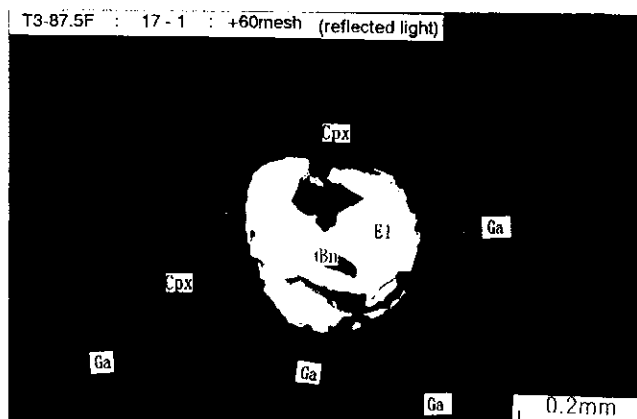
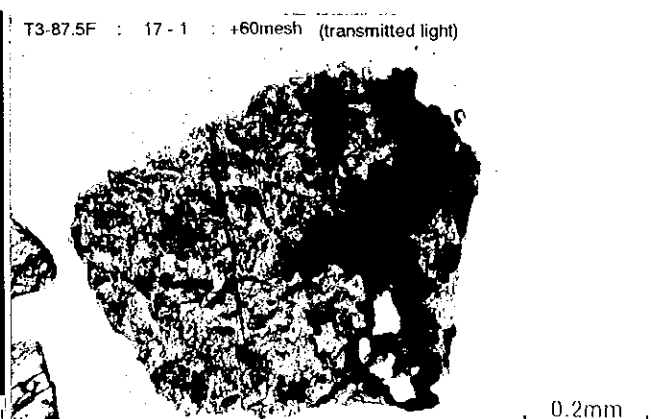
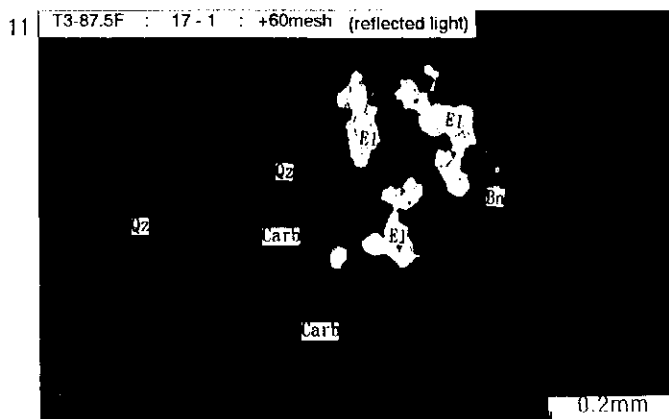
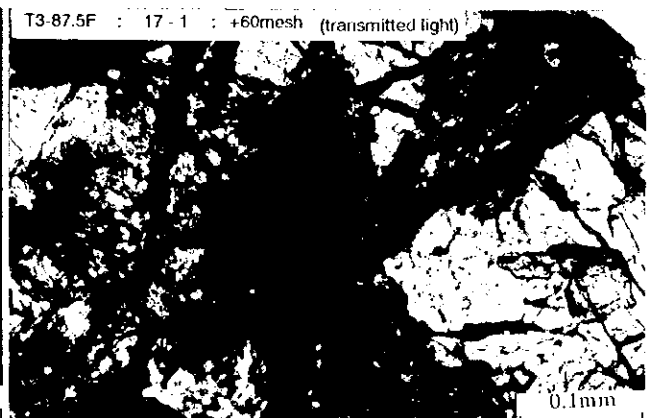
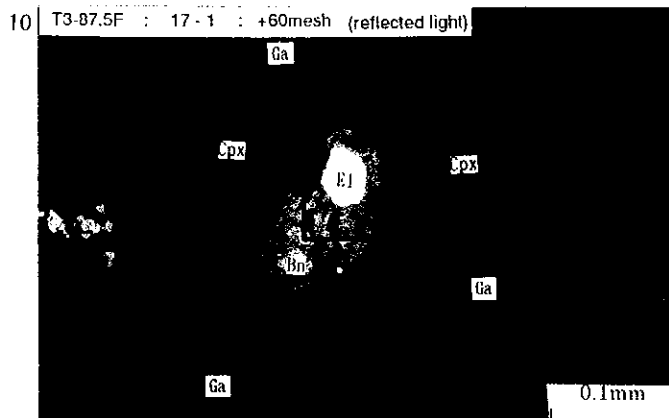
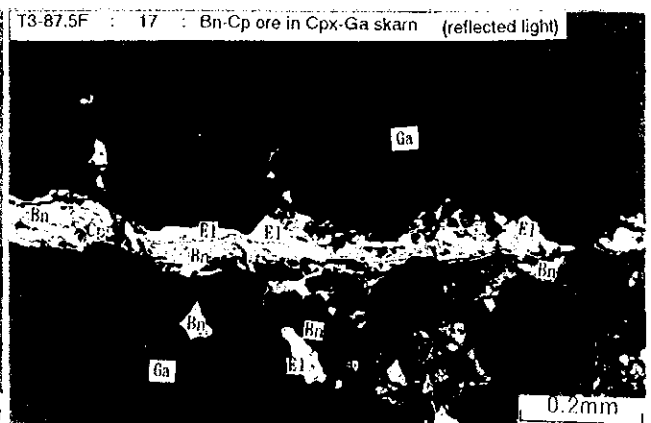
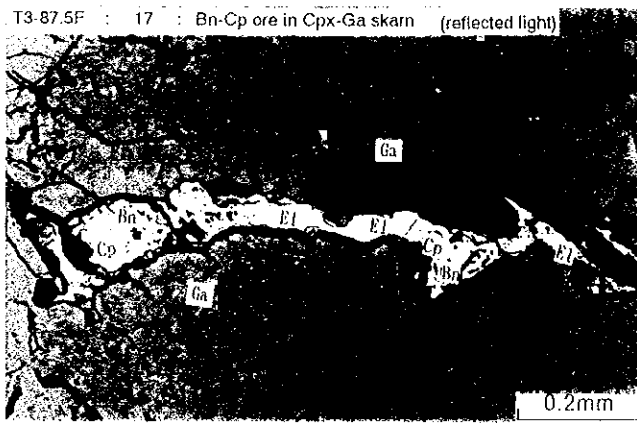
Appendix 16 Photomicrographs of the Polished Thin Sections(Au grain distribution test)





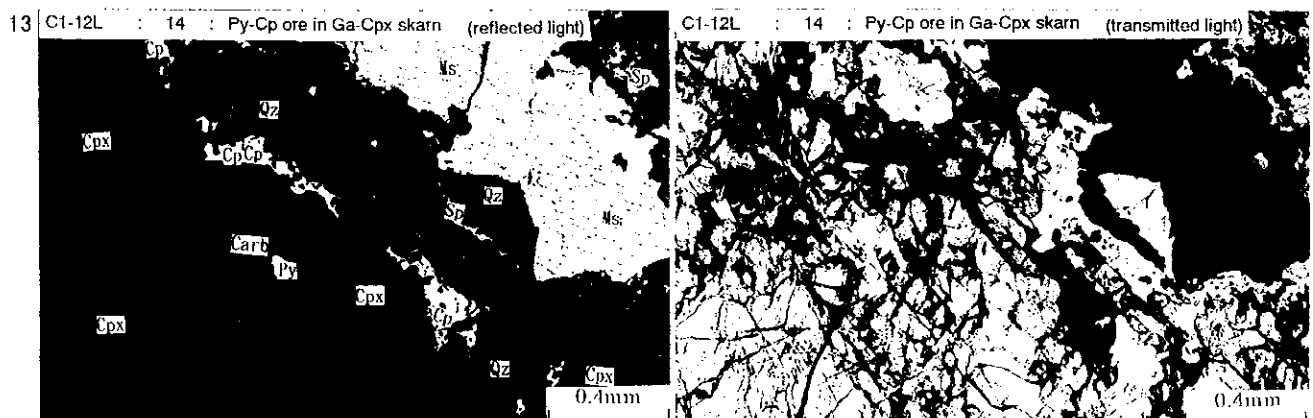
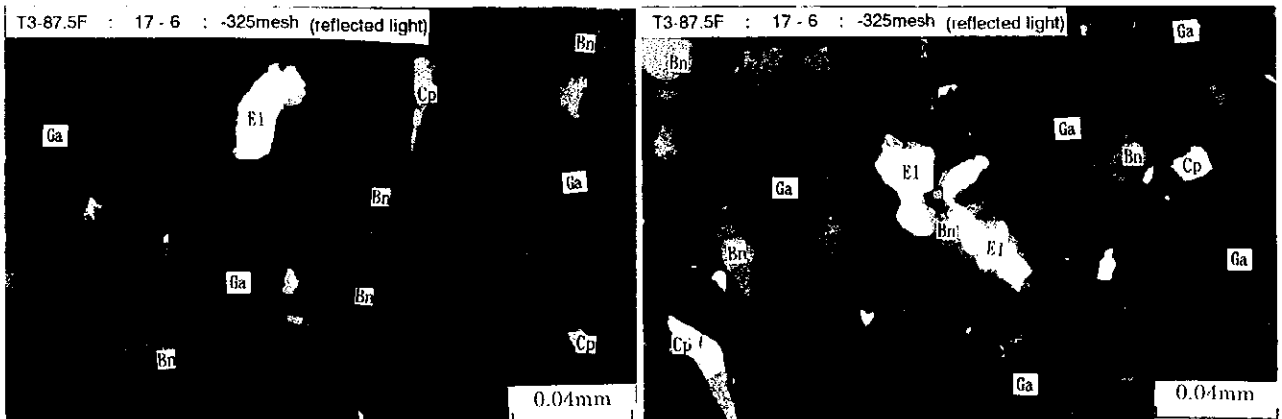
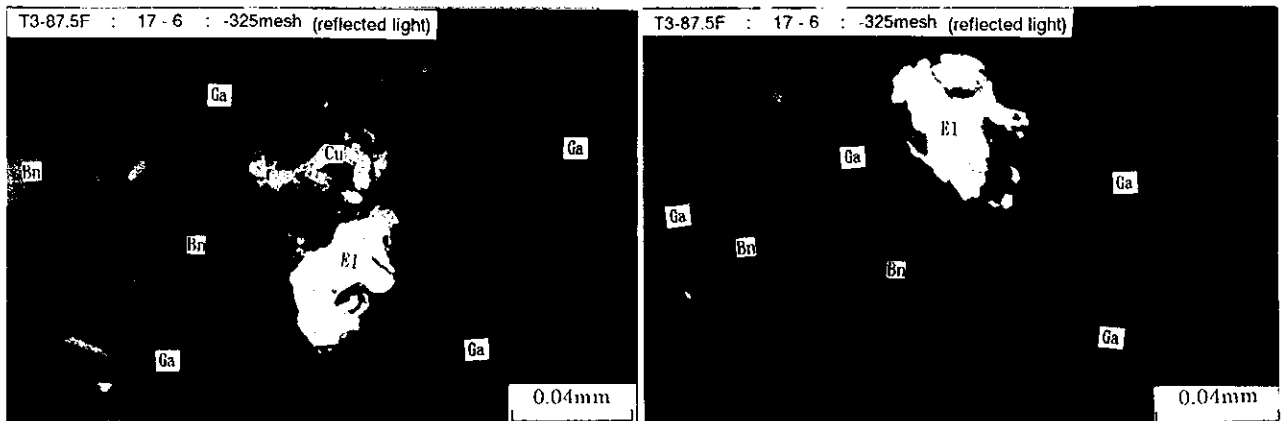
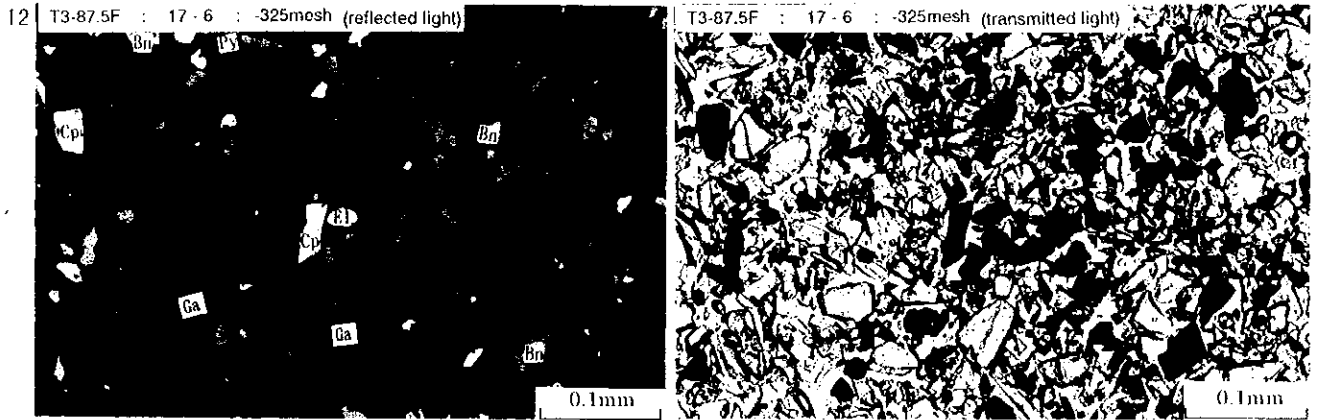


Appendix 16 Photomicrographs of the Polished Thin Sections(Au grain distribution test)



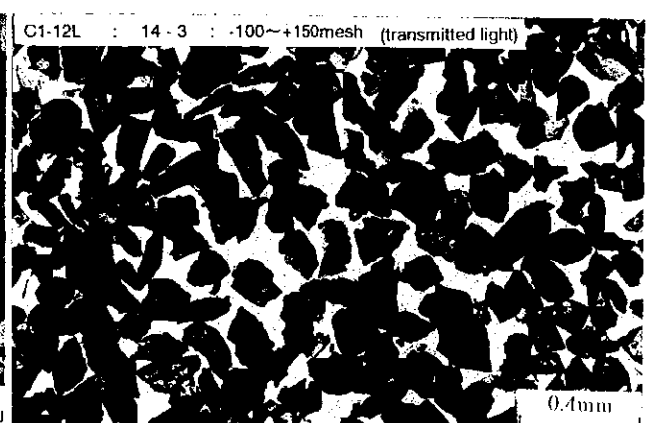
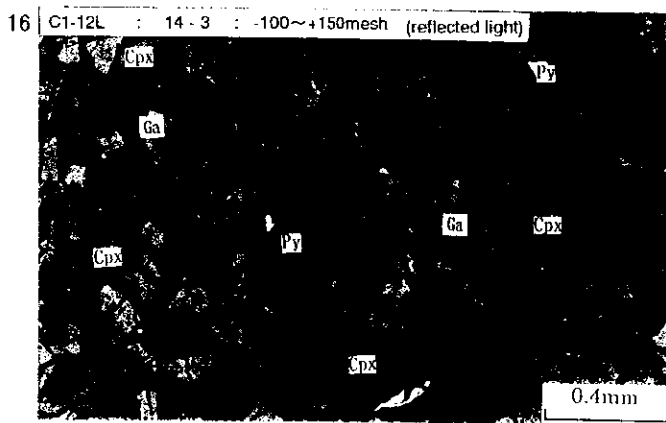
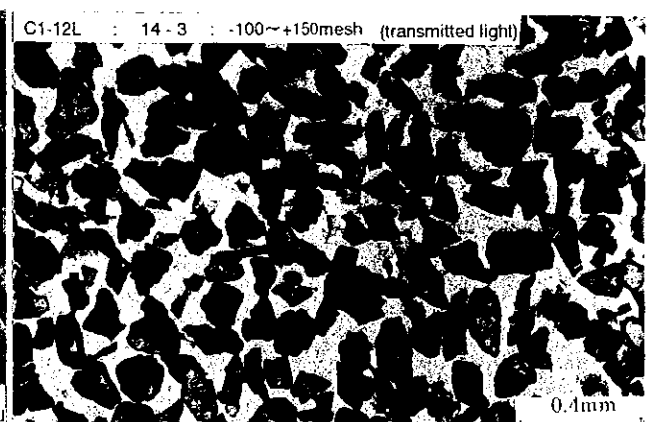
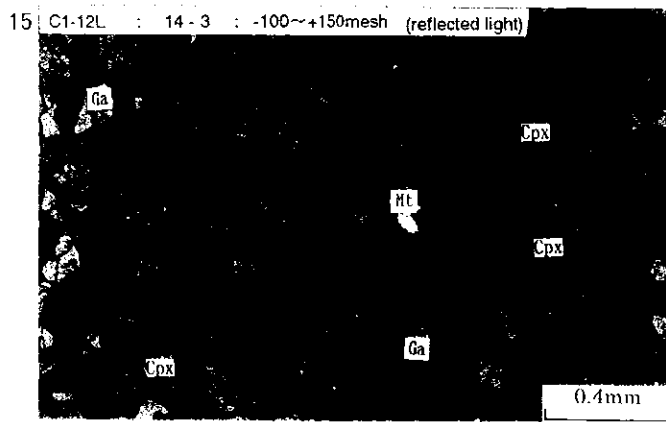
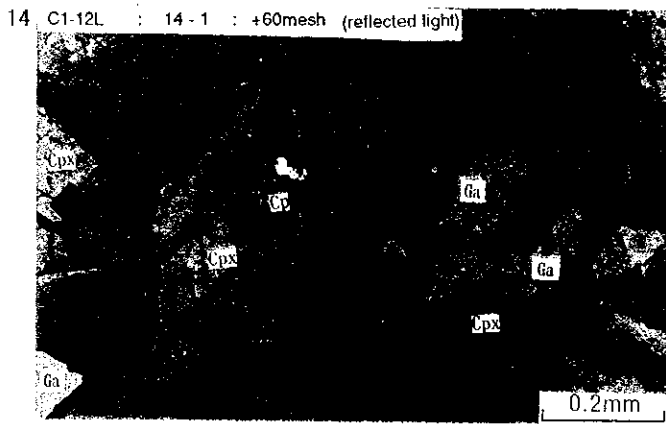
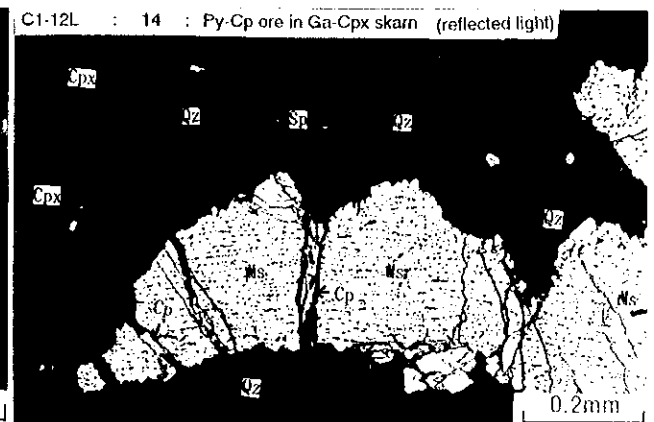
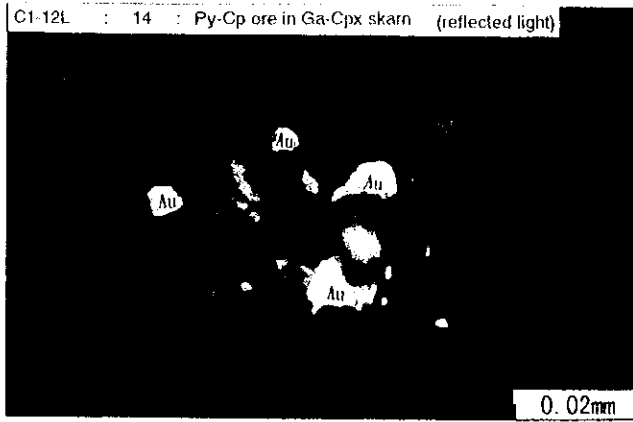


Appendix 16 Photomicrographs of the Polished Thin Sections(Au grain distribution test)



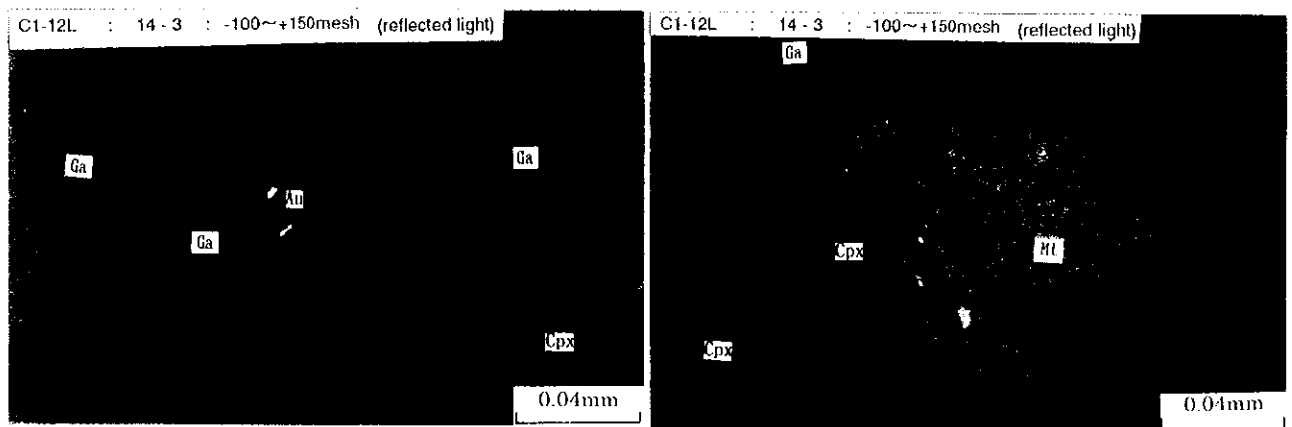


Appendix 16 Photomicrographs of the Polished Thin Sections(Au grain distribution test)





Appendix 16 Photomicrographs of the Polished Thin Sections(Au grain distribution test)









Appendix 17 Result of Modal Analysis for Mineral Separation Test

No.	Sample no.	Test no.	Grain size (mesh)	Ore minerals																		Gangue minerals												
				Total	Mt	Hem	Goe	Py	Ms	Po	Asp	Cu	Bn	Cp	Td	En	Cv	Cc	Stan	Gn	Sp	Au	El	Tb	Qz	Ga	Cpx	Hb	Carb	Cal	Sid	Ilv	Ch	
1	T3-3L	15-1	+60	Counting	2000			15	1309		2	10			3	8								161	5				298	188				
				Mode	100			1	65		0	1			0	0										8	0				15	9		
2	T3-3L	15-1	+60	Counting	2000		1	32	1404		1	14			1	8	11							174	7				229	117				
				Mode	100		0	2	70		0	1		0	0	1										9	0				11	6		
3	T3-3L	15-2	-60~+100	Counting	2000			43	1614					6		7	6							93	27				102	98				
				Mode	100			2	81				0	0	0	0										5	1				5	5		
4	T3-63.7L	16-4	-325	Counting	2000	399	6		22	2															95	1466	8					2		
				Mode	100	20	0		1	0																	5	73	0					0
5	T3-63.7L	16-6	-325	Counting	2000	420	3		19	1															82	1469		3				3		
				Mode	100	21	0		1	0																	4	73		0				0
6	T3-63.7L	16-6	-150~+200	Counting	2000	1144	8		3	1														2	196	619	14	9				4		
				Mode	100	57	0		0	0																0	10	31	1	0				0
7	T3-87.5F	17-1	+60	Counting	2000										27	1									3	1316	546	63	23			6	15	
				Mode	100												1	0									0	66	27	3	1			0
8	T3-87.5F	17-1	+60	Counting	2000										22	2						1			2	1406	463	69	18			6	11	
				Mode	100												1	0					0				0	70	23	3	1			0
9	T3-87.5F	17-6	-325	Counting	2000			8							356	103									1353	161	9	2				4		
				Mode	100			0									18	5									68	8	0	0				0
10	C1-12	14-1	-100~+150	Counting	2000	1			1	2																1021	12	18					5	
				Mode	100	0			0	0																		51	1	1				
11	C1-12	14-3	-100~+150	Counting	2000	1			8	1																	1023	26	22					3
				Mode	100	0			0	0																			51	1	1			
12	C1-12	14-3	+60	Counting	2000																													43
				Mode	100																													

Amp: Amphibole  
 Asp: Arsenopyrite  
 Au: Native gold  
 Bn: Bornite  
 Cal: Calcite  
 Carb: Carbonate  
 Cc: Chalcocite  
 Ch: Chlorite

Cp: Chalcopyrite  
 Cpx: Clinopyroxene  
 Cu: Native copper  
 Cv: Covellite  
 El: Electrum  
 En: Enargite  
 Ga: Garnet  
 Gn: Galena

Goe: Goethite  
 Hem: Hematite  
 Ilv: Ilvaite  
 Ms: Marcasite  
 Mt: Magnetite  
 Po: Pyrrhotite  
 Py: Pyrite  
 Qz: Quartz

Sid: Siderite  
 Sp: Sphalerite  
 Stan: Stannite  
 Tb: Telluro-bismuthite  
 Td: Tetrahedrite



Appendix 18 Result of EPMA Analysis for Mineral Separation Test

Sample no.	Test no.	Grain size (mesh)	Analyzed domain	Analyzed ore minerals	Analyzed gangue minerals	Remarks
T3-3L	15 - 1	+60mesh	Native Au with Sid	Native Au: Au-(Ag) Bismite: Bi <sub>2</sub> O <sub>3</sub>	Siderite: FeCO <sub>3</sub> Mg-Siderite: (Fe, Mg)CO <sub>3</sub> Calcite: CaCO <sub>3</sub>	Native Au includes a little amount of Ag
T3-63.7L	16 - 6	-325mesh	Op with Mt	Chalcopyrite: CuFeS <sub>2</sub> Magnetite: Fe <sub>3</sub> O <sub>4</sub>		
T3-87.5F	17 - 1	+60mesh	El and Bn with Ga, Cpx and Cal	Electrum: Au, Ag Bornite: Cu <sub>5</sub> FeS <sub>4</sub>	Andradite: Ca <sub>3</sub> Fe <sub>2</sub> (SiO <sub>4</sub> ) <sub>3</sub> Diopside: Ca (Mg, Fe)Si <sub>2</sub> O <sub>6</sub> Calcite: CaCO <sub>3</sub> Quartz: SiO <sub>2</sub>	
C1-12L	14 - 3	-100~+150mesh	Native Au with Ga	Native Au: Au-(Ag)	Andradite: Ca <sub>3</sub> Fe <sub>2</sub> (SiO <sub>4</sub> ) <sub>3</sub>	Native Au includes a little amount of Ag

Bn: Bornite

Cal: Calcite

Cp: Chalcopyrite

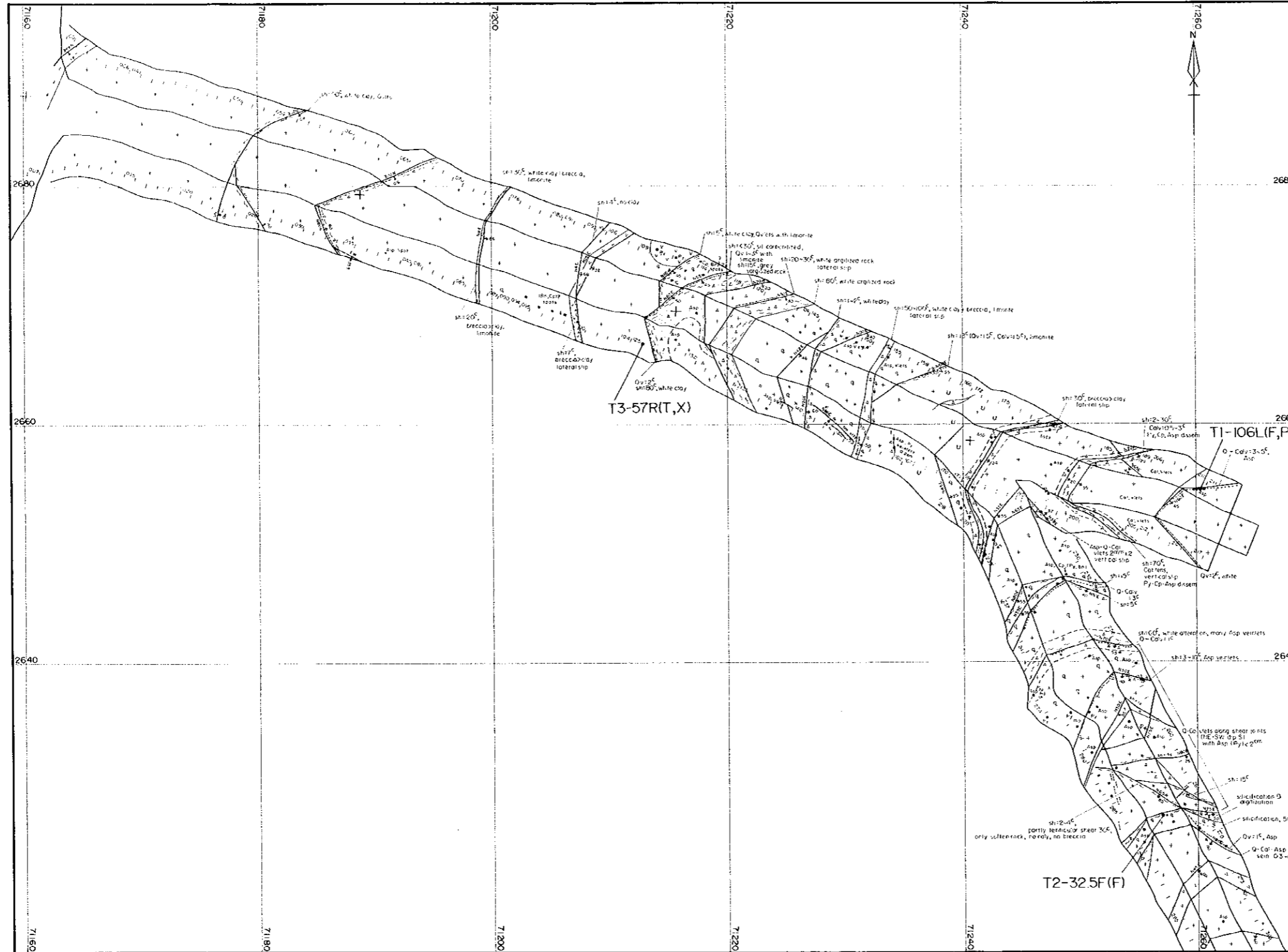
Cpx: Clinopyroxene

El: Electrum

Ga: Garnet

Mt: Magnetite

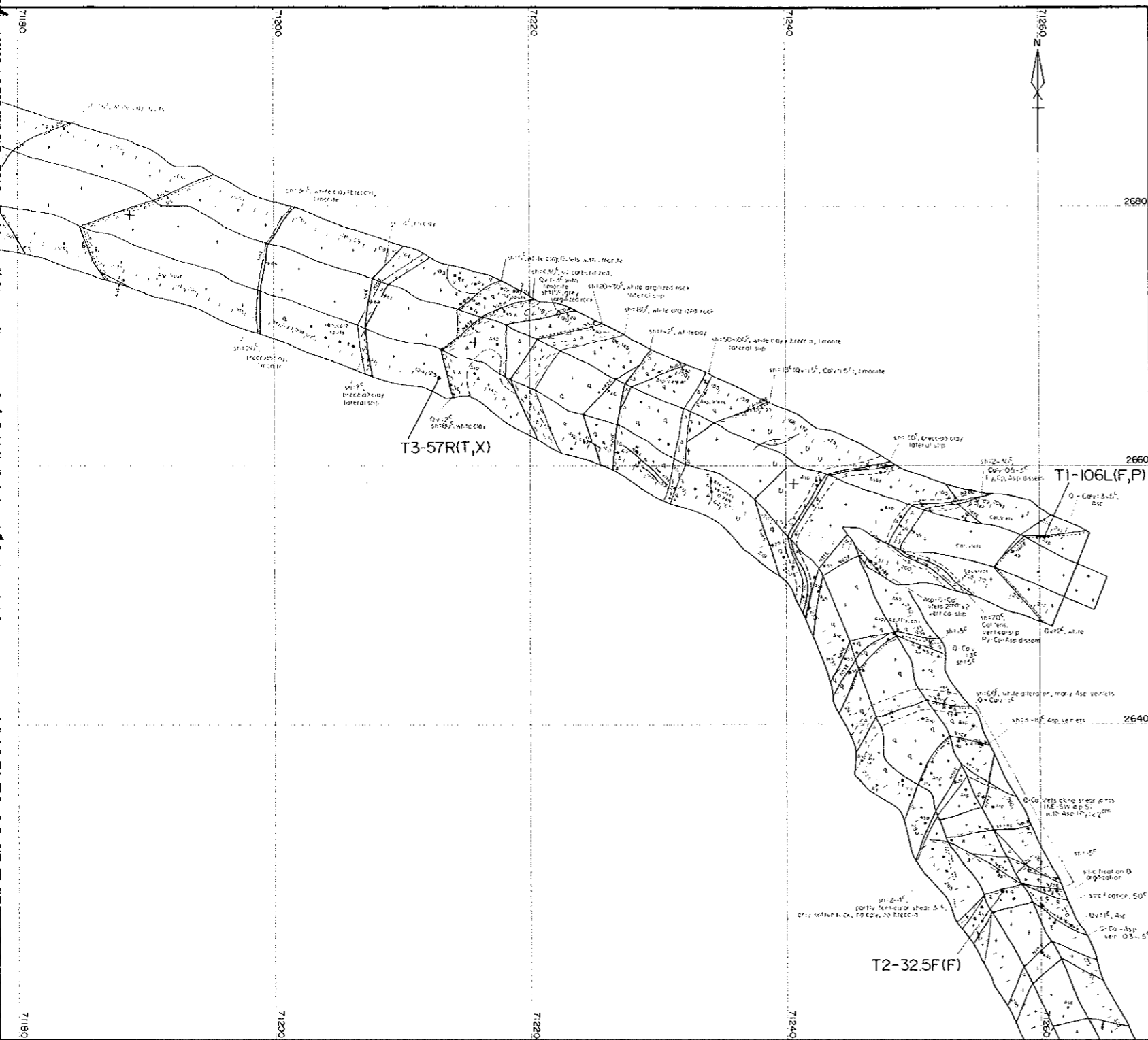
Sid: Siderite



### LEGEND

<b>Host rocks</b>		<b>Others</b>	
+ +	granitoides	—	alteration boundary
x x	gabbroid	—	intrusive boundary
/ / /	skarnized gabbro (strong)	—	fault
/ / /	skarnized gabbro (medium)	—	shear joint
/ / /	skarnized gabbro (weak)	—	ridge
M M	marble	—	fault breccia
		—	shear joint zone
		—	channel sample location
<b>Skarns</b>		<b>Veins</b>	
◆	garnet skarn	—	arsenite vein
◆	pyroxene-garnet skarn (Cpx<Gx)	—	calcite vein
◆	garnet-pyroxene skarn (Ga<Cpx)	—	quartz-calcite vein
◆	pyroxene skarn (medium grain)		
◆	pyroxene skarn (very fine grain)		
◆	pyroxene big crystal		
H H	siliceous carbonate altered rock	<b>Abbreviations</b>	
C C	carbonate skarn	Asp	arsenopyrite
W W	wollastonite skarn	Bn	hornblende
G-Cpx-Hb-Bi	Ga-Cpx-Hb-Bi band in marble	Cp	chalcopyrite
		Cpx	clinopyroxene
		Cu	cooperite
		Ga	garnet
		Mo	moldavite
		Mt	magnetite
		Py	pyrite
<b>Dikes</b>		<b>Sample location</b>	
A A	lamprophyre	•	(T) thin section
+ + +	amphibolite, O <sub>2</sub> -monzonite	•	(P) polished thin section
+ + +	diorite porphyry	—	(X) x-ray diffraction
		T1 Tunnel I	(F) filling temperature
		T2 Tunnel II & Sidetrack I	(E) EPMA
		T3 Tunnel III	(M) mineral separation test
		C1 Sidetrack II & Cross cut I	Numerical figures show
		C2 Cross cut II	the distance of the locality
		R	right wall
		L	left wall
		F	face
		FR	right corner on a face
		FL	left corner on a face
		C	cut
<b>Mineralization &amp; Alteration</b>			
q	quartzification		
q	quartzification (strong)		
q	quartzification (weak)		
A	arsenite band		
•	dissemination of sulphide minerals		
•	linonite		
u	carbonization		

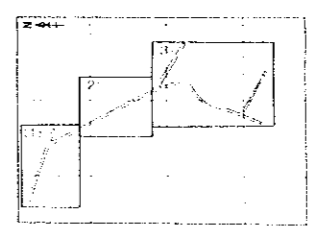
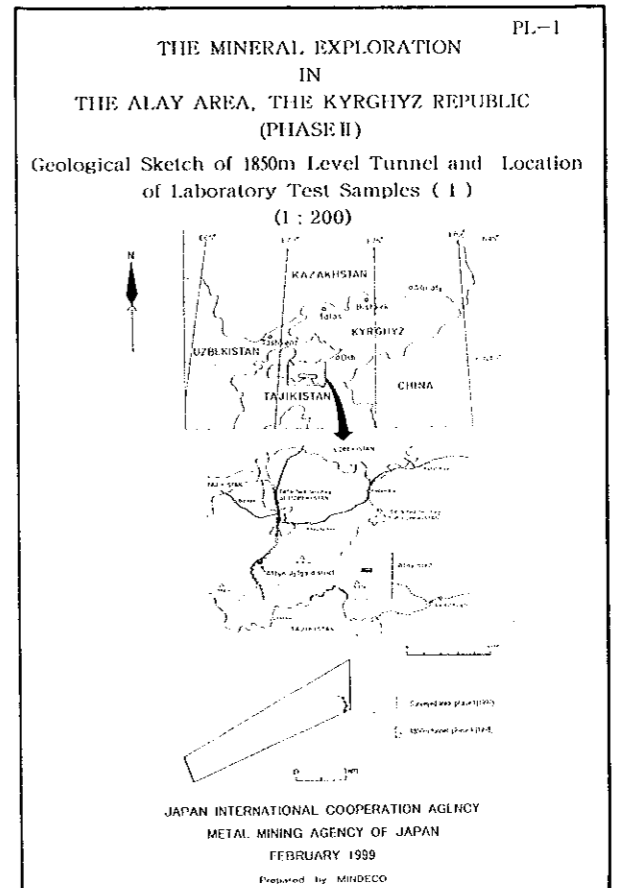
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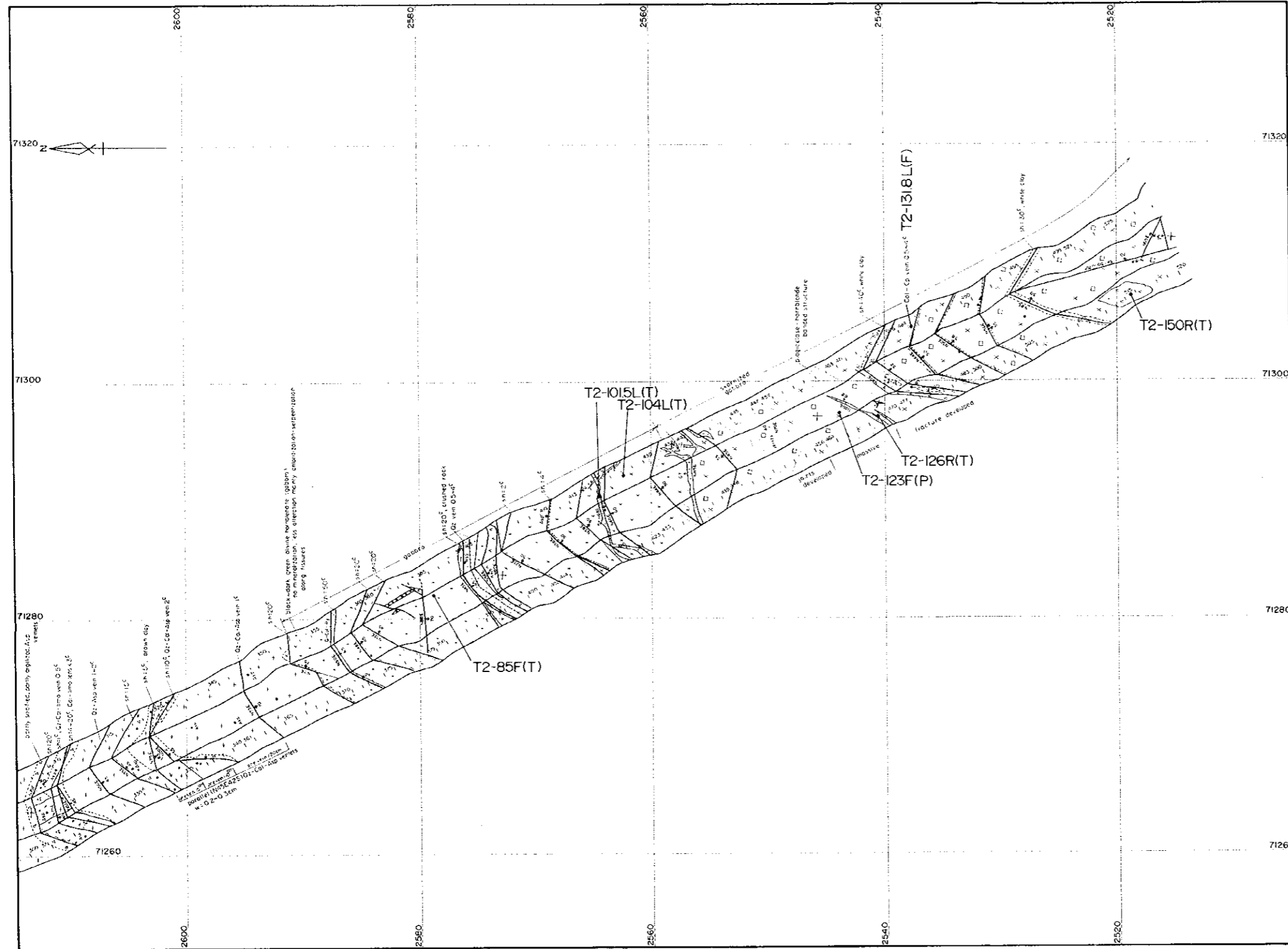


**LEGEND**

<b>Host rocks</b>		<b>Others</b>	
□ □ □ granodiorites		— alteration boundary	
× × × gabbro		— intrusive boundary	
/// (strong)		— fault	
--- (medium)		— shear joint	
--- (weak)		— gouge	
□ × □ marble		— fault breccia	
■ ■ ■ gabbro skarn		— shear joint zone	
◆ ◆ ◆ pyroxene-garnet skarn (Cpx < Ga)		— channel sample location	
▲ ▲ ▲ garnet-pyroxene skarn (Ga < Cpx)			
× × × pyroxene skarn (medium grain)		<b>Veins</b>	
◆ ◆ ◆ pyroxene skarn (very fine grain)		— quartz vein	
◇ ◇ ◇ pyroxene big crystal		— calcite vein	
■ ■ ■ siliceous carbonate altered rock		— quartz calcite vein	
□ □ □ carbonate skarn			
■ ■ ■ wollastonite skarn		<b>Abbreviations</b>	
— Ga-Cpx-Hbl-Bi band in marble		Asp arsenopyrite	
		Bn bornite	
<b>Dikes</b>		Cp chalcopyrite	
▲ ▲ ▲ amphibophyre		Cu copper green	
□ □ □ anorthosite, Qtz-monzodiorite		Ga garnet	
■ ■ ■ diorite porphyry		Mo molybdenite	
		Mt magnetite	
		Py pyrite	
<b>Mineralization &amp; Alteration</b>			
□ □ □ sulfidation		<b>Sample location</b>	
--- argillization (strong)		● T3-15SLIP	
--- argillization (weak)		T1 Tunnel 1	
--- fine grain Py-Asp band		T2 Tunnel 2 & Sidetrack 1	
• • • dissemination of sulphide minerals		T3 Tunnel 3	
▲ ▲ ▲ limonite		C1 Sidetrack 1 & Cross cut 1	
U U carbonization		C2 Cross cut 2	
		R right wall	
		L left wall	
		F face	
		FR right corner on a face	
		FL left corner on a face	
		C roof	

Scale: 1:200

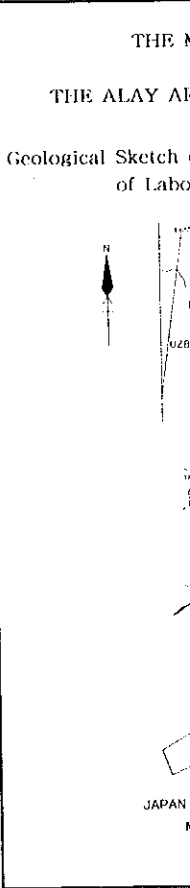


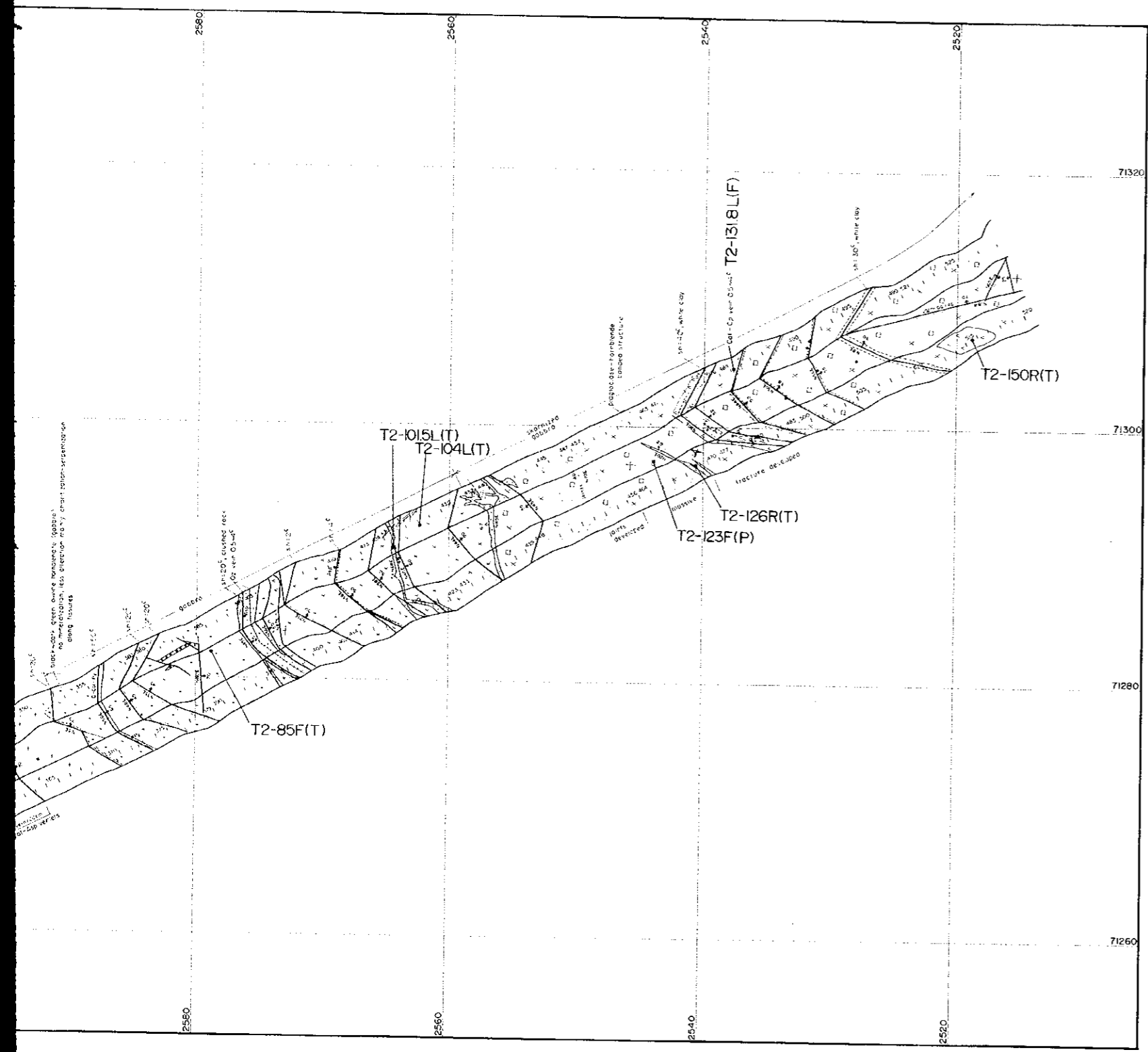


### LEGEND

<b>Host rocks</b>		<b>Others</b>
+ + granodiorites		--- alteration boundary
x x gabbro		--- intrusive boundary
I I I } skarnized gabbro (strong)		--- fault
I I } (medium)		--- shear joint
I I I } (weak)		--- zone
M M marble		--- fault breccia
		--- shear joint zone
<b>Skarns</b>		--- channel sample location
* * garnet skarn		
* * pyroxene-garnet skarn (Cpx < Ga)	<b>Veins</b>	--- quartz vein
* * garnet-pyroxene skarn (Ga < Cpx)		--- calcite vein
* * pyroxene skarn (medium grain)		--- quartz-calcite vein
* * pyroxene skarn (very fine grain)		
* * pyroxene big crystal	<b>Abbreviations</b>	
H H siliceous carbonate altered rock	Asp	arsenopyrite
C C carbonate skarn	Bn	bornite
W W wollastonite skarn	Cp	chalcopyrite
Ga-Cpx-Pl-Bi band in marble	Cpx	clinopyroxene
	Cu	copper green
<b>Dikes</b>	Ga	garnet
A A lamprophyre	Mo	moldenite
+ + anorthosite, Gz-monzodiorite	Mt	magnetite
+ + rhyolite porphyry	Py	pyrite
<b>Mineralization &amp; Alteration</b>		
q q silicification	<b>Sample location</b>	(T) thin section
argillization (strong)	● T3-165L(P)	(P) polished thin section
argillization (weak)	T1 Tunnel I	(X) x-ray diffraction
line grain Py-Asp lund	T2 Tunnel II & Sidetrack I	(F) filling temperature
dispersion of sulphide minerals	T3 Tunnel III	(E) EPMMA
limonite	C1 Sidetrack II & Cross cut I	(M) mineral separation test
carbonization	C2 Cross cut II	Numerical figures show
	R right wall	the distance of the locality
	L left wall	on each tunnel segments
	F face	
	FR right corner on a face	
	FL left corner on a face	
	C roof	

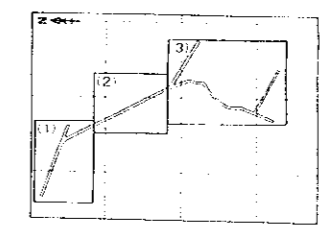
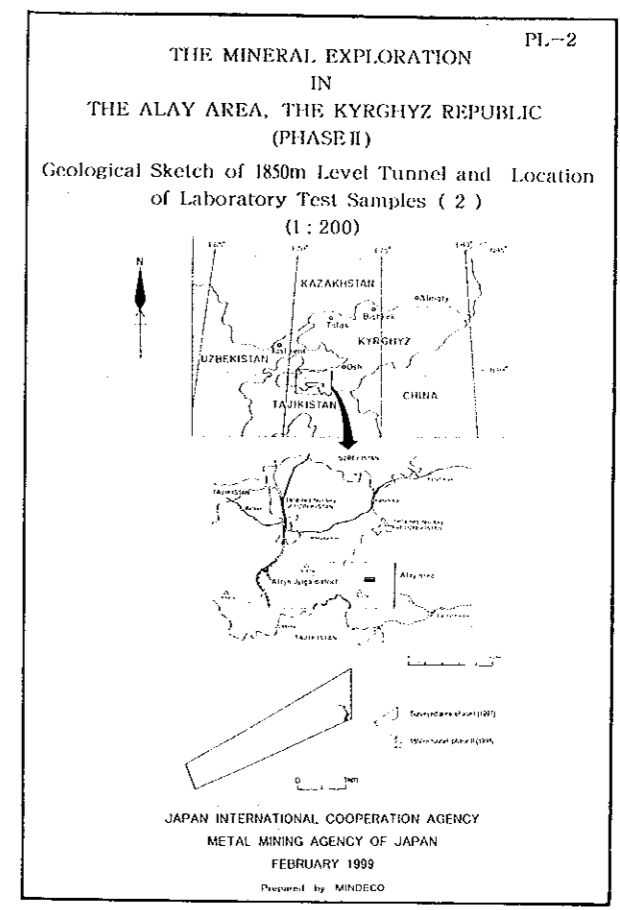
0 10m  
1:200



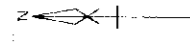
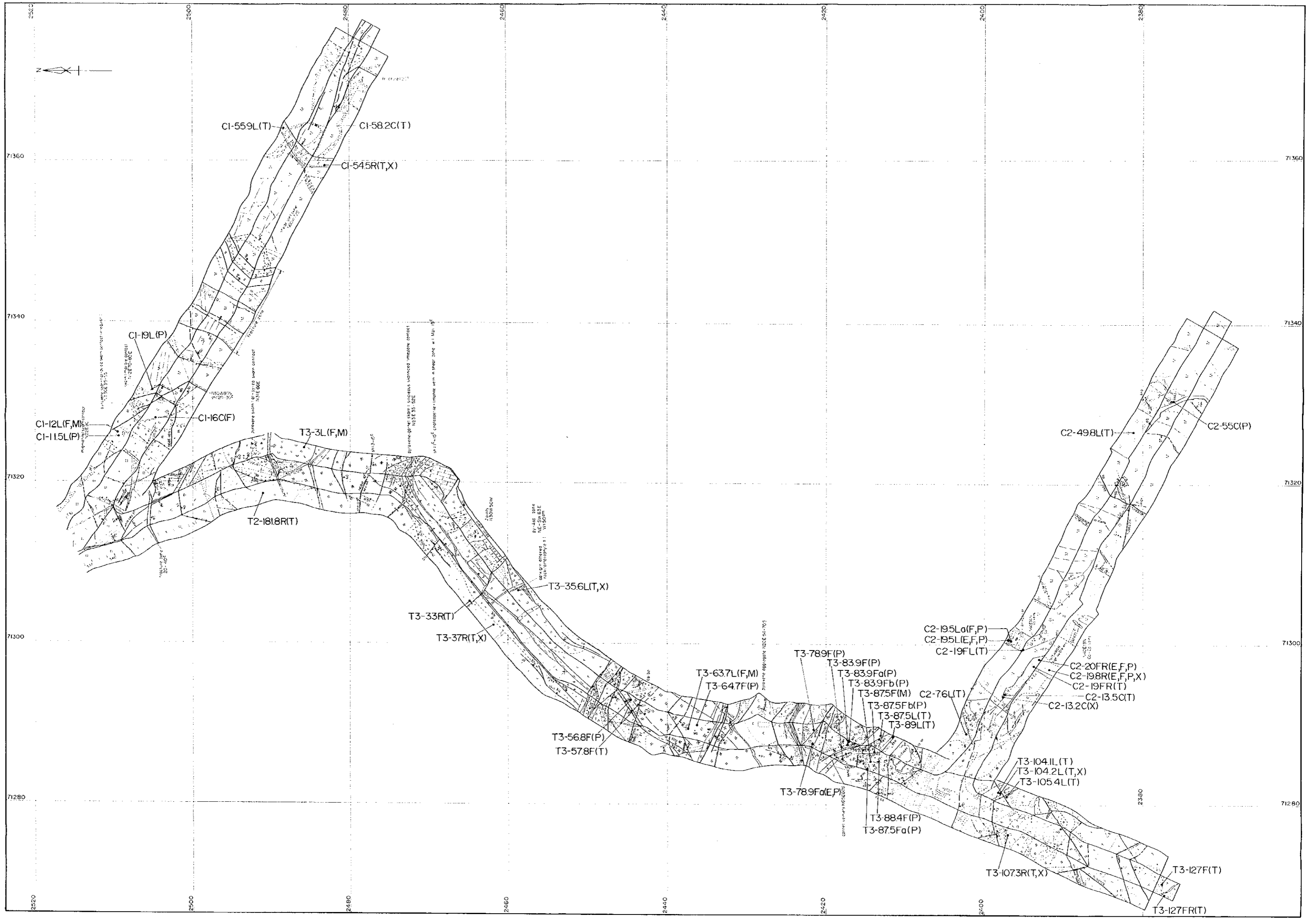


### LEGEND

<b>Host rocks</b>	<b>Others</b>
□ granitoidites	--- alteration boundary
× gabbro	--- intrusive boundary
(strong)	--- fault
--- (medium)	--- shear joint
--- (weak)	--- ginge
□ marble	--- fault breccia
	--- shear joint zone
<b>Skarns</b>	--- tunnel sample location
★ garnet skarn	<b>Veins</b>
★ pyroxene-garnet skarn (Cpx < Ga)	--- quartz vein
★ garnet-pyroxene skarn (Ga < Cpx)	--- calcite vein
★ pyroxene skarn (medium grain)	--- quartz-calcite vein
★ pyroxene skarn (very fine grain)	
★ pyroxene big crystal	<b>Abbreviations</b>
■ siliceous carbonate altered rock	Asp arsenopyrite
□ carbonate skarn	Bn bornite
□ wollastonite skarn	Cp chalcopyrite
□ Ga-Cpx-Hb-Bi band in marble	Cpx clinopyroxene
	Cu copper green
<b>Dikes</b>	Mo molybdenite
△ lamprophyre	Mt magnetite
+ + + anorthosite, Qz=monzonite	Py pyrite
+ + + + diorite porphyry	
<b>Mineralization &amp; Alteration</b>	<b>Sample location</b>
□ silicification	(T) thin section
□ (strong)	(*) polished thin section
□ (weak)	(X) x-ray diffraction
□ fine grain Py Asp band	(F) filling temperature
□ dissemination of sulphide minerals	(E) EPMA
□ limonite	(M) mineral separation test
□ carbonization	Numerical figures show the distance of the locality on each tunnel segments
	R right wall
	L left wall
	F face
	FR right corner on a face
	FL left corner on a face
	C roof







CI-559L(T) CI-58.2C(T)

CI-545R(T,X)

CI-19L(P)

CI-16C(F)

T3-3L(F,M)

CI-12L(F,M)  
CI-11.5L(P)

T2-181.8R(T)

T3-35.6L(T,X)

T3-33R(T)

T3-37R(T,X)

T3-63.7L(F,M)

T3-64.7F(P)

T3-56.8F(P)  
T3-57.8F(T)

T3-78.9F(P)

T3-83.9F(P)

T3-83.9Fa(P)

T3-87.5F(M)

T3-87.5Fb(P)

T3-87.5L(T)

T3-89L(T)

T3-78.9Fa(E,P)

T3-88.4F(P)  
T3-87.5Fa(P)

C2-19.5La(F,P)  
C2-19.5L(E,F,P)  
C2-19FL(T)

C2-20FR(E,F,P)  
C2-198R(E,F,P,X)  
C2-19FR(T)

C2-13.5C(T)  
C2-13.2C(X)

T3-104.1L(T)  
T3-104.2L(T,X)  
T3-105.4L(T)

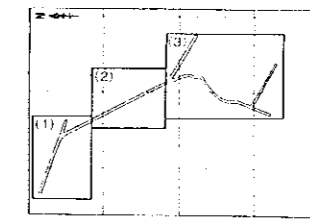
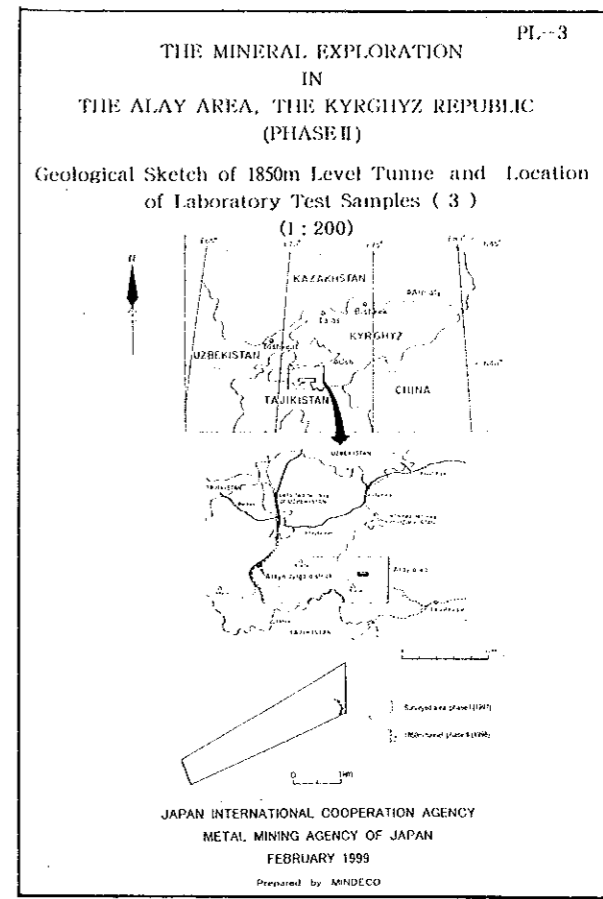
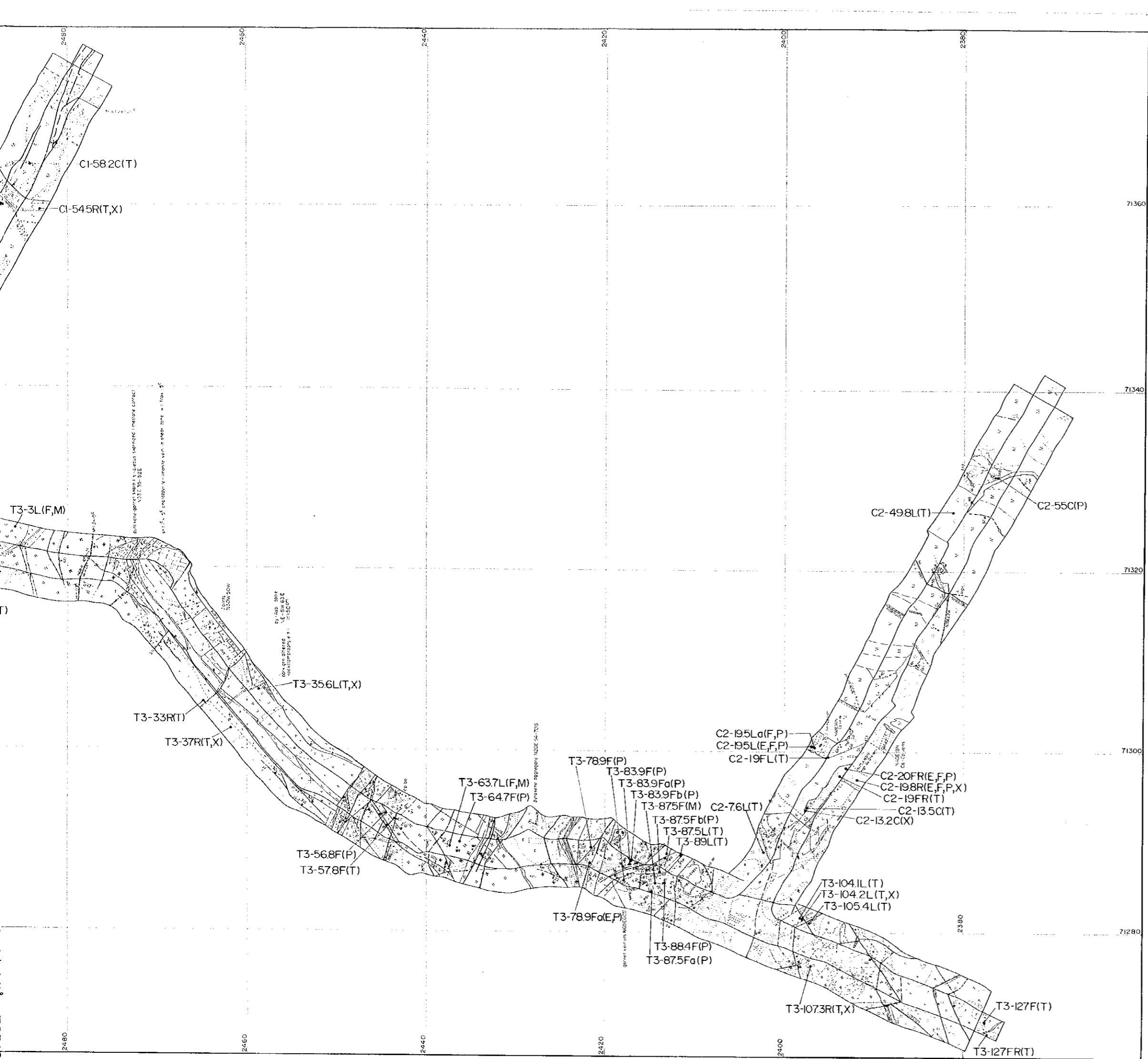
T3-107.3R(T,X)

T3-127F(T)

T3-127FR(T)

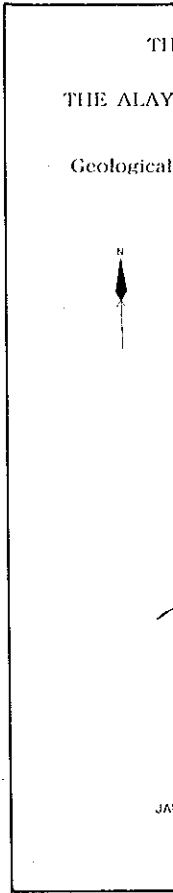
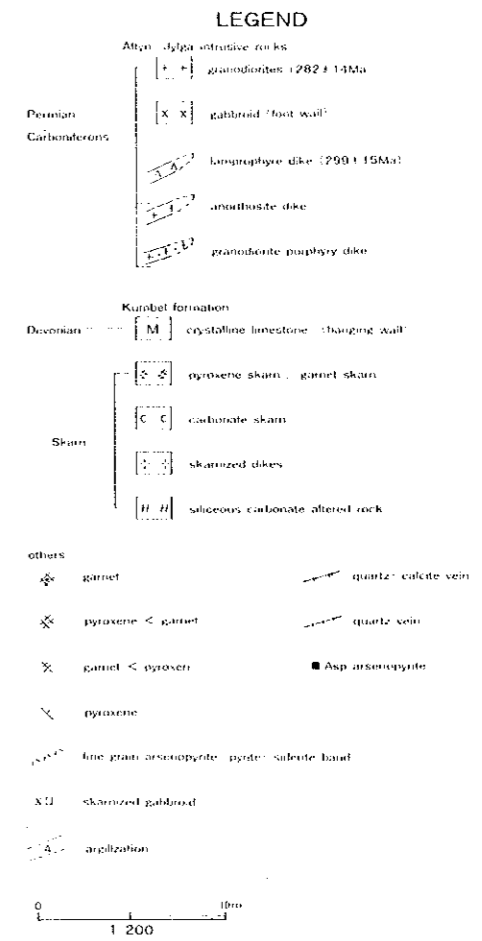
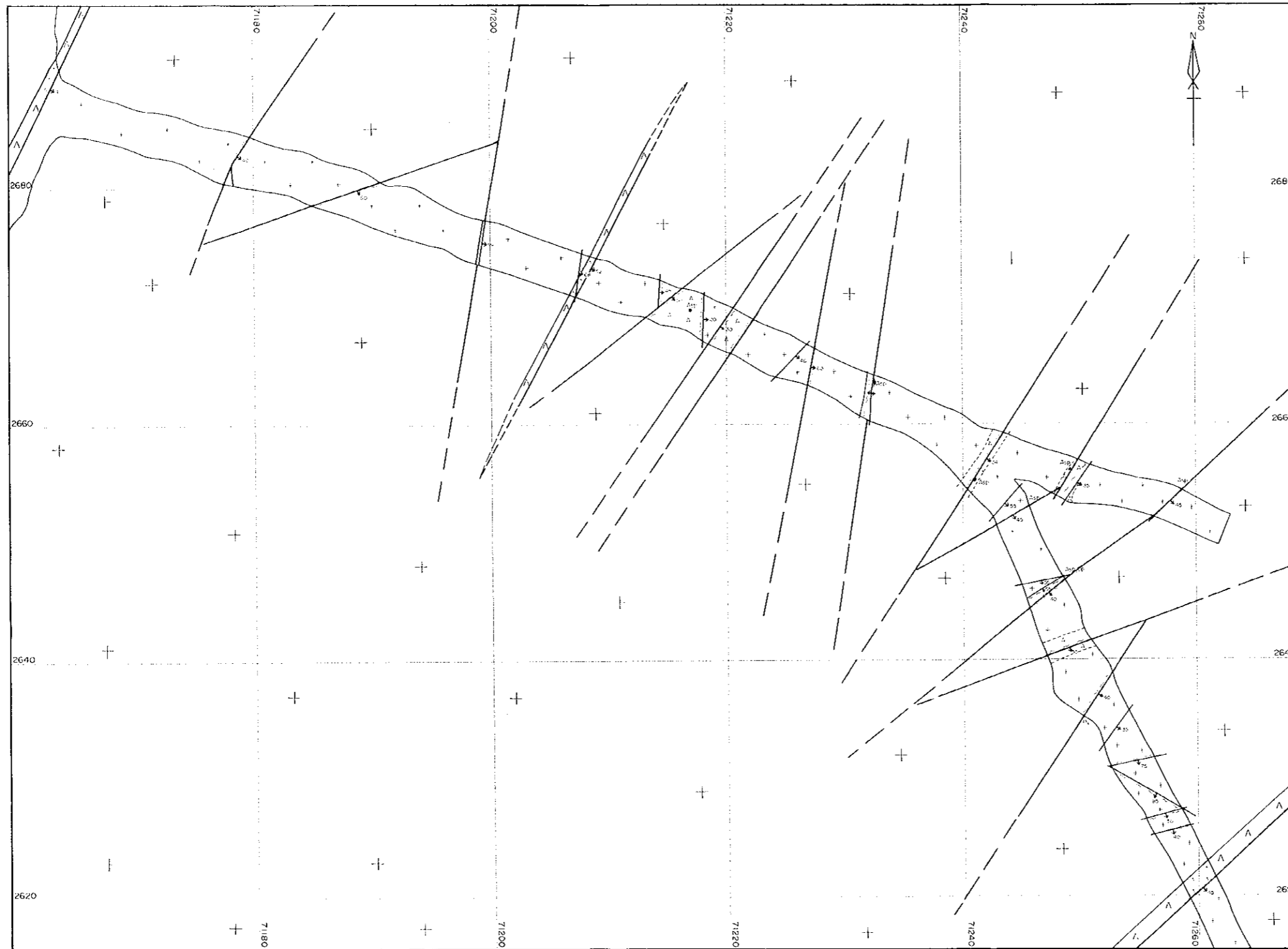
C2-498L(T)

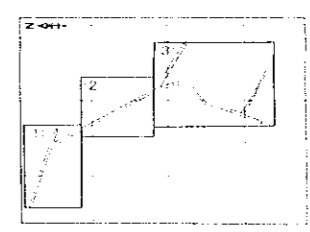
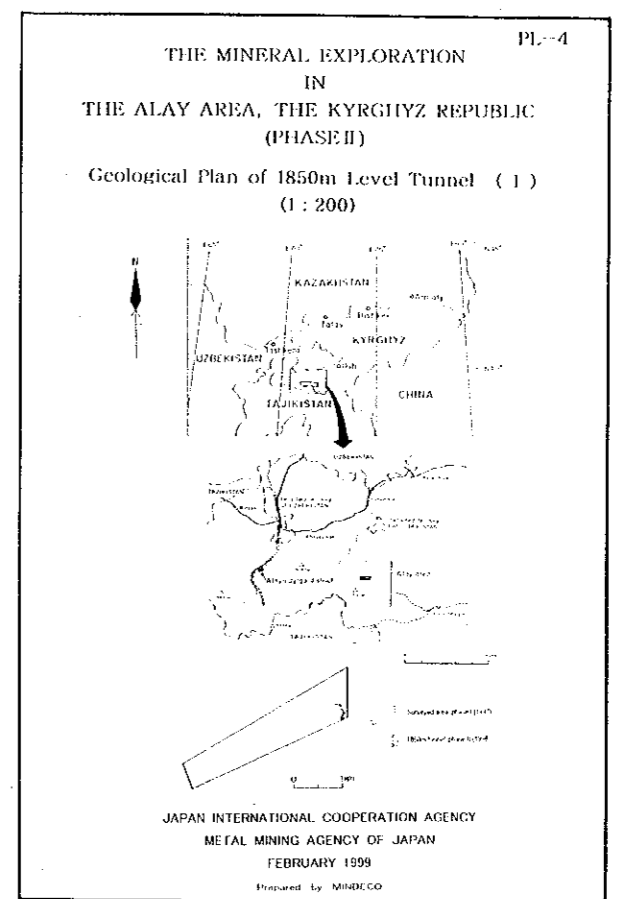
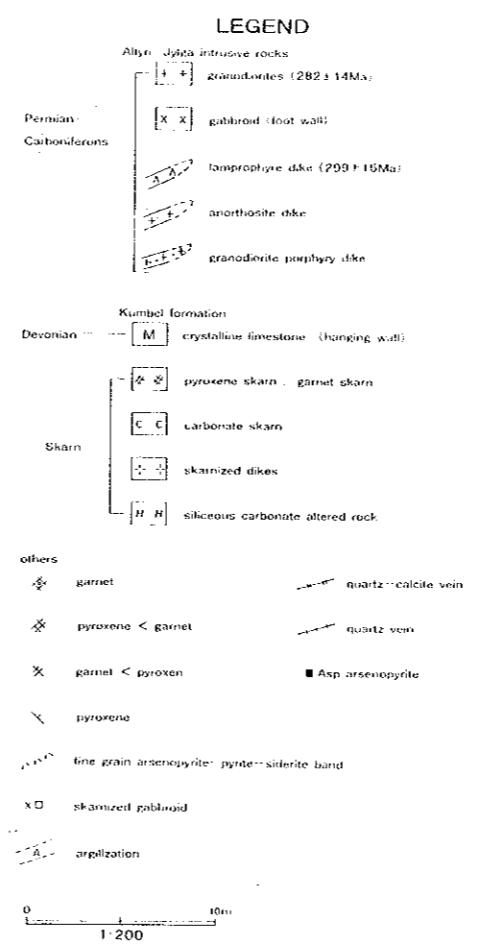
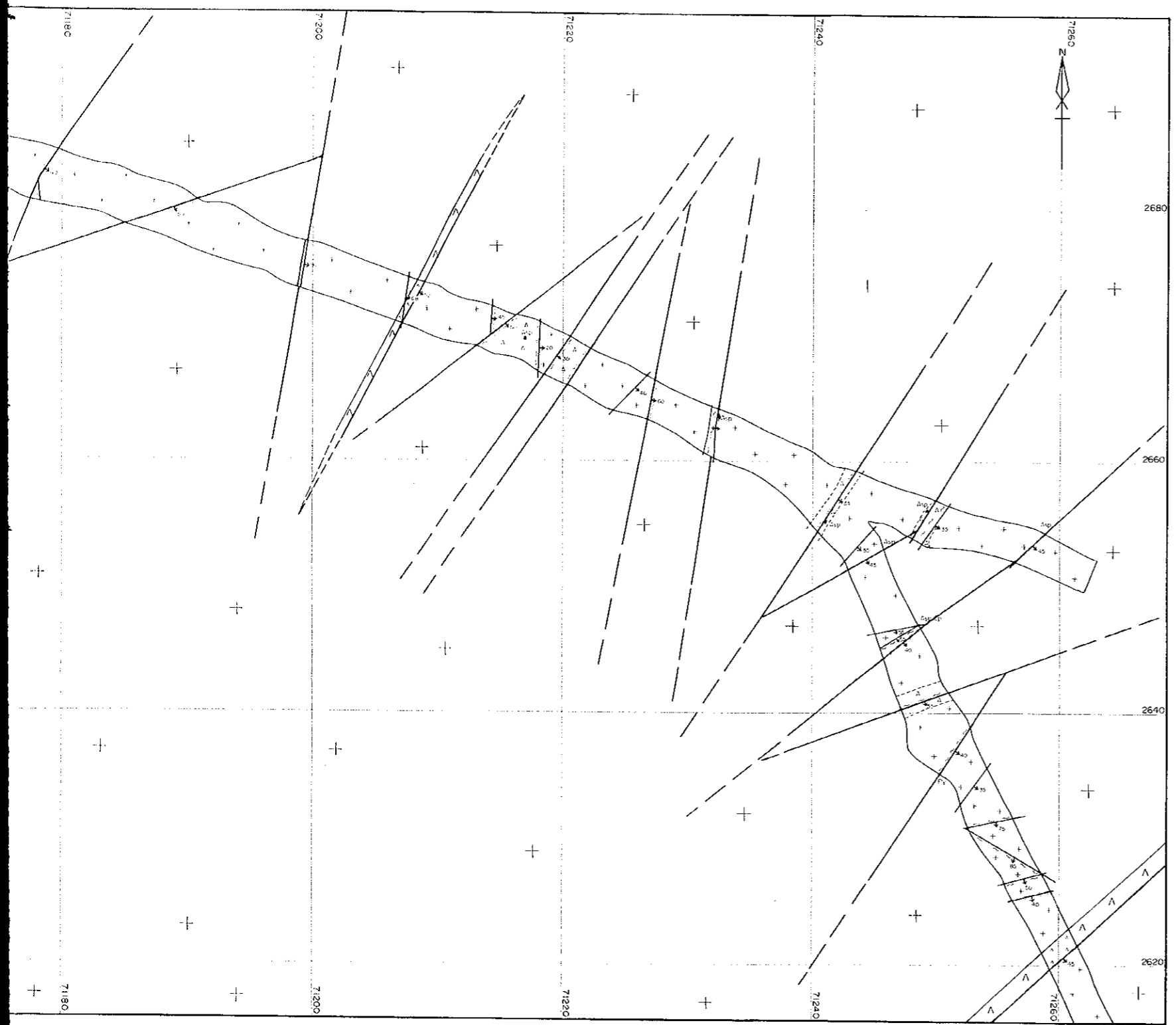
C2-55C(P)

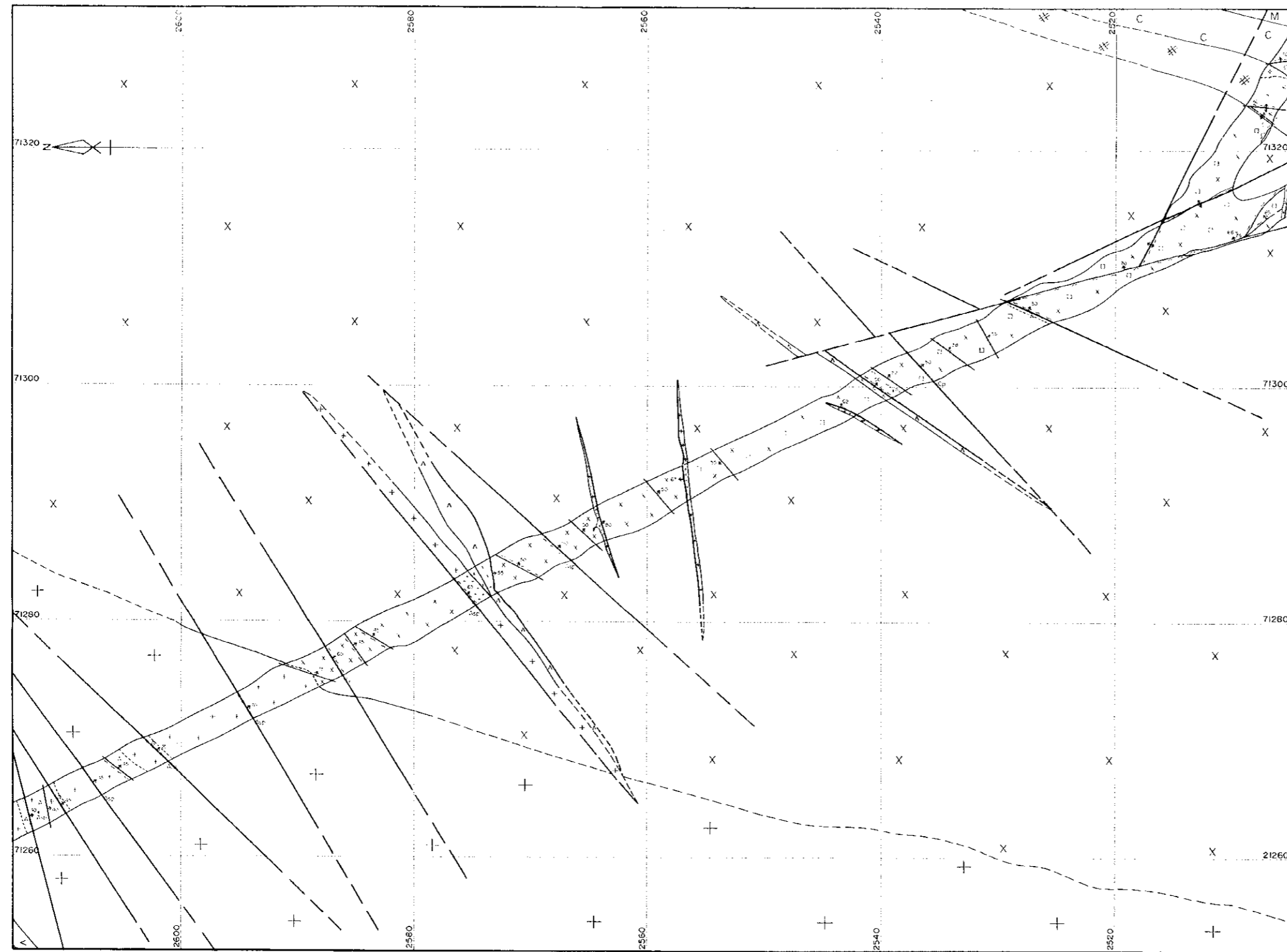


**LEGEND**

<b>Host rocks</b>		<b>Others</b>
+ + granodiorites		--- alteration boundary
x x gabbroid		--- intrusive boundary
(strong) skarnized gabbro (medium)		--- fault
(weak) skarnized gabbro (weak)		--- shear joint
M N marble		--- zone
		--- fault breccia
<b>Skarns</b>		--- shear joint zone
* garnet skarn		--- channel sample location
* pyroxene-garnet skarn (Cpx<Ga)		
* garnet-pyroxene skarn (Ga<Cpx)		<b>Veins</b>
* pyroxene skarn (medium grain)		--- quartz vein
* pyroxene skarn (very fine grain)		--- calcite vein
* pyroxene big crystal		--- quartz-calcite vein
siliceous carbonate altered rock		
C carbonate skarn		<b>Abbreviations</b>
∇ wollastonite skarn		Asp arsenopyrite
∇ Ga-Cpx-Hs-Bi band in marble		Bn bornite
		Cp chalcopyrite
<b>Dikes</b>		Cpx clinopyroxene
△△ lamprophyre		Cu copper green
+++ anorthosite - Qtz-monzodiorite		Ga garnet
+++ diolite porphyry		Mo malachite
		Mt magnetite
		Py pyrite
<b>Mineralization &amp; Alteration</b>		
q silicification		
(strong) silicification		
(weak) silicification		
△ fine grain Py-Asp band		
••••• dissemination of sulphide minerals		
††† limonite		
u carbonatization		
		<b>Sample location</b>
		• T3-165L(P)
		I1 Tunnel I
		I2 Tunnel II & Subtrack I
		I3 Tunnel III
		C1 Subtrack II & Cross cut I
		C2 Cross cut II
		R right wall
		L left wall
		F face
		FR right corner on a face
		FL left corner on a face
		C roof
		(T) thin section
		(P) polished thin section
		(X) x-ray diffraction
		(F) filling temperature
		(E) EPMA
		(M) mineral separation test
		Numerical figures show the distance of the locality on each tunnel segments







### LEGEND

Altogether intrusive rocks:

- granodiorites (282 ± 14Ma)
- gabbroid (float wall)
- Impure dike (299 ± 15Ma)
- amphibole dike
- granodiorite porphyry dike

Permian-Carboniferous

Kumbei formation

Devonian

Skarn

- pyroxene skarn, garnet skarn
- carbonate skarn
- skarnized dikes
- siliceous carbonate altered rock

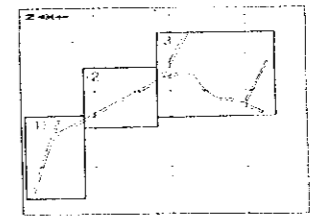
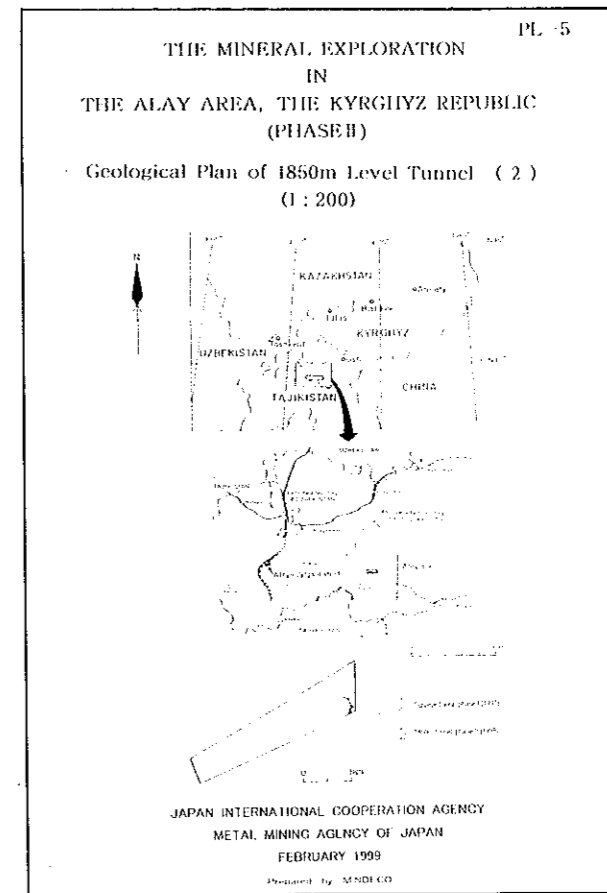
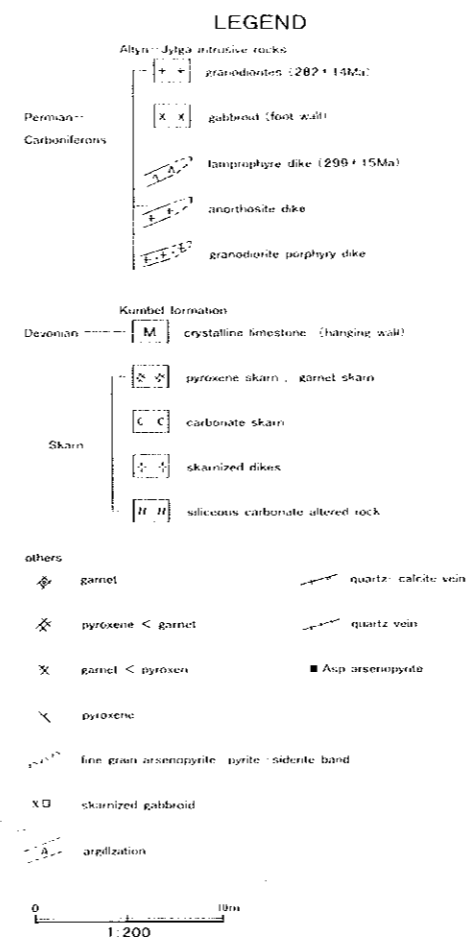
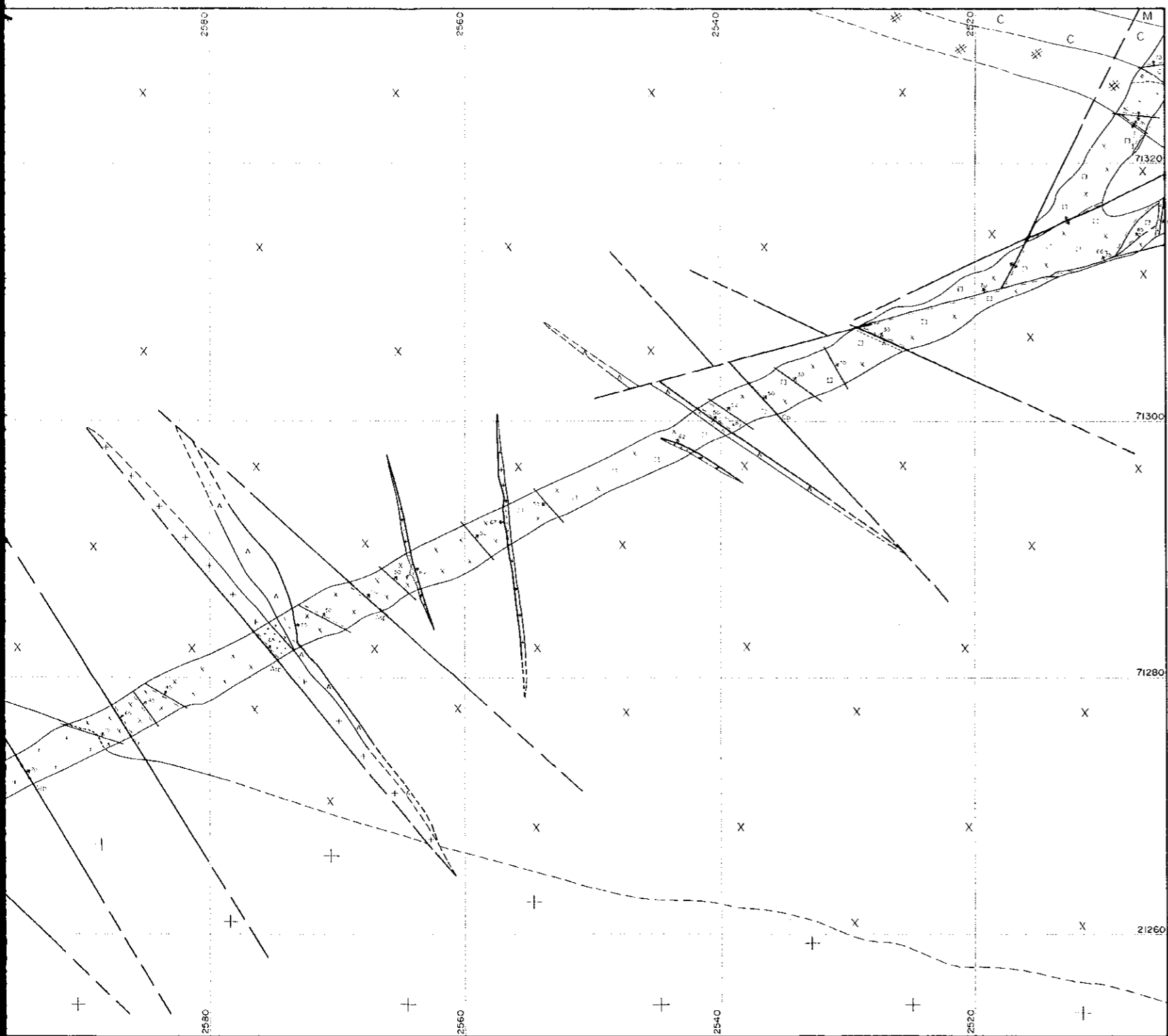
others

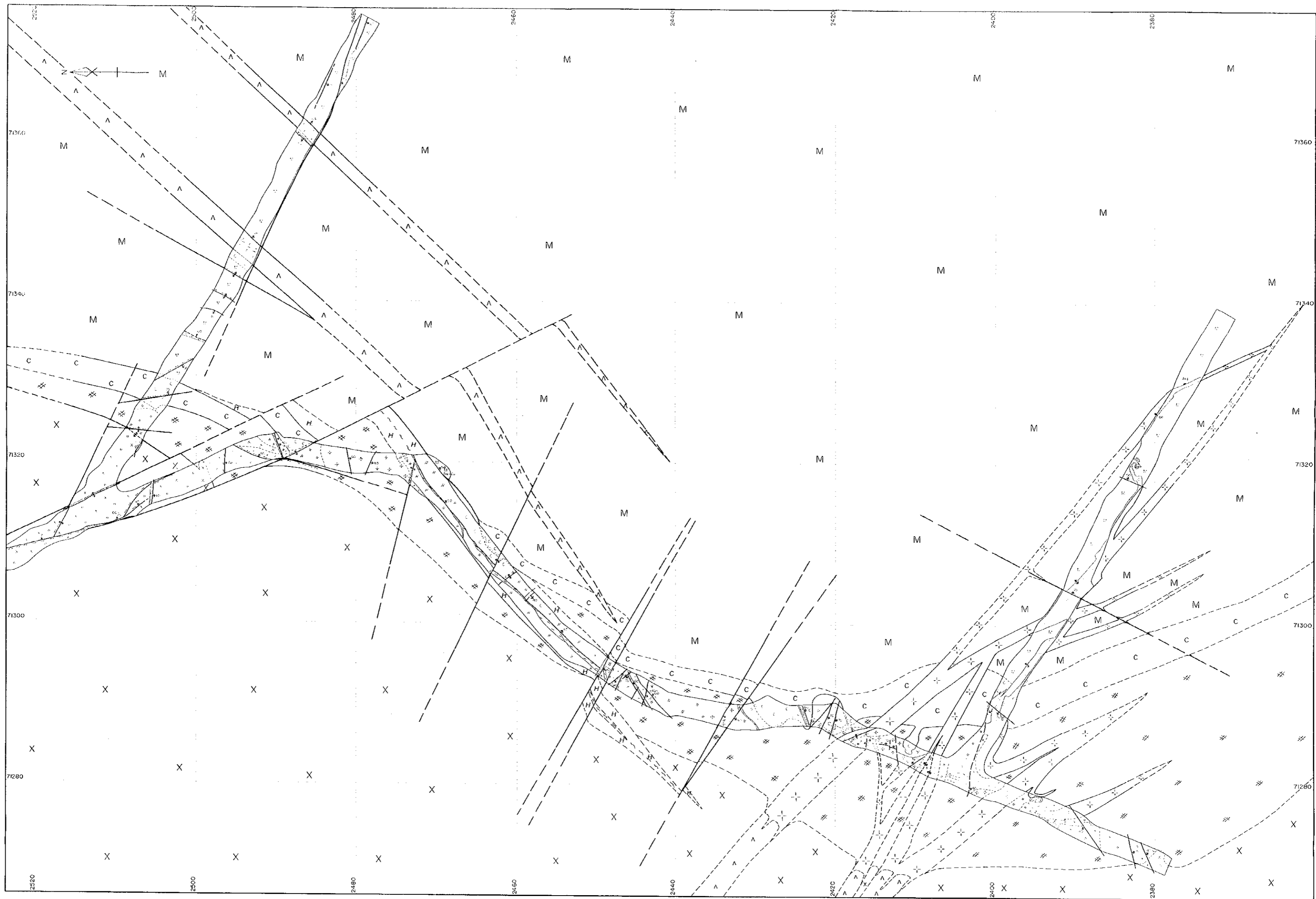
- garnet
- pyroxene < garnet
- garnet < pyroxene
- pyroxene
- fine grain arsenopyrite, pyrite, siderite lund
- skarnized gabbroid
- unzoned
- quartz-calcite vein
- quartz vein
- Asp arsenopyrite

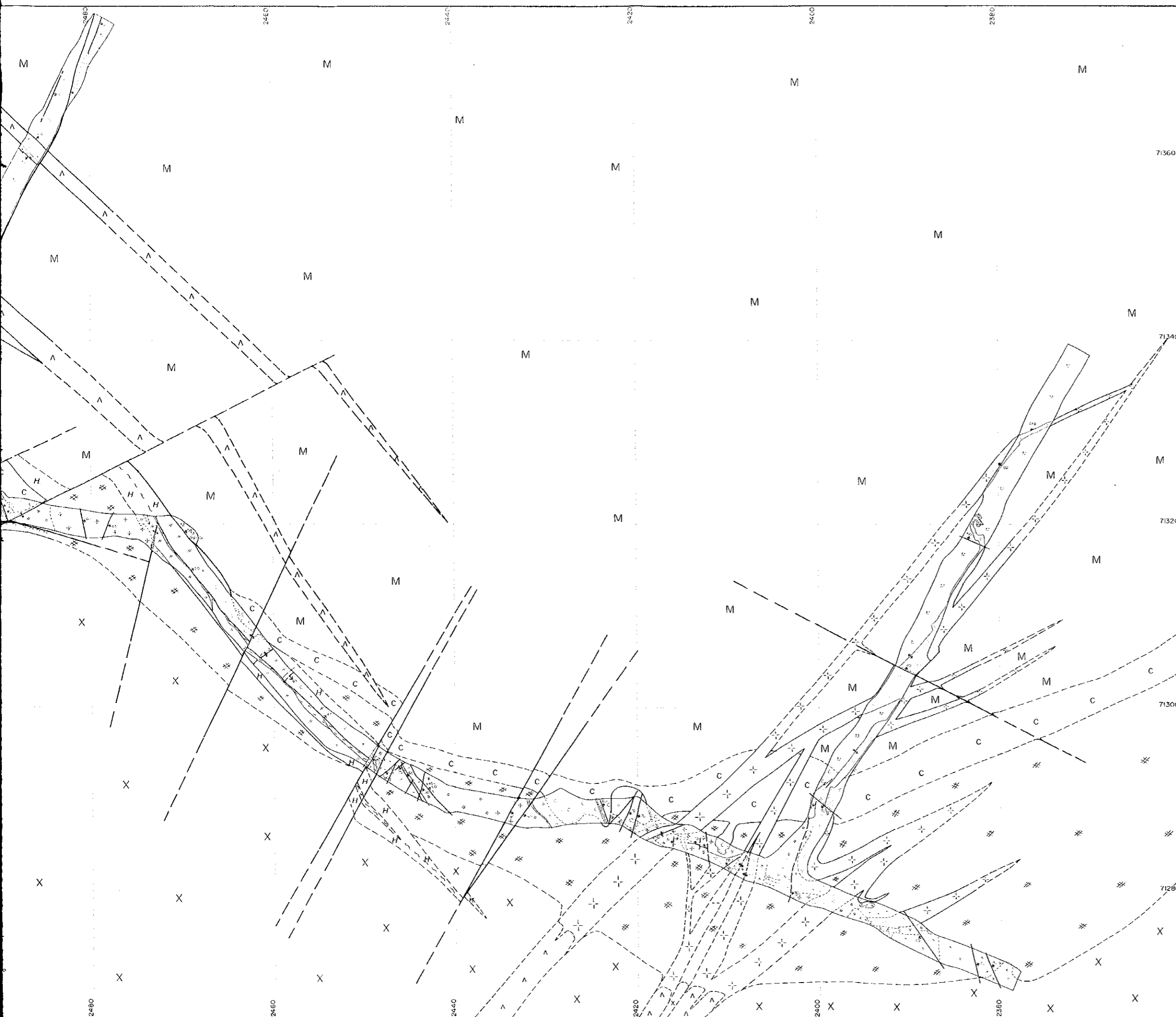
0 1000 2000  
1:200

THE  
THE ALAY A  
Geological P

JAPAN







PL. - 6

THE MINERAL EXPLORATION  
IN  
THE ALAY AREA, THE KYRGHYZ REPUBLIC  
(PHASE II)  
Geological Plan of 1850m Level Tunnel ( 3 )  
( 1 : 200 )

JAPAN INTERNATIONAL COOPERATION AGENCY  
METAL MINING AGENCY OF JAPAN  
FEBRUARY 1999  
Prepared by IMBECO

**LEGEND**

Alay-Jyja intrusive rocks

- granodiorite (282 ± 14Ma)
- gabbro (foot wall)

Permian

Carboniferous

- tanzanite dike (299 ± 15Ma)
- anorthosite dike
- granodiorite porphyry dike

Kumbel formations

Devonian

- crystalline limestone (hanging wall)

Skarn

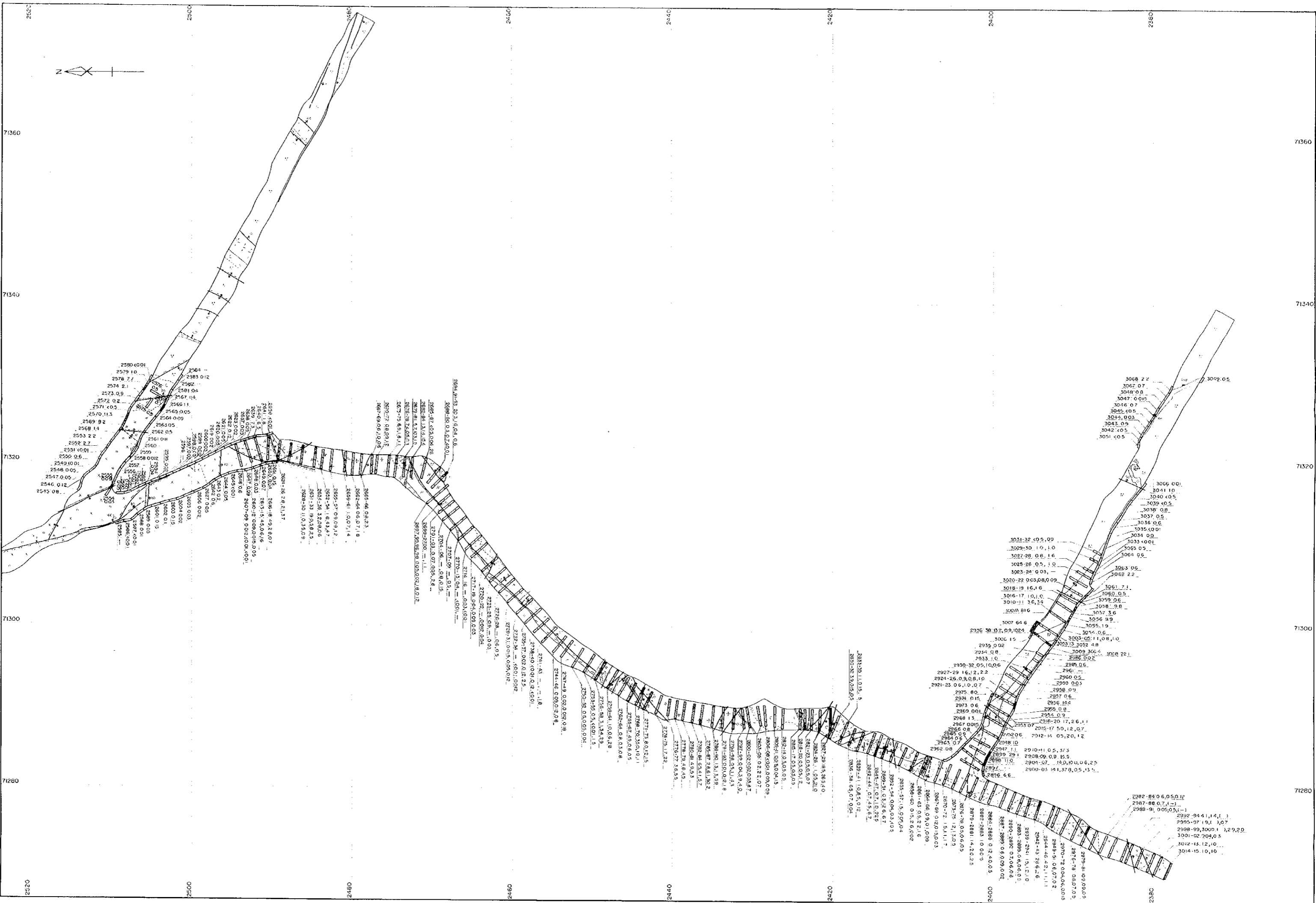
- pyroxene skarn - garnet skarn
- carbonate skarn
- skarnized dikes
- siliceous carbonate altered rock

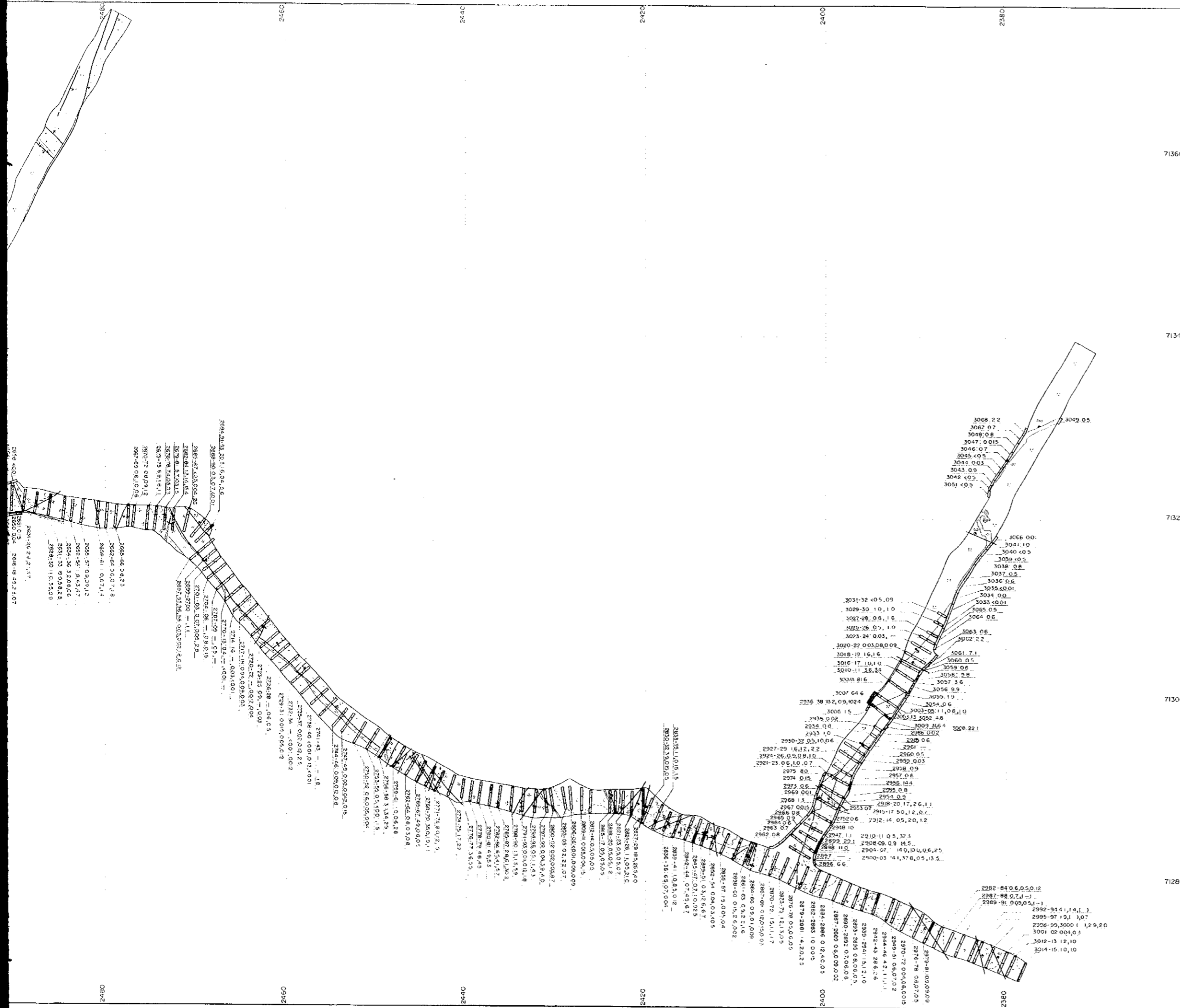
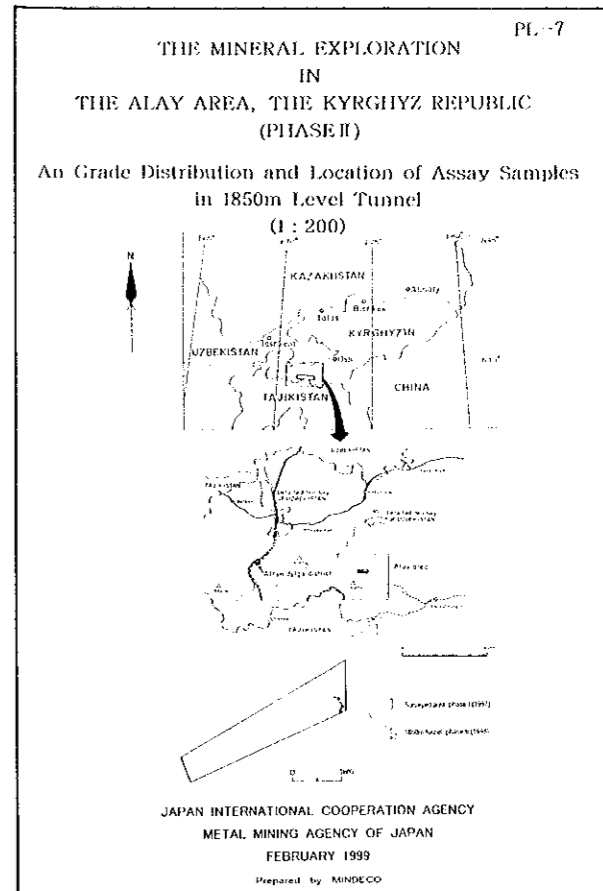
others

- garnet
- pyroxene < garnet
- garnet < pyroxene
- pyroxene
- fine grain arsenopyrite - pyrite - siderite band
- skarnized gabbro
- argillization
- quartz-calcite vein
- quartz vein
- Aspidosephite

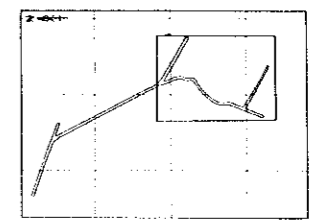
0 1 200 1000







71360  
71340  
71320  
71300  
71280



#### LEGEND

- Sample Location: 350 27 105 50 38
- Au grade (g/t): sample number
- Charred sample location: 350 27 105 50 38
- Au grade classification:
- 10g t ≤ Au
  - 3g t ≤ Au < 10g t
  - 1g t ≤ Au < 3g t
  - Au < 1g t
- Geological symbols:
- Skarn
    - garnet
    - pyroxene < garnet
    - garnet < pyroxene
    - pyroxene
    - carbonate
    - siliceous carbonate altered rock
    - skarnized dikes
    - garnet concentration
  - Others
    - fault
    - shear zone with gouge
    - fault breccia
    - quartz-calcite vein
    - quartz vein
    - fine grained arsenopyrite-pyrite and sulfide band
    - skarnized gabbroid

1400  
1200

2800

2600

Mine mouth  
X=2687.72  
Y=1160.14

Side track I

20m

20/Aug

Tunnel I

88m

Tunnel II

185m

Side track II

20m

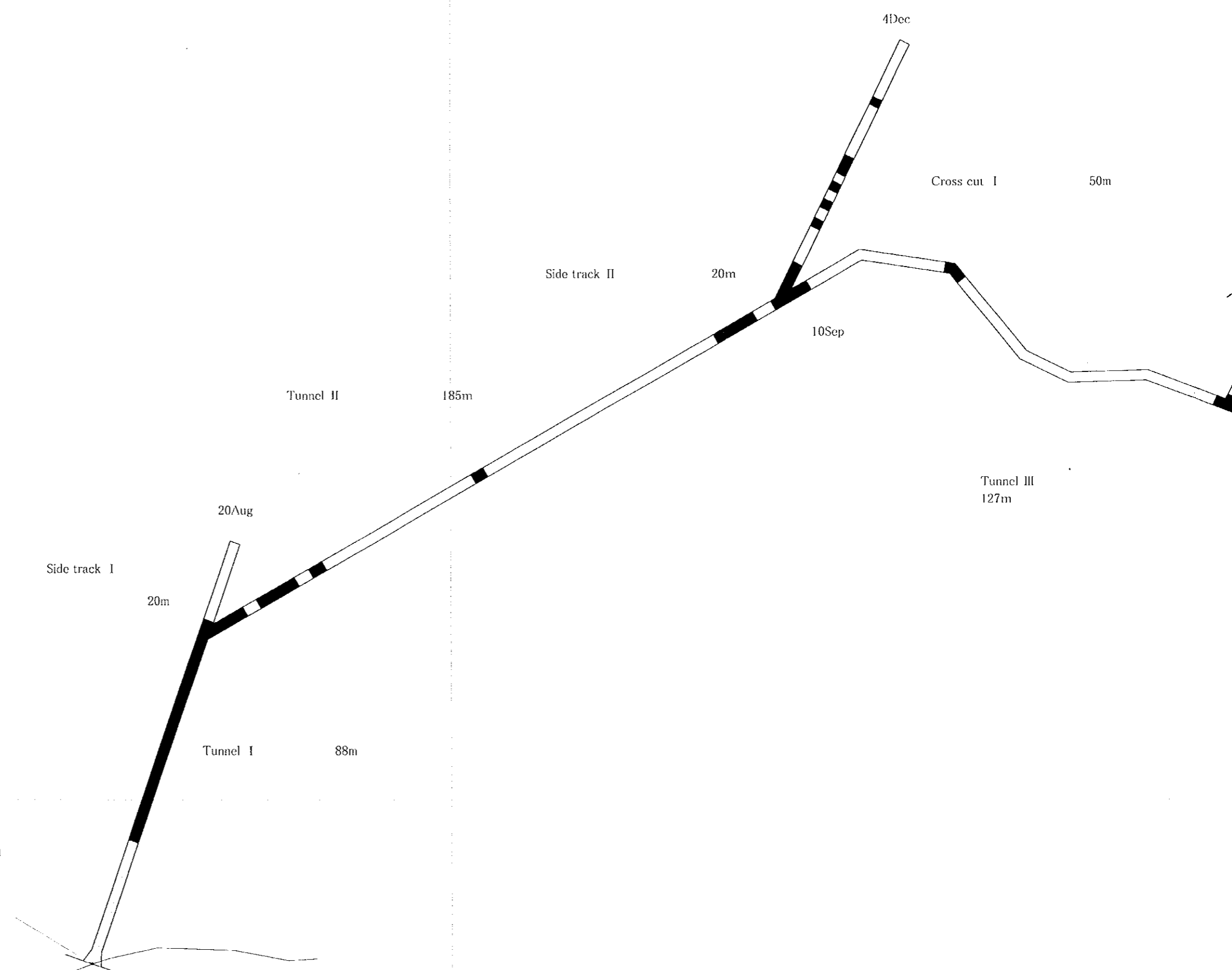
10/Sep

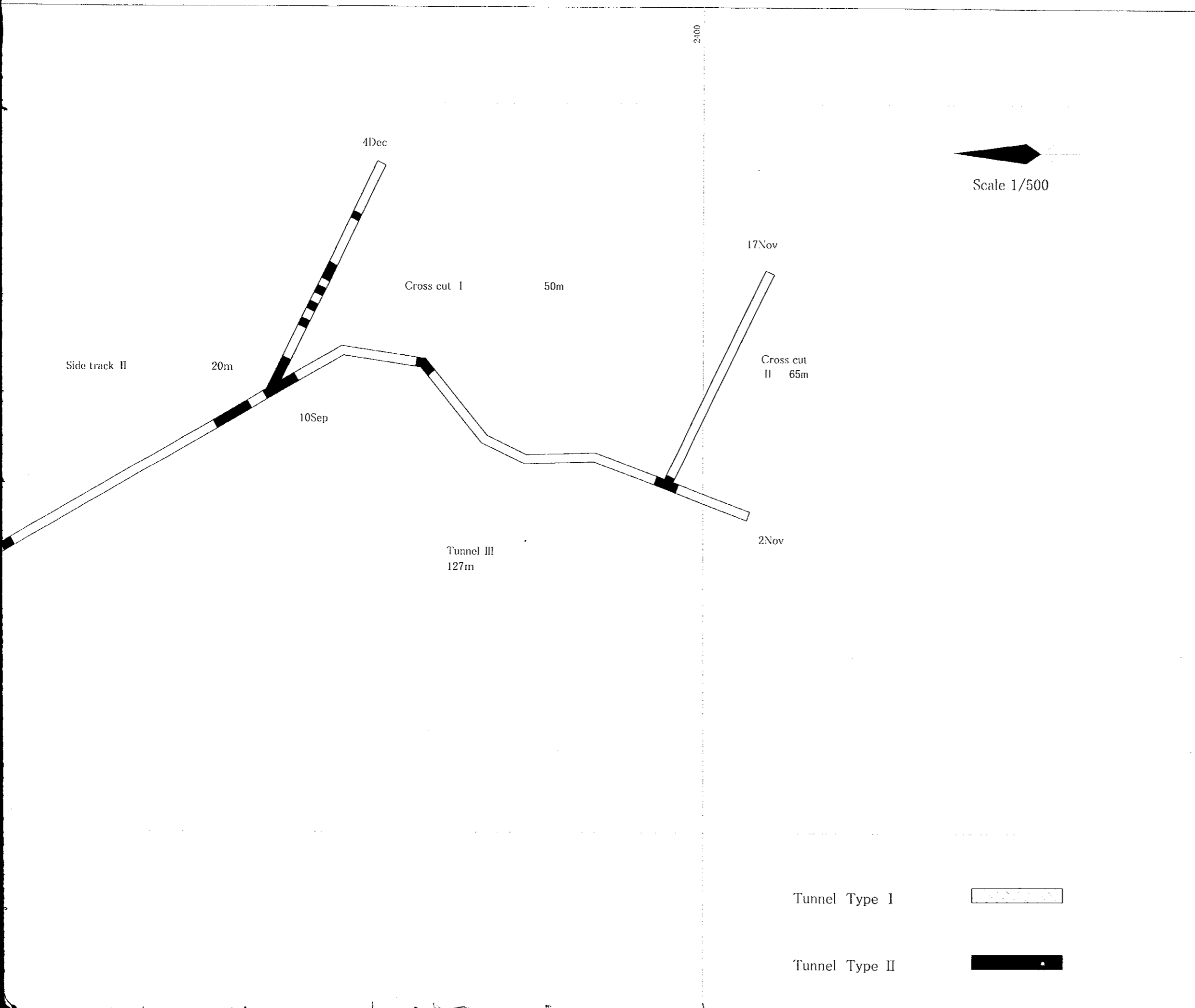
Cross cut I

50m

Tunnel III  
127m

4/Dec





PL-8

THE MINERAL EXPLORATION  
IN  
THE ALAY AREA, THE KYRGHYZ REPUBLIC  
(PHASE II)

Tunnel Types and its Completion Date  
(1:500)

JAPAN INTERNATIONAL COOPERATION AGENCY  
METAL MINING AGENCY OF JAPAN  
FEBRUARY 1999  
Prepared by MIHDECO

