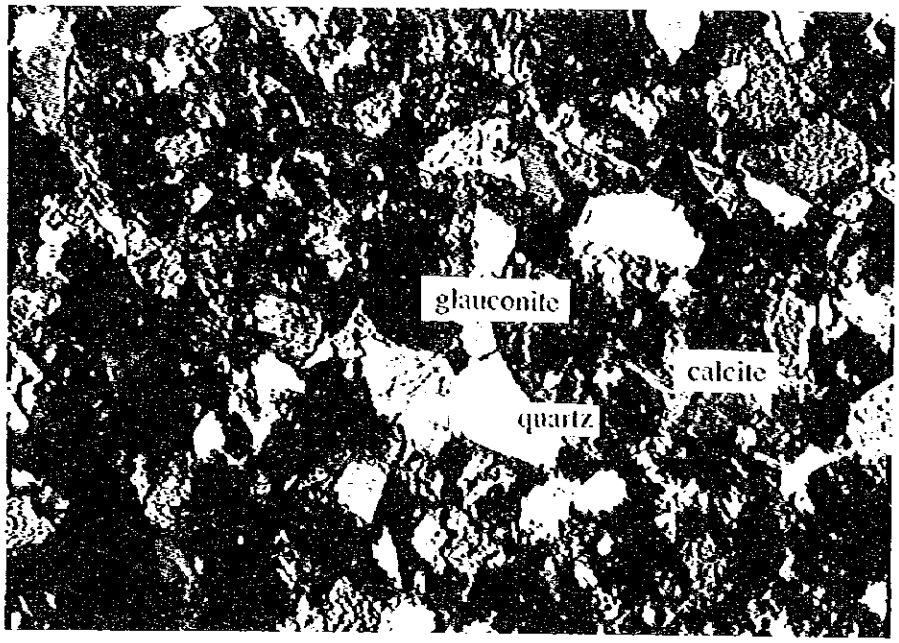
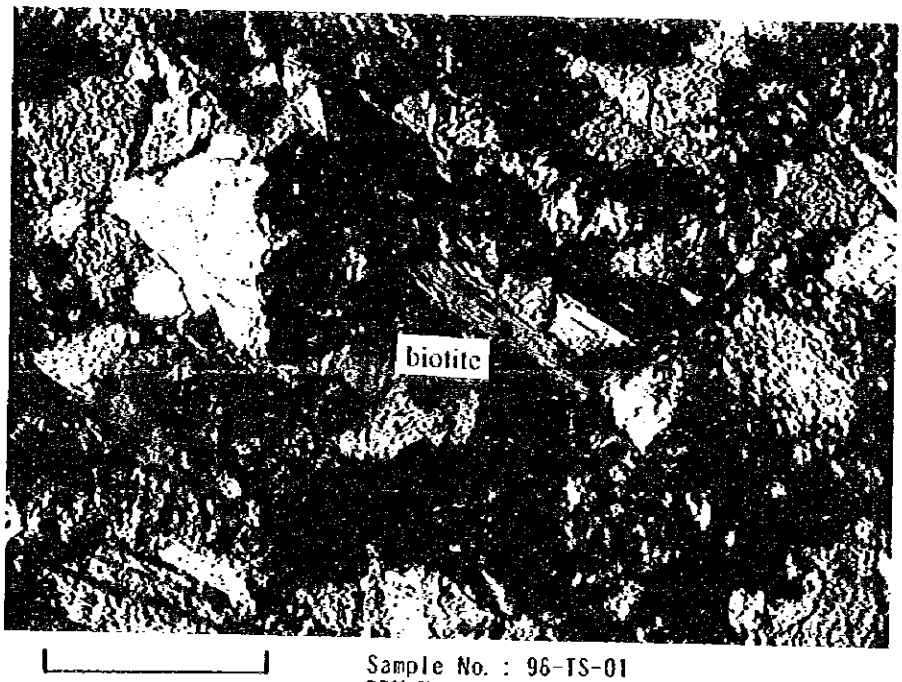


0.5 mm

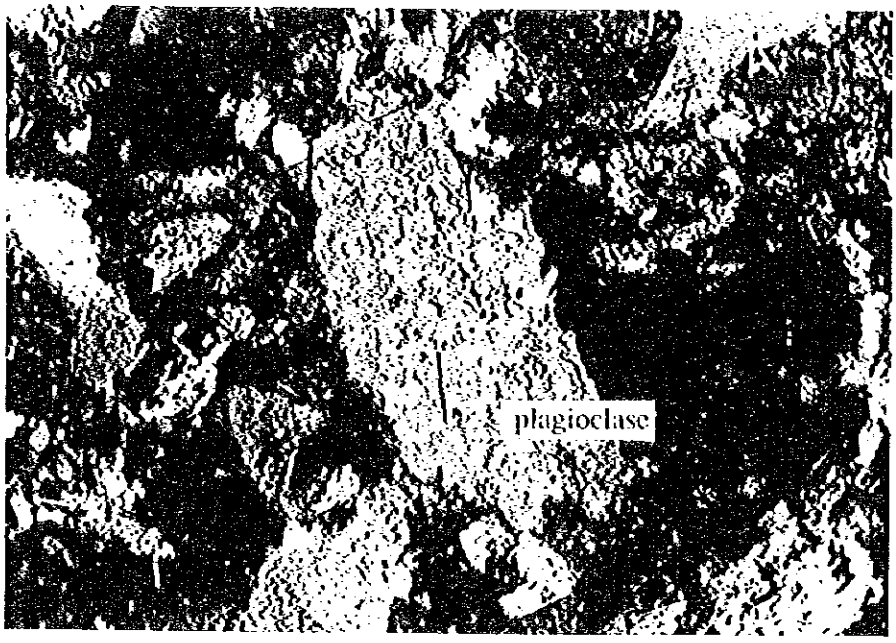
Sample No. : 96-TS-01
DDH No. : MJK-2
Depth : 608.10m
Formation : Zhezkazgan
Rock Name : Medium grained sandstone



0.25 mm

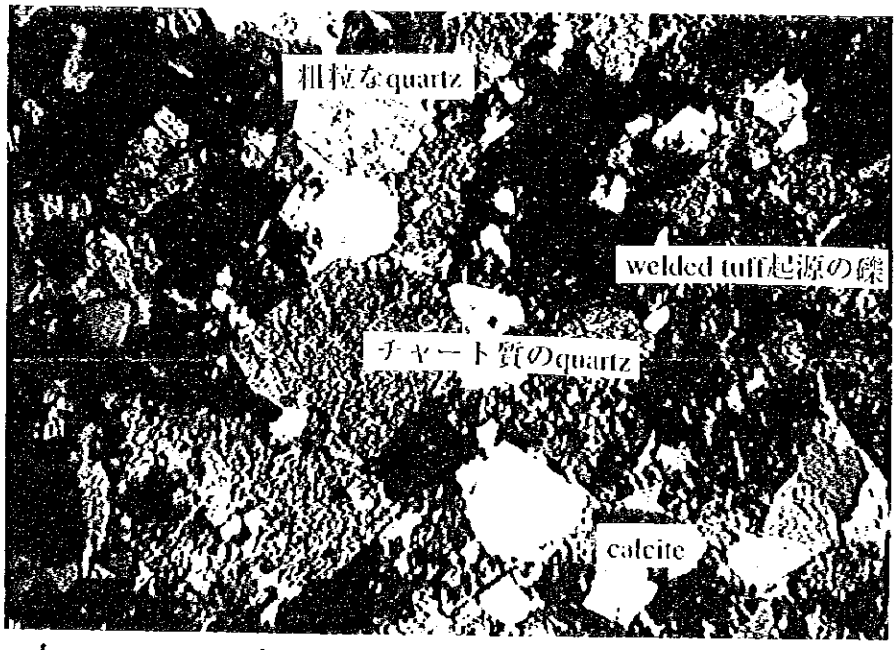
Sample No. : 96-TS-01
DDH No. : MJK-2
Depth : 608.10m
Formation : Zhezkazgan
Rock Name : Medium grained sandstone

Appendix 29 Photomicrographs of Minerals in Thin Sections from the Drill Hole "MJK-2", the Zhaman-Aibat Ore Deposit (1/4)



0.25 mm

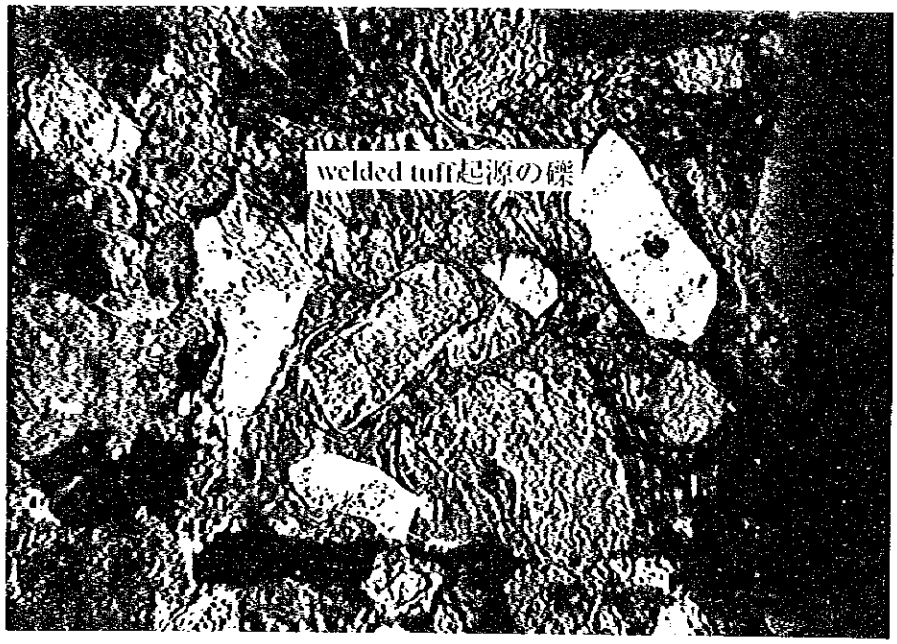
Sample No. :96-TS-02
DDH No. :MJK-2
Depth :608.88m
Formation :Zhezkazgan
Rock Name :Fine grained sandstone



1.25 mm

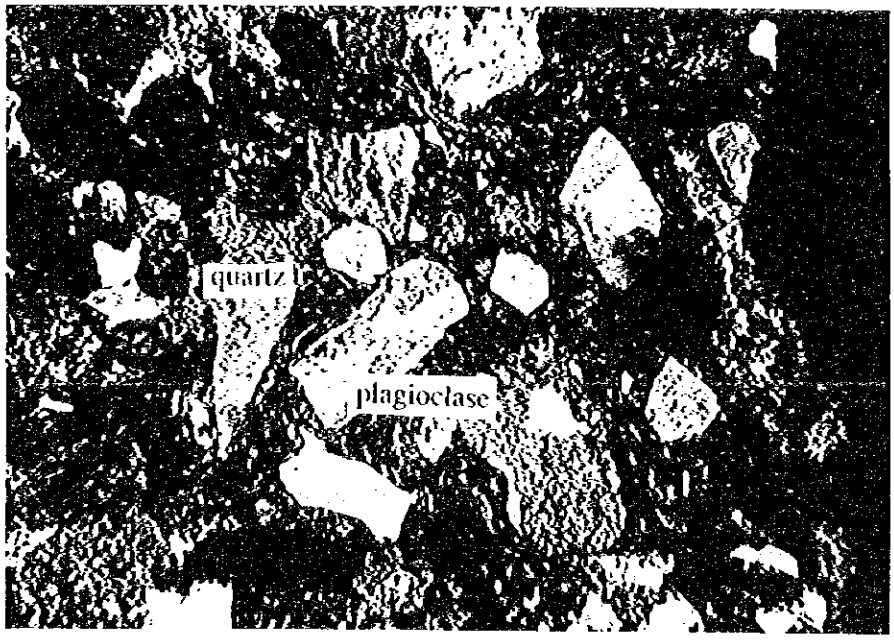
Sample No. :96-TS-03
DDH No. :MJK-2
Depth :609.32m
Formation :Zhezkazgan
Rock Name :Coarse grained sandstone

Appendix 29 Photomicrographs of Minerals in Thin Sections from the Drill Hole "MJK-2", the Zhaman-Aibat Ore Deposit (2/4)



1.25 mm

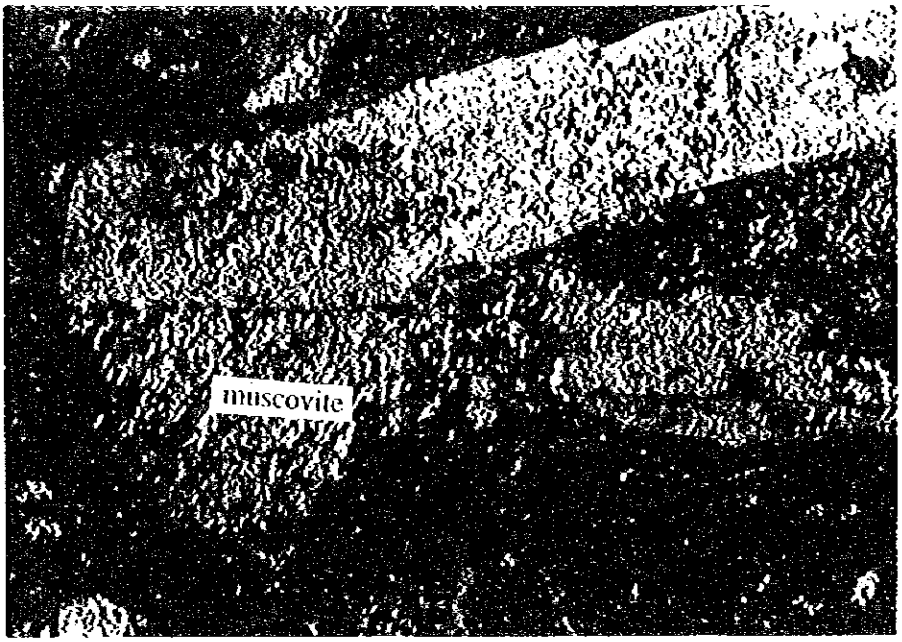
Sample No. :96-TS-08
DDH No. :MJK-2
Depth :613.50m
Formation :Zhezkazgan
Rock Name :Very coarse grained sandstone



1.25 mm

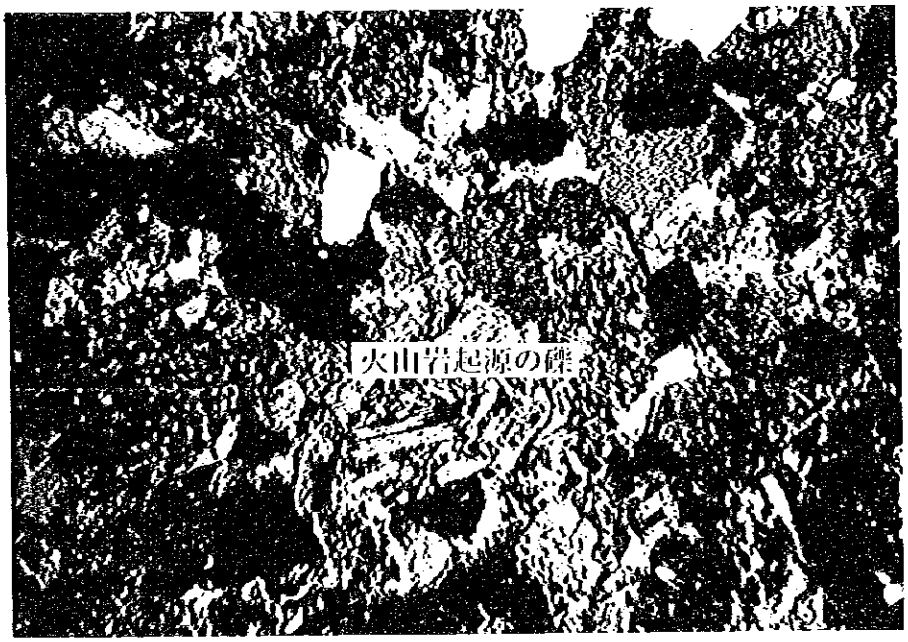
Sample No. :96-TS-08
DDH No. :MJK-2
Depth :613.50m
Formation :Zhezkazgan
Rock Name :Very coarse grained sandstone

Appendix 29 Photomicrographs of Minerals in Thin Sections from the Drill Hole "MJK-2", the Zhaman-Aibat Ore Deposit (3/4)



0.25 mm

Sample No. :96-TS-08
DDH No. :MJK-2
Depth :613.50m
Formation :Zhezkazgan
Rock Name :Very coarse grained sandstone



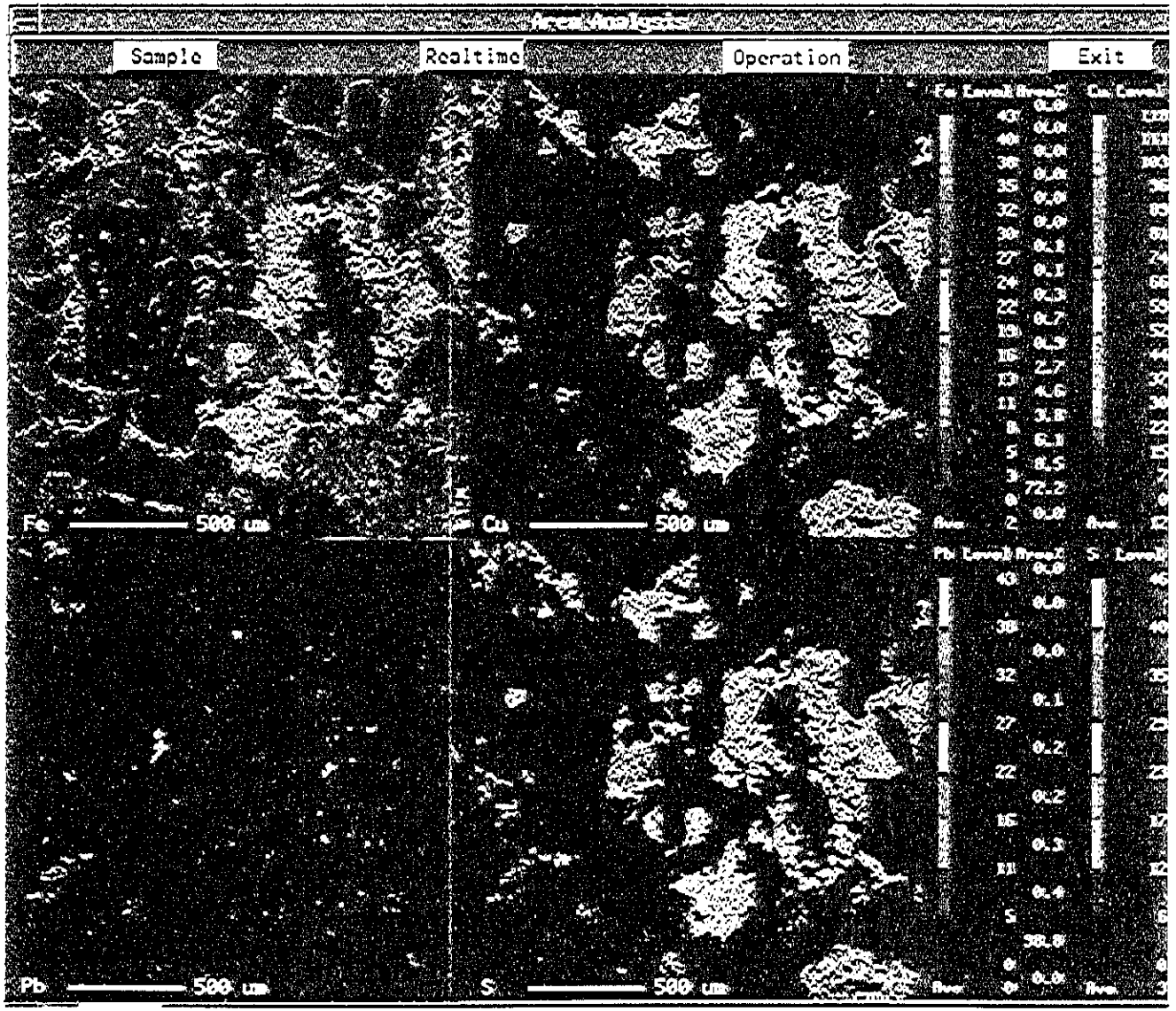
1.25 mm

Sample No. :96-TS-08
DDH No. :MJK-2
Depth :613.50m
Formation :Zhezkazgan
Rock Name :Very coarse grained sandstone

Appendix 29 Photomicrographs of Minerals in Thin Sections from the Drill Hole "MJK-2", the Zhaman-Aibat Ore Deposit (4/4)

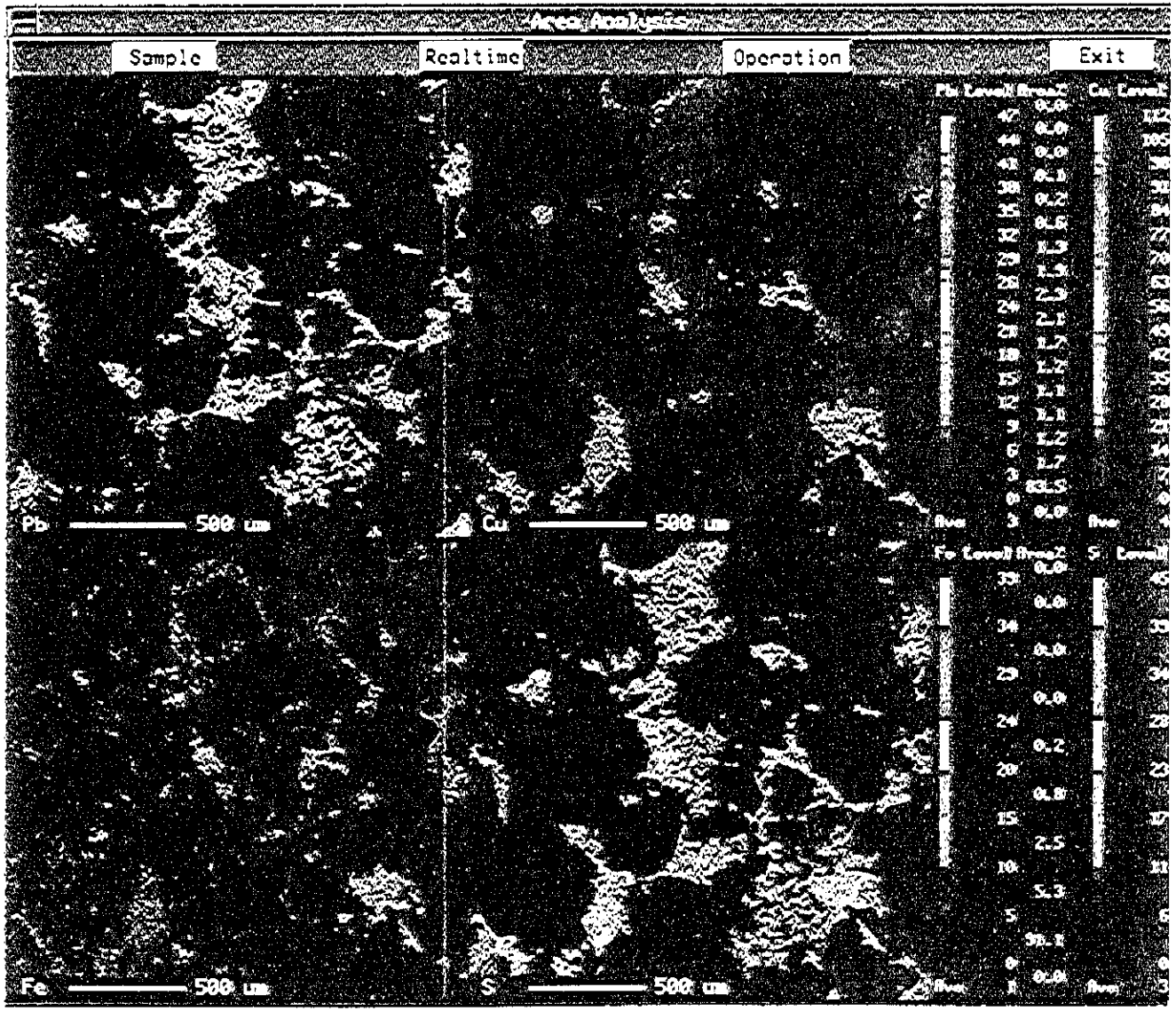
Appendix 30 EPMA Quantitative Analysis of Ore Samples from the Drill Hole "MJK-2", the Zhaman-Aibat Ore Deposit

Sample	Mineral	wt (%)							Atomic ratio					
		S	Ag	Zn	Cu	Fe	Pb	Total	S	Ag	Zn	Cu	Fe	Pb
96-PS-04	Chalcocite	22.04	0.00	0.18	78.45	0.02	0.06	100.75	35.7	0.0	0.1	64.1	0.0	0.0
96-PS-04	Bornite	25.69	0.02	0.00	64.09	10.76	0.00	100.56	40.0	0.0	0.0	50.4	9.6	0.0
96-PS-04	Bornite	26.00	0.06	0.14	63.34	11.37	0.04	100.94	40.3	0.0	0.1	49.5	10.1	0.0
96-PS-04	Galena	13.50	0.00	0.00	0.75	0.19	86.95	101.39	49.2	0.0	0.0	1.4	0.4	49.0
96-PS-05	Chalcocite	23.47	0.08	0.00	77.67	0.45	0.00	101.67	37.3	0.0	0.0	62.3	0.4	0.0
96-PS-05	Bornite	26.16	0.05	0.02	63.87	11.30	0.03	101.43	40.3	0.0	0.0	49.7	10.0	0.0
96-PS-05	Galena	13.65	0.01	0.05	0.88	0.00	86.07	100.65	49.7	0.0	0.1	1.6	0.0	48.5
96-PS-05	Galena	13.69	0.00	0.00	1.01	0.00	85.01	99.70	50.0	0.0	0.0	1.9	0.0	48.1
96-PS-05	Galena	13.79	0.00	0.13	0.55	0.04	85.30	99.81	50.4	0.0	0.2	1.0	0.1	48.3
96-PS-09	Chalcocite	21.46	0.02	0.12	78.90	0.03	0.00	100.53	35.0	0.0	0.1	64.9	0.0	0.0
96-PS-09	Galena	21.24	0.02	0.08	77.71	0.30	0.00	99.34	35.0	0.0	0.1	64.6	0.3	0.0
96-PS-09	Bornite	26.03	0.00	0.01	63.76	10.66	0.06	100.51	40.5	0.0	0.0	50.0	9.5	0.0
96-PS-09	Bornite	25.95	0.12	0.03	63.68	10.74	0.00	100.52	40.4	0.1	0.0	50.0	9.6	0.0



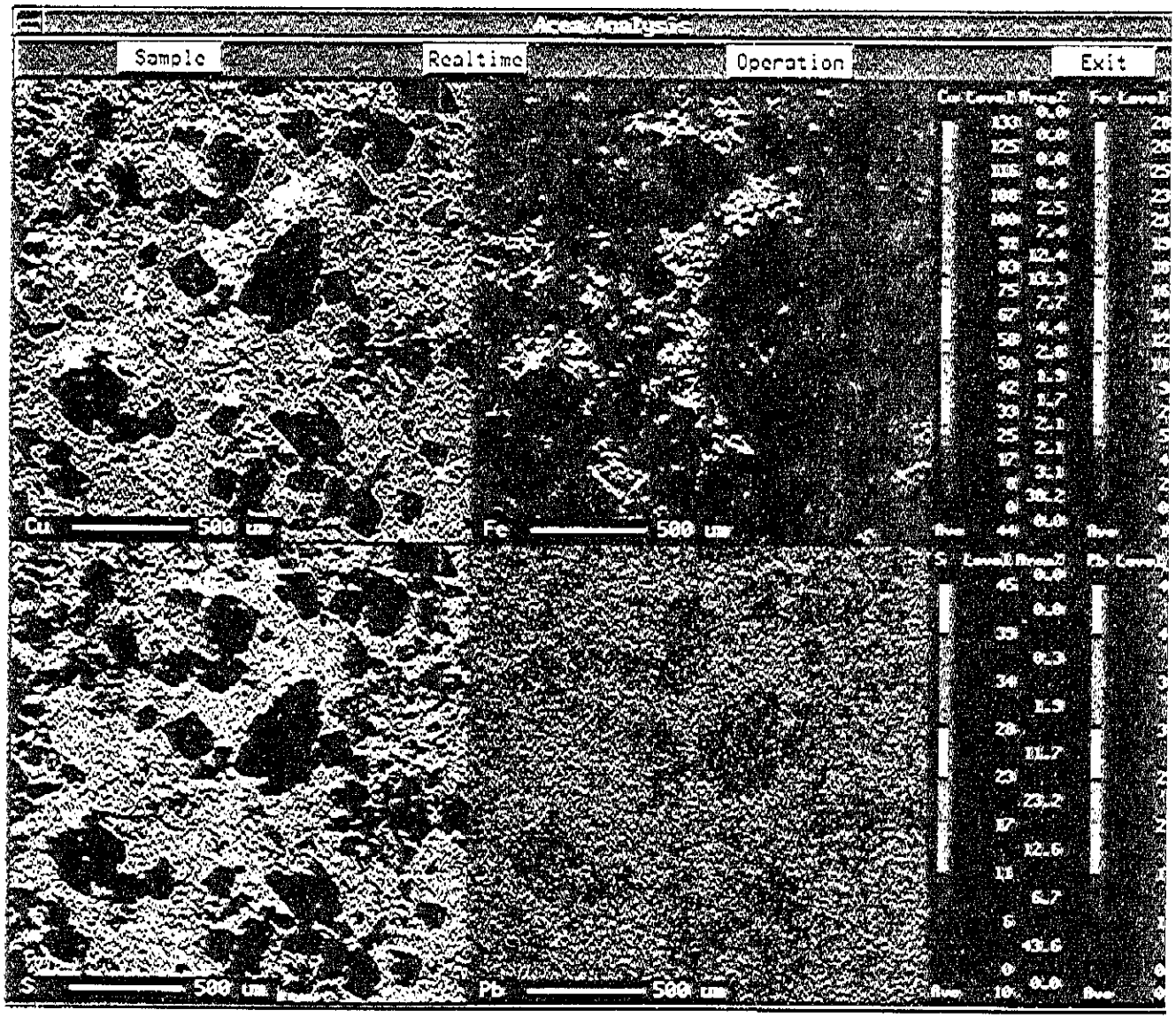
Sample No. : 96-PS-04
Location : Central Orebody
DDH : MJK-2
Depth : 609.32m
Ore Type : Complex Ore
Minerals :
Cc : Chalcocite like minerals
Bn : Bornite
Gn : Galena

Appendix 31 EPMA Color Image of Complex Ore
from the Central Orebody of the Zhaman-Aibat Ore Deposit (1/3)



Sample No. : 96-PS-05
Location : Central Orebody
DDH : MJK-2
Depth : 609.60m
Ore Type : Complex Ore
Minerals :
Cc : Chalcocite like minerals
Bn : Bornite
Gn : Galena

Appendix 31 EPMA Color Image of Complex Ore
from the Central Orebody of the Zhaman-Aibat Ore Deposit (2/3)



Sample No. : 96-PS-09
Location : Central Orebody
DDH : MJK-2
Depth : 612.30m
Ore Type : Complex Ore
Minerals :
Cc : Chalcocite like minerals
Bn : Bornite
Gn : Galena

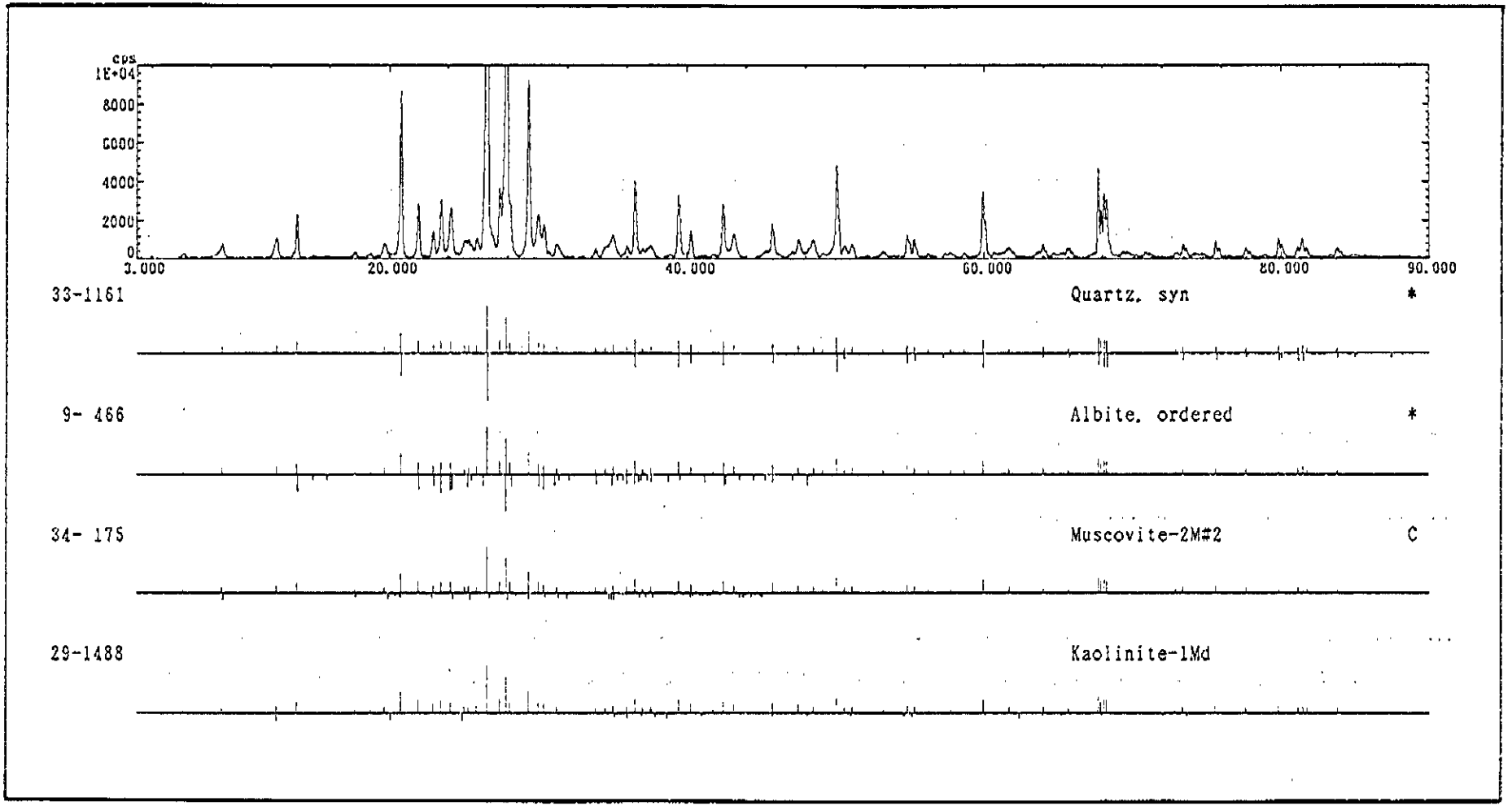
Appendix 31 EPMA Color Image of Complex Ore
from the Central Orebody of the Zhaman-Aibat Ore Deposit (3/3)

Appendix 32 Results of X-ray Deffraction Test of Rock Samples from the Drill Hole "MJK-2", Zhaman-Albat Ore Deposit

Sample No.	Drill No.	Depth (m)	Location	Remarks	Qz	Fd	Cal	Ser	Cc	Bn	Cp	Gn	Py	Go
96-X-01	MJK-2	608.10	Central Orebody	This sample is same sample of polished section "96-PS-01" Cu grade : 0.11% Pb grade : 2.00%	◎	○	○	○	+	?	+	○	+	+
96-X-03	MJK-2	608.88	Central Orebody	This sample is same sample of polished section "96-PS-03" Cu grade : 1.02% Pb grade : 1.42%	◎	◎	○	○				○	△	+
96-X-04	MJK-2	609.32	Central Orebody	This sample is same sample of polished section "96-PS-04" Cu grade : 6.20% Pb grade : 15.30%	◎	+	△	△	△	○		△		
96-X-06	MJK-2	610.20	Central Orebody	This sample is same sample of polished section "96-PS-06" Cu grade : 10.90% Pb grade : 16.00%	◎	+	○	+	△	○		+		
96-X-13	MJK-2	630.50	Central Orebody	This sample is same sample of polished section "96-PS-13" Cu grade : 1.03% Pb grade : 0.01%	◎	○	△	△	△					△

Qz: Quartz, Fd: Feldspar, Cal: Calcite, Ser: Sericite, Cc: Chalcocite like minerals, Bn: Bornite, Cp: Chalcopyrite, Gn: Galena,, Py: Pyrite, Go: Goethite
◎: abundant, ○: Common △: Rare, +: very rare

Appendix 33 X-ray Diffraction Tests of Feed Ore from the Drill Hole "MJK-1", the Zhaman-Aibat Ore Deposit



Appendix 34 Griding Tests of the Complex Ore from the Drill Hole "MJK-1", the Zhanan-Aibat Ore Deposit

Test No. 5+5 Grind

	Products	Weight (g)	Weight (%)	Assay (%) Cu	Pb	S	Distribution (%) Cu	Pb	S
	Feed	494.2	100.00	1.72	0.52	1.01	100.00	100.00	100.00
1	+149μm	71.9	14.55	1.08	0.21	0.58	9.14	5.89	8.34
2	+105μm	104.4	21.13	1.20	0.25	0.72	14.75	10.19	15.03
3	+ 75μm	82.1	16.61	1.69	0.36	0.98	16.33	11.53	16.09
4	+ 45μm	64.2	12.99	2.22	0.54	1.19	16.78	13.53	15.28
5	+ 20μm	63.8	12.91	2.92	0.86	1.62	21.93	21.41	20.67
6	- 20μm	107.8	21.81	1.66	0.89	1.14	21.07	37.45	24.59
	1+2	176.3	35.68	1.15	0.23	0.66	23.89	16.08	23.37
	1+2+3	258.4	52.29	1.32	0.27	0.76	40.22	27.61	39.46
	1+2+3+4	322.6	65.28	1.50	0.33	0.85	57.00	41.14	54.74
	1+2+3+4+5	386.4	78.19	1.74	0.41	0.98	78.93	62.55	75.41
	5+6	171.6	34.72	2.13	0.88	1.32	43.00	58.86	45.26
	4+5+6	235.8	47.71	2.15	0.79	1.28	59.78	72.39	60.54
	3+4+5+6	317.9	64.32	2.03	0.68	1.21	76.11	83.92	76.63
	2+3+4+5+6	422.3	85.45	1.83	0.57	1.09	90.86	94.11	91.66

Test No. 7.5+7.5 Grind

	Products	Weight (g)	Weight (%)	Assay (%) Cu	Pb	S	Distribution (%) Cu	Pb	S
	Feed	464.1	100.00	1.70	0.52	1.04	100.00	100.00	100.00
1	+149μm	18.0	3.88	0.68	0.15	0.40	1.55	1.11	1.50
2	+105μm	63.3	13.64	0.77	0.18	0.48	6.17	4.69	6.32
3	+ 75μm	94.8	20.43	1.26	0.30	0.84	15.12	11.71	16.58
4	+ 45μm	89.9	19.37	1.89	0.45	1.15	21.50	16.66	21.52
5	+ 20μm	90.3	19.46	2.71	0.72	1.54	30.97	26.77	28.95
6	- 20μm	107.8	23.22	1.81	0.88	1.12	24.69	39.06	25.13
	1+2	81.3	17.52	0.75	0.17	0.46	7.72	5.80	7.82
	1+2+3	176.1	37.95	1.02	0.24	0.67	22.84	17.51	24.40
	1+2+3+4	266.0	57.32	1.32	0.31	0.83	44.34	34.17	45.92
	1+2+3+4+5	356.3	76.78	1.67	0.42	1.01	75.31	60.94	74.87
	5+6	198.1	42.68	2.22	0.81	1.31	55.66	65.83	54.08
	4+5+6	288.0	62.05	2.12	0.70	1.26	77.16	82.49	75.60
	3+4+5+6	382.8	82.48	1.90	0.60	1.16	92.28	94.20	92.18
	2+3+4+5+6	446.1	96.12	1.74	0.54	1.06	98.45	98.89	98.50

Test No. 10+10 Grind

	Products	Weight (g)	Weight (%)	Assay (%) Cu	Pb	S	Distribution (%) Cu	Pb	S
	Feed	495.3	100.00	1.74	0.54	0.98	100.00	100.00	100.00
1	+105μm	32.8	6.62	0.57	0.12	0.38	2.16	1.48	2.57
2	+ 75μm	68.7	13.87	0.90	0.19	0.56	7.16	4.90	7.93
3	+ 45μm	116.6	23.54	1.57	0.34	0.88	21.19	14.87	21.16
4	+ 20μm	114.6	23.14	2.60	0.64	1.36	34.49	27.51	32.13
5	- 20μm	162.6	32.83	1.86	0.84	1.08	35.00	51.24	36.21
	1+2	101.5	20.49	0.79	0.17	0.50	9.32	6.38	10.50
	1+2+3	218.1	44.03	1.21	0.26	0.70	30.51	21.25	31.66
	1+2+3+4	332.7	67.17	1.69	0.39	0.93	65.00	48.76	63.79
	4+5	277.2	55.97	2.17	0.76	1.20	69.49	78.75	68.34
	3+4+5	393.8	79.51	1.99	0.63	1.10	90.68	93.62	89.50
	2+3+4+5	462.5	93.38	1.83	0.57	1.02	97.84	98.52	97.43

Appendix 35 Screen Analysis of Tailing of the Complex Ore from the Drill Hole "MJK-1", the Zhanan-Aibat Ore Deposit

Test No. KS-1 Tail

	Products	Weight (g)	Weight (%)	Assay (%) Cu	Pb	Distribution (%) Cu	Pb
	Feed	431.0	100.00	0.20	0.05	100.00	100.00
1	+149μm	66.4	15.41	0.47	0.11	37.03	34.30
2	+105μm	95.0	22.03	0.26	0.06	29.30	26.78
3	+ 75μm	71.3	16.54	0.17	0.04	14.38	13.40
4	+ 45μm	59.6	13.83	0.11	0.03	7.78	8.40
5	+ 20μm	51.7	12.00	0.07	0.02	4.29	4.86
6	- 20μm	87.0	20.19	0.07	0.03	7.22	12.26
	1+2	161.4	37.44	0.35	0.08	66.33	61.08
	1+2+3	232.7	53.98	0.29	0.07	80.71	74.48
	1+2+3+4	292.3	67.81	0.26	0.06	88.49	82.88
	1+2+3+4+5	344	79.81	0.23	0.05	92.78	87.74
	5+6	138.7	32.19	0.07	0.03	11.51	17.12
	4+5+6	198.3	46.02	0.08	0.03	19.29	25.52
	3+4+5+6	269.6	62.56	0.11	0.03	33.67	38.92
	2+3+4+5+6	364.6	84.59	0.15	0.04	62.97	65.70

Test No. KS-2 Tail

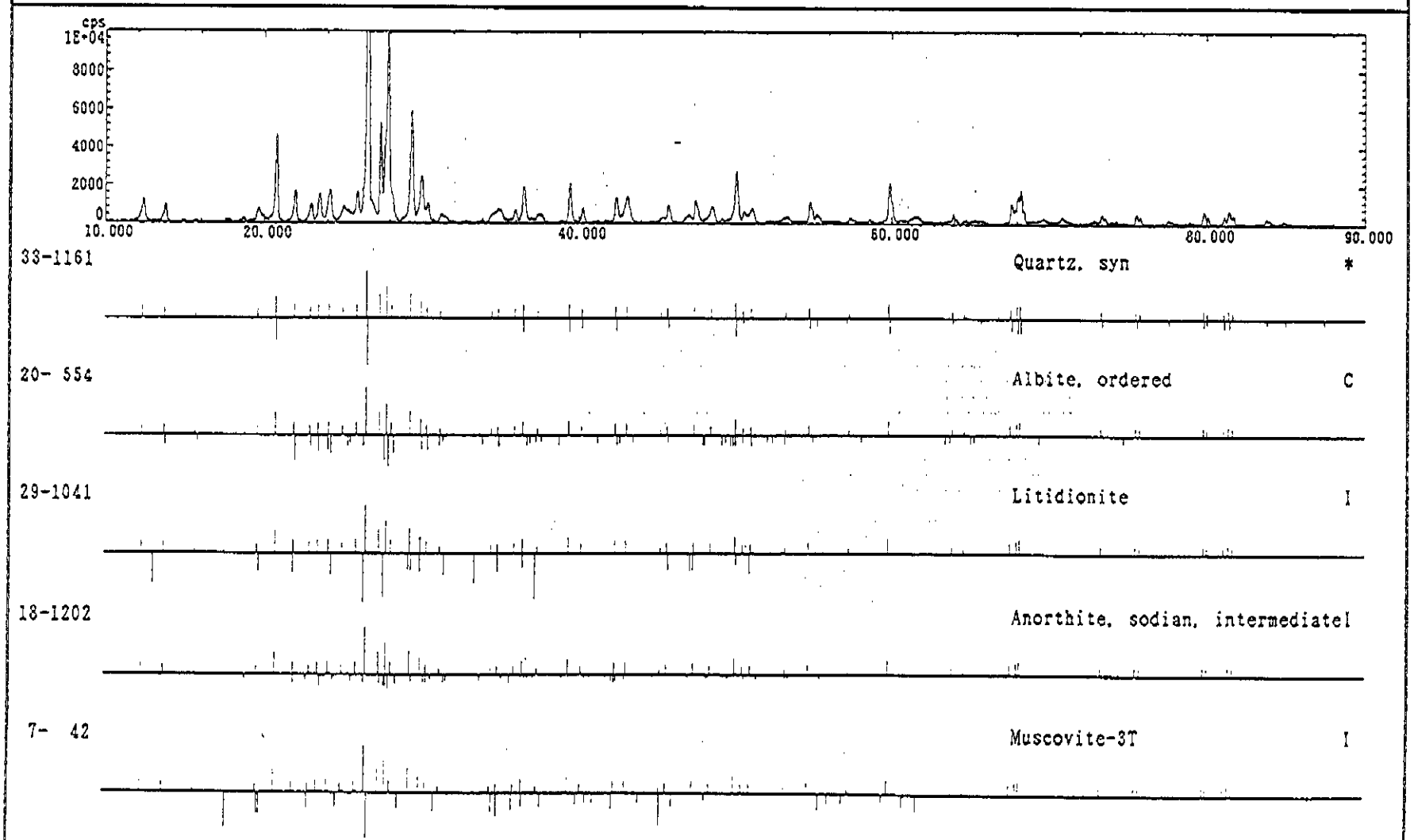
	Products	Weight (g)	Weight (%)	Assay (%) Cu	Pb	Distribution (%) Cu	Pb
	Feed	419.9	100.00	0.10	0.03	100.00	100.00
1	+149μm	13.7	3.26	0.30	0.11	9.41	10.39
2	+105μm	56.7	13.50	0.19	0.06	24.67	23.45
3	+ 75μm	86.5	20.60	0.12	0.04	23.77	23.85
4	+ 45μm	87.6	20.86	0.09	0.03	18.05	18.12
5	+ 20μm	75.6	18.00	0.06	0.02	10.39	10.42
6	- 20μm	99.8	23.78	0.06	0.02	13.71	13.76
	1+2	70.4	16.76	0.21	0.07	34.08	33.84
	1+2+3	156.9	37.36	0.16	0.05	57.85	57.70
	1+2+3+4	244.5	58.22	0.14	0.04	75.90	75.82
	1+2+3+4+5	320.1	76.22	0.12	0.04	86.29	86.24
	5+6	175.4	41.78	0.06	0.02	24.10	24.18
	4+5+6	263.0	62.64	0.07	0.02	42.15	42.30
	3+4+5+6	349.5	83.24	0.08	0.03	65.92	66.16
	2+3+4+5+6	406.2	96.74	0.10	0.03	90.59	89.61

Test No. KS-3 Tail

	Products	Weight (g)	Weight (%)	Assay (%) Cu	Pb	Distribution (%) Cu	Pb
	Feed	420.1	100.00	0.08	0.03	100.00	100.00
1	+105μm	23.8	5.67	0.17	0.07	12.30	13.84
2	+ 75μm	68.7	16.35	0.12	0.04	25.07	22.82
3	+ 45μm	107.4	25.57	0.08	0.03	26.13	26.77
4	+ 20μm	99.6	23.71	0.06	0.02	18.17	16.54
5	- 20μm	120.6	28.70	0.05	0.02	18.33	20.03
6							
	1+2	92.5	22.02	0.13	0.05	37.37	36.66
	1+2+3	199.9	47.59	0.10	0.04	63.50	63.43
	1+2+3+4	299.5	71.30	0.09	0.03	81.67	79.97
	4+5	220.2	52.41	0.05	0.02	36.50	36.57
	3+4+5	327.6	77.98	0.06	0.02	62.63	63.34
	2+3+4+5	396.3	94.33	0.07	0.03	87.70	86.16

Appendix 36 X-Ray Diffraction Test of Feed Ore from the Drill Hole "MJK-2"

ｻﾝﾌﾟﾙ名 : USA80119 宮下　　ｺﾒﾝﾄ : カザフ鉱石　　平滑化点数 : 11　　Kα2除去 :
ﾌｧｲﾙ名 : 1)原鉱　　ﾊﾞｯｸｸﾞﾗﾝﾄﾞ除去: 実行　　系統誤差補正 :



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Appendix 37-1(1) Grindability Work Index Measurement

Sample

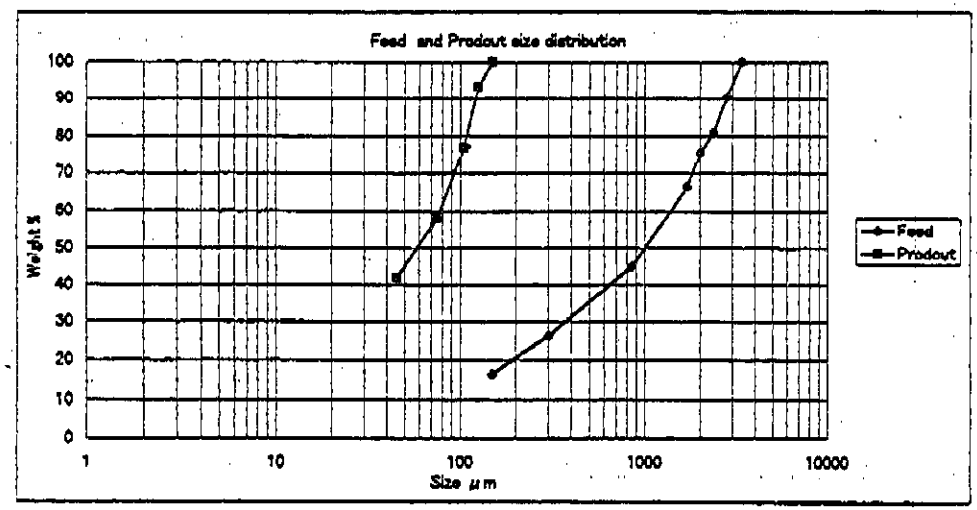
Wa= 1308.3 Ua= 0.1648 P1= 149 μm
F80= 2284 μm P80= 108 μm
Wi= 13.2 kWh/t

(0) Test No.	(1) ミルの回転数 N	(2) P1網上生成量 A (g)	(3) 新給鉱添加量 W-A (g)	(4) 粉砕前P1網下量 (3)×U (g)	(5) 粉砕後P1網下生成量 (3)−(4)(g)	(6) 目標生成量 (g) W/3.5−(4)'	(7) 循環率 (%) (2)/(3)	(8) Gbp (5)/(1)	(9) 予想回転数 (6)/(8)
1	150	896.1	410.2	215.6	194.6	306.2	218.9	1.297	236
2	236	883.2	425.1	67.6	357.5	303.7	207.8	1.515	200
3	200	908.4	399.9	70.1	329.8	307.9	227.2	1.649	187
4	187	925.3	383.0	65.9	317.1	310.7	241.6	1.696	183
5	183	932.6	375.7	63.1	312.6	311.9	248.2	1.708	183
6	183	934.3	374.0	61.9	312.1	312.2	249.8	1.705	183
7	183	930.4	377.9	61.6	316.3	311.5	246.2	1.728	180
8	180			62.3					
9									
10									
11									
				3 回 平 均			248.1	1.714	

Feed Size μm	Feed Wt%		Product Size μm	Product Wt%		Feed	Prodout
3360		100.00				3360	100.00
2800	9.39	90.61				2800	90.61
2360	9.60	81.01				2360	81.01
2000	5.28	75.73			100.00	2000	75.73
1700	9.17	66.56	125	6.80	93.20	1700	66.56
850	21.44	45.12	105	16.36	76.84	850	45.12
300	18.63	26.49	75	18.63	58.21	300	26.49
149	10.01	16.48	45	16.29	41.92	149	16.48 100
−149	16.48		−45	41.92		125	93.2
合計	100.00		合計	100.00		105	76.84
						75	58.21
						45	41.92

Appendix 37-2(2) Grindability Work Index Measurement

		Size μm	Wt%	1	2	3	4	5	6	7	8	9	10	11	12
		2800	9.39	122.8	38.5	39.9	37.6	36.0	35.3	35.1	35.5	0.0	0.0	0.0	0.0
-30.71	218.0	2360	9.60	125.6	39.4	40.8	38.4	36.8	36.1	35.9	36.3	0.0	0.0	0.0	-0.1
-13.23	225.5	2000	5.28	69.1	21.7	22.4	21.1	20.2	19.8	19.7	20.0	0.0	0.0	0.0	0.0
-0.87	239.0	1700	9.17	120.0	37.6	39.0	36.7	35.1	34.5	34.3	34.7	0.0	0.0	0.0	0.0
3.86	245.5	850	21.44	280.5	87.9	91.0	85.8	82.1	80.5	80.2	81.0	0.0	0.1	0.0	-0.1
2.85	248.1	300	18.63	243.7	76.4	79.2	74.5	71.4	70.0	69.7	70.4	0.0	0.0	0.0	0.0
2.86	248.0	149	10.01	131.0	41.1	42.6	40.0	38.3	37.6	37.4	37.8	0.0	0.0	0.0	0.0
5.19	246.2	-149	16.48	215.6	67.6	70.1	65.9	63.1	61.9	61.6	62.3	0.0	0.0	0.0	0.0
#DIV/0!	#DIV/0!	合計	100.00	1308.3	410.2	425.0	399.8	383.0	375.7	373.9	378.0	0.0	0.1	0.0	-0.2
#DIV/0!	#DIV/0!														
	#DIV/0!														
	#DIV/0!														
	248.1														
	248.1														
5.14	248.1														



Appendix 37-2(1) Results of the Grinding Test

(3)選鉱試験
②試験内容
3) 選鉱基礎試験
g) 浮選原鉱/尾鉱粒度分布測定

Test No.	K-2	Feed								
Products	Weight (g)	Weight (%)	Assay (%) Cu	Pb	Zn	Fe	S	Distribution (%) Cu	Pb	Zn
Feed	986.7	100.00	1.66	1.13	0.04	2.44	0.91	100.00	100.00	100.00
1 +210μm	102.7	10.41	1.04	0.55	0.03	1.96	0.55	6.54	5.09	8.00
2 +149μm	157.0	15.91	1.06	0.59	0.03	1.91	0.57	10.19	8.34	12.22
3 +105μm	178.0	18.04	1.28	0.75	0.03	1.99	0.68	13.95	12.02	13.86
4 + 75μm	108.2	10.97	1.74	1.04	0.04	2.04	0.96	11.53	10.13	11.23
5 + 45μm	97.1	9.84	2.39	1.32	0.04	2.16	1.18	14.21	11.54	10.08
6 + 20μm	116.5	11.81	3.09	1.90	0.05	2.32	1.58	22.03	19.93	15.12
7 − 20μm	227.2	23.02	1.55	1.61	0.05	3.73	1.01	21.55	32.95	29.49
1+2	259.7	26.32	1.05	0.57	0.03	1.93	0.56	16.73	13.43	20.22
1+2+3	437.7	44.36	1.14	0.65	0.03	1.95	0.61	30.68	25.45	34.08
1+2+3+4	545.9	55.33	1.26	0.72	0.03	1.97	0.68	42.21	35.58	45.31
1+2+3+4+5	643.0	65.17	1.43	0.81	0.03	2.00	0.76	56.42	47.12	55.39
1+2+3+4+5+6	759.5	76.98	1.69	0.98	0.04	2.05	0.88	78.45	67.05	70.51
6+7	343.7	34.83	2.07	1.71	0.05	3.25	1.20	43.58	52.88	44.61
5+6+7	440.8	44.67	2.14	1.62	0.05	3.01	1.20	57.79	64.42	54.69
4+5+6+7	549.0	55.64	2.06	1.51	0.05	2.82	1.15	69.32	74.55	65.92
3+4+5+6+7	727.0	73.68	1.87	1.32	0.04	2.62	1.04	83.27	86.57	79.78
2+3+4+5+6+7	884.0	89.59	1.73	1.19	0.04	2.49	0.95	93.46	94.91	92

Test No.	K-2	Tail								
Products	Weight (g)	Weight (%)	Assay (%) Cu	Pb	Zn			Distribution (%) Cu	Pb	Zn
Feed	844.9	100.00	0.13	0.07	0.01			100.00	100.00	100.00
1 +210μm	92.0	10.89	0.49	0.25	0.01			41.34	36.91	9.01
2 +149μm	130.8	15.48	0.17	0.08	0.01			20.39	16.80	12.82
3 +105μm	156.2	18.49	0.10	0.05	0.01			14.33	12.54	15.30
4 + 75μm	102.7	12.16	0.07	0.04	0.01			6.59	6.59	10.06
5 + 45μm	87.2	10.32	0.05	0.03	0.01			4.00	4.20	8.54
6 + 20μm	100.3	11.87	0.04	0.02	0.01			3.68	3.22	9.83
7 − 20μm	175.7	20.79	0.06	0.07	0.02			9.67	19.74	34.44
1+2	222.8	26.37	0.30	0.15	0.01			61.73	53.71	21.83
1+2+3	379.0	44.86	0.22	0.11	0.01			76.06	66.25	37.13
1+2+3+4	481.7	57.02	0.19	0.09	0.01			82.65	72.84	47.19
1+2+3+4+5	568.9	67.34	0.17	0.08	0.01			86.65	77.04	55.73
1+2+3+4+5+6	669.2	79.21	0.15	0.07	0.01			90.33	80.26	65.56
6+7	276.0	32.66	0.05	0.05	0.02			13.35	22.96	44.27
5+6+7	363.2	42.98	0.05	0.05	0.01			17.35	27.16	52.81
4+5+6+7	465.9	55.14	0.06	0.05	0.01			23.94	33.75	62.87
3+4+5+6+7	622.1	73.63	0.07	0.05	0.01			38.27	46.29	78.17
2+3+4+5+6+7	752.9	89.11	0.08	0.05	0.01			58.66	63.09	90.99

Appendix 37-2(2) Results of the Grinding Test

	Test No. K-3 Products	Feed Weight (g)	Feed Weight (%)	Assay (%) Cu	Pb	Zn	Fe	S	Distribution (%) Cu	Pb	Zn
	Feed	986.9	100.00	1.67	1.15	0.03	2.40	0.89	100.00	100.00	100.00
1	+149 μm	42.2	4.28	0.58	0.32	0.02	1.49	0.33	1.49	1.19	2.50
2	+105 μm	152.2	15.42	0.82	0.39	0.03	1.60	0.43	7.59	5.21	13.51
3	+ 75 μm	178.9	18.13	1.24	0.67	0.03	1.84	0.65	13.49	10.52	15.89
4	+ 45 μm	155.2	15.73	1.95	1.06	0.04	1.97	0.93	18.40	14.44	18.38
5	+ 20 μm	168.0	17.02	2.96	1.77	0.05	2.20	1.47	30.24	26.09	24.86
6	- 20 μm	290.4	29.42	1.63	1.67	0.05	3.64	1.01	28.79	42.55	24.86
	1+2	194.4	19.7	0.77	0.37	0.03	1.58	0.41	9.08	6.40	16.01
	1+2+3	373.3	37.83	0.99	0.52	0.03	1.70	0.52	22.57	16.92	31.90
	1+2+3+4	528.5	53.56	1.27	0.68	0.03	1.78	0.64	40.97	31.36	50.28
	1+2+3+4+5	696.5	70.58	1.68	0.94	0.04	1.88	0.84	71.21	57.45	75.14
	5+6	458.4	46.44	2.12	1.71	0.04	3.11	1.18	59.03	68.64	49.72
	4+5+6	613.6	62.17	2.08	1.54	0.04	2.82	1.12	77.43	83.08	68.10
	3+4+5+6	792.5	80.3	1.89	1.35	0.04	2.60	1.01	90.92	93.60	83.99
	2+3+4+5+6	944.7	95.72	1.71	1.19	0.03	2.44	0.92	98.51	98.81	97.50

	Test No. K-3 Products	Tail Weight (g)	Tail Weight (%)	Assay (%) Cu	Pb	Zn	Distribution (%) Cu	Pb	Zn
	Feed	857.4	100.00	0.06	0.05		100.00	100.00	
1	+149 μm	37.5	4.37	0.15	0.09	<0.01	10.21	8.30	
2	+105 μm	128.6	15.00	0.09	0.05	<0.01	21.01	15.81	
3	+ 75 μm	163.2	19.03	0.07	0.04	<0.01	20.74	16.05	
4	+ 45 μm	150.5	17.55	0.06	0.04	0.01	16.39	14.80	
5	+ 20 μm	144.3	16.83	0.04	0.03	0.01	10.48	10.64	
6	- 20 μm	233.3	27.22	0.05	0.06	0.02	21.17	34.40	
	1+2	166.1	19.37	0.10	0.06		31.22	24.11	
	1+2+3	329.3	38.40	0.09	0.05		51.96	40.16	
	1+2+3+4	479.8	55.95	0.08	0.05		68.35	54.96	
	1+2+3+4+5	624.1	72.78	0.07	0.04		78.83	65.60	
	5+6	377.6	44.05	0.05	0.05	0.02	31.65	45.04	
	4+5+6	528.1	61.6	0.05	0.05	0.01	48.04	59.84	
	3+4+5+6	691.3	80.63	0.05	0.04		68.78	75.89	
	2+3+4+5+6	819.9	95.63	0.06	0.05		89.79	91.70	

Appendix 37-2(3) Results of the Grinding Test

	Test No. K-4 Products	Feed Weight (g)	Feed Weight (%)	Assay (%) Cu	Pb	Zn			Distribution (%) Cu	Pb	Zn
	Feed	987.5	100.02	1.68	1.15	0.04	2.43	0.89	100.00	100.00	100.00
1	+105 μm	61.0	6.18	0.49	0.25	0.02	1.41	0.27	1.80	1.34	3.32
2	+ 75 μm	138.3	14.01	0.85	0.38	0.02	1.61	0.44	7.07	4.63	7.52
3	+ 45 μm	225.2	22.81	1.53	0.74	0.03	1.81	0.72	20.72	14.69	18.38
4	+ 20 μm	213.0	21.57	2.82	1.58	0.04	2.06	1.36	36.11	29.66	23.18
5	− 20 μm	350.0	35.45	1.63	1.61	0.05	3.55	1.00	34.30	49.68	47.60
	1+2	199.3	20.19	0.74	0.34	0.02	1.55	0.39	8.87	5.97	10.84
	1+2+3	424.5	43	1.16	0.55	0.03	1.69	0.56	29.59	20.66	29.22
	1+2+3+4	637.5	64.57	1.71	0.90	0.03	1.81	0.83	65.70	50.32	52.40
	4+5	563	57.02	2.08	1.60	0.05	2.99	1.14	70.41	79.34	70.78
	3+4+5	788.2	79.83	1.92	1.35	0.04	2.65	1.02	91.13	94.03	89.16
	2+3+4+5	926.5	93.84	1.76	1.21	0.04	2.49	0.93	98.20	98.66	98.68

	Test No. K-4 Products	Tail Weight (g)	Tail Weight (%)	Assay (%) Cu	Pb	Zn	Distribution (%) Cu	Pb	Zn
	Feed	853.5	100.00	0.05	0.04		100.00	100.00	
1	+105 μm	54.9	6.43	0.09	0.06	<0.01	11.19	9.70	
2	+ 75 μm	130.4	15.28	0.06	0.04	0.01	17.72	15.36	
3	+ 45 μm	196.4	23.01	0.05	0.03	<0.01	22.24	17.35	
4	+ 20 μm	201.6	23.62	0.04	0.03	0.01	18.26	17.81	
5	− 20 μm	270.2	31.66	0.05	0.05	0.02	30.59	39.78	
	1+2	185.3	21.71	0.07	0.05		28.91	25.06	
	1+2+3	381.7	44.72	0.06	0.04		51.15	42.41	
	1+2+3+4	583.3	68.34	0.05	0.04		69.41	60.22	
	4+5	471.8	55.28	0.05	0.04	0.02	48.85	57.59	
	3+4+5	668.2	78.29	0.05	0.04		71.09	74.94	
	2+3+4+5	798.6	93.57	0.05	0.04		88.81	90.30	

Appendix 37-2(4) Results of the Grinding Test

	Test No. K-5 Products	Feed Weight (g)	Feed Weight (%)	Assay (%) Cu	Pb	Zn	Fe	S	Distribution (%) Cu	Pb	Zn
	Feed	988.4	99.99	1.69	1.14	0.04	2.40	0.92	100.00	100.00	100.00
1	+ 75 μm	111.6	11.29	0.58	0.25	0.02	1.44	0.30	3.87	2.48	5.72
2	+ 45 μm	223.2	22.58	1.24	0.54	0.03	1.64	0.61	16.55	10.72	17.16
3	+ 20 μm	259.8	26.28	2.56	1.33	0.04	1.86	1.25	39.78	30.74	26.64
4	− 20 μm	393.8	39.84	1.69	1.60	0.05	3.45	1.05	39.80	56.06	50.48
	1+2	334.8	33.87	1.02	0.44	0.03	1.57	0.51	20.42	13.20	22.88
	1+2+3	594.6	60.15	1.69	0.83	0.03	1.70	0.83	60.20	43.94	49.52
	3+4	653.6	66.12	2.04	1.49	0.05	2.82	1.13	79.58	86.80	77.12
	2+3+4	876.8	88.7	1.83	1.25	0.04	2.52	1.00	96.13	97.52	94.28

	Test No. K-5 Products	Tail Weight (g)	Tail Weight (%)	Assay (%) Cu	Pb	Zn	Distribution (%) Cu	Pb	Zn
	Feed	846.0	100.00	0.05	0.04		100.00	100.00	
1	+ 75 μm	101.6	12.01	0.07	0.05	<0.01	17.03	13.35	
2	+ 45 μm	200.5	23.70	0.05	0.04	<0.01	24.00	21.07	
3	+ 20 μm	255.9	30.25	0.04	0.03	0.01	24.50	20.17	
4	− 20 μm	288.0	34.04	0.05	0.06	0.02	34.47	45.41	
	1+2	302.1	35.71	0.06	0.04		41.03	34.42	
	1+2+3	558.0	65.96	0.05	0.04		65.53	54.59	
	3+4	543.9	64.29	0.05	0.05	0.02	58.97	65.58	
	2+3+4	744.4	87.99	0.05	0.04		82.97	86.65	

Appendix 37-3 Results of the Bulk Rougher Flotation Test

(3)選鉱試験
②試験内容
3) 試拡基礎試験
b) 浮選試験(総合浮選)

バルク浮選試験(環境技試験所)

Flowsheet

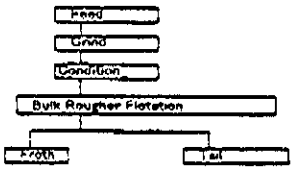


Table-	Condition			
	Test No.	K-1		
Circuit Name	Grind	Condition	Bulk Flotation	Total
Grinding time (min.)	23+23			
Condition time (min.)		3		
Flotation time (min.)			17	17
Pulp Temperature (℃)		18	18	
Pulp pH		8.1~8.3	8.0~8.2	
Pulp ORP (mV)		180~140	160~150	
Feed size (μm)	88.71			
Reagent (g/t)				
MIBC		37	26	63
NaPX		84	56	140
	SUS(Test			
Test Mill	Rod Ball			
Test Machine	No.1	AG500g	AG500g	

	Test No.	K-1													
	Products	Weight	Weight	Assay (%)						Distribution (%)					
				Cu	Pb	Zn	Fe	S	SiO2	Cu	Pb	Zn	Fe	S	
	Feed	712.6	100.00	1.70	1.15	0.03		0.93		100.00	100.00	100.00		100.00	
1	Froth	123.8	17.37	9.59	6.32	0.15	3.61	4.44	46.8	98.05	95.68	75.93		83.09	
2	Tail	588.8	82.63	0.04	0.06	0.01		0.19		1.95	4.32	24.07		16.91	

Appendix 37-4(1) Bulk Rougher Flotation in Deifferent Griding Sizes

粒度別粗選試験 (Size -75 μm 44.67%)

Flowsheet

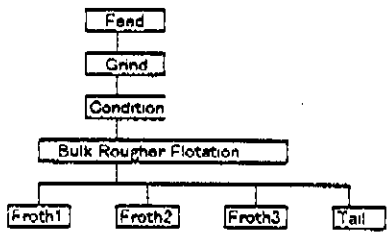


Table-	Condition Test No.	K-2				
Circuit Name	Grind	Condition	Bulk Rougher Flotation			Total
			Froth 1	Froth 2	Froth 3	
Grinding time (min.)	8+8					
Condition time (min.)		3				
Flotation time (min.)			3	7	7	17
Pulp temperature (°C)	18				18	
Pulp pH	8.7	8.8-8.8	8.8		8.6	
Pulp ORP (mV)	120	70-110	110		120	
Feed size (-75 μ mWt%)	44.67					
Reagent (g/t)						
MIBC		48		22	11	81
NaIPX		60		27	8	95
Na2SO3	50					50
Na2CO3	600					600
Soduim Silicate	150					150
	SUS Steel					
Test Mill	Rod Ball					
Test Machine	No.1	AG500g	AG500g	AG500g	AG500g	

	Test No. K-2 Products	Weight (g)	Weight (%)	Assay (%) Cu	Pb	Zn	Distribution (%) Cu	Pb	Zn
	Feed	986.7	100.00	1.66	1.11	0.03	100.00	100.00	100.00
1	Froth 1	67.3	6.82	20.30	14.00	0.33	83.16	86.34	65.57
2	Froth 2	48.7	4.94	3.17	1.27	0.05	9.40	5.67	7.19
3	Froth 3	25.8	2.61	0.81	0.43	0.03	1.27	1.02	2.29
4	Tail	844.9	85.63	0.12	0.09	0.01	6.17	6.97	24.95
	1+2	116.0	11.76	13.11	8.66	0.21	92.56	92.01	72.76
	1+2+3	141.8	14.37	10.87	7.16	0.18	93.83	93.03	75.05
	3+4	870.7	88.24	0.14	0.10	0.01	7.44	7.99	27.24
	2+3+4	919.4	93.18	0.30	0.16	0.01	16.84	13.66	34.43

Appendix 37-4(2) Bulk Rougher Flotation in Deifferent Griding Sizes

粒度別粗選試験 (Size −75 μm 62.18%)

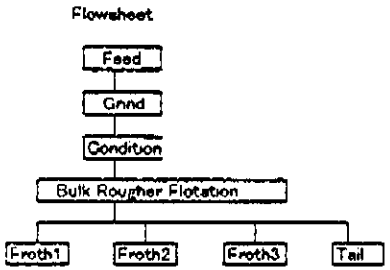
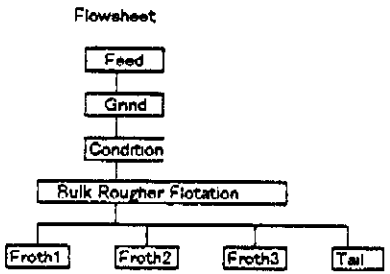


Table-	Condition Test No.	K-3				
Circuit Name	Grind	Condition	Bulk Rougher Flotation			Total
			Froth 1	Froth 2	Froth 3	
Grinding time (min.)	14+14					
Condition time (min.)		3				
Flotation time (min.)			3	7	7	17
Pulp temperature (℃)	16				19	
Pulp pH	8.8	9.0–9.0	9		8.9	
Pulp ORP (mV)	100	70–110	110		100	
Feed size (−75 μ mWt%)	62.18					
Reagent (g/t)						
MIBC		48		22	11	81
NaIPX		60		27	8	95
Na2SO3	50					50
Na2CO3	600					600
Sodium Silicate	150					150
	SUS Steel					
Test Mill	Rod Ball					
Test Machine	No.1	AG500g	AG500g	AG500g	AG500g	

Test No. K-3									
	Products	Weight (g)	Weight (%)	Assay (%) Cu	Pb	Zn	Distribution (%) Cu	Pb	Zn
	Feed	986.9	100.00	1.70	1.17	0.03	100.00	100.00	100.00
1	Froth 1	72.4	7.34	21.50	14.50	0.30	92.69	90.97	67.86
2	Froth 2	36.0	3.65	1.66	1.21	0.03	3.56	3.78	3.37
3	Froth 3	21.1	2.14	0.55	0.43	0.03	0.69	0.79	1.98
4	Tail	857.4	86.87	0.06	0.06	0.01	3.06	4.46	26.79
	1+2	108.4	10.99	14.91	10.09	0.21	96.25	94.75	71.23
	1+2+3	129.5	13.13	12.57	8.51	0.18	96.94	95.54	73.21
	3+4	878.5	89.01	0.07	0.07	0.01	3.75	5.25	28.77
	2+3+4	914.5	92.66	0.13	0.11	0.01	7.31	9.03	32.14

Appendix 37-4(3) Bulk Rougher Flotation in Deifferent Griding Sizes



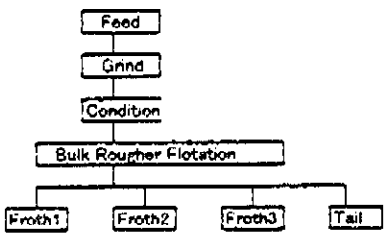
粒度別粗選試験 (Size -75 μm 79.83%)

Table-	Condition Test No.	K-4				
Circuit Name	Grind	Condition	Bulk Rougher Flotation			Total
			Froth 1	Froth 2	Froth 3	
Grinding time (min.)	19+19					
Condition time (min.)		3				
Flotation time (min.)			3	7	7	17
Pulp temperature (°C)	17				21	
Pulp pH	9.2	9.3-9.3	9.3		9.2	
Pulp ORP (mV)	110	50-100	100		90	
Feed size (-75 μ mWt%)	79.83					
Reagent (g/t)						
MIBC		48		22	11	81
NaIPX		60		27	8	95
Na2SO3	50					50
Na2CO3	600					600
Soduim Silicate	150					150
	SUS Steel					
Test Mill	Rod Ball					
Test Machine	No.1	AG500g	AG500g	AG500g	AG500g	

	Test No. K-4 Products	Weight (g)	Weight (%)	Assay (%) Cu	Pb	Zn	Distribution (%) Cu	Pb	Zn
	Feed	987.5	100.00	1.68	1.12	0.04	100.00	100.00	100.00
1	Froth 1	75.3	7.63	20.70	13.40	0.32	93.82	91.17	68.46
2	Froth 2	37.0	3.75	1.38	1.28	0.04	3.07	4.28	4.21
3	Froth 3	21.7	2.20	0.41	0.35	0.05	0.54	0.69	3.08
4	Tail	853.5	86.42	0.05	0.05	0.01	2.57	3.86	24.25
	1+2	112.3	11.38	14.33	9.41	0.23	96.89	95.45	72.67
	1+2+3	134.0	13.58	12.08	7.94	0.20	97.43	96.14	75.75
	3+4	875.2	88.62	0.06	0.06	0.01	3.11	4.55	27.33
	2+3+4	912.2	92.37	0.11	0.11	0.01	6.18	8.83	31.54

Appendix 37-4(4) Bulk Rougher Flotation in Deifferent Griding Sizes

Flowsheet



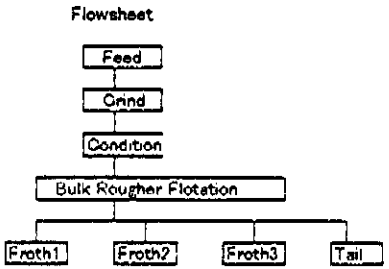
粒度別組選試験 (Size -75 μ m 88.71%)

Table-	Condition Test No.	K-5				
Circuit Name	Grind	Condition	Bulk Rougher Flotation			Total
			Froth 1	Froth 2	Froth 3	
Grinding time (min.)	23+23					
Condition time (min.)		3				
Flotation time (min.)			3	7	7	17
Pulp temperature (°C)	19				23	
Pulp pH	9.3	9.4-9.3	9.3		9.3	
Pulp ORP (mV)	100	50-90	90		100	
Feed size (-75 μ mWt%)	88.71					
Reagent (g/t)						
MIBC		48		22	11	81
NaIPX		60		27	8	95
Na2SO3	50					50
Na2CO3	600					600
Soduim Silicate	150					150
	SUS Steel					
Test Mill	Rod Ball					
Test Machine	No.1	AG500g	AG500g	AG500g	AG500g	

Test No. K-5

	Products	Weight (g)	Weight (%)	Assay (%) Cu	Pb	Zn	Distribution (%) Cu	Pb	Zn
	Feed	988.4	100.00	1.72	1.13	0.03	100.00	100.00	100.00
1	Froth 1	80.6	8.15	19.9	12.4	0.28	94.60	89.78	67.70
2	Froth 2	45.3	4.58	1.15	1.26	0.04	3.07	5.13	5.44
3	Froth 3	16.5	1.67	0.34	0.36	0.03	0.33	0.53	1.48
4	Tail	846.0	85.60	0.04	0.06	0.01	2.00	4.56	25.38
	1+2	125.9	12.73	13.15	8.39	0.19	97.67	94.91	73.14
	1+2+3	142.4	14.40	11.67	7.46	0.17	98.00	95.44	74.62
	3+4	862.5	87.27	0.05	0.07	0.01	2.33	5.09	26.86
	2+3+4	907.8	91.85	0.10	0.13	0.01	5.40	10.22	32.30

Appendix 37-5(1) Selection of Collecter

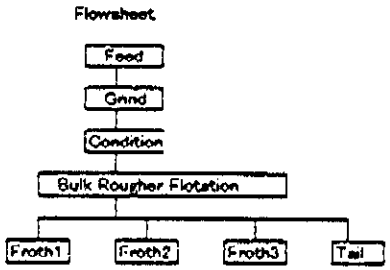


条件剤の検討 (Size -75μm 62.18%)

Table-	Condition Test No.	K-6				
Circuit Name	Grind	Condition	Bulk Rougher Flotation			Total
			Froth 1	Froth 2	Froth 3	
Grinding time (min.)	14+14					
Condition time (min.)		3				
Flotation time (min.)			3	7	7	17
Pulp temperature (°C)	18				22	
Pulp pH	8.8	8.9-8.9	8.9		9	
Pulp ORP (mV)	210	180-190	190		180	
Feed size (-75μmWt%)	62.18					
Reagent (g/t)						
MIBC		48		22	11	81
NaIPX		60		27	8	95
	SUS Steel					
Test Mill	Rod Ball					
Test Machine	No.1	AG500g	AG500g	AG500g	AG500g	

	Test No. K-6 Products	Weight (g)	Weight (%)	Assay (%) Cu	Pb	Zn	Distribution (%) Cu	Pb	Zn
	Feed	987.7	100.00	1.70	1.14	0.03	100.00	100.00	100.00
1	Froth 1	89.6	9.07	17.8	11.9	0.27	94.76	94.91	71.05
2	Froth 2	31.6	3.20	0.99	0.6	0.03	1.86	1.69	2.78
3	Froth 3	12.4	1.26	0.46	0.33	0.03	0.34	0.36	1.09
4	Tail	854.1	86.47	0.06	0.04	0.01	3.04	3.04	25.08
	1+2	121.2	12.27	13.42	8.95	0.21	96.62	96.60	73.83
	1+2+3	133.6	13.53	12.21	8.15	0.19	96.96	96.96	74.92
	3+4	866.5	87.73	0.07	0.04	0.01	3.38	3.40	26.17
	2+3+4	898.1	90.93	0.10	0.06	0.01	5.24	5.09	28.95

Appendix 37-5(2) Selection of Collector



捕収剤の検討 (M1661)

Table-	Condition Test No.	K-7				
Circuit Name	Grind	Condition	Bulk Rougher Flotation			Total
			Froth 1	Froth 2	Froth 3	
Grinding time (min.)	14+14					
Condition time (min.)		3				
Flotation time (min.)			3	7	7	17
Pulp temperature (℃)	16				19	
Pulp pH	7.9	7.9-7.9	7.9		7.9	
Pulp ORP (mV)	170	180-180	180		180	
Feed size (-75μ mWt%)	62.18					
Reagent (g/t)						
MIBC		48		22	11	81
M1661		60		26	7	93
	SUS Steel					
Test Mill	Rod Ball					
Test Machine	No.1	AG500g	AG500g	AG500g	AG500g	

Test No. K-7

	Products	Weight (g)	Weight (%)	Assay (%) Cu	Pb	Zn	Distribution (%) Cu	Pb	Zn
	Feed	986.7	100.00	1.70	1.13	0.03	100.00	100.00	100.00
1	Froth 1	77.9	7.90	20.3	13.2	0.31	94.23	92.23	70.12
2	Froth 2	49.5	5.02	0.77	0.75	0.03	2.27	3.33	4.31
3	Froth 3	21.1	2.14	0.4	0.36	0.02	0.50	0.68	1.23
4	Tail	838.2	84.94	0.06	0.05	0.01	3.00	3.76	24.34
	1+2	127.4	12.92	12.71	8.36	0.20	96.50	95.56	74.43
	1+2+3	148.5	15.06	10.96	7.23	0.18	97.00	96.24	75.66
	3+4	859.3	87.08	0.07	0.06	0.01	3.50	4.44	25.57
	2+3+4	908.8	92.1	0.11	0.10	0.01	5.77	7.77	29.88

Appendix 37-5(3) Selection of Collector

捕収剤の検討 (AP3818a+Aero5415)

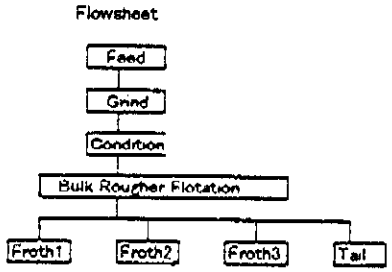


Table-	Condition Test No.	K-8				
Circuit Name	Grind	Condition	Bulk Rougher Flotation			Total
			Froth 1	Froth 2	Froth 3	
Grinding time (min.)	14+14					
Condition time (min.)		3				
Flotation time (min.)			3	7	7	17
Pulp temperature (°C)	16				20	
Pulp pH	8.0	8.0-8.0	8.0		8.0	
Pulp ORP (mV)	160	170-170	170		170	
Feed size (-75 μ mWt%)	62.18					
Reagent (g/t)						
MIBC		48		22	11	81
AP3418a		28		13	4	45
Aero5415	32			14	4	50
	SUS Steel					
Test Mill	Rod Ball					
Test Machine	No.1	AG500g	AG500g	AG500g	AG500g	

	Test No. K-8 Products	Weight (g)	Weight (%)	Assay (%) Cu	Pb	Zn	Distribution (%) Cu	Pb	Zn
	Feed	987.2	100.00	1.73	1.15	0.03	100.00	100.00	100.00
1	Froth 1	80.4	8.14	20	13.1	0.29	94.13	92.99	69.82
2	Froth 2	31.4	3.18	1.25	0.96	0.03	2.30	2.66	2.82
3	Froth 3	19.1	1.93	0.5	0.34	0.03	0.56	0.57	1.72
4	Tail	856.3	86.75	0.06	0.05	0.01	3.01	3.78	25.64
	1+2	111.8	11.32	14.73	9.69	0.22	96.43	95.65	72.64
	1+2+3	130.9	13.25	12.66	8.33	0.19	96.99	96.22	74.36
	3+4	875.4	88.68	0.07	0.06	0.01	3.57	4.35	27.36
	2+3+4	906.8	91.86	0.11	0.09	0.01	5.87	7.01	30.18

Appendix 37-5(4) Selection of Collector

捕収剤の検討 (AP242)

Flowsheet

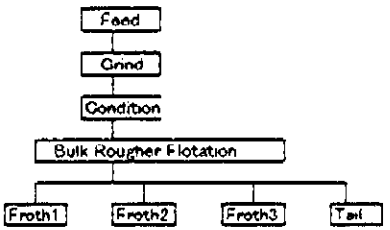
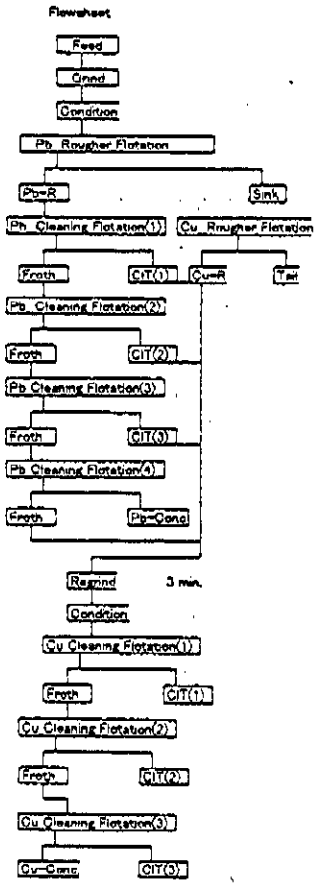


Table-	Condition Test No.	K-9				
Circuit Name	Grind	Condition	Bulk Rougher Flotation			Total
			Froth 1	Froth 2	Froth 3	
Grinding time (min.)	14+14					
Condition time (min.)		3				
Flotation time (min.)			3	7	7	17
Pulp temperature (°C)	17				22	
Pulp pH	7.9	8.0-8.0	8.0		7.9	
Pulp ORP (mV)	130	140-170	170		150	
Feed size (-75 μ mWt%)	62.18					
Reagent (g/t)						
MIBC		48		22	11	81
AP242		60		27	8	95
	SUS Steel					
Test Mill	Rod Ball					
Test Machine	No.1	AG500g	AG500g	AG500g	AG500g	

	Test No. K-9 Products	Weight (g)	Weight (%)	Assay (%) Cu	Pb	Zn	Distribution (%) Cu	Pb	Zn
	Feed	987.3	100.00	1.71	1.12	0.03	100.00	100.00	100.00
1	Froth 1	70.7	7.16	22.4	14.3	0.34	93.82	91.61	70.30
2	Froth 2	32.7	3.31	1.33	1.02	0.03	2.58	3.02	2.87
3	Froth 3	16.9	1.71	0.52	0.43	0.03	0.52	0.66	1.48
4	Tail	867.0	87.82	0.06	0.06	0.01	3.08	4.71	25.35
	1+2	103.4	10.47	15.74	10.10	0.24	96.40	94.63	73.17
	1+2+3	120.3	12.18	13.60	8.74	0.21	96.92	95.29	74.65
	3+4	883.9	89.53	0.07	0.07	0.01	3.60	5.37	26.83
	2+3+4	916.6	92.84	0.11	0.10	0.01	6.18	8.39	29.70

Appendix 37-6 Straight-Diffential Flotation



ストレート浮選試験

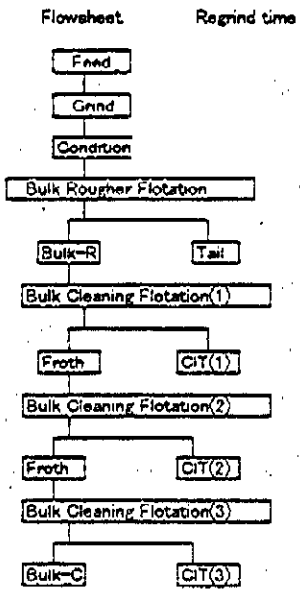
Condition

Table	Test No.	K-16												
Circuit Name	Grind	Condition	Pb Rou. Flotation	Pb Cleaning Flotation 1	2	3	4	Cu Rougher Flotation	Regrind	Condition	Cu Cleaning Flotation 1	2	3	Total
Grinding time (min.)	23-23								3					
Condition time (min.)		5		5	3	3	5			3				
Flotation time (min.)			5	5	3	2	3	15			10	7	5	
Pulp temperature (℃)	13		16	14-16	16-16	16-16	16-17	16-17	17	17-19	19-19	18-19	19-20	
Pulp pH	8.8	8.6-8.8	8.8-8.7	9.4-9.2-8.7	8.4-8.8-8.8	8.2-8.3-8.7	2.4-2.5-8.2-4.3	8.7-8.5	8.7	8.7-8.7	8.7-8.2	7.7-7.9	7.5-7.8	
Pulp ORP (mV)	60	80-100	100-90	60-70-90	90-80-90	90-90-100	200-190-130-220	90-110	70	70-90	90-90	130-120	140-120	
Feed size (-75μm wt%)	88.71													
Reagent (g/t)														
MIBC		48		0			5	33			5			94
AF65														0
AP242		20					5	40			10			75
NaIPX							5	35			10			50
Potassium Ferrocyanide	600			200	100	100				500				1700
SO2 Water							300			50				350
Starch							30			160				190
Ca(OH)2							130							130
NaCO3				80										80
	SUS Steel								SUS8 Mild2					
Test Mill	Rod Ball								Rod					
Test Machine	No.1	AG500g	AG500g	AG250g	AG100g	AG100g	AG100g	AG500g	No.1	AG500g	AG500g	AG500g	AG250g	

Test No. K-16

Products	Weight (g)	Weight (%)	Assay (%) Cu	Pb	Zn	Distribution (%) Cu	Pb	Zn
0 Feed	979.0	100.00	1.46	1.06	0.03	100.00	100.00	100.00
1 Pb-Conc.	12.1	1.24	11.8	58.0	1.08	9.87	67.42	41.20
2 Cu-Conc.	29.7	3.03	38.1	6.49	0.21	78.19	18.51	19.66
3 CL-T(3)	4.2	0.43	3.46	2.24	0.06	1.01	0.90	0.79
4 CL-T(2)	16.6	1.70	1.33	1.26	0.04	1.53	2.01	2.09
5 CL-T(1)	78.0	7.97	0.67	1.06	0.04	3.61	7.84	9.83
6 Tail	838.4	85.63	0.10	0.04	0.01	5.79	3.22	26.43
2	29.7	3.03	38.10	6.49	0.21	78.19	18.51	19.66
2+3	33.9	3.46	33.81	5.96	0.19	79.20	19.41	20.45
2+3+4	50.5	5.16	23.13	4.42	0.14	80.73	21.42	22.54
2+3+4+5	128.5	13.13	9.50	2.38	0.08	84.34	29.36	32.37
5+6	916.4	93.60	0.15	0.13	0.01	9.40	11.16	36.26

Appendix 37-7(1) Semi-Bulk Flotation



再磨鉱の検討(バルク再選)

Table-	Condition Test No.	K-10						
Circuit Name	Grind	Condition	Bulk Rou. Flotation	Regrind	Bulk Cleaning Flotation 1	2	3	Total
Grinding time (min.)	14+14			0				
Condition time (min.)		3						
Flotation time (min.)			17		10	10	8	45
Pulp temperature (°C)	16		20		20-21	19-21	19-20	
Pulp pH	8.1	8.2-8.2	8.0-8.2		7.8-7.9	7.5-7.9	6.9-6.8	
Pulp ORP (mV)	130	130-130	130-100		120-130	120-130	110-70	
Feed size (-75 μ mWt%)	62.18			76.84				
Reagent (g/t)								
MIBC		48	33				5	86
AP242		60	15		2	2	2	81
NaIPX			20		3	3	2	28
	SUS Steel			SUS Mild				
Test Mill	Rod Ball			Rod				
Test Machine	No.1	AG500g	AG500g	No.1	AG500g	AG250g	AG250g	

Test No. K-10

	Products	Weight (g)	Weight (%)	Assay (%) Cu	Pb	Zn	SiO2	Distribution (%) Cu	Pb	Zn
	Feed	1000.0	100.00	1.63	1.10	0.03		100.00	100.00	100.00
1	Bulk-Conc.	65.4	6.54	23.8	15.9	0.36	30.2	95.49	94.94	68.61
2	CIT(3)	3.2	0.32	0.92	0.97	0.04		0.18	0.28	0.37
3	CIT(2)	7.4	0.74	0.46	0.47	0.03		0.21	0.32	0.65
4	CIT(1)	59.1	5.91	0.26	0.24	0.03		0.94	1.30	5.17
5	Tail	864.9	86.49	0.06	0.04	0.01		3.18	3.16	25.20
	1+2	68.6	6.86	22.73	15.20	0.35		95.67	95.22	68.98
	1+2+3	76.0	7.60	20.56	13.77	0.31		95.88	95.54	69.63
	1+2+3+4	135.1	13.51	11.68	7.85	0.19		96.82	96.84	74.80
	4+5	924.0	92.40	0.07	0.05	0.01		4.12	4.46	30.37
	3+4+5	931.4	93.14	0.08	0.06	0.01		4.33	4.78	31.02
	2+3+4+5	934.6	93.46	0.08	0.06	0.01		4.51	5.06	31.39

Appendix 37-7(2) Semi-Bulk Flotation

再摩鉱の検討(バルク浮選)

Flowsheet Regrind time 3 min.

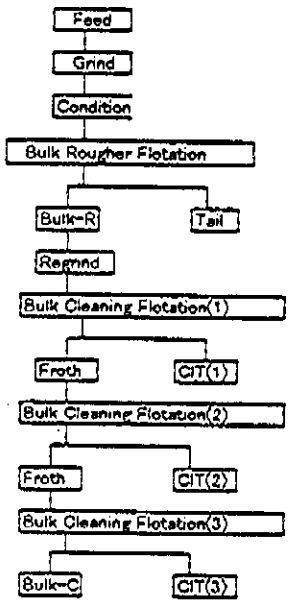


Table-	Condition Test No.	K-11						
Circuit Name	Grind	Condition	Bulk Rou. Flotation	Regrind	Bulk Cleaning Flotation 1	2	3	Total
Grinding time (min.)	14+14			3				
Condition time (min.)		3						
Flotation time (min.)			17		10	10	8	45
Pulp temperature (°C)	16		20		17-19	19-20	19-21	
Pulp pH	8.1	8.2-8.2	8.0-8.2		7.8-7.9	7.6-7.9	7.1-7.8	
Pulp ORP (mV)	130	130-130	130-100		90-120	60-110	70-90	
Feed size (-75 μ mWt%)	62.18							
Reagent (g/t)								
MIBC		48	33				5	86
AP242		60	15		2	2	2	81
NaIPX			20		3	3	2	28
	SUS Steel			SUS8 Mild2				
Test Mill	Rod Ball			Rod				
Test Machine	No.1	AG500g	AG500g	No.1	AG500g	AG250g	AG250g	

Test No.	K-11									
	Products	Weight (g)	Weight (%)	Assay (%) Cu	Pb	Zn	SiO2	Distribution (%) Cu	Pb	Zn
	Feed	971.9	100.00	1.65	1.05	0.03		100.00	100.00	100.00
1	Bulk-Conc.	50.6	5.21	30.2	19.0	0.46	20.7	95.41	94.17	69.62
2	CIT(3)	4.5	0.47	1.06	1.07	0.03		0.30	0.48	0.41
3	CIT(2)	9.2	0.95	0.38	0.47	0.03		0.22	0.42	0.83
4	CIT(1)	66.9	6.88	0.22	0.25	0.02		0.92	1.64	4.00
5	Tail	840.6	86.49	0.06	0.04	0.01		3.15	3.29	25.14
	1+2	55.2	5.68	27.77	17.51	0.42		95.71	94.65	70.03
	1+2+3	64.4	6.63	23.86	15.07	0.37		95.93	95.07	70.86
	1+2+3+4	131.3	13.51	11.81	7.52	0.19		96.85	96.71	74.86
	4+5	907.5	93.37	0.07	0.06	0.01		4.07	4.93	29.14
	3+4+5	916.7	94.32	0.07	0.06	0.01		4.29	5.35	29.97
	2+3+4+5	921.3	94.79	0.08	0.06	0.01		4.59	5.83	30.38

Appendix 38-1(1) Regrinding of Bulk Concentrate

(3)選鉱試験
①試験内容
4) 選鉱本格試験
a) 再磨鉱試験(標準)

再磨鉱の検討(標準試験)

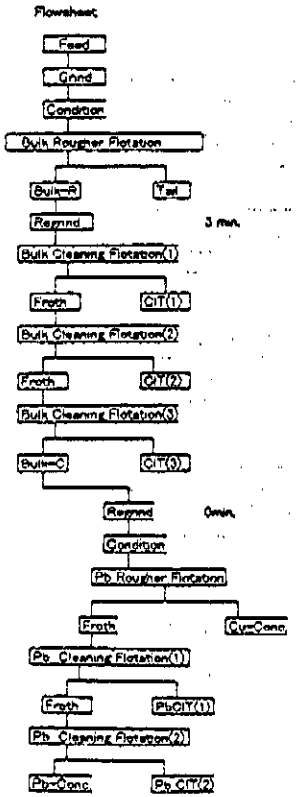


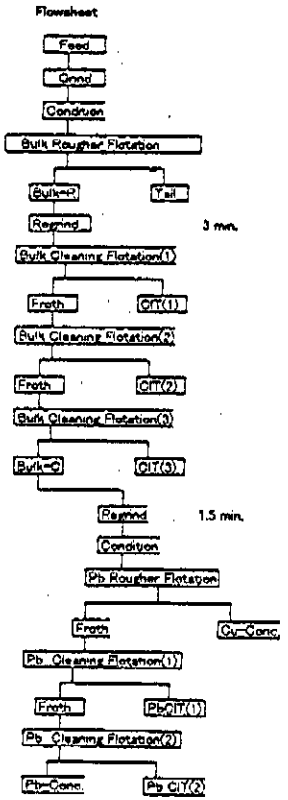
Table-
Condition
Test No. K-12

Circuit Name	Grind	Condition	Bulk Rou. Flotation	Regrind	Bulk Cleaning Flotation 1	2	3	Regrind	Condition	Pb Rougher Flotation	Pb Cleaner Flotation 1	2	Total
Grinding time (min.)	14+14			3				0					
Condition time (min.)		3							8		4	3	
Flotation time (min.)			17		10	10	6			5	3	3	
Pulp temperature (℃)	12		16		17~19	20~21	20~21	13		14	15~16	14~16	
Pulp pH	8.3	8.3~8.3	8.3~8.2		8.1~8.1	7.9~8.4	7.6~8.1	6	8.1~9.2	9.2~8.8	8.6~8.1~8.7	8.3~8.7~8.7	
Pulp ORP (mV)	130	130~130	130~130		100~150	70~100	60~70	120	30~20	20~50	30~0~60	70~70~50	
Feed size (-75μmWt%)	62.18												
Reagent (g/t)													
MIBC		48	33				5						38
AF65											0.5	0.8	1.3
AP242		60	15		2	2	2			0.2			21.2
NaIPX			20		3	3	2			0.3		0.4	28.7
Potassium Ferrocyanide								800			200	200	1200
	SUS Steel			SUS6 Mild2				SUS6 Mild2					
Test Mill	Rod Ball			Rod				Rod					
Test Machine	No.1	AG500g	AG500g	No.1	AG500g	AG250g	AG250g	No.1	AG100g	AG100g	AG100g	AG100g	

Test No. K-12

	Products	Weight (g)	Weight (%)	Assay (%) Cu	Pb	Zn	Distribution (%) Cu	Pb	Zn	Cu	Pb
0	Feed	994.4	100.00	1.67	1.14	0.03	100.00	100.00	100.00	1660.17	1133.4
1	Pb-Conc.	13.3	1.34	15.1	58.1	1.62	12.10	68.18	62.03	200.83	772.
2	PbCIT(2)	13.7	1.38	53.3	14.4	0.08	43.98	17.40	3.16	730.21	197
3	PbCIT(1)	12.3	1.24	39.6	5.39	0.04	29.34	5.85	1.42	487.08	66.9
4	Cu-Conc.	14.0	1.40	11.8	2.48	0.08	9.95	3.06	3.22	165.2	34
5	CL-T(3)	4.6	0.46	0.96	0.87	0.03	0.27	0.35	0.40	4.416	4.0
6	CL-T(2)	11.6	1.17	0.37	0.44	0.03	0.26	0.45	1.00	4.292	5.1
7	CL-T(1)	74.4	7.48	0.23	0.26	0.02	1.03	1.71	4.26	17.112	19.3
8	Tail	850.5	85.53	0.06	0.04	0.01	3.07	3.00	24.49	51.03	34.
	1	13.3	1.34	15.1	58.1	1.62	12.10	68.18	62.03	200.83	772.
	1+2	27.0	2.72	34.5	35.9	0.84	56.08	85.58	85.19	931.04	970.
	1+2+3	39.3	3.96	36.1	26.4	0.59	85.42	91.43	66.61	1418.12	1036.
	1+2+3+4	53.3	5.36	29.7	20.1	0.46	95.37	94.49	69.83	1583.32	1071.
	4	14.0	1.40	11.8	2.48	0.08	9.95	3.06	3.22	165.20	34.
	3+4	26.3	2.64	24.8	3.84	0.06	39.29	8.91	4.64	652.28	101.
	2+3+4	40.0	4.02	34.8	7.46	0.07	83.27	26.31	7.80	1382.49	296.
	7+8	924.9	93.01	0.07	0.06	0.01	4.10	4.71	28.77	68.14	53.
	6+7+8	936.5	94.18	0.08	0.06	0.01	4.36	5.16	29.77	72.43	58.
	5+6+7+8	941.1	94.64	0.08	0.07	0.01	4.63	5.51	30.17	76.85	62.

Appendix 38-1(2) Regrinding of Bulk Concentrate



再粉砕の試験(精選試験)

Condition

Table-	Test No.	K-13											
Circuit Name	Grind	Condition	Bulk Rou. Flotation	Regrind	Bulk Cleaning Flotation 1	2	3	Regrind	Condition	Pb Rougher Flotation	Pb Cleaner Flotation 1	2	Total
Grinding time (min.)	14=14			3				1.5					
Condition time (min.)		3							5		4	3	
Flotation time (min.)			17		10	10	8			5	3	3	
Pulp temperature (℃)	12		18		17-19	20-21	20-21	14		16	18-16	18-19	
Pulp pH	8.3	8.3-8.3	8.3-8.2		8.1-8.1	7.9-8.4	7.8-8.1	9.1	9.1-9.5	9.5-8.9	8.7-8.7-8.9	7.6-8.6-8.6	
Pulp ORP (mV)	130	130-130	130-130		100-150	70-100	80-70	-30	(-30)-(-60)	(-60)-30	50-20-70	50-50-70	
Feed size (-75 μ m%)	62.18												
Reagent (g/t)													
MIBC		48	33				5						36
AF65									0.5		1	0.5	2
AP242		60	15		2	2	2		0.2		0.2		21.4
NaIPX			20		3	3	2		0.3		0.2	0.2	28.7
Potassium Ferrocyanide								600			200	200	1200
	SUS Steel			SUS8 Mild2				SUS4 Mild1					
Test Mill	Rod Ball			Rod				Rod					
Test Machine	No.1	AG500g	AG500g	No.1	AG500g	AG250g	AG750g	No.1	AG100g	AG100g	AG100g	AG100g	

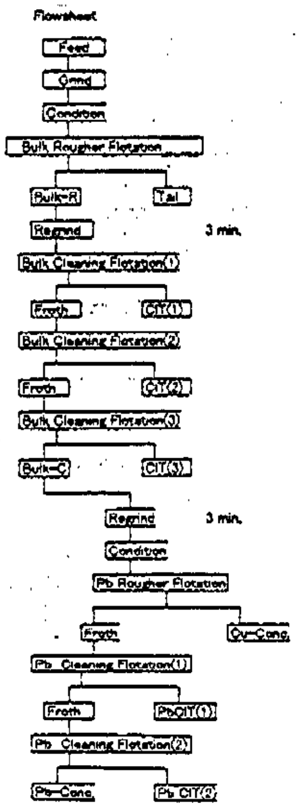
Test No. K-13

Products	Weight (g)	Weight (%)	Assay (%) Cu	Pb	Zn	Distribution (%) Cu	Pb	Zn
0 Feed	988.9	100.00	1.69	1.11	0.03	100.00	100.00	100.00
1 Pb-Conc.	13.2	1.34	15.0	59.0	1.62	11.89	71.27	63.67
2 PbCIT(2)	12.5	1.27	54.7	13.3	0.07	41.08	15.21	2.61
3 PbCIT(1)	10.8	1.09	46.0	4.29	0.04	29.84	4.24	1.29
4 Cu-Conc.	16.4	1.66	12.8	2.40	0.03	12.61	3.60	1.47
5 CL-T(3)	4.5	0.46	0.98	0.87	0.03	0.26	0.36	0.40
6 CL-T(2)	11.6	1.17	0.37	0.44	0.03	0.26	0.47	1.04
7 CL-T(1)	73.8	7.48	0.23	0.26	0.02	1.02	1.76	4.40
8 Tail	844.1	85.53	0.06	0.04	0.01	3.04	3.09	25.12
1	13.2	1.34	15.0	59.0	1.62	11.89	71.27	63.67
1+2	25.7	2.61	34.3	36.8	0.87	52.97	86.48	66.28
1+2+3	36.5	3.70	37.8	27.2	0.62	82.81	90.72	67.57
1+2+3+4	52.9	5.36	30.0	19.5	0.44	95.42	94.32	69.04
4	16.4	1.66	12.8	2.40	0.03	12.61	3.60	1.47
3+4	27.2	2.75	26.0	3.15	0.03	42.45	7.84	2.76
2+3+4	39.7	4.02	35.0	6.35	0.05	83.53	23.05	5.37
7+8	917.9	93.01	0.07	0.06	0.01	4.06	4.85	29.52
6+7+8	929.5	94.18	0.06	0.06	0.01	4.32	5.32	30.56
5+6+7+8	934.0	94.64	0.08	0.07	0.01	4.58	6.69	30.96

Cu	
1664.702	10
198	
683.75	
496.8	
209.92	
4.32	
4.292	
16.974	
50.646	
198.00	
881.75	
1378.55	
1588.47	1
209.92	
706.72	
1390.47	
67.62	
71.91	
76.23	

Appendix 38-1(2)　Regrinding of Bulk Concentrate

Flowsheet



再磨鉱の検討(閉回路試験)

Table-　Condition　Test No.　K-14

Circuit Name	Grind	Condition	Bulk Rou. Flotation	Regrind	Bulk Cleaning Flotation 1	Bulk Cleaning Flotation 2	Bulk Cleaning Flotation 3	Regrind	Condition	Pb Rougher Flotation	Pb Cleaner Flotation 1	Pb Cleaner Flotation 2	Total
Grinding time (min.)	14+14			3				3					
Condition time (min.)		3							8		4	3	
Flotation time (min.)			17		10	10	8			5	3	3	
Pulp temperature (℃)	12		18		17~19	20~21	20~21	14		17	18~19	18~19	
Pulp pH	8.3	8.3~8.3	8.3~8.2		8.1~8.1	7.9~8.4	7.8~8.1	9.5	9.5~10.2	10.2~9.4	8.9~9.4~9.4	7.7~8.4~8.7	
Pulp ORP (mV)	130	130~130	130~130		100~150	70~100	80~70	10	10~(-50)	(-50)~(-20)	20~0~50	60~50~60	
Feed size (-75 μ mWt%)	62.18												
Reagent (g/t)													
MIBC		48	33				5						38
AF65										0.5	0.5	0.5	1.5
AP242		60	15		2	2	2			0.2		0.2	21.4
NaIPX			20		3	3	2			0.3		0.2	28.5
Potassium Ferrocyanide								800			200	200	1200
	SUS Steel			SUS8 Mild2				SUS8 Mild2					
Test Mill	Rod Ball			Rod				Rod					
Test Machine	No.1	AG500g	AG500g	No.1	AG500g	AG250g	AG250g	No.1	AG100g	AG100g	AG100g	AG100g	

Test No.　K-14

	Products	Weight (g)	Weight (%)	Assay (%) Cu	Assay (%) Pb	Assay (%) Zn	Distribution (%) Cu	Distribution (%) Pb	Distribution (%) Zn	Cu	Pb
0	Feed	998.1	100.00	1.69	1.09	0.03	100.00	100.00	100.00	1691.622	1091.676
1	Pb-Conc.	14.7	1.47	21.2	54.0	1.38	18.42	72.71	62.67	311.64	793.8
2	PbClT(2)	8.0	0.80	58.1	10.4	0.06	27.48	7.62	1.48	464.8	83.2
3	PbClT(1)	9.4	0.94	52.5	6.24	0.07	29.16	5.37	2.03	493.5	58.656
4	Cu-Conc.	21.4	2.15	16.1	4.36	0.02	20.37	8.55	1.32	344.54	93.304
5	CL-T(3)	4.6	0.46	0.96	0.87	0.03	0.26	0.37	0.43	4.416	4.007
6	CL-T(2)	11.7	1.17	0.37	0.44	0.03	0.26	0.47	1.06	4.329	5.148
7	CL-T(1)	74.7	7.48	0.23	0.26	0.02	1.02	1.78	4.62	17.181	19.422
8	Tail	853.6	85.53	0.06	0.04	0.01	3.03	3.13	26.37	51.216	34.144
	1	14.7	1.47	21.2	54.0	1.38	18.42	72.71	62.67	311.64	793.80
	1+2	22.7	2.27	34.2	38.6	0.91	45.90	80.33	64.15	776.44	877.00
	1+2+3	32.1	3.21	39.8	29.1	0.67	75.06	85.70	66.18	1269.94	935.66
	1+2+3+4	53.5	5.36	30.2	19.2	0.41	95.43	94.25	67.50	1614.48	1028.96
	4	21.4	2.15	16.1	4.36	0.02	20.37	8.55	1.32	344.54	93.30
	3+4	30.8	3.09	27.2	4.93	0.04	49.53	13.92	3.35	838.04	151.96
	2+3+4	38.8	3.89	33.6	6.06	0.04	77.01	21.54	4.83	1302.64	235.16
	7+8	928.3	93.01	0.07	0.06	0.01	4.05	4.91	30.99	68.40	53.57
	6+7+8	940.0	94.18	0.08	0.06	0.01	4.31	5.38	32.07	72.73	58.71
	5+6+7+8	944.6	94.64	0.08	0.07	0.01	4.57	5.75	32.50	77.14	62.72

Appendix 38-2(1) Lead-Copper/Zinc Bulk-Differential Flotation and Cleaning Flotation

(3)選鉱試験
②試験内容
a) 選鉱本格試験
b) 鉛－銅亜鉛分離浮選試験
d) 精選試験(鉛、銅精選)

Flowsheet

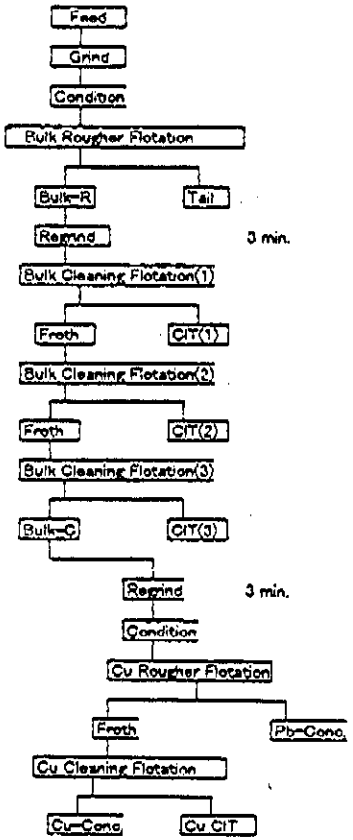


Table-

Condition
Test No. K-15

Circuit Name	Grind	Condition	Bulk Rou. Flotation	Regrind	Bulk Cleaning Flotation 1	2	3	Regrind	Condition	Cu Rougher Flotation	Cu Cleaner Flotation	Total
Grinding time (min.)	14+14			3				3				
Condition time (min.)		3							8			
Flotation time (min.)			17		10	10	8			5	3	
Pulp temperature (℃)	12		18		17-19	20-21	20-21	15		20	15-16	
Pulp pH	8.3	8.3-8.3	8.3-8.2		8.1-8.1	7.9-8.4	7.8-8.1	8.2	4.1-4.2-5.8	5.8-5.1	8.6-9.1-8.7	
Pulp ORP (mV)	130	130-130	130-130		100-150	70-100	80-70	30	180-150-100	100-180	30-0-60	
Feed size (-75 μ mWt%)	62.18											
Reagent (g/t)												
MIBC		48	33				5					38
AF65											0.5	0.5
AP242		60	15		2	2	2			0.2		21.2
NaIPX			20		3	3	2			0.3		28.3
SO2 Water									500		100	600
Starch									50			50
Ca(OH)2									160		100	260
	SUS Steel			SUS8 Mild2				SUS8 Mild2				
Test Mill	Rod Ball			Rod				Rod				
Test Machine	No.1	AG500g	AG500g	No.1	AG500g	AG250g	AG250g	No.1	AG100g	AG100g	AG100g	

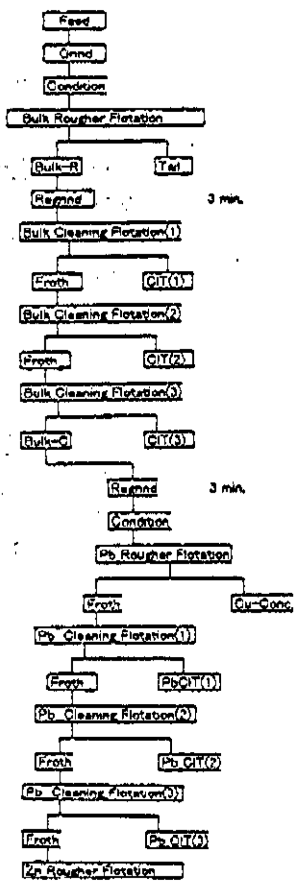
Test No. K-15

	Products	Weight (g)	Weight (%)	Assay (%) Cu	Pb	Zn	Distribution (%) Cu	Pb	Zn
0	Feed	964.6	100.00	1.71	1.12	0.03	100.00	100.00	100.00
1	Cu-Conc.	14.0	1.45	40.9	30.4	0.82	34.70	39.46	34.60
2	Cu CIT	2.6	0.27	20.0	20.0	0.25	3.15	4.82	1.96
3	Pb-Conc.	35.1	3.64	27.1	15.4	0.31	57.64	50.11	32.80
4	CL-T(3)	4.4	0.46	0.96	0.87	0.03	0.26	0.35	0.40
5	CL-T(2)	11.3	1.17	0.37	0.44	0.03	0.25	0.46	1.02
6	CL-T(1)	72.1	7.48	0.23	0.26	0.02	1.00	1.74	4.35
7	Tail	825.1	85.53	0.06	0.04	0.01	3.00	3.06	24.87
	1	14.0	1.45	40.9	30.4	0.82	34.70	39.46	34.60
	1+2	16.6	1.72	37.6	28.8	0.73	37.85	44.28	36.56
	1+2+3	51.7	5.36	30.5	19.7	0.45	95.49	94.39	69.36
	3	35.1	3.64	27.1	15.4	0.31	57.64	50.11	32.80
	2+3	37.7	3.91	26.6	15.7	0.31	60.79	54.93	34.76
	6+7	897.2	93.01	0.07	0.06	0.01	4.00	4.80	29.22
	5+6+7	908.5	94.18	0.08	0.06	0.01	4.25	5.26	30.24
	4+5+6+7	912.9	94.64	0.08	0.07	0.01	4.51	5.61	30.64

Appendix 38-2(2) Lead-Copper/Zinc Bulk-Differential Flotation and Cleaning Flotation

(3) 選鉱試験
②試験内容
4) 選鉱本格試験
b) 鉛-銅亜鉛分離浮選試験
d) 精選試験(鉛、銅精選)

Flowsheet



Condition
Table-
Test No. K-17

Circuit Name	Grind	Condition	Bulk Rou. Flotation	Regrind	Bulk Cleaning Flotation 1	2	3	Regrind	Condition	Pb Rougher Flotation	Pb Cleaner Flotation 1	2	3	Zn Rou. Flotation	Total
Grinding time (min.)	14+14			3				3							
Condition time (min.)		3							6		4	3	4	3	
Flotation time (min.)			17		10	10	6			5	3	3	3	3	
Pulp temperature (℃)	13		18	17	17-19	22-24	23-25	19		17	23-24	22-23	23-25	23-24	
Pulp pH	8.2	8.3-8.2	8.2-8.2	7.9	7.9-8.0	7.6-8.0	7.7-7.9	8.1	9.0-9.0	9.0-8.7	8.9-9.5-9.0	9.5-8.9-8.8	9.0-9.5-8.8	8.5-5.7	
Pulp ORP (mV)	120	120-120	120-120	150	150-130	160-150	130-150	30	30-30	30-60	40-10-50	60-40-70	70-70-80	150-170	
Feed size (-75 μ mWt%)	82.18														
Reagent (g/t)															
MIBC		48	33		5	8				3					97
AF65												0.5	0.5	0.5	1.5
AP242		60	15		2	2	2			2					83
NaIPX			20		3	3	2			3				0.2	31.2
Potassium Ferrocyanide								800			200	200	100	100	1400
SO2 Water														200	200
Starch														30	30
Ca(OH)2														130	130
Test Mill	SUS Steel Rod Ball			SUS8 Mild2 Rod				SUS8 Mild2 Rod							
Test Machine	No.1	AG500g	AG500g	No.1	AG500g	AG250g	AG250g	No 1	AG250g	AG250g	AG100g	AG100g	AG100g	AG100g	

Test No. K-17

Products	Weight (g)	Weight (%)	Assay (%) Cu	Pb	Zn	Distribution (%) Cu	Pb	Zn
0 Feed	987.8	100.00	1.72	1.07	0.03	100.00	100.00	100.00
1 Pb-Conc.	10.8	1.09	11.8	64.0	1.43	7.49	65.60	48.25
2 ZnR-Conc.	2.2	0.22	8.75	68.5	1.95	1.13	14.30	13.40
3 PbCIT(3)	3.8	0.38	60.9	7.86	0.06	13.61	2.84	0.71
4 PbCIT(2)	5.4	0.55	60.2	5.68	0.05	19.12	2.91	0.84
5 PbCIT(1)	11.0	1.11	55.6	3.75	0.04	35.97	3.92	1.37
6 Cu-Conc.	16.2	1.64	18.1	2.56	0.05	17.24	3.94	2.53
7 CL-T(3)	5.6	0.57	0.97	0.92	0.03	0.32	0.49	0.52
8 CL-T(2)	13.8	1.40	0.54	0.59	0.03	0.44	0.77	1.29
9 CL-T(1)	76.2	7.72	0.27	0.28	0.02	1.21	2.03	4.76
10 Tail	842.6	85.32	0.07	0.04	0.01	3.47	3.20	26.33
1	10.8	1.09	11.6	64.0	1.40	7.49	65.60	48.25
1+2	13.0	1.31	11.3	64.8	1.52	8.62	79.90	61.65
1+2+3	16.8	1.69	22.5	51.9	1.19	22.23	82.74	62.30
1+2+3+4	22.2	2.24	31.7	40.7	0.91	41.35	85.65	63.20
1+..+5	33.2	3.35	39.60	28.4	0.62	77.32	89.57	64.57
1+..+6	49.4	4.99	32.55	19.9	0.43	94.56	93.51	67.10
6	16.2	1.64	18.10	2.56	0.05	17.24	3.94	2.53
5+6	27.2	2.75	33.27	3.04	0.05	53.21	7.86	3.90
4+5+6	32.6	3.30	37.73	3.48	0.05	72.33	10.77	4.74
3+4+5+6	36.4	3.68	40.15	3.94	0.05	85.94	13.61	5.45
2+..+6	38.6	3.90	38.38	7.62	0.16	87.07	27.91	18.85
9+10	918.8	93.04	0.09	0.06	0.01	4.68	5.23	31.09

Appendix 38-3(1) Cleaning of Rougher Copper and Lead Concentrates

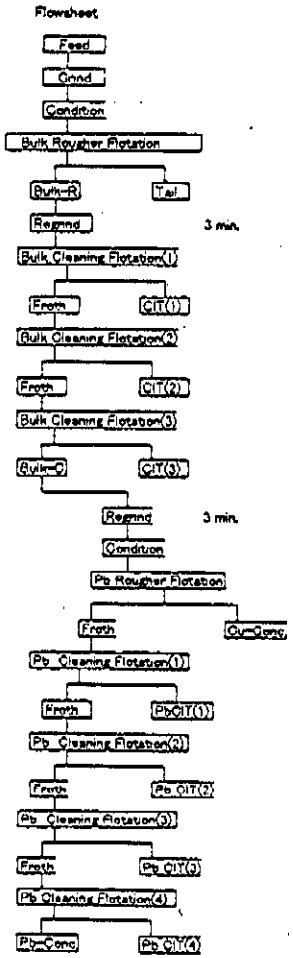
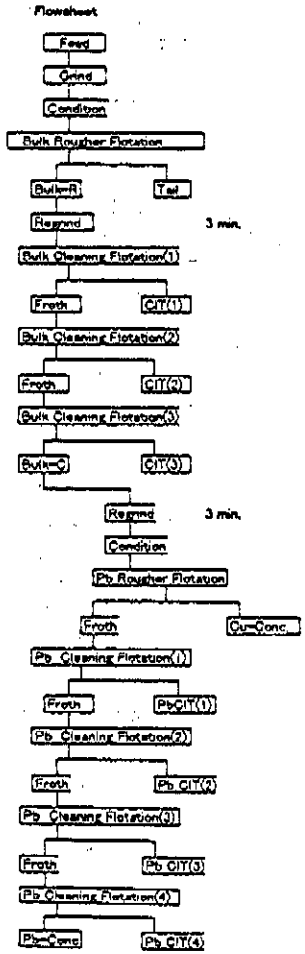


Table	Condition														
Test No.	K-18														
Circuit Name	Grind	Condition	Bulk Rou. Flotation	Regrind	Bulk Cleaning Flotation 1	2	3	Regrind	Condition	Pb Rougher Flotation	Pb Cleaner Flotation 1	2	3	4	Total
Grinding time (min.)	14→14			3				3							
Condition time (min.)		3							8		8	8	8	8	
Flotation time (min.)			17		10	10	8			5	3	3	3	3	
Pulp temperature (℃)	13		18	18	18-20	22-23	22-23	21		24	23-27	23-27	23-25	21-23	
Pulp pH	8.1	8.1-8.1	8.1-8.3	7.6	7.6-8.0	7.7-7.9	7.2-7.8	9.5	9.5-10.2	10.5-9.2	9.2-9.9-9.7	9.0-9.8-9.3	9.6-9.8-9.7	8.8-9.2-9.6	
Pulp ORP (mV)	110	120-110	110-120	120	120-120	100-90	100-90	-60	(-60)-(-50)	(-50)-30	(-20)-(-20)-30	30-30-50	70-80-80	90-220-270	
Feed size (-75 μ m%)	62.16														
Reagent (g/t)															
MIBC		48	33		5	8									94
AF65											0.5	0.5			1
AP242		60	15		2	2	2			0.2					81.2
NaIPX			20		3	3	2			0.3				0.2	28.5
Potassium Ferrocyanide								1000			500	500	500		2500
H2SO4														50	50
Na2S														20	20
Ca(OH)2														10	10
Test Mill	SUS Steel Rod Ball			SUS8 Mild2 Rod				SUS8 Mild2 Rod							
Test Machine	No.1	AG500g	AG500g	No.1	AG500g	AG250g	AG250g	No.1	AG250g	AG250g	AG100g	AG100g	AG100g	AG100g	

Test No. K-18 Products	Weight (g)	Weight (%)	Assay (%) Cu	Pb	Zn	Distribution (%) Cu	Pb	Zn
0 Feed	986.8	100.00	1.70	1.07	0.03	100.00	100.00	100.00
1 Pb-Conc.	6.9	0.70	3.1	73.1	2.33	1.28	47.83	49.91
2 PbCIT(4)	3.1	0.31	12.3	63.4	0.72	2.28	18.64	6.93
3 PbCIT(3)	3.1	0.31	44.3	25.9	0.2	8.21	7.61	1.92
4 PbCIT(2)	7.4	0.75	58.9	10.5	0.09	26.04	7.37	2.07
5 PbCIT(1)	12.9	1.31	53.5	6.52	0.07	41.24	7.58	2.80
6 Cu-Conc.	17.0	1.72	15.6	2.74	0.07	15.85	4.42	3.69
7 CL-T(3)	8.2	0.83	1.42	1.03	0.03	0.70	0.80	0.78
8 CL-T(2)	12.5	1.27	0.41	0.44	0.03	0.31	0.52	1.16
9 CL-T(1)	75	7.00	0.24	0.23	0.02	1.08	1.04	4.66
10 Tail	840.7	85.20	0.06	0.04	0.01	3.01	3.19	26.10
1	6.9	0.70	3.1	73.1	2.33	1.28	47.83	49.91
1+2	10.0	1.01	6.0	70.1	1.83	3.56	66.47	56.84
1+2+3	13.1	1.32	15.0	58.6	1.44	11.77	74.08	58.76
1+2+3+4	20.5	2.07	30.9	41.9	0.96	37.81	81.45	60.83
1+..+5	33.4	3.38	39.6	28.2	0.61	79.05	89.43	63.63
1+..+6	50.4	5.10	31.5	19.6	0.43	94.90	93.65	67.32
6	17.0	1.72	15.6	2.74	0.07	15.85	4.42	3.69
5+6	29.9	3.03	32.0	4.37	0.07	57.09	12.40	6.49
4+5+6	37.3	3.78	37.3	5.59	0.07	80.13	18.77	8.36
3+4+5+6	40.4	4.09	37.8	7.15	0.08	91.34	27.38	10.46
2+..+6	43.5	4.40	36.0	11.2	0.13	93.62	46.02	17.41
9+10	915.7	92.80	0.07	0.06	0.01	4.09	4.83	30.76

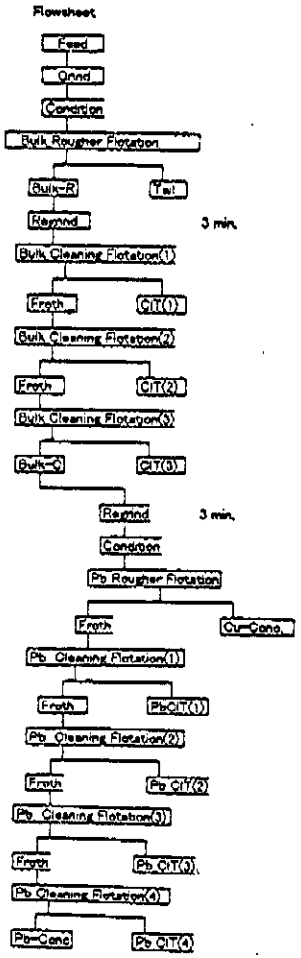
Appendix 38-3(2) Cleaning of Rougher Copper and Lead Concentrates



Table=	Condition														
Test No.	K-19														
Circuit Name	Grind	Condition	Bulk Rou. Flotation	Regrind	Bulk Cleaning Flotation 1	2	3	Regrind	Condition	Pb Roughar Flotation	Pb Cleaner Flotation 1	2	3	4	Total
Grinding time (min.)	14-14			5				3							
Condition time (min.)		3							8		8	8	8	8	
Flotation time (min.)			17		10	10	8			5	3	3	3	3	
Pulp temperature (℃)	16		20	16	18-19	19-20	19-20	16		16-19	19-20	19-20	19-20	19-20	
Pulp pH	8	8.1-8.0	8.0-8.1	7.7	7.7-7.9	7.6-8.0	7.0-7.7	9.7	9.6-10.4	10.4-9.4	9.4-10.0	9.7-9.6	9.6-9.3	9.0-9.5-9.1	9.0-5.2-5.9
Pulp ORP (mV)	120	120-130	130-135	130	130-130	70-60	60-60	10	0-(-10)	(-10)-40	(-35)-0-30	80-80-30	0-70-40	(-50)-240-230	
Feed size (-75 μ mWt%)	62.18														
Reagent (g/t)															
MIBC		48	33		5	4	3								97
AF65											0.5	0.5	0.5	0.5	2
AP242		60	15		2	2	2			0.2					81.2
NaIPX			20		3	3	2			0.3					28.3
Potassium Ferrocyanide								1000			500	500	500		2500
Na2S								20	20		20	10	10	20	100
H2SO4														50	50
	SUS Steel			SUS8 Mild2				SUS8 Mild2							
Test Mill	Rod Ball			Rod				Rod							
Test Machine	No.1	AG500g	AG500g	No.1	AG500g	AG250g	AG250g	No.1	AG250g	AG250g	AG100g	AG100g	AG100g	AG100g	

Test No. K-19									
Products	Weight (g)	Weight (%)	Assay (%) Cu	Pb	Zn	Distribution (%) Cu	Pb	Zn
0 Feed	988.2	100.00	1.65	1.08	0.04	100.00	100.00	100.00
1 Pb=Conc.	7.4	0.75	2.79	73.4	2.4	1.25	50.82	50.99
2 PbCIT(4)	6.4	0.65	23.1	48.5	0.71	8.92	29.04	13.05
3 PbCIT(3)	3.5	0.35	61.8	5.84	0.05	13.05	1.91	0.50
4 PbCIT(2)	6.1	0.62	61.0	4.72	0.04	22.45	2.69	0.70
5 PbCIT(1)	12.6	1.28	50.0	4.67	0.05	38.03	5.51	1.81
6 Cu=Conc.	15.7	1.59	12.1	2.22	0.06	11.46	3.26	2.71
7 CL-T(3)	5.0	0.51	1.13	1.11	0.03	0.34	0.52	0.43
8 CL-T(2)	12.4	1.25	0.46	0.5	0.03	0.34	0.58	1.07
9 CL-T(1)	81.4	8.24	0.23	0.23	0.02	1.13	1.75	4.68
10 Tail	837.7	84.76	0.06	0.05	0.01	3.03	3.92	24.06
1	7.4	0.75	2.8	73.4	2.40	1.25	50.82	50.99
1+2	13.8	1.40	12.2	61.9	1.62	10.17	79.86	64.04
1+2+3	17.3	1.75	22.2	50.5	1.30	23.22	81.77	64.54
1+2+3+4	23.4	2.37	32.3	38.8	0.97	45.67	84.46	65.24
1+..+5	36.0	3.85	38.5	28.7	0.65	83.70	89.97	67.05
1+..+6	51.7	5.24	30.5	19.3	0.47	95.18	93.23	69.76
6	15.7	1.59	12.1	2.22	0.06	11.46	3.26	2.71
5+6	28.3	2.87	28.0	3.31	0.06	49.49	8.77	4.52
4+5+6	34.4	3.49	34.7	3.58	0.05	71.94	11.48	5.22
3+4+5+6	37.9	3.84	37.2	3.77	0.05	84.99	13.37	5.72
2+..+6	44.3	4.49	35.1	10.23	0.15	93.91	42.41	18.77
9+10	919.1	93.00	0.08	0.07	0.01	4.18	5.67	28.74

Appendix 38-3(3) Cleaning of Rougher Copper and Lead Concentrates



Condition

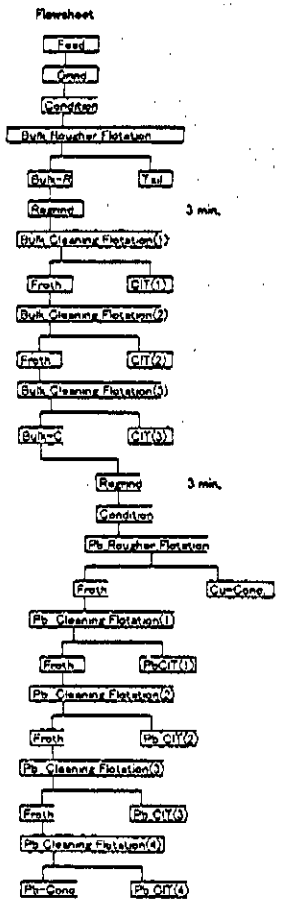
Test No. K-20

Circuit Name	Grind	Condition	Bulk Rou. Flotation	Regrind	Bulk Cleaning Flotation 1	2	3	Regrind	Condition	Pb Rougher Flotation	Pb Cleaner Flotation 1	2	3	4	Total
Grinding time (min)	14+14			3				3							
Condition time (min)		3							8		4	3	3	3	
Flotation time (min)			17		10	10	8			5	3	3	3	3	
Pulp temperature (℃)	13		16	17	17~19	22~24	23~25	18		17	23~24	22~23	23~25	23~24	
Pulp pH	8.2	8.2~8.3	8.2~8.2	7.9	7.9~8.0	7.6~8.0	7.7~7.9	8.1	9.0~9.0	9.0~8.7	8.9~8.5~9.0	9.5~8.8~8.8	9.0~9.5~8.6	8.5~8.7	
Pulp ORP (mV)	120	120~120	120~120	150	150~130	150~150	130~150	30	30~30	30~60	40~10~50	60~40~70	70~70~80	150~170	
Feed size (-75μ mW%)	62.18														
Reagent (g/t)															
MIBC		48	33		5	5				3					97
AF65												0.5	0.5	0.5	1.5
AP242		50	15		2	2	2			2					83
NaIPX			20		3	3	2			3				0.2	31.2
Potassium Ferrocyanide								1000			500	500	500	500	3000
NaCN									100		10	10	10	10	140
Test Mil	SUS Steel Rod Ball			SUS6 Mild2 Rod				SUS6 Mild2 Rod							
Test Machine	No.1	AG500g	AG500g	No.1	AG500g	AG250g	AG250g	No.1	AG250g	AG250g	AG100g	AG100g	AG100g	AG100g	

Test No. K-20

	Products	Weight (g)	Weight (%)	Assay (%) Cu	Pb	Zn	Distribution (%) Cu	Pb	Zn
0	Feed	987.2	100.00	1.71	1.10	0.03	100.00	100.00	100.00
1	Pb-Conc.	22.7	2.30	40.0	38.1	0.88	53.95	79.80	58.37
2	PbCIT(4)	2.4	0.24	49.5	17.8	0.34	7.06	3.93	2.38
3	PbCIT(3)	2.8	0.28	49.5	12	0.23	8.23	3.09	1.68
4	PbCIT(2)	3.8	0.38	47.1	7.49	0.17	10.63	2.62	1.89
5	PbCIT(1)	5.5	0.56	35.3	4.84	0.12	11.53	2.35	1.93
6	Cu-Conc.	14.9	1.51	4.10	1.78	0.06	3.63	2.41	2.61
7	CL-T(3)	8.6	0.87	1.21	1.01	0.03	0.47	0.61	0.58
8	CL-T(2)	13.1	1.33	0.44	0.46	0.03	0.34	0.55	1.15
9	CL-T(1)	84.3	8.54	0.24	0.23	0.02	1.20	1.78	4.93
10	Tail	831.1	84.19	0.06	0.04	0.01	2.96	3.06	24.28
	1	22.7	2.30	40.0	38.1	0.88	53.95	79.80	58.37
	1+2	25.1	2.54	40.9	36.2	0.83	61.01	83.53	60.75
	1+2+3	27.9	2.82	41.8	33.7	0.77	80.24	86.82	62.63
	1+2+3+4	31.7	3.20	42.4	30.59	0.70	78.87	89.24	64.52
	1+..+5	37.2	3.76	41.36	26.75	0.61	91.40	91.59	66.45
	1+..+6	52.1	5.27	30.70	19.80	0.45	95.03	94.00	69.06
	6	14.9	1.51	4.10	1.78	0.06	3.63	2.41	2.61
	5+6	20.4	2.07	12.51	2.54	0.08	15.16	4.76	4.54
	4+5+6	24.2	2.45	17.94	3.31	0.09	25.79	7.38	8.43
	3+4+5+6	27.0	2.73	21.22	4.22	0.11	34.02	10.47	8.31
	2+..+6	28.4	2.87	23.52	5.32	0.12	41.08	14.40	10.69
	9+10	915.4	92.73	0.08	0.06	0.01	4.16	4.84	29.21

Appendix 38-4 Results of Confirmation Test



Condition

Test No. K-21

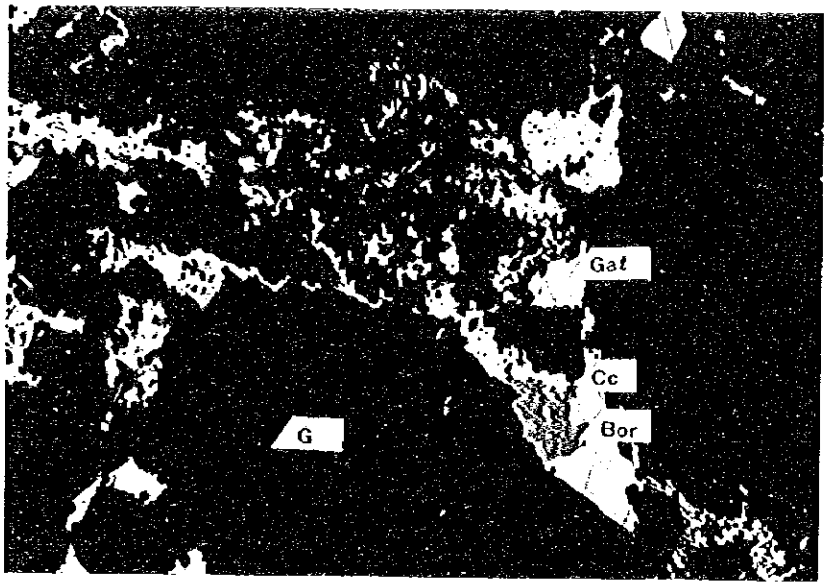
Circuit Name	Grind	Condition	Bulk Rou. Flotation	Regrind	Bulk Cleaning Flotation 1	2	3	Regrind	Condition	Pb Rougher Flotation	Pb Cleaner Flotation 1	2	3	4	Total
Grinding time (min)	(14→14)※6			6→3				9							
Condition time (min)		3							10		10	10	10	10	
Flotation time (min)			17→3		10→3	12	10			5	5	4	3	3	
Pulp temperature (℃)	16		19	18	18→19	18→19	19→18	14		14→16	17→20	17→20	18→20	18→20	
Pulp pH	8.2	8.4→9.4	8.4→8.3	8.4	8.4→8.3	8.3→8.3	8.3→8.3	10	10.0→10.3	10.3→9.8	9.7→10.5→10	9.7→10.2→9	9.6→10.7→9.6	9.6→9.7→9.2	
Pulp ORP (mV)	120	136→134	134→134	117	117→117	118→145	124→131	30	30→10	10→20	50→90→70	80→80→90	80→80→90	120→100→120	
Feed size (-75 μ m%)	67.16														
Reagent (g/t)															
MIBC		48	33								1	1			83
AP242		60	15		2	1.3	2				1	1			82.3
NaIPX			20		3	2	2				1	1			29
Potassium Ferrocyanide								1000			500	500	500	200	2700
No25											5	5			10
	SUS Steel			SUS6 Mild2				SUS4 Mild							
Test Mill	Rod Ball			Rod				Rod							
Test Machine	No.1	AG2000g	AG2000g	No.1	AG2000g	AG2000g	AG2000g	No.1	AG500g	AG500g	AG500g	AG500g	AG500g	AG500g	

Test No. K-21

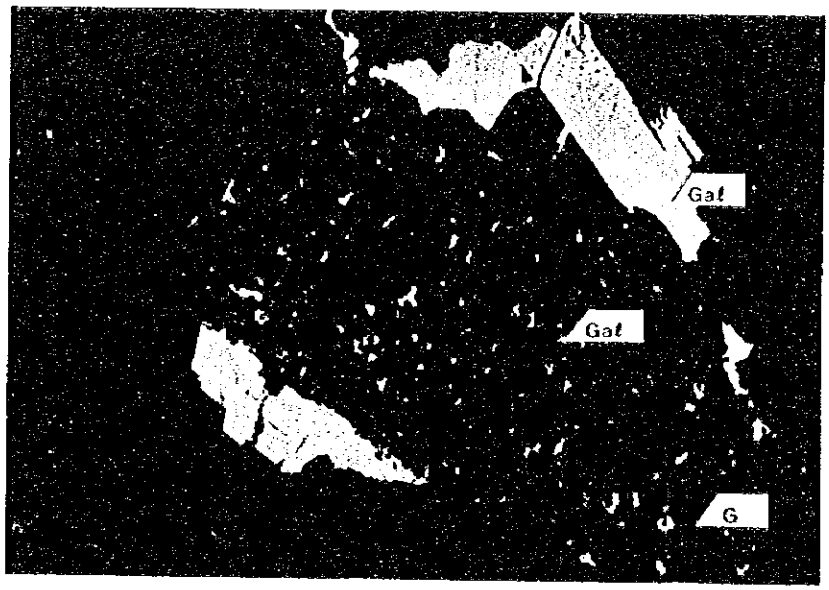
	Products	Weight (g)	Weight (%)	Assay (%) Cu	Pb	Zn	Distribution (%) Cu	Pb	Zn		Cu
	Feed	5910.8	100.00	1.72	1.14	0.05	100.00	100.00	100.00	選鉱試験で注	Cu
0	Pb-Conc.	61.4	1.04	2.3	75.0	2.32	1.40	68.43	48.97	Cu-Conc. Assay Cu % 33 Recovery Cu % 92.3	10156.2
1	PbCIT(4)	8.1	0.14	10.8	44.5	0.37	0.88	5.36	1.06	Cu-Conc. Assay Cu % 33.1 Recovery Cu % 89.8	141.22
2	PbCIT(3)	8.5	0.16	26.7	20.8	0.34	2.68	3.78	1.13	Pb-Conc. Assay Pb % 71.4 Recovery Pb % 73.6	87.48
3	PbCIT(2)	21.4	0.36	58.3	5.36	0.46	12.28	1.70	3.45	Pb-Conc. Assay Pb % 66.1 Recovery Pb % 77.8	272.65
4	PbCIT(1)	121.8	2.06	54.0	5.06	0.41	64.75	9.16	17.51	の成績が得られた。	1247.82
5	Cu-Conc.	131.4	2.22	9.71	2.28	0.08	12.56	4.45	3.69	・・は精選試験と同等の成績が得られた。	6577.2
6	CL-T(3)	67.5	1.14	0.56	0.66	0.04	0.37	0.68	0.95		1275.894
7	CL-T(2)	131.5	2.22	0.32	0.40	0.03	0.41	0.78	1.36		37.8
8	CL-T(1)	595.2	10.07	0.24	0.24	0.02	1.41	2.12	4.17		42.08
9	Tail	4763	80.59	0.07	0.05	0.01	3.28	3.54	18.70		142.648
10											333.41
	1	61.4	1.04	2.3	75.0	2.32	1.40	68.43	48.97		
	1+2	69.5	1.18	3.3	71.4	2.09	2.28	73.79	51.02		141.22
	1+2+3	78	1.34	6.3	66.1	1.88	4.84	77.57	52.15		228.70
	1+2+3+4	100.4	1.70	17.4	53.14	1.56	17.22	79.27	55.80		501.35
	1+...+5	222.2	3.76	37.47	26.76	0.84	81.97	88.43	73.11		1748.97
	1+...+6	353.6	5.98	27.16	17.88	0.52	94.53	92.88	76.80		8326.17
	6	131.4	2.22	9.71	2.28	0.08	12.56	4.45	3.69		9602.06
	5+6	253.2	4.28	31.02	3.62	0.24	77.31	13.81	21.20		1275.89
	4+5+6	274.6	4.64	33.14	3.75	0.26	89.59	15.31	24.65		7853.09
	3+4+5+6	284.1	4.80	32.98	4.52	0.26	92.27	19.09	25.76		9100.71
	2+...+6	292.2	4.94	32.36	5.83	0.26	93.13	24.45	26.83		9373.36
	9+10	5358.2	90.66	0.09	0.07	0.01	4.69	5.66	20.87		9460.64
											476.26

Appendix 39 (1) Photomicrographs of Ore Minerals, (Ore Dressing Test for the Complex Ore)

Feed



50μm
180×



50μm
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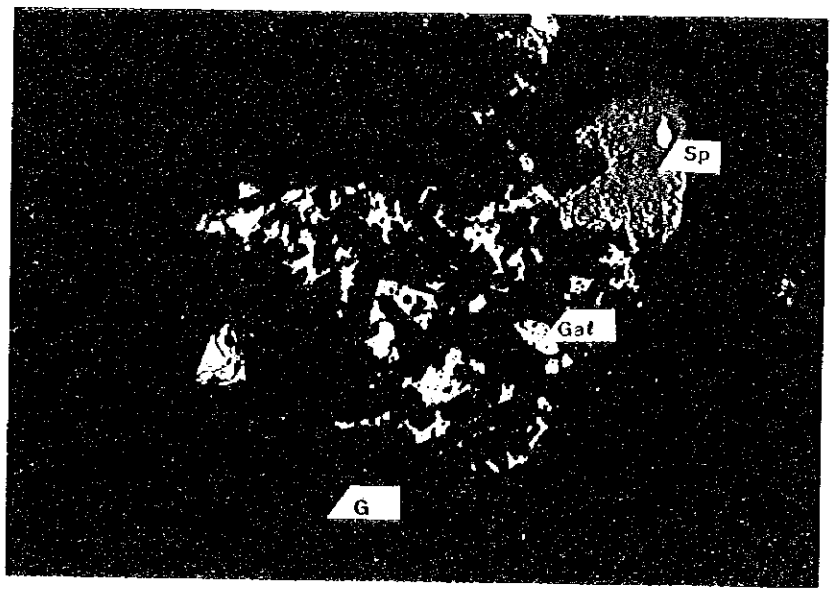
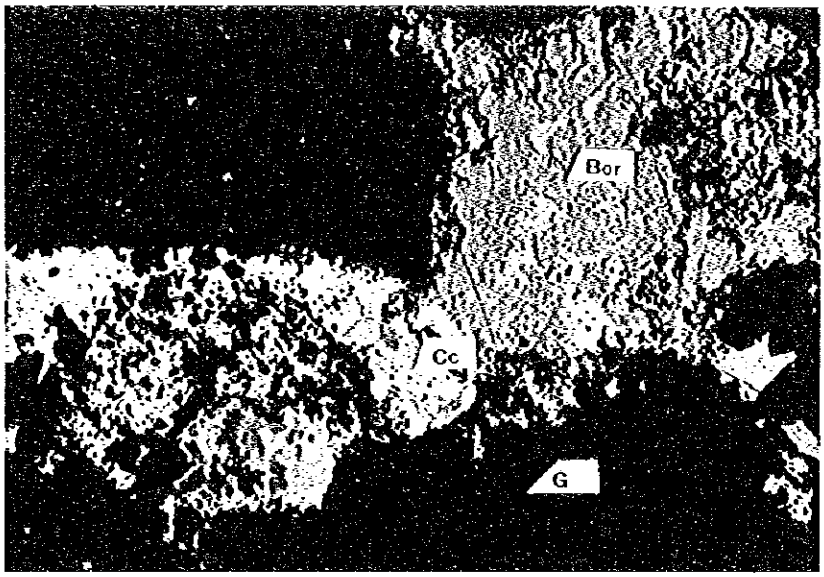


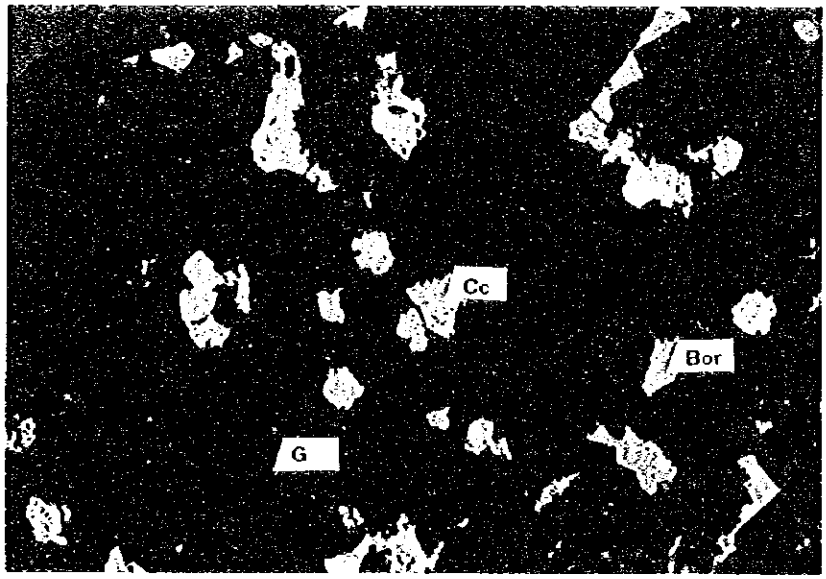
50μm
180×

Appendix 39 (2) Photomicrographs of Ore Minerals, (Ore Dressing Test for the Complex Ore)

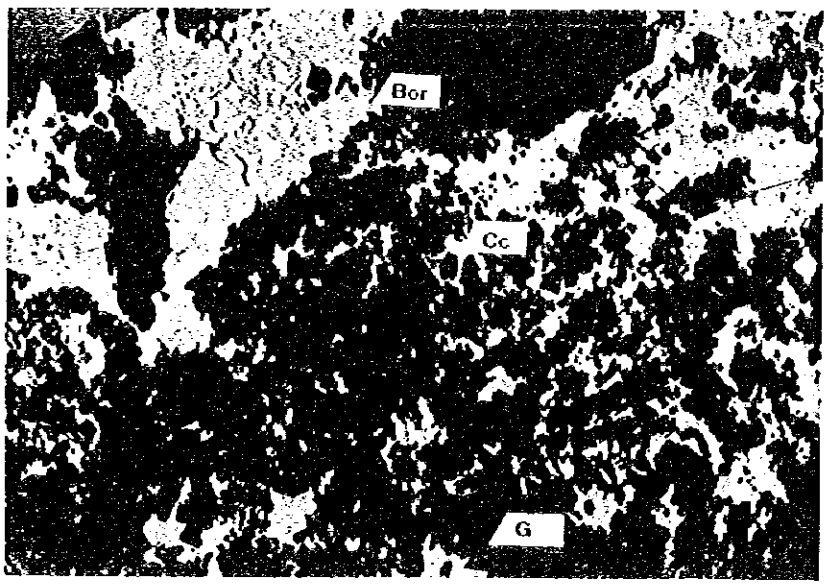
Feed



100μm
90×



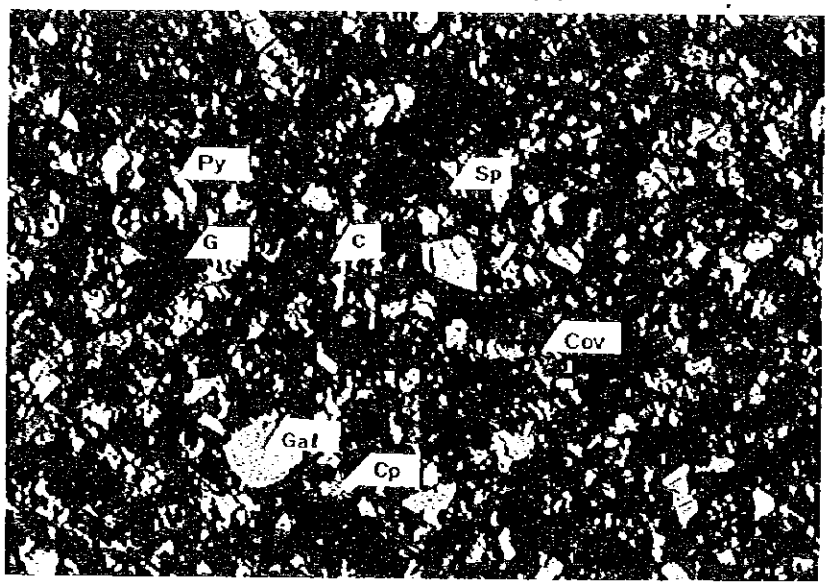
100μm
90×



50μm
180×

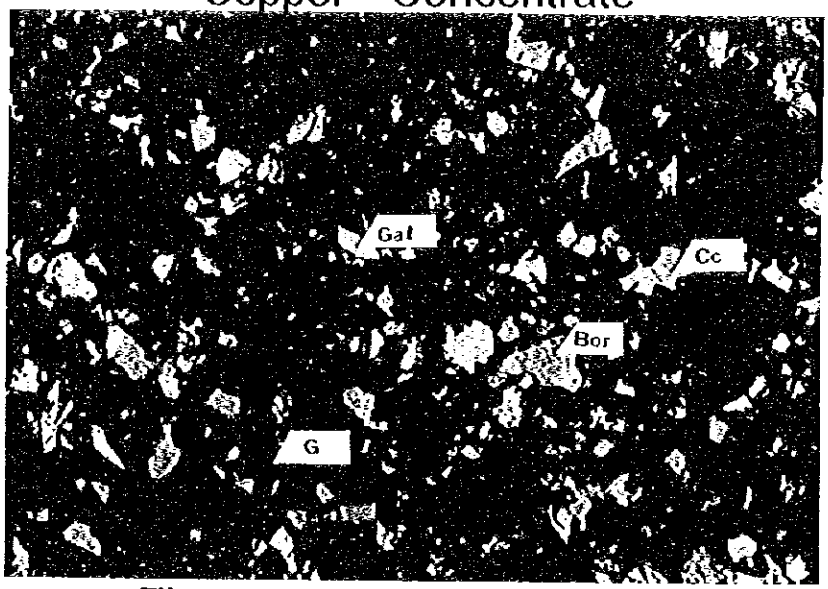
Appendix 39 (3) Photomicrographs of Ore Minerals, (Ore Dressing Test for the Complex Ore)

Lead Concentrate



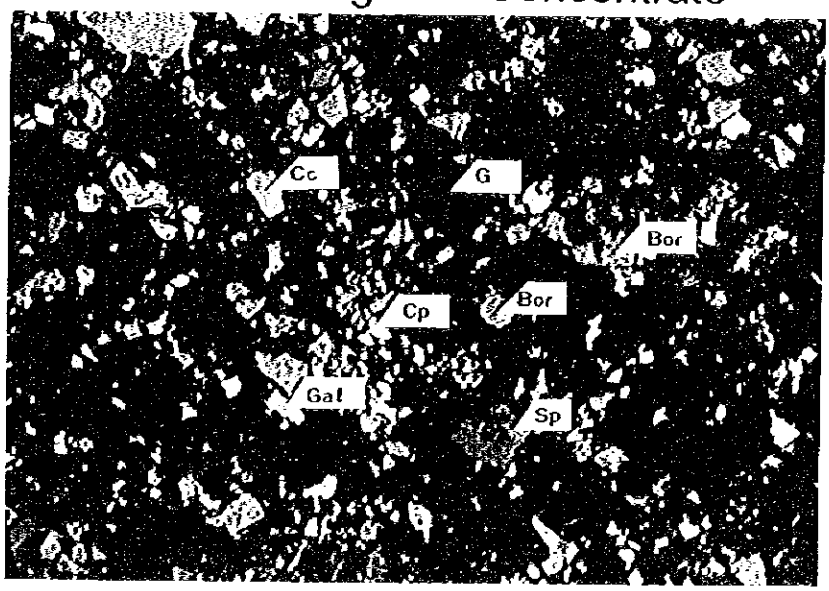
50μm
180×

Copper Concentrate



50μm
180×

Zinc Rougher Concentrate



50μm
180×

Appendix 40 Result of Minable Ore Reserve Estimation of Ore Horizon 4-1 (with 5.0% dilution)

1997-January

Mining Area #	Block	Thickness (m)	Reserve Ore (ktons)	Minable Ore (ktons)	Cu Grade (%)	Ag Grade (g/ton)	Pb Grade (%)	Zn Grade (%)	Cu Metal (kton)	Ag Metal (kg)	Pb Metal (kton)	Zn Metal (kton)
1	8	6.35	1321	1040	0.695	3.695	0.522	0.006	7.23	3844.11	5.43	0.06
2	18	4.14	1939	1527	1.410	9.200	0.976	0.018	21.52	14048.06	14.91	0.28
3	40	4.90	5098	4015	1.800	10.133	0.510	0.016	72.26	40682.04	20.49	0.65
4	35	5.49	5000	3938	2.029	11.181	1.192	0.093	79.88	44025.00	46.95	3.68
5	37	4.39	4228	3330	1.371	8.600	0.852	0.212	45.66	28634.13	28.38	7.07
6	33	4.24	3640	2867	1.371	7.686	0.450	0.069	39.31	22031.10	12.89	1.97
7	38	4.12	4067	3203	1.286	11.486	0.418	0.110	41.18	36786.02	13.39	3.54
8	47	3.46	4228	3330	1.105	8.771	0.301	0.089	36.78	29204.91	10.02	2.95
9	31	3.78	3047	2400	1.067	6.019	0.161	0.033	25.59	14442.78	3.86	0.80
10	17	3.23	1427	1124	1.048	45.971	0.000	0.000	11.77	51660.97	0.00	0.00
11	33	3.44	2951	2324	0.933	16.048	0.010	0.000	21.69	37293.26	0.22	0.00
12	19	4.09	2020	1591	0.705	4.724	0.008	0.005	11.21	7514.40	0.12	0.08
13	23	4.77	2852	2246	0.762	7.257	0.130	0.030	17.11	16299.18	2.93	0.66
14	42	6.69	7309	5756	1.648	8.981	0.130	0.085	94.83	51692.90	7.46	4.88
15	46	6.27	7504	5909	1.533	7.467	0.063	0.038	90.61	44123.52	3.71	2.25
16	49	6.21	7914	6232	1.114	5.124	0.072	0.022	69.45	31932.99	4.51	1.37
17	55	5.65	8078	6361	1.133	5.524	0.091	0.007	72.10	35139.30	5.82	0.42
18	62	6.46	10422	8207	0.981	3.810	0.042	0.027	80.51	31266.00	3.44	2.19
19	46	8.11	9698	7637	1.000	4.762	0.043	0.006	76.37	36367.50	3.27	0.44
20	21	7.43	4058	3196	1.314	6.705	0.055	0.000	42.00	21426.24	1.77	0.00
21	19	5.27	2602	2049	0.667	1.324	0.002	0.000	13.66	2712.59	0.04	0.00
22	16	3.72	1547	1218	0.638	1.305	0.000	0.000	7.77	1589.54	0.00	0.00
23	14	7.01	2551	2009	0.962	10.438	0.021	0.000	19.32	20969.22	0.42	0.00
24	23	5.05	3019	2377	1.190	8.210	0.016	0.001	28.30	19517.84	0.38	0.02
25	33	4.96	4257	3352	1.600	8.114	0.029	0.002	53.64	27202.23	0.96	0.06
26	23	4.61	2756	2170	1.619	6.162	0.029	0.000	35.14	13373.49	0.62	0.00
27	22	4.20	2402	1892	0.762	4.971	0.004	0.000	14.41	9403.83	0.07	0.00
28	35	4.75	4322	3404	1.257	11.467	0.001	0.000	42.79	39027.66	0.03	0.00
29	47	6.53	7977	6282	0.905	11.181	0.022	0.017	56.84	70237.49	1.38	1.08
30	36	4.94	4623	3641	0.800	8.771	0.026	0.010	29.12	31933.37	0.94	0.38
31	20	4.53	2353	1853	0.695	7.105	0.006	0.000	12.88	13165.04	0.11	0.00
32	21	10.90	5949	4685	1.048	16.010	0.011	0.000	49.08	75002.02	0.54	0.00
33	17	9.37	4142	3262	0.600	8.133	0.004	0.000	19.57	26529.51	0.12	0.00
34	9	4.93	1154	909	0.733	16.571	0.000	0.000	6.66	15059.70	0.00	0.00
35	26	6.40	4329	3409	0.838	16.210	0.000	0.000	28.57	55259.69	0.00	0.00
Total & Ave.	1061	5.47	150784.00	118742.40	1.1578	8.5850	0.1644	0.0293	1374.85	1019397.60	195.17	34.81

Appendix 41 Estimated Operating Costs of Zhaman-Aibat Mine (Production: 4.5 Mt/year)

Item	Specification	Operation Cost (US$/t ore)
1 .Mining		
Boring (Exploration Drilling)	5,000m/year	0.063
Stope Preparation		0.467
Ore Extraction		2.582
Ore Lifting	700m - 1,100t/hr	0.470
Lifting for service	700m	0.270
Rail Haulage	one way 5.5km	0.861
Truck Haulage	one way 1.0km	0.849
Mining Subtotal		5.562
2. Operation for mining facilities		
Compressed Air	1,800m^3/min	0.629
General and Others		0.970
Ore storage		0.169
Ventilation System	40,000m^3/min	0.081
Waste water treatment System	20,000m^3/day	0.370
Water supply System	5,000m^3/day	0.053
Mining Facilities Subtotal		2.272
3. Ore Dressing	16,000t/day	4.330
4. Administration and General		1.028
5. Concentrates Transportation	one way 155km -560t/day	0.311
6. Camp administration	for 2,000 person	3.246
Operation Total		16.749

Appendix 42 Estimated Operating Costs of Zhanan-Aibat Mine
(Production: 5.6 Mt/year)

Item	Specification	Operation Cost (US$/t ore)
1 .Mining		
Boring (Exploration Drilling)	5,000m/year	0.051
Stope Preparation		0.467
Ore Extraction		2.510
Ore Lifting	700m - 1,300t/hr	0.435
Lifting for service	700m	0.236
Rail Haulage	one way 5.5km	0.765
Truck Haulage	one way 1.0km	0.843
Mining Subtotal		5.307
2. Operation for mining facilities		
Compressed Air	2,000m^3/min	0.572
General and Others		0.899
Ore storage		0.152
Ventilation System	64,000m^3/min	0.103
Waste water treatment System	20,000m^3/day	0.296
Water supply System	5,000m^3/day	0.042
Mining Facilities Subtotal		2.064
3. Ore Dressing	20,000t/day	4.080
4. Administration and General		0.934
5. Concentrates Transportation	one way 155km -700t/day	0.311
6. Camp administration	for 2.000 person	2.597
Operation Total		15.293

Appendix 43 Estimated Operating Costs of Zhaman-Aibat Mine (Production: 6.7 Mt/year)

Item	Specification	Operation Cost (US$/t ore)
1 .Mining		
Boring (Exploration Drilling)	5,000m/year	0.042
Stope Preparation		0.467
Ore Extraction		2.452
Ore Lifting	700m - 1,600t/hr	0.436
Lifting for service	700m	0.221
Rail Haulage	one way 5.5km	0.696
Truck Haulage	one way 1.0km	0.838
Mining Subtotal		5.152
2. Operation for mining facilities		
Compressed Air	2,200m^3/min	0.535
General and Others		0.845
Ore storage		0.140
Ventilation System	82,000m^3/min	0.110
Waste water treatment System	20,000m^3/day	0.246
Water supply System	5,000m^3/day	0.035
Mining Facilities Subtotal		1.911
3. Ore Dressing	24,000t/day	4.000
4. Administration and General		0.863
5. Concentrates Transportation	one way 155km -840t/day	0.311
6. Camp administration	for 2.000 person	2.164
Operation Total		14.401

Appendix 44 Estimated Capital Costs of Zhaman-Aibat Mine (Production: 4.5 Mt/year)

Item	Specification	Unit price (US$)	Number of Unit		Amount (US$)
1. Underground Development					
Sinking for main shaft	diameter 7.5m	11,228	700	m	7,859,600
Sinking for service shaft	diameter 6.5m	10,429	700	m	7,300,300
Sinking for ventilation shaft	diameter 6.5m	10,429	4,200	m	43,801,800
Main drift	18m^2	985	11,000	m	10,835,000
Main hauling drift (Rail haulage)	18m^2	1,469	11,000	m	16,159,000
Cross cutting	18m^2	985	31,800	m	31,323,000
Ventilation drift	14.4m^2	732	10,500	m	7,686,000
Ore pass	diameter 4.0m	3,351	1,460	m	4,892,460
U / G Crusher room	300m^2	8,281	80	m	662,480
U / G Work shop (Repair shop)	120m^3	3,770	80	m	301,600
Ore storage bin	8,000t	238,076	2	unit	476,152
U / G drainage system	20,000m^3/day	30,777	1	unit	30,777
U / G Subtotal					131,328,169
2. Mining Equipment & Machine					
Winding facilities for skip	1,100t/hr	6,790,718	1	unit	6,790,718
Winding facilities for service		2,240,937	1	unit	2,240,937
U / G Crusher facilities		4,771,397	2	unit	9,542,794
Equipment for drilling & blasting		7,666,096	3	unit	22,998,288
LHD Equipment		4,710,679	3	unit	14,132,037
Equipment for rail haulage		16,605,327	3	unit	49,815,981
Equipment for truck haulage		14,706,500	3	unit	44,119,500
Mining Equipment & Machine Subtotal					149,640,255
3. Mine Plant					
Communication System		86,599	1	unit	86,599
Compressed air facilities	1,800m^3/min	2,039,888	1	unit	2,039,888
Electrical system	80,000kw	3,984,960	1	unit	3,984,960
Fuel supply system		50,823	1	unit	50,823
Administration office		1,082,880	1	unit	1,082,880
Assay office		525,744	1	unit	525,744
Surface repair shops & Warehouse		2,393,450	1	unit	2,393,450
U / G repair shops & Warehouse		811,251	1	unit	811,251
Surface ore storage facilities	19,200t	651,036	1	unit	651,036
Surface other buildings		1,122,390	1	unit	1,122,390
Ventilation system	40,000m^3/min	1,977,164	1	unit	1,977,164
Waste water system & treatment plant	20,000m^3/day	1,317,698	1	unit	1,317,698
Water supply system	5,000m^3/day	662,124	1	unit	662,124
Mine Plant Total					16,706,007
4. Infrastructure					
Access road	width 5m	74,955	85	km	6,371,175
Railroad		303,724	155	km	47,077,220
Main power lines & transformers	40MVA	118,981	130	km	15,467,530
Houses		5,600	1,000		5,600,000
Infrastructure Total					74,515,925
5. Ore dressing	16,000t/day	78,000,000	1	unit	78,000,000
Subtotal					450,190,356
Working Capital (three monthes of operation cost)					18,700,000
Capital Cost Total					468,890,356

Appendix 45 Estimated Capital Costs of Zhaman-Aibat Mine (Production: 5.6 Mt/year)

Item	Specification	Unit price (US$)	Number of Unit		Amount (US$)
1. Underground Development					
Sinking for main shaft	diameter 7.5m	11,228	700	m	7,859,600
Sinking for service shaft	diameter 6.5m	10,429	700	m	7,300,300
Sinking for ventilation shaft	diameter 6.5m	10,429	6,300	m	65,702,700
Main drift	18m^2	985	11,000	m	10,835,000
Main hauling drift (Rail haulage)	18m^2	1,469	11,000	m	16,159,000
Cross cutting	18m^2	985	31,800	m	31,323,000
Ventilation drift	14.4m^2	732	10,500	m	7,686,000
Ore pass	diameter 4.0m	3,351	1,460	m	4,892,460
U / G Crusher room	300m^2	8,281	80	m	662,480
U / G Work shop (Repair shop)	120m^3	3,770	80	m	301,600
Ore storage bin	10,000t	289,802	2	unit	579,604
U / G drainage system	20,000m^3/day	30,777	1	unit	30,777
U / G Subtotal					153,332,521
2. Mining Equipment & Machine					
Winding facilities for skip	1,300t/hr	7,916,209	1	unit	7,916,209
Winding facilities for service		2,612,349	1	unit	2,612,349
U / G Crusher facilities		5,672,191	2	unit	11,344,382
Equipment for drilling & blasting		9,244,465	2	unit	18,488,930
LHD Equipment		5,888,348	2	unit	11,776,696
Equipment for rail haulage		18,727,592	2	unit	37,455,184
Equipment for truck haulage		17,730,456	2	unit	35,460,912
Mining Equipment & Machine Subtotal					125,054,662
3. Mine Plant					
Communication System		95,939	1	unit	95,939
Compressed air facilities	2,000m^3/min	2,194,865	1	unit	2,194,865
Electrical system	100,000kw	4,679,497	1	unit	4,679,497
Fuel supply system		60,938	1	unit	60,938
Administration office		1,236,635	1	unit	1,236,635
Assay office		596,388	1	unit	596,388
Surface repair shops & Warehouse		2,856,124	1	unit	2,856,124
U / G repair shops & Warehouse		898,345	1	unit	898,345
Surface ore storage facilities	24,000t	743,973	1	unit	743,973
Surface other buildings		1,237,629	1	unit	1,237,629
Ventilation system	64,000m^3/min	5,163,752	1	unit	5,163,752
Waste water system & treatment plant	20,000m^3/day	1,317,698	1	unit	1,317,698
Water supply system	5,000m^3/day	662,124	1	unit	662,124
Mine Plant Total					21,743,907
4. Infrastructure					
Access road	width 5m	74,955	85	km	6,371,175
Railroad		303,724	155	km	47,077,220
Main power lines & transformers	50MVA	126,596	130	km	16,457,480
Houses		5,600	1,000		5,600,000
Infrastructure Total					75,505,875
5. Ore dressing	20,000t/day	95,000,000	1	unit	95,000,000
Subtotal					470,636,965
Working Capital (three monthes of operation cost)					21,300,000
Capital Cost Total					491,936,965

Appendix 46 Estimated Capital Costs of Zhaman-Aibat Mine
(Production: 6.7 Mt/year)

Item	Specification	Unit price (US$)	Number of Unit	Amount (US$)
1. Underground Development				
Sinking for main shaft	diameter 7.5m	11,228	700 m	7,859,600
Sinking for service shaft	diameter 6.5m	10,429	700 m	7,300,300
Sinking for ventilation shaft	diameter 6.5m	10,429	8,400 m	87,603,600
Main drift	18m^2	985	11,000 m	10,835,000
Main hauling drift (Rail haulage)	18m^2	1,469	11,000 m	16,159,000
Cross cutting	18m^2	985	31,800 m	31,323,000
Ventilation drift	14.4m^2	732	10,500 m	7,686,000
Ore pass	diameter 4.0m	3,351	1,460 m	4,892,460
U / G Crusher room	300m^2	8,281	80 m	662,480
U / G Work shop (Repair shop)	120m^3	3,770	80 m	301,600
Ore storage bin	12,000t	340,890	2 unit	681,780
U / G drainage system	20,000m^3/day	30,777	1 unit	30,777
U / G Subtotal				175,335,597
2. Mining Equipment & Machine				
Winding facilities for skip	1,600t/hr	9,578,542	1 unit	9,578,542
Winding facilities for service		3,160,919	1 unit	3,160,919
U / G Crusher facilities		6,533,055	2 unit	13,066,110
Equipment for drilling & blasting		10,772,459	2 unit	21,544,918
LHD Equipment		7,066,018	2 unit	14,132,036
Equipment for rail haulage		20,661,442	2 unit	41,322,884
Equipment for truck haulage		20,657,311	2 unit	41,314,622
Mining Equipment & Machine Subtotal				144,120,031
3. Mine Plant				
Communication System		104,313	1 unit	104,313
Compressed air facilities	2,200m^3/min	2,345,178	1 unit	2,345,178
Electrical system	120,000kw	5,335,925	1 unit	5,335,925
Fuel supply system		71,054	1 unit	71,054
Administration office		1,378,334	1 unit	1,378,334
Assay office		661,098	1 unit	661,098
Surface repair shops & Warehouse		3,299,807	1 unit	3,299,807
U / G repair shops & Warehouse		976,402	1 unit	976,402
Surface ore storage facilities	28,800t	829,674	1 unit	829,674
Surface other buildings		1,340,515	1 unit	1,340,515
Ventilation system	82,000m^3/min	10,608,583	1 unit	10,608,583
Waste water system & treatment plant	20,000m^3/day	1,317,698	1 unit	1,317,698
Water supply system	5,000m^3/day	662,124	1 unit	662,124
Mine Plant Total				28,930,705
4. Infrastructure				
Access road	width 5m	74,955	85 km	6,371,175
Railroad		303,724	155 km	47,077,220
Main power lines & transformers	60MVA	133,178	130 km	17,313,140
Houses		5,600	1,000	5,600,000
Infrastructure Total				76,361,535
5. Ore dressing	24,000t/day	112,000,000	1 unit	112,000,000
Subtotal				536,747,868
Working Capital (three monthes of operation cost)				24,100,000
Capital Cost Total				560,847,868

	Cu	Ag
Ave. Mill Recov.%	90.0	90.0
Smelter Recov. %	98.0	94.5
Price $/t ($/kg)	2,500	128.6
TC-RC Cent lb ($/kg)	20	9.65
Mining Cost $/t	5.560	
Milling Cost $/t	4.330	
Maintenance & others	2.272	
Administration $/t	4.274	
Transportation $/t	0.311	

Appendix 47 Table of Cashflow of the Zhaman-Aibat Mine (Production: 4.5 Mt/year)

		Year	-3	-2	-1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	Total
Production	Total ore mined	kt				4,500	4,500	4,500	4,500	4,500	4,500	4,500	4,500	4,500	4,500	4,500	4,500	4,500	4,500	4,500	4,500	4,500	4,500	4,500	4,500	4,500	4,500	4,500	4,500	4,500	4,500	1,730	118,730
	Ore to mill	kt				4,500	4,500	4,500	4,500	4,500	4,500	4,500	4,500	4,500	4,500	4,500	4,500	4,500	4,500	4,500	4,500	4,500	4,500	4,500	4,500	4,500	4,500	4,500	4,500	4,500	4,500	1,730	118,730
	Feed grade (Cu)	%				1.21	1.21	1.21	1.21	1.21	1.18	1.18	1.18	1.18	1.18	1.18	1.18	1.18	1.18	1.18	1.29	1.29	1.29	1.29	1.29	1.03	1.03	1.03	1.03	1.03	0.84	0.84	1.160
	Feed grade (Ag)	g/t				5.62	5.62	5.62	5.62	5.62	6.14	6.14	6.14	6.14	6.14	7.46	7.46	7.46	7.46	7.46	10.21	10.21	10.21	10.21	10.21	11.53	11.53	11.53	11.53	11.53	15.67	15.67	8.584
	Contained Cu	kt				54.45	54.45	54.45	54.45	54.45	53.1	53.1	53.1	53.1	53.1	53.1	53.1	53.1	53.1	53.1	58.05	58.05	58.05	58.05	58.05	46.35	46.35	46.35	46.35	46.35	37.8	14.532	1,377.58
	Contained (Ag)	t				25.29	25.29	25.29	25.29	25.29	27.63	27.63	27.63	27.63	27.63	33.57	33.57	33.57	33.57	33.57	45.945	45.945	45.945	45.945	45.945	51.885	51.885	51.885	51.885	51.885	70.515	27.109	1,019.22
Cu Conc.	Conc. grade (Cu)	%				35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.00
	Conc. Grade (Ag)	g/t				162.56	162.56	162.56	162.56	162.56	182.12	182.12	182.12	182.12	182.12	221.27	221.27	221.27	221.27	221.27	277.02	277.02	277.02	277.02	277.02	391.80	391.80	391.80	391.80	391.80	652.92	652.92	258.95
	Conc.	kt				140.014	140.014	140.014	140.014	140.014	136.543	136.543	136.543	136.543	136.543	136.543	136.543	136.543	136.543	136.543	149.271	149.271	149.271	149.271	149.271	119.186	119.186	119.186	119.186	119.186	97.200	37.368	3,542.354
	Contained Cu	kt				49.005	49.005	49.005	49.005	49.005	47.790	47.790	47.790	47.790	47.790	47.790	47.790	47.790	47.790	47.790	52.245	52.245	52.245	52.245	52.245	41.715	41.715	41.715	41.715	41.715	34.020	13.079	1,239.824
	Contained Ag	t				22.761	22.761	22.761	22.761	22.761	24.867	24.867	24.867	24.867	24.867	30.213	30.213	30.213	30.213	30.213	41.351	41.351	41.351	41.351	41.351	46.697	46.697	46.697	46.697	46.697	63.464	24.398	917.302
Revenue	Payable Cu	kt				48.025	48.025	48.025	48.025	48.025	46.834	46.834	46.834	46.834	46.834	46.834	46.834	46.834	46.834	46.834	51.200	51.200	51.200	51.200	51.200	40.881	40.881	40.881	40.881	40.881	33.340	12.817	1,215.027
	Payable Ag	t				21.509	21.509	21.509	21.509	21.509	23.499	23.499	23.499	23.499	23.499	28.551	28.551	28.551	28.551	28.551	39.076	39.076	39.076	39.076	39.076	44.128	44.128	44.128	44.128	44.128	59.973	23.056	866.850
	Revenue Cu	K$				120,062	120,062	120,062	120,062	120,062	117,086	117,086	117,086	117,086	117,085	117,085	117,086	117,086	117,086	117,086	128,000	128,000	128,000	128,000	128,000	102,202	102,202	102,202	102,202	102,202	83,349	32,043	3,037,568
	Revenue Ag	K$				2,766	2,766	2,766	2,766	2,766	3,022	3,022	3,022	3,022	3,022	3,672	3,672	3,672	3,672	3,672	5,025	5,025	5,025	5,025	5,025	5,675	5,675	5,675	5,675	5,675	7,713	2,965	111,477
	Total revenue	K$				122,828	122,828	122,828	122,828	122,828	120,108	120,108	120,108	120,108	120,108	120,757	120,757	120,757	120,757	120,757	133,025	133,025	133,025	133,025	133,025	107,877	107,877	107,877	107,877	107,877	91,062	35,008	3,149,045
Operating	Mining cost	K$				25,020	25,020	25,020	25,020	25,020	25,020	25,020	25,020	25,020	25,020	25,020	25,020	25,020	25,020	25,020	25,020	25,020	25,020	25,020	25,020	25,020	25,020	25,020	25,020	25,020	25,020	9,619	660,139
	Milling cost	K$				19,485	19,485	19,485	19,485	19,485	19,485	19,485	19,485	19,485	19,485	19,485	19,485	19,485	19,485	19,485	19,485	19,485	19,485	19,485	19,485	19,485	19,485	19,485	19,485	19,485	19,485	7,491	514,101
	Maintenance & others	K$				10,224	10,224	10,224	10,224	10,224	10,224	10,224	10,224	10,224	10,224	10,224	10,224	10,224	10,224	10,224	10,224	10,224	10,224	10,224	10,224	10,224	10,224	10,224	10,224	10,224	10,224	3,931	269,755
	Administration	K$				19,233	19,233	19,233	19,233	19,233	19,233	19,233	19,233	19,233	19,233	19,233	19,233	19,233	19,233	19,233	19,233	19,233	19,233	19,233	19,233	19,233	19,233	19,233	19,233	19,233	19,233	7,394	507,452
	Transportation	K$				1,400	1,400	1,400	1,400	1,400	1,400	1,400	1,400	1,400	1,400	1,400	1,400	1,400	1,400	1,400	1,400	1,400	1,400	1,400	1,400	1,400	1,400	1,400	1,400	1,400	1,400	538	36,925
	Smelting & Refining	K$				21,383	21,383	21,383	21,383	21,383	20,877	20,877	20,877	20,877	20,877	20,926	20,926	20,926	20,926	20,926	22,952	22,952	22,952	22,952	22,952	18,451	18,451	18,451	18,451	18,451	15,279	5,874	544,095
	Total cost	K$				96,744	96,744	96,744	96,744	96,744	96,238	96,238	96,238	96,238	96,238	96,287	96,287	96,287	96,287	96,287	98,314	98,314	98,314	98,314	98,314	93,812	93,812	93,812	93,812	93,812	90,640	34,846	2,532,466
Capital Cost	Capital Cost	K$	42,550	119,956	135,027	414	414	414	1,027	2,326	7,253	7,499	29,342	29,931	8,169	2,860	2,860	2,860	3,530	3,547	3,741	25,584	25,587	5,058	5,292	711	711	711	711	812	0	0	468,897
	Working Cost	K$	0	0	18,700	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-18,700	0
	Total Cost	K$	42,550	119,956	153,727	414	414	414	1,027	2,326	7,253	7,499	29,342	29,931	8,169	2,860	2,860	2,860	3,530	3,547	3,741	25,584	25,587	5,058	5,292	711	711	711	711	812	0	-18,700	468,897
Cash Flow	Cash Flow	K$	-42,550	-119,956	-153,727	25,670	25,670	25,670	25,057	23,758	16,616	16,370	-5,473	-6,062	15,700	21,610	21,610	21,610	20,940	20,923	30,971	9,128	9,125	29,654	29,420	13,353	13,353	13,353	13,353	13,252	421	18,862	147,682
	Accum. net profit	K$	-42,550	-162,506	-316,233	-290,563	-264,893	-239,223	-214,166	-190,407	-173,791	-157,421	-162,894	-168,956	-153,256	-131,646	-110,036	-88,426	-67,486	-46,563	-15,592	-6,464	2,661	32,314	61,734	75,087	88,440	101,793	115,147	128,399	128,820	147,682	
	Preproduction cost	K$	297,533																														

	Cu	Ag
Ave. Mill Recov.%	90.0	90.0
Smelter Recov. %	98.0	94.5
Price $/t ($/kg)	2,500	128.6
TC-RC Cent/lb ($/kg)	20	9.65
Mining Cost $/t	5.306	
Milling Cost $/t	4.08	
Maintenance & others $/t	2.064	
Administration $/t	3.53	
Transportation $/t	0.311	

Appendix 48 Table of Cashflow of the Zhaman-Aibat Mine (Production: 5.6 Mt/year)

			-3	-2	-1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	Total
Production	Total ore mined	kt				5,600	5,600	5,600	5,600	5,600	5,600	5,600	5,600	5,600	5,600	5,600	5,600	5,600	5,600	5,600	5,600	5,600	5,600	5,600	5,600	5,600	5,600	123,200
	Ore to mill	kt				5,600	5,600	5,600	5,600	5,600	5,600	5,600	5,600	5,600	5,600	5,600	5,600	5,600	5,600	5,600	5,600	5,600	5,600	5,600	5,600	5,600	5,600	123,200
	Feed grade (Cu)	%				1.16	1.16	1.16	1.16	1.16	1.23	1.23	1.23	1.23	1.23	1.04	1.04	1.04	1.04	1.04	1.28	1.28	1.28	1.28	1.28	0.84	0.84	1.15
	Feed grade (Ag)	g/t				5.31	5.31	5.31	5.31	5.31	6.93	6.93	6.93	6.93	6.93	9.19	9.19	9.19	9.19	9.19	11.19	11.19	11.19	11.19	11.19	15.71	15.71	8.84
	Contained Cu	kt				64.96	64.96	64.96	64.96	64.96	68.88	68.88	68.88	68.88	68.88	58.24	58.24	58.24	58.24	58.24	71.68	71.68	71.68	71.68	71.68	47.04	47.04	1,412.88
	Contained (Ag)	t				29.74	29.74	29.74	29.74	29.74	38.81	38.81	38.81	38.81	38.81	51.46	51.46	51.46	51.46	51.46	62.66	62.66	62.66	62.66	62.66	87.98	87.98	1,089.31
Cu Conc.	Conc. grade (Cu)	%				35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.00
	Conc. Grade (Ag)	g/t				160.22	160.22	160.22	160.22	160.22	197.20	197.20	197.20	197.20	197.20	309.28	309.28	309.28	309.28	309.28	305.98	305.98	305.98	305.98	305.98	654.58	654.58	269.85
	Conc.	kt				167.04	167.04	167.04	167.04	167.04	177.12	177.12	177.12	177.12	177.12	149.76	149.76	149.76	149.76	149.76	184.32	184.32	184.32	184.32	184.32	120.96	120.96	3,633.12
	Contained Cu	kt				58.46	58.46	58.46	58.46	58.46	61.99	61.99	61.99	61.99	61.99	52.42	52.42	52.42	52.42	52.42	64.51	64.51	64.51	64.51	64.51	42.34	42.34	1,271.59
	Contained Ag	t				26.76	26.76	26.76	26.76	26.76	34.93	34.93	34.93	34.93	34.93	46.32	46.32	46.32	46.32	46.32	56.40	56.40	56.40	56.40	56.40	79.18	79.18	980.38
Revenue	Payable Cu	kt				57.29	57.29	57.29	57.29	57.29	60.75	60.75	60.75	60.75	60.75	51.37	51.37	51.37	51.37	51.37	63.22	63.22	63.22	63.22	63.22	41.49	41.49	1246.16
	Payable Ag	t				25.29	25.29	25.29	25.29	25.29	33.01	33.01	33.01	33.01	33.01	43.77	43.77	43.77	43.77	43.77	53.30	53.30	53.30	53.30	53.30	74.82	74.82	926.46
	Revenue Cu	K$				143,237	143,237	143,237	143,237	143,237	151,880	151,880	151,880	151,880	151,880	128,419	128,419	128,419	128,419	128,419	158,054	158,054	158,054	158,054	158,054	103,723	103,723	3,115,400
	Revenue Ag	K$				3,252	3,252	3,252	3,252	3,252	4,245	4,245	4,245	4,245	4,245	5,629	5,629	5,629	5,629	5,629	6,854	6,854	6,854	6,854	6,854	9,622	9,622	119,143
	Total revenue	K$				146,489	146,489	146,489	146,489	146,489	156,125	156,125	156,125	156,125	156,125	134,048	134,048	134,048	134,048	134,048	164,908	164,908	164,908	164,908	164,908	113,346	113,346	3,234,543
Operating	Mining cost	K$				29,714	29,714	29,714	29,714	29,714	29,714	29,714	29,714	29,714	29,714	29,714	29,714	29,714	29,714	29,714	29,714	29,714	29,714	29,714	29,714	29,714	29,714	653,699
	Milling cost	K$				22,848	22,848	22,848	22,848	22,848	22,848	22,848	22,848	22,848	22,848	22,848	22,848	22,848	22,848	22,848	22,848	22,848	22,848	22,848	22,848	22,848	22,848	502,656
	Maintenance & others	K$				11,558	11,558	11,558	11,558	11,558	11,558	11,558	11,558	11,558	11,558	11,558	11,558	11,558	11,558	11,558	11,558	11,558	11,558	11,558	11,558	11,558	11,558	254,285
	Administration	K$				19,768	19,768	19,768	19,768	19,768	19,768	19,768	19,768	19,768	19,768	19,768	19,768	19,768	19,768	19,768	19,768	19,768	19,768	19,768	19,768	19,768	19,768	434,896
	Transportation	K$				1,742	1,742	1,742	1,742	1,742	1,742	1,742	1,742	1,742	1,742	1,742	1,742	1,742	1,742	1,742	1,742	1,742	1,742	1,742	1,742	1,742	1,742	38,315
	Sub total	K$				85,630	85,630	85,630	85,630	85,630	85,630	85,630	85,630	85,630	85,630	85,630	85,630	85,630	85,630	85,630	85,630	85,630	85,630	85,630	85,630	85,630	85,630	1,883,851
	Smelting & Refining	K$				25,506	25,506	25,506	25,506	25,506	27,105	27,105	27,105	27,105	27,105	23,071	23,071	23,071	23,071	23,071	28,390	28,390	28,390	28,390	28,390	19,016	19,016	558,397
	Total cost	K$				111,136	111,136	111,136	111,136	111,136	112,735	112,735	112,735	112,735	112,735	108,701	108,701	108,701	108,701	108,701	114,020	114,020	114,020	114,020	114,020	104,645	104,645	2,442,248
Capital Cost	Capital	K$	24,344	139,614	177,805	4,513	5,556	5,565	6,209	6,226	6,861	7,904	7,904	34,420	34,635	4,174	5,388	5,388	5,723	6,058	632	731	731	731	831	0	0	491,943
	Working Capital	K$	0	0	21,300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-21,300	0
	Total Cost	K$	24,344	139,614	199,105	4,513	5,556	5,565	6,209	6,226	6,861	7,904	7,904	34,420	34,635	4,174	5,388	5,388	5,723	6,058	632	731	731	731	831	0	-21,300	491,943
																												0
Cash Flow	Cash Flow	K$	-24,344	-139,614	-199,105	30,840	29,797	29,788	29,144	29,127	36,529	35,486	35,486	8,970	8,755	21,173	19,959	19,959	19,624	19,289	50,257	50,158	50,158	50,158	50,058	8,700	30,000	300,352
	Accum. net profit	K$	-24,344	-163,958	-363,063	-332,223	-302,426	-272,638	-243,494	-214,366	-177,837	-142,351	-106,865	-97,895	-89,140	-67,967	-48,008	-28,049	-8,425	10,864	61,120	111,278	161,436	211,593	261,651	270,351	300,352	

	Cu	Ag
Ave. Mill Recov.%	90.0	90.0
Smelter Recov. %	98.0	94.5
Price $/t ($/kg)	2500	128.6
TC-RC Cent/lb ($/kg)	20	9.65
Mining Cost $/t	5.152	
Milling Cost $/t	4.000	
Maintenance & others $/t	1.912	
Administration $/t	3.027	
Transportation $/t	0.311	

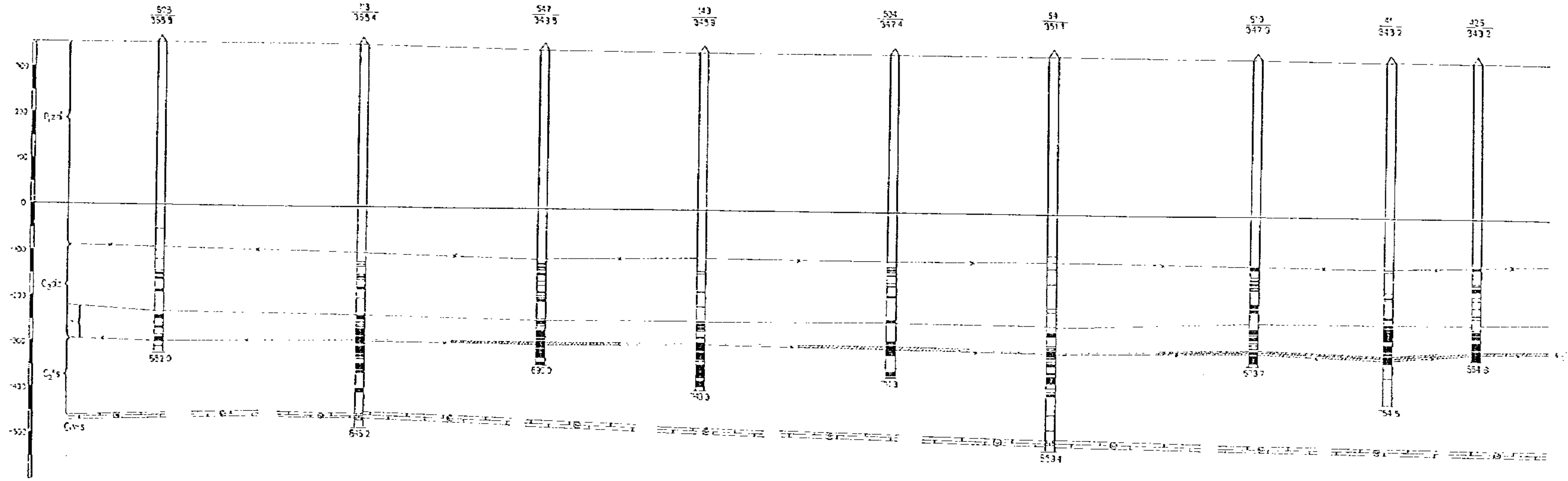
Appendix 49 Table of Cashflow of the Zhaman-Aibat Mine (Production: 6.7 Mt/year)

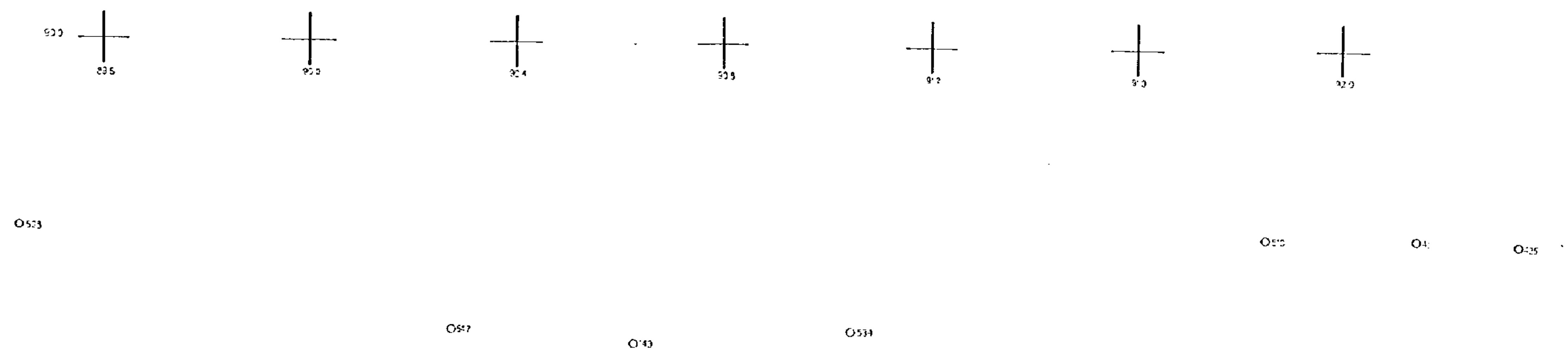
			-3	-2	-1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	Total
Production	Total ore mined	kt				6,700	6,700	6,700	6,700	6,700	6,700	6,700	6,700	6,700	6,700	6,700	6,700	6,700	6,700	6,700	6,700	6,700	4,830	118,730
	Ore to mill	kt				6,700	6,700	6,700	6,700	6,700	6,700	6,700	6,700	6,700	6,700	6,700	6,700	6,700	6,700	6,700	6,700	6,700	4,830	118,730
	Feed grade (Cu)	%				1.14	1.14	1.14	1.14	1.14	1.23	1.23	1.23	1.23	1.23	1.15	1.15	1.15	1.15	1.15	1.07	1.07	1.07	1.157
	Feed grade (Ag)	g/t				5.22	5.22	5.22	5.22	5.22	7.52	7.52	7.52	7.52	7.52	10.66	10.66	10.66	10.66	10.66	12.92	12.92	12.92	8.586
	Contained Cu	kt				76.38	76.38	76.38	76.38	76.38	82.41	82.41	82.41	82.41	82.41	77.05	77.05	77.05	77.05	77.05	71.69	71.69	51.681	1,374.26
	Contained (Ag)	t				34.97	34.97	34.97	34.97	34.97	50.38	50.38	50.38	50.38	50.38	71.42	71.42	71.42	71.42	71.42	86.56	86.56	62.40	1,019.43
Cu Conc.	Conc. grade (Cu)	%				35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.00
	Conc. Grade (Ag)	g/t				160.26	160.26	160.26	160.26	160.26	213.98	213.98	213.98	213.98	213.98	324.43	324.43	324.43	324.43	324.43	422.62	422.62	422.62	259.63
	Conc.	kt				196.41	196.41	196.41	196.41	196.41	211.91	211.91	211.91	211.91	211.91	198.13	198.13	198.13	198.13	198.13	184.35	184.35	132.89	3533.81
	Contained Cu	kt				68.74	68.74	68.74	68.74	68.74	74.17	74.17	74.17	74.17	74.17	69.35	69.35	69.35	69.35	69.35	64.52	64.52	46.51	1236.83
	Contained Ag	t				31.48	31.48	31.48	31.48	31.48	45.35	45.35	45.35	45.35	45.35	64.28	64.28	64.28	64.28	64.28	77.91	77.91	56.16	917.49
Revenue	Payable Cu	kt				67.37	67.37	67.37	67.37	67.37	72.69	72.69	72.69	72.69	72.69	67.96	67.96	67.96	67.96	67.96	63.23	63.23	45.58	1212.10
	Payable Ag	t				29.75	29.75	29.75	29.75	29.75	42.85	42.85	42.85	42.85	42.85	60.74	60.74	60.74	60.74	60.74	73.62	73.62	53.07	867.03
	Revenue Cu	K$				168,418	168,418	168,418	168,418	168,418	181,714	181,714	181,714	181,714	181,714	169,895	169,895	169,895	169,895	169,895	158,076	158,076	113,957	3,030,246
	Revenue Ag	K$				3,825	3,825	3,825	3,825	3,825	5,511	5,511	5,511	5,511	5,511	7,812	7,812	7,812	7,812	7,812	9,468	9,468	6,825	111,500
	Total revenue	K$				172,243	172,243	172,243	172,243	172,243	187,225	187,225	187,225	187,225	187,225	177,707	177,707	177,707	177,707	177,707	167,544	167,544	120,782	3,141,745
Operating	Mining cost	K$				34,518	34,518	34,518	34,518	34,518	34,518	34,518	34,518	34,518	34,518	34,518	34,518	34,518	34,518	34,518	34,518	34,518	24,884	611,697
	Milling cost	K$				26,800	26,800	26,800	26,800	26,800	26,800	26,800	26,800	26,800	26,800	26,800	26,800	26,800	26,800	26,800	26,800	26,800	19,320	474,920
	Maintenance & others	K$				12,810	12,810	12,810	12,810	12,810	12,810	12,810	12,810	12,810	12,810	12,810	12,810	12,810	12,810	12,810	12,810	12,810	9,235	227,012
	Administration	K$				20,281	20,281	20,281	20,281	20,281	20,281	20,281	20,281	20,281	20,281	20,281	20,281	20,281	20,281	20,281	20,281	20,281	14,620	359,396
	Transportation	K$				2,084	2,084	2,084	2,084	2,084	2,084	2,084	2,084	2,084	2,084	2,084	2,084	2,084	2,084	2,084	2,084	2,084	1,502	36,925
	Sub total	K$				96,493	96,493	96,493	96,493	96,493	96,493	96,493	96,493	96,493	96,493	96,493	96,493	96,493	96,493	96,493	96,493	96,493	69,562	1,709,949
	Smelting & Refining	K$				29,991	29,991	29,991	29,991	29,991	32,462	32,462	32,462	32,462	32,462	30,550	30,550	30,550	30,550	30,550	28,590	28,590	20,610	542,805
	Total cost	K$				126,484	126,484	126,484	126,484	126,484	128,955	128,955	128,955	128,955	128,955	127,044	127,044	127,044	127,044	127,044	125,083	125,083	90,172	2,252,755
Capital Cost	Capital	K$	24,773	158,707	180,928	9,237	12,305	12,305	13,092	13,310	6,412	8,794	38,371	39,043	9,481	1,397	1,938	1,938	1,938	2,776	0	0	0	536,745
	Working Capital	K$	0	0	24,100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-24,100	0
	Total Cost	K$	24,773	158,707	205,028	9,237	12,305	12,305	13,092	13,310	6,412	8,794	38,371	39,043	9,481	1,397	1,938	1,938	1,938	2,776	0	0	-24,100	536,745
Cash Flow	Cash Flow	K$	-24,773	-158,707	-205,028	36,522	33,454	33,454	32,667	32,449	51,857	49,475	19,898	19,226	48,788	49,266	48,725	48,725	48,725	47,887	42,461	42,461	54,710	352,246
	Accum. net profit	K$	-24,773	-183,480	-388,508	-351,986	-318,532	-285,077	-252,410	-219,961	-168,104	-118,628	-98,730	-79,504	-30,716	18,551	67,276	116,001	164,727	212,614	255,075	297,536	352,246	

Appendix 50 List of the Previous Data Collected in the Kazakhstan

Area	Item	Remarks	Quantity
	Relief Map	1 : 200,000	1
Zhaman-Aibat	Relief Map	1 : 50,000	1
	Relief Map	1 : 10,000	4
	Geomorphology Map	1 :100,000	1
	Tectonic Map	1 : 100,000	1
	Geological Map	1 : 500,000	1
	Geological Map	1 : 100,000	1
	Geological Map	1 : 50,000	2
	Geological Map (Revised)	1 : 50,000	2
	Geological Map	1 : 25,000	4
	Geological Map (Revised)	1 : 25,000	4
	Geochemical Map	1 : 100,000	1
	Copper Mineral Assembledge Map	1 : 25,000	1
	Geologic Cross-Section	1 : 10,000	11
	Geologic Cross-Section	1 : 5,000	24
	Geologic Cross-Section	1 : 2,000	29
	Lithostratigraphic Correlation of Drill Holes	1 : 200	4
	Drill Location Map	1 : 25,000	4
	Drill Location Map (Reviced)	1 : 25,000	4
	Ore Block Map of Deposit, Horizon 4-I	1 : 10,000	6
	Ore Block Map of Deposit, Horizon 4-I (Reviced)	1 : 10,000	6
	Ore Block Map of Deposit, Horizon 4-I	1 : 5,000	6
	Ore Block Map of Deposit, Horizon 4-I (Reviced)	1 : 5,000	6
	Magnetic Anomaly Map	1 : 100,000	1
	Gravity Anomaly Map	1 : 100,000	1
	Electrical Exploration Map	1 : 100,000	1
	Report on Ore Dressing Tests	-	2
	Abstruct of the Reports on Ore Dressing Test	-	17
	Drill Hole Coodinetes Data	X,Y,Z(elevation)	799
	Drill Hole Inclination Data	Inclination, Azimuth	16,383
	Dirill Core Assay Data	6 elements	7,897
	Ore Horizon Data for Each Assay Samples	-	7,897
	Relief Map	1 : 200,000	1
Samarsky	Relief Map	1 : 50,000	1
	Relief Map	1 : 25,000	1
	Relief Map	1 : 10,000	1
	Geomorphology Map	1 :100,000	1
	Tectonic Map	1 : 100,000	1
	Geological Map	1 : 500,000	1
	Geological Map	1 : 50,000	1
	Geological Map	1 : 10,000	1
	Geological Map	1 : 2,000	1
	Geochemical Map	1 : 25,000	1
	Geochemical Map	1 : 10,000	1
	Geologic Cross-Section	1 : 10,000	1
	Geologic Cross-Section	1 : 2,000	1
	Drill Location Map	1 : 10,000	1
	Drill Location Map	1 : 2,000	1
	Ore Block Map	1 : 2,000	1
	Level Sliced Map	1 : 2,000	1
	Magnetic Anomaly Map	1 : 50,000	1
	Magnetic Anomaly Map	1 : 25,000	1
	Magnetic Anomaly Map	1 : 10,000	1
	Magnetic Anomaly Map	1 : 2,000	1
	Gravity Anomaly Map	1 : 50,000	1
	Gravity Anomaly Map	1 : 25,000	1
	Electrical Exploration Map	1 : 10,000	1

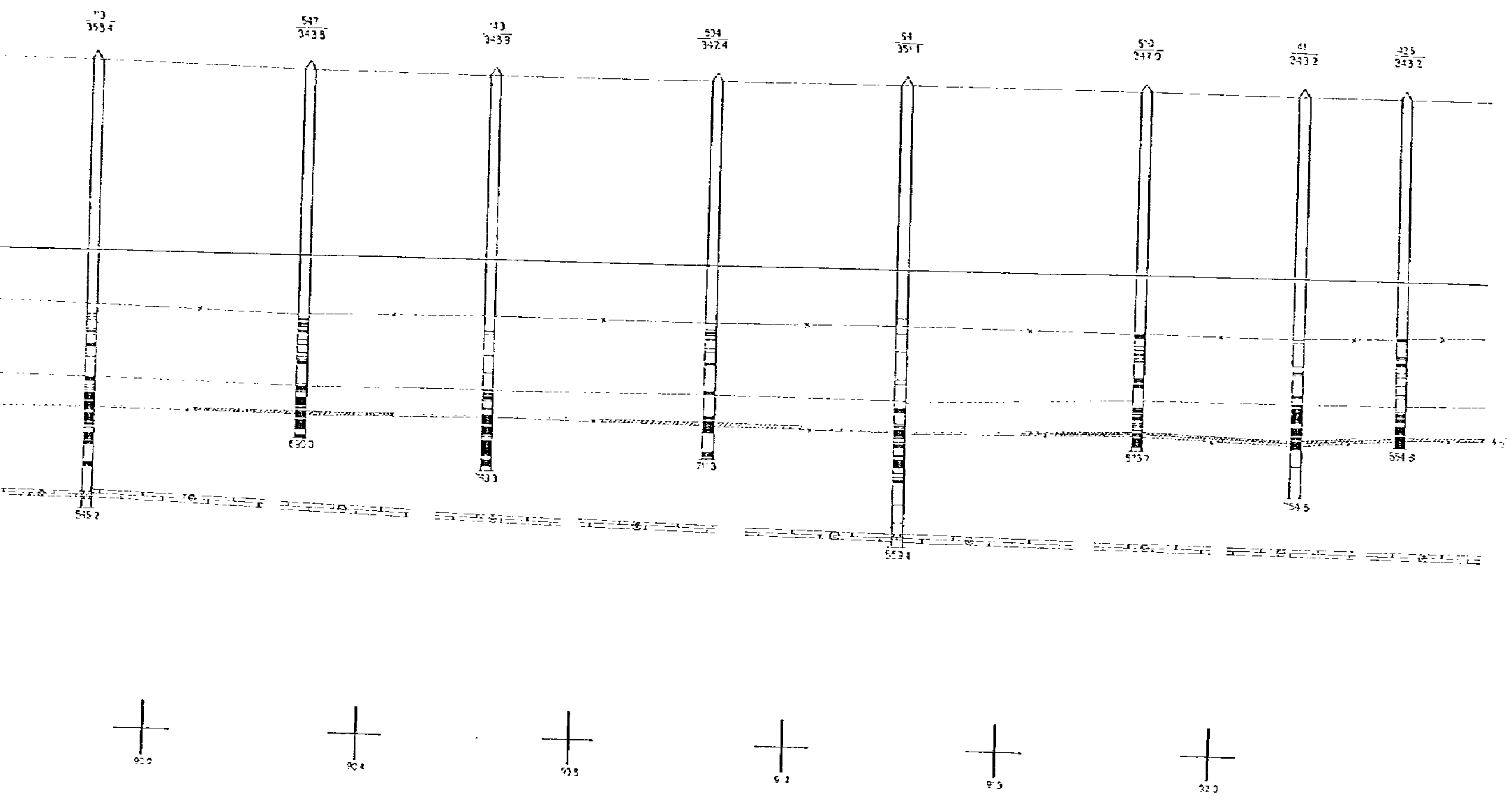
SCHEMATIC GEOLOGICAL CROSS-SECTION 608-695

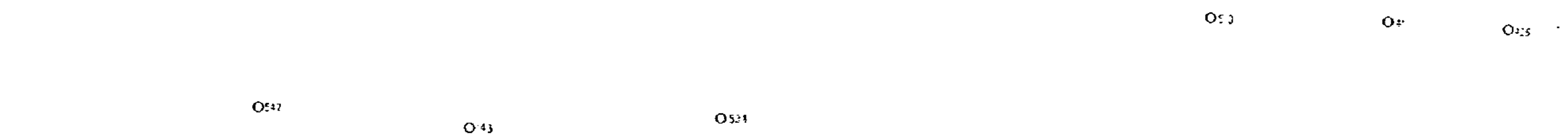




Well no.	mineralized interval		thickness	core recovery		grade						category	commercial characteristics	Ore type
	from	to				Cu %	Pb %	Zn %	[illegible] g/t	Ag g/t	S %			
508	[illegible]	[illegible]	0.5	80		0.25				2.50		[illegible]	mineraliz.	copper
113	[illegible]	[illegible]	3.3	97			0.37		[illegible]	1.0	[illegible]	[illegible]	mineraliz.	lead
547	[illegible]	[illegible]	1.5	100		[illegible]	1.55		[illegible]	[illegible]	[illegible]	[illegible]	balance	complex
143	[illegible]	[illegible]	4.0	98		[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	mineraliz.	lead
534	[illegible]	[illegible]	2.0	100		[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	balance	copper

SCHEMATIC GEOLOGICAL CROSS-SECTION 608-695



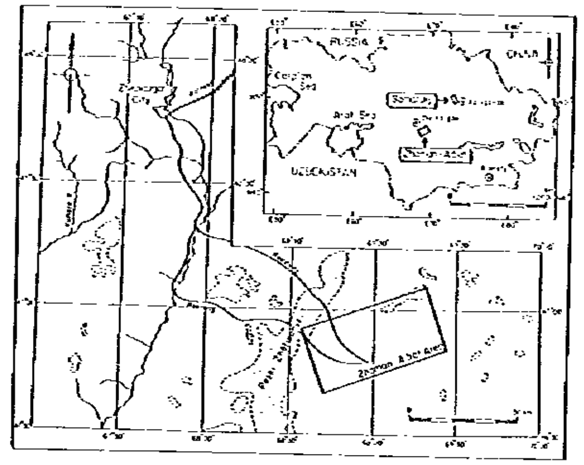


Well no.	Interval on hole: from	to	Thickness	Core recovery %		Grade: Cu %	Pb %	Zn %	Re g/t	Ag g/t	S %	Category	Commercial characteristics	Ore type
608	649.1	658.[illegible]	0.5	83		0.25				2.50		4-1	mineraliz	copper
413	[illegible]	[illegible]	0.3	97			0.37		0.16	1.0	0.2[illegible]	4-1	mineraliz	lead
547	[illegible]	[illegible]	1.5	100		[illegible]	1.55		1.59	[illegible]	0.48	4-1	balance	complex
443	[illegible]	[illegible]	4.0	93		[illegible]	0.51		0.29	0.56	0.29	4-1	mineraliz	lead
534	[illegible]	[illegible]	2.0	100		0.75			0.64	[illegible]	[illegible]	4-1	balance	copper
54	[illegible]	[illegible]	1.0	101		[illegible]	[illegible]					[illegible]		

Plate I-1

Report on the Mineral Exploration
in
the Zhaman Aibat and Samarsky Area, Republic of Kazakhstan
(Phase III)

Schematic Section of the Eastern and Central Orebody in the Zhaman-Aibat Ore Deposit (along the line DH608-DH425)



Japan International Cooperation Agency
Metal Mining Agency of Japan

February 1997

Scale 1 : 5,000

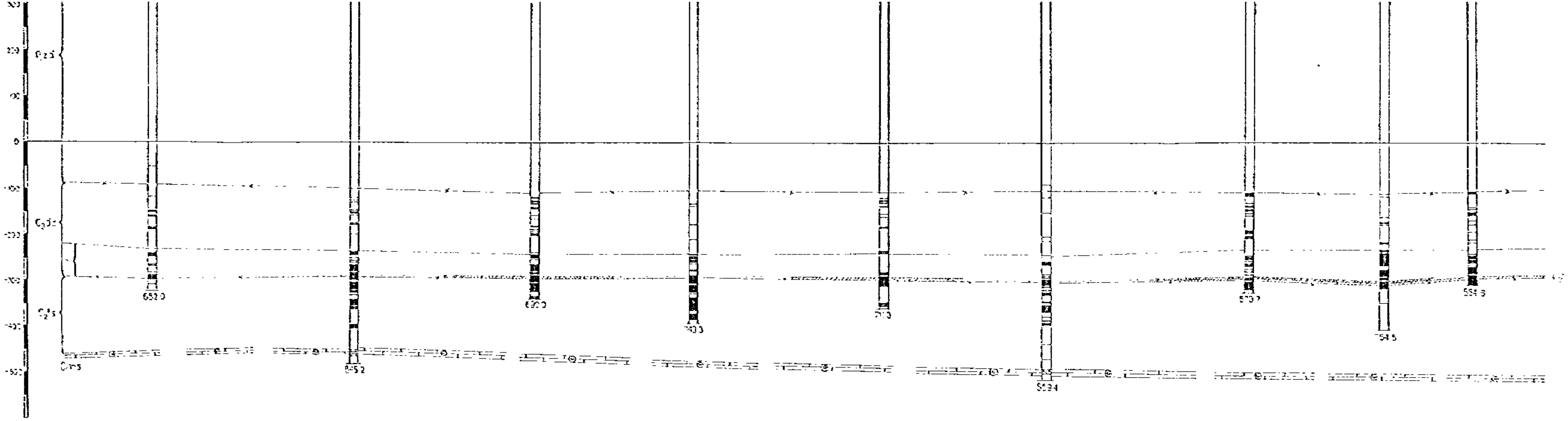
0 100 200 300 400 500m

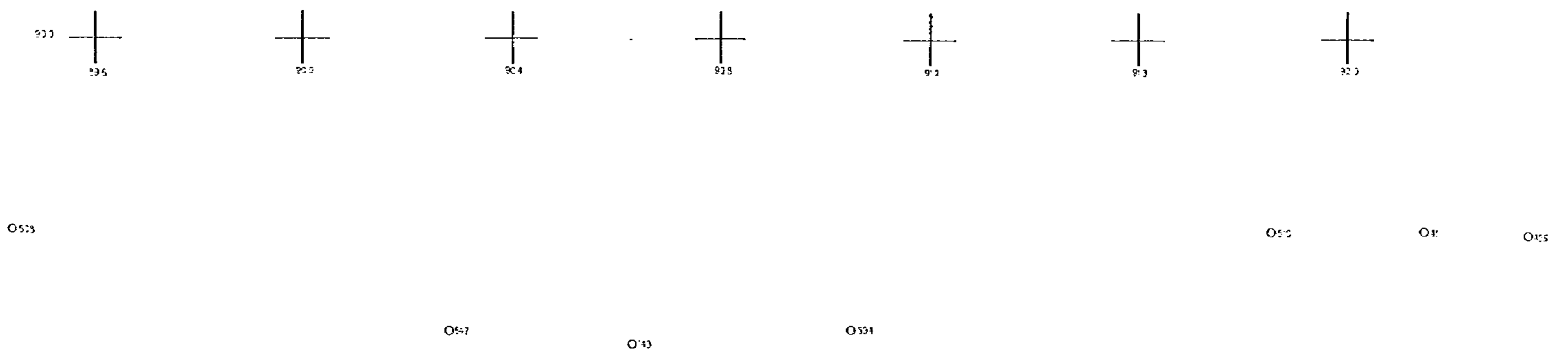
LEGEND

1. Conglomerate Interformational ("Raimundo")
2. Fine-coarse-grained sandstone
3. Aleurolite, aleurosandstone, sandstones (fine grained grey)
4. Sandstone (fine-coarse grained), aleurolite, aleurosandstone red

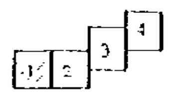
Ore

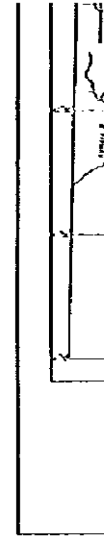
1. Copper (balanced)
2. Complex (balanced)
3. Silver-containing balanced
4. Mineralization

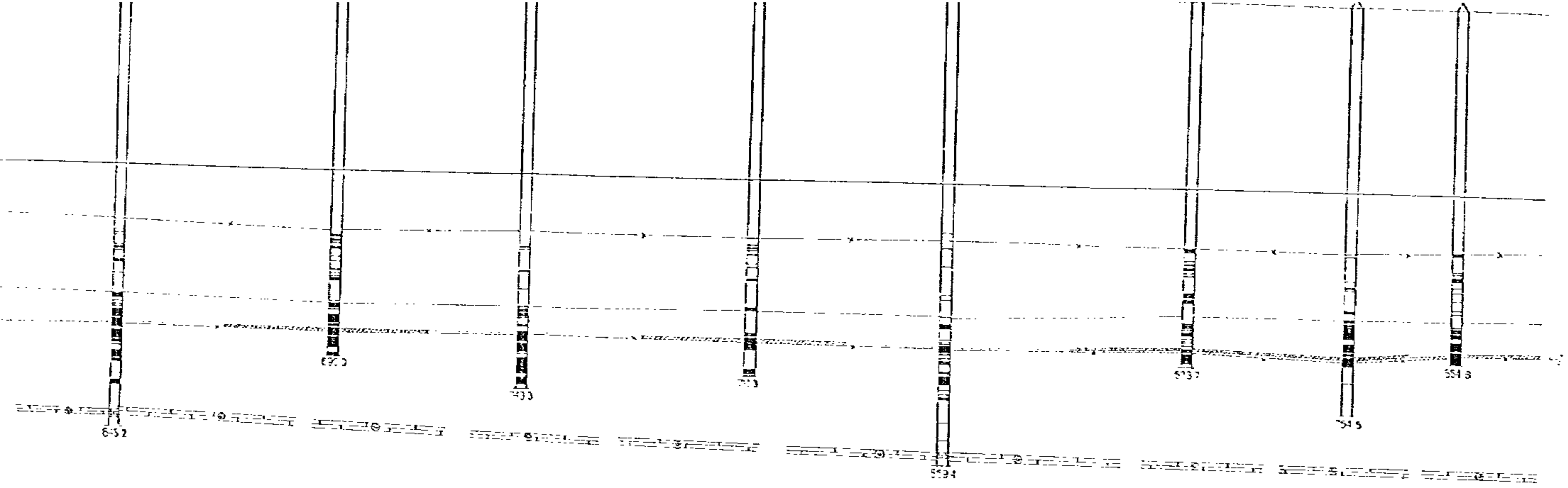


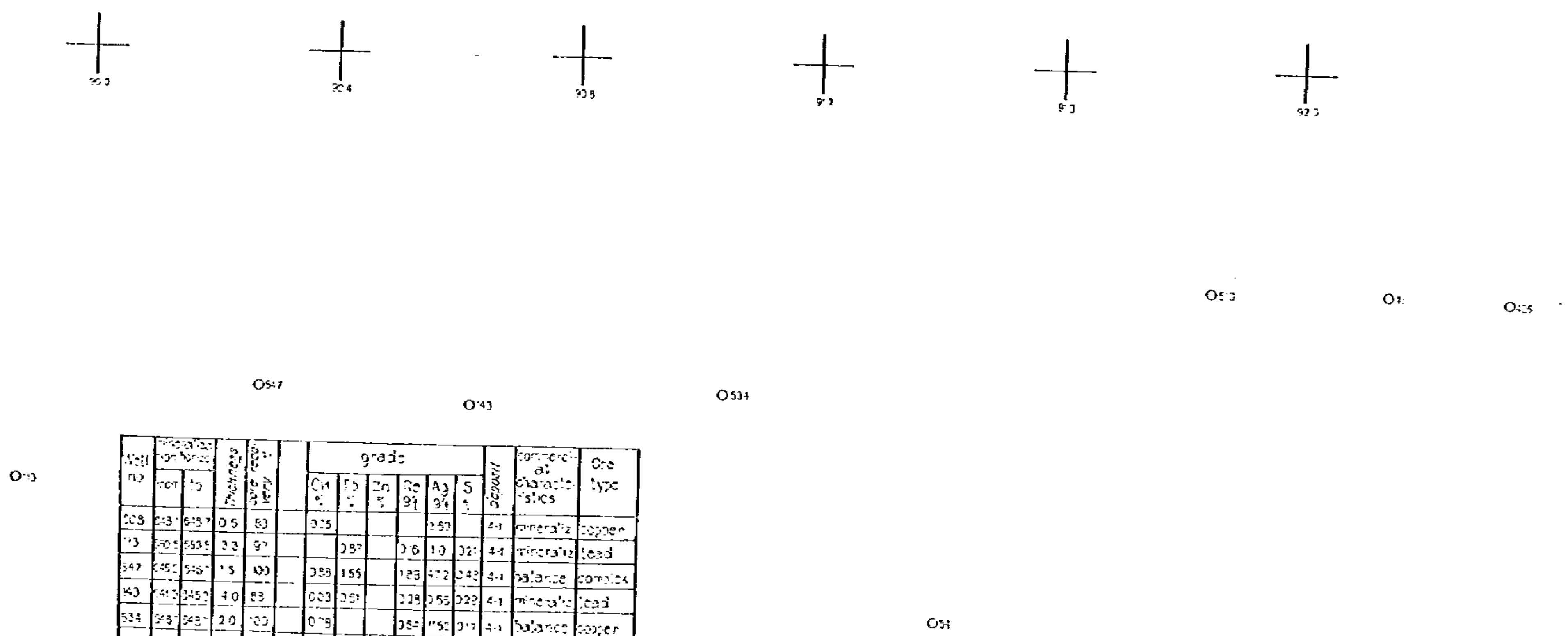


Well no	mineralization horizon		Thickness	Core recovery		grade						Dip	commercial characteristics	Ore type
	from	to				Cu %	Pb %	Zn %	[illegible] g/t	Ag g/t	S %			
508	643.1	643.7	0.5	80		0.25				2.50		4-1	mineraliz	copper
113	630.5	633.5	3.3	97			0.37		0.16	1.0	0.21	4-1	mineraliz	lead
547	645.0	[illegible]	1.5	100		0.33	1.55		1.83	47.2	2.45	4-1	balance	complex
143	641.3	645.3	4.0	53		0.03	0.51		0.23	0.55	0.29	4-1	mineraliz	lead
534	645.7	648.7	2.0	100		0.75			0.64	11.52	0.17	4-1	balance	copper
54	653.8	654.8	1.0	100		0.07	0.41					4-1	mineraliz	lead
510	640.7	644.9	4.2	100		0.52	4.32		2.77	3.03	1.18	4-1	balance	complex
	644.3	[illegible]	0.3	100		1.74			2.3	8.0	0.92	4-1	balance	copper
[illegible]	[illegible]	[illegible]	2.55	100			2.19	0.37	5.40	0.39	1.72	4-1	balance	lead-zinc
	[illegible]	643.2	4.75	100		0.55	0.30	0.16	3.43	3.54	1.35	4-1	balance	copper
425	536.4	541.5	5.4	100		0.54	0.33	1.11	2.02	0.37	0.34	4-1	mineraliz	lead-zinc
	541.5	542.8	1.3	100		2.48			0.74	17.0	0.72	4-1	balance	copper

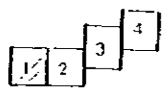


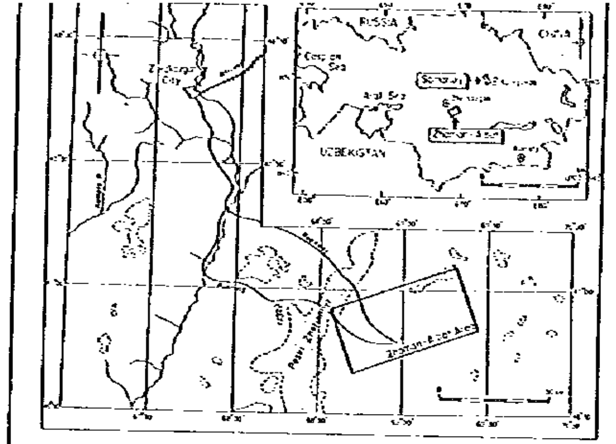






Well no	mineralization horizon from	to	thickness	core recovery		grade Cu %	Pb %	Zn %	Re g/t	Ag g/t	S %	deposit	commercial characteristics	Ore type
209	648.1	648.7	0.5	80		0.25				2.60		4-1	mineraliz	copper
113	550.5	553.5	3.3	97			0.57		0.16	1.0	0.21	4-1	mineraliz	lead
547	545.2	546.7	1.5	100		0.58	1.55		1.23	47.2	0.43	4-1	balance	complex
140	541.3	545.3	4.0	83		0.03	0.51		0.29	0.55	0.22	4-1	mineraliz	lead
534	546.1	548.1	2.0	100		0.79			0.54	15.2	0.17	4-1	balance	copper
54	553.5	554.5	1.0	100		0.07	0.41					4-1	mineraliz	lead
510	540.7	544.9	4.2	100		3.52	4.30		3.77	3.00	1.18	4-1	balance	complex
	544.8	545.7	0.5	100		1.74			2.9	9.0	0.50	4-1	balance	copper
41	534.5	[illegible]	2.55	100			2.19	0.37	5.40	0.53	1.22	4-1	balance	lead-zinc
	537.5	542.2	4.75	100		2.55	0.33	0.16	2.43	3.54	1.25	4-1	balance	copper
425	530.4	541.8	5.4	100		0.54	0.33	1.11	2.02	0.07	0.34	4-1	mineraliz	lead-zinc
	541.8	542.8	1.0	100		2.48			0.74	17.0	0.72	4-1	balance	copper





Japan International Cooperation Agency
Metal Mining Agency of Japan
February 1997

Scale 1 : 5,000
0 100 200 300 400 500m

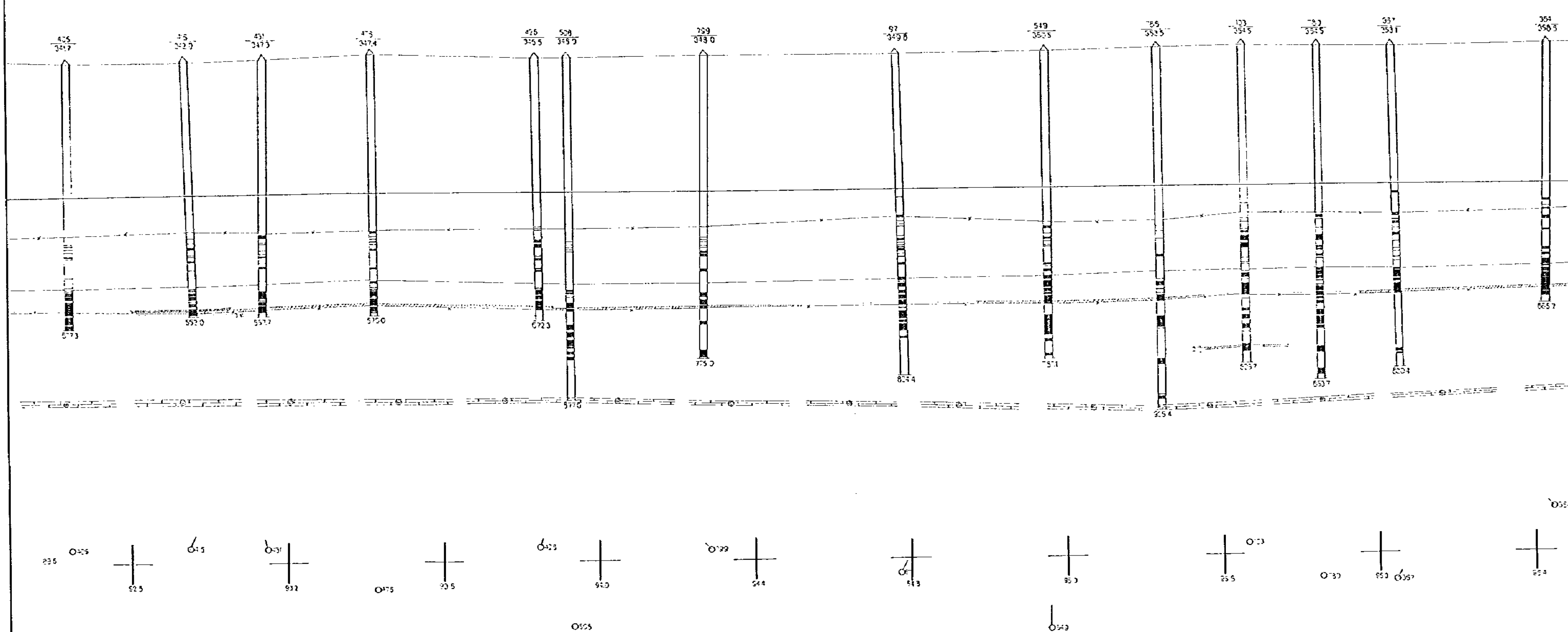
LEGEND

1. Conglomerate Interformational ("Raimundo")
2. Fine-coarse-grained sandstone
3. Aleurolite, aleurosandstone, sandstones (fine grained grey)
4. Sandstone (fine-coarse-grained), aleurolite, aleurosandstone red

Ore

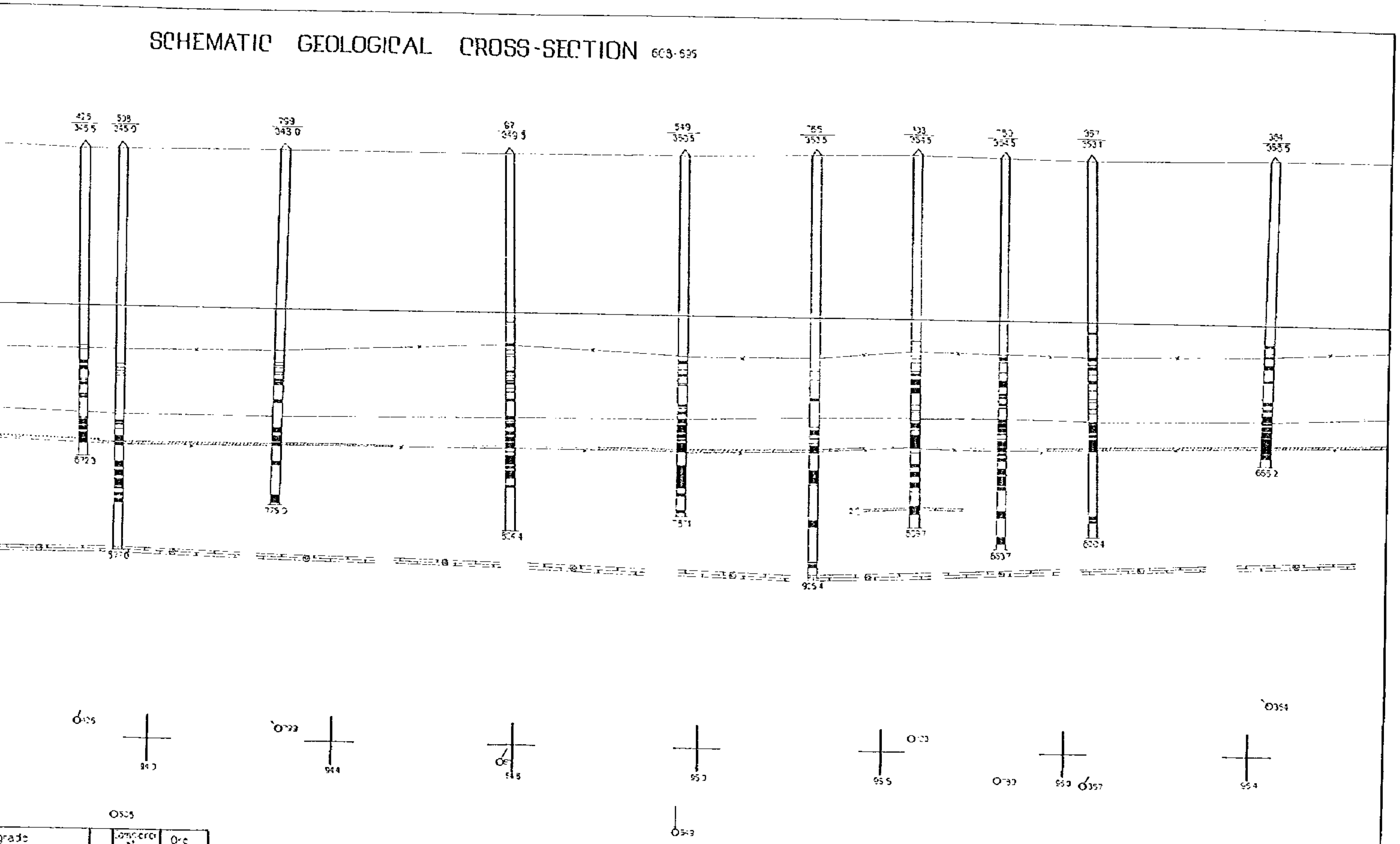
1. Copper (balanced)
2. Complex (balanced)
3. Silver-containing balanced
4. Mineralization

SCHEMATIC GEOLOGICAL CROSS-SECTION 603-695



Well no	mineralization contours from	to	thickness	core recovery		Cu %	Pb %	Zn %	Re g/t	Ag g/t	S %	deposit	commercial characteristics	Ore type
405	630 5	633 5	2 9	100			024	079	385	073	129	4-1	mineraliz	zinc
	635 5	639 0	2 6	96		043			014	045	013	3-VI	off-balan	copper
415	631 2	635 7	4 5	100		014	080		038	070	051	4-1	balance	lead
	635 7	636 85	1 15	100		2 32			123	105	070	4-1	balance	copper
	640 5	641 5	1 1	100		082			012	5 8	014	3-VI	off-balan	copper
431	632 6	641 55	8 95	100		070	014		153	15 12	125	4-1	balance	copper
475	639 [illegible]	[illegible]	1 75	94		2 43	039	007	5 0	44 0	173	4-1	balance	copper
425	[illegible]	[illegible]	1 05	100		022	2 04		053	190	121	4-1	off-balan	lead
	[illegible]	643 2	1 5	100		053	022		127	4 1	042	4-1	off-balan	copper
508	647 9	649 1	1 3	51		1 43			150	7 83	081	4-1	balance	copper
399	644 7	645 6	0 9	100		1 82			380	4 25	116	4-1	balance	copper
97	640 8	642 1	1 3	69		072			380	1 0		4-1	off-balan	copper
549	[illegible]	645 7	3 55	100		051	025		035	2 09	049	4-1	balance	copper
785	643 3	645 8	2 5	100		065	075		127	4 54	045	4-1	balance	copper
103	[illegible]	634 3	2 7	92		020	035	013				4-1	mineraliz	copper
	[illegible]	[illegible]	2 0	70		039	075		038	1 15	024	2-III	balance	copper
780	[illegible]	[illegible]	5 9	100		031	028		031	2 92	078	4-1	off-balan	copper
357	[illegible]	[illegible]	2 5	100		031	029		100	2 53	027	4-1	balance	copper
354	[illegible]	[illegible]	5 5	100		1 34			075	[illegible]	107	4-1	balance	copper

SCHEMATIC GEOLOGICAL CROSS-SECTION

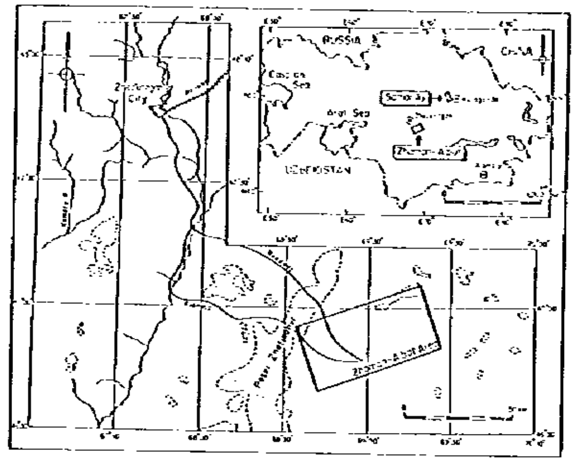


grade						
Zn %	Re g/t	Ag g/t	S %	deposit	concerns of characteristics	Ore type
079	085	073	129	4-I	mineraliz	zink
	014	345	013	3-VI	diff-balan	copper
	038	370	051	4-I	balance	lead
	153	105	073	4-I	balance	copper
	012	5.8	014	3-VI	diff-balan	copper
	153	519	125	4-I	balance	copper
107	5.0	410	179	4-I	balance	copper
	053	190	121	4-I	diff-balan	lead
	127	4.1	042	4-I	diff-balan	copper
	150	782	031	4-I	balance	copper
	380	[illegible]	116	4-I	balance	copper
	260	1.0		4-I	diff-balan	copper
	035	239	049	4-I	balance	copper
	127	151	045	4-I	balance	copper
13				4-I	mineraliz	copper
	033	115	024	2-III	balance	copper
	031	702	079	4-I	diff-balan	copper
	130	393	037	4-I	balance	copper
	075	151	107	4-I	balance	copper

Plate I-2

Report on the Mineral Exploration
in
the Zhaman Aibat and Samarsky Area, Republic of Kazakhstan
(Phase III)

Schematic Section of the Eastern and Central Orebody in the Zhaman-Aibat Ore Deposit (along the line DH405-DH364)



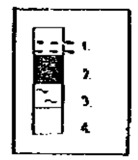
Japan International Cooperation Agency
Metal Mining Agency of Japan

February 1997

Scale 1 : 5,000

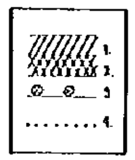
0 100 200 300 400 500m

LEGEND

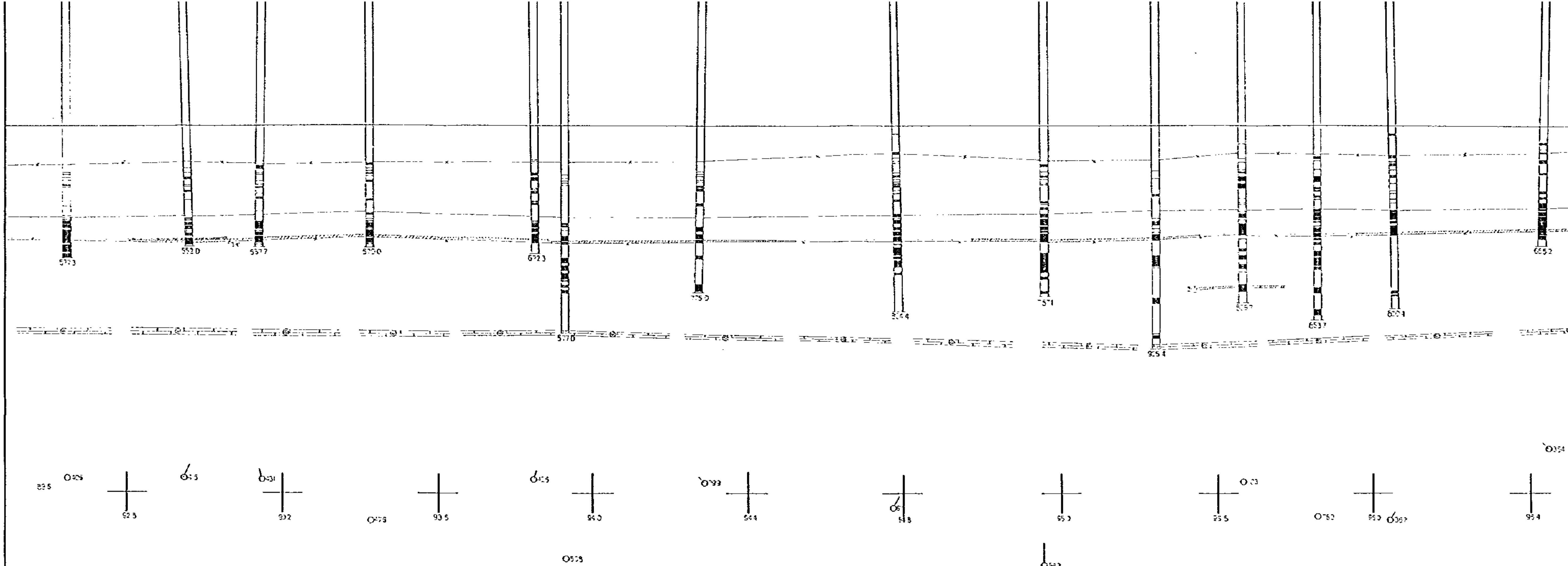


1 Conglomerate Interformational ("Raimundo")
2 Fine-coarse-grained sandstone
3 Aleurolite, aleurosandstone, sandstones (fine grained grey)
4 Sandstone (fine-coarse grained), aleurolite, aleurosandstone red

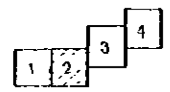
Ore



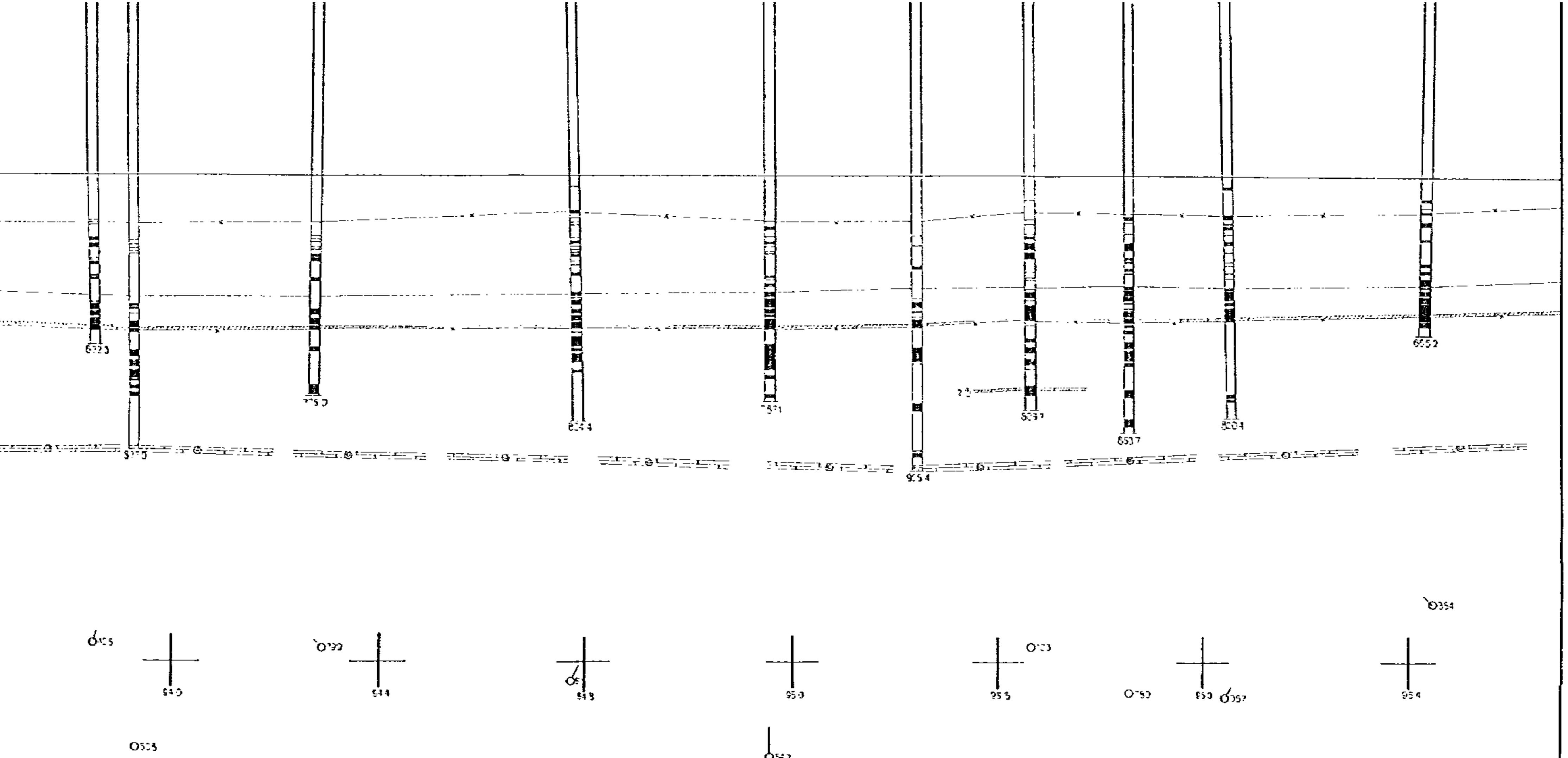
1. Copper (balanced)
2. Complex (balanced)
3. Silver-containing balanced
4. Mineralization

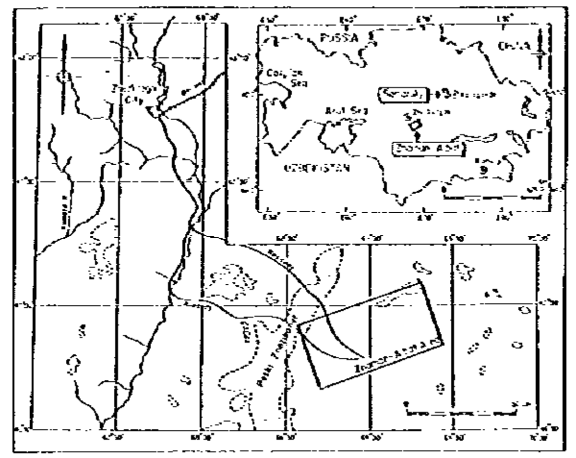


Well no	Mineralized horizon from	to	Thickness	core recovery %		grade Cu %	Pb %	Zn %	Re g/t	Ag g/t	S %	deposit	Commercial characteristics	Ore type
405	630.5	633.5	2.9	100			0.24	0.79	0.55	0.73	1.29	4-I	mineraliz	zinc
	635.5	639.2	2.5	95		0.43			0.14	3.45	0.13	3-III	off-balan	copper
415	631.2	635.7	4.5	100		0.14	0.80		0.38	0.79	0.51	4-I	balance	lead
	635.7	636.85	1.15	100		2.32			1.23	10.5	0.73	4-I	balance	copper
	643.05	644.15	1.1	100		0.82			0.12	5.8	0.14	3-III	off-balan	copper
431	632.6	641.55	8.95	100		3.70	0.14		1.53	51.9	1.25	4-I	balance	copper
476	639.3	641.05	1.75	94		2.49	0.39	0.07	5.0	44.10	1.79	4-I	balance	copper
525	640.3	641.7	1.35	100		0.22	2.24		0.50	1.90	1.21	4-I	off-balan	lead
	641.7	643.0	1.5	100		0.60	0.22		1.27	4.1	0.42	4-I	off-balan	copper
505	647.9	649.1	1.3	81		1.43			1.50	7.81	0.31	4-I	balance	copper
799	648.7	649.6	0.9	100		1.62			3.80	14.26	1.16	4-I	balance	copper
97	642.5	643.1	1.0	69		0.72			0.80	1.0		4-I	off-balan	copper
599	643.2	645.7	2.55	100		0.61	0.05		0.36	2.09	0.49	4-I	balance	copper
735	643.3	645.9	2.5	100		0.66	0.75		1.27	4.54	0.45	4-I	balance	copper
703	651.6	654.3	2.7	92		0.23	0.05	0.13				4-I	mineraliz	copper
	702.8	720.5	2.0	70		0.29	0.75		0.03	7.15	0.24	2-III	balance	copper
750	591.5	597.7	5.9	100		0.31	0.05		0.31	2.02	0.73	4-I	off-balan	copper
357	529.1	532.1	2.5	100		0.91	0.39		1.00	2.33	0.87	4-I	balance	copper
354	620.1	625.5	5.8	100		4.34			0.75	21.55	1.07	4-I	balance	copper



(along the line DH405 - DH364)





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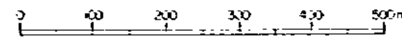
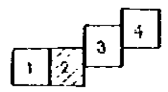
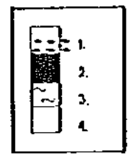
Scale 1 : 5,000



Zn %	Pb %	Ag g/t	S %	deposit	Commercial characteristics	Ore type
079	085	073	129	4-I	mineraliz	zinc
	014	045	013	3-VI	off-balan	copper
	033	070	051	4-I	balance	lead
	123	105	073	4-I	balance	copper
	012	5.8	014	3-VI	off-balan	copper
	153	51.9	125	4-I	balance	copper
007	5.0	44.0	179	4-I	balance	copper
	053	190	121	4-I	off-balan	lead
	127	4.1	042	4-I	off-balan	copper
	150	732	081	4-I	balance	copper
	380	425	106	4-I	balance	copper
	050	7.0		4-I	off-balan	copper
	035	209	049	4-I	balance	copper
	127	454	045	4-I	balance	copper
013				4-I	mineraliz	copper
	093	7.5	024	2-III	balance	copper
	051	203	079	4-I	off-balan	copper
	130	358	057	4-I	balance	copper
	075	21.5	107	4-I	balance	copper

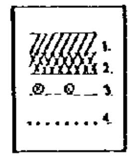


LEGEND



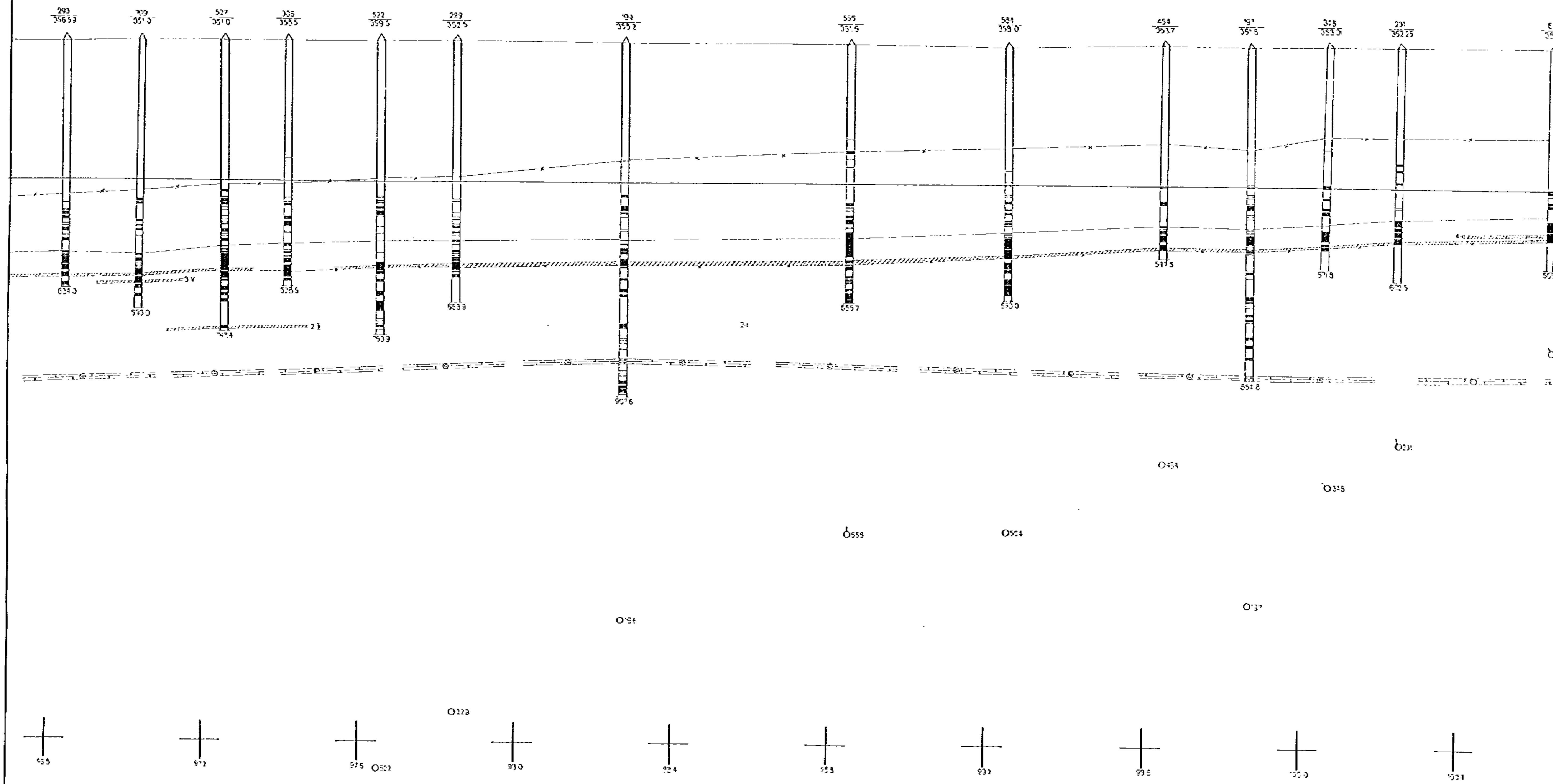
1 Conglomerate Interformational ("Raimundo")
2 Fine-coarse-grained sandstone
3 Aleurorite, aleurosandstone sandstones (fine grained grey)
4 Sandstone (fine-coarse grained) aleurolite, aleurosandstone red

Ore



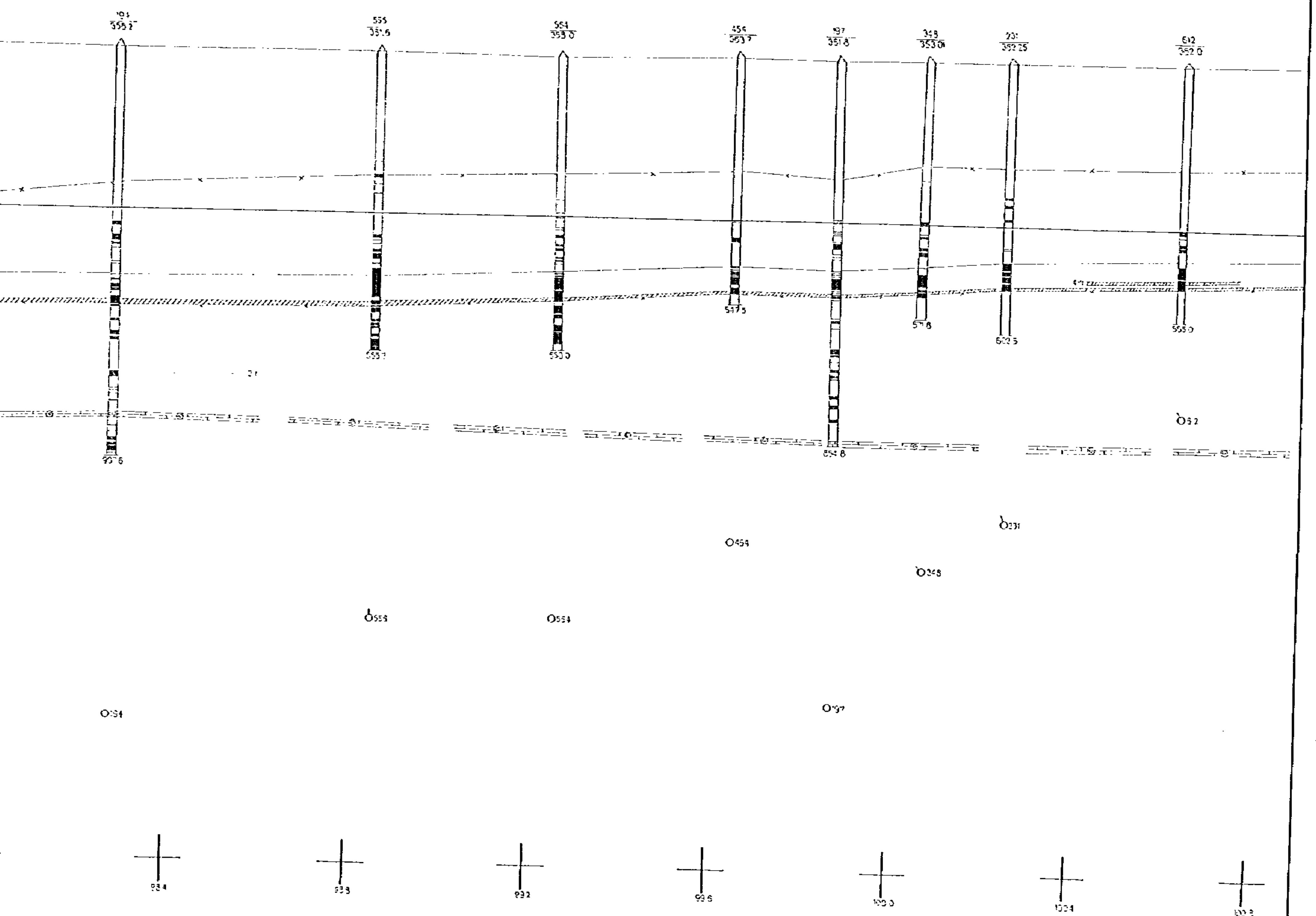
1. Copper (balanced)
2 Complex (balanced)
3 Silver-containing balanced
4 Mineralization

SCHEMATIC GEOLOGICAL CROSS-SECTION 503-695



Well no	mineralized interval from	to	thickness m	core recovery %		grade Cu %	Pb %	Zn %	Re g/t	Ag g/t	S %	density	ore characteristics	ore type
293	504.3	507.9	3.3	100		0.9			0.30	1.94	[illegible]	4.1	balance	copper
309	502.5	503.2	2.3	100		1.70	0.07		2.2	5.7	0.65	4.1	balance	copper
	[illegible]	[illegible]	5.1	100		0.65				[illegible]		3.1	balance	copper
527	555.7	558.4	1.7	100		1.54	0.24		1.5	6.55	0.72	4.1	balance	copper
	[illegible]	[illegible]	2.25	99		0.77				0.96	[illegible]	[illegible]	balance	copper
335	552.0	553.7	9.7	100		0.50			0.54	2.85	0.30	4.1	[illegible]	copper
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

SCHEMATIC GEOLOGICAL CROSS-SECTION 553-695

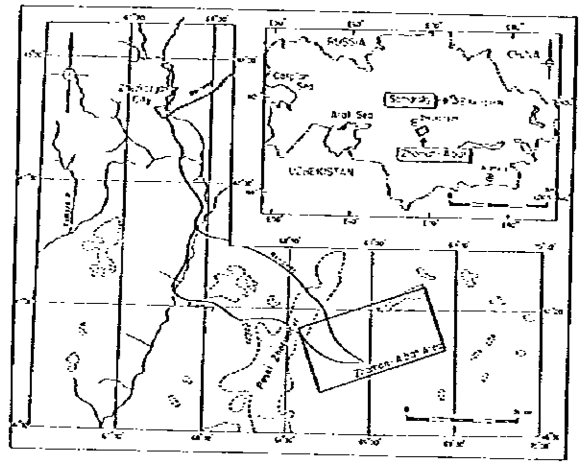


Well no	Intersection from	to	thickness m	core recovery		Cu %	Pb %	Zn %	Re g/t	Ag g/t	S %	density	mineral characteristics	ore type
293	534.0	537.5	3.5	100		0.8			0.20	1.84	1.09	4.4	balance	copper
[illegible]	529.8	530.1	2.3	100		1.70	0.27		2.2	5.7	0.55	4.2	balance	copper
	[illegible]	[illegible]	5.1	100		0.65				0.17		3.1	balance	copper
327	558.7	559.4	1.7	100		1.54	0.24		1.5	5.52	0.72	4.4	balance	copper
	[illegible]	[illegible]	2.25	33		0.77				0.56	[illegible]	[illegible]	balance	copper
[illegible]	[illegible]	[illegible]	0.7	100		0.50			0.54	2.80	[illegible]	4.1	[illegible]	copper
[illegible]	[illegible]	[illegible]	4.7	100		0.37			0.25	[illegible]	[illegible]	4.1	balance	copper
	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Plate I-3

Report on the Mineral Exploration
in
the Zhaman-Aibat and Samarsky Area, Republic of Kazakhstan
(Phase III)

Schematic Section of the Eastern and Central Orebody in the Zhaman-Aibat Ore Deposit (along the line DH293-DH612)



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Scale 1 : 5,000

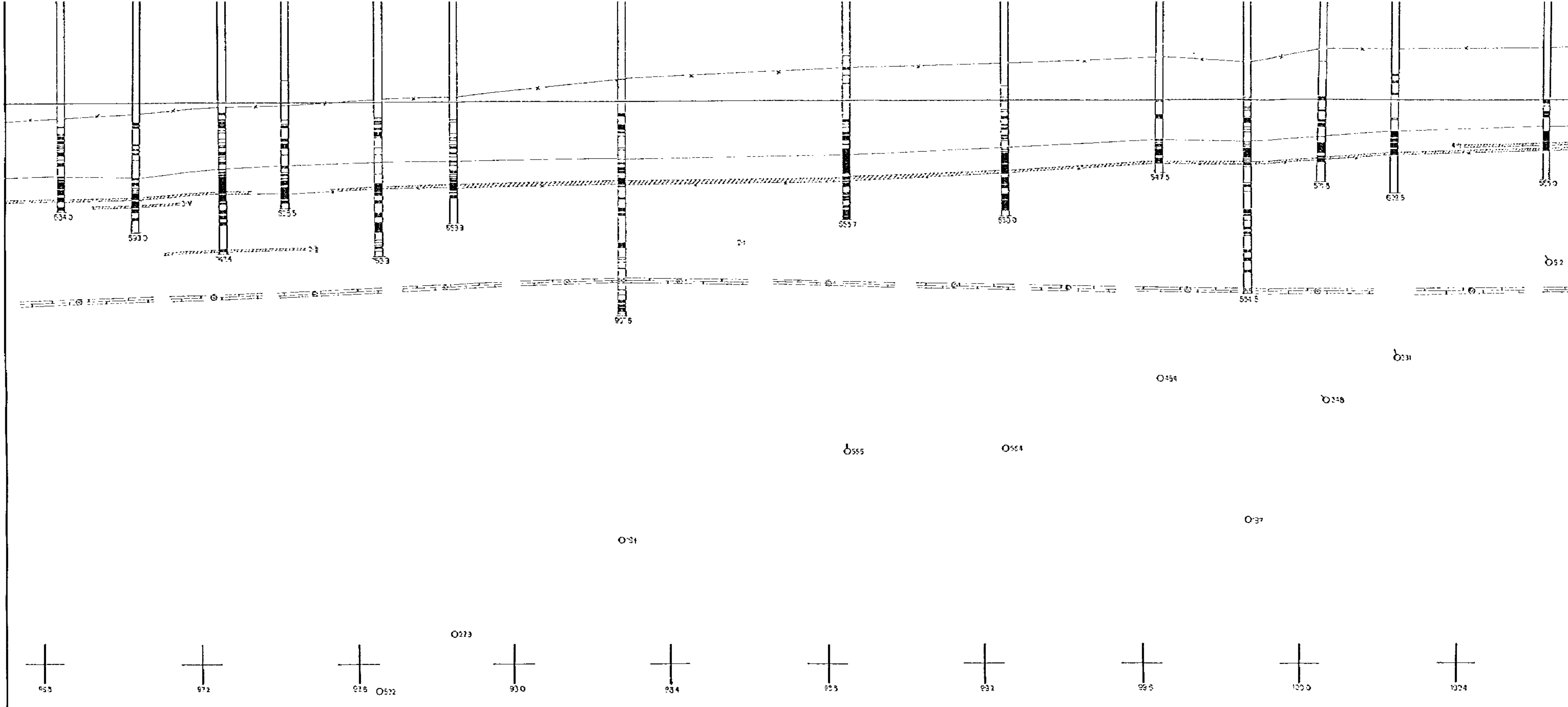
0 100 200 300 400 500 m

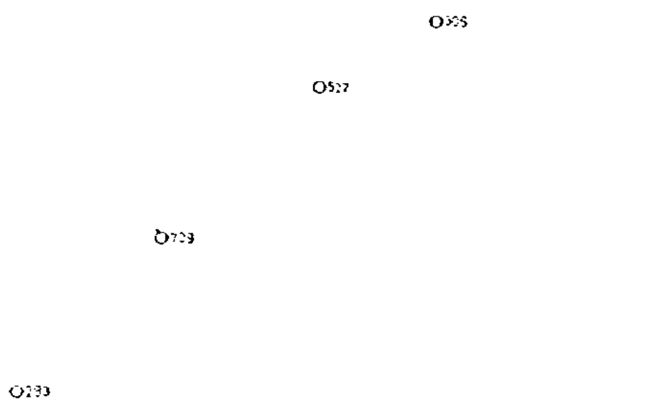
LEGEND

1. Conglomerate interformational ("Raimundo")
2. Fine-coarse-grained sandstone
3. Aleurolite, aleurosandstone, sandstones (fine grained grey)
4. Sandstone (fine-coarse grained), aleurolite, aleurosandstone red

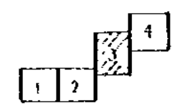
Ore

1. Copper (balanced)
2. Complex (balanced)
3. Silver-containing balanced
4. Mineralization

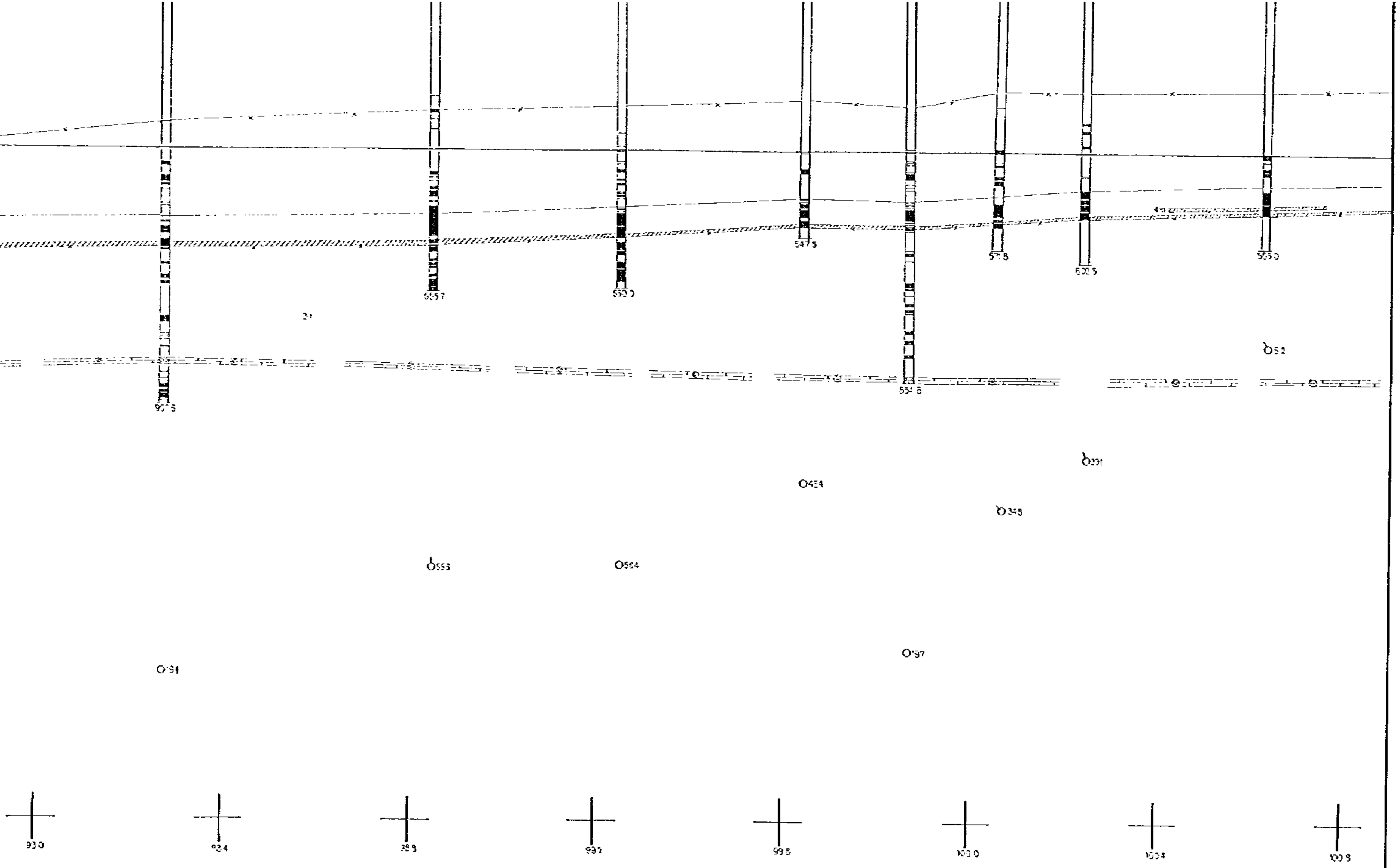


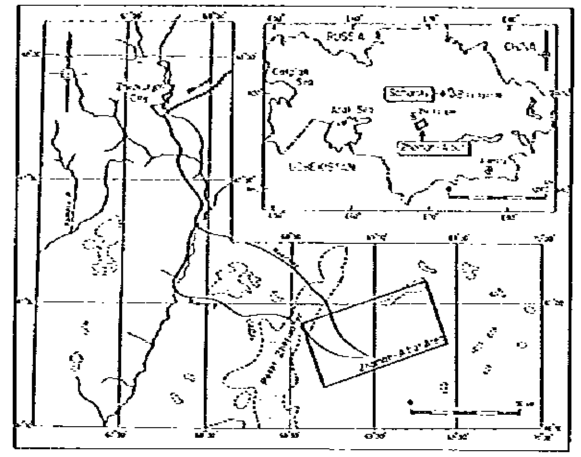


Well no	mineralized horizon from	mineralized horizon to	thickness	core recovery		grade Cu %	grade Pb %	grade Zn %	grade Re g/t	grade Ag g/t	grade S %	category	commercial characteristics	ore type
293	[illegible]	[illegible]	38	100		39			030	324	109	4-1	balance	copper
209	5059	5092	23	100		170	007		22	57	055	4-1	balance	copper
	5205	5256	61	100		065				017		3-V	balance	copper
527	5567	5584	17	100		154	024		15	959	072	4-1	balance	copper
	7071	[illegible]	225	98		077				085	017	2-III	balance	copper
305	5920	5927	07	100		050			054	260	030	4-1	[illegible]	copper
322	5746	5793	47	100		057			026	225	020	4-1	balance	copper
	5793	5817	24	100		031			025	101	020	4-1	off-balance	copper
229	5795	5835	[illegible]	100		115				372	031	4-1	balance	copper
124	5850	5940	90	100		115			079	43	025	4-1	balance	copper
	7218	7241	23	100		053			[illegible]	285	010	2-1	off-balance	copper
556	5630	5725	95	100		159			110	548	052	4-1	balance	copper
554	5315	5364	49	100		155	011		42	264	164	4-1	balance	copper
454	5932	5939	05	100		015	035		350	23	117	4-1	off-balance	complex
	598	6225	37	95		137	002		175	951	137	4-1	balance	copper
97	5172	5219	47	100		072			[illegible]	018	140	4-1	balance	copper
343	5111	5153	42	100		142			15	108	053	4-1	balance	copper
231	4935	4970	35	97		149			15	507	039	4-1	balance	copper
	4970	5003	33	100		039			029	022	009	4-1	off-balance	copper
52	4773	4788	15	100		107			415	454	045	4-1	balance	copper
	4944	4949	05	100		115			210	345	125	4-1	balance	copper



(along the line DH293-DH612)





Japan International Cooperation Agency
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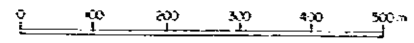
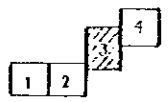
February 1997

Scale 1 : 5,000

0 100 200 300 400 500 m



Well no	mineralization interval from	to	thickness m	core recovery		Cu %	Pb %	Zn %	Re g/t	Ag g/t	S %	deposit	mineral characteristics	ore type
293	504.0	507.5	3.5	100		3.8			0.30	3.24	1.09	4-I	balance	copper
709	500.5	503.0	2.3	100		1.70	0.07		2.2	5.7	0.55	4-I	balance	copper
	520.5	526.6	6.1	100		0.55				0.17		3-V	balance	copper
527	585.7	598.4	1.7	100		1.54	0.24		1.5	8.59	0.72	4-I	balance	copper
	[illegible]	[illegible]	22.5	99		0.77				0.25	0.17	2-III	balance	copper
325	592.0	592.7	0.7	100		0.50			0.54	2.80	0.30	4-I	mineraliz	copper
522	574.6	579.3	4.7	100		0.57			0.25	2.25	0.20	4-I	balance	copper
	579.3	581.7	2.4	100		0.31			0.15	1.01	0.20	4-I	balance	copper
328	573.5	583.5	10.0	100		1.15				3.72	0.30	4-I	balance	copper
534	[illegible]	[illegible]	9.0	100		1.18			0.75	4.3	0.25	4-I	balance	copper
	721.9	[illegible]	2.3	100		0.50			0.09	0.35	0.10	2-I	balance	copper
556	553.0	572.5	9.5	100		1.59			1.10	[illegible]	0.58	4-I	balance	copper
554	501.5	506.4	4.9	100		1.55	0.11		4.2	9.54	1.64	4-I	balance	copper
554	[illegible]	[illegible]	0.5	100		0.35	0.35		[illegible]	2.0	1.17	4-I	[illegible]	complex
	[illegible]	522.5	3.7	95		[illegible]	0.02		[illegible]	[illegible]	1.37	4-I	balance	copper
97	517.2	521.9	4.7	100		0.72			[illegible]	3.8	1.43	4-I	balance	copper
349	511	513.3	4.2	100		1.42			1.5	[illegible]	0.95	4-I	balance	copper
23	[illegible]	[illegible]	3.5	97		1.49			1.5	5.07	[illegible]	4-I	balance	copper
	[illegible]	500.5	3.3	100		0.98			0.09	0.37	1.28	4-I	[illegible]	copper
612	[illegible]	479.5	1.5	100		[illegible]			4.15	[illegible]	0.45	4-I	balance	copper
	[illegible]	[illegible]	2.5	100		3.15			2.10	[illegible]	1.05	4-I	balance	copper



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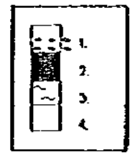
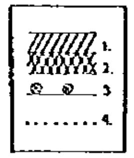


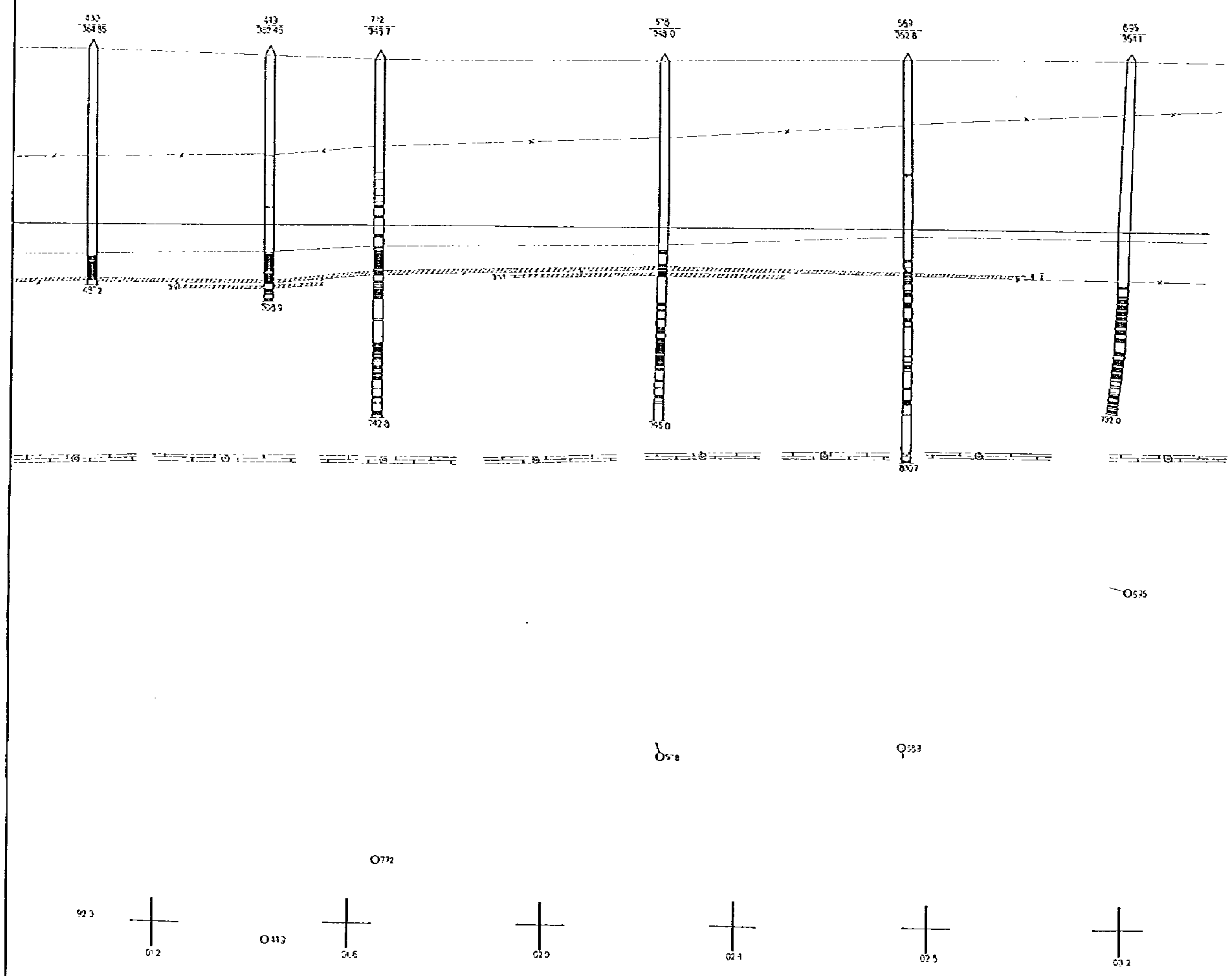
1 Conglomerate Interformational ("Raimundo")
2 Fine-coarse-grained sandstone
3 Aleurorite, aleurosandstone, sandstones (fine-grained grey)
4 Sandstone (fine-coarse-grained) aleurolite, aleurosandstone red

Ore



1 Copper (balanced)
2 Complex (balanced)
3 Silver-containing balanced
4 Mineralization

SCHEMATIC GEOLOGICAL CROSS-SECTION 608-695



Well no	Intervals of ore (from)	Intervals of ore (to)	thickness m	[illegible]		grade Cu %	Pb %	Zn %	Re g/t	Ag g/t	S %	category	commercial characteristics	ore type
430	478.0	479.4	1.4	86		5.59			4.0	5.71	1.25	4-I	balance	copper
449	557.5	583.5	1.0	100		7.69			10.3	6.9	1.55	4-I	balance	copper
	478.4	480.[illegible]	2.5	100		1.90			0.29	11.27	0.55	3-VI	balance	copper
772	[illegible]	408.4	4.7	90		0.30			0.08	2.67	0.11	4-I	off balance	copper
	538.4	[illegible]	5.4	94		0.5			0.10	8.44	0.07	4-I	balance	copper
578	[illegible]	[illegible]	3.8	100		1.61			0.47	31.19	0.78	4-I	balance	copper
	[illegible]	[illegible]	25.5	91		5.21			6.59	79.25	1.17	3-V	balance	copper
553	[illegible]	[illegible]	3.7	100		1.14			0.25	11.59	0.25	4-I	balance	copper
695													barren	

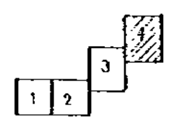
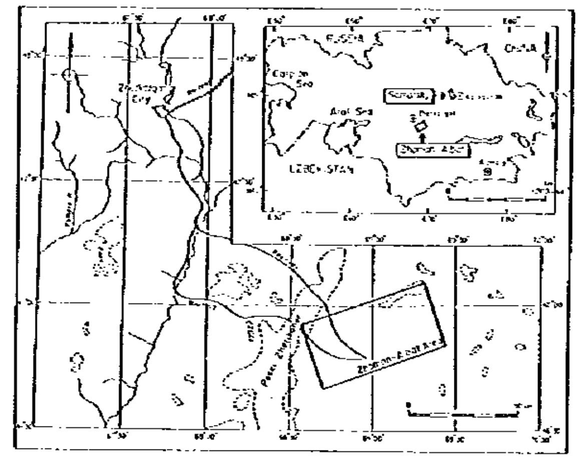


Plate I-4

Report on the Mineral Exploration in the Zhaman Aibat and Samarsky Area, Republic of Kazakhstan (Phase III)

Schematic Section of the Eastern and Central Orebody in the Zhaman-Aibat Ore Deposit (along the line DH430-DH695)



Japan International Cooperation Agency
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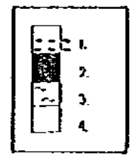
February 1997

Scale 1 : 5,000

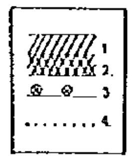
0 100 200 300 400 500m

LEGEND



1 Conglomerate Interformational ("Raimundo")
2 Fine-coarse-grained sandstone
3 Aleurolite, aleurosandstone, sandstones (fine grained grey)
4 Sandstone (fine-coarse-grained), aleurolite, aleurosandstone red

Ore



1 Copper (balanced)
2 Complex (balanced)
3 Silver-containing balanced
4 Mineralization