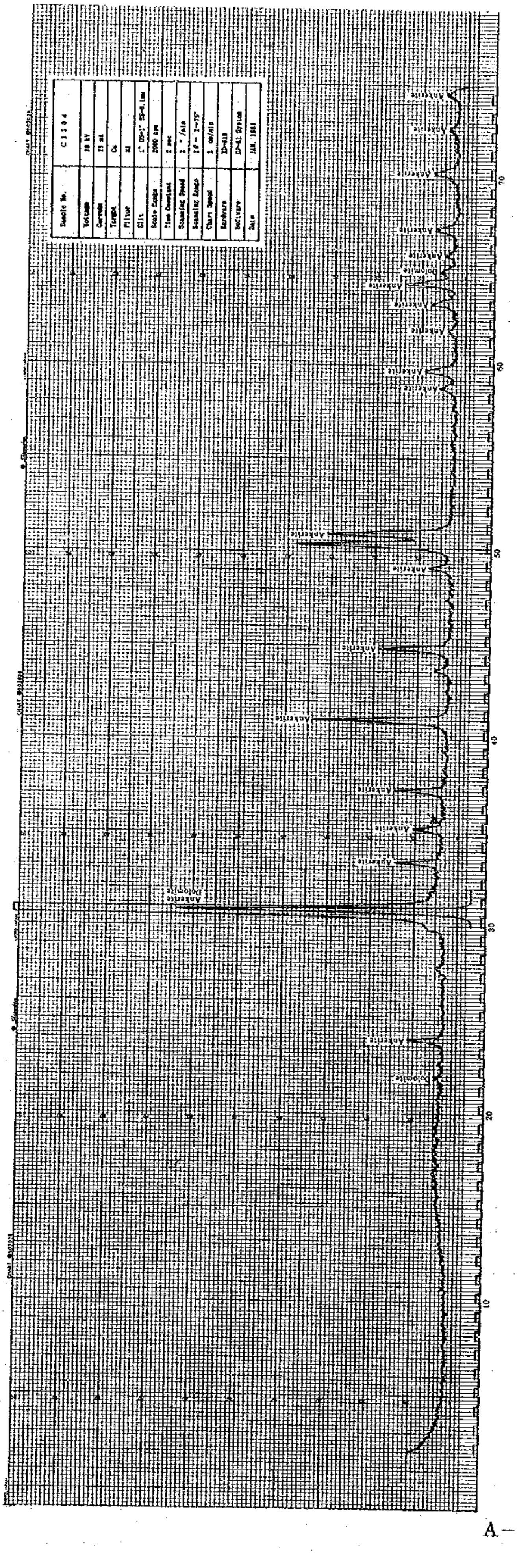
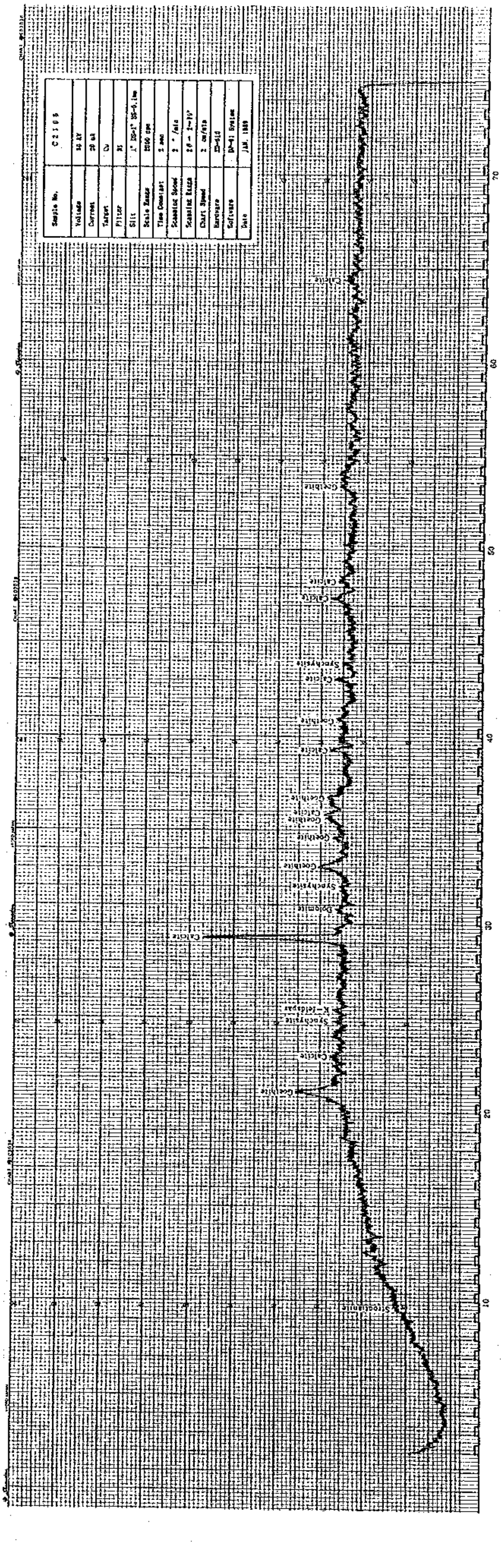
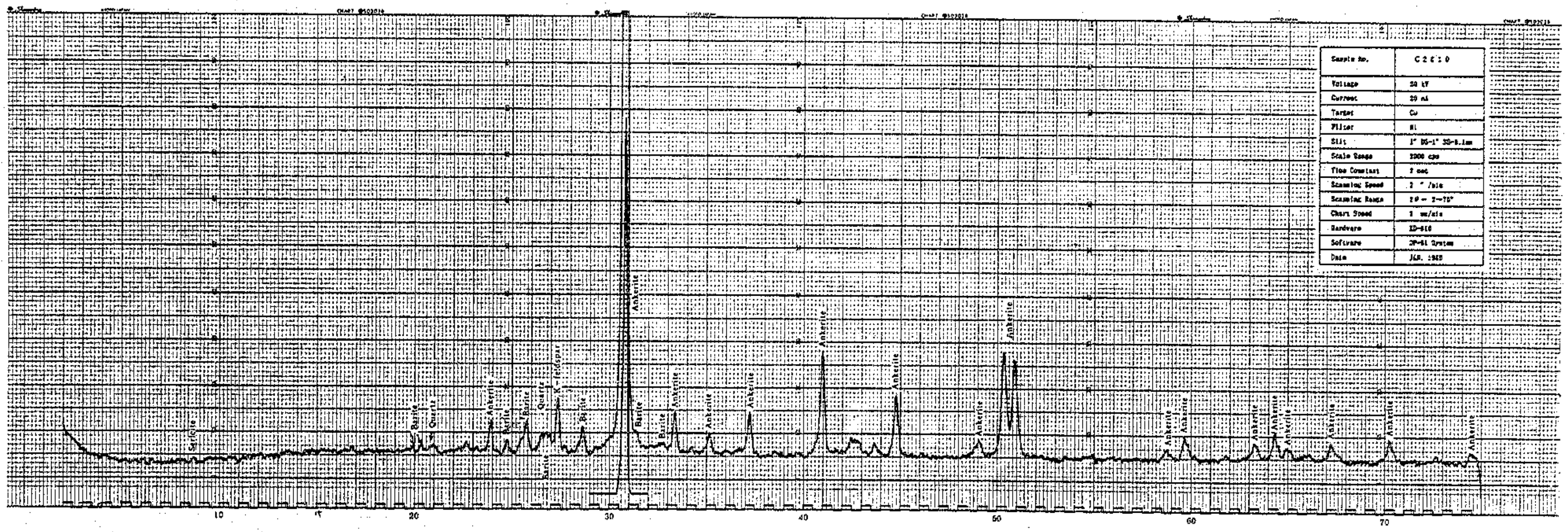

Ankerite
Dolomite
10
20
30
40
50
60
70

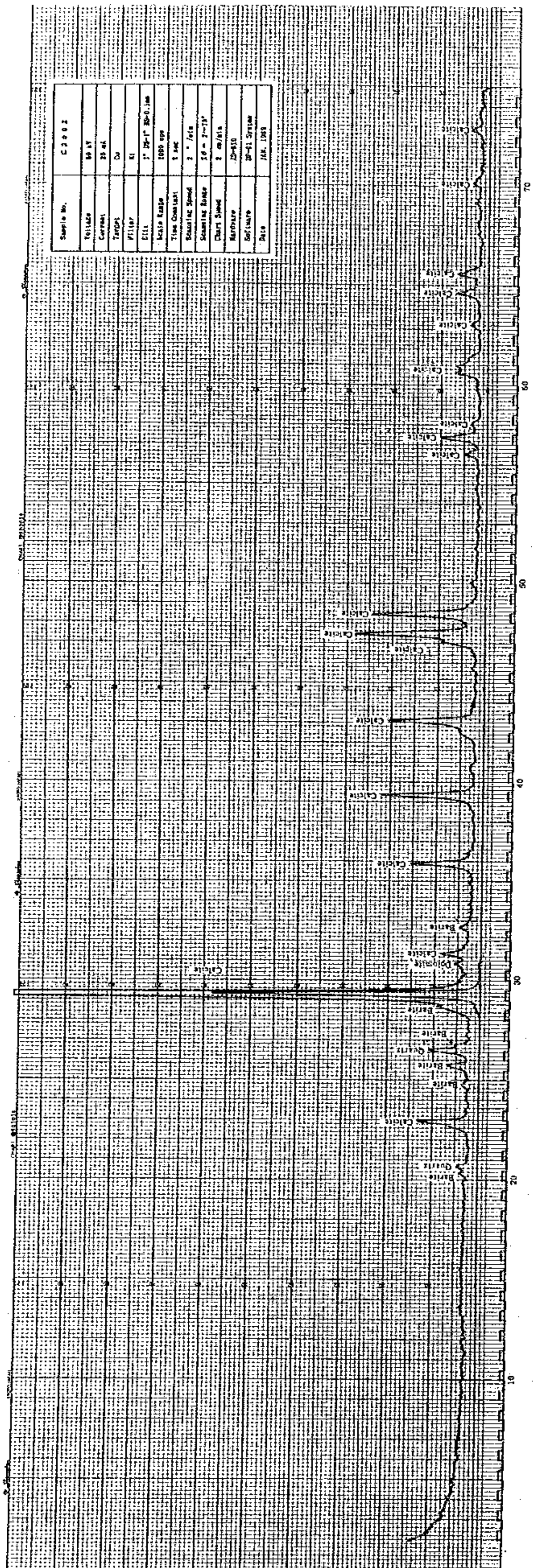

Calcite
Goethite
Synchysite
Dolomite
K-feldspar
10
20
30
40
50
60
70

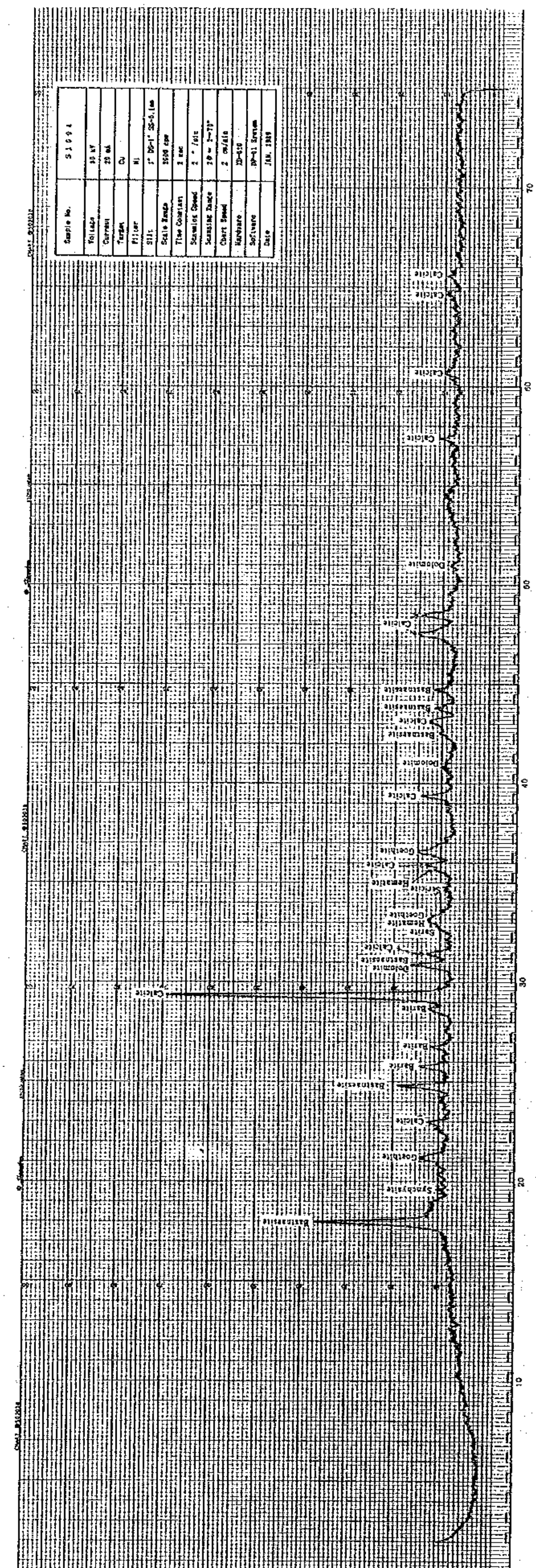
Sample No.	C C 2 0 4
Voltage	30 kV
Current	25 mA
Target	Cu
Filter	Ni
Slit	1° DS-1° RS-0.1mm
Scale Range	2000 cps
Time Constant	1 sec
Scanning Speed	2 °/min
Scanning Range	2θ = 2~75°
Chart Speed	2 cm/min
Hardware	XD-610
Software	DP-01 System
Date	JAN. 1988

Sample No.	C C 2 0 5
Voltage	30 kV
Current	25 mA
Target	Cu
Filter	Ni
Slit	1° DS-1° RS-0.1mm
Scale Range	2000 cps
Time Constant	1 sec
Scanning Speed	2 °/min
Scanning Range	2θ = 2~75°
Chart Speed	2 cm/min
Hardware	XD-610
Software	DP-01 System
Date	JAN. 1988


Sample No.
C2610
Voltage
Current
Target
Cu
Filter
Ni
Slit
Scale Range
Time Constant
2 sec
Scanning Speed
Scanning Range
Chart Speed
Hardware
Software
Date
Sericite
Barite
Quartz
Ankerite
K-feldspar
10
20
30
40
50
60
70


Sample No.
C2984
Voltage
Current
Target
Cu
Filter
Ni
Slit
Scale Range
2000 cps
Time Constant
2 sec
Scanning Speed
Scanning Range
Chart Speed
Hardware
Software
Date
Ankerite
Strontianite
Quartz
5
10
20
30
40
50
60
70


Sample No.
Voltage
Current
Target
Filter
Slit
Scale Range
Time Constant
Scanning Speed
Scanning Range
Chart Speed
Hardware
Software
Date
Calcite
Dolomite
Barite
Quartz
10
20
30
40
50
60
70


Sample No.
Voltage
Current
Target
Filter
Slit
Scale Range
Time Constant
Scanning Speed
Scanning Range
Chart Speed
Hardware
Software
Date
Calcite
Dolomite
Bastnaesite
Barite
Goethite
Hematite
Synchysite
10
20
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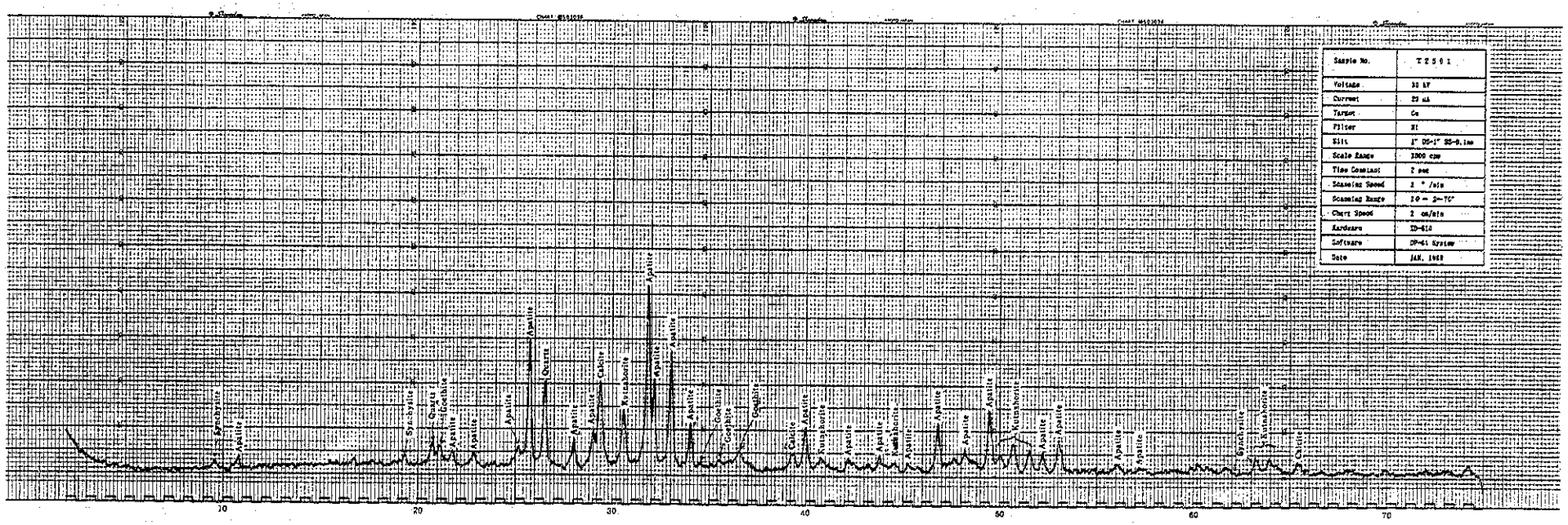
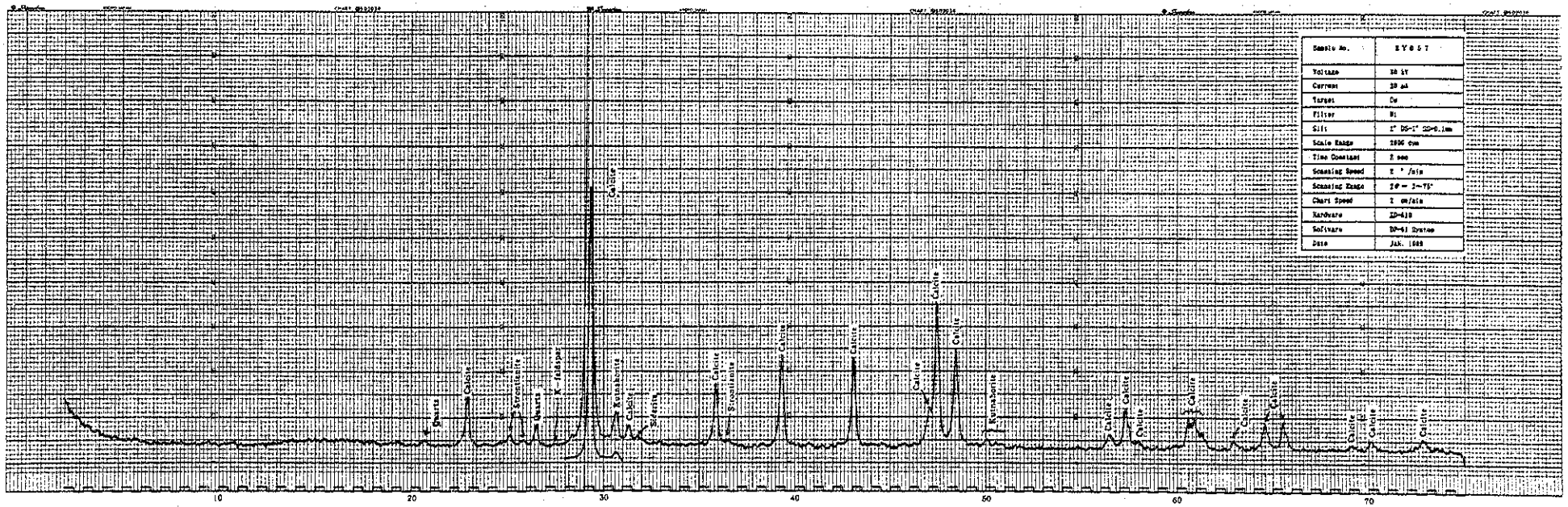
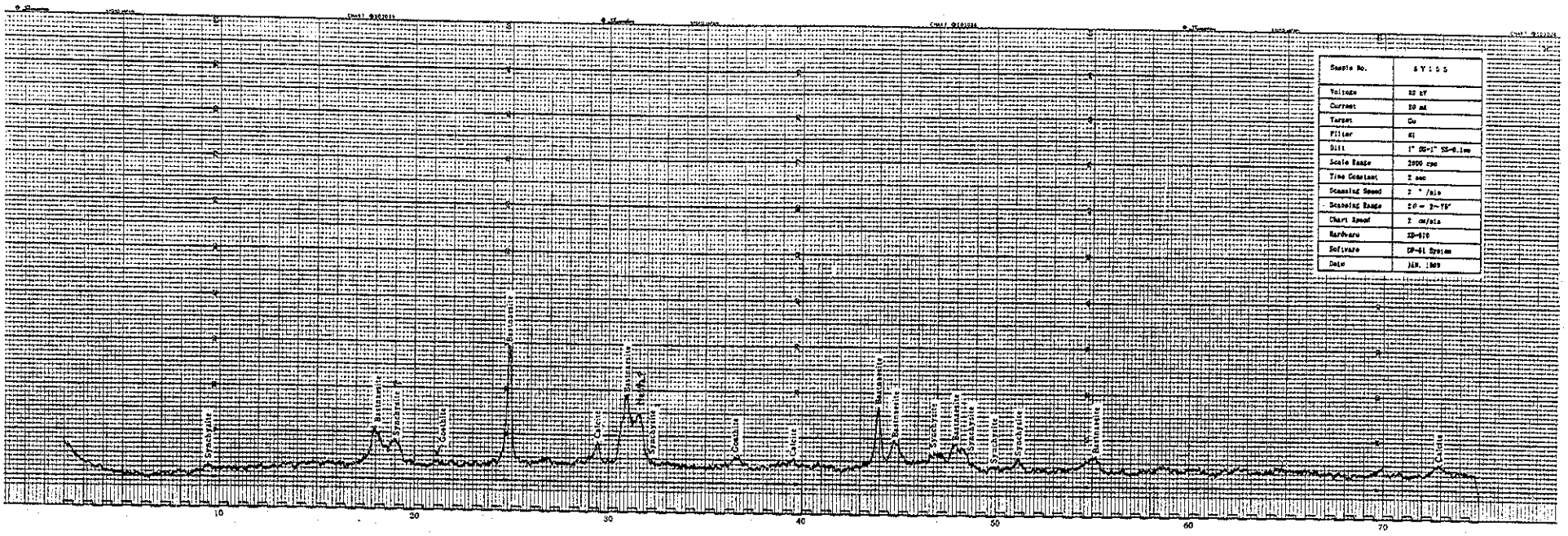
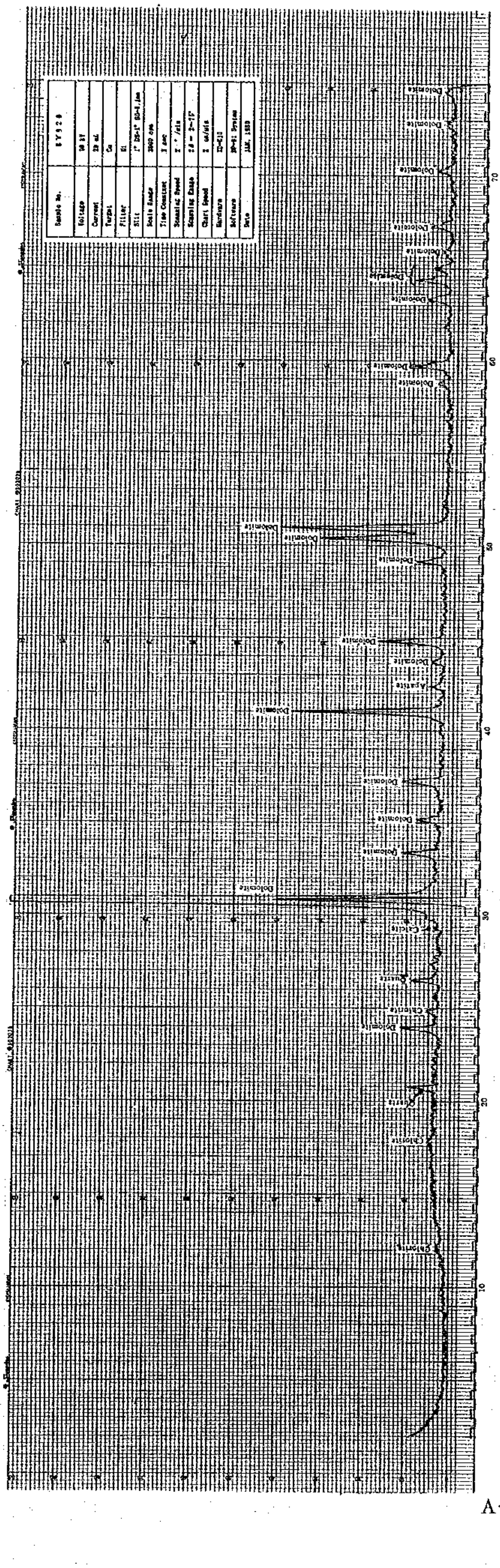
40
50
60
70

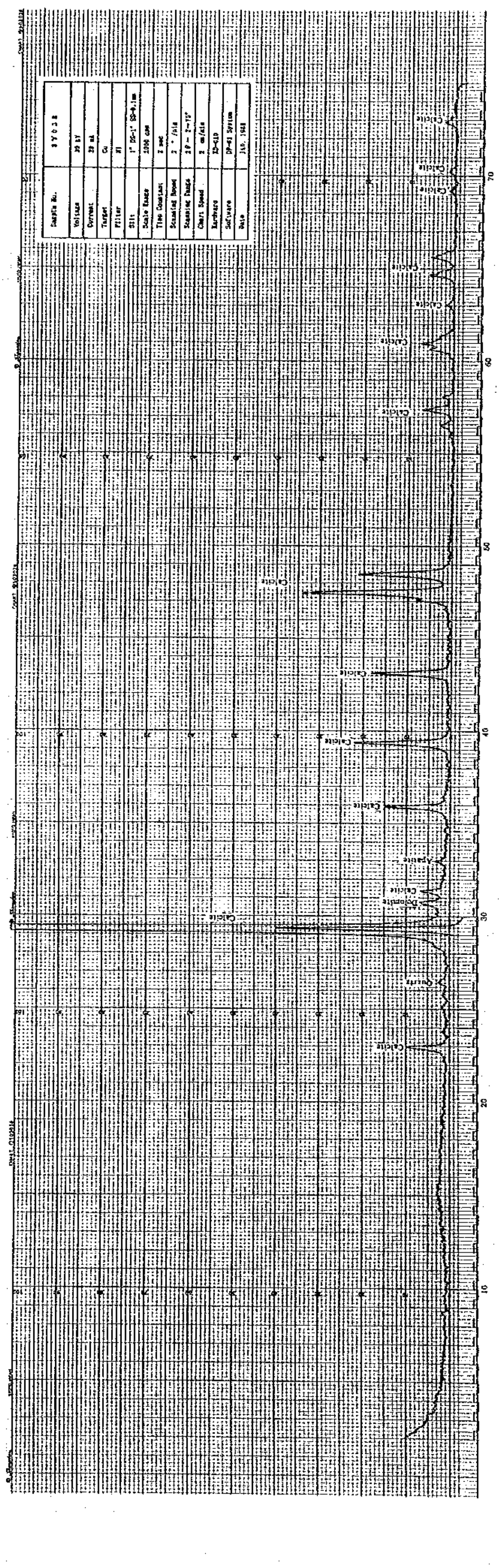

Sample No. TZ501
Voltage 30 kV
Current 20 mA
Target Cu
Filter Ni
Slit 1° DS-1° SS-0.1mm
Scale Range 1000 cps
Time Constant 2 sec
Scanning Speed 2 °/min
Scanning Range 2θ = 2~70°
Chart Speed 2 cm/min
Hardware ID-410
Software DP-61 System
Date JAN. 1988
Apatite
Quartz
Calcite
Kutnahorite
Goethite
Gypsum
Graphite
Synchysite
Pyrochlore
10
20
30
40
50
60
70


Sample No. SY057
Voltage 30 kV
Current 20 mA
Target Cu
Filter Ni
Slit 1° DS-1° SS-0.1mm
Scale Range 1000 cps
Time Constant 2 sec
Scanning Speed 2 °/min
Scanning Range 2θ = 2~75°
Chart Speed 2 cm/min
Hardware ID-410
Software DP-61 System
Date JAN. 1988
Calcite
Quartz
Kutnahorite
Siderite
Strontianite
K-feldspar
10
20
30
40
50
60
70


Sample No. AY155
Voltage 35 kV
Current 20 mA
Target Cu
Filter Ni
Slit 1° DS-1° SS-0.1mm
Scale Range 2000 cps
Time Constant 2 sec
Scanning Speed 2 °/min
Scanning Range 10 ~ 2θ ~ 70°
Chart Speed 2 cm/min
Hardware XD-610
Software DP-01 System
Date JAN. 1989
Syngenite
Barassanite
Bassanite
Gypsum
Calcite
Dolomite
Anhydrite
10
20
30
40
50
60
70

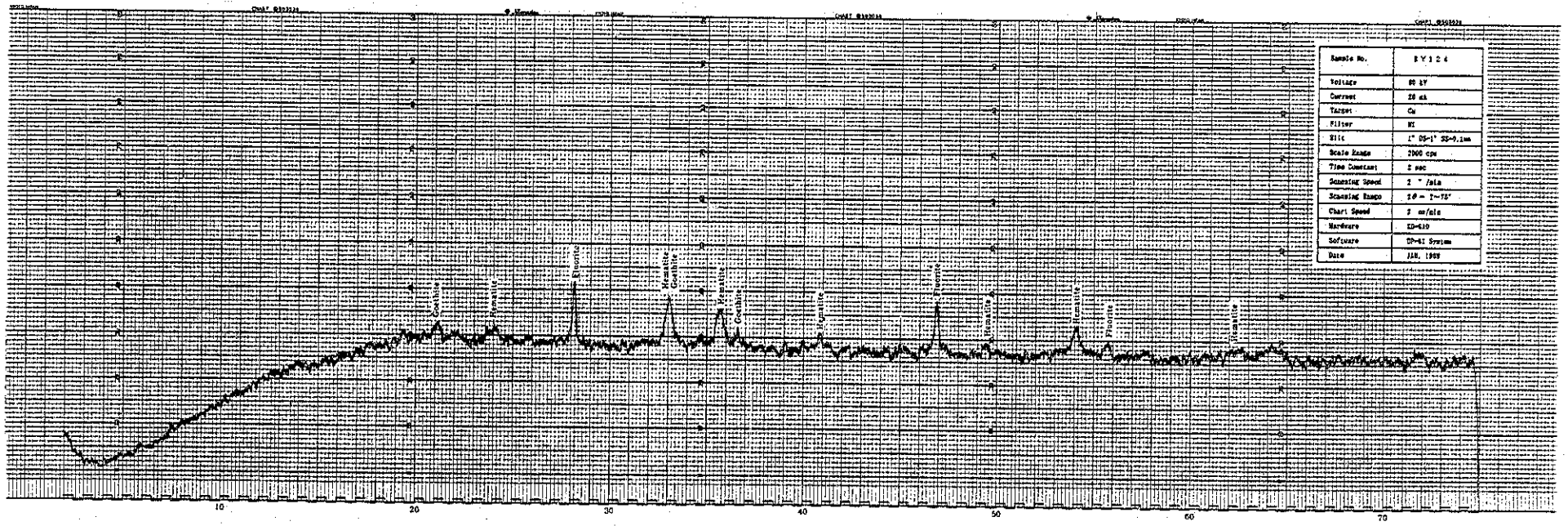

Sample No. AY689
Voltage 35 kV
Current 20 mA
Target Cu
Filter Ni
Slit 1° DS-1° SS-0.1mm
Scale Range 2000 cps
Time Constant 2 sec
Scanning Speed 2 °/min
Scanning Range 10 ~ 2θ ~ 70°
Chart Speed 2 cm/min
Hardware XD-610
Software DP-01 System
Date JAN. 1989
Anhydrite
Quartz
Plagioclase
Dolomite
Calcite
10
20
30
40
50
60
70

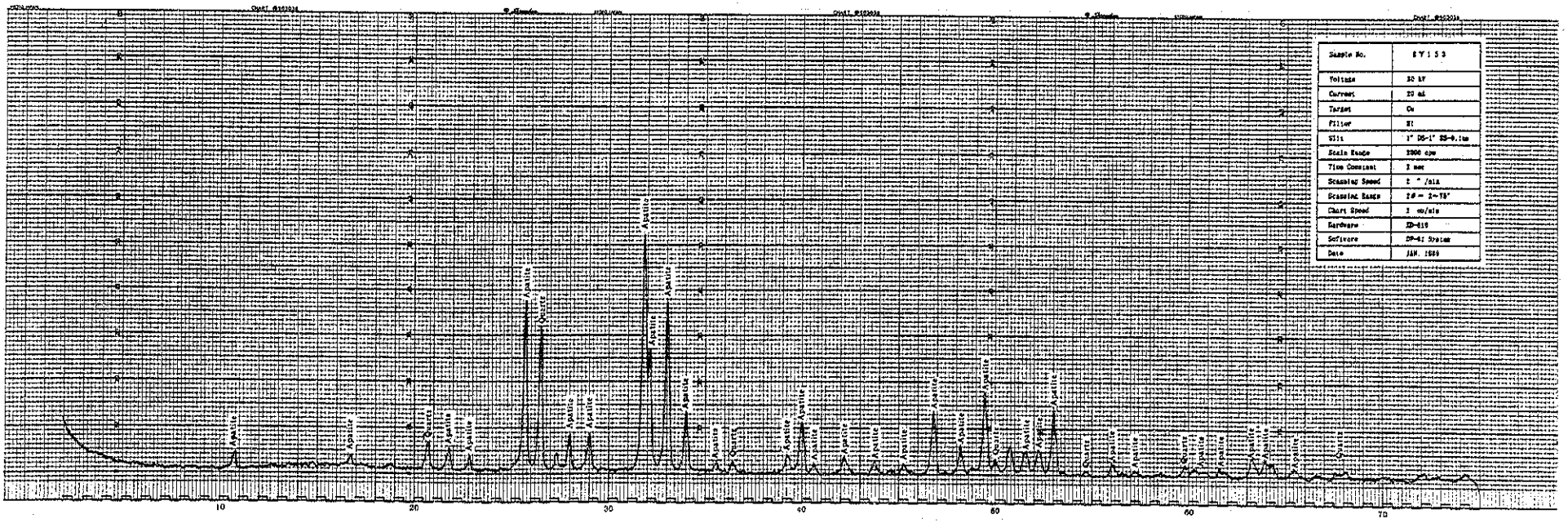





Sample No. 8Y055
Voltage 35 kV
Current 20 mA
Target Cu
Filter Ni
Slit 1° DS-1° SS-0.1mm
Scale Range 7000 cps
Time Constant 2 sec
Scanning Speed 2 °/min
Scanning Range 2θ = 2~75°
Chart Speed 2 cm/min
Hardware ID-810
Software DP-41 System
Date JAN. 1989
Pyrochlore
Quartz
Columbite
Zircon
Calcite
Strontianite
Ankerite
Fluorite
10
20
30
40
50
60
70

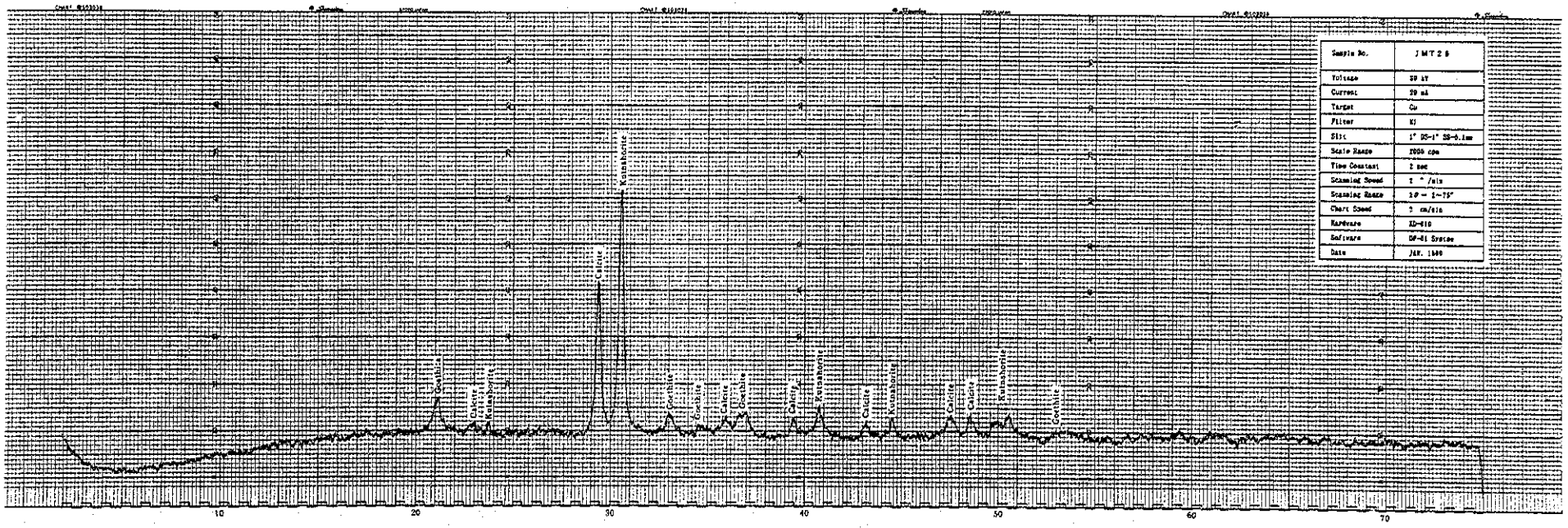

Sample No. 8Y055
Voltage 35 kV
Current 20 mA
Target Cu
Filter Ni
Slit 1° DS-1° SS-0.1mm
Scale Range 7000 cps
Time Constant 1 sec
Scanning Speed 2 °/min
Scanning Range 2θ = 2~75°
Chart Speed 1 cm/min
Hardware ID-810
Software DP-41 System
Date JAN. 1989
Columbite
Hematite
Fluorite
10
20
30
40
50
60
70


Sample No. BY124
Voltage 50 kV
Current 20 mA
Target Cu
Filter Ni
Slit 1° DS-1° SS-0.1mm
Scale Range 2000 cps
Time Constant 2 sec
Scanning Speed 2 °/min
Scanning Range 2θ = 7°-75°
Chart Speed 2 cm/min
Hardware XD-610
Software DP-41 System
Date JAN. 1989
Goethite
Hematite
Fluorite
Apatite
10
20
30
40
50
60
70


Sample No. BY153
Voltage 50 kV
Current 20 mA
Target Cu
Filter Ni
Slit 1° DS-1° SS-0.1mm
Scale Range 2000 cps
Time Constant 2 sec
Scanning Speed 2 °/min
Scanning Range 2θ = 2°-75°
Chart Speed 2 cm/min
Hardware XD-610
Software DP-41 System
Date JAN. 1989
Apatite
Quartz
10
20
30
40
50
60
70

Sample No. 2Y1164
Voltage 30 kV
Current 20 mA
Target Cu
Filter Ni
Slit 1° 1°-0.3 15mm
Scale Range 2000 cps
Time Constant 1 sec
Scanning Speed 2 °/min
Scanning Range 2θ = 2~70°
Chart Speed 1 cm/min
Hardware D/max-rA
Software JADE 3 System
Date Jan. 1989
Quartz
Albite
Chlorite
Kaolinite
Pyrophyllite
Calcite
Dolomite
Siderite
Magnesite
Rutile
Anatase
Pyrite
K-feldspar
Hematite
Goethite
Gypsum
Bassanite
Halite
Sylvite
Fluorite
Celestite
Barite
Strontianite
Witherite
Zincite
Sphalerite
Galena
Cerussite
Anglesite
Sample No. 1477
Voltage 30 kV
Current 20 mA
Target Cu
Filter Ni
Slit 1° 1°-0.3 15mm
Scale Range 2000 cps
Time Constant 1 sec
Scanning Speed 2 °/min
Scanning Range 5° = 2~70°
Chart Speed 2 cm/min
Hardware D/max-rA
Software JADE 3 System
Date Jan. 1989

Sample No.	J M T 2 2
Voltage	35 kV
Current	20 mA
Target	Cu
Filter	Ni
Slit	1° DS-1° SS-0.1mm
Scale Range	2000 cps
Time Constant	2 sec
Scanning Speed	2 °/min
Scanning Range	2θ = 2~75°
Chart Speed	2 cm/min
Hardware	XD-610
Software	DP-01 Version
Date	JAN. 1988



Sample No.	J M T 2 5
Voltage	35 kV
Current	20 mA
Target	Cu
Filter	Ni
Slit	1° DS-1° SS-0.1mm
Scale Range	2000 cps
Time Constant	2 sec
Scanning Speed	2 °/min
Scanning Range	2θ = 2~75°
Chart Speed	2 cm/min
Hardware	XD-610
Software	DP-01 Version
Date	JAN. 1988

Appendix 5

Result of EPMA Analysis

Procedure of the quantitative analysis

The quantitative analysis has been carried out as the following experimental procedure;

(1) High quality standard samples of pyroclore, monazite, Y-stabilized zircon (artificial) were obtained, which were checked these homogeneous qualities by an electron microprobe analyzer.

(2) Quantitative analyses of REE in these standard samples were taken by means of sequential type inductively coupled argon plasma/optical emission spectrophotometer (ICP).

(3) Polished sections of three standard samples were made for EPMA standard.

(4) Target points of REE minerals in the present specimens for the REE qualitative analyses were selected by means of optical microscopy method and X-ray deffraction method.

(5) On the basis of standard sample data [process (2) and (3)], selected target points [process (4)] were analyzed by EPMA method.

Remarks: Results of quantitative analysis for standard samples are the following;

#1(Pyroclore)

Ca	1.1 wt.%
Ti	1.0 wt.%
Nb	52.9 wt.%
Ta	0.3 wt.%

#2(Y-stabilized zircon, artificial)

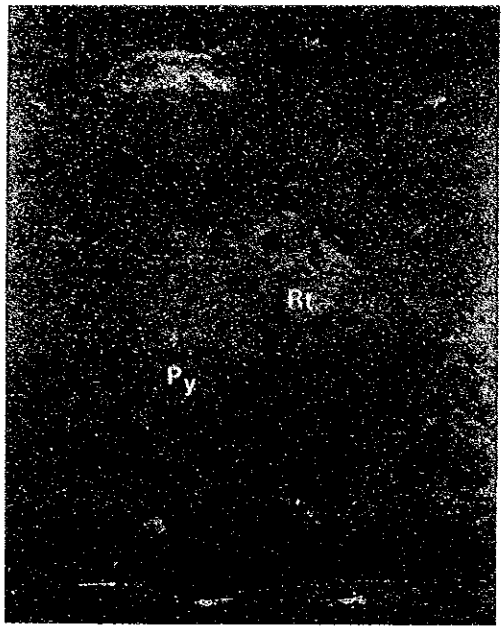
Y	35.0 wt.%
Zr	49.6 wt.%

#3(Monazite)

Al	2300 ppm
Ca	3.7 wt.%
Y	2.7 wt.%
Zr	1300 ppm
Nb	1.2 wt.%
La	8.2 wt.%
Ce	23.6 wt.%
Sm	4.3 wt.%
Eu	250 ppm
Gd	2.6 wt.%
Dy	1.0 wt.%
Er	1400 ppm
Yb	280 ppm
Lu	43 ppm
Th	1.1 wt.%

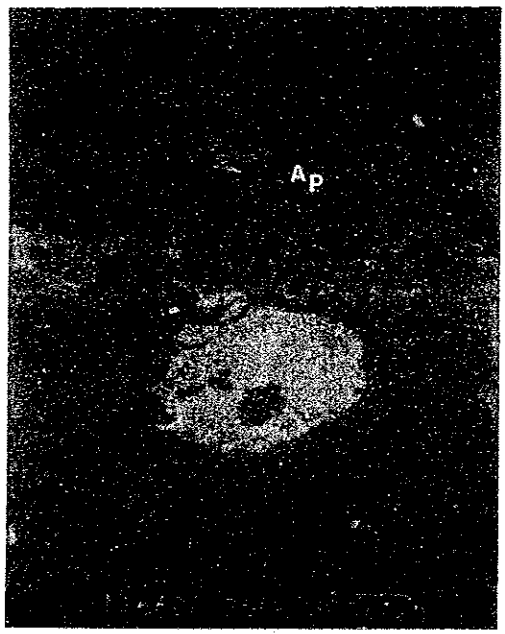
Result of quantative EPMA analysis

No.	Sample No.	Sector	Locality	Rock name	Mineral	Element (wt %)											
						La	Ce	Sm	Gd	Dy	Nb	Y	Na	Ca	Ti	Th	Zr
1	C1306	Chilwa Island	JMC-13 30.2m	Apatite sövite	Rutil	0	9.68	0	0	0	4.43	0	0.14	1.19	69.6	0	0.29
2	C1306	"	"	"	Apatite	7.12	13.7	0	0.29	0	0	2.44	0.12	0.83	0	1.21	1.58
3	C3211	"	-32 47.4m	Sövite	Pyrochlore	0	2.76	0	0	0	47.4	2.50	1.06	14.0	1.70	0	4.13
4	S1604	Songwe	JMS- 4 14.0m	Iron oxide ore	Bastnaesite (?)	38.5	29.3	5.39	0.58	0	0.16	0	0.21	9.01	0	0.01	0
5	T2501	Tundulu	JMT-15 3.2m	Apatite rock	Pyrochlore	0	0.53	2.76	0	1.62	18.7	1.28	4.07	6.32	1.21	0	2.19
6	T2501	"	"	"	Bastnaesite	9.62	14.1	2.58	0.69	0	1.21	0	0.19	7.66	0	0	0
7	T2607	"	MJT-26 28.9m	Apatite rock	Pyrochlore	0	0.16	0.59	0	0.32	19.1	0.82	0.61	6.22	0.90	0	1.44
8	T2607	"	"	"	Bastnaesite	15.0	17.1	4.67	0.20	0	0	0	0	5.90	0	0.19	0
9	8Y058	Chilwa Island	Surface	Sövite	Pyrochlore	0	1.33	3.90	0	0	37.8	1.82	1.03	11.0	1.68	0	3.26
10	8Y058	"	"	"	Pyrochlore	0	1.69	0	0.84	0	33.1	3.01	1.06	12.8	1.28	0	3.70



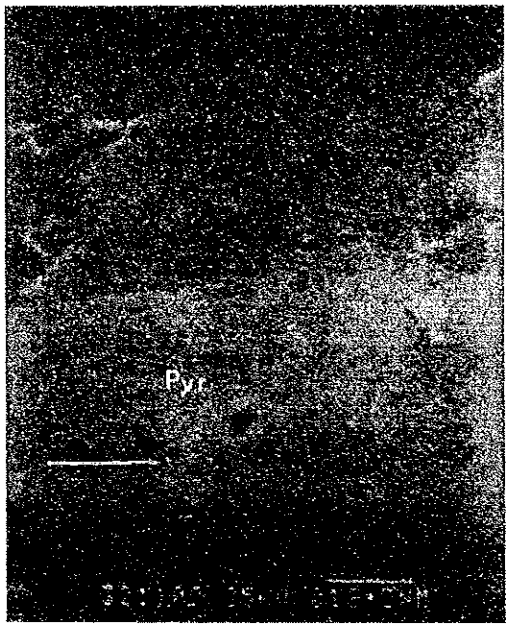
Sample No. : C 1306
Rock Name : Apatite sovite
Sector : Chilwa Is.

0 0.5mm



Sample No. : C 1306
Rock Name : Apatite sovite
Sector : Chilwa Is.

0 0.1mm

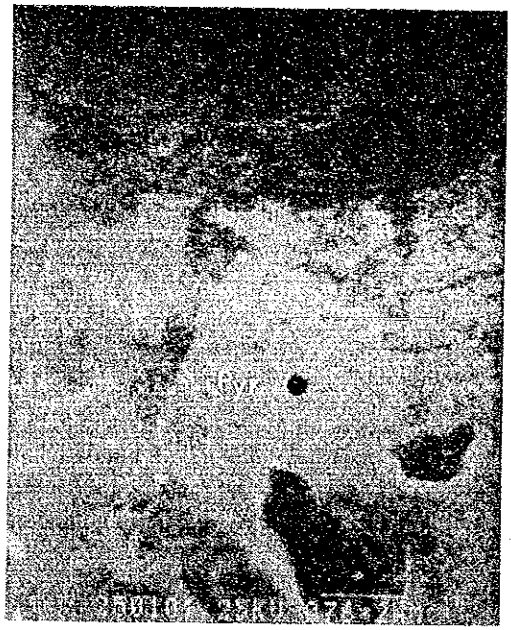


Sample No. : C 3211
Rock Name : Sovite
Sector : Chilwa Is.

0 0.1mm

Sample No. : S 1604
Rock Name : Iron oxide ore
Sector : Songwe

0 0.1mm

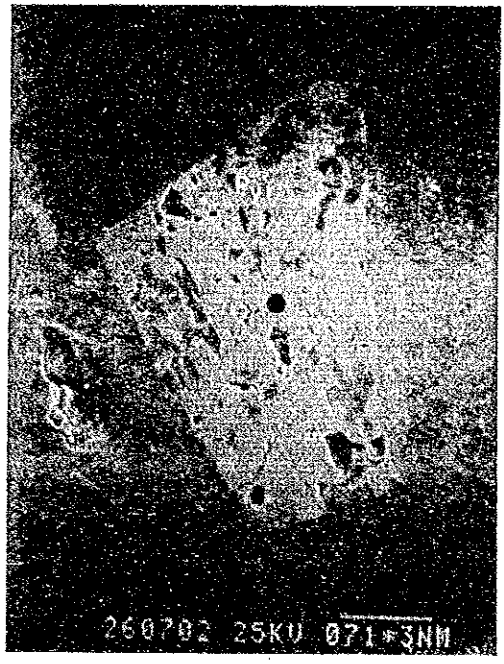


Sample No. : T 2501
Rock Name : Apatit rock
Sector : Tundulu

0 0.03mm

Sample No. : T 2501
Rock Name : Apatit rock
Sector : Tundulu

0 0.5mm



Sample No. : T 2607
Rock Name : Apatit rock
Sector : Tundulu

0 0.3mm

Sample No. : T 2607
Rock Name : Apatit rock
Sector : Tundulu

0 0.1mm