

REPORTE DE LAS PRUEBAS PARA RECUPERACIÓN DE

MANGANESO DEL MINERAL DE BERENGUELA

Por..

CARLOS VALENCIA DIAZ

FERNANDO ZEGARRA CASTANEDA

REPORTE DE LAS PRUEBAS PARA RECUPERACION DE MANGANESO DEL
MINERAL DE BERENGUELA

INTRODUCCION

Con la finalidad de dar mayor rentabilidad al proyecto de Berenguela , se realizaron estudios exploratorios en el laboratorio de procesamiento de minerales * de Mitsui Mining and Smelting Company, para recuperar el contenido de manganeso mediante la separación magnética, ensayando dos alternativas

- a) Preconcentración magnética del mineral de cabeza
- b) Concentración magnética del manganeso a partir de los relaves del proceso de segregación

Los resultados obtenidos fueron muy interesantes y son materia del presente informe.

Agradecemos la colaboración y facilidades prestadas por Mitsui Company , al brindarnos sus instalaciones y el asesoramiento de su personal técnico de gran experiencia , en especial nuestro agradecimientos al Ing. Kenji Itho y al Ing. Toshihisa Shimokura por sus valiosas enseñanzas:

* MINERAL AND METALLURGY LABORATORY
MINERAL AND ENERGY RESOURCES DEP.

REPORTE DE LAS PRUEBAS PARA LA RECUPERACION DE MANGANESO DEL MINERAL DE BERENGUELA

1. CONCLUSIONES Y RECOMENDACIONES :

- 1.1 Las pruebas de preconcentración magnética en seco del mineral de Berenguela (tipo-2) se realizaron según como indica el flow Sheet N° 1, y demuestra que es posible con una intensidad magnética de 4,100 Gauss (0.8 amp). Obtener un concentrado magnético de 55.2% de Mn, 334 ppm, de Ag y 1.6% de Cu y con recuperaciones de 44.75 para Mn, 29.54% para la plata y 18.3% para el cobre, resultados que se observan en la tabla - 1 del test N° 2 y Tabla N° 1.
- 1.2 El proceso más adecuado para la recuperación del contenido de Ag (334 ppm) y Cu 1.6% del concentrado magnético es la segregación ya que la Ag y el Cu se encuentran finalmente diseminados en todo el mineral especialmente en la matriz del mineral de manganeso (psilomelano, todoroquita, Birnesita, etc.) tal como lo demuestra los estudios por EPMA realizados por el Dr. HIDEKI IMAI ver anexo N° 1 *
- 1.3 Una alternativa que es recomendable estudiar y que elevará la recuperación total de plata un 9% más y que además permitirá obtener un concentrado de Mn de valor comercial Mn=55 - 60% y con una recuperación de 40% aproximadamente, se muestra en el Flow Sheet N° 3 y consistiría en tratar por segregación separadamente el concentrado magnético y la fracción no magnética; para decidir las condiciones óptimas de segregación y flotación del concentrado magnético de Mn sería necesario realizar las pruebas correspondientes.
- 1.4 Las pruebas de concentración magnética de Mn a partir de relaves del proceso de segregación del mineral de Berenguela alternativa B se realizaron siguiendo el Flow Sheet N° 2 y los resultados se muestran en la tabla N° 3 y en el gráfico N° 2 y se observa que no es posible elevar el grado de concentrado Magnético de Mn a más de 22% Mn cuya recuperación, al igual que el Fe es proporcional al peso del concentrado (gráfico N° 2), esto se explica por la aparición durante el proceso de segregación de minerales de transformación, como la magnetita

* Dr. IMAI HIDEKI : P.H.D Universidad de Tokio
Asesor del Dpto. de Investigaciones
Geológicas MITSUI MINING COMPANY.

Fe₃O₄ y la manganesita MnO, como producto de las limonitas y todoroquita respectivamente como se demuestra en los análisis por difracción de R-X de las muestras respectivas (ver anexo N° 2) los cuales están diseminados y elevan la susceptibilidad magnética de todo el mineral haciendo muy difícil su concentración por separación magnética.

2. DETALLE DE LAS PRUEBAS REALIZADAS

- 2.1 Alternativa A: Pruebas de preconcentración magnética del mineral de cabeza de Berenguela tipo N° 2. Estas pruebas se diseñaron según el Flow Sheet N° 1 y teniendo en cuenta la susceptibilidad magnética del mineral de Berenguela, escogiéndose un rango entre 3,300 a 8,200 Gauss (0.65 - 2.1 Amp) ver gráfico N° 3 y para ello se utilizó un separador magnético de disco tipo MAG RAPID el cual se calibró especialmente para las pruebas (ver gráficos N° 3 y Tabla N° 6).
Las pruebas se realizaron con 40 gr. de mineral Berenguela tipo N° 2 a 100% - 48 mallas... los resultados de la concentración magnética se muestran en la tabla N° y demuestran que el concentrado de mejor ley de Mn obtiene con una intensidad magnética de 4,100 Gauss (0.8 Amp), con la fracción no magnética obtenida con 3,300 Gauss (0.65 Amp), se hizo una flotación standart de 100 gr. según el esquema N° 1 cuyo Balance Metalúrgico se encuentra en la tabla N° 2, y cuyas condiciones fueron las que normalmente se usan para las pruebas standart de segregación a nivel de laboratorio.
- 2.2 Alternativa B: Las pruebas de segregación del mineral de cabeza tipo N° 2 de Berenguela fueron hechos usando un Horno Tubular (Estático) con una navecilla de silica para 100 gr. de mineral, un pirómetro y un sistema de neutralización de gases, los reactivos para estas pruebas se dosificaron de la siguiente manera:

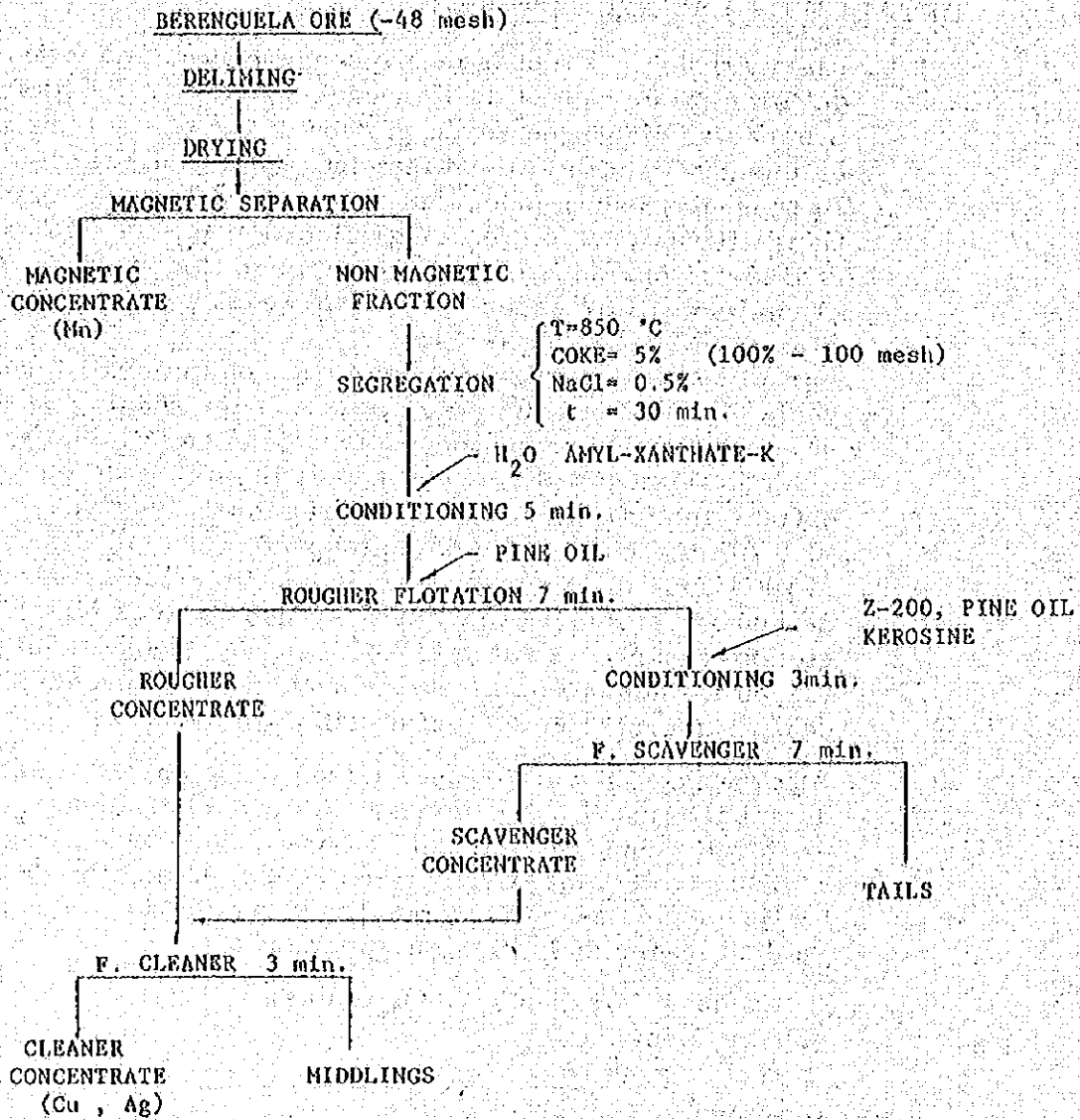
coque = 5% (100% - 100 mallas)
segregación:

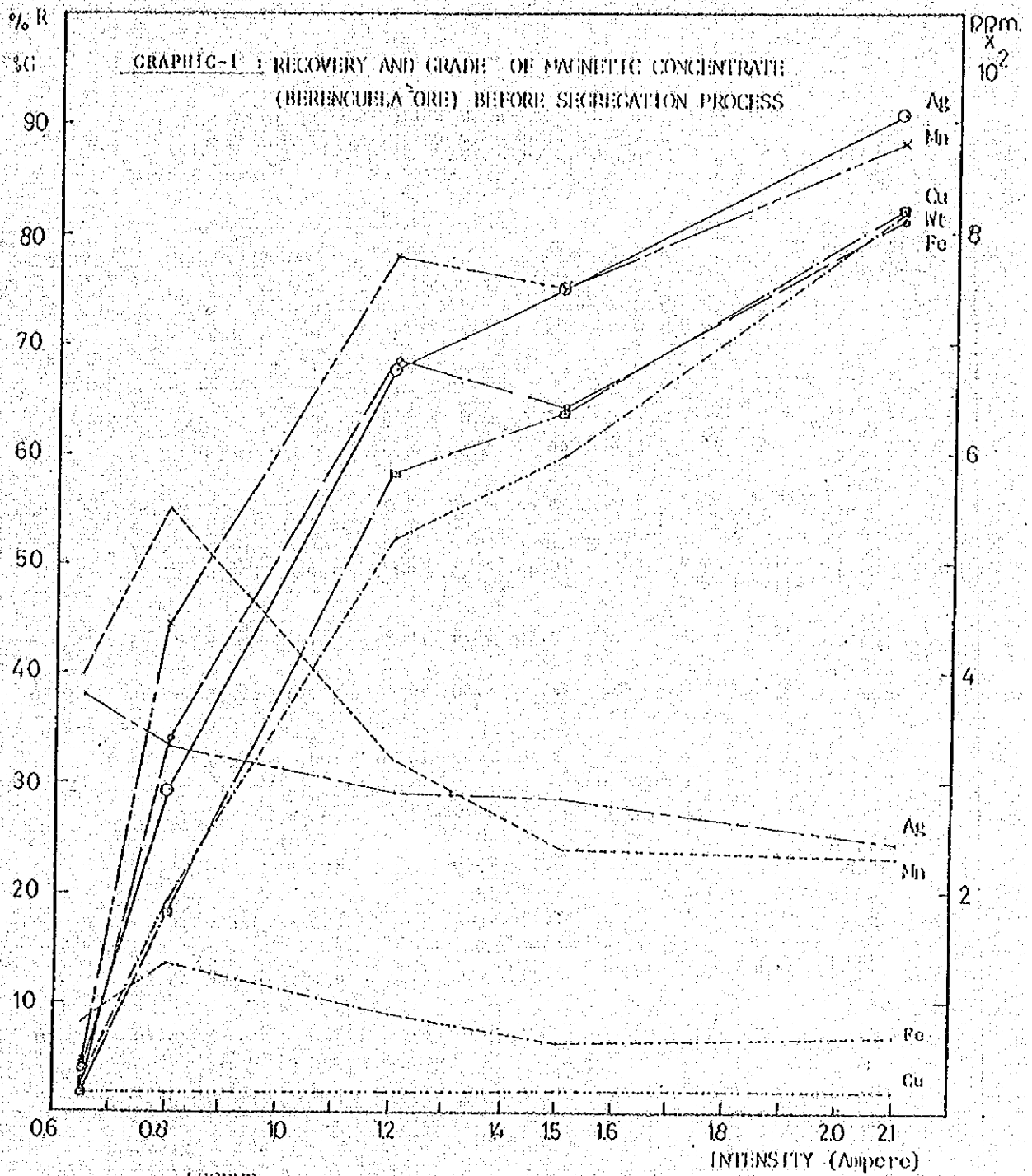
NaCl = 0.5%

flotación:

Xantato Amilico Potasio	= 200 gr./TM (1%)
2 - 200	= 100 gr./TM
Aceite de Pino	= 200 gr./TM
Kerosene	= 50 gr./TM

FLOW SHEET N- 1 : PRE-CONCENTRATION FOR MAGNETIC SEPARATION





LEGEND

- Recovery Ag
- x Recovery Mn
- ◻ Recovery Cu
- ◊ Recovery Fe
- % Conc. Weight
- Grade Ag (p.p.m.)
- Grade Mn (%)
- Grade Fe (%)
- Grade Cu (%)

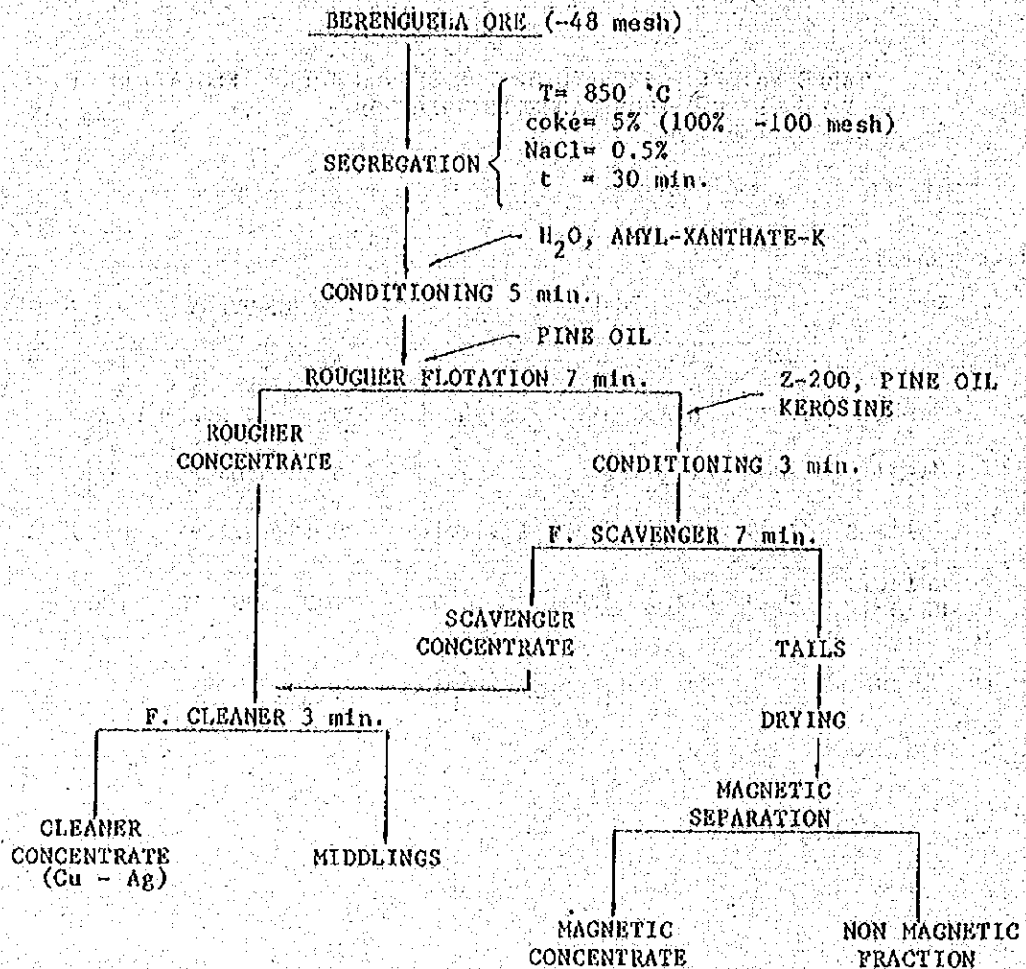
TABLE No. I -- RESULTS OF THE MAGNETIC PRE-CONCENTRATION OF THE BERENGUELA ORE WITH THE DISK-TYPE MAGNETIC SEPARATOR

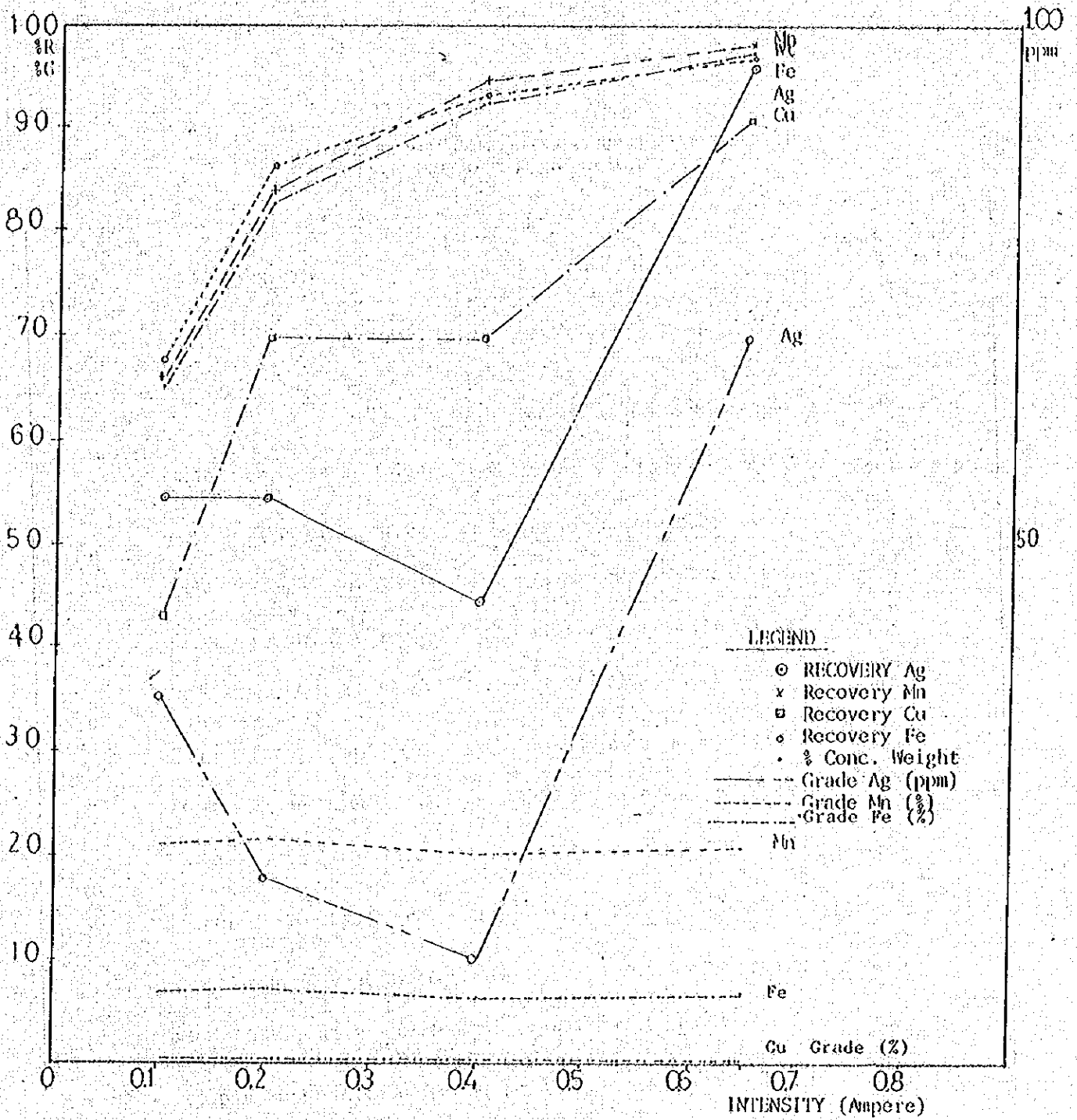
TEST NUMBER	SAMPLE NAME	GRADE					RECOVERY			TEST CONDITION	
		W%	Ag ppm	Cu %	Mn %	Fe %	Ag %	Cu %	Mn %		Fe %
1 A	Head	100	217.2	1.8	21.6	7.3					
	Magnet. Conc.	2.41	381.6	1.77	40.17	8.19	4.05	2.07	4.99	3.11	
	Non M. Conc.	97.6	222.7	2.07	18.85	6.30	95.95	97.93	95.01	96.89	I= 0.65
	Calc. Head	100	226.5	2.06	19.36	6.35	100.0	100.0	100.0	100.0	
2 A	Magnet. Conc.	19.3	334.5	1.60	55.2	13.6	29.54	18.37	44.75	34.05	
	Non M. Conc.	80.7	190.8	1.70	16.3	6.30	70.46	81.63	55.25	65.95	I= 0.80
	Calc. Head	100	218.5	1.68	23.81	7.70	100.0	100.0	100.0	100.0	
3 A	Magnet. Conc.	52.3	293.1	1.92	32.5	8.90	67.76	58.38	78.09	68.43	
	Non M. Conc.	47.7	152.9	1.50	10.0	4.50	32.24	41.62	21.91	31.57	I= 1.20
	Calc. Head	100	226.2	1.72	21.77	6.80	100.0	100.0	100.0	100.0	
4 A	Magnet. Conc.	59.8	286.2	1.90	23.90	6.40	75.07	63.85	75.08	63.80	
	Non M. Conc.	40.2	141.4	7.6	11.80	5.40	24.93	36.45	24.92	36.20	I= 1.50
	Calc. Head	100	227.9	1.78	19.04	6.00	100.0	100.0	100.0	100.0	
5 A	Magnet. Conc.	81.9	244.8	1.80	23.0	7.00	90.93	81.90	88.12	81.45	
	Non M. Conc.	18.8	110.3	1.80	14.0	7.20	9.07	18.10	11.88	18.55	I= 2.10
	Calc. Head	100	220.4	1.80	21.37	7.04	100.0	100.0	100.0	100.0	

TABLE No. II.- RESULTS OF THE SEGREGATION - FLOTATION OF
NON MAGNETIC FRACTION

Test No.	Sample Name	GRADE				RECOVERY				Test Cond.	
		W%	Ag ppm	Cu %	Mn %	Fe %	Ag %	Cu %	Mn %		Fe %
6 A	Conc.	5.63	4078.0	31.9	2.88	0.91	85.3	79.8	0.8	0.75	Non Magnetic Fraction I = 0.65 A. Coke = 5 % Cl a = 0.5%
	Middling	7.00	212.8	1.63	23.5	7.48	5.53	5.06	8.1	7.66	
	Tailing	87.38	28.27	0.39	21.1	7.16	9.19	15.1	91.1	91.6	
	Calcul. Head f	100.0	269.0	2.25	20.2	6.83	100	100	100	100	

FLOW SHEET N- 2 : MAGNETIC SEPARATION OF SEGREGATION PROCESS TAILS





GRAPHIC-2 : RECOVERY AND GRADE OF MAGNETIC CONCENTRATE FROM FLOTATION TAILINGS AFTER SEGREGATION PROCESS BERENGUELA ORE

TABLE No. III .- RESULTS OF THE MAGNETIC SEPARATION OF
TAILING OF SEGREGATION PROCESS

Test No.	Sample Name	GRADE					RECOVERY				Test Condit.
		W%	Ag ppm	Cu %	Mn %	Fe %	Ag %	Cu %	Mn %	Fe %	
8 B	Head	100	28.27	0.34	21.40	7.24					0.1 A
	Magnet. Conc.	65.24	35.46	0.23	21.15	6.77	54.61	42.68	66.29	67.42	
	Non M. Conc.	34.76	55.32	0.58	20.25	6.14	45.39	57.32	33.78	32.58	
	Calcul. Head	100	42.36	0.35	20.84	6.55	100	100	100	100	
9 B	Magnet. Conc.	82.74	18.44	0.22	21.40	7.17	54.51	64.63	84.02	86.18	0.2 A
	Non M. Conc.	17.26	73.76	0.46	19.51	5.51	45.49	30.37	15.98	13.82	
	Calcul. Head	100	27.98	0.26	21.07	6.88	100	100	100	100	
	Magnet. Conc.	92.76	9.93	0.21	20.16	6.38	44.25	69.87	94.72	93.26	
10 B	Non M. Conc.	7.24	160.28	1.16	14.40	5.91	55.75	30.13	5.28	6.74	0.4 A
	Calcul. Head	100	20.82	0.28	19.74	6.35	100	100	100	100	
	Magnet. Conc.	96.88	69.50	0.24	20.82	6.69	95.90	90.96	98.08	96.52	
	Non M. Conc.	3.12	92.20	0.74	12.67	7.48	4.10	9.04	1.92	3.48	
11 B	Calc. Head	100.00	70.20	0.26	20.57	6.71	100.00	100.0	100.0	100.00	0.65 A

TABLE No. IV .- RESULTS OF THE SEGREGATION-FLOTATION PROCESS WITH BERENGUELA ORE

Test No.	Sample Name	GRADE					RECOVERY				Test Condition
		W%	Ag ppm	Cu %	Mn %	Fe %	Ag %	Cu %	Mn %	Fe %	
7-B	Conc.	5.82	3617	31.7	3.29	1.17	85.35	82.9	0.93	0.96	Head:Crude Ore
	Middling	8.38	141.8	1.07	23.5	9.84	4.82	4.03	9.58	11.6	Coke:5.0%
	Tailings	85.8	28.3	0.34	21.4	7.24	9.83	13.1	89.5	87.4	ClNa:0.5%
	Calcul. Head	100.0	246.7	2.23	20.52	7.10	100.0	100	100	100	

FLOW SHEET - No 3 : PROBABLE FLOW SHEET AND RESULTS TO BE INVESTIGATED

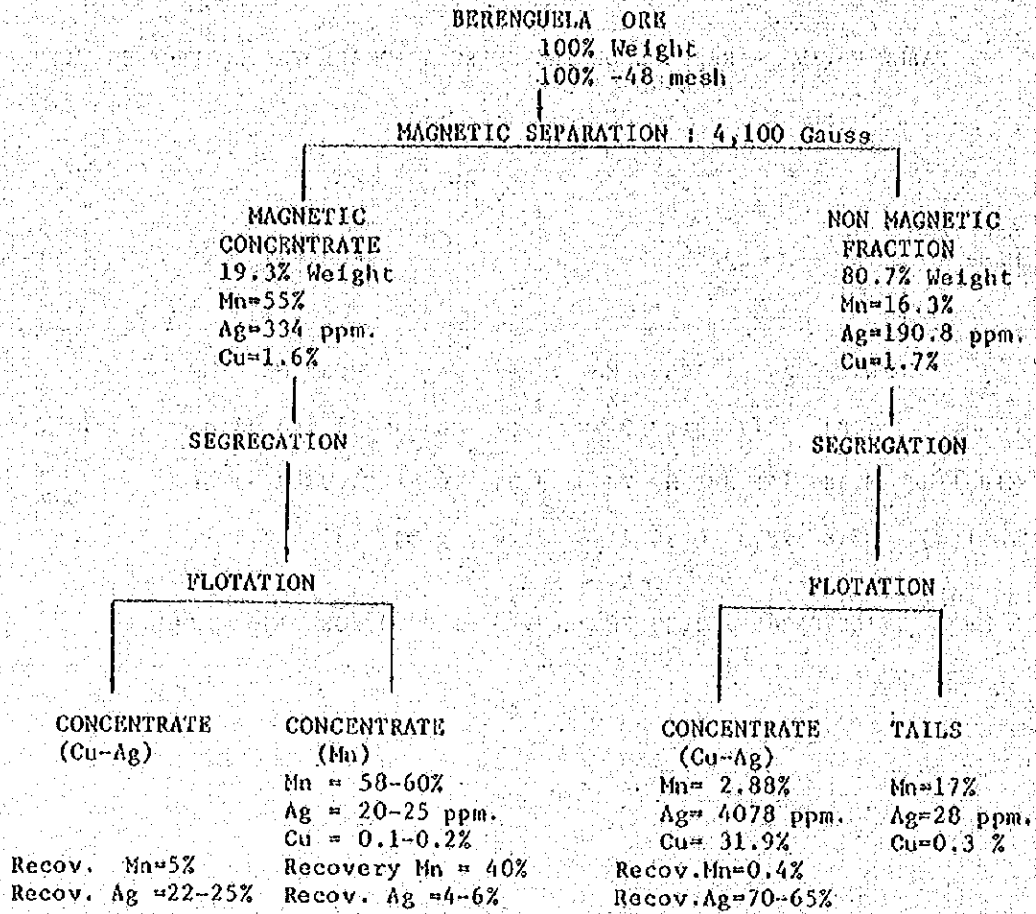
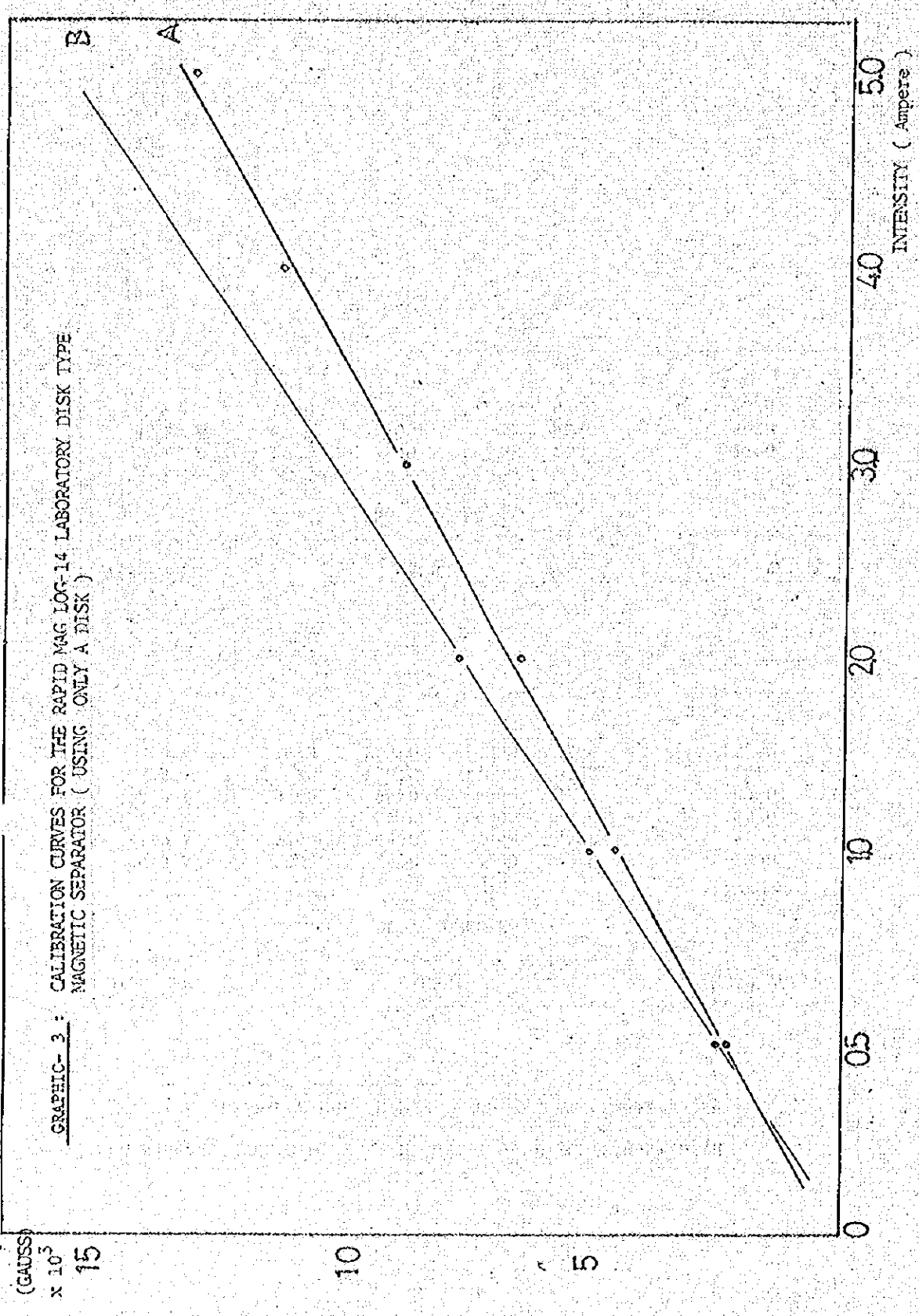


TABLE V: MEASUREMENTS OF THE INTENSITY OF FIELD (GAUSS) WITH
 THE DIGITAL GAUSS-METER ML-100 MAGNET LABORATORIES INC.

DISK NAME	GAUSS				MEAN VALUE
	BELT ZONES No.				
A	1	2	3	4	A
0.5 A.	2300	2400	2130	2330	2298
1.0 A.	4760	4850	4440	4490	4635
1.5 A.	6760	6770	6000	6600	6530
2.0 A.	8900	9510	8960	8330	8930
2.5 A.	12520	13070	11000	10380	11410
3.0 A.	13670	13610	13000	12500	13200

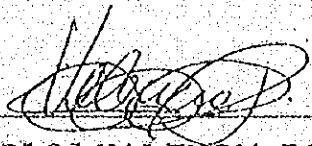
DISK NAME	GAUSS				MEAN VALUE
	BELT ZONES No.				
B	1	2	3	4	A
0.5 A.	2900	2590	2250	2200	2490
1.0 A.	5570	5400	4750	4340	5020
1.5 A.	8850	8500	7250	6700	7830



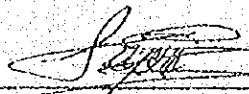
Los relaves de flotación fueron concentrados por separación magnética, usando el separador de disco en seco y las pruebas se efectuaron de acuerdo al Flow Sheet N° 2 la alta susceptibilidad magnética de los relaves del proceso de segregación solo permitió escoger un rango de intensidad magnética en tre 600 y 3300 Gauss, esto es - (0.1 - 0.65 Amp) Ver gráfico N° 3.

El cual muestra que el grado del concentrado magnético permanece casi constante (22% Mn), es decir que la recuperación sigue la misma tendencia que el peso del concentrado, similar tendencia siguen el grado de Cu y Fe.

Tokio, 19 de Febrero de 1989



CARLOS VALENCIA DIAZ



FERNANDO ZEGARRA C.

A P E N D I X 1

M I C R O S C O P I C A N A L Y S I S D O N E B Y

D O C T O R E N G I N E E R H I D E K I I M A I

ベルンゲラ (Benqueña) 鉛石

12-7112

今井 喜喜

ベルンゲラ 鉛石 DDH 12 (100.16 ~ 112.49 m)
DDH 17 (23.19 ~ 30.00 m), DDH 49
(36.18 m)

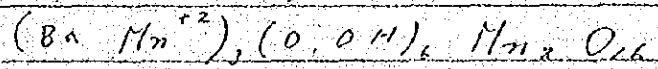
の3個について鉛物の学的研究を行
った。その方法として透過顕微鏡
反射顕微鏡 XMA, X線回折に
よってその結果を報告した。

1. 鉛物の組成

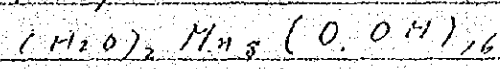
DDH 12

存在する鉛物として

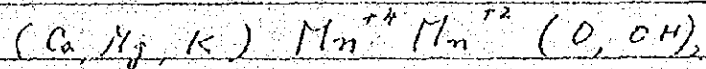
マンガン鉛 (psilomelane)



鉛石 (todonofite)



Bianchessite



鉛鉛鉛 (goorite)

石灰

(お1回 (A), (B), (C), (D), X線回折
No. 1 参照)

銅, 鉛は上記マンガン酸化物に吸着
して存在する (お1回 (A), (B))

またマンガン酸化物中には acanthite
(Ag₂S) を認め (お1回 (D))

DDH 17

硬マニカニ鉱, 霽石, *biannessite*,
石炭,

銅鉛は上記マニカニ酸化合物に吸着
されている。

(第2図 (A), (B), (C), X線回折チャート
No. 2 参照)

DDH 49

硬マニカニ鉱, 霽石, *biannessite*,
方解石, ドロマイト

(第3図 (A), (B), X線回折チャート
No. 3 参照)

銅鉛は同じくマニカニ酸化合物に
吸着されている。

石炭とレニゲラ鉱石中には1984年
三井金属(株)資源開発部技術開発室
の報告したカオソン, カリ石, 絹雲母,
孔雀石, 菱孔雀石, 銅藍(*covellite*
 CuS)がある⁽¹⁾。これは日産銅力事業団
の1984年の報告中に光輝銅鉱, 黄銅鉱,
黄鉄鉱が記載されている⁽²⁾。

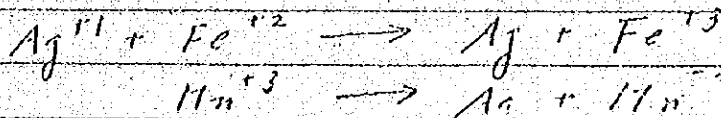
正 鉛物組成 : 打子 解説

酸化マンガン鉛物、針鉄鉛、孔雀石、銅藍、輝銅鉛などの酸化二次鉛物、硫化二次鉛物の E.R.-PH 条件を第 4, 5, 6 図に示す (Garrel and Christ 1965)⁽³⁾

上記鉛物の安定領域を赤色に塗っており、第 3 図に示すように二次酸化マンガン鉛物の方解石と共生し細粒の方解石と二次酸化マンガン (硬マンガン鉛、輝石 *birnessite*) は方解石と同時に生成する。その場合の PH は 8.7 以上 T.3. (一國 1972, 添付資料 1)⁽⁴⁾ といふ第 6 図に示す打子に銅藍の酸性溶液が生成した。

打子二次生成の硫化鉛 (*acanthite*) (第 1 図 10) は Boyle⁽⁵⁾ の論じているように初成鉛硫化鉛物の酸化により生じた $[Ag(S_2O_3)_2]^{-3}$ が酸性溶液の下に *acanthite* を生じたことがある (添付資料 2)。

一般的には初成鉛鉛物は風化により露天化作用により Ag^+ と H^+ となり、マンガン、鉄の酸化物に置換すること。



つまり自然銀となる。本鉛床に打子とし二次酸化マンガンは吸着している銀は自然銀であろう。

以上本鉛床におけるマニガン、鉄、銅、銀などの沈殿環境におけるpH、E_hは一定でなく、局部的に異なり、大範圍にわたる一様な流水による生成した堆積鉛床ではなく、現在の鉛床の直下より下口付近に根拠が存在し、局部的に環境に差がある状態で生成した原地堆積型またはこれに外、鉛床であると考へる。

文献

- (1) 三井金属鉱業株式会社、資源開発本部技術開発室 (1984) : Peru共和国 Beranguela 鉛選鉱試験報告書
- (2) 国際協力事業団 (1984) : ペルー共和国 酸化鉛処理プロジェクト計画打合せ4-4報告書
- (3) Garrel, R. M. and Christ, C. L. (1965) Solution, Minerals and Equilibria
- (4) 一岡雅巳 (1972) 無機地球化学 培風館 (添付資料 1)
- (5) Boyle, R. W. (1968) : The Geochemistry of Silver and its Deposits (添付資料 2)

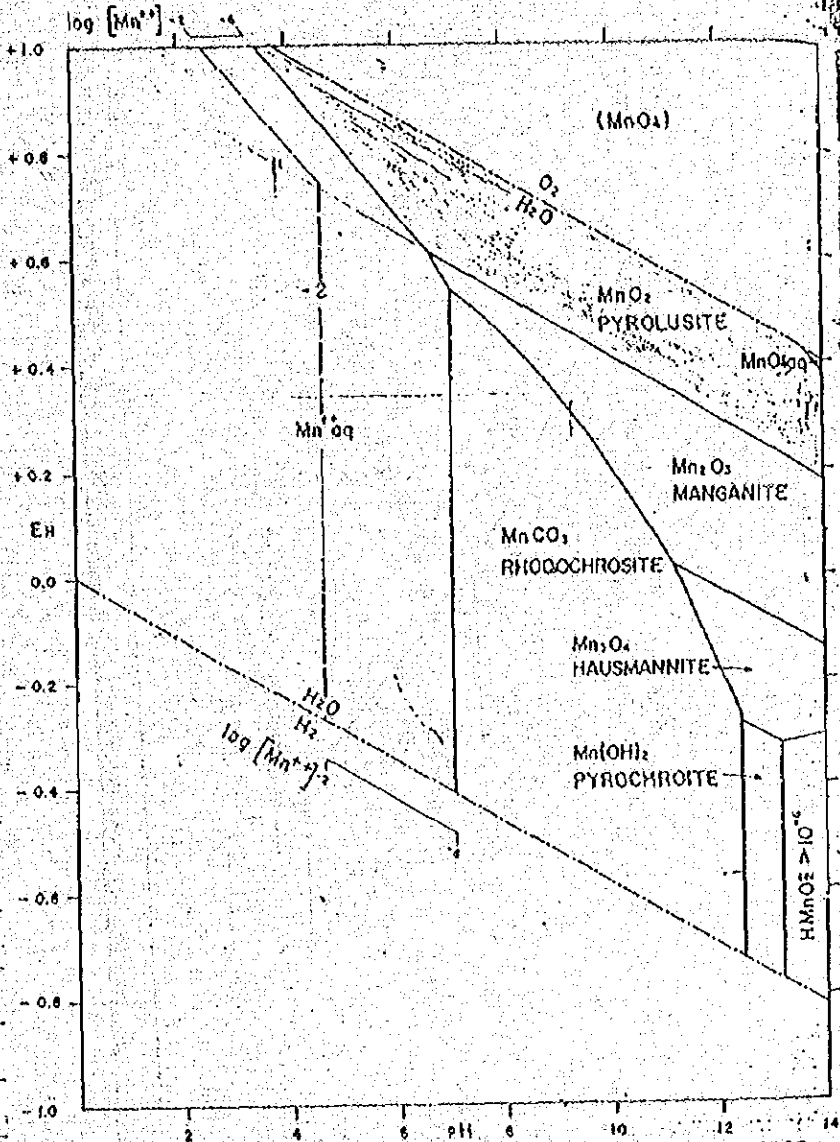


FIG. 7.28a. Stability relations among some manganese compounds in water at 25 °C and 1 atmosphere total pressure. Total dissolved carbonate species $\approx 10^{-4}$. [Courtesy E. Gaucher.]

第4図 マンガン酸化物
の Eh-pH 生成条件
(Garrel, Christ)

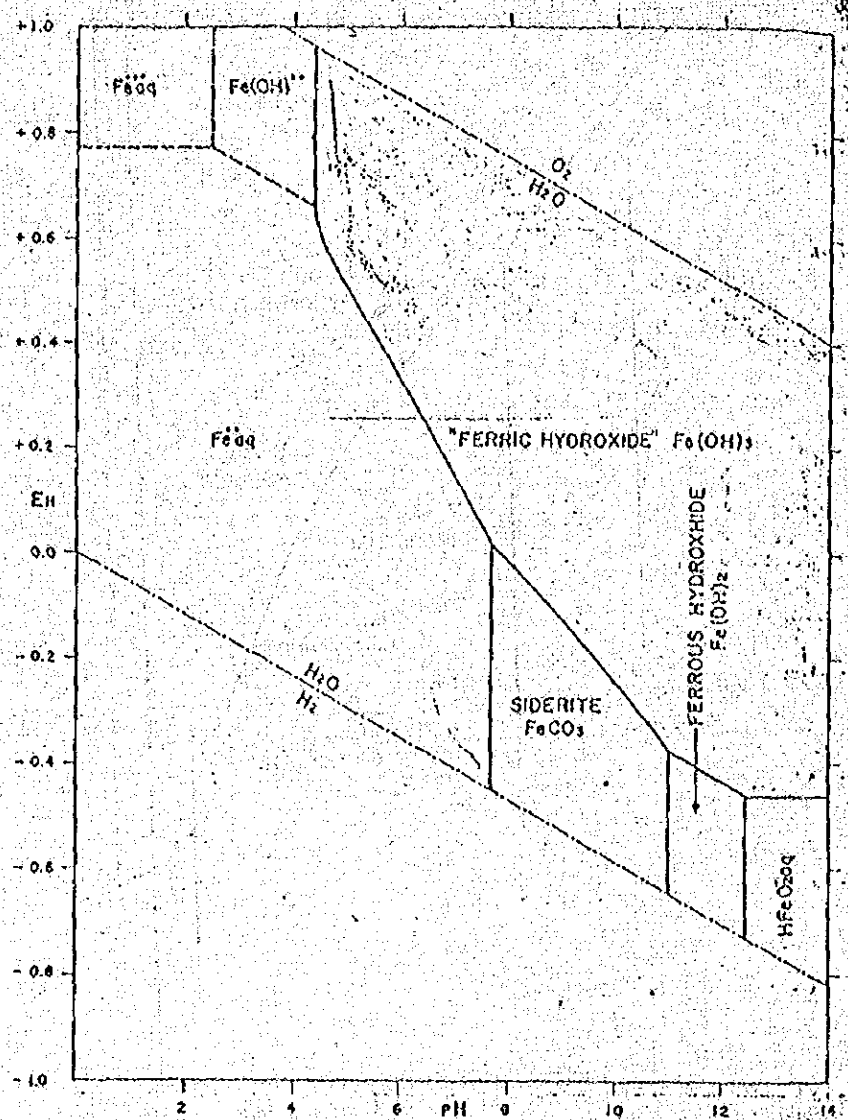


FIG. 7.14. Diagram showing the relations among the metastable iron hydroxides and siderite at 25 °C and 1 atmosphere total pressure. Boundary between solids and ions at total activity of dissolved species = 10⁻⁴. Total dissolved carbonate species = 10⁻³. Dashed lines are boundaries between fields dominated by the labeled ion.

第5圖 鉄酸化物物の
 Eh-PH 生成條件
 (Grainal, Christ)

添存礦物 2.

THE ORGANO-CHEMISTRY OF SILVER AND ITS DEPOSITS

H₂S or S²⁻ bearing waters, rising or moving laterally from petroliferous or carbonaceous beds or fetid limestones, etc. would precipitate silver sulphides along their zones of contact. Silver-bearing sulphides in the cap rocks of salt domes and in certain reef complexes probably owe their origin to such a mechanism.

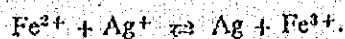
4. Precipitation of silver (or its compounds) owing to the decomposition of inorganic complexes of the type [AgCl₂]⁻ and [AgCl₃]²⁻ as a result of a decrease in the chloride ion concentration. A decrease in the CO₂ concentration similarly causes a breakdown of the soluble hydrogen carbonate complex of silver with consequent precipitation of the silver. These two mechanisms could conceivably operate where silver-bearing waters or vapours come into contact with reactive rocks, or in the case of CO₂ where a decrease in pressure takes place as the waters or vapours move toward the surface or into dilatant geological structures such as fractures, faults, etc.

5. Precipitation of silver (or its compounds) owing to a decrease in the hydrogen-ion concentration where the element is transported as Ag⁺ in solution. In acidic solutions silver ion is more soluble and mobile. As the acidity of the solutions is reduced by reactions with wall-rock or gangue minerals or by dilution, silver tends to precipitate, the compounds or minerals formed being dependent on the composition of the solutions. The pH of hydrolysis of silver from aqueous solution as the oxide or as basic salts is 7.5 to 8.0. Silver is relatively insoluble in alkaline solutions unless ammonia or some other complexing agent is present. Reduction in acidity is partly responsible for the precipitation of silver during secondary enrichment processes, and may also be effective in the primary precipitation of the element in certain cases.

(6) Precipitation as Ag₂S due to the decomposition of the complex ion [Ag(S₂O₃)₂]³⁻ as a result of an increase in the acidity of the solutions. Reducing agents, such as carbonaceous matter, also precipitate Ag₂S from solutions containing silver as the thiosulphate complex. These reactions are probably important in the oxidation of silver deposits.

7. Precipitation of silver sulphide and other silver sulphide-arsenide or antimonide, telluride, and selenide minerals owing to an increase in the hydrogen-ion concentration where the element is carried as a sulphide complex, e.g. [AgS]⁻, arsenide complex, telluride complex, etc. These reactions are probably responsible mainly for primary precipitation of silver, although they may be important in secondary enrichment processes as well.

8. Changes in oxidation-reduction potential. These may work in two ways. Decrease in the oxidation-reduction potential permits a greater concentration of Fe²⁺ in solutions and this ion precipitates the native metal from silver solutions

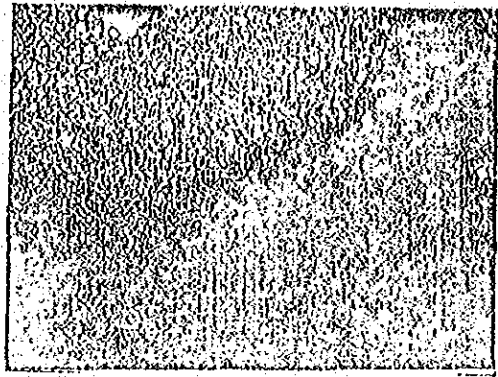
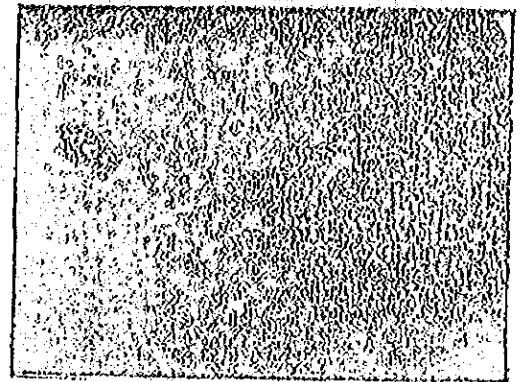
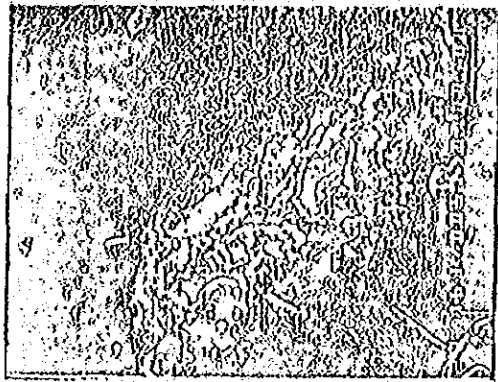


Because the reaction is reversible and the concentration of Fe³⁺ increases with increasing oxidation potential this renders silver more soluble and mobile.

第1回(A)

試験結果

DDH
32C

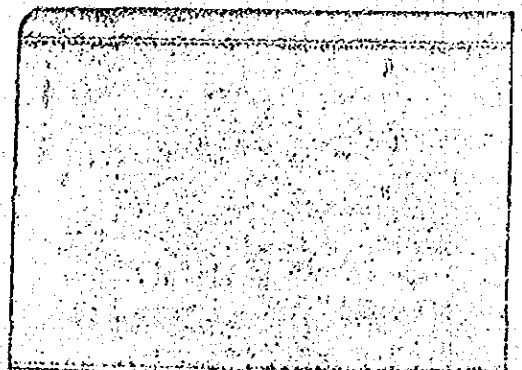
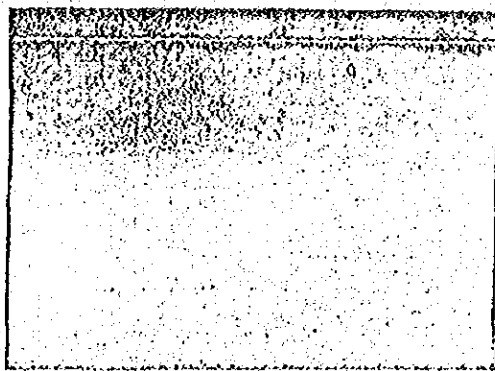
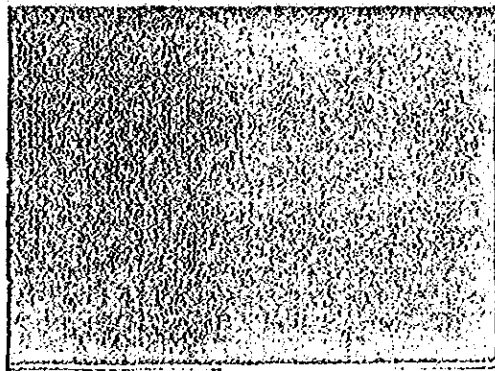


1/10



MITSUMI MINING & SMELTING CO., LTD.
CENTRAL RESEARCH LABORATORY

備考:



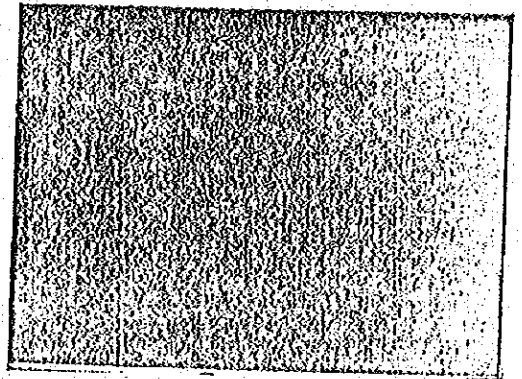
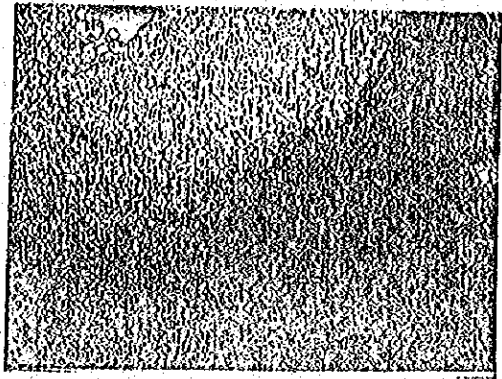
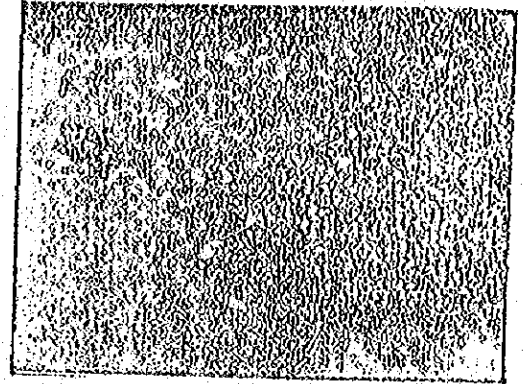
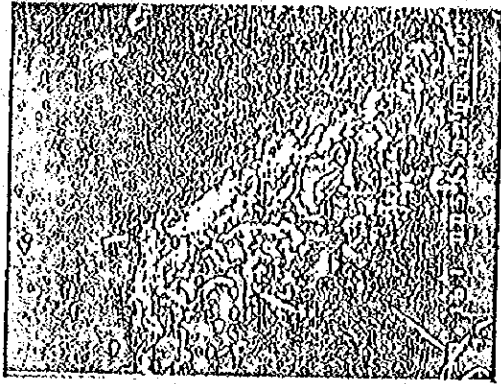
撮影ノ尺法

(C)

第1回 (A)

A 試験結果

DDH
32 C



770

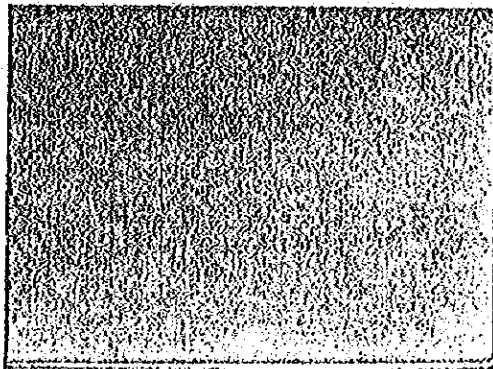


MITSUI MINING & SMELTING CO., LTD.

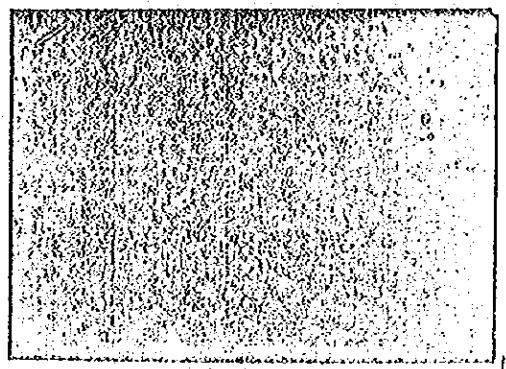
CENTRAL RESEARCH LABORATORY

備考:

B-

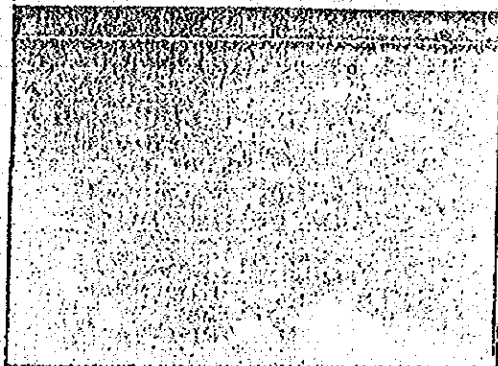


M

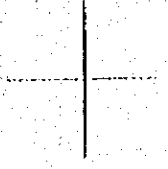
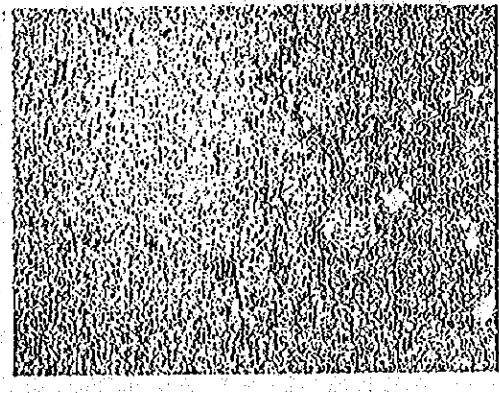
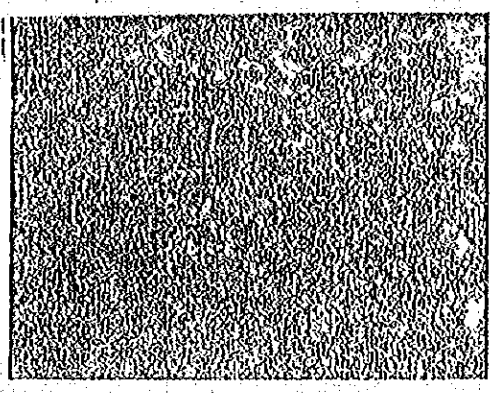
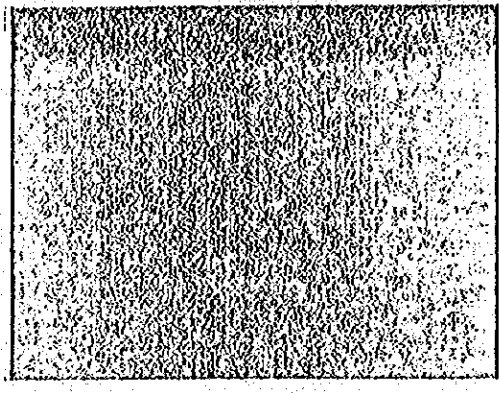
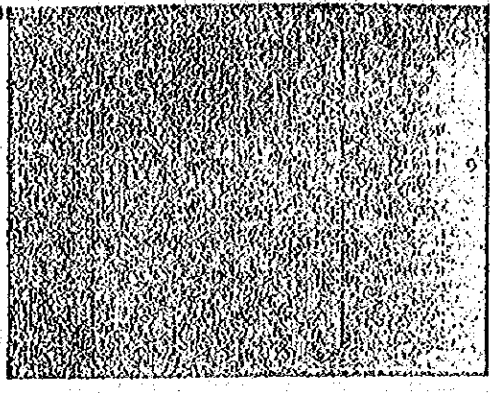


撮影ノイル人控

(C)



(10)



・撮影7.9x15

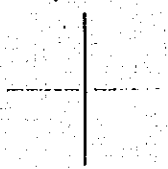
目 録 :

MITSUBISHI MINING & SMELTING CO., LTD.

CENTRAL RESEARCH LABORATORY



300

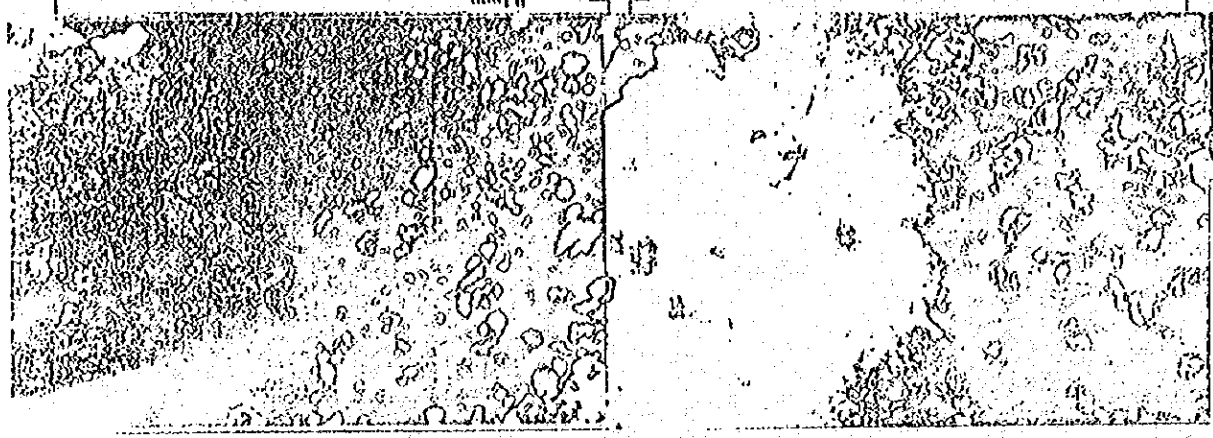


・撮影7.9x15

RESEARCH REPORT No. 300

五ヶ所銅線管
上 厚 1.0mm 上 厚 1.5mm
上 厚 2.0mm 上 厚 2.5mm
時 間 約 : 22分
材 質

0.1mm



7.9x15	撮影
A. H. 5	測定
KV	電圧
10	倍率
X	目 鏡
100	接眼

EPMA 試験結果
DBH 17A

EPMA試験結果

DDM 32 D

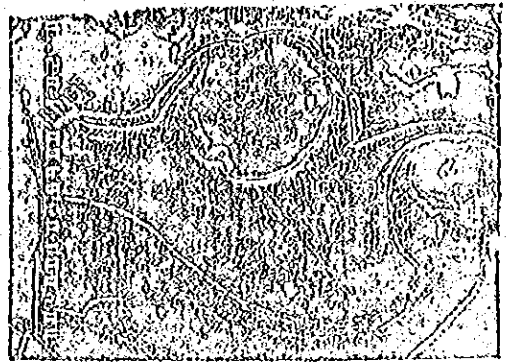
試料番号	
測定箇所	
加速電圧	15KV
電子線電流	10A
倍率	×
測定年月日	



0.2mm

反射顕微鏡写真

灰色部 硬質の石英
暗黒部 毒石, Binnessite



走査電顕像

200

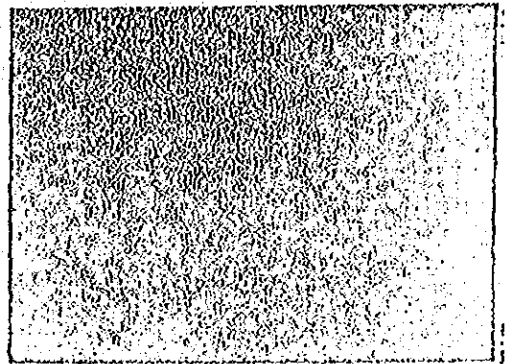
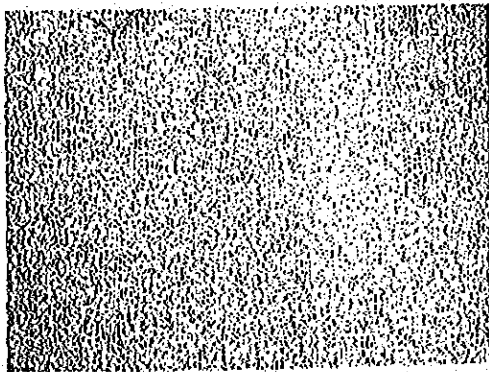
撮影：アルカ



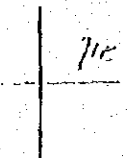
MITSUMI-MINING & SMELTING CO., LTD.
CENTRAL RESEARCH LABORATORY

備考:

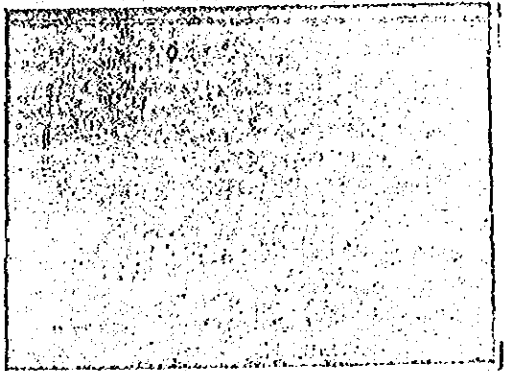
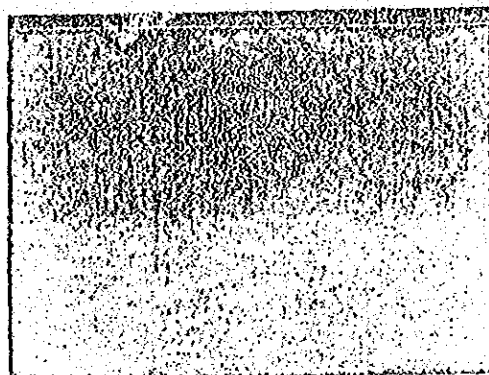
7/10



撮影：アルカ



7/10



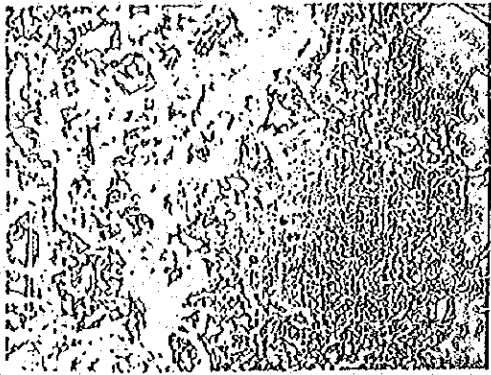
EPMA 試験結果

DD11 19 A

分析番号	
試 料 名	
加速電圧	KV
電子線電流	nA
倍 率	x
測定年月日	



0.1mm



石部 顕微鏡写真
 上左 平片コロ 上右 十字
 上左の白色部: 珪石
 暗色部: Biotite
 珪石

光電顕像 倍率 300

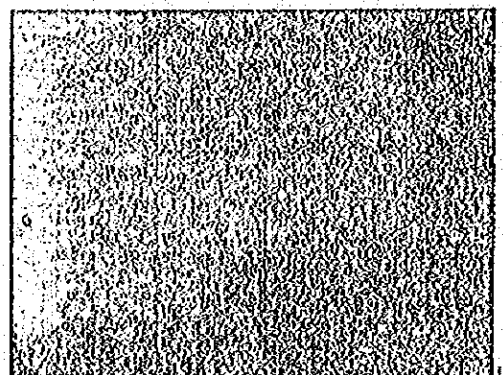
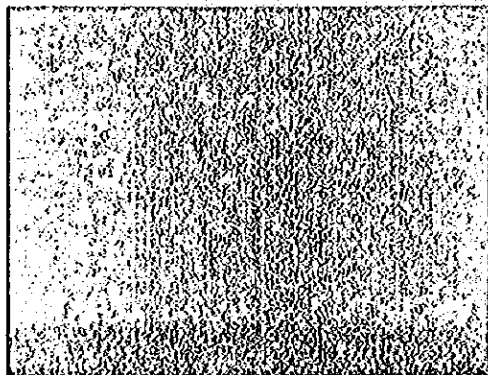
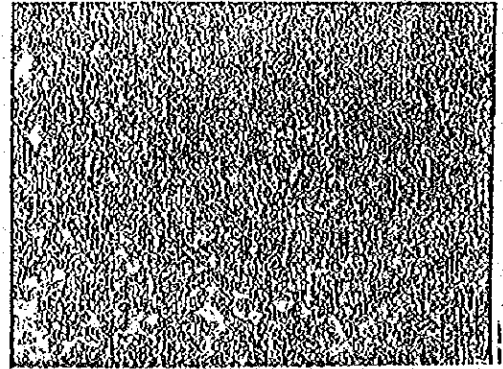
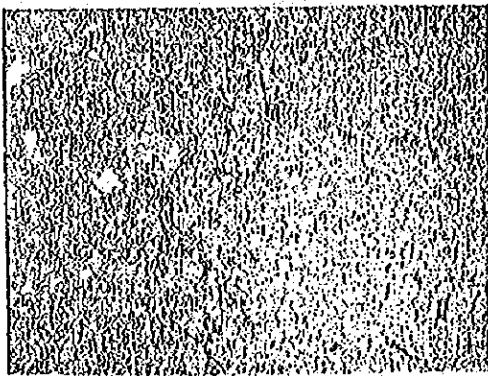
300

・撮影フィルム控



MITSUI-MINING & SMELTING CO., LTD.
 CENTRAL RESEARCH LABORATORY

備考:

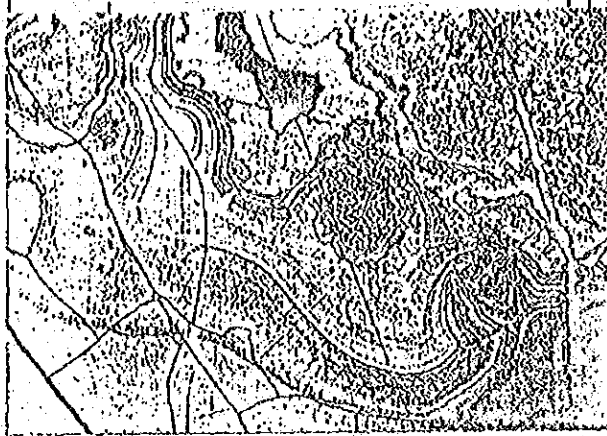


・撮影フィルム控

EPMA試験結果

DDH 32 D

試料番号	
試料名	
加速電圧	KV
電子線電流	nA
倍率	x
測定年月日	

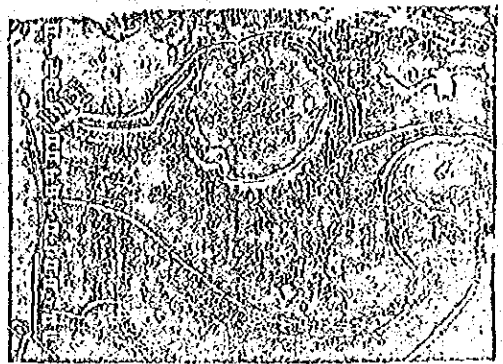


0.2mm

反射顕微鏡了具

原色部: 石英, 金

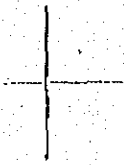
暗色部: 輝石, Bismessite



走査電顕像

200

撮影ノルム控

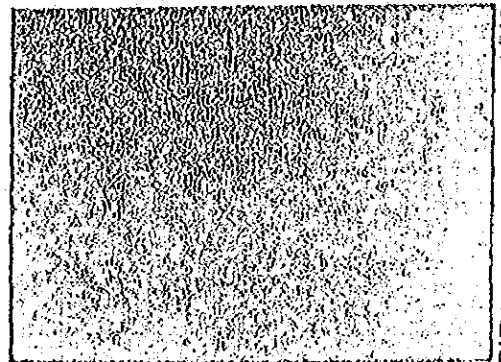
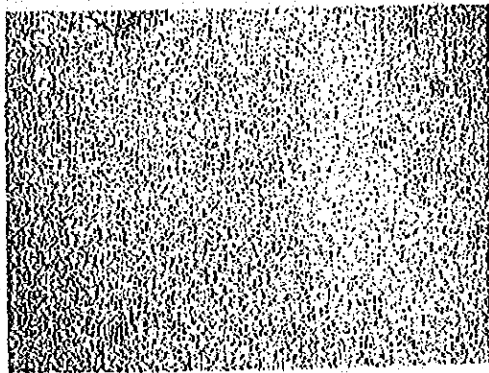


MITSUI MINING & SMELTING CO., LTD.

CENTRAL RESEARCH LABORATORY

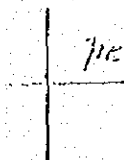
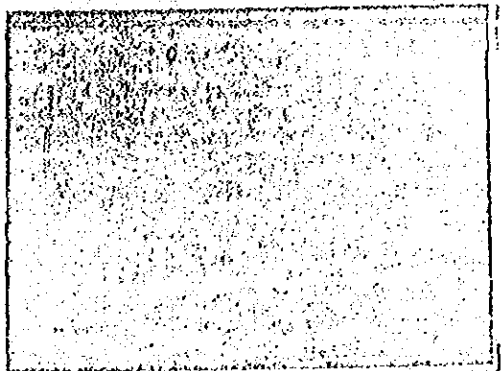
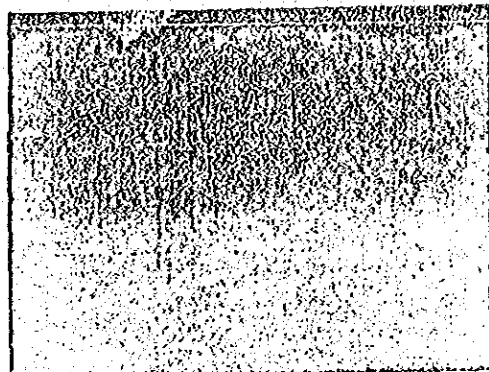
備考:

1/4



撮影ノルム控

1/2



EPMA 試験結果

DDH77B

受託番号	
試料名	
加速電圧	KV
電子線強度	μ A
倍率	\times
測定年月日	

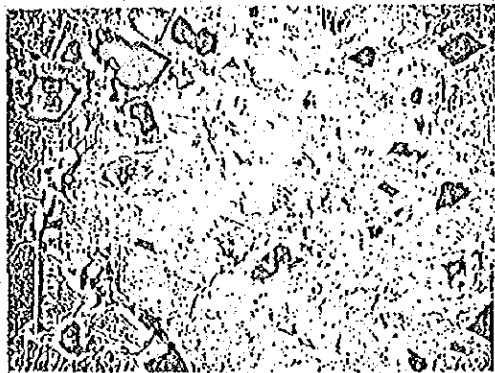


反射顕微鏡

灰包部: Bismessite
輝石

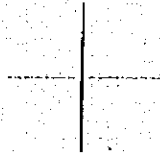
暗黒部: 石英

0.1mm



上図 輝石

撮影フィルム控



走査電顕像

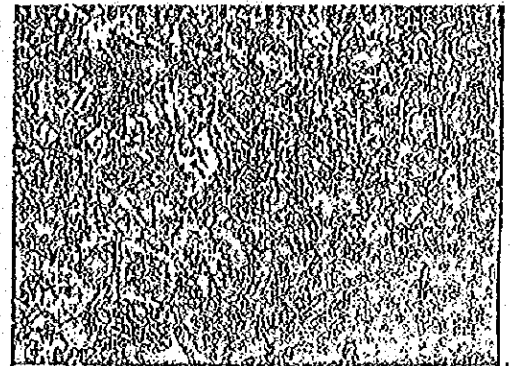
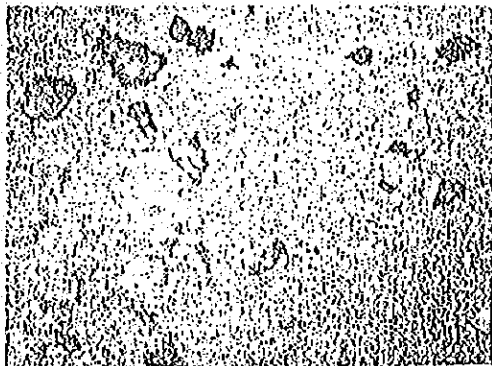
$\times 300$



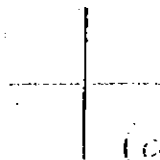
MITSUI-MINING & SMELTING CO., LTD.
CENTRAL RESEARCH LABORATORY

備考:

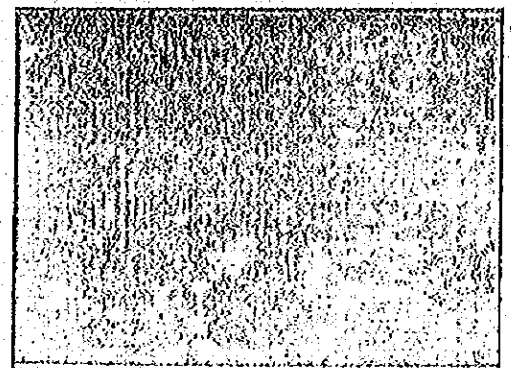
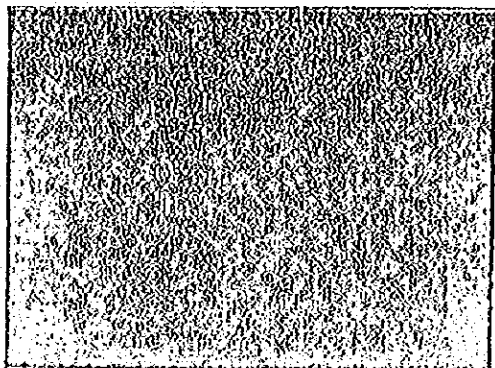
1/a



撮影フィルム控



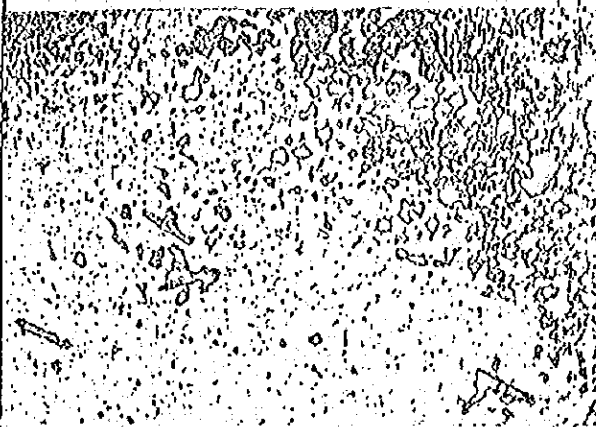
(Cu)



EPMA試験結果

Beamline VPM11

装置番号	
試料名	
加速電圧	KV
電子線電流	μA
倍率	×
測定年月日	

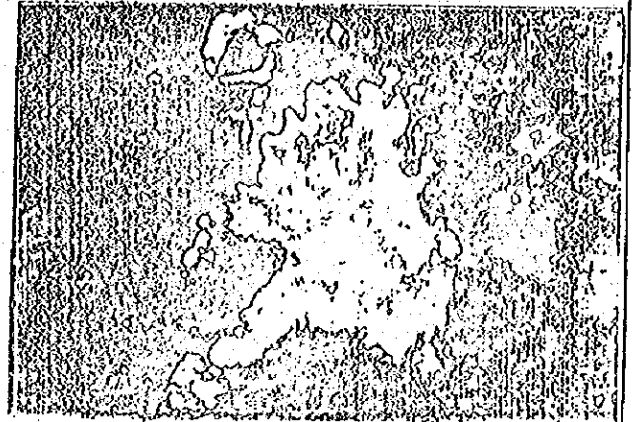


反射顕微鏡写真

0.2mm

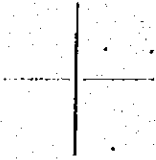
白色: Acanthite
 灰色: 磨石, Biancospite

反射顕微鏡 (100倍以内)
 写真



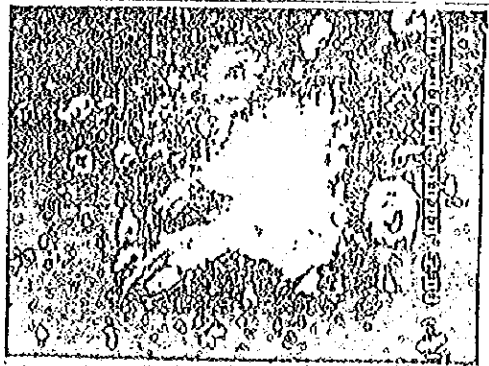
0.02mm

撮影フィルム控

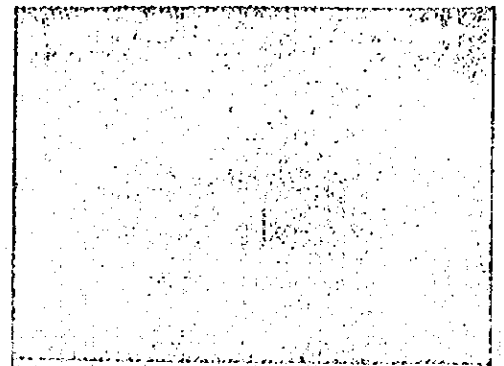
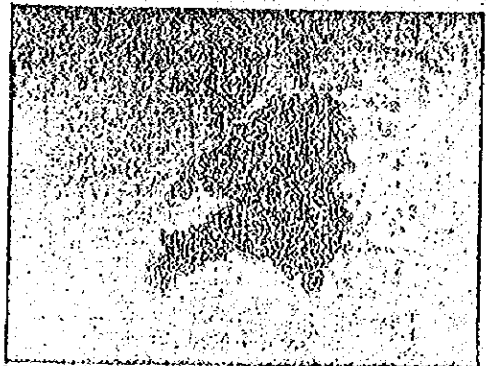
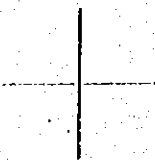


MITSUMI MINING & SMELTING CO., LTD.
 CENTRAL RESEARCH LABORATORY

備考:



撮影フィルム控



A P E N D I X II

X RAY DIFFRACTION OF NEXT SAMPLES ;

SAMPLE NUMBER

- 1 Magnetic Concentrate of Berenguela Ore 0.8 A
- 2 Non Magnetic Concentrate of Berenguela Ore 0.8 A.
- 3 Magnetic Concentrate of tailings from Segregation -Flotation 0.1 A.
- 4 Non Magnetic Concentrate of tailings from Segregation-Flotation 0.1 A.

CHAR. NO. AC-01

КОВАЧОВИ НЕОЛУНИ

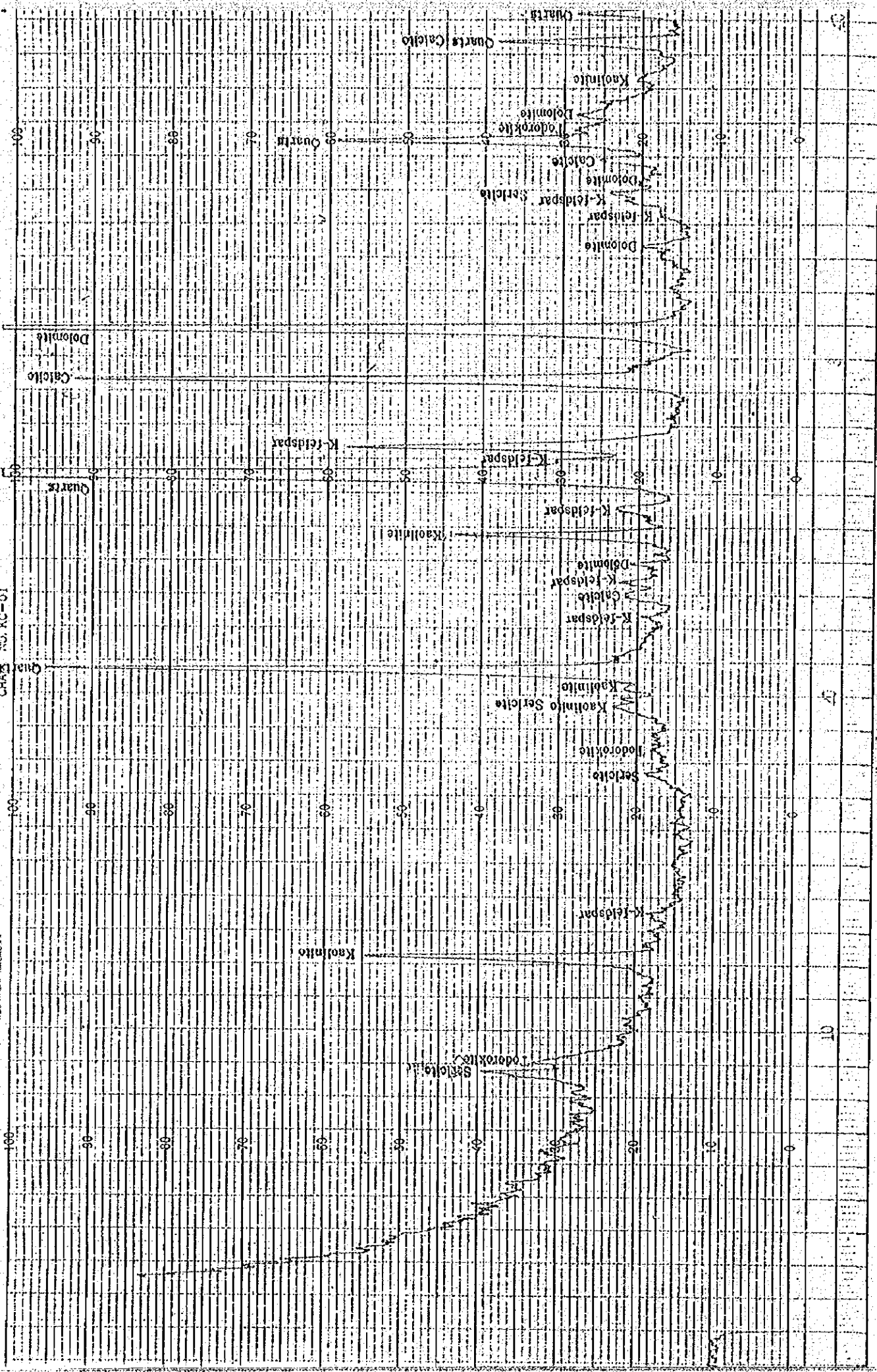
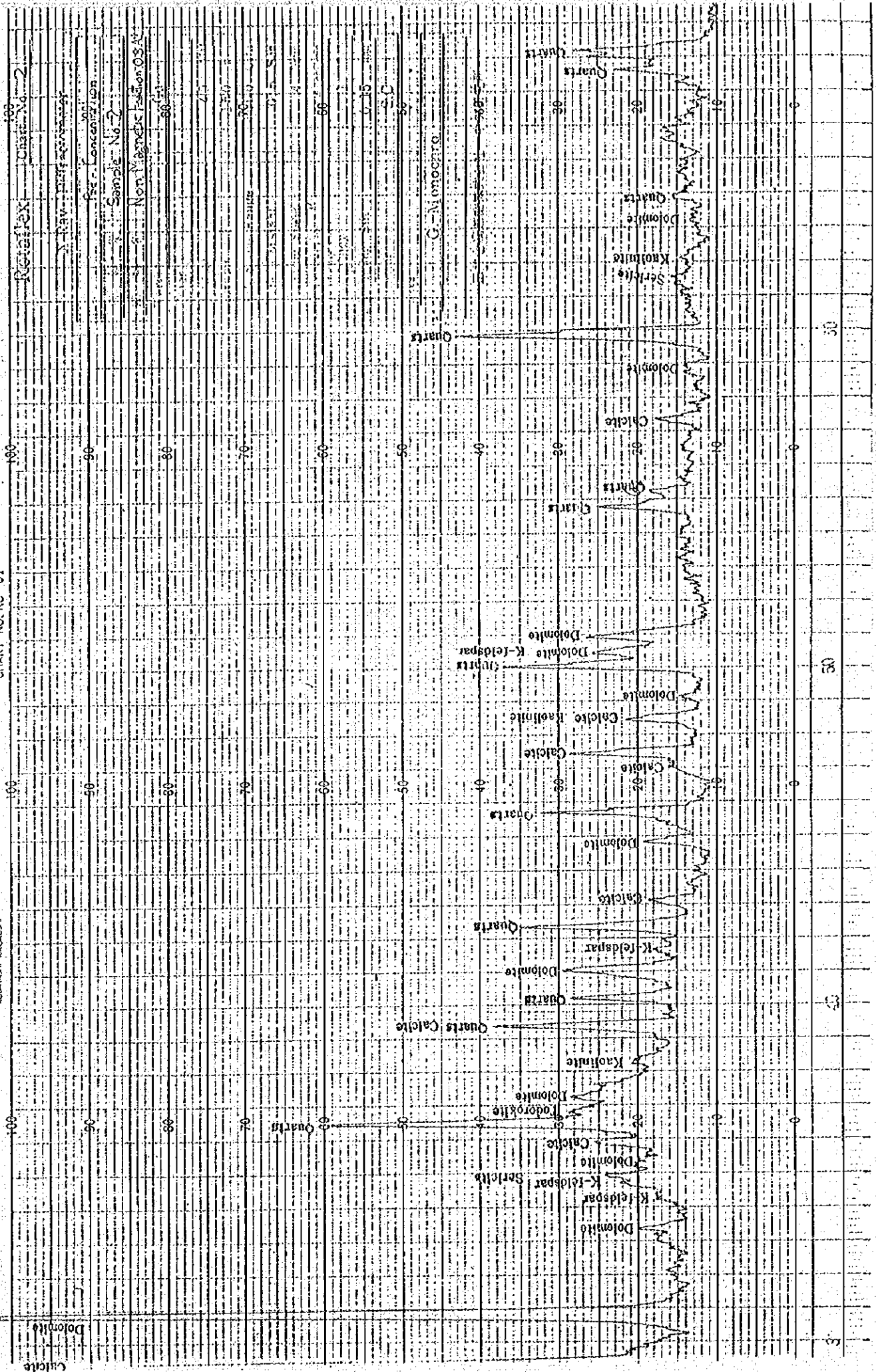
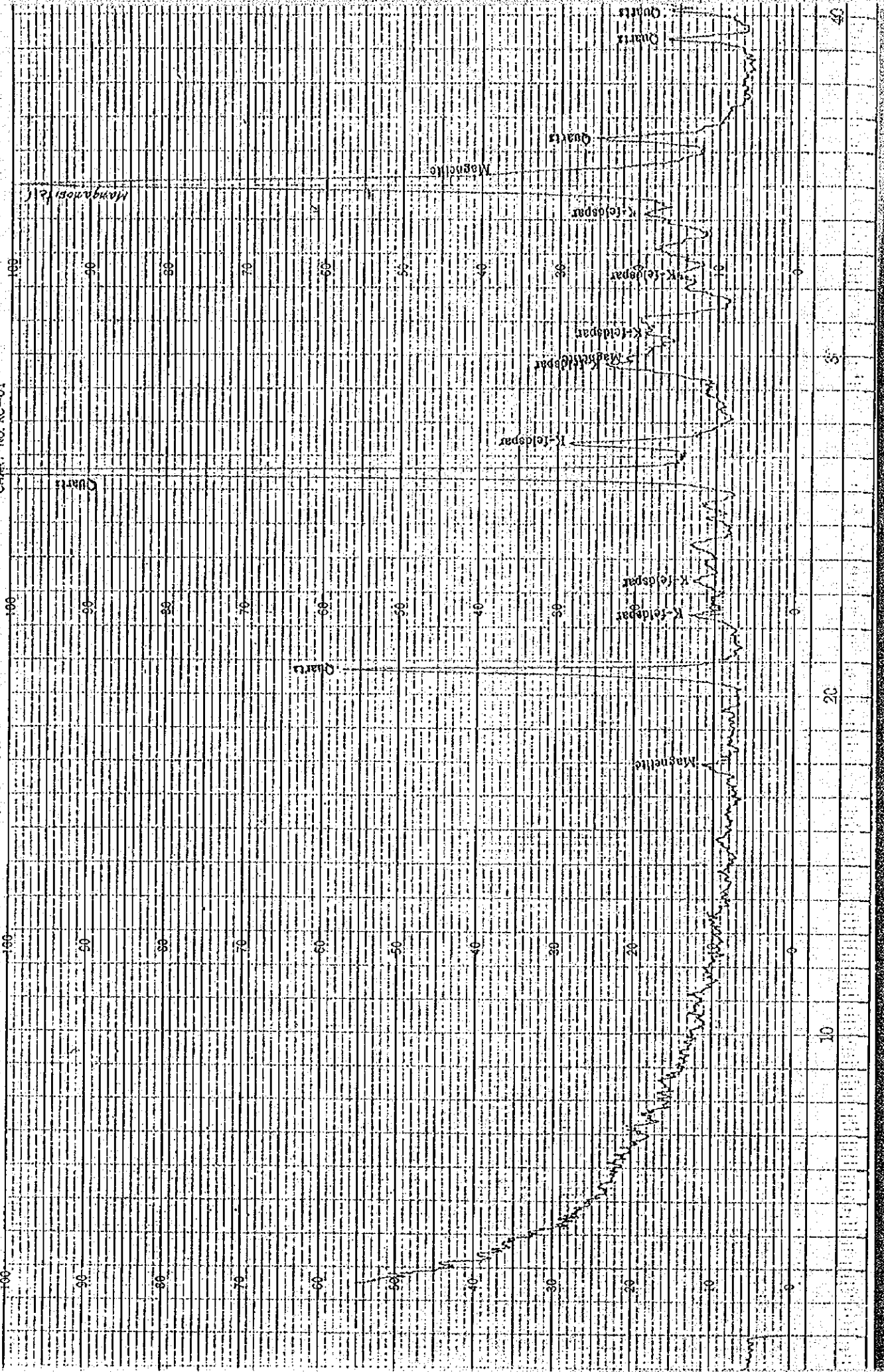
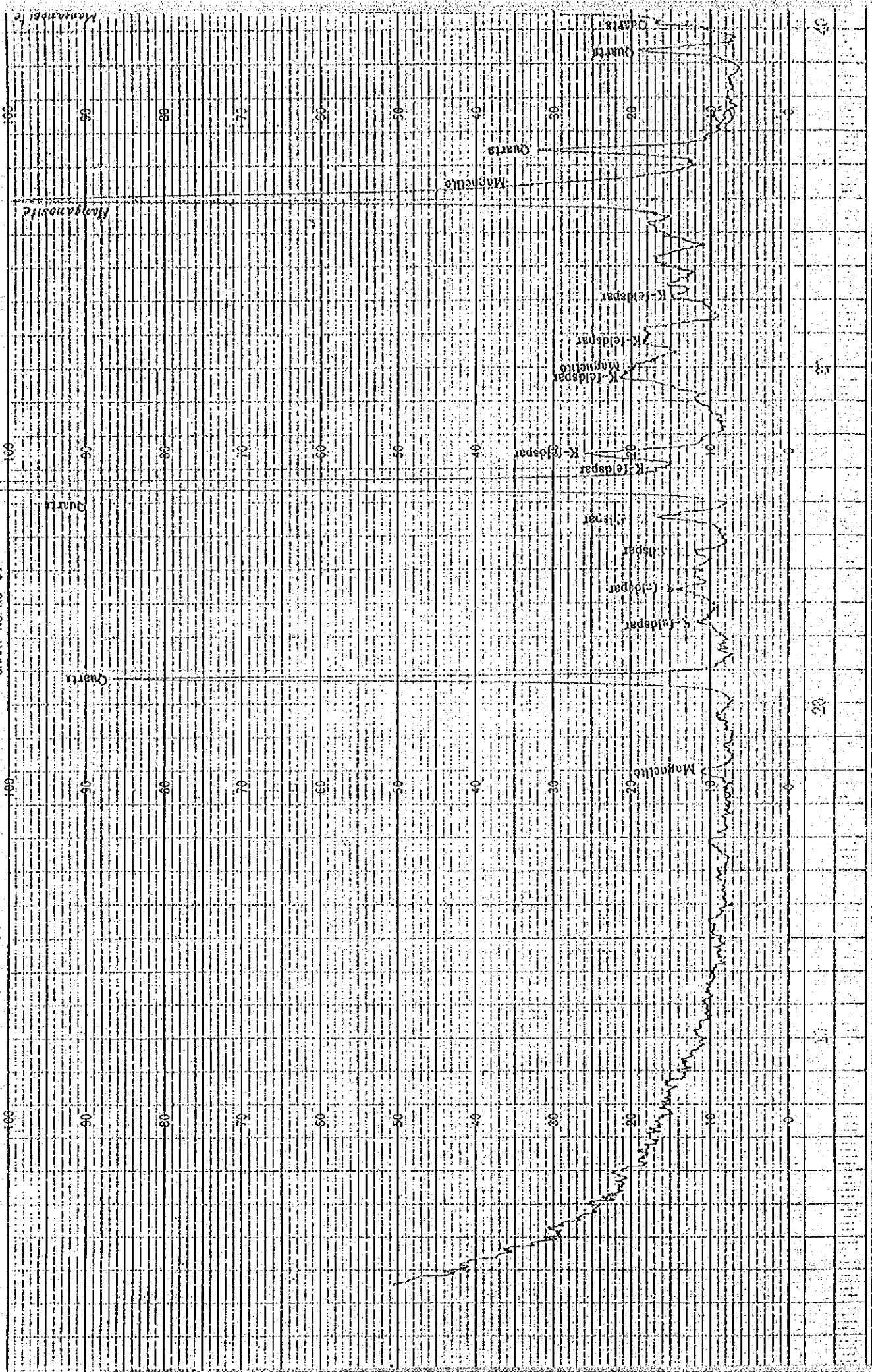


CHART NO. KC-01







Rotaflex Chart No. 6

X-Ray Diffractometer

Model No. JARIS Segenow Union

Sample No. 51

Prepared by Don Magdoe Station OLA

Scale: 1000

Wavelength: 1.5406 Å

Slit: 0.5 mm

Scan Rate: 1.0 deg/min

Temperature: 25°C

Humidity: 50%

Operator: J. S. G.

Date: 10/1/54

Time: 10:00 AM

Location: 100

Notes: 100

100

100

100

100

100

100

100

100

100

100

100

100

100

100

100

100

100

100

100

100

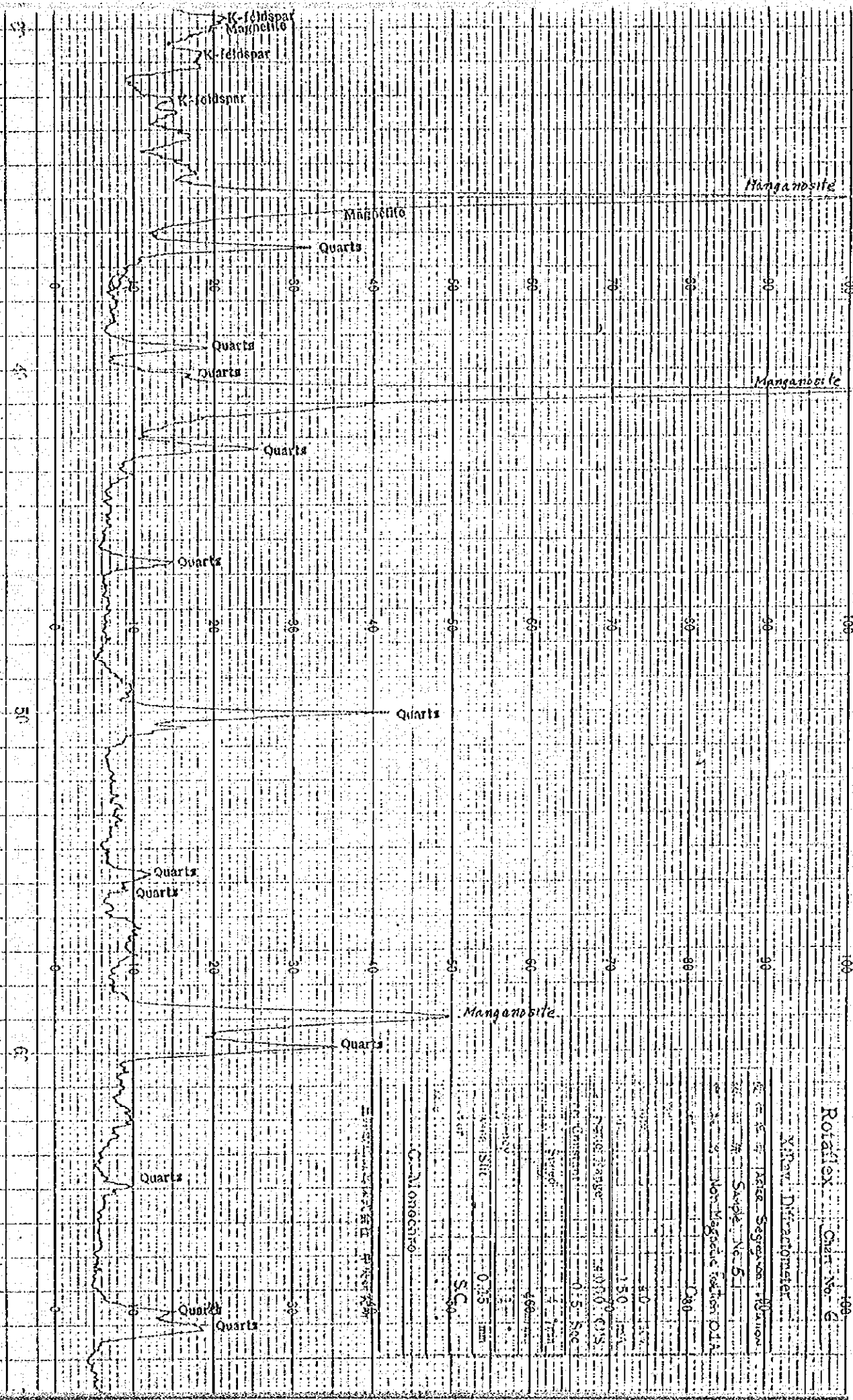


CHART NO. KC-01

KODATAMA BAKUKUIC

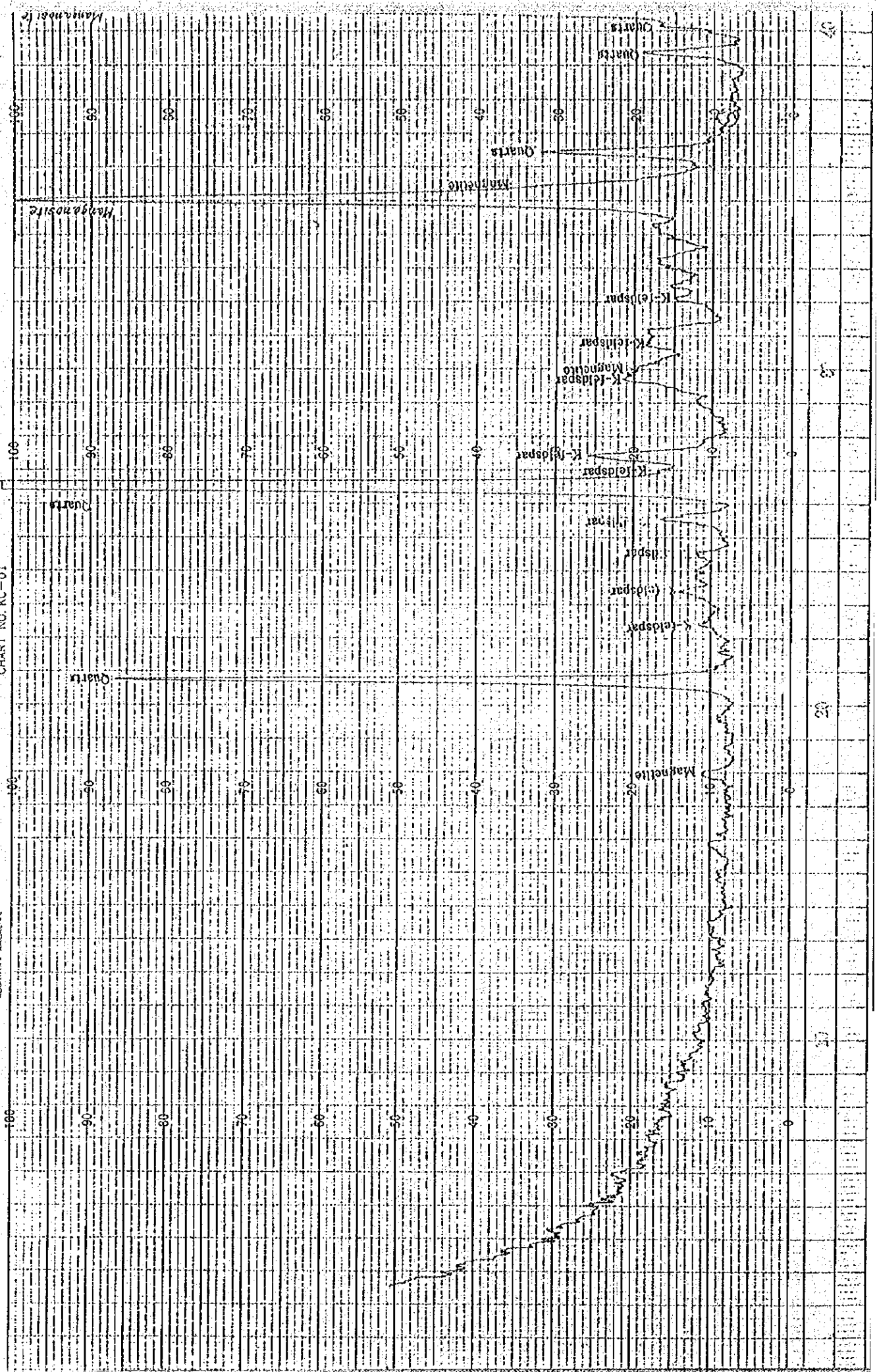
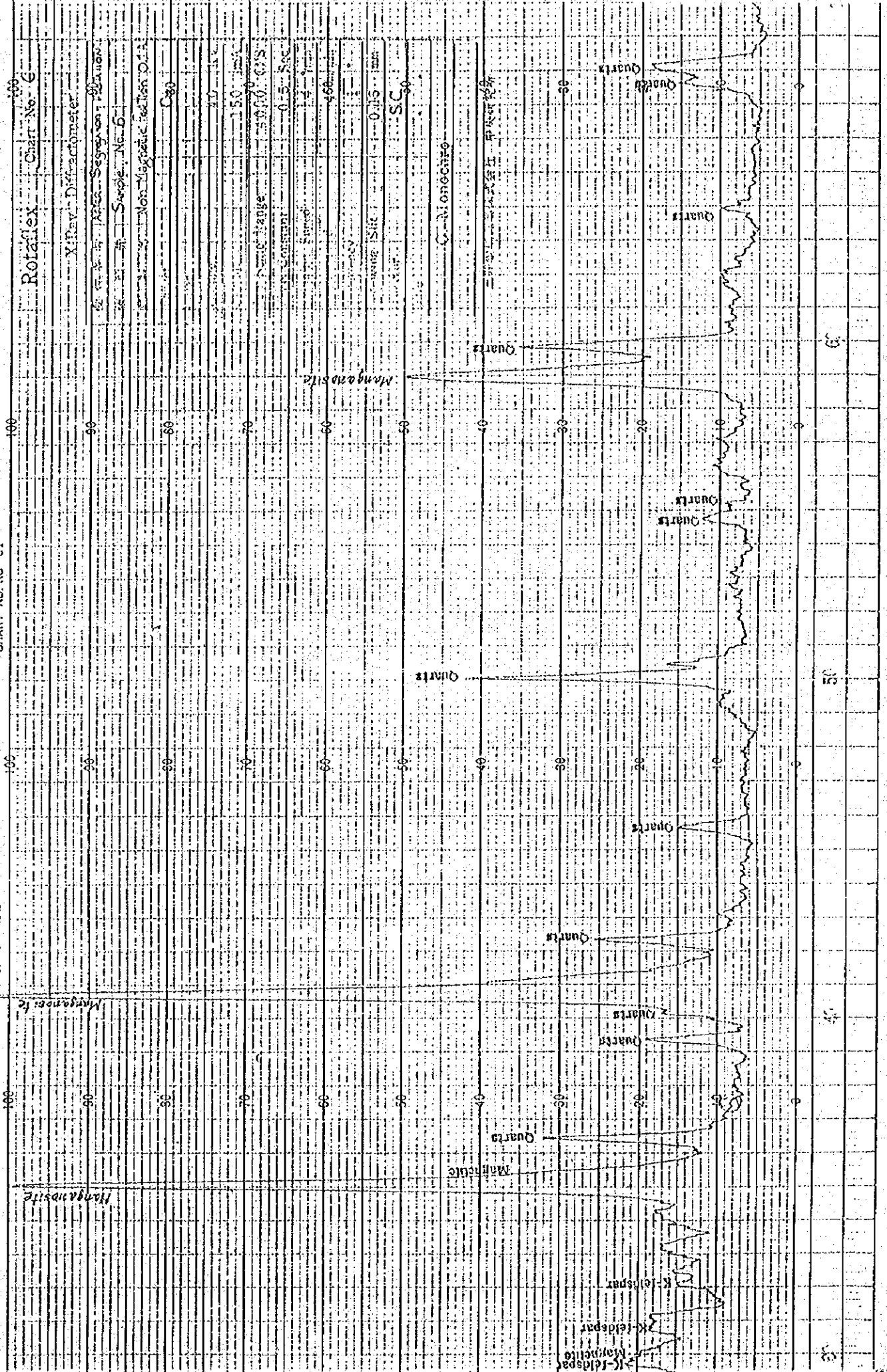


CHART NO. KC-01

NON-VOLATILE SOLIDS



Rotaflex Chart No. 6

X-Ray: Diffractometer

Cu K-alpha

Nickel Filter

Sample: No. 6

Scan Range: 5.000 (2-theta)

Scan Rate: 0.5 deg

Voltage: 40KV

Current: 15mA

Slit: 0.15 mm

C-Monochromator

Manganese

Quartz

Quartz

Quartz

Quartz

Anorthite

K-feldspar

K-feldspar

K-feldspar

K-feldspar

K-feldspar

K-feldspar

K-feldspar

Quartz

Quartz

Quartz

Quartz

Quartz

Quartz

Quartz

Quartz

Quartz

52

35

35

35

100