

Appendix 7 Result of X-ray Diffraction Analysis

No.	Sample No.	Rock name	Quartz	Ankerite	Kaolinite	Sericite	Chlorite	Smectite	Plagioclase	K-feldspar	Amphibole	Clinopyroxene	Epidote	Calcite	Grossularite	Dolomite	Wollastonite	Andradite	Sepiolite	Rhodochrosite	Chalcopyrite	Remarks	
1	T1-57R	Altered granodiorite porphyry	⊙	○	○	○	○	○	○														
2	T3-35.6L	Brecciated limestone	⊙	⊙	○	○	△						⊙										
3	T3-37R	Gpx skarn			△	△	○	○	○		○	○	△										Cpx: Augite
4	T3-104.2L	Ga-Hb-Gpx skarn (gabbro?)			○	○	○	○	○		△	○	△										Cpx: Augite
5	T3-107.3R	Gpx-Ga skarn							△				△										
6	C1-54.5R	Skarnized lamprophyre	△		○	○	○	○	⊙	○	△	○	△	△									Cpx: Augite
7	C2-13.2C	Wollastonite skarn										△											Cpx: Hedenbergite ?
8	C2-19.8R	Sheared drusy Cp ore in skarn	⊙								⊙			△					△	△	△	⊙	

⊙ : abundant, ○ : common, △ : poor, ○ : rare

Cp: Chalcopyrite
 Cpx: Clinopyroxene
 Ga: Garnet
 Hb: Hornblende

Appendix 8 Result of Homogenization Temperature Measurement of Fluid Inclusions

No.	Sample No.	Rock name	Mineral	Range of temperature (°C)			Number of Inclusions	Homogenization temperature (°C)																					
				Min.	Max.	Ave.																							
1	T1-106L	Qz vein	quartz	111	160	135	10	135	135	124	121	137	151	111	133	160	146												
2	T2-32.5F	Cal-Qz-Asp vein	calcite	94	139	115	13	115	114	121	108	105	128	107	122	139	124	123	94	101									
3	T2-131.8L	Cal-Py vein	calcite	87	132	111	11	98	112	113	117	125	101	127	87	132	114	94											
4	T3-3L(1)	Py-Qz-Cal skarn	calcite	97	115	108	5	109	113	115	97	106																	
5	T3-3L(2)	Py-Qz-Cal skarn	calcite	86	168	119	16	168	140	122	112	117	120	121	123	122	118	135	115	86	112	96	101						
6	T3-63.7L(1)	Mt-Cpx skarn	quartz	118	296	165	14	296	148	213	225	125	145	118	133	149	136	134	154										
7	T3-63.7L(2)	Mt-Cpx skarn	calcite	107	270	149	14	121	123	270	112	247	123	107	113	114	175	181	128	132	138								
8	C1-12L(1)	fine-grained Ga-Cpx skarn	quartz	187	275	239	13	265	254	201	224	269	234	198	194	274	187	275	268	261									
9	C1-12L(2)	fine-grained Ga-Cpx skarn	calcite	94	374	149	13	102	94	151	144	374	113	139	106	122	198	98	146	152									
10	C1-12L(2)	fine-grained Ga-Cpx skarn	quartz	128	175	146	8	171	175	136	164	128	133	128	131														
11	C1-16C(1)	Py-Cal skarn	calcite	87	246	121	11	98	108	87	134	101	110	125	114	101	246	105											
12	C1-16C(2)	Py-Cal skarn	calcite	88	138	115	12	91	101	119	114	126	121	138	128	130	110	115	88										
13	C2-19.5L	Cp ore in Ga skarn	calcite	94	173	125	12	97	94	101	106	158	165	108	107	110	104	173	172										
14	C2-19.5La	Cp ore in Ga-Cpx skarn	calcite	113	276	189	23	276	154	205	165	167	265	128	252	167	142	141	269	131	119	148	113						
15	C2-19.8R	Cp ore in Ga-Cpx skarn	calcite	84	135	111	12	133	102	97	117	104	118	121	135	84	128	91	101										
16	C2-20FR	Cp ore in Ga-Cpx skarn	calcite	92	242	148	25	125	126	134	132	117	101	150	125	92	130	111	238	242	120	158	184						
								164	165	166	112	201	187	139	139	152													

Asp: Arsenopyrite

Cal: Calcite

Cpx: Clinopyroxene

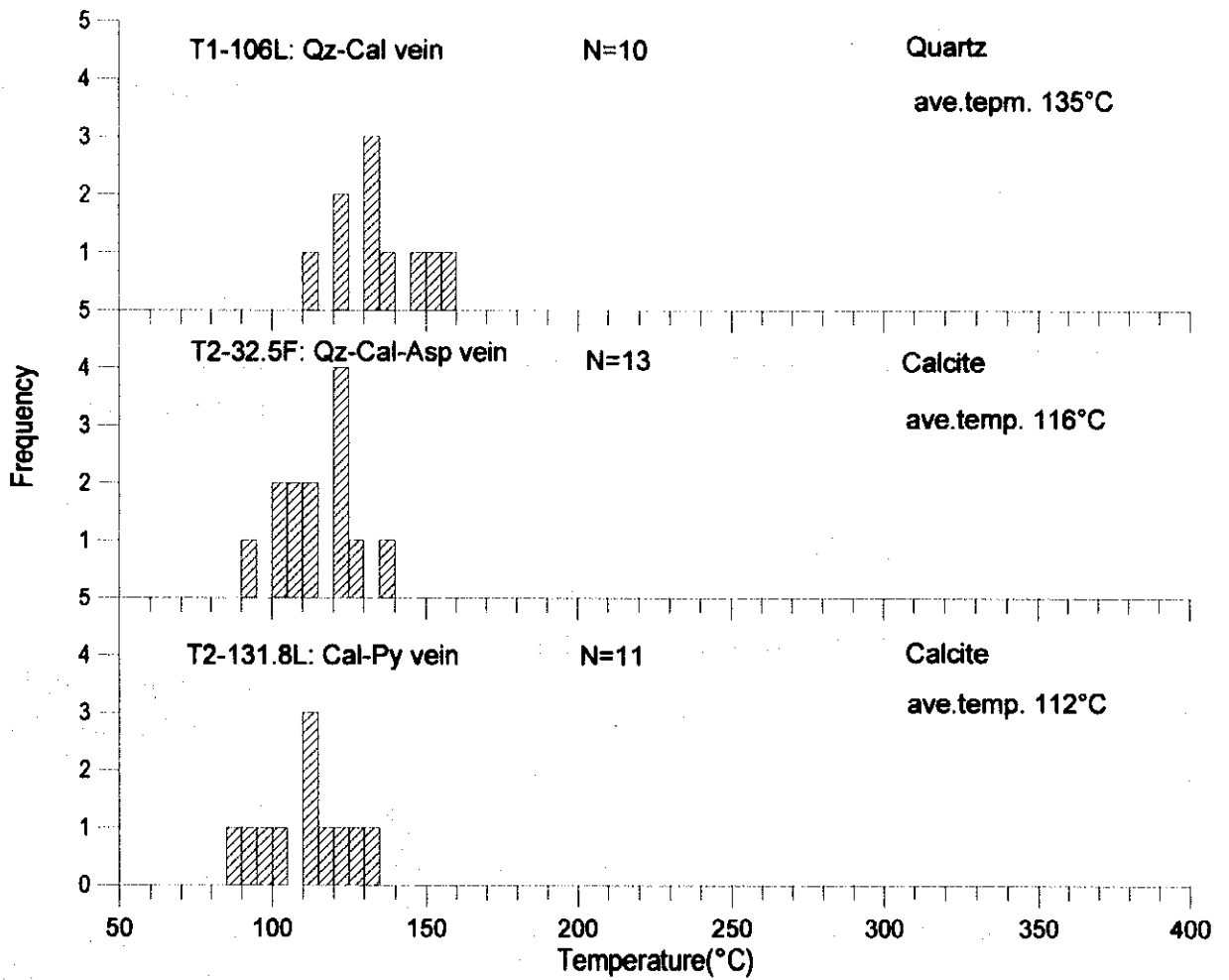
Ga: Garnet

Mt: Magnetite

Py: Pyrite

Qz: Quartz




Qz-Cal-Asp vein in the Altyn-Jylga intrusive body(Au-As ore)

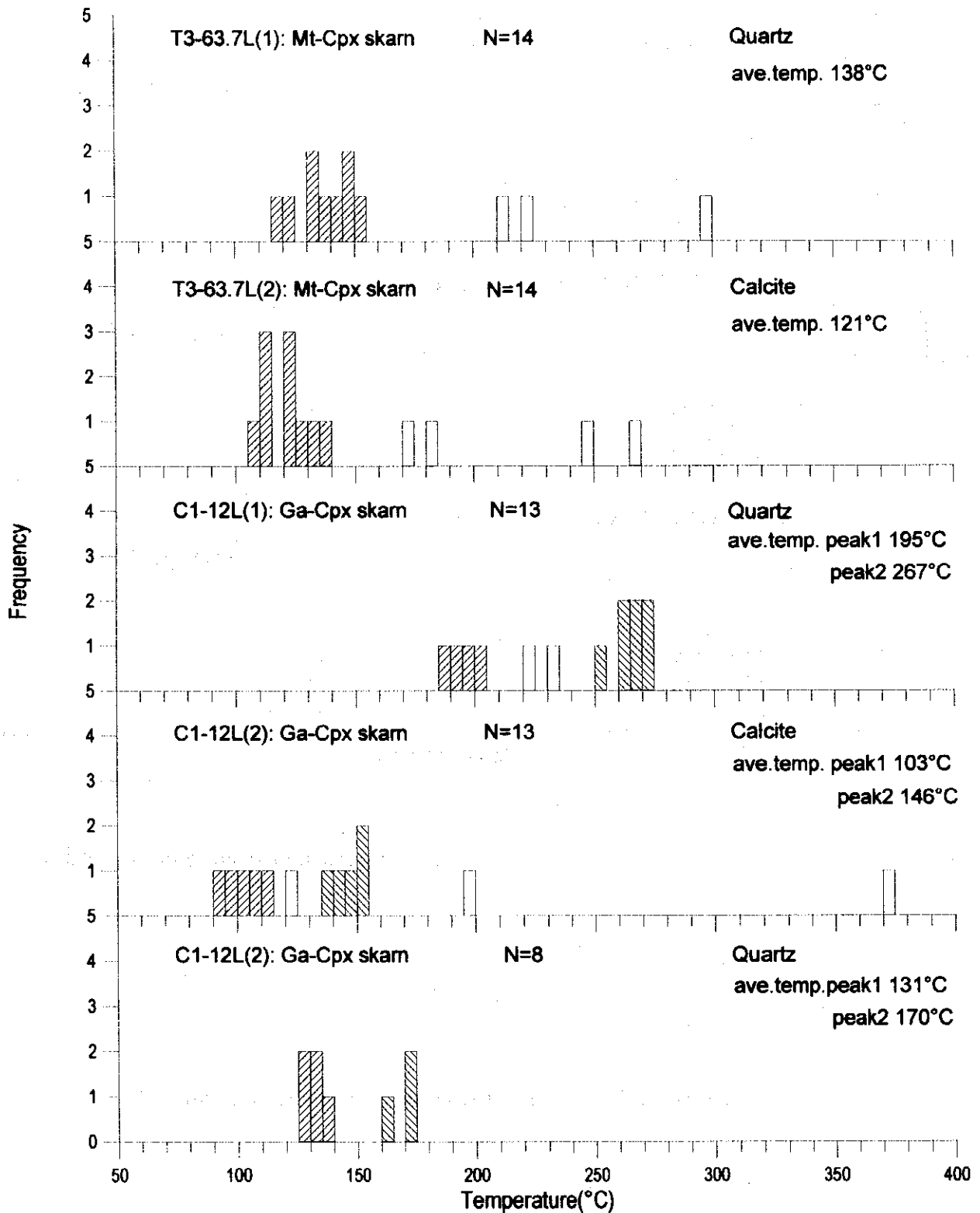


▨ : used data for average temp. calculation

Appendix 9 Histogram of Homogenization Temperature (1)

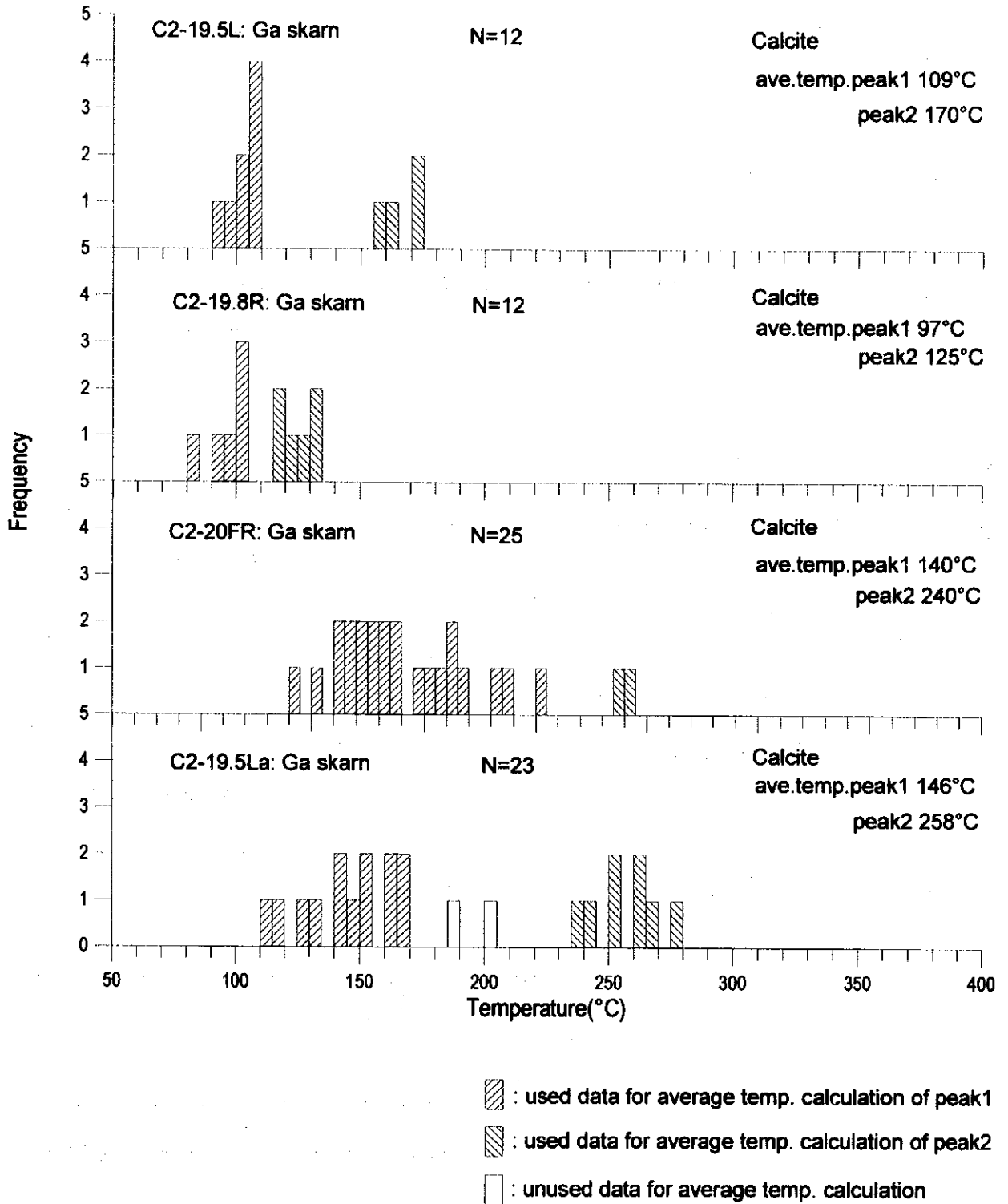
Ga and Cpx skarn (Au-Cu ore)

-  : used data for average temp. calculation of peak 1
-  : used data for average temp. calculation of peak 2
-  : unused data for average temp. calculation



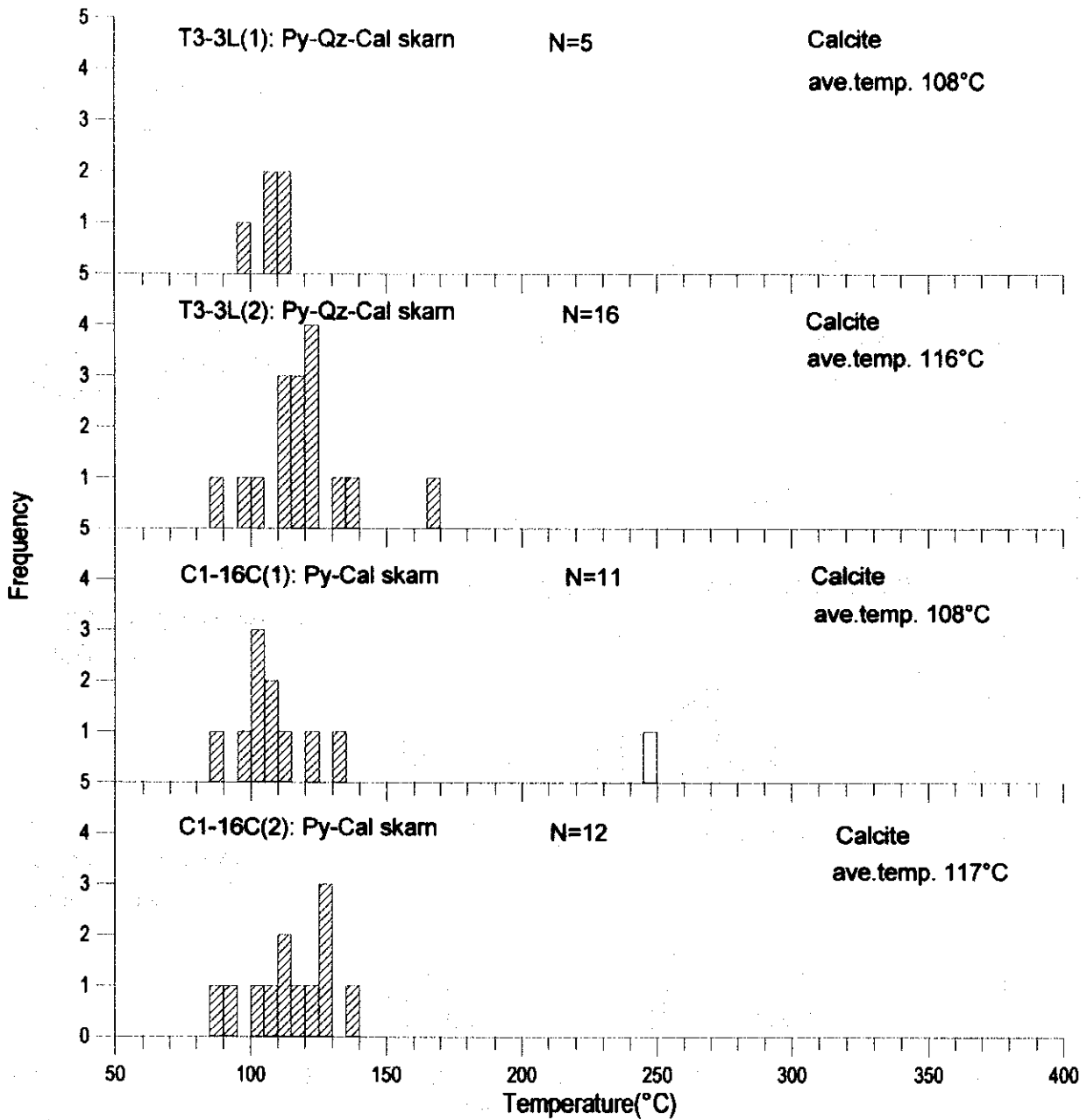
Appendix 9 Histogram of Homogenization Temperature (2)

Ga skarn (Au-Cu ore, high grade)



Appendix 9 Histogram of Homogenization Temperature (3)

Carbonate skarn(Au-Fe ore)



▨ : used data for average temp. calculation
 □ : unused data for average temp. calculation

Appendix 9 Histogram of Homogenization Temperature (4)

Appendix 10 Result of EPMA Analysis

Electrum

Sample no.	Grain	Au (wt. %)	Ag (wt. %)	total (wt. %)	Au (at. %)	Ag (at. %)
C2-19. 5L	1	66. 52	33. 38	99. 90	52. 18	47. 82
	2	71. 99	27. 03	99. 02	59. 32	40. 68
	3	68. 52	31. 82	100. 3	54. 11	45. 89
	4	67. 85	32. 24	100. 1	53. 55	46. 45
C2-19. 8R	1	67. 53	32. 18	99. 71	53. 48	46. 52
	2	67. 13	31. 85	99. 98	53. 58	46. 42
	3	69. 67	31. 50	101. 2	54. 78	45. 22
	4	67. 77	32. 23	100. 00	53. 52	46. 48
	5	68. 32	33. 01	101. 3	53. 13	46. 87
	6	66. 47	32. 89	99. 36	52. 54	47. 46
	7	68. 45	31. 67	100. 1	54. 20	45. 80
C2-20FR	1	67. 57	32. 48	100. 1	52. 51	47. 49
	2	67. 32	33. 26	100. 6	52. 58	47. 42
	3	68. 56	31. 96	100. 5	54. 02	45. 98
	4	68. 9	31. 91	100. 8	54. 18	45. 82
	5	68. 87	32. 05	100. 9	54. 07	45. 93
	6	66. 24	32. 32	98. 56	52. 89	47. 11

Minerals unidentified under microscope

<Stannoidite>

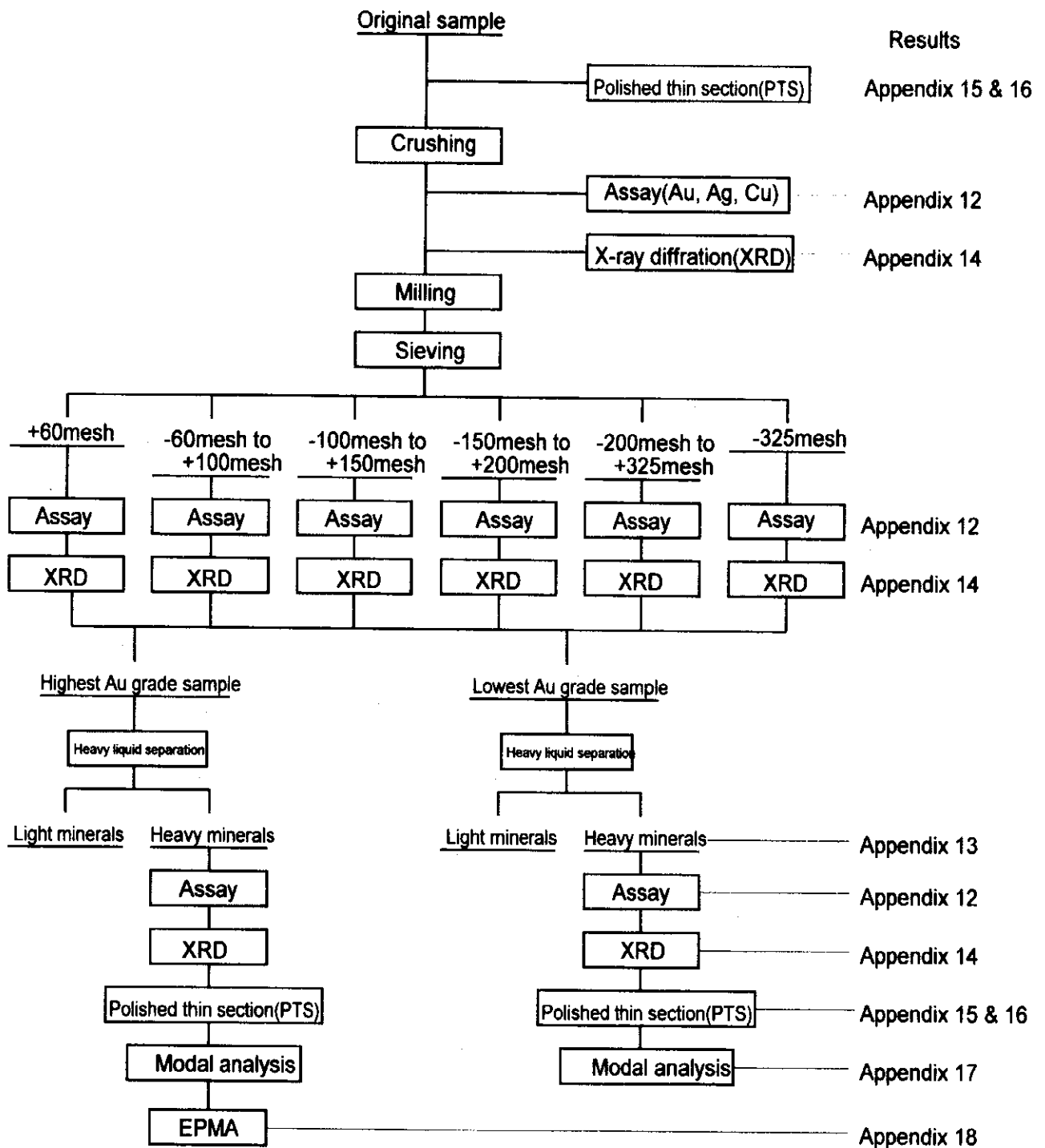
Sample no.	Grain	Cu (wt%)	Sn (wt%)	Fe (wt%)	Zn (wt%)	S (wt%)	total (wt%)	Cu (at. %)	Sn (at. %)	Fe (at. %)	Zn (at. %)	S (at. %)
C2-19. 8R	1	39. 41	18. 09	10. 61	2. 77	29. 63	100. 51	32. 17	7. 90	9. 85	2. 14	47. 94
	2	39. 34	18. 23	10. 76	2. 76	29. 64	100. 73	32. 04	7. 95	9. 97	2. 18	47. 86
	3	39. 57	17. 55	10. 65	2. 79	29. 62	100. 18	32. 30	7. 67	9. 90	2. 21	47. 92

<Tetrahedrtie series mineral>

Sample no.	Grain	Cu (wt%)	Sb (wt%)	Fe (wt%)	Zn (wt%)	S (wt%)	total (wt%)	Cu (at. %)	Sb (at. %)	Fe (at. %)	Zn (at. %)	S (at. %)
T3-78. 8Fa	1	38. 64	27. 61	2. 01	5. 34	25. 26	98. 86	34. 94	13. 03	2. 06	4. 69	45. 28
	2	38. 77	27. 47	2. 20	5. 36	25. 49	99. 29	34. 82	12. 88	2. 24	4. 68	45. 38
	3	38. 58	27. 32	2. 44	5. 22	25. 48	99. 04	34. 70	12. 82	2. 50	4. 56	45. 42
	4	38. 56	27. 01	2. 67	5. 10	25. 44	98. 78	34. 71	12. 69	2. 73	4. 46	45. 40

<Bi-Te mineral>

Sample no.	Grain	Bi (wt%)	Te (wt%)	Cu (wt%)	Se (wt%)	total (wt%)	Bi (at. %)	Te (at. %)	Cu (at. %)	Se (at. %)
C2-19. 8R	1	75. 96	21. 87	0. 69	0. 76	99. 28	65. 46	30. 86	1. 95	1. 73
	2	81. 29	16. 62	0. 03	0. 83	98. 77	73. 37	24. 57	0. 09	1. 97
	3	80. 59	18. 88	0. 00	0. 66	100. 13	71. 16	27. 30	0. 00	1. 54
	4	80. 13	19. 07	0. 00	0. 64	99. 84	70. 87	27. 62	0. 01	1. 50
	5	80. 63	18. 18	0. 10	0. 68	99. 59	71. 67	26. 46	0. 28	1. 59
	6	80. 17	18. 99	0. 16	0. 77	100. 09	70. 43	27. 32	0. 45	1. 80
	7	77. 68	19. 06	1. 08	0. 89	98. 71	67. 66	27. 19	3. 11	2. 04
	8	79. 23	19. 29	0. 31	0. 64	99. 47	69. 78	27. 83	0. 90	1. 49



Appendix 11 Flow Chart of Mineral Separation Test

Appendix 12 Assay Result for Mineral Separation Test

Sample no.	Test no.	Grain size (mesh)	Au(g/t)	Ag(g/t)	Cu(%)
T3-3L	15-0	original	1.6	2	0.059
	15-1	+60	1.6	1	0.029
	15-2	-60~ +100	1.0	1	0.028
	15-3	-100~+150	1.2	2	0.038
	15-4	-150~+200	1.2	2	0.043
	15-5	-200~+325	1.3	2	0.046
	15-6	-325	1.0	3	0.064
T3-63.7L	16-0	original	<1	<1	0.001
	16-1	+60	<1	<1	<0.001
	16-2	-60~ +100	<1	<1	<0.001
	16-3	-100~+150	<1	2	<0.001
	16-4	-150~+200	<1	<1	0.002
	16-5	-200~+325	<1	<1	0.002
	16-6	-325	<1	1	0.009
T3-87.5F	17-0	original	41.3	105	3.02
	17-1	+60	273.1	197	0.76
	17-2	-60~ +100	123.8	169	1.47
	17-3	-100~+150	77.2	118	2.94
	17-4	-150~+200	91.4	141	5.11
	17-5	-200~+325	58.1	137	6.10
	17-6	-325	23.2	143	8.02
C1-12L	14-0	original	1.3	1	0.005
	14-1	+60	<1	<1	0.005
	14-2	-60~ +100	<1	<1	0.004
	14-3	-100~+150	3.8	1	0.003
	14-4	-150~+200	1.4	1	0.003
	14-5	-200~+325	1.5	1	0.004
	14-6	-325	1.2	1	0.013

Method : Au(AA)
Ag, Cu(ICP)

: highest grade of Au
 : lowest grade of Au

Appendix 13 Result of Heavy Liquid Separation and Assay

Sample no.	Test no.	Grain size (mesh)	Light minerals (S.G. <3.5)		Heavy minerals (S.G. >3.5)					Total		
			Weight (g)	Weight (%)	Weight (g)	Weight (%)	Au (g/t)	Ag (g/t)	Cu (%)	Weight (g)	Weight (%)	
T3-3L	15-1	+60	62.1	79.3	16.2	20.7	3	3	6	0.088	78.3	100
	15-2	-60~+100	34.0	36.1	60.2	63.9	3	3	4	0.083	94.2	100
T3-63.7L	16-4	-150~+200	15.6	33.8	30.5	66.2	1	1	2	0.002	46.1	100
	16-6	-325	19.3	58.5	13.7	41.5	1	1	1	0.009	33.0	100
T3-87.5F	17-1	+60	29.4	62.8	17.4	37.2	191	191	208	0.97	46.8	100
	17-6	-325	21.3	74.5	7.3	25.5	44	44	174	10.8	28.6	100
C1-12L	14-1	+60	15.7	27.9	40.6	72.1	<1	<1	<1	0.002	56.3	100
	14-3	-100~+150	29.2	51.4	27.6	48.6	1	1	1	0.002	56.8	100

Appendix 14 Result of X-ray Diffraction Analyses for Mineral Separation Test

Sample no.	Test no.	Grain size (mesh)	Quartz	Calcite	Kutnahorite	Siderite	Andradite	Grossularite	Clinopyroxene	Amphibole	Chlorite	Chalcopyrite	Bornite	Pyrite	Magnetite	
T3-3L	15-0	original	◎	◎	△	△								○		
	15-1	+60	◎	○	△	○									○	
		heavy minerals	△	△	△	△									◎	
	15-2	-60~+100	◎	○	△	△									△	
		heavy minerals	△	△	·	△									◎	
	15-3	-100~+150	◎	○	△	△									○	
	15-4	-150~+200	○	○	△	△									○	
15-5	-200~+325	○	○	△	△									○		
15-6	-325	○	◎	△	△									○		
T3-63.7L	16-0	original	○	·			△		◎	△	·				△	
	16-1	+60	○	·			△		◎	△	·				△	
	16-2	-60~+100	○	·			△		◎	△	·				△	
	16-3	-100~+150	○	·			△		◎	△	·				△	
	16-4	-150~+200	○	△			△		◎	△	·				△	
		heavy minerals					△		○						◎	
	16-5	-200~+325	○	△			△		◎	△	·				△	
16-6	-325	○	○			△		○	○	·				△		
	heavy minerals					△		○						◎		
T3-87.5F	17-0	original	△				◎		△	△	·	·	·			
	17-1	+60	△				◎		△	△		·	·			
		heavy minerals					◎		△	△						
	17-2	-60~+100	△				◎		△	△		·	·			
	17-3	-100~+150	△				◎		△	△		·	·			
	17-4	-150~+200	△				◎		△	△		·	·			
	17-5	-200~+325	△				◎		△	△		△	△			
17-6	-325	△				◎		△	△		△	△				
	heavy minerals					◎		·	·		△	△				
C1-12L	14-0	original	○	·				○	◎	△	△					
	14-1	+60	◎	·				○	◎	△	△					
		heavy minerals						◎	◎	△	·					
	14-2	-60~+100	◎	·				○	◎	△	△					
	14-3	-100~+150	◎	·				○	◎	△	△					
		heavy minerals						◎	◎	·	·					
	14-4	-150~+200	○	·				○	◎	△	△					
14-5	-200~+325	○	·				○	◎	△	△						
14-6	-325	○	△				○	◎	△	△						

◎ : abundant, ○ : common, △ : poor, · : rare

Appendix 15 Microscopic Observations of the Polished Thin Sections for Mineral Separation Test

No.	Sample number	Test no.	Rock name	Sieved grain size	Ore minerals																	Gangue minerals													
					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	Py ore in Px-Qz-Carb skarn	uncrushed(original)				⊙			.																	⊙			⊙				
2	T3-3L	15 - 1	Heavy mineral portion of separated mineral samples	+60mesh	.		.	⊙		.	Δ		.	Δ		.	.	.		.								⊙	Δ	.			○	○
3	T3-3L	15 - 1		+60mesh	.		.	⊙		.	Δ		.	Δ		.	.	.		.								⊙	Δ	.			○	○
4	T3-3L	15 - 2		-60~+100mesh	.		Δ	⊙		.	Δ		.	.	.	.	.	.		.								⊙	Δ	.			○	○
5	T3-63.7L	16		Cp-Py ore in Mt-Cpx skarn	uncrushed(original)	⊙	Δ				.																	.	.	⊙	Δ		○		
6	T3-63.7L	16 - 4	Heavy mineral portion of separated mineral samples	-150~+200mesh	⊙	.		.	.				.														.	?	○	⊙	.	.
7	T3-63.7L	16 - 6		-325mesh	○	.		Δ	.					.														Δ	⊙	.	.				
8	T3-63.7L	16 - 6		-325mesh	○	.		Δ						.														Δ	⊙	.	.				
9	T3-87.5F	17		Bn-Cp ore in Cpx-Ga skarn	uncrushed(original)				.					⊙	○							.	.					Δ	⊙	○	Δ	Δ			
10	T3-87.5F	17 - 1	Heavy mineral portion of separated mineral samples	+60mesh									Δ	Δ							.					.	.	Δ	⊙	○	Δ	Δ		.	.
11	T3-87.5F	17 - 1		+60mesh				.						Δ	Δ						.					.	.	Δ	⊙	○	Δ	Δ		.	.
12	T3-87.5F	17 - 6		-325mesh		.		.					.	○	Δ						.					.	.	⊙	○	.	.			.	
13	C1-12L	14		Py-Cp ore in Ga-Cpx skarn	uncrushed(original)				.	Δ					Δ						.	Δ	.					○	Δ	⊙	Δ	○			Δ
14	C1-12L	14 - 1	Heavy mineral portion of separated mineral samples	+60mesh	.			.	.					.								.					Δ	⊙	⊙	Δ	Δ			Δ
15	C1-12L	14 - 3		-100~+150mesh	.		.	.	.	.				.								.						⊙	⊙	.	.			.
16	C1-12L	14 - 3		-100~+150mesh	.		.	.	.	.	.			.								.						⊙	⊙	.	.			.

- 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 bismuthinite
 Td: Tetrahedrite

Sample number : T1(Tunnel-I), T2(Tunnel-II), T3(Tunnel-III), C1(Crosscut-I), C2(Crosscut-II),
 R(Right wall), L(Left wall), F(Face), FR(Right hand on a Face), FL(Left hand on a Face), C(Roof)
 *numerical figures in a sample number show the distance from the starting point in each tunnel segments.

Appendix 16

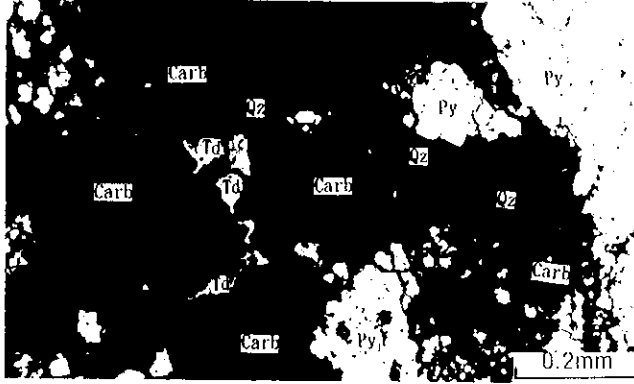
Photomicrographs of the Polished Thin Sections for Mineral Separation Test

Abbreviations

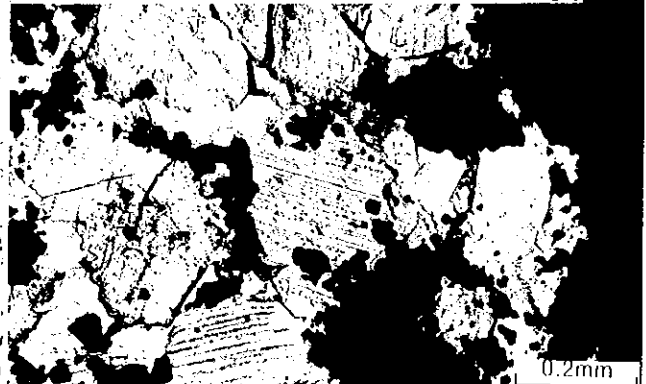
Asp	:Arsenopyrite
Au	:Native gold
Bn	:Bornite
Bt	:Biotite
Carb	:Carbonate
Cp	:Chalcopyrite
Cpx	:Clinopyroxene
Cu	:Native copper
Cv	:Covellite
El	:Electrum
En	:Enargite
Ga	:Garnet
Ms	:Marcasite
Mt	:Magnetite
Py	:Pyrite
Qz	:Quartz
Se	:Sericite
Sid	:Siderite
Sp	:Sphalerite
Stan	:Stannite
Td	:Tetrahedrite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

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

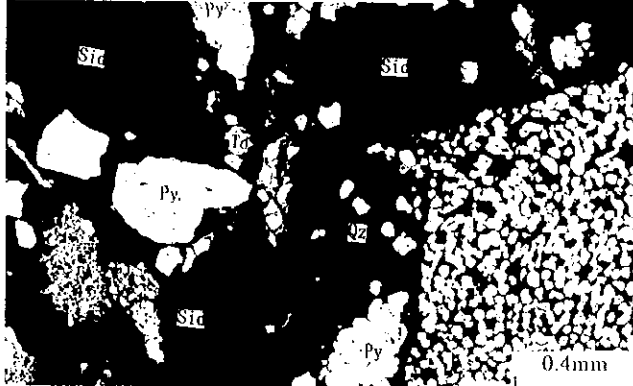
1 T3-3L : 15 : Py ore in Px-Qz-Carb skarn (reflected light)



T3-3L : 15 : Py ore in Px-Qz-Carb skarn (transmitted light)



2 T3-3L : 15 - 1 : +60mesh (reflected light)



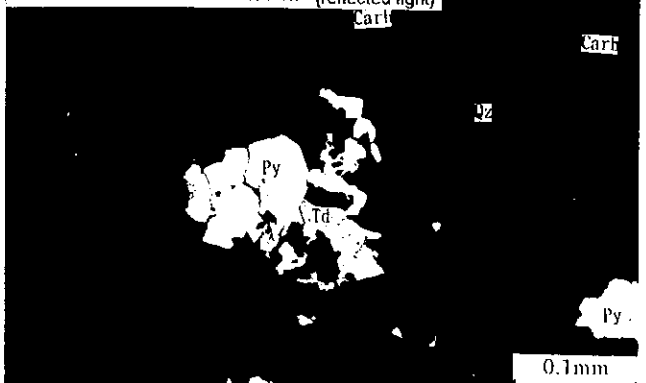
T3-3L : 15 - 1 : +60mesh (transmitted light)



T3-3L : 15 - 1 : +60mesh (reflected light)



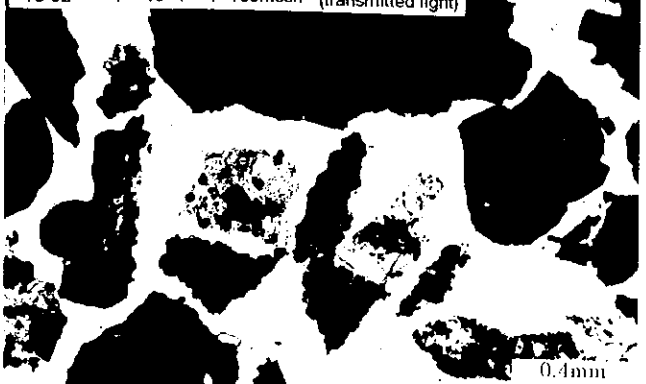
T3-3L : 15 - 1 : +60mesh (reflected light)



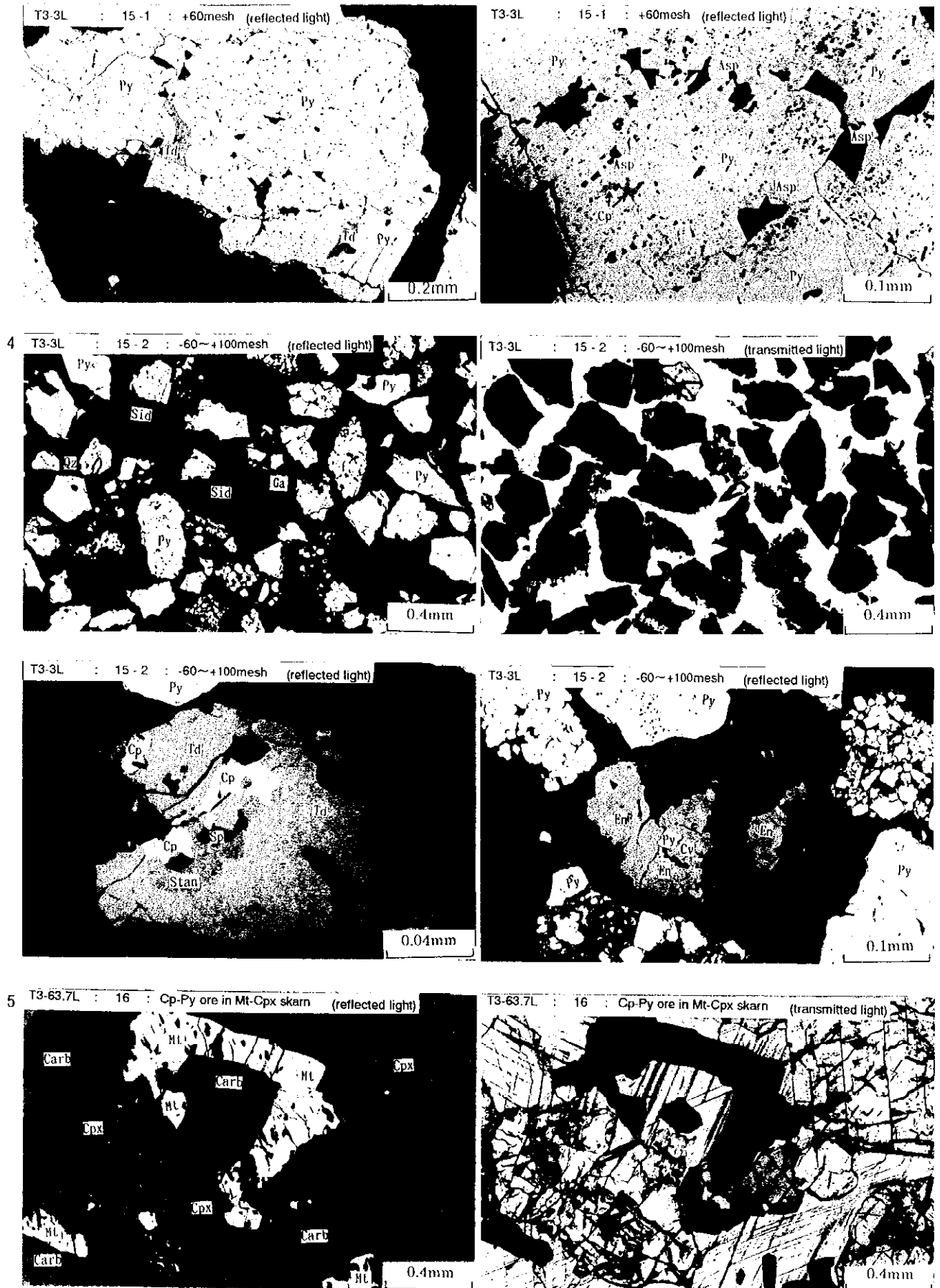
3 T3-3L : 15 - 1 : +60mesh (reflected light)



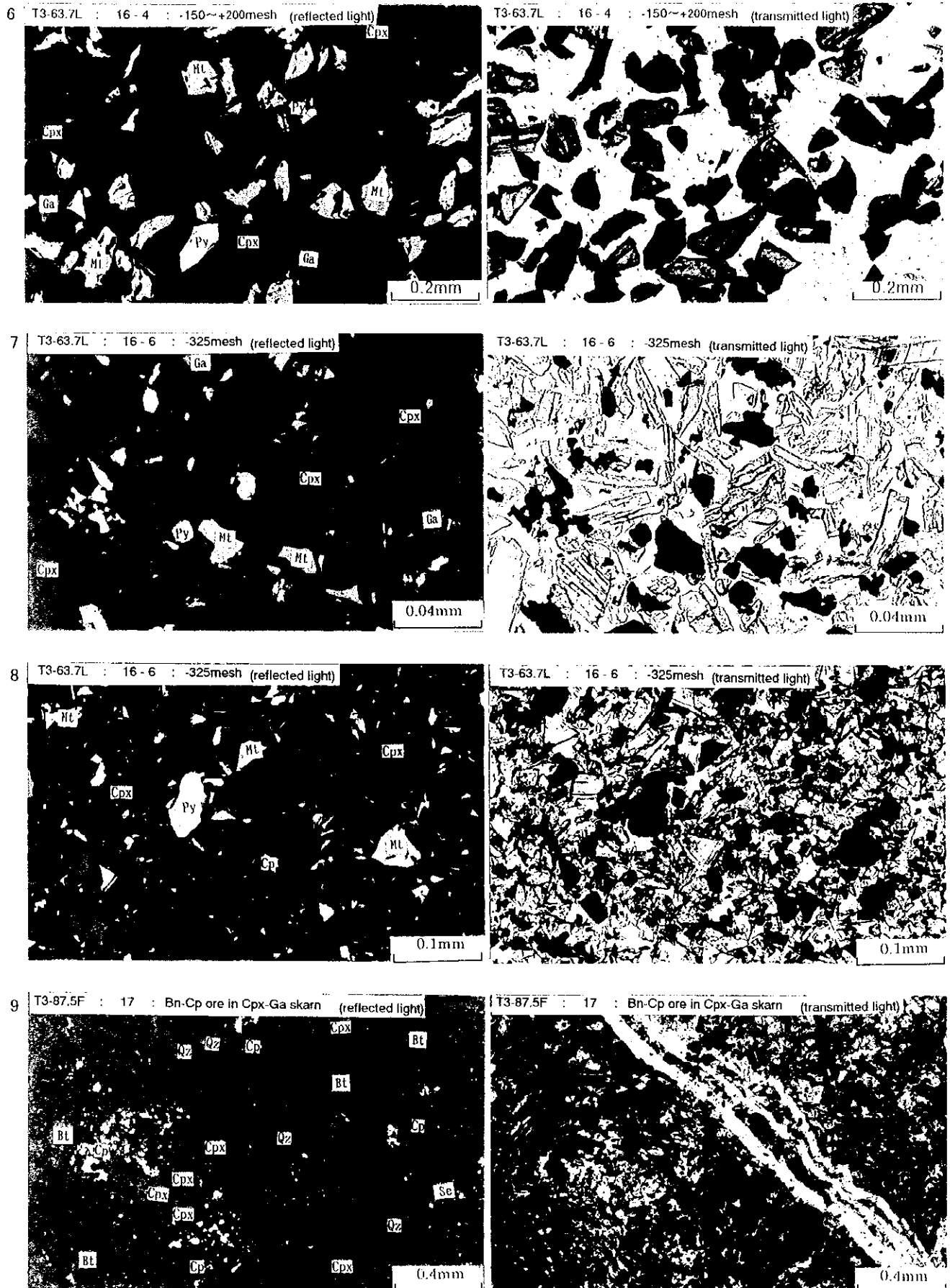
T3-3L : 15 - 1 : +60mesh (transmitted light)



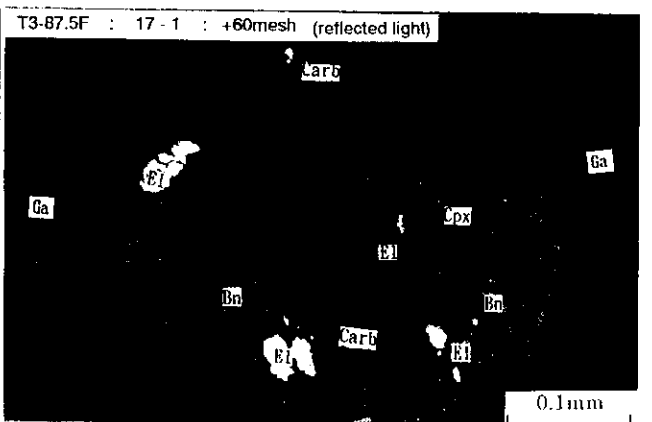
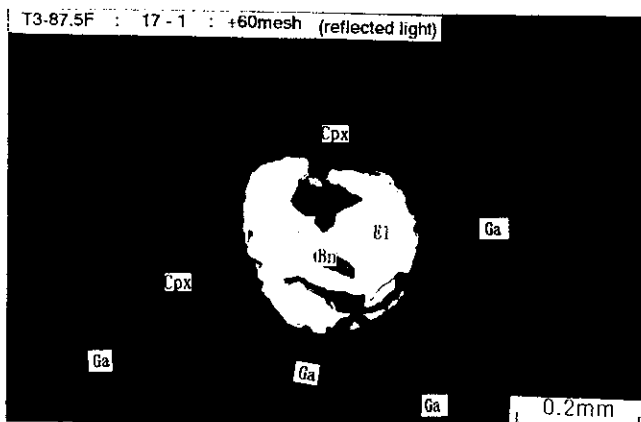
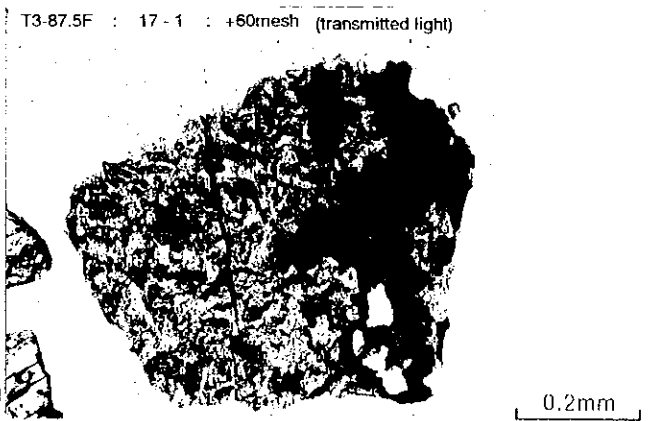
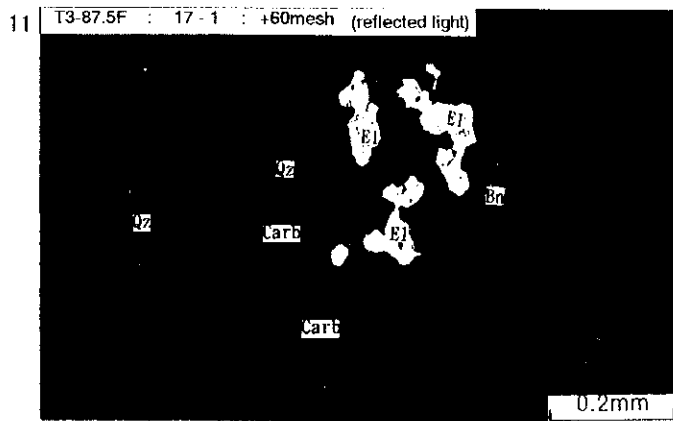
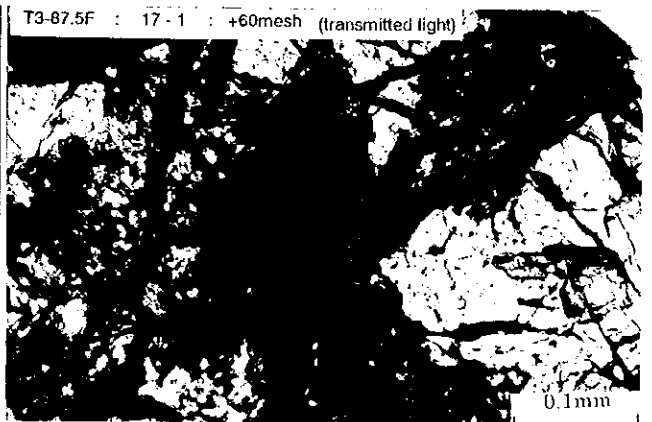
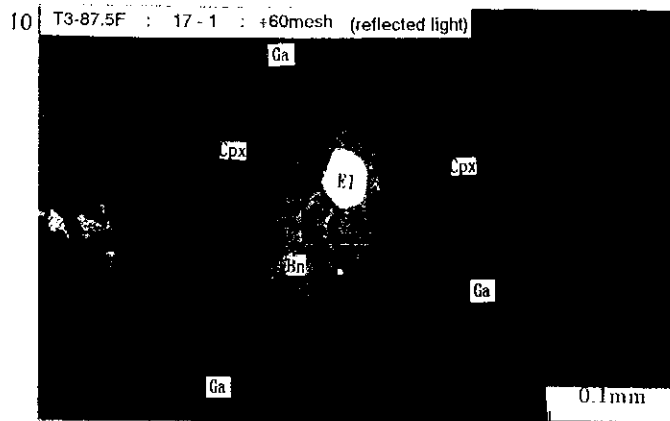
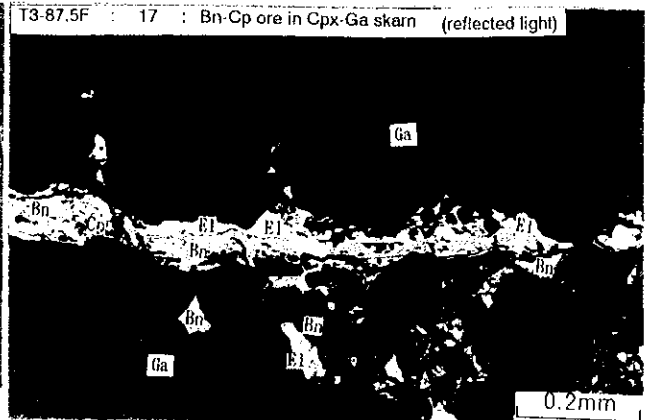
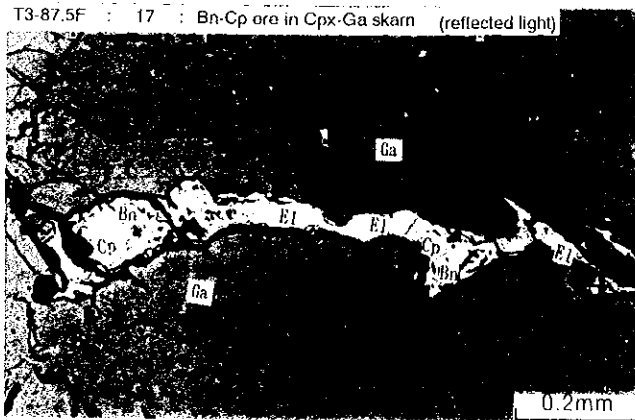
Appendix 16 Photomicrographs of the Polished Thin Sections(Au grain distribution test)



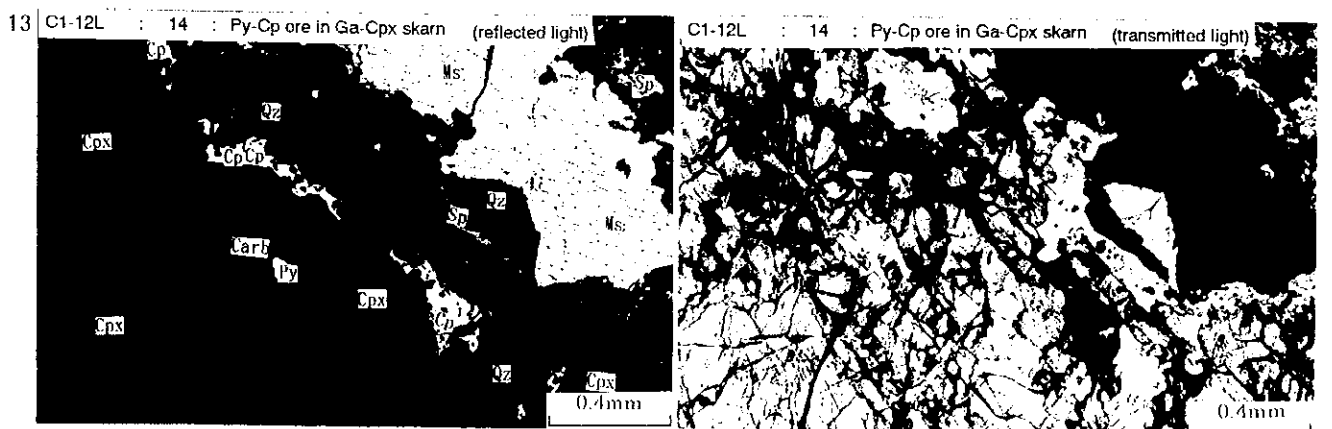
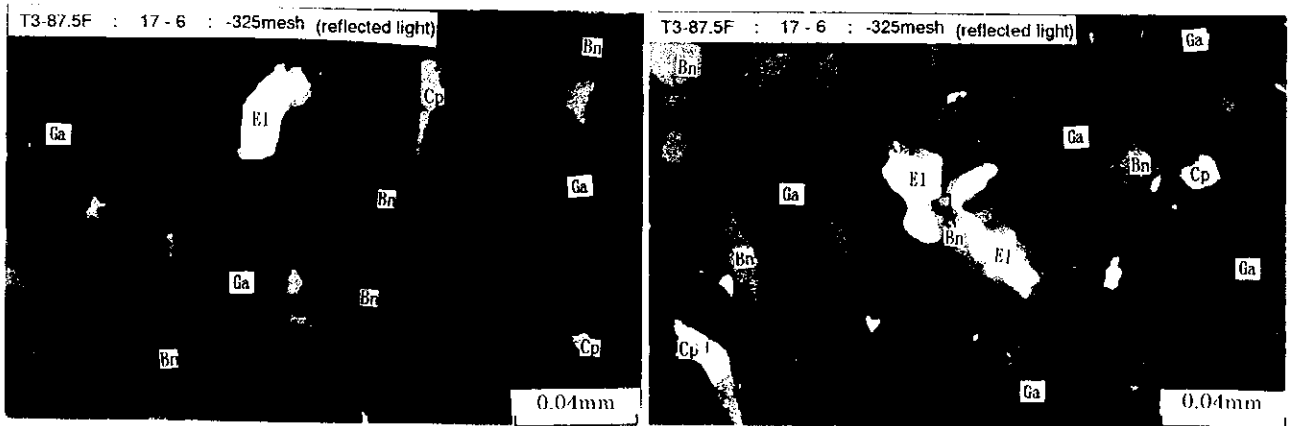
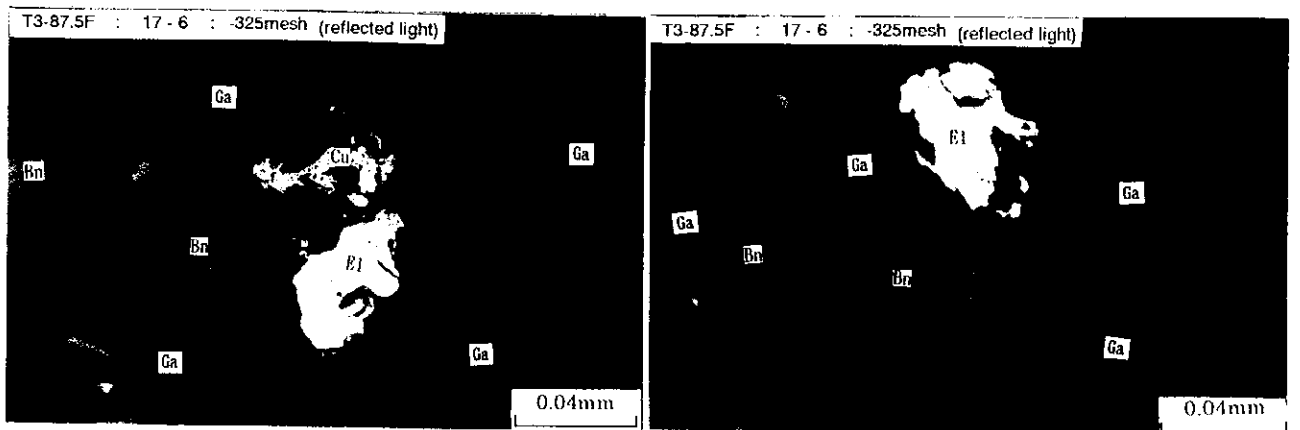
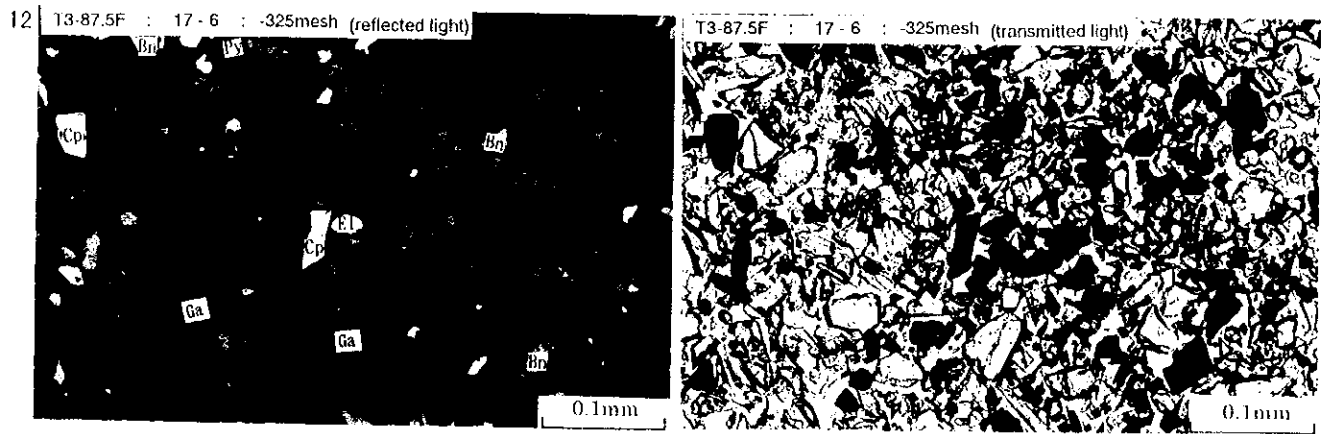
Appendix 16 Photomicrographs of the Polished Thin Sections(Au grain distribution test)



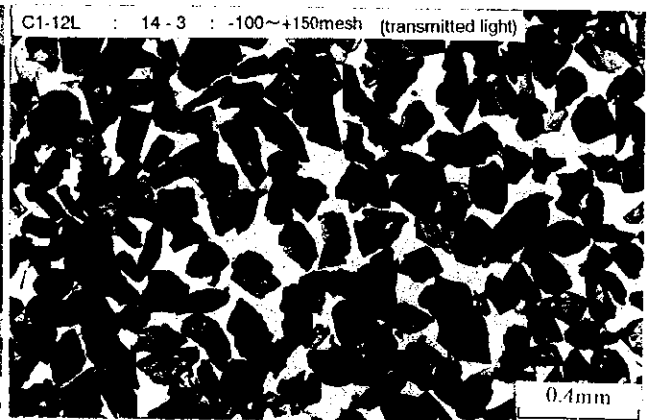
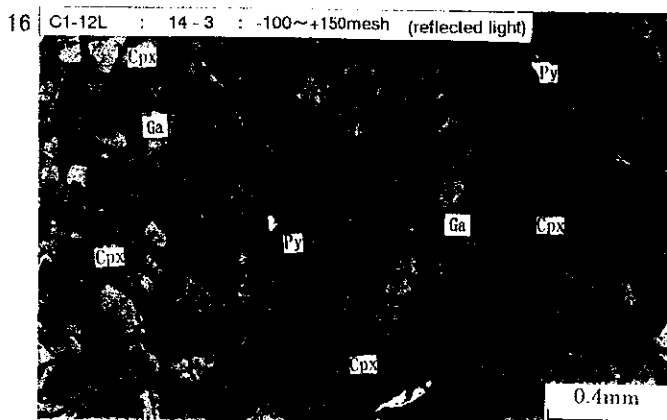
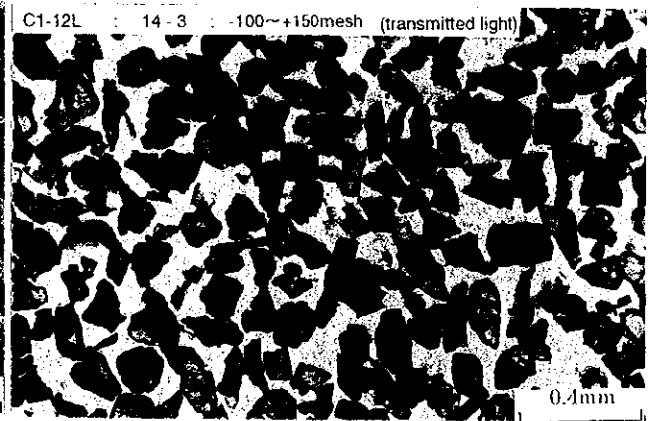
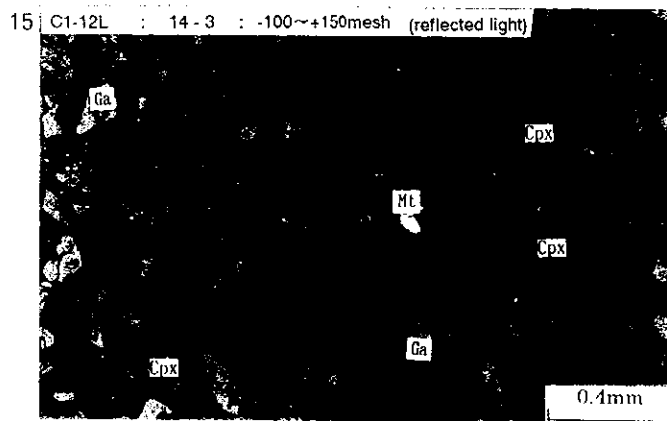
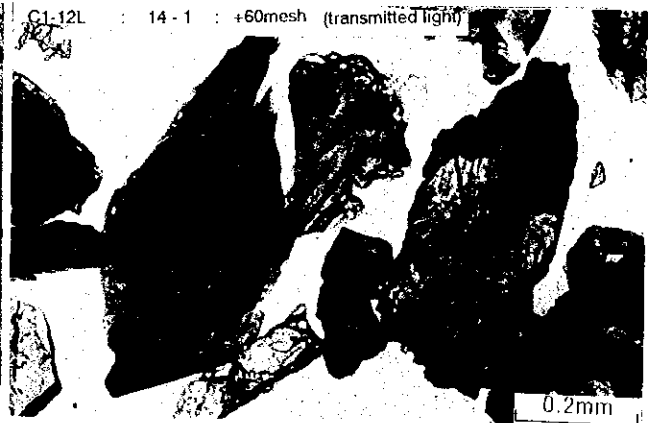
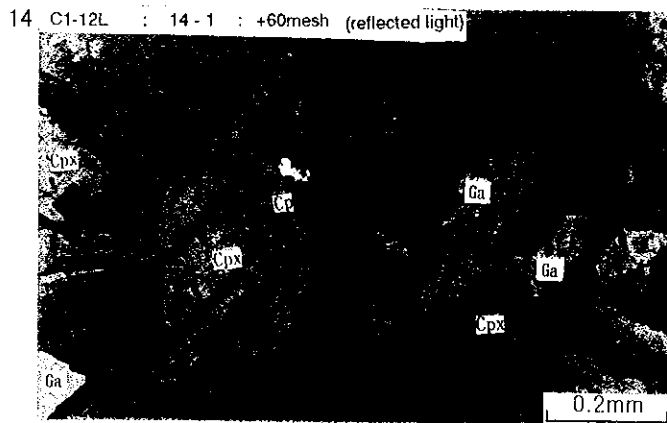
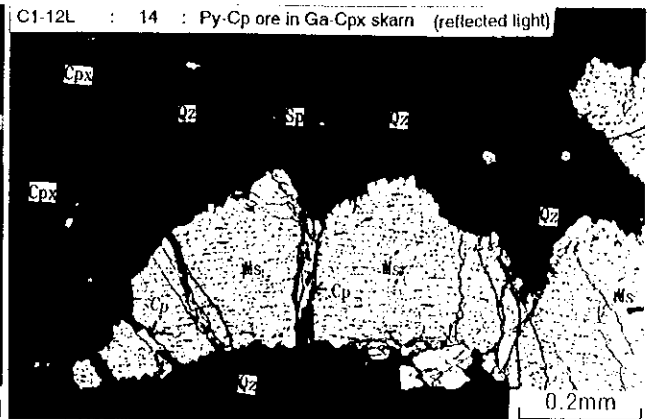
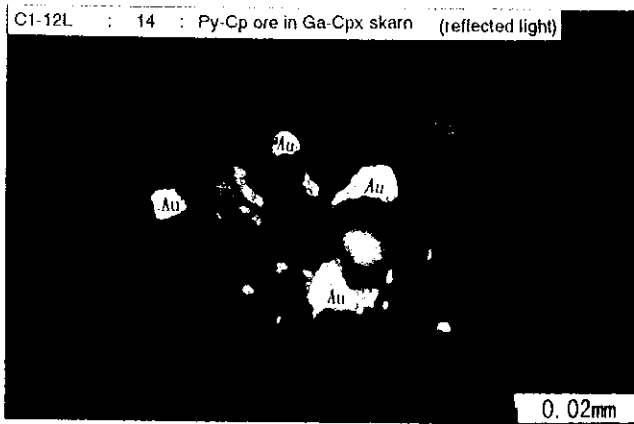
Appendix 16 Photomicrographs of the Polished Thin Sections(Au grain distribution test)



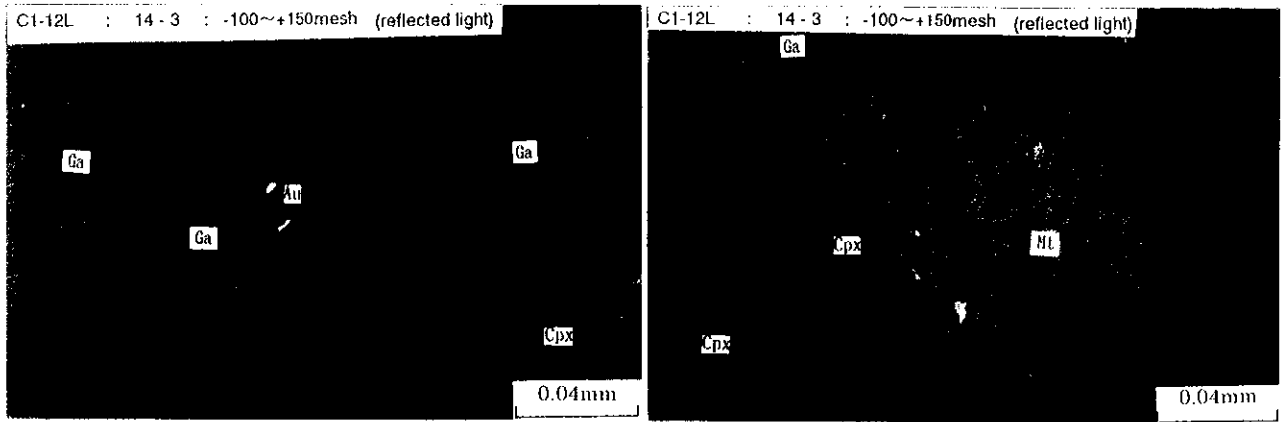
Appendix 16 Photomicrographs of the Polished Thin Sections(Au grain distribution test)



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)		Total	Ore minerals																	Gangue minerals									
						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			1					161	5				298	188		
				Mode	100			1	65		0	1			0	0			0						8	0				15	9	
2	T3-3L	15-1	+60	Counting	2000		1	32	1404		1	14		1	8	11			1					174	7				229	117		
				Mode	100		0	2	70		0	1		0	0	1			0						9	0				11	6	
3	T3-3L	15-2	-60~+100	Counting	2000			43	1614			6		2	7	6			2					93	27				102	98		
				Mode	100			2	81			0		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			
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		
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		
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	1
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	1
9	T3-87.5F	17-6	-325	Counting	2000				8					356	103					4					1353	161	9	2			4	
				Mode	100				0							18	5					0					68	8	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																				11	1052	29	68				43
				Mode	100																					1	53	1	3			

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 ₂ O ₃	Siderite: FeCO ₃ Mg-Siderite: (Fe, Mg)CO ₃ Calcite: CaCO ₃	Native Au includes a little amount of Ag
T3-63.7L	16 - 6	-325mesh	Op with Mt	Chalcopyrite: CuFeS ₂ Magnetite: Fe ₃ O ₄		
T3-87.5F	17 - 1	+60mesh	El and Bn with Ga, Cpx and Cal	Electrum: Au, Ag Bornite: Cu ₅ FeS ₄	Andradite: Ca ₃ Fe ₂ (SiO ₄) ₃ Diopside: Ca (Mg, Fe) Si ₂ O ₆ Calcite: CaCO ₃ Quartz: SiO ₂	
C1-12L	14 - 3	-100~-+150mesh	Native Au with Ga	Native Au: Au-(Ag)	Andradite: Ca ₃ Fe ₂ (SiO ₄) ₃	Native Au includes a little amount of Ag

Bn: Bornite

Cal: Calcite

Cp: Chalcopyrite

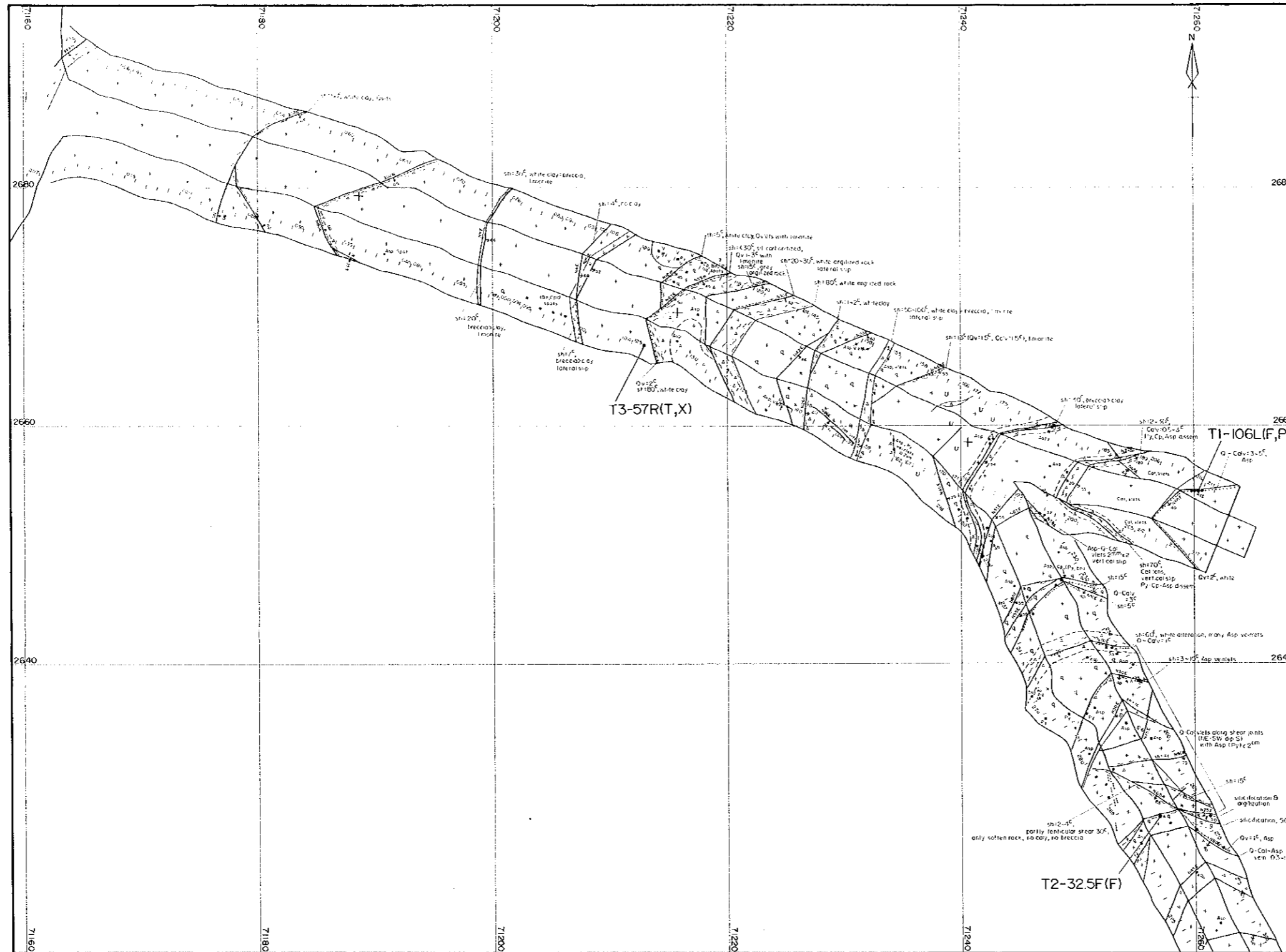
Cpx: Clinopyroxene

El: Electrum

Ga: Garnet

Mt: Magnetite

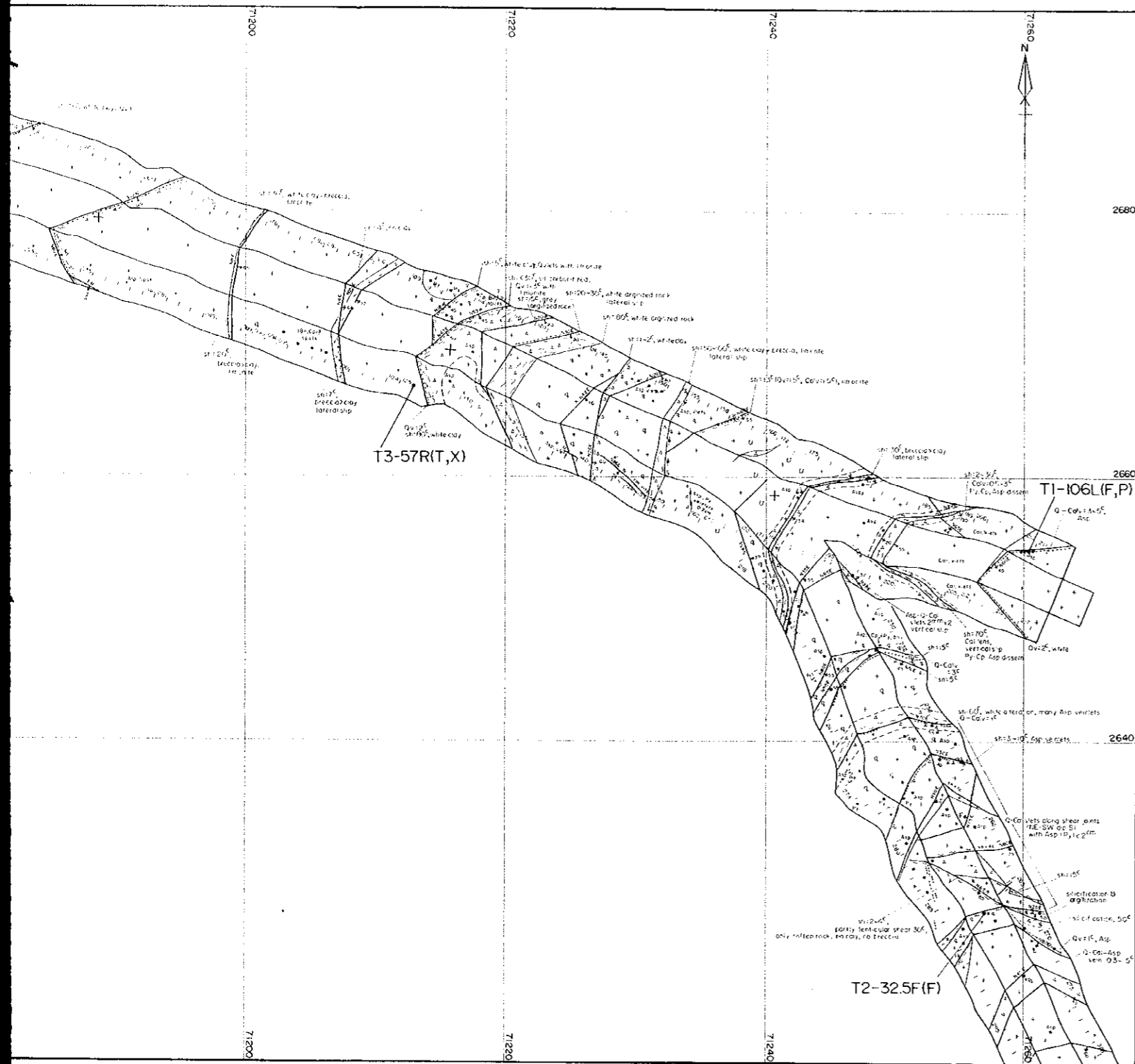
Sid: Siderite



LEGEND

Host rocks		Others
□ granodiorites		--- alteration boundary
× gabbro/d		--- mineral boundary
||||| (strong)		--- fault
--- (medium)		--- shear joint
--- (weak)		--- gnepe
□ marble		--- fault breccia
		--- shear joint zone
Skarns		--- channel sample location
◆ garnet skarn		
◆ pyroxene-garnet skarn (Gpx < Ga)		Veins
◆ garnet-pyroxene skarn (Ga < Cpx)		--- quartz vein
◆ pyroxene skarn (medium grain)		--- calcite vein
◆ pyroxene skarn (very fine grain)		--- quartz-calcite vein
◆ pyroxene big crystal		
◆ siliceous carbonate altered rock		Abbreviations
◆ carbonate skarn		Asp arsenopyrite
◆ wollastonite skarn		Bn barite
◆ Ga-Cpx-Hb-Bt band in marble		Cp chalcocyanite
		Cpx clinopyroxene
		Cu copper green
Dikes		Ga garnet
▲ lamprophyre		Mo molybdenite
▲ anorthosite, Oz=monzonite		Mt magnetite
▲ diorite porphyry		Py pyrite
Mineralization & Alteration		
□ silicification		Sample location
□ (strong)		(T) thin section
□ (weak)		(P) polished thin section
□ fine grain Py-Asp lens		(X) x-ray diffraction
□ dissemination of sulphide minerals		(F) filling temperature
□ limonite		(E) EPMA
□ carbonatization		(M) mineral separation test
		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

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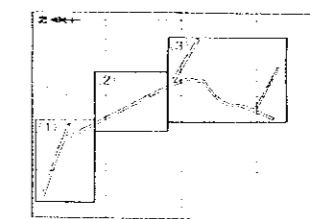
Host rocks	Others
G granodiorites	alteration boundary
X gabbro	intrusive boundary
skarnized gabbro (strong)	fault
skarnized gabbro (medium)	shear joint
skarnized gabbro (weak)	gozge
M marble	fault breccia
	shear joint zone
	channel sample location
Skarns	Veins
G garnet skarn	quartz vein
Cpx < Ga pyroxene-garnet skarn	calcite vein
Ga < Cpx garnet-pyroxene skarn	quartz-calcite vein
Py pyroxene skarn (medium grain)	
Py pyroxene skarn (very fine grain)	
Py pyroxene big crystal	
H siliceous carbonate altered rock	Abbreviations:
C carbonate skarn	Asp arsenopyrite
W wollastonite skarn	Bn bornite
Ga-Cpx-Hb-Bi band in marble	Cn chalcopyrite
	Cpx clinopyroxene
Dikes	Cu copper green
A lamprophyre	Ga garnet
An anorthosite, Oz monzonite	Mo moldenite
D diorite porphyry	Mi magnetite
	Py pyrite
Mineralization & Alteration	Sample location
Q silicification (strong)	(I) thin section
Q silicification (weak)	(P) polished thin section
A argillization (strong)	T1 Tunnel I
A argillization (weak)	T2 Tunnel II & Sidetrack I
Py-Asp fine grain Py-Asp band	T3 Tunnel III
Dissemination of sulphide minerals	C1 Sidetrack II & Cross cut I
L limonite	C2 Cross cut II
U carbonization	R right wall
	L left wall
	F face
	FR right corner on a face
	FL left corner on a face
	C roof

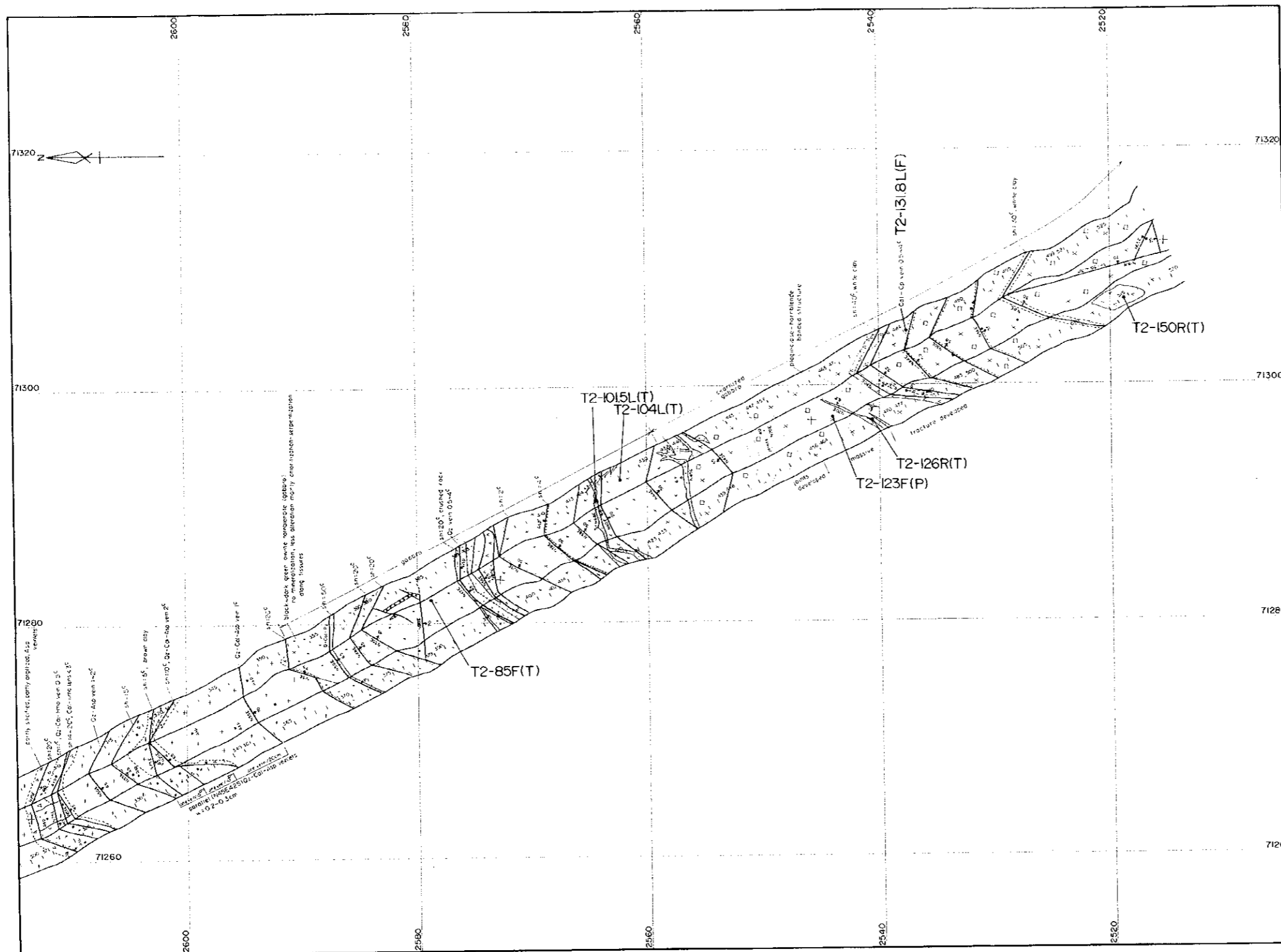
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1:200

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

Geological Sketch of 1850m Level Tunnel and Location
of Laboratory Test Samples (1)
(1 : 200)

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



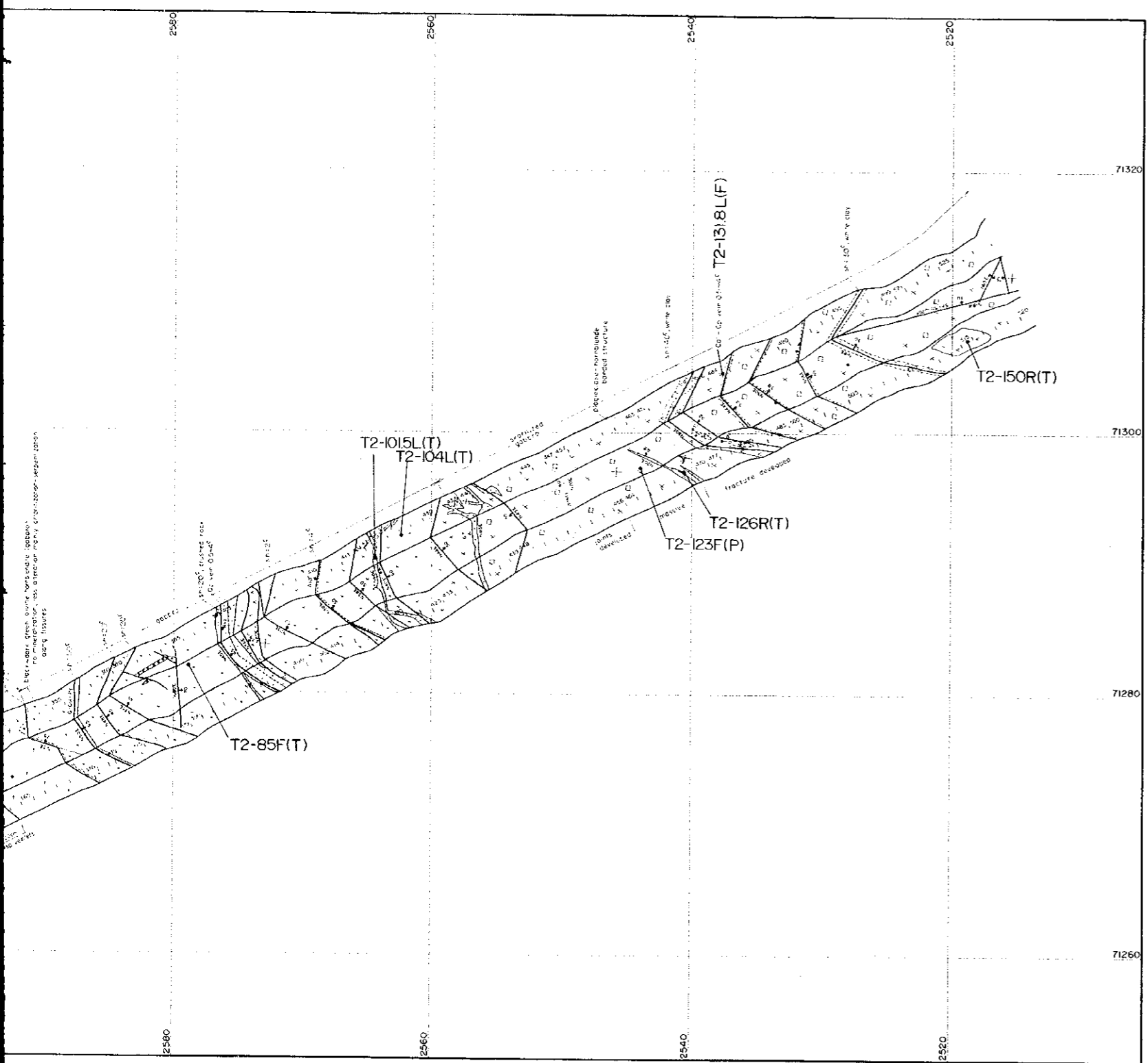


LEGEND

Host rocks		Others	
□ □ □ granodiorites		— alteration boundary	
× × × gabbro		— intrusive boundary	
||||| (strong)		— fault	
--- (medium)		— shear joint	
--- (weak)		— glide	
□ □ □ mafic		— fault breccia	
□ □ □ mafic		— shear joint zone	
★ ★ ★ garnet skarn		— (1:50) 1	chonet sample location
★ ★ ★ pyroxene-garnet skarn (Cpx C_{Gx})			
★ ★ ★ garnet-pyroxene skarn (Ga C_{Gx})		Veins	
× × × pyroxene skarn (medium grain)		— quartz vein	
× × × pyroxene skarn (very fine grain)		— calcite vein	
× × × pyroxene big crystal		— quartz-calcite vein	
□ □ □ siliceous carbonate altered rock		Abbreviations	
□ □ □ carbonate skarn		Asp arsenopyrite	
□ □ □ wollastonite skarn		Bn hornblende	
□ □ □ Ga-Cpx-Hb-Bi band in mafic		Cp chalcopyrite	
		Cpx clinopyroxene	
		Cu copper green	
		Ga garnet	
		Mo molybdenite	
		Ml muscovite	
		Py pyrite	
Dikes		Sample location	(T) thin section
△ △ △ Isomphrelyte		● T3-155L(P)	(P) polished thin section
△ △ △ anorthosite, Qz-monzonite		T1 Tunnel - I	(X) x-ray diffraction
△ △ △ diorite porphyry		T2 Tunnel II & Sidetrack I	(F) filling temperature
		T3 Tunnel III	(E) EPMA
Mineralization & Alteration		C1 Sidetrack II & Cross cut I	(M) mineral separation test
□ □ □ calcification (strong)		C2 Cross cut II	Numerical figures show
□ □ □ calcification (weak)		R right wall	the distance of the locality
□ □ □ fine grain Py-Asp band		L left wall	on each tunnel segments
□ □ □ dissemination of sulphide minerals		F face	
□ □ □ limonite		FR right corner on a face	
□ □ □ carbonitization		FL left corner on a face	
		C root	

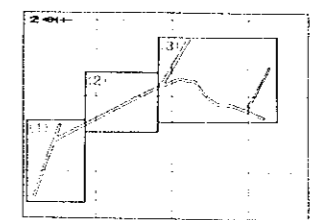
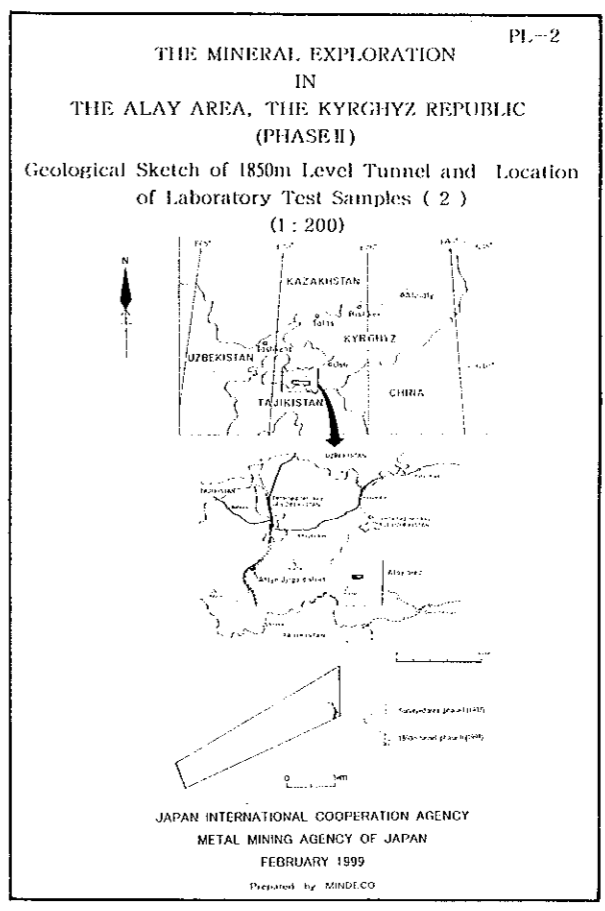
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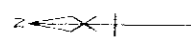
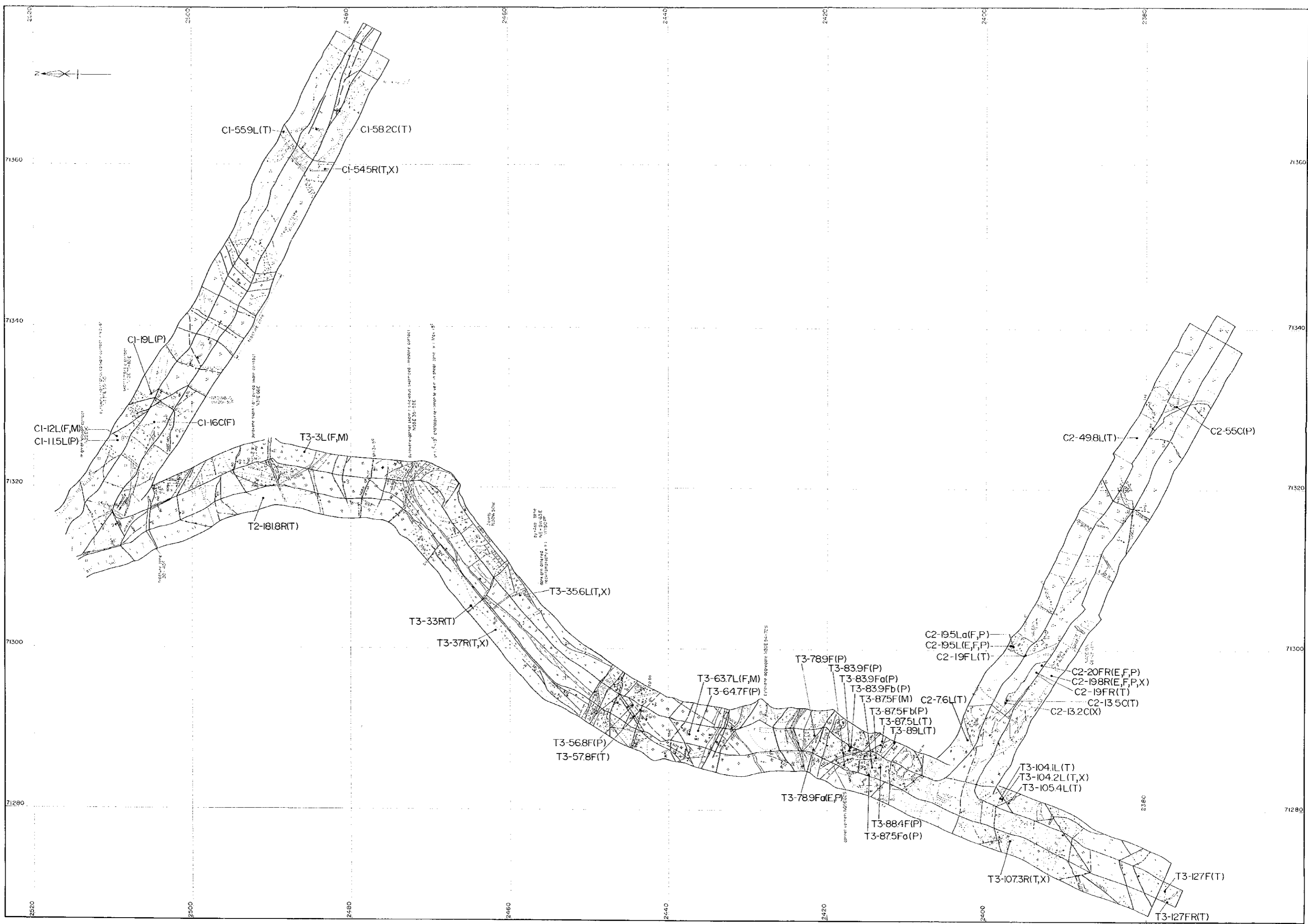
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Host rocks		Others	
□ □ granodiorites		--- alteration boundary	
X X gabbro		--- intrusion boundary	
||||| (strong)		--- fault	
--- (medium)		--- shear joint	
□ X □ (weak)		--- zone	
□ marble		--- fault breccia	
Skarns		--- shear joint zone	
◆ garnet skarn		--- channel sample location	
◆ pyroxene-garnet skarn (Cpx<Ga)			
◆ garnet-pyroxene skarn (Ga<Cpx)		Veins	
◆ pyroxene skarn (medium grain)		--- quartz vein	
◆ pyroxene skarn (very fine grain)		--- calcite vein	
◆ pyroxene big crystal		--- quartz-calcite vein	
◆ siliceous carbonate altered rock		Abbreviations	
◆ carbonate skarn		Asp arsenopyrite	
◆ wollastonite skarn		Bn bornite	
◆ Ga-Cpx-Hb-Bi band in marble		Cp chalcopyrite	
Dikes		Cpx clinopyroxene	
▲ lamprophyre		Gu copper green	
▲ anorthosite, Qz-nonzodiorite		Ga garnet	
▲ diorite porphyry		Mo molybdenite	
		Mt magnetite	
		Py pyrite	
Mineralization & Alteration			
□ silicification (strong)		Sample location	(T) thin section
□ silicification (weak)		● T3-155L(P)	(P) polished thin section
▲ fine grain Py-Asp band		T1 Tunnel - I	(X) x-ray diffraction
▲ dissemination of sulphide minerals		T2 Tunnel II & Sidetrack I	(F) filling temperature
▲ limonite		T3 Tunnel III	(E) EPMA
▲ carbonization		C1 Sidetrack II & Cross cut I	(M) mineral separation test
		C2 Cross cut II	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-582C(T)

CI-545R(T,X)

CI-19L(P)

CI-12L(F,M)
CI-115L(P)

CI-16C(F)

T3-3L(F,M)

T2-181.8R(T)

T3-356L(T,X)

T3-33RT)

T3-37R(T,X)

T3-568F(P)
T3-578F(T)

T3-637L(F,M)
T3-647F(P)

T3-789F(P)
T3-839F(P)

T3-839Fa(P)
T3-839Fb(P)

T3-875F(M)
T3-875Fb(P)

T3-875L(T)
T3-89L(T)

T3-789Fa(P)

T3-884F(P)
T3-875Fa(P)

C2-195La(F,P)
C2-195L(E,F,P)
C2-19FL(T)

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

C2-19FR(T)
C2-135C(T)

C2-132C(X)

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

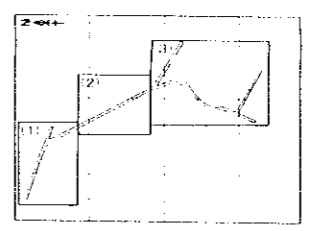
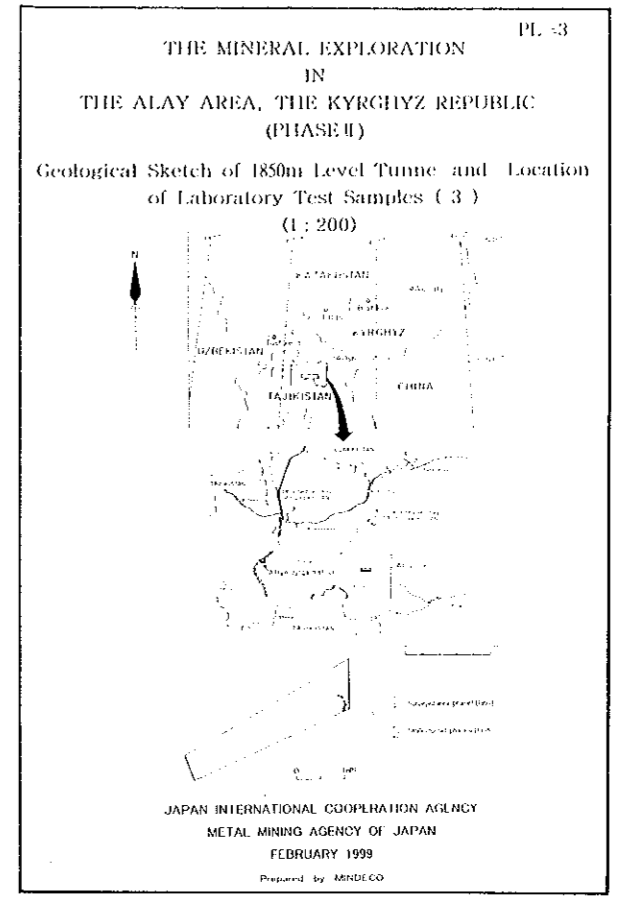
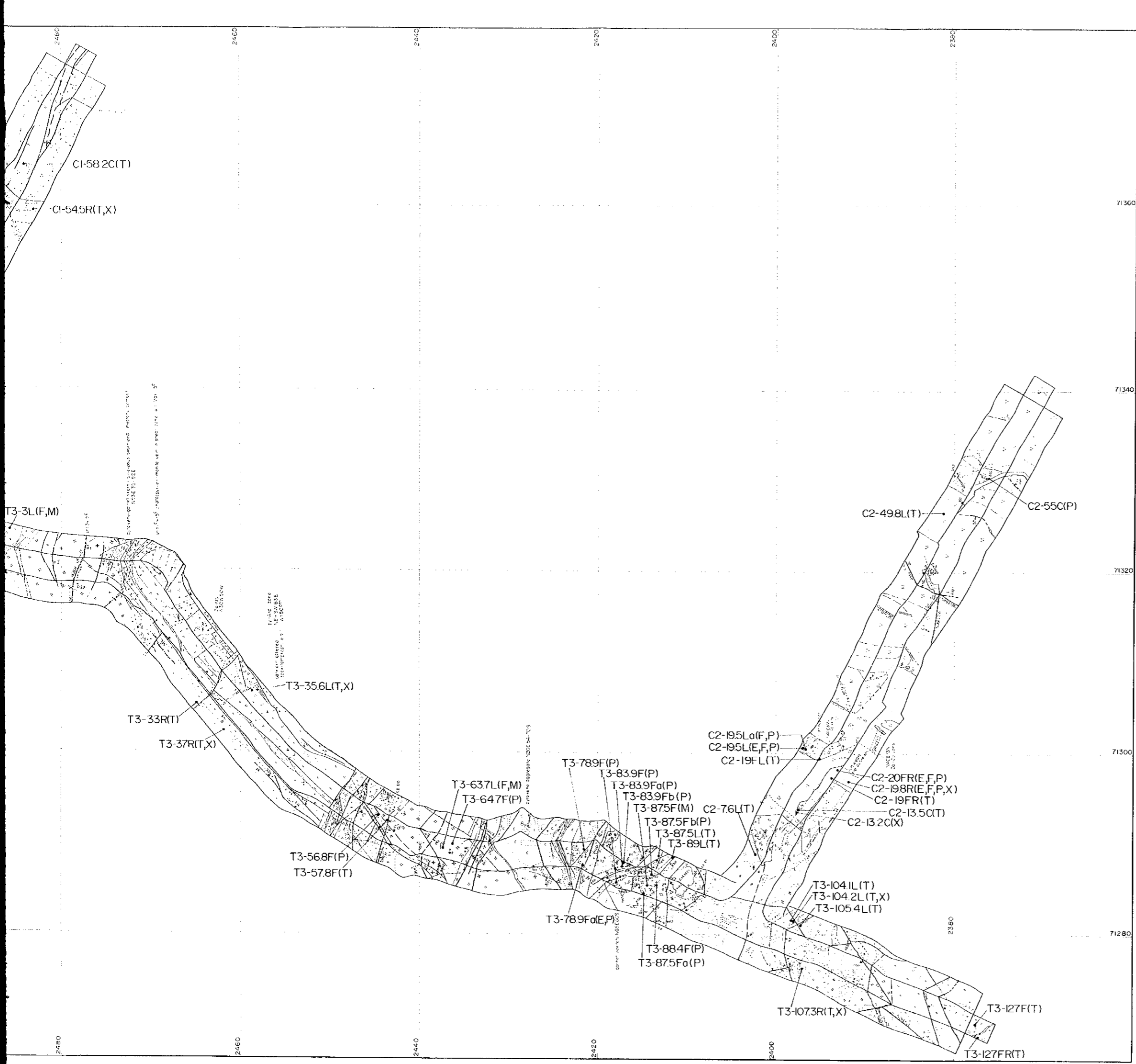
T3-1073R(T,X)

T3-127F(T)

T3-127FR(T)

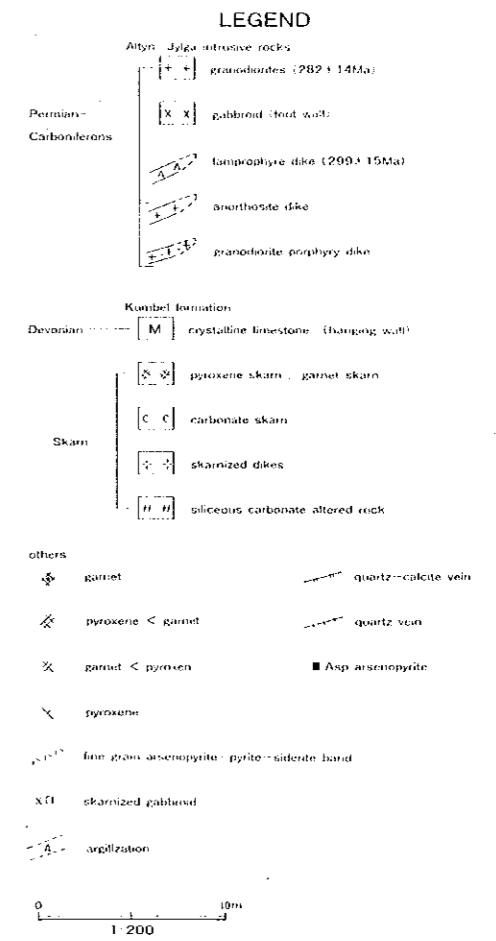
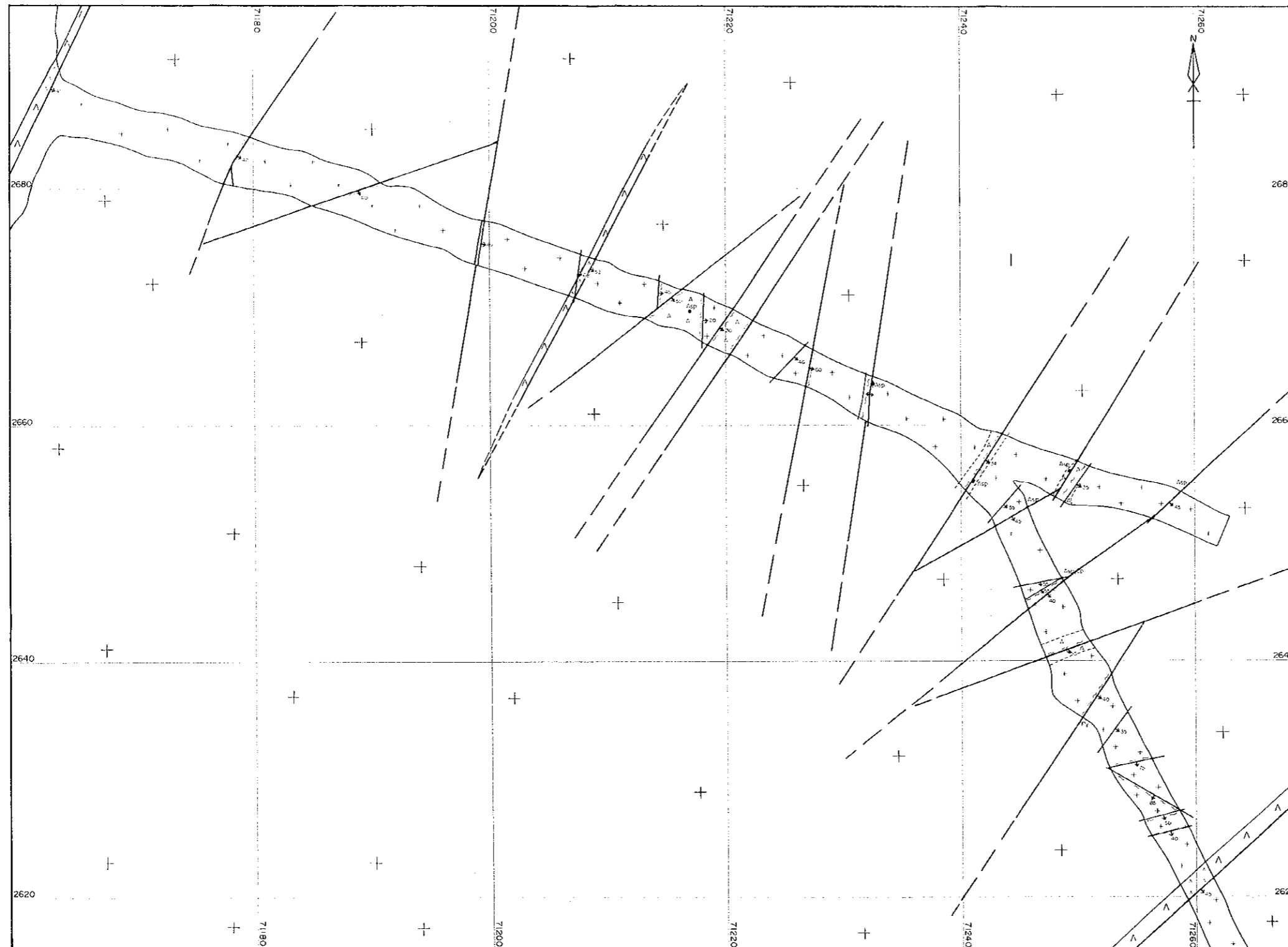
C2-498L(T)

C2-55C(P)

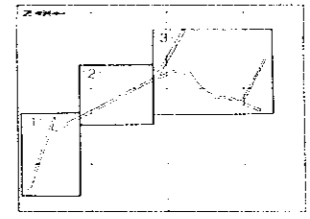
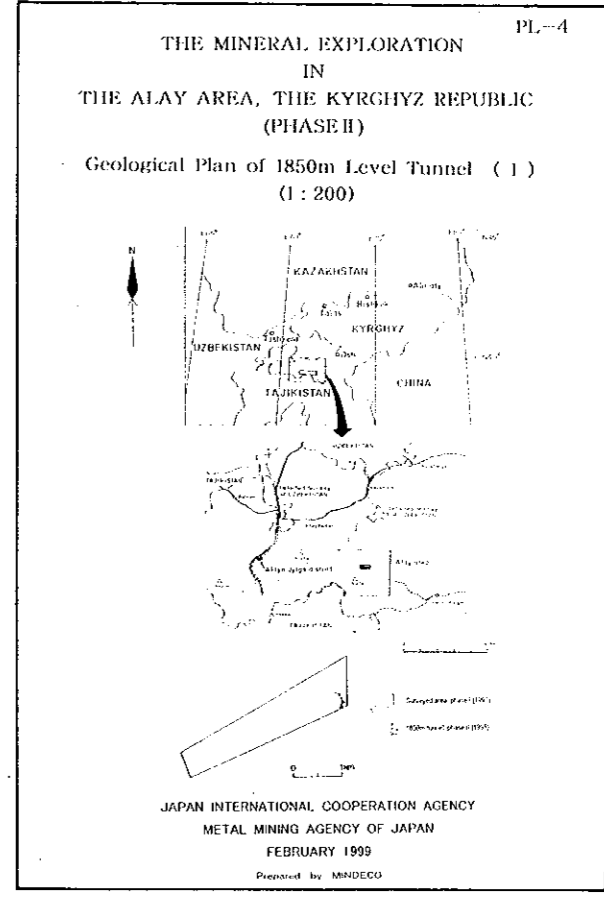
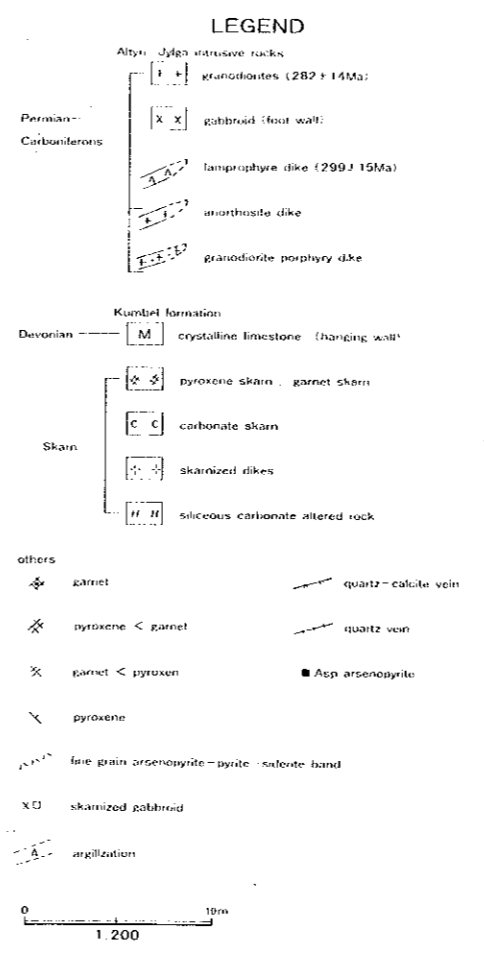
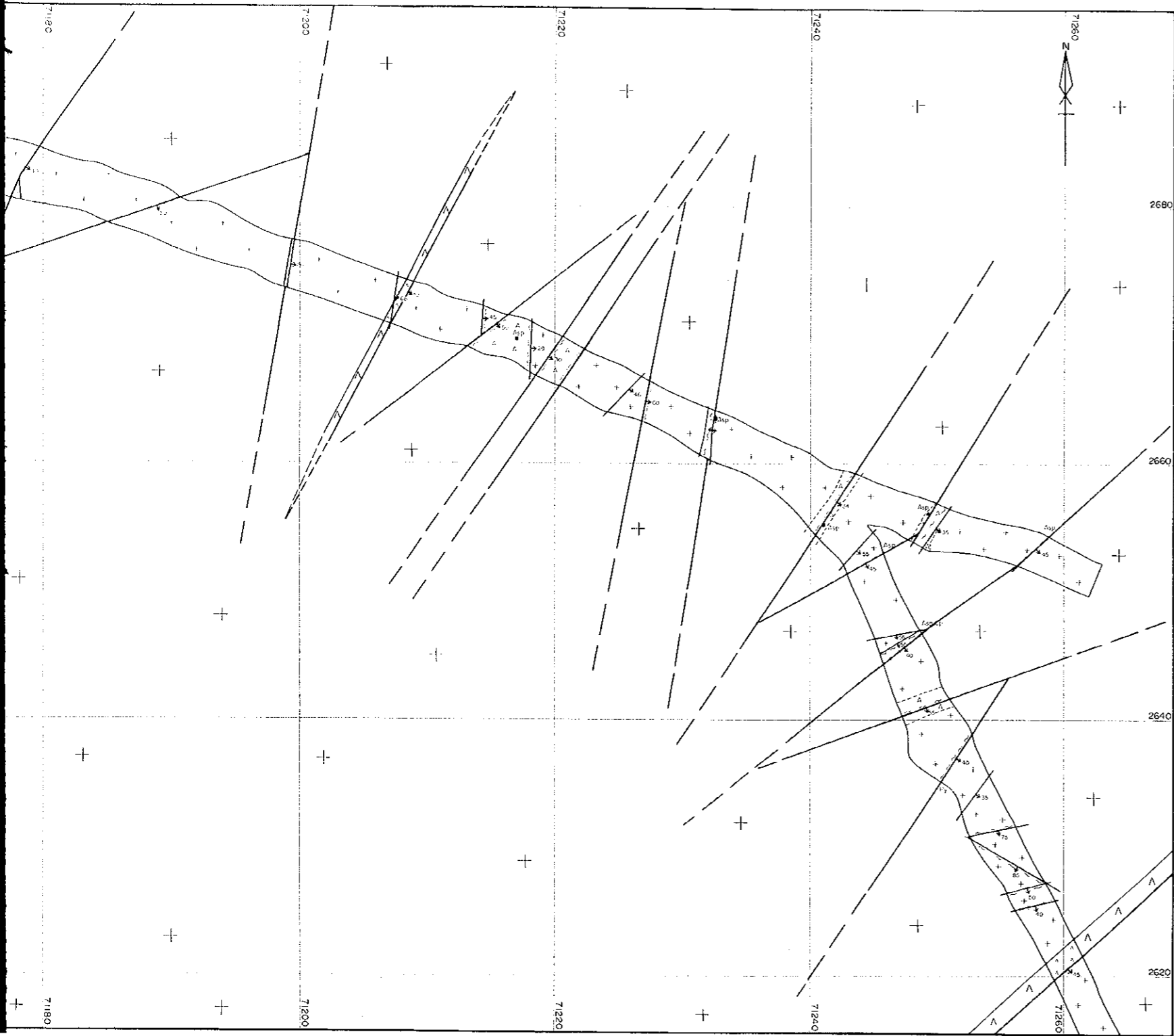


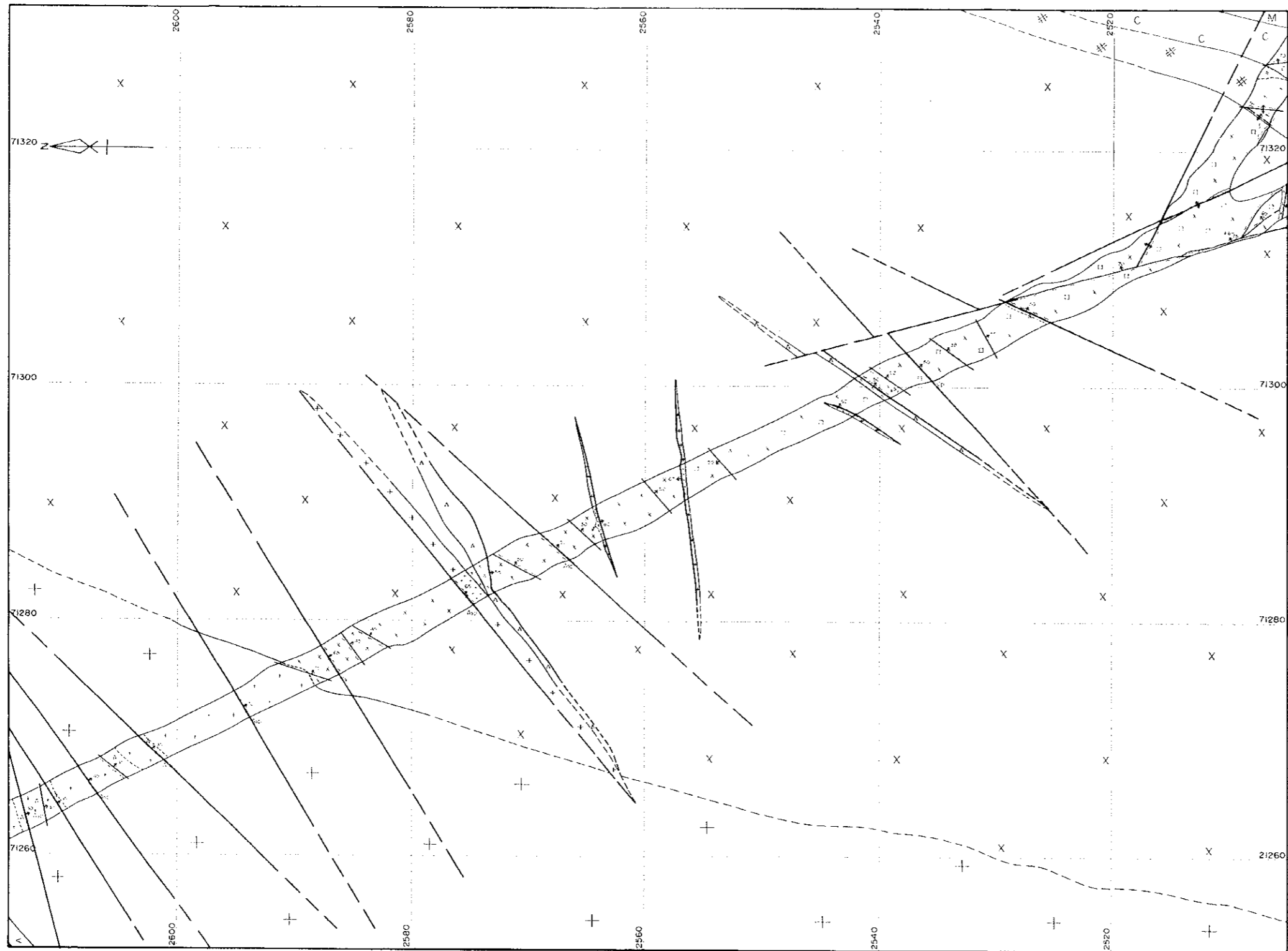
LEGEND

Host rocks	Others
□ granitoides	--- alteration boundary
× gabbroid	--- intrusive boundary
||||| (strong)	--- fault
||||| (medium)	--- shear joint
||||| (weak)	--- mine
□ marble	--- fault breccia
	--- shear joint zone
	--- channel sample location
Skarns	Veins
◆ garnet skarn	--- quartz vein
◆ pyroxene-garnet skarn (Ga<Ca)	--- calcite vein
◆ garnet-pyroxene skarn (Ga<Cpx)	--- quartz-calcite vein
◆ pyroxene skarn (medium grain)	
◆ pyroxene skarn (very fine grain)	Abbreviations
◆ pyroxene lng crystal	Asp anseroprite
◆ siliceous carbonate altered rock	Bn barite
◆ carbonate skarn	Cp chalcopyrite
◆ wollastonite skarn	Cpx chloroprosopite
◆ Ga Cpx Hb Bt band in marble	Cu copper green
	Ga garnet
	Mo molybdenite
	Mt magnetite
	Py pyrite
Mineralization & Alteration	Sample location
• silicification (strong)	• T3-163(P)
• argillization (weak)	T3 Tunnel I
• fine grain Py Asp band	T2 Tunnel II & Subtrack I
• dissemination of sulfide minerals	T3 Tunnel III
• limonite	C1 Subtrack II & Cross cut I
• carbonization	C2 Cross cut II
	R right wall
	L left wall
	F face
	FR right corner on a face
	FL left corner on a face
	G road
	T thin section
	P polished thin section
	X x-ray diffraction
	T filling temperature
	C EPMA
	M mineral separation test
	H distance of figure show
	H distance of locality
	on each tunnel segment



THE ALAY
 Geological





LEGEND

Alga Jyga intrusive rocks

- [+] granodiorite (282 ± 14Ma)

Permian - Carboniferous

- [X X] gabbroed floor wall
- [---] lamprophyre dike (289 ± 15Ma)
- [---] anorthosite dike
- [---] granodiorite porphyry dike

Devonian

- [M] crystalline limestone - longoz wall

Skarn

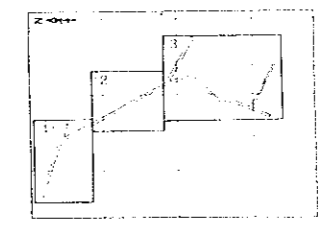
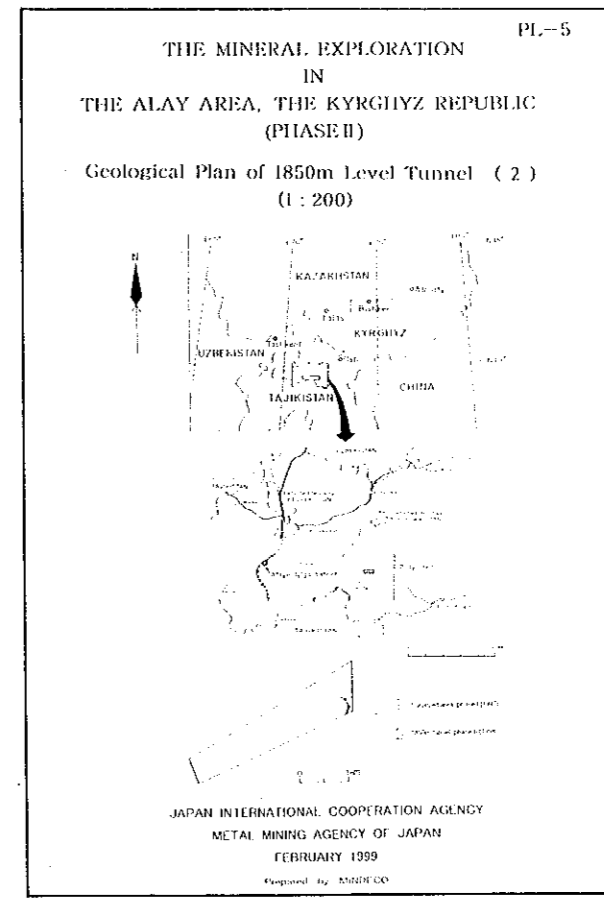
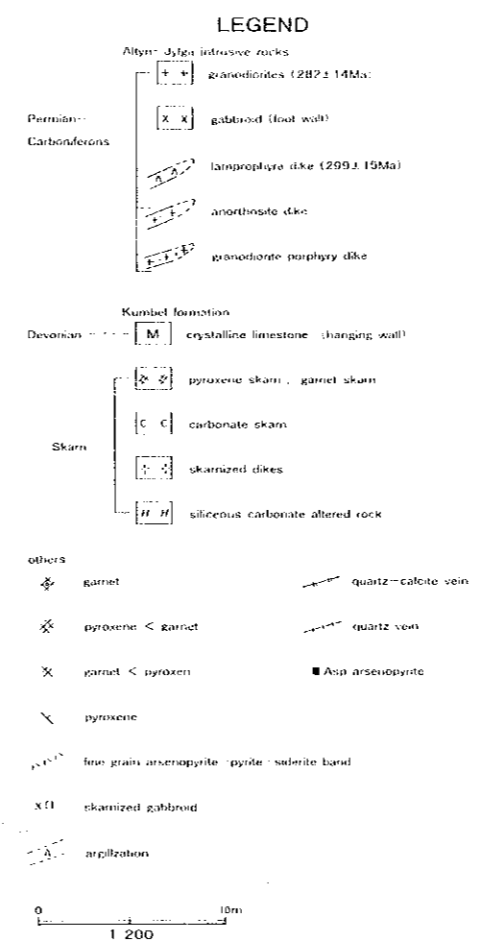
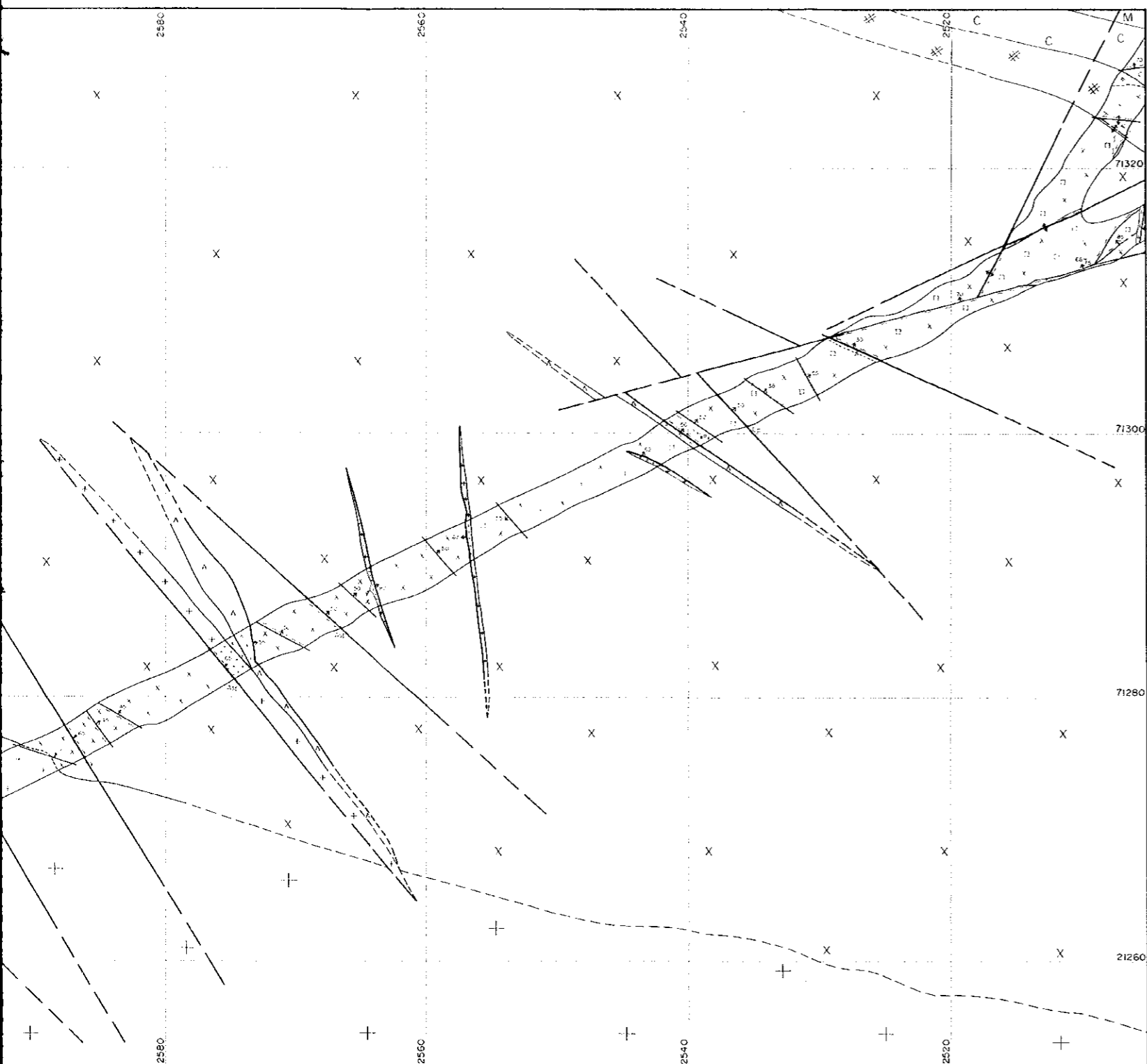
- [G G] pyroxene skarn - garnet skarn
- [C C] carbonate skarn
- [D D] dioritized dikes
- [H H] silicious carbonate altered rock

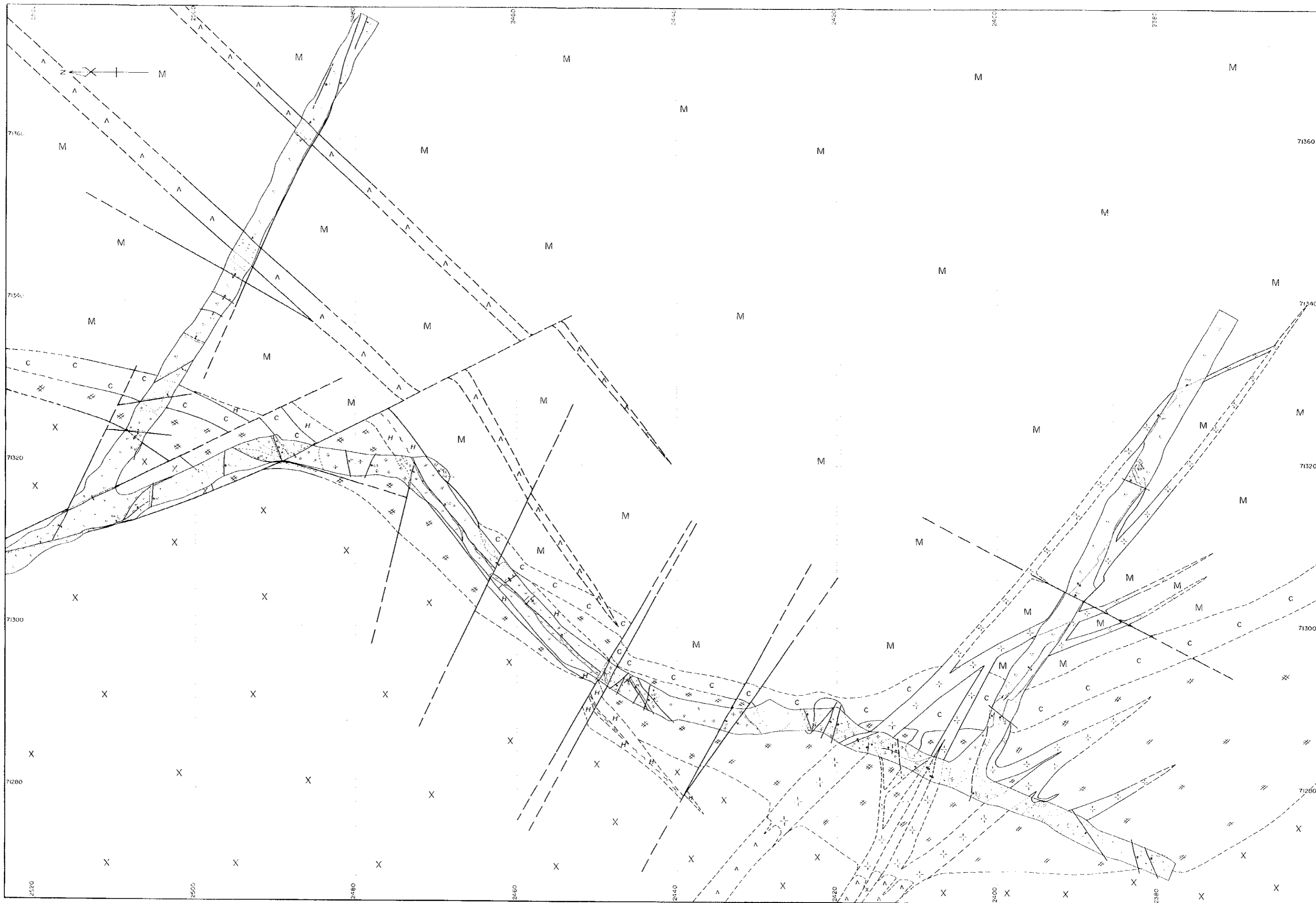
others

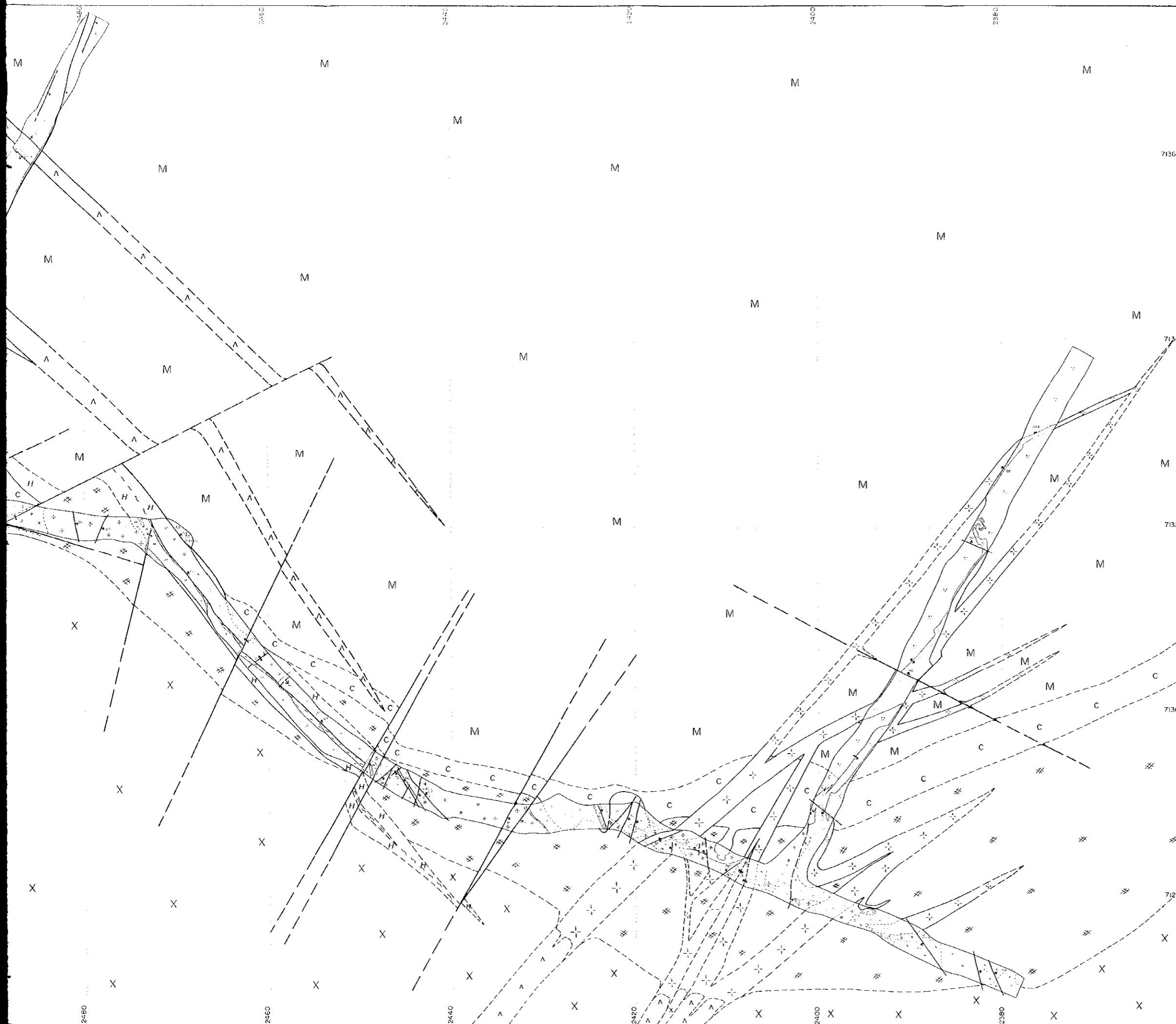
- [◇] garnet
- [✕] pyroxene < garnet
- [X] garnet < pyroxene
- [/] pyroxene
- [~] fine-grained actinolite - pyrite - siderite band
- [.] skarnized gabbro
- [---] argillization
- [---] quartz-tri-feldite vein
- [---] quartz vein
- [■] Asp. premonite

0 100m
1:200

THE AL
Geologic





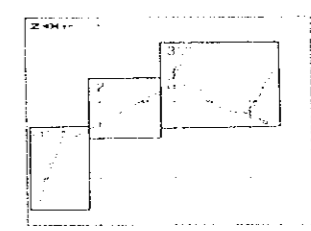


PL. 6

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 MMR&CO



LEGEND

Alay-type intrusive rocks

- [+ +] granodiorites (282 ± 14Ma)

Permian Carboniferous

- [x x] gabbroid (toot wall)
- [//] lamprophyre dike (260 ± 15Ma)
- [//] anorthosite dike
- [//] granularite porphyry dike

Kumbul formation

Devonian

- [M] crystalline limestone (changing wall)

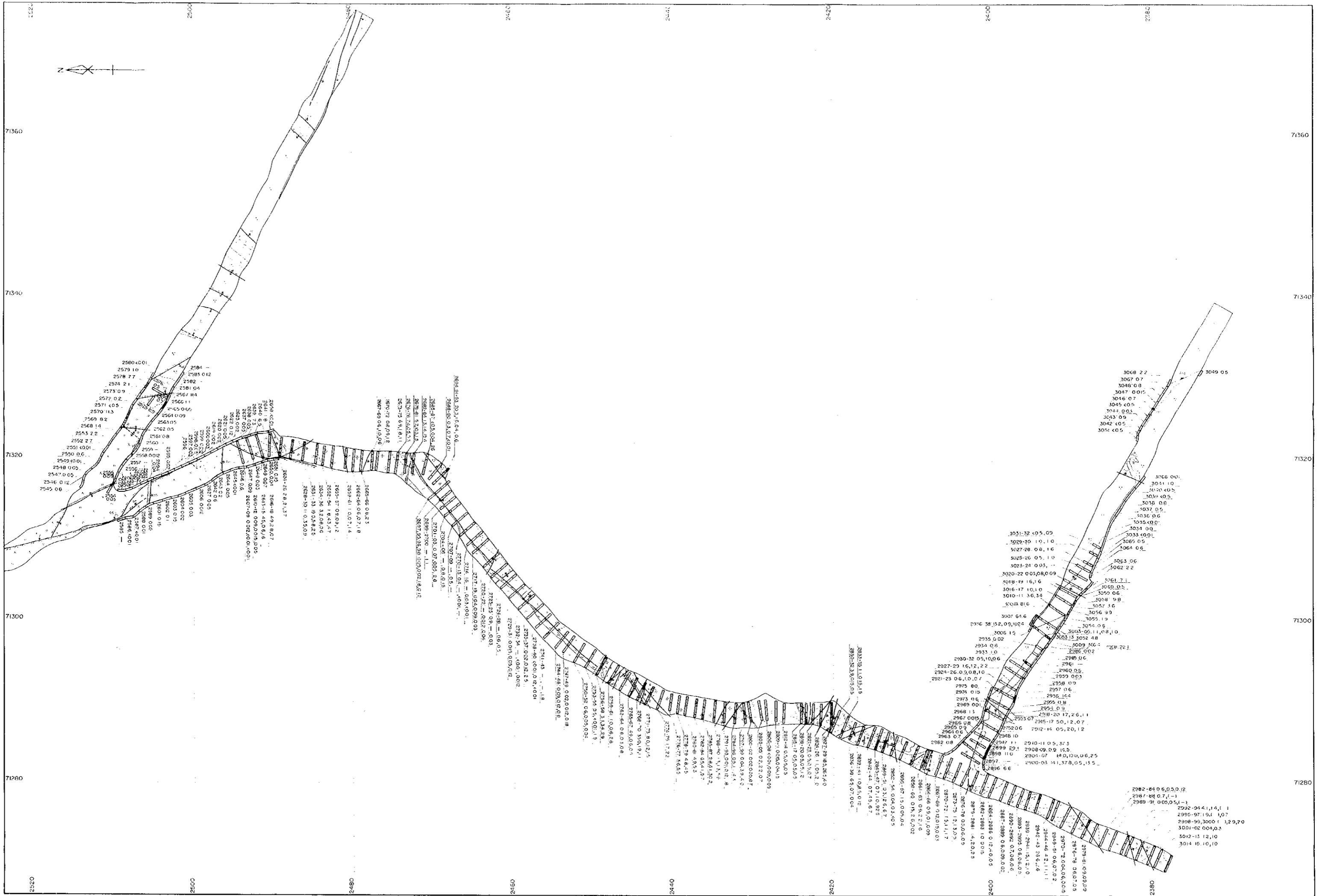
Skarn

- [◇] pyroxene skarn, garnet skarn
- [C] calcic skarn
- [//] sheared dikes
- [H] siliceous carbonate altered rock

others

- [◇] garnet
- [◇] pyroxene < garnet
- [x] garnet < pyroxene
- [x] pyroxene
- [◇] fine grain arsenopyrite, pyrite-sulphide band
- [x] sheared gabbroid
- [//] upliftation
- [//] quartz-calcite vein
- [//] quartz vein
- [■] Al₂SiO₅ arsenopyrite

0 10m
1 : 200



71360

71340

71320

71300

71280

2452

2500

2480

2460

2440

2420

2400

2380

71360

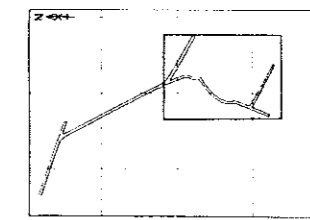
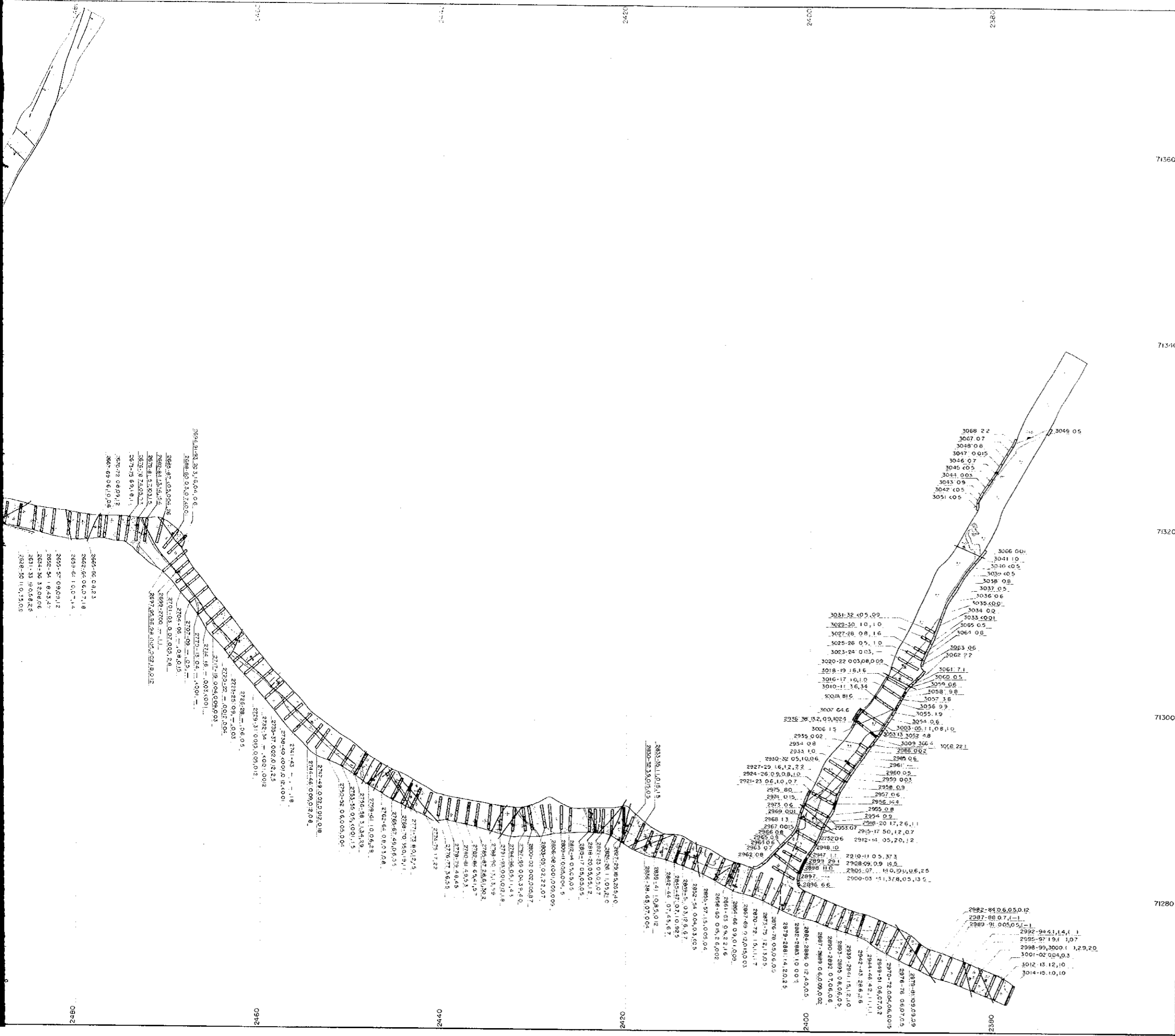
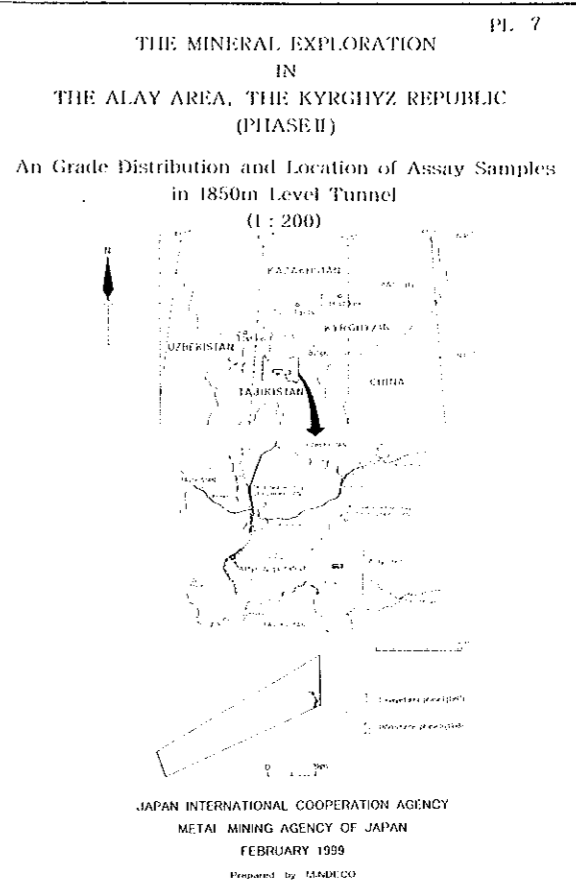
71340

71320

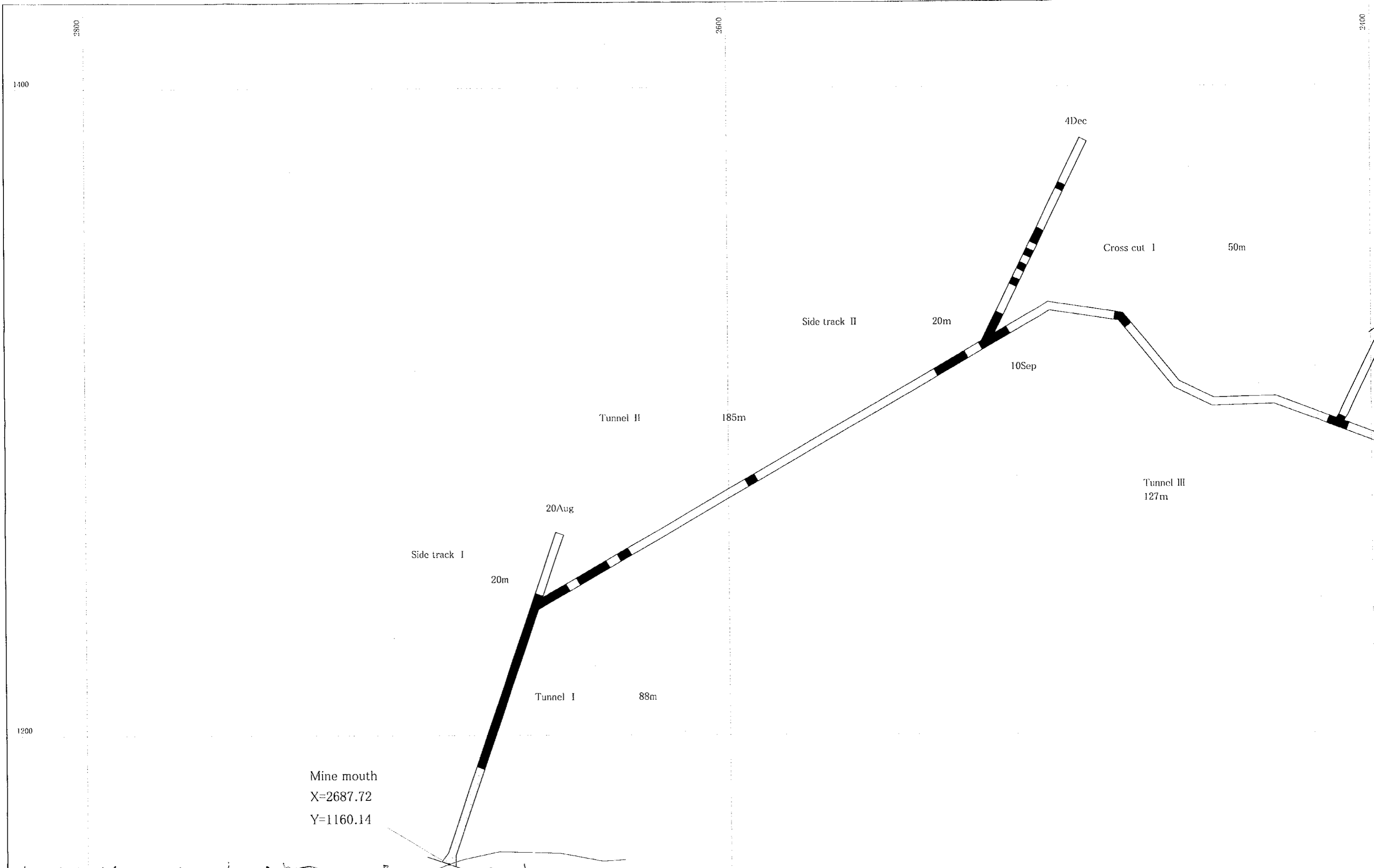
71300

71280

2400



- ### LEGEND
- Sample Location
- 350.57 105.60 38
- Au grade (g/t)
sample number
- Channel sample location
- 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
- 70 fault
 - shear zone with gouge
 - fault breccia
 - quartz calcite vein
 - quartz vein
 - fine grained arsenopyrite pyrite and siderite bed
 - skarnized gabbro
- 1:200



Mine mouth
X=2687.72
Y=1160.14

Side track I

20m

20Aug

Tunnel I 88m

Tunnel II 185m

Side track II

20m

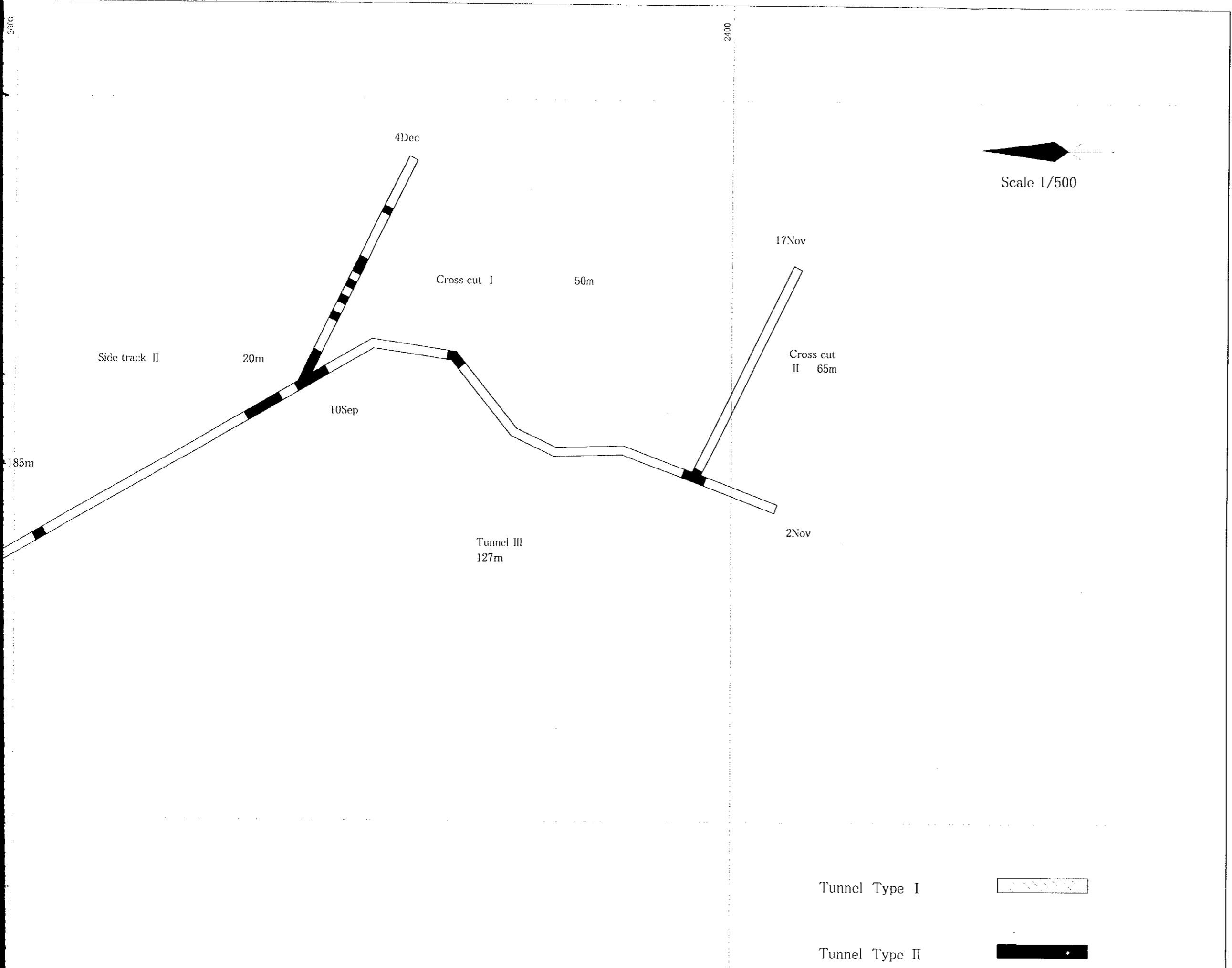
10Sep

Cross cut 1

50m

Tunnel III
127m

4Dec



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 MINDECO

