APPENDICES

APPENDICES

1. Field parameters of Geophysical Survey (SIP Method)
   Electrode configulation: dipole-dipole array
   Electrode separation: 100m
   Electrode separation index: n=1 to 5
   Frequencies: 18 frequencies from 0.125 to 88 Hz
   Line lengths: six lines of 1km each
   Lines J, K & L on the Sable Antelope area
   Lines M, N & O on the Kamiyobo area

2. Survey method

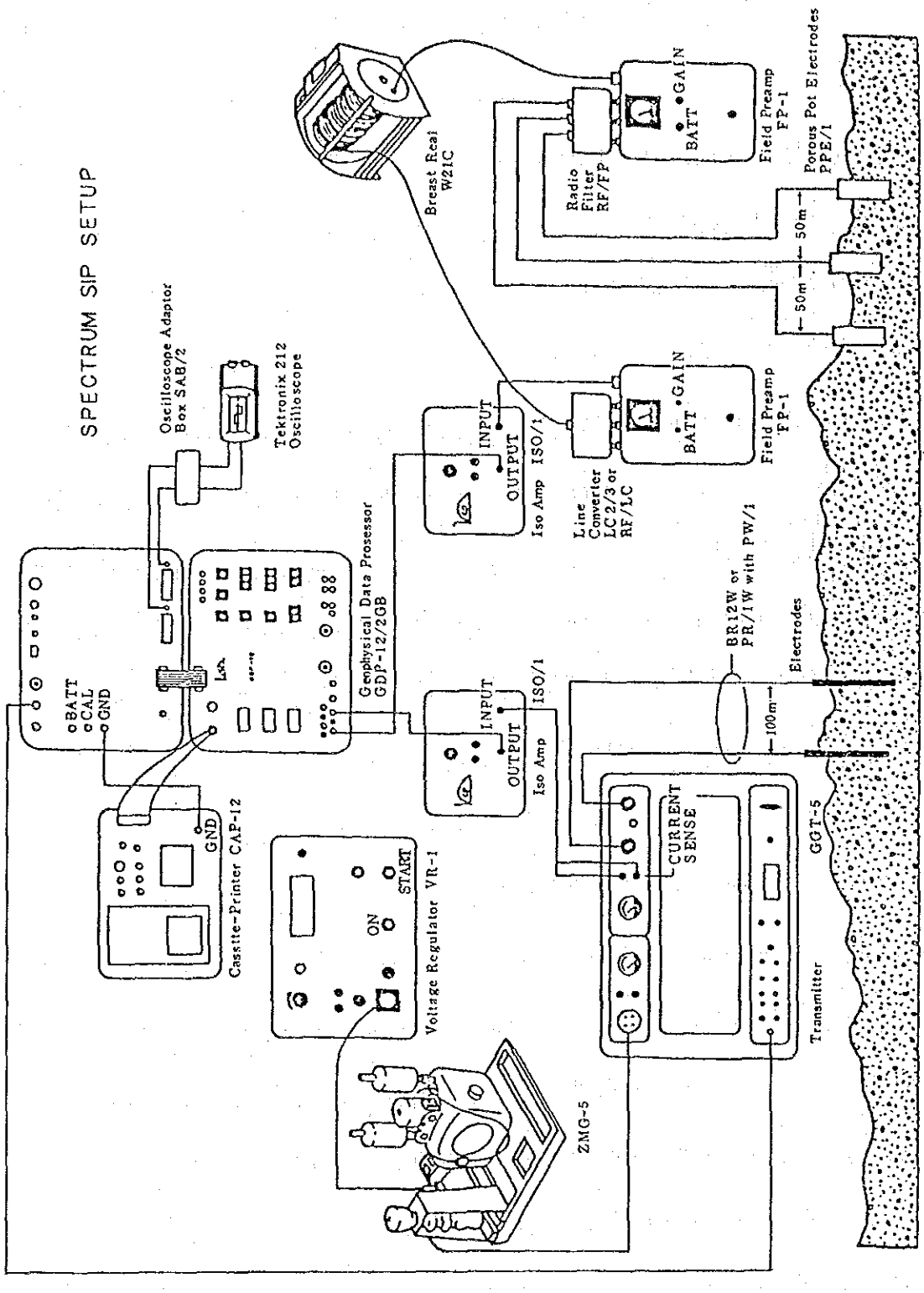
The spectral induced polarization (SIP) method is to measure the induced polarization phenomena over a broad range of frequencies, generally from 0.01 to 100 Hz. The results are given on diagrams of phase, magnitude spectra and Cole-Cole's. The characteristic of the method is that an analysis of frequency spectra of IP response makes it possible to discriminate types of mineralization and to eliminate an effect of electromagnetic coupling. In this survey, the harmonic system, a newly developed technique by Zonge Inc., USA, was applied. The system uses three fundamental waves of 0.125, 1.0 and 8 Hz. The responses on 3-, 5-, 7-, 9- and 11- harmonics are calculated by the fast Fourier transform (FFT) from the survey results. Thus the IP spectra over a range of 0.125 to 88 Hz can be obtained.

3. Set-up of field equipment

A set of field equipments is listed in Ap.Table 1 and a block diagram of set-up is illustrated in Ap.Fig. 1.

AP.Table 1 SIP Equipments

Equipment	Model	Specification	Qty
Power Supply	ZMG-5	Maximum Power: 5kw Alternator: 400Hz, 115V Engine : Honda G400 10HP	1
Regulator	VR-1	Voltage Regulation	1
Transmitter	GGT-5	Output Voltage: 250, 500 750, 1000V Output current: Max 20A Square Wave Frequency : DC - 10KHz	1
Receiver	GDP-12/2GB	2 Channel Data Processor	1
Cassette/printer	CAP-12	Printer, Minicassette	1
Isolation Amp	ISO/1		2
Field Preamp	FP-1		2



AP.Fig. 1 Block Diagram of SIP Survey System

4. Data processing

Measurements of SIP are taken on the fundamental waves of 0.125, 1.0 and 8 Hz and are expressed by a series of a real part and an imaginary part on each frequency. Output are also the magnitude of fundamental waves, the phase, the apparent resistivity and the frequency effects calculated on magnitudes of seventh and the ninth harmonics of the fundamental wave of 0.125Hz.

From these data,

(1) Cole-Cole diagram
(2) magnitude spectrum
(3) phase spectrum
(4) raw phase
(5) PFE pseudosection, and
(6) AR pseudosection

are provided.

The Cole-Cole diagram is a graphical representation of a real number component on the abscissa and an imaginary number component in the ordinate on each frequency (Ap.Fig. 2). The Mi is the magnitude and Oi represents the phase.

The magnitude on the magnitude spectra has been normalized by being divided with the magnitude of minimum frequency of 0.125 Hz.

The diagram of phase spectra shows phases of each frequency.

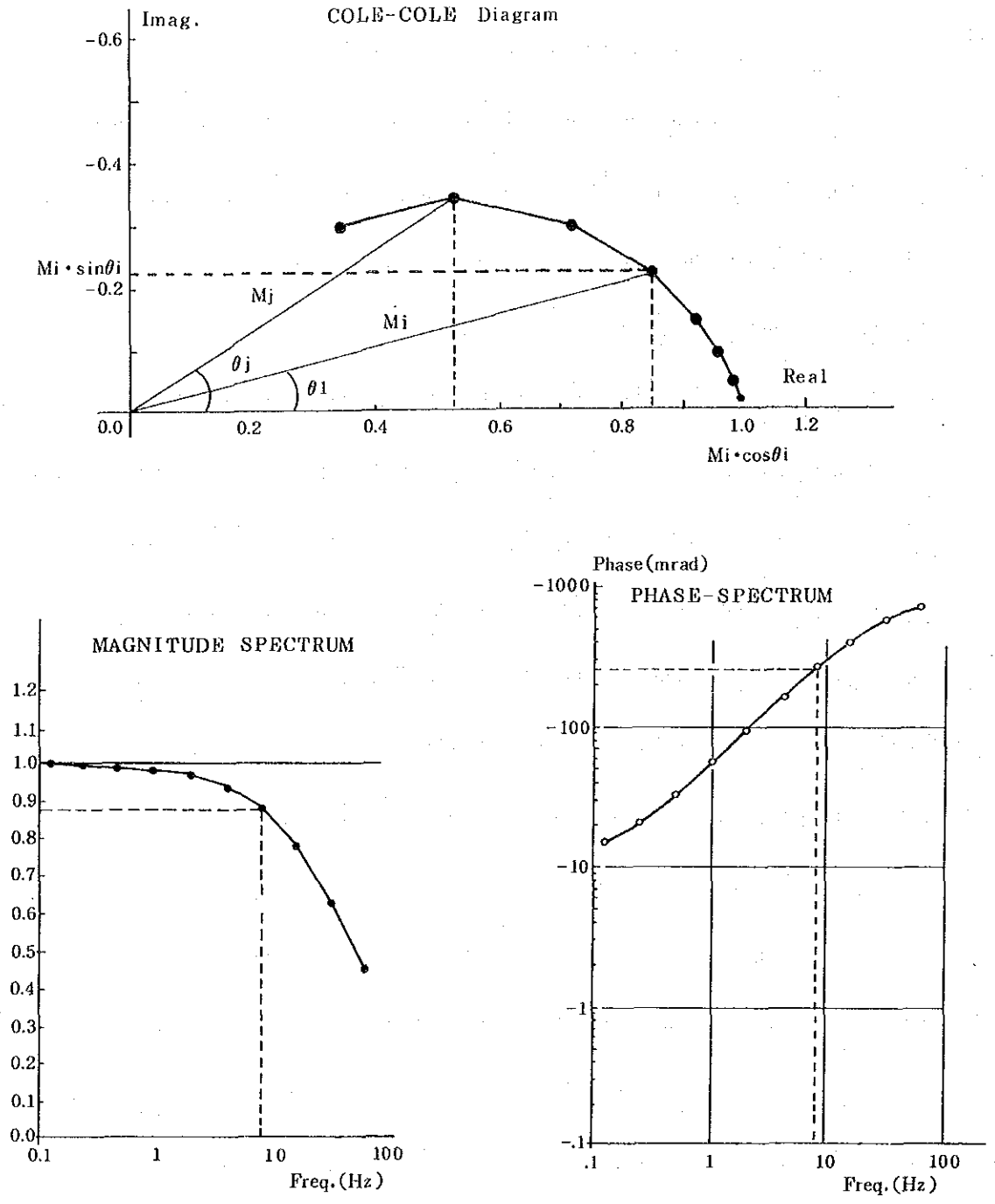
5. Decoupling

Decoupling denotes the removal of electromagnetic coupling effects which are encountered in the SIP measurements. The decoupling procedure of this investigation is based on the method developed by P. G. Hallof & W. H. Pelton. The analytical method is summarized as follows.

A complex impedance Za (f) obtained in the SIP measurements is approximated by the following equation.

$$Za(f) = Ro\left[1 - m_1\left\{1 - \frac{1}{1 + (i2\pi f\tau_1)^{c_1}}\right\} - m_2\left\{1 - \frac{1}{1 + (i2\pi f\tau_2)^{c_2}}\right\} + m_3\left\{1 - \frac{1}{1 + (i2\pi f\tau_3)^{c_3}}\right\}\right] \quad \ldots\ (1)$$

where, m: chargeability
τ: time constant
C: frequency dependence
f: frequency



AP.Fig. 2 Cole-Cole Diagram,Magnitude,Phase Spectrum

The equation comprises

$$1 - m_1 \left\{ 1 - \frac{1}{1 + (i2\pi f\tau_1)^{C_1}} \right\} \quad \ldots\ldots (2)$$

$$- m_2 \left\{ 1 - \frac{1}{1 + (i2\pi f\tau_2)^{C_2}} \right\} \quad \ldots\ldots (3)$$

and

$$- m_3 \left\{ 1 - \frac{1}{1 + (i2\pi f\tau_3)^{C_3}} \right\} \quad \ldots\ldots (4)$$

The terms (2) refer an IP response, the term (3) shows an electromagnetic coupling derived from a homogeneous earth and the term (4) represents a value of electromagnetic coupling in a couductor. Ten parameters (R_0, m_1, τ_1, C_1, m_2, τ_2, C_2, m_3, τ_3, C_3) are determined by the SIP measurements using the least square method of a non-linear type. The complex impedance $Zc_0(f)$ of the IP response only is thus obtained.

6. Laboratory Work

The SIP characteristics of drilled cores in this year were measured. The Cole-Cole diagrams, phase spectra and magnitude spectra are illustrated in Ap.Fig. 3. The results are summarized in Ap.Table 3.

Many shales, sandstones with prites and limestones often show a high PFE and a large phase. Phase spectra of rocks with high PFE are of types C or Y, in which a phase decreases in accordance with an increase of frequency. Many of phase spectra of rocks with a low PFE and a small phase are of A-type in which the phase increases in accordance with an increase of frequency. There can be seen in places a B-type in which phases are rather stable. In particular, the following tendency is observed in phase spectra in the field of a low frequency ranging from 0.125 to 3 Hz on samples of the second and the third year.

AP.Table 2 Phase Characteristics of Rock and Ore

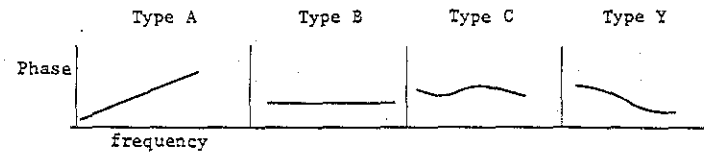
Rock and ore	Phase		
	0.125Hz	0.125 to 0.375Hz	1 to 3Hz
Ores of Sable Antelope with chalcopyrite and pyrite	larger than -20mrad	increasing or stable	not definite
Black shales with chalco-pyrite and pyrite	ditto	decreasing or stable	ditto
Black shales	ditto	slightly increasing	slightly increasing
Sandstones & Limestones with pyrite dissemination	ditto	decreasing	decreasing
Sandstones & Limestones	smaller than -20mrad	increasing	increasing

Many phase decreases are observed in accordance with the increase of frequency from 0.125 to 0.375Hz in black shales with pyrites, penetrated in the third year. On the other hand, many phase increases are noticed with the increase of frequency from 0.125 to 0.375Hz in ores with chalcopyrites of Sable Antelope mine.

These results will be useful in analysis of anomalous zones.

AP.Table 3 Electrical Property of Rock and Ore Samples

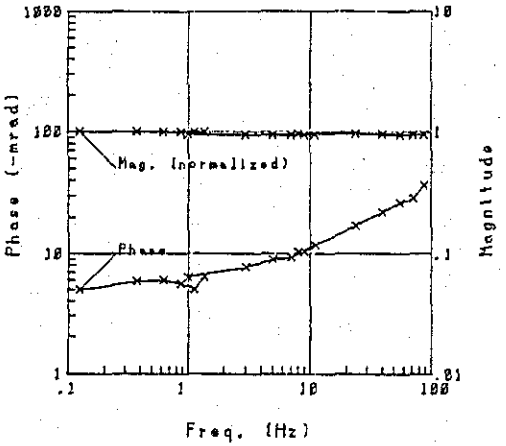
Sample No.	Rock	Location		Resistivity 0.125 Hz (ohm-m)	PFE 0.125 - 1 Hz (%)	Phase 0.125 Hz (-mrad)	Type of Spectrum	Description
		Drill Hole No.	Depth (m)					
1	Calcareous Sandstone	MJZ-8	101.0	29,900	0.7	5.0	A	dolomite veinlet
2	do.		107.6	15,400	2.3	15.2	A	sandstone bearing black shale lamina
3	Siderite Sandstone		118.8	195	3.0	26.8	C	brown limestone like marl
4	Sandstone		153.5	9,460	0.8	5.3	A	sandy shale, dolomite veinlet
5	do.		192.4	1,200	0.4	3.6	A	black shale, massive, dolomite veinlet
6	Shale		223.6	6,280	2.3	15.9	A	do. , do. , do
7	Sandstone		275.3	79	57.0	395.0	C	black silty shale, phillitic pyrite diss.
8	Shale		290.8	6,080	4.3	31.1	A	black shale, phillitic
9	do.		298.9	9,700	4.8	34.5	A	do , brecciated
10	Shale	MJZ-7	44.7	8,860	2.1	14.2	A	sandy, dolomitic
11	do.		83.0	38,900	1.8	12.4	A	silty, dolomitic
12	Calcareous Shale		124.0	238	1.9	17.3	C	black shale, brecciated
13	Limestone		152.0	1,020	4.2	36.2	Y	brown limestone bearing hematite shale
14	Shale		170.0	14,800	5.5	34.8	B	silty shale
15	Black Shale	MJZ-9	121.5	1,720	123.2	558.6	Y	conglomeratic, matrix, massive, pyrite diss.
16	do.		147.6	8,780	3.0	21.5	B	pyrite diss.
17	do.		179.0	11,800	0.8	5.8	A	do. , silty shale
18	Conglomerate		294.3	4,070	1.5	12.7	B	micro porphyry breccia
19	Chert	MJZ-10	109.5	38,900	0.4	2.9	A	brecciated
20	Conglomeratic Shale		187.8	4,740	67.1	533.2	C	hematite around pebbles, pyrite, hematite
21	do.		226.4	3,900	126.5	736.1	C	sdy banded pebbles, pyrite diss.
22	do.		297.2	4,630	75.8	540.5	C	sandy, silic, black shale etc. pyrite diss.
23	Dolomitic Limestone	MJZ-11	86.1	20,600	0.4	3.0	A	conglomeratic
24	do.		117.2	14,000	0.3	2.5	A	brecciated
25	Siliceous Rock		151.4	5,530	0.9	6.7	A	pyrite diss. porous/calcite
26	do.		174.2	10,200	2.1	15.1	B	do. , massive/sandy
27	do.		212.2	70,300	0.7	5.2	A	milky
28	do.		265.9	9,600	0.5	4.6	A	pinkish film portion
29	Sandy Rock	MJZ-12	37.5	7,180	0.9	6.7	B	py, bearing
30	Dolomitic Rock		62.5	6,640	1.2	8.5	B	aukerite, calcite in druse
31	Siliceous Rock		133.4	13,700	0.8	6.3	B	argillaceous layer bearing
32	Limestone		192.4	10,800	0.3	2.0	A	argillaceous?



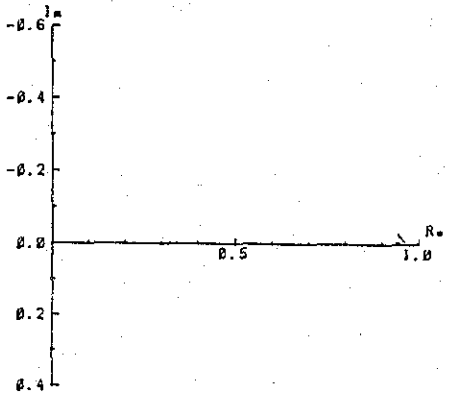
Phase Spectrum Types of Rock Sample

AP.Fig. 3 Phase,Magnitude SPectrum,Cole-Cole Diagran of Rock and ore SamPles

NO. 1

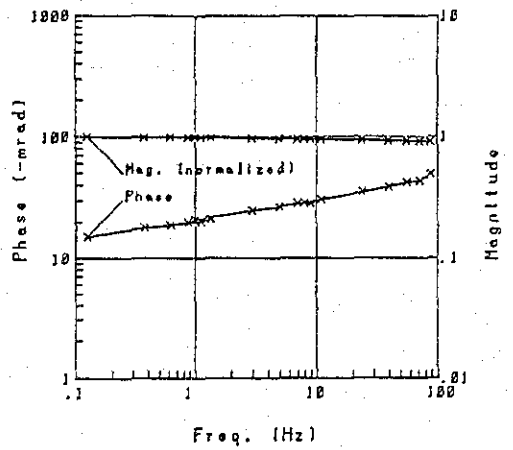


NO. 1 Cole-Cole Diagram

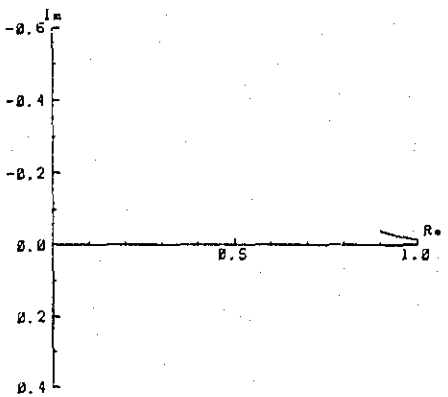


Spectrum type A
Calcareous Sandstone
Phase = 5.0 (-mrad)
P F E = 0.7 (%)
Resi. = 29900 (ohm-m)

NO. 2

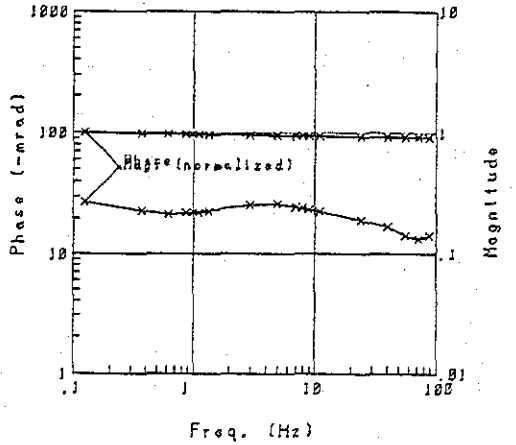


NO. 2 Cole-Cole Diagram

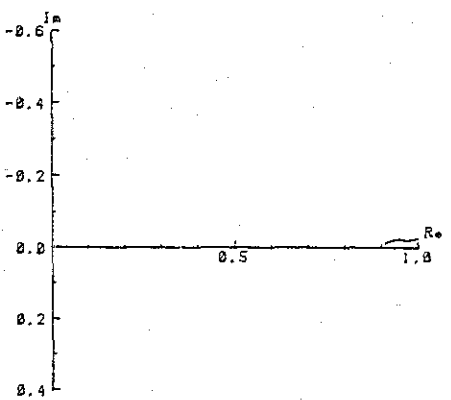


Spectrum type A
Calcareous Sandstone
Phase = 15.2 (-mrad)
P F E = 2.3 (%)
Resi. = 15400 (ohm-m)

NO. 3

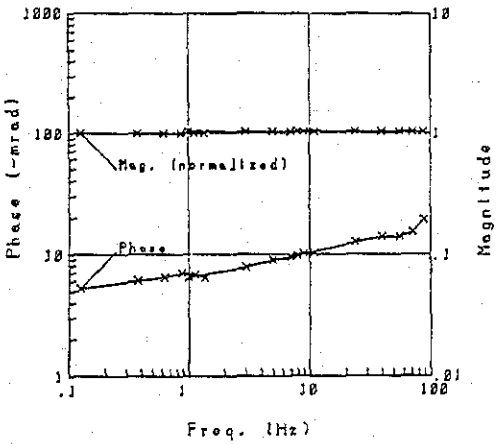


NO. 3 Cole-Cole Diagram

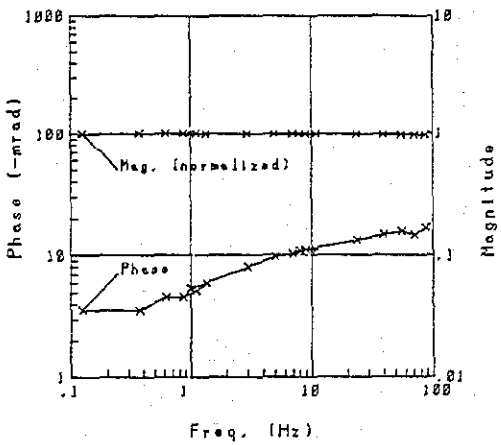


Spectrum type C
Siderite Sandstone
Phase = 26.8 (-mrad)
P F E = 3.0 (%)
Resi. = 195 (ohm-m)

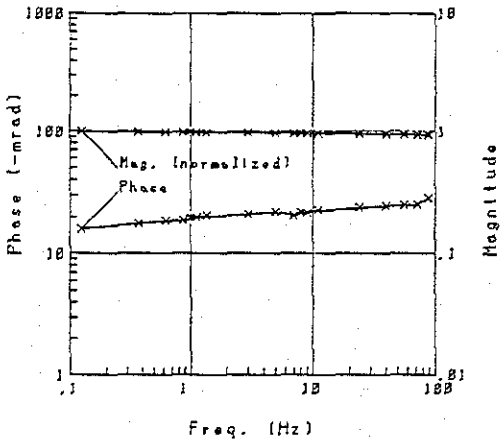
NO. 4



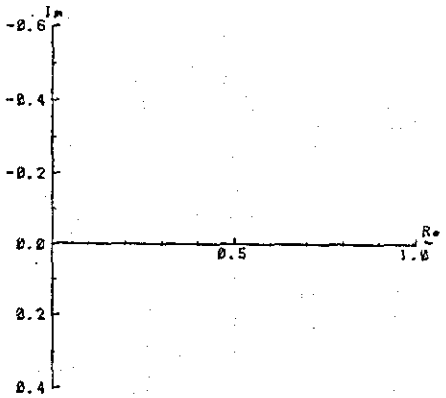
NO. 5



NO. 6

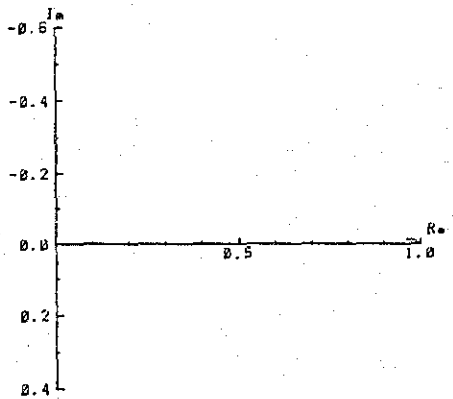


NO. 4 Cole-Cole Diagram



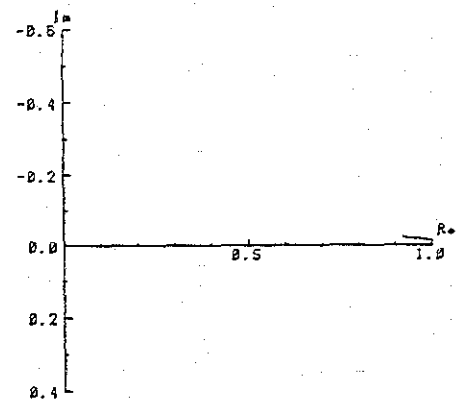
Spectrum type A
Sandstone
Phase = 5.3 (-mrad)
P F E = 0.8 (%)
Resi. = 9460 (ohm-m)

NO. 5 Cole-Cole Diagram



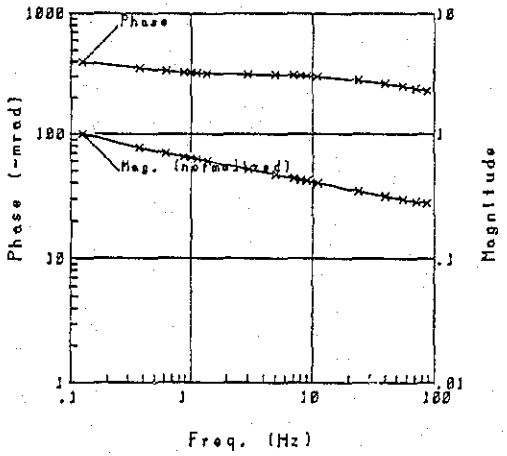
Spectrum type A
Sandstne
Phase = 3.6 (-mrad)
P F E = 0.4 (%)
Resi. = 1200 (ohm-m)

NO. 6 Cole-Cole Diagram

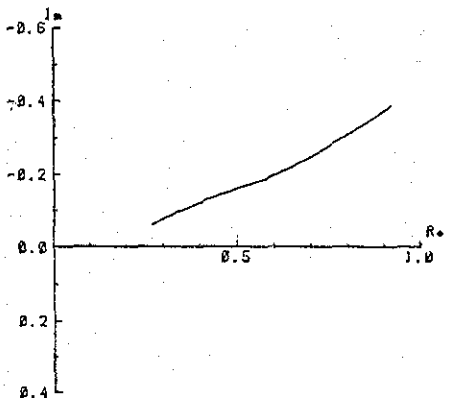


Spectrum type A
Shale
Phase = 15.9 (-mrad)
P F E = 2.3 (%)
Resi. = 6280 (ohm-m)

NO. 7

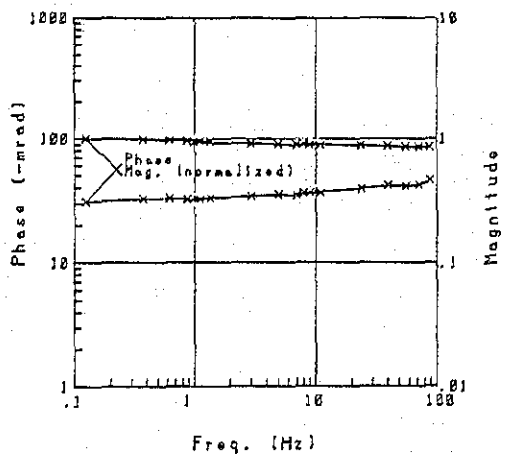


NO. 7 Cole-Cole Diagram

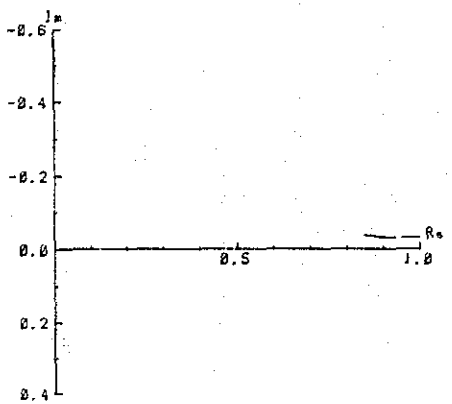


Spectrum type C
Sandstone
Phase = 395 (-mrad)
P F E = 57.0 (%)
Resi. = 79 (ohm-m)

NO. 8

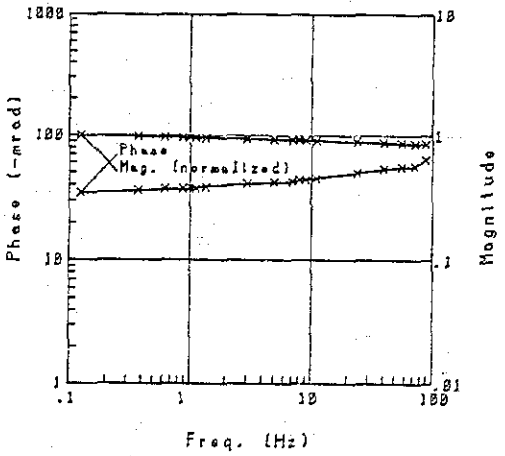


NO. 8 Cole-Cole Diagram

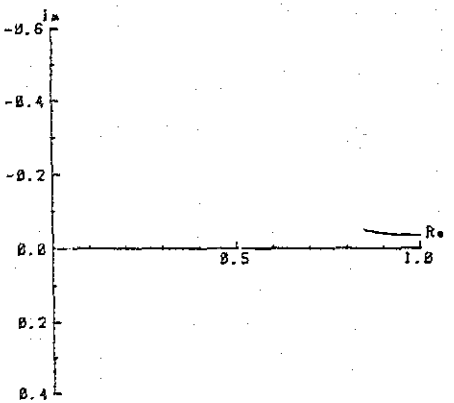


Spectrum type A
Shale
Phase = 31.1 (-mrad)
P F E = 4.3 (%)
Resi. = 6080 (ohm-m)

NO. 9

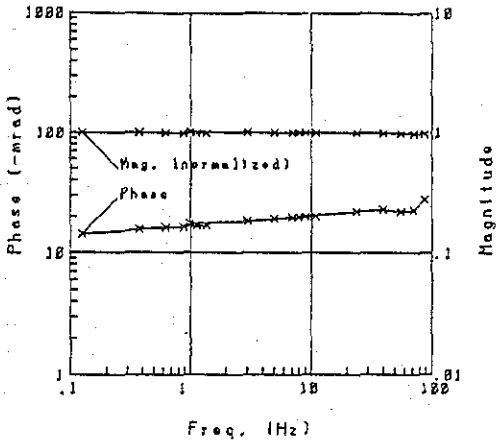


NO. 9 Cole-Cole Diagram

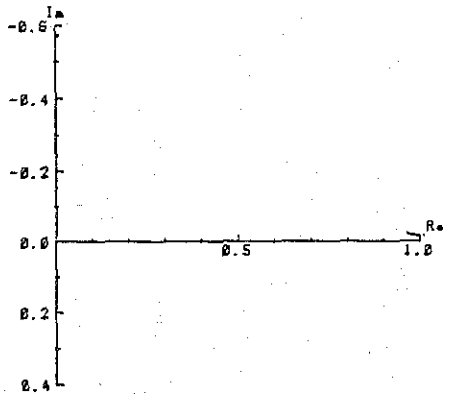


Spectrum type A
Shale
Phase = 34.5 (-mrad)
P F E = 4.8 (%)
Resi. = 9700 (ohm-m)

NO. 10

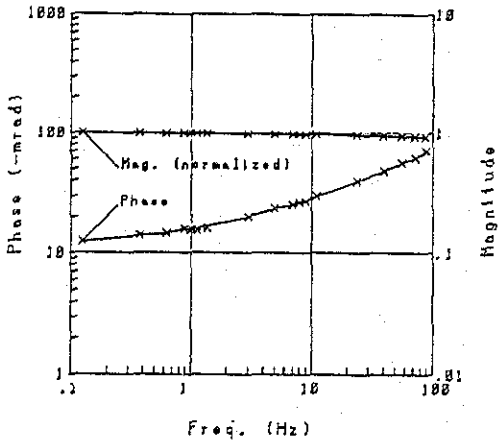


NO. 10 Cole-Cole Diagram

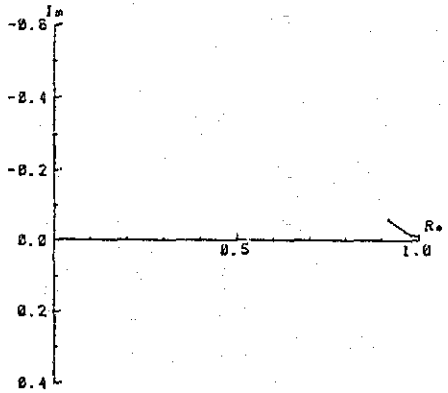


Spectrum type A
Shale
Phase = 14.2 (-mrad)
P F E = 2.1 (%)
Resi. = 8860 (ohm-m)

NO. 11

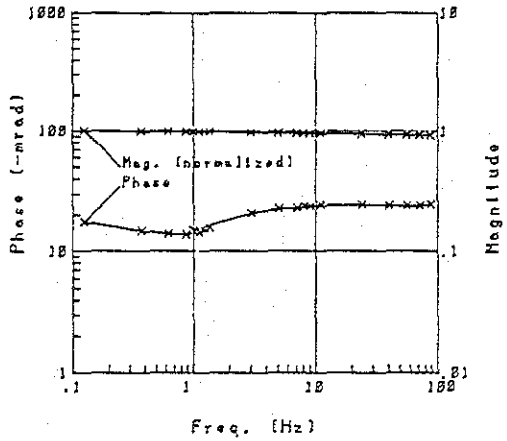


NO. 11 Cole-Cole Diagram

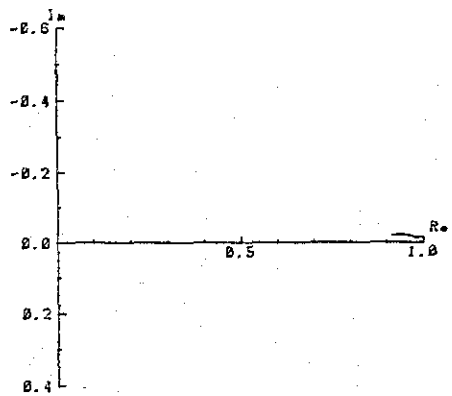


Spectrum type A
Shale
Phase = 12.4 (-mrad)
P F E = 1.8 (%)
Resi. = 38900 (ohm-m)

NO. 12

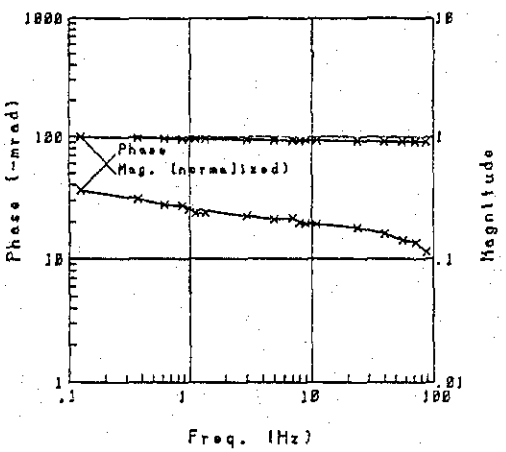


NO. 12 Cole-Cole Diagram

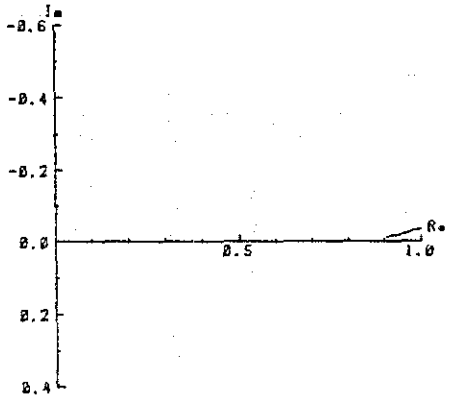


Spectrum type C
Calcareous Shale
Phase = 17.3 (-mrad)
P F E = 1.9 (%)
Resi. = 238 (ohm-m)

NO. 13

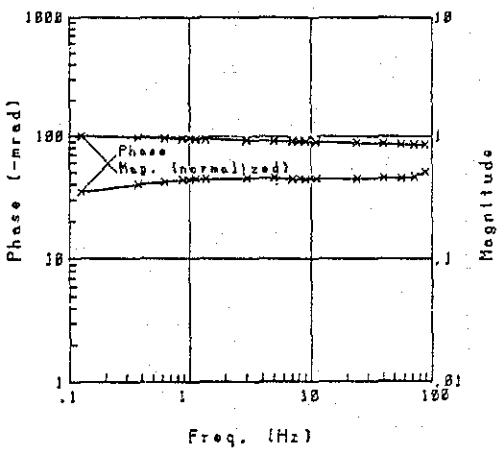


NO. 13 Cole-Cole Diagram

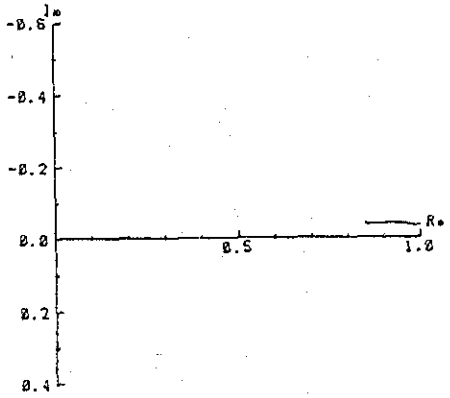


Spectrum type Y
Limestone
Phase = 36.2 (-mrad)
P F E = 4.2 (%)
Resi. = 1020 (ohm-m)

NO. 14

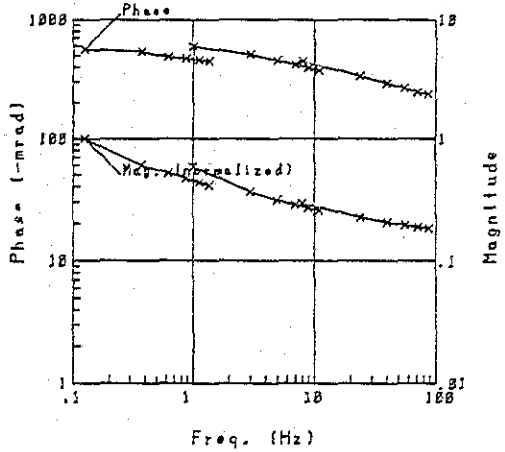


NO. 14 Cole-Cole Diagram

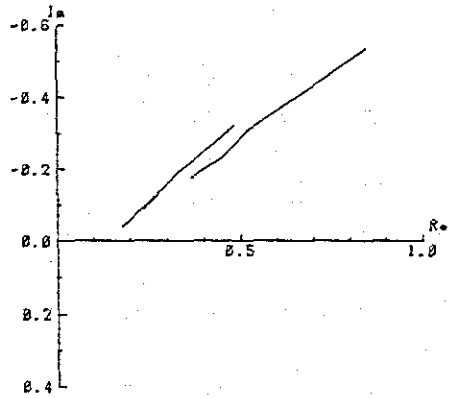


Spectrum type B
Shale
Phase = 34.8 (-mrad)
P F E = 5.5 (%)
Resi. = 14800 (ohm-m)

NO. 15

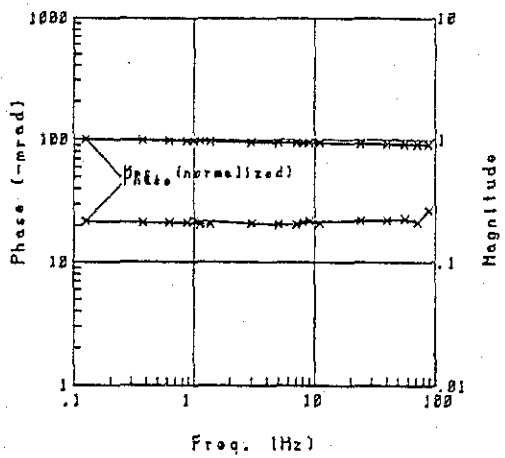


NO. 15 Cole-Cole Diagram

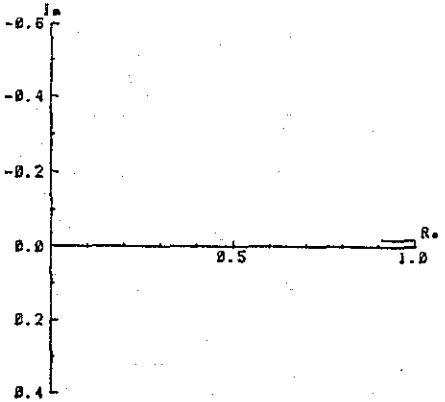


Spectrum type Y
Black Shale
Phase = 558 (-mrad)
P F E = 123 (%)
Resi. = 1720 (ohm-m)

NO. 16

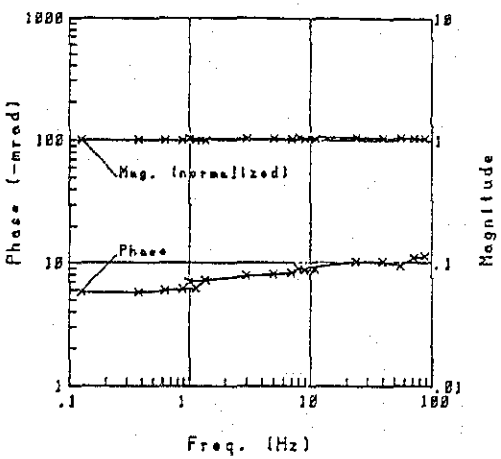


NO. 16 Cole-Cole Diagram

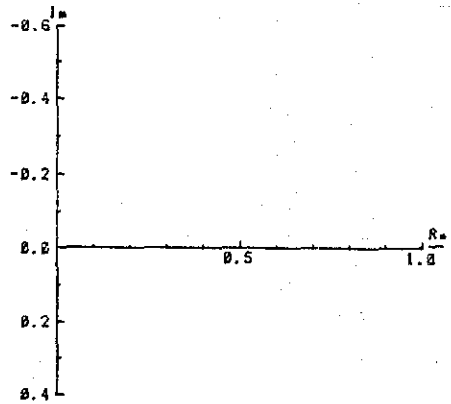


Spectrum type B
Black Shale
Phase = 21.5 (-mrad)
P F E = 3.0 (%)
Resi. = 8780 (ohm-m)

NO. 17

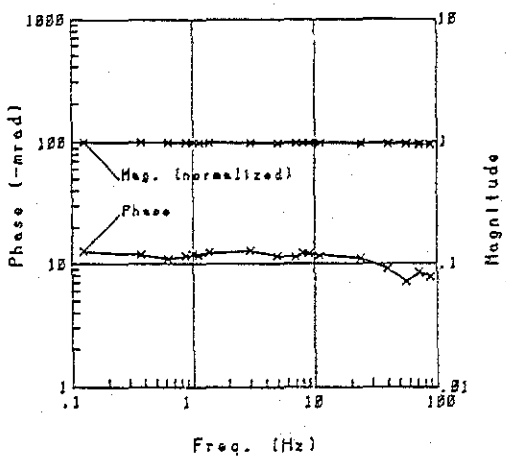


NO. 17 Cole-Cole Diagram

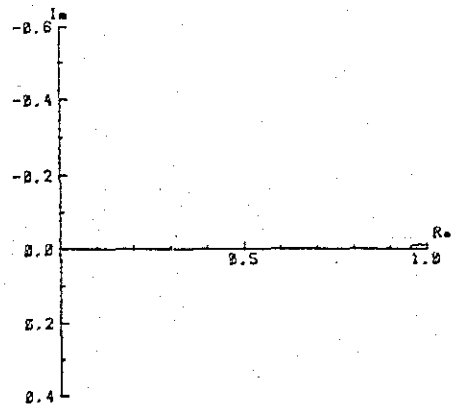


Spectrum type A
Black Shale
Phase = 5.8 (-mrad)
P F E = 0.8 (%)
Resi. = 11800 (ohm-m)

NO. 18

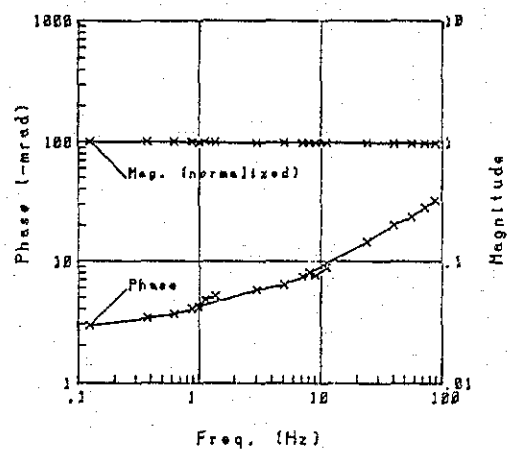


NO. 18 Cole-Cole Diagram

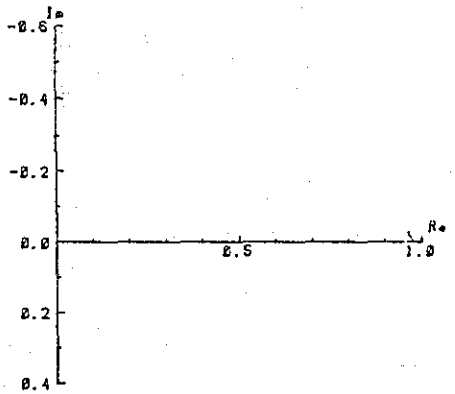


Spectrum type B
Conglomerete
Phase = 12.7 (-mrad)
P F E = 1.5 (%)
Resi. = 4070 (ohm-m)

NO. 19

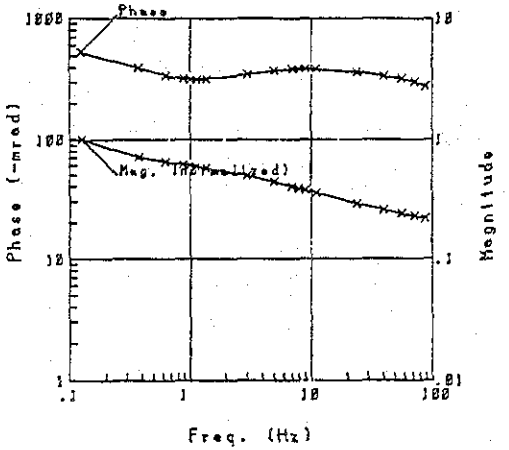


NO. 19 Cole-Cole Diagram

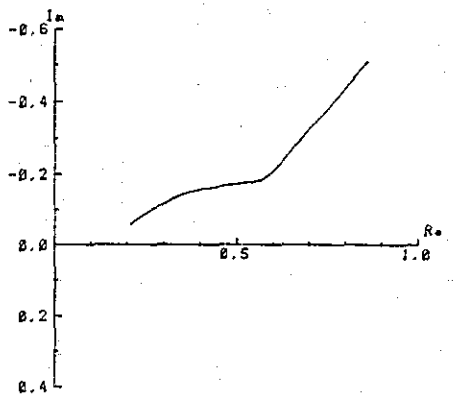


Spectrum type A
Chert
Phase = 2.9 (-mrad)
P F E = 0.4 (%)
Resi. = 38900 (ohm-m)

NO. 20

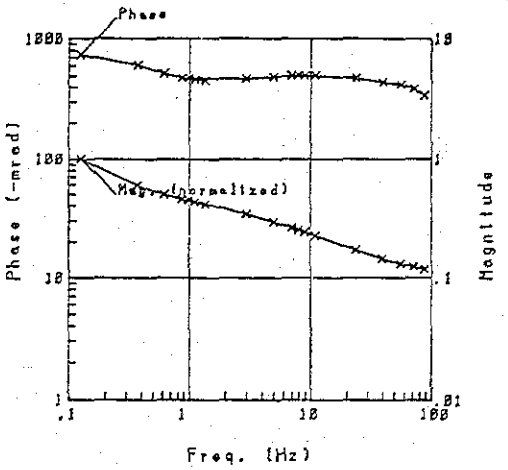


NO. 20 Cole-Cole Diagram

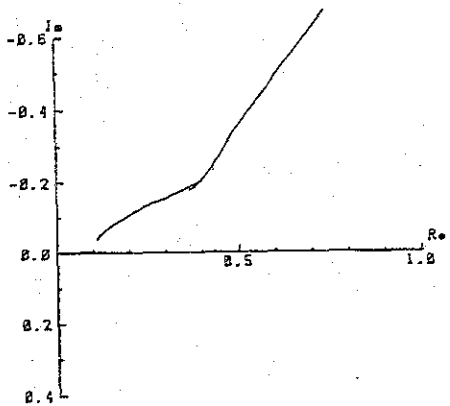


Spectrum type C
Conglomeretic Shale
Phase = 533 (-mrad)
P F E = 67.1 (%)
Resi. = 4740 (ohm-m)

NO. 21

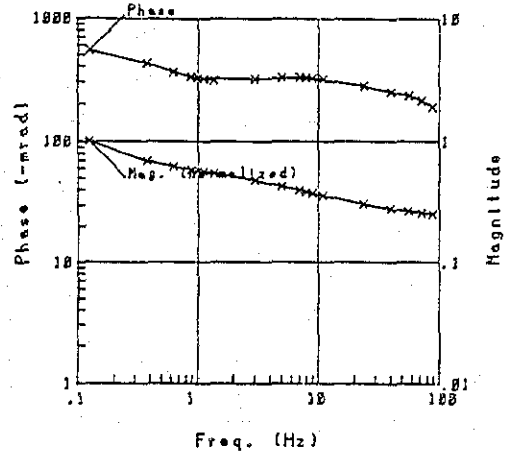


NO. 21 Cole-Cole Diagram

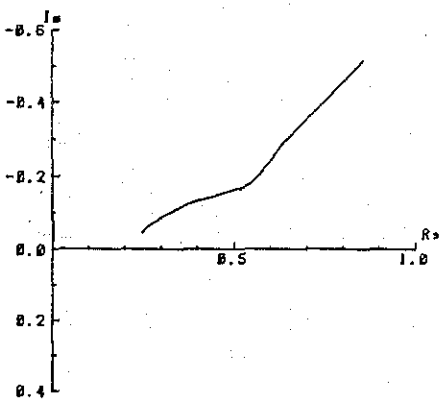


Spectrum type C
Conglomeretic Shale
Phase = 736 (-mrad)
P F E = 126 (%)
Resi. = 3900 (ohm-m)

NO. 22

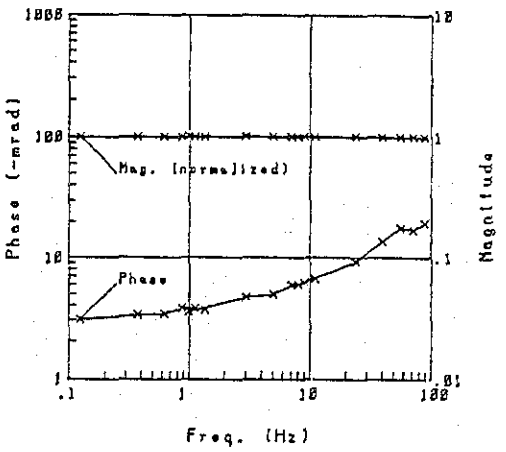


NO. 22 Cole-Cole Diagram

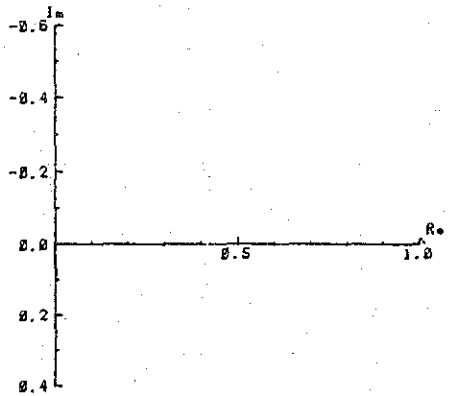


Spectrum type C
Conglomeretic Shale
Phase = 540 (-mrad)
P F E = 75.8 (%)
Resi. = 4630 (ohm-m)

NO. 23

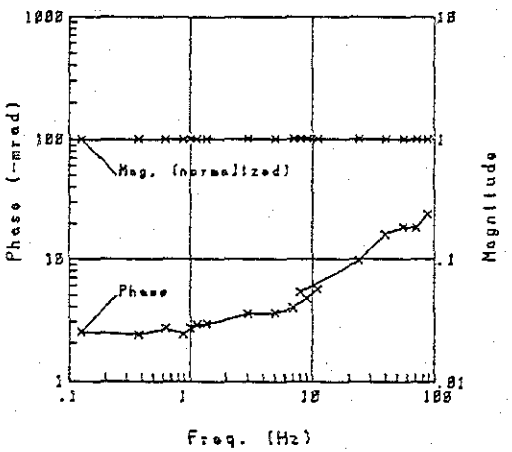


NO. 23 Cole-Cole Diagram

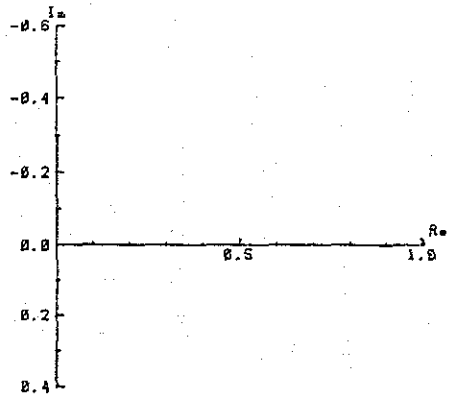


Spectrum type A
Dolomitic Limestone
Phase = 3.0 (-mrad)
P F E = 0.4 (%)
Resi. = 20600 (ohm-m)

NO. 24

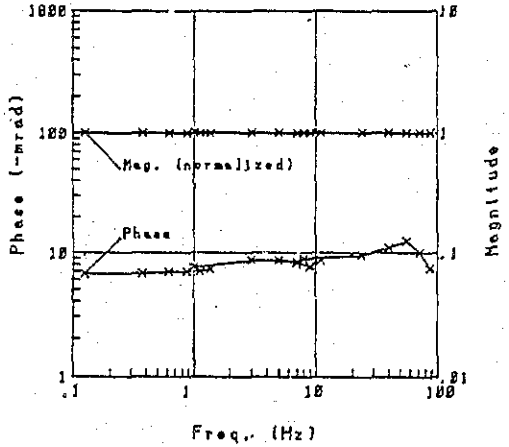


NO. 24 Cole-Cole Diagram

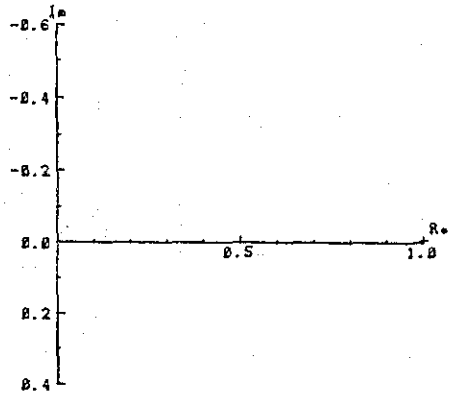


Spectrum type A
Dolomitic Limestone
Phase = 2.5 (-mrad)
P F E = 0.3 (%)
Resi. = 14000 (ohm-m)

NO. 25

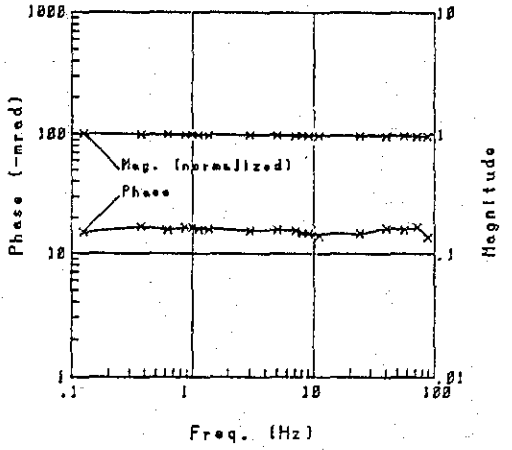


NO. 25 Cole-Cole Diagram

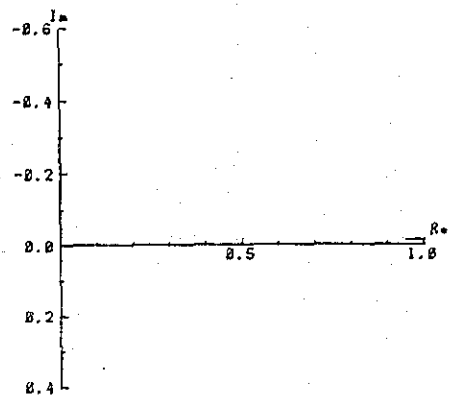


Spectrum type A
Siliceous Rock
Phase = 6.7 (-mrad)
P F E = 0.9 (%)
Resi. = 5530 (ohm-m)

NO. 26

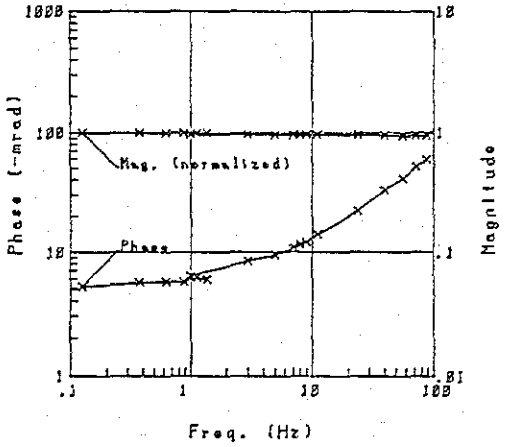


NO. 26 Cole-Cole Diagram

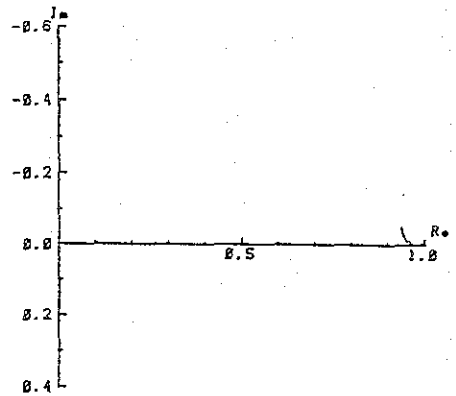


Spectrum type B
Siliceous Rock
Phase = 15.1 (-mrad)
P F E = 2.1 (%)
Resi. = 10200 (ohm-m)

NO. 27

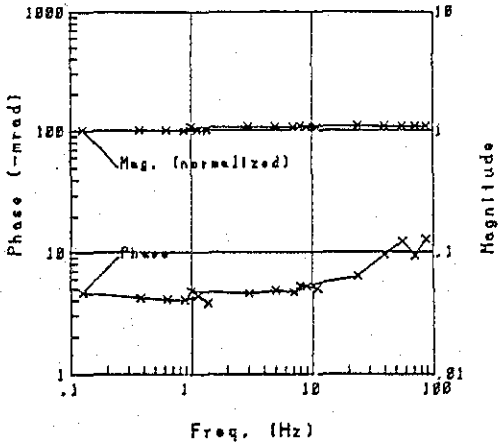


NO. 27 Cole-Cole Diagram

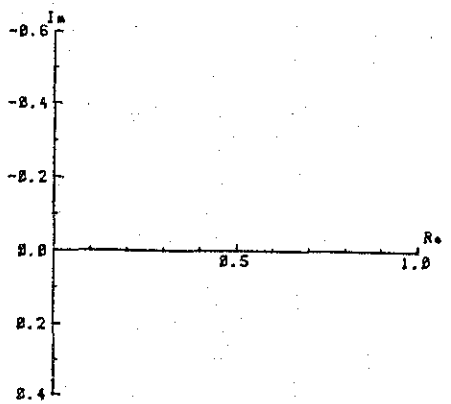


Spectrum type A
Siliceous Rock
Phase = 5.2 (-mrad)
P F E = 0.7 (%)
Resi. = 70300 (ohm-m)

NO. 28

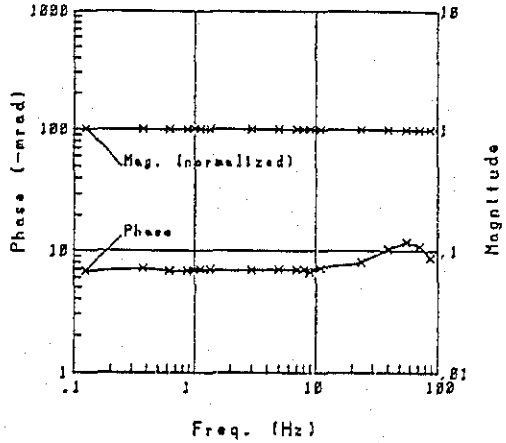


NO. 28 Cole-Cole Diagram

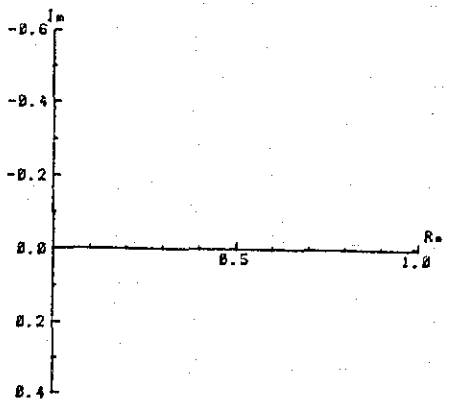


Spectrum type A
Siliceous Rock
Phase = 4.6 (-mrad)
P F E = 0.5 (%)
Resi. = 9600 (ohm-m)

NO. 29

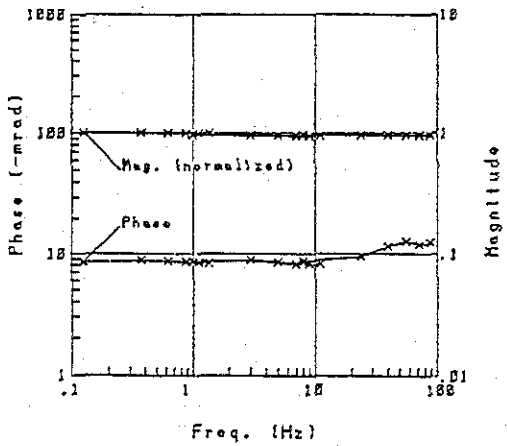


NO. 29 Cole-Cole Diagram

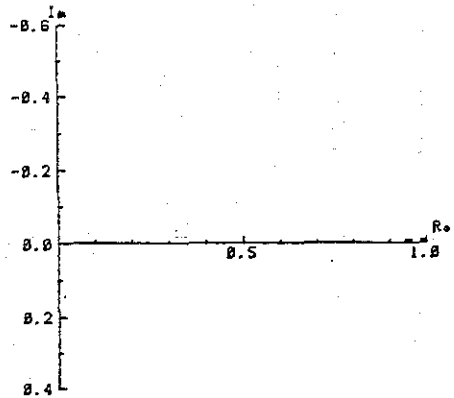


Spectrum type B
Sandy Rock
Phase = 6.7 (-mrad)
P F E = 0.9 (%)
Resi. = 7180 (ohm-m)

NO. 30

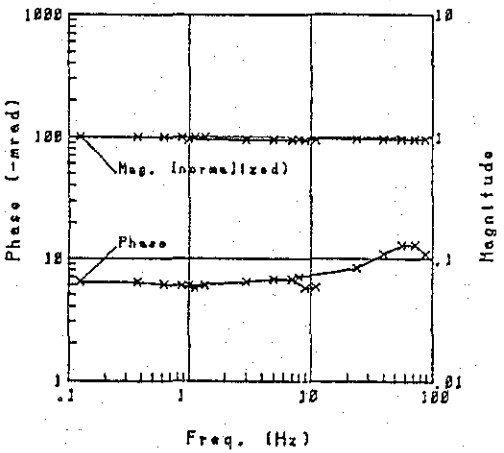


NO. 30 Cole-Cole Diagram

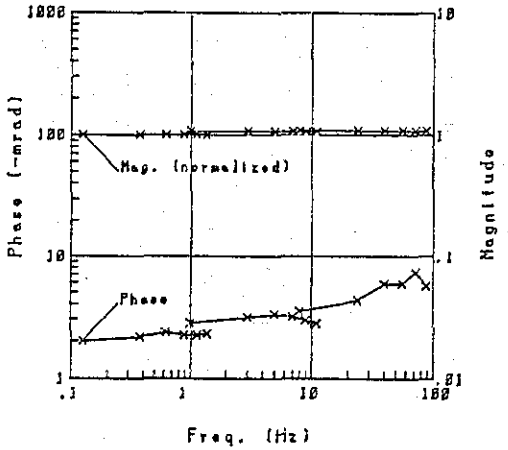


Spectrum type B
Dolomitic Rock
Phase = 8.5 (-mrad)
P F E = 1.2 (%)
Resi. = 6640 (ohm-m)

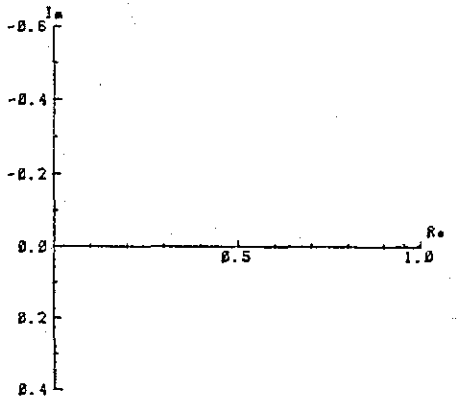
NO. 31



NO. 32

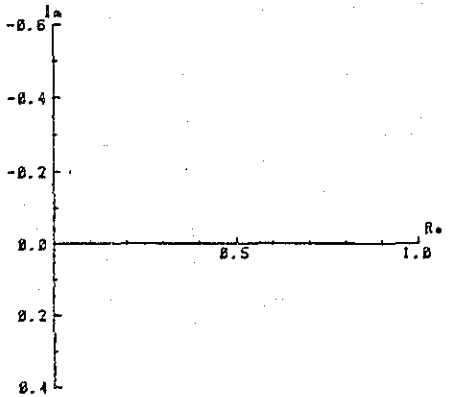


NO. 31 Cole-Cole Diagram

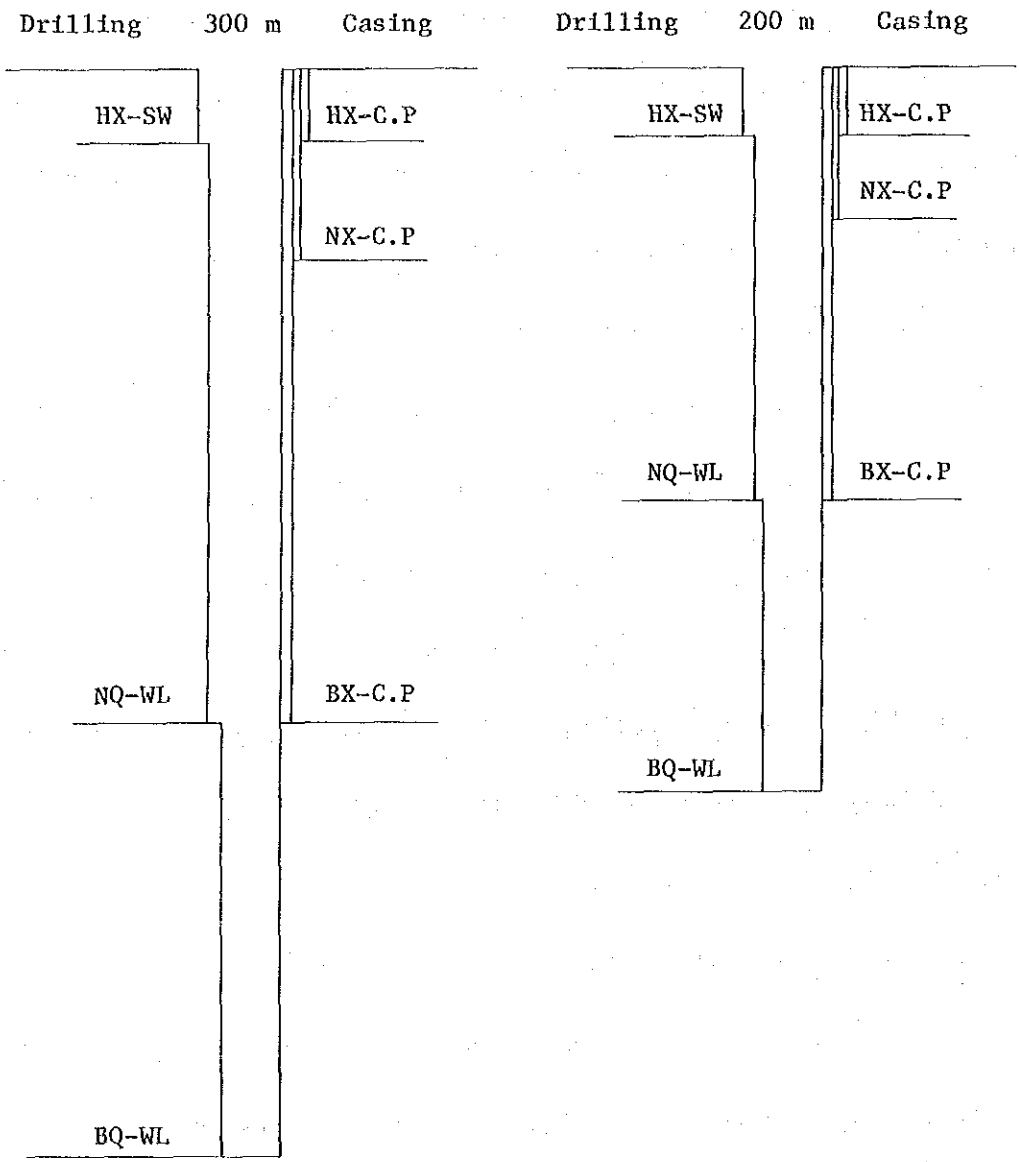


Spectrum type B
Siliceous Rock
Phase = 6.3 (-mrad)
P F E = 0.8 (%)
Resi. = 13700 (ohm-m)

NO. 32 Cole-Cole Diagram



Spectrum type A
Limestone
Phase = 2.0 (-mrad)
P F E = 0.3 (%)
Resi. = 10800 (ohm-m)



AP.Fig. 4 Casing Program

AP.Table 4 Drilling Machine and Equipment Used

Drilling Machine Model "OE-8BL"	1 set
Specifications:	
Capacity	300 m (BQ-WL)
Dimensions L × W × H	1,550mm × 700mm × 1,510mm
Hoisting capacity	2,000 kg
Spindle speed	forward 100,190,320,530, rpm
Engine Model "F2L912"	25.5 ps/1,800 rpm
Drilling Pump Model "WLMG-10"	1 set
Specifications:	
Piston diameter	68 mm
Stroke	100 mm
Capacity	discharge capacity 144 ℓ/min
Dimensions L × W × H	1,460mm × 580mm × 980mm
Engine Model "NF-110K"	11 ps/2,200 rpm
Wire line hoist Model "WLH-4"	1 set
Specifications:	
Rope capacity	500 m
Hoisting speed	8 ∿ 105m/min
Engine Model "NF-80K"	8ps/2,200 rpm
Mud Mixer Model "HM-250"	1 set
Specifications:	
Capacity	200 ℓ/600 rpm
Engine Model "NF-80K"	8ps/2,200 rpm
Generator Model "YSG-10E"	1 set
Specifications:	
Capacity	10KVA 8KW 220V
Generator Model "YSG-2000B"	3 set
Specifications:	
Capacity	2KVA 1.7KW 100V
Water supply pump Model "KTV-22H"	1 set
Specifications:	
Capacity	discharge capacity 300 ℓ/min
Derrick	1 set
Specifications:	
Height	9.5 m
Max load capacity	4,000 kg
Drilling tools	
Dri-ling rod	NQ-WL 3 m 67 pcs
	BQ-WL 3 m 100 pcs
Casing pipe	HX 1.5 m 5 pcs
	HX 1 m 3 pcs
	NX 1 m 2 pcs
	NX 3 m 11 pcs
	BX 1 m 2 pcs
	BX 3 m 60 pcs

AP.Table 5 Specification of Diamond Bit Used

Item	Size of bit	Type of bit	Carats of bit	Matrix	Stones per carat	Waterway	Total bit Used
Diamond bit	94 mm	HX - SW	25 ct	E	15	4	2
	79 mm	NQ - WL	30	E	15	4	14
		NQ - WL	30	CE	15	4	10
	62 mm	BQ - WL	22	E	15	4	14
		BQ-WL	22	CE	25	4	4
Total			*1,166				44

E : for ordinary rock

CE : for harder rock

* : total amount of diamond carat

AP.Table 6 Drilling Meterage of Diamond Bit Used

Item	Size	Bit No.	Drilling Meterage by Unit: Meter						Total (m)
			MJZ-7	MJZ-8	MJZ-9	MJZ-10	MJZ-11	MJZ-12	
Diamond Bit	HX	186561	5.00	4.00	5.00				14.00
		186562				18.80	5.50	3.60	27.90
		Total	5.00	4.00	5.00	18.80	5.50	3.60	41.90
			Drilling length/bit (41.90/2)						20.95
	NQ	186551		30.40					30.40
		186552		26.00					26.00
		186553		27.80					27.80
		186554		27.60					27.60
		186555		35.60					35.60
		186556		28.10					28.10
		186557	38.00						38.00
		186558	44.30						44.30
		186559	47.20						47.20
		186560	44.60						44.60
		NNZ-1			31.20				31.20
		NNZ-2			39.70				39.70
		NNZ-3			36.60				36.60
		NNZ-4			31.40				31.40
		NNZ-5				45.70			45.70
		NNZ-6				42.00			42.00
		NNZ-7				34.50			34.50
		NNZ-8					41.00		41.00
		NNZ-9					48.00		48.00
		NNZ-10					38.20		38.20
		NNZ-11						52.80	52.80
		NNZ-12						52.30	52.30
		NNZ-13						49.50	49.50
		NNZ-14						42.40	42.40
		Total	174.10	175.50	138.90	122.20	127.20	197.00	934.90
			Drilling length/bit (934.90/24)						38.95
	BQ	175472		31.90					31.90
		175473		33.00					33.00
		175474		25.80					25.80
		175475		30.30					30.30
		NBZ-1	44.40						44.40
		NBZ-2	36.00						36.00
		NBZ-3	41.00						41.00
		NBZ-4			34.50				34.50
		NBZ-5			45.00				45.00
		NBZ-6			42.00				42.00
		NBZ-7			35.10				35.10
		NBZ-8				37.40			37.40
		NBZ-9				48.00			48.00
		NBZ-10				36.00			36.00
		NBZ-11				38.10			38.10
		NBZ-12					51.70		51.70
		NBZ-13					57.00		57.00
		NBZ-14					59.10		59.10
		Total	121.40	121.00	156.60	159.50	167.80		726.30
			Drilling length/bit (726.30/18)						40.35
Grand Total			300.50	300.50	300.50	300.50	300.50	200.60	1,703.10
			Drilling length/bit (1,703.10/44)						38.70

AP.Table 7 Consumables Used

Description	Specifications	Unit	Quantity						Total
			MJZ-7	MJZ-8	MJZ-9	MJZ-10	MJZ-11	MJZ-12	
Light oil		l	870	1,110	825	1,100	1,090	615	5,610
Petrol		l	1,150	1,400	965	950	970	310	5,745
Hydraulic oil		l		40	10		12		62
Engine oil		l	32	30	20	30	24	24	160
Gear oil		l	5	12	8	5	5	5	40
Greas		kg	6	10	8	6	8	5	43
Bentonite		kg	2,375	2,100	1,450	1,375	850	700	8,850
C.M.C.		kg	44	48	52	49	41	28	262
Tel - stop		kg	10	20	20	20	30		100
Mud oil		l	144	162	118	222	214	36	896
Cement		kg	200	100	150	200	150	250	1,050
Diamond bit	HX-SW	pc		1		1			2
Diamond bit	NQ-WL	pc	4	6	4	3	3	4	24
Diamond bit	BQ-WL	pc	3	4	4	4	3		18
Diamond reamer	NQ-WL	pc	2	2	1	2	1	2	10
Diamond reamer	BQ-WL	pc	1	2	2	2	2		9
Casing diamond shoe	NX	pc		1		1			2
Casing metal shoe	HX	pc	1	1	1	1	1	1	6
Casing metal shoe	BX	pc	1	1	1	1	1		5
Core barrel Ass'y	NQ-WL	set		1	1		1		3
Core barrel Ass'y	BQ-WL	set		1	1		1		3
Inner tube	NQ-WL	pc		1	2		2		5
Inner tube	BQ-WL	pc	2	1		2			5
Core lifter case	NQ-WL	pc	4	6	4	4	4	4	26
Core lifter case	BQ-WL	pc	2	4	2	2	2		12
Core lifter	NQ-WL	pc	4	6	4	4	4	4	26
Core lifter	BQ-WL	pc	2	4	2	2	2		12
Thrust ball bearing	NQ-WL	pc	2	4	4	4	2	2	18
Thrust ball bearing	BQ-WL	pc	2	2	4	2	4		14
Innertube stabilizer	NQ-WL	pc	2	2	1	2	1	2	10
Innertube stabilizer	BQ-WL	pc	1	2	2	2	2		9
Chack piece	NQ-WL	set		1		1		1	3
Chack piece	BQ-WL	set		1		1			2
Cylinder liner	MG-10 68mm	pc	2			2		2	6
Piston rod		pc	2			2		2	6
Piston rubber	68mm	pc	4	4	4	4	4	2	22
Valve seat		pc			8				8
Steel ball		pc			8				8
V - packing		pc	14			14		14	42
Waste		kg	15	20	20	15	20	30	120
Wire rope	6mm × 300m	roll		1		1			2
Core box	NQ-WL	pc	25	31	20	17	18	31	142
Core box	BQ-WL	pc	13	13	16	19	29		90

AP.Table 8 Working Time Analysis of the Drilling Operation

Hole No.	Drilling			Shift		Working man		Working Time						
	Bit size	Drilling	Core length	Drilling	Total	Engineer	Worker	Drilling	Other working	Recovering	Total	Removing	Road construction and others	G.Total
		m	m	shift	shift	man	man	h	h	h	h	h	h	h
MJZ-7	HX	5.00	-	1	6	24	67	2°00'	6°00'	-	8°00'	43°00'	-	51°00'
	NQ	174.10	162.80	17	17	24	83	90°50'	45°10'	-	136°00'	-	-	136°00'
	BQ	121.40	121.00	12	17	31	113	64°40'	41°20'	-	106°00'	8°00'	24°00'	138°00'
	Total	300.50	283.80	30	40	79	263	157°30'	92°30'	-	250°00'	51°00'	24°00'	325°00'
MJZ-8	HX	4.00	1.10	1	11	44	152	2°40'	3°20'	-	6°00'	78°00'	9°00'	93°00'
	NQ	175.50	159.50	20	21	28	98	95°20'	75°10'	0°30'	171°00'	-	-	171°00'
	BQ	121.00	120.70	16	18	28	95	76°20'	59°40'	-	136°00'	8°00'	-	144°00'
	Total	300.50	281.30	37	50	100	345	174°20'	138°10'	0°30'	313°00'	86°00'	9°00'	408°00'
MJZ-9	HX	5.00	-	1	7	26	111	2°00'	4°00'	-	6°00'	54°00'	-	60°00'
	NQ	138.90	128.60	11	11	14	53	61°20'	28°40'	-	90°00'	-	-	90°00'
	BQ	156.60	156.60	14	16	23	85	79°50'	37°50'	2°20'	120°00'	8°00'	-	128°00'
	Total	300.50	285.20	26	34	63	349	143°10'	70°30'	2°20'	216°00'	62°00'	-	278°00'
MJZ-10	HX	18.80	-	1	3	10	42	3°30'	4°30'	-	8°00'	20°00'	-	28°00'
	NQ	122.20	110.30	11	11	14	55	61°00'	27°00'	-	88°00'	-	-	88°00'
	BQ	159.50	159.50	17	19	27	106	99°30'	44°30'	-	144°00'	9°00'	-	153°00'
	Total	300.50	269.80	29	33	51	203	164°00'	76°00'	-	240°00'	29°00'	-	269°00'
MJZ-11	HX	5.50	-	1	5	18	80	2°10'	5°50'	-	8°00'	37°00'	-	45°00'
	NQ	127.20	117.30	12	12	16	58	63°00'	33°00'	-	96°00'	-	-	96°00'
	BQ	167.80	167.80	14	15	21	80	84°50'	30°40'	-	115°30'	6°30'	-	122°00'
	Total	300.50	285.10	27	32	55	218	150°00'	69°30'	-	219°30'	43°30'	-	263°00'
MJZ-12	HX	3.60	2.60	1	4	14	53	1°00'	3°00'	-	4°00'	27°00'	-	31°00'
	NQ	197.00	195.90	17	31	77	283	100°40'	39°20	-	140°00'	40°00'	72°00'	252°00'
	Total	200.60	198.50	18	35	91	336	101°40'	42°20'	-	144°00'	67°00'	72°00'	283°00'
Grand Total		1,703.10	1,603.70	167	224	439	1,614	890°40'	489°00'	2°50'	1,382°30'	338°30'	105°00'	1,826°00'

AP.Table 9 The Results of Chemical Analysis of Ores (1~2)

No.	Sample Locality	Depth m	Wd. m	Ag g/t	Cu ppm	Pb ppm	Zn ppm
1	MJZ-7	46.23- 46.41	0.13	2.0	1220	28	78
2		47.29- 47.66	0.37	2.0	3600	32	130
3		49.62- 49.92	0.30	2.0	700	24	76
4		51.85- 52.05	0.20	1.4	720	24	54
5		128.11-128.52	0.41	0.1	98	24	36
6		128.66-129.00	0.34	0.4	136	24	78
7		129.00-129.60	0.60	0.6	580	28	118
8		129.60-130.30	0.70	<0.10	98	30	82
9		130.30-130.70	0.40	<0.10	76	28	70
10		130.70-132.67	1.97	<0.10	50	24	34
11		135.32-135.70	0.38	<0.10	70	20	66
12		136.30-136.50	0.20	0.4	84	28	34
13		136.50-137.55	1.05	0.4	76	32	54
14		197.77-198.20	0.43	1.0	180	32	118
15		256.50-256.86	0.36	1.0	1900	44	940
16		280.56-280.76	0.20	2.0	660	52	440
17		280.76-281.63	0.87	1.0	300	56	640
18		292.20-292.49	0.29	1.4	320	124	700
19	MJZ-8	3.40- 3.80	0.40	<1.0	37500	44	112
20		3.80- 5.90	2.10	<1.0	350	56	440
21	MJZ-8	5.90- 14.20	8.30	<1.0	150	68	700
22		104.80-107.00	2.20	<1.0	950	60	60
23		107.00-107.10	0.10	480.0	137500	44	4400
24		107.10-109.55	2.45	<1.0	150	40	72
25		126.25-127.45	1.20	<1.0	200	40	60
26		195.85-196.40	0.55	0.3	24	24	36
27		231.77-231.90	0.13	0.3	120	28	48
28		254.65-256.40	1.75	0.1	88	84	52
29		256.40-256.94	0.54	<0.1	24	30	44
30		282.49-282.98	0.49	0.6	26	28	36
31		282.98-283.62	0.64	0.3	16	24	24
32	MJZ-9	53.28- 53.53	0.25	0.2	1640	52	180
33		54.08- 54.26	0.18	0.5	440	60	124
34		136.30-137.00	0.70	1.7	8000	50	360
35		154.27-155.55	1.28	0.9	640	72	132
36		155.55-157.00	1.45	0.3	144	60	68
37		157.00-158.55	1.55	0.2	400	52	112
38		158.55-160.15	1.60	0.2	360	35	116
39		196.16-197.26	1.10	0.2	220	68	140
40		198.48-199.40	0.92	0.1	92	37	64

No.	Sample Locality	Depth m	Wd. m	Ag g/t	Cu ppm	Pb ppm	Zn ppm
41	MJZ-9	199.40-200.10	0.70	0.1	40	30	96
42		205.65-206.76	1.11	0.2	280	36	70
43		206.76-207.40	0.64	0.1	76	24	172
44		240.20-241.40	1.20	0.1	56	28	280
45		241.40-242.40	1.00	< 0.1	76	24	124
46		242.40-243.40	1.00	0.1	80	24	88
47		243.40-244.40	1.00	0.1	32	20	100
48		244.40-244.80	0.40	< 0.1	40	22	120
49		253.25-254.40	1.15	0.1	164	30	180
50		254.40-255.40	1.00	< 0.1	132	24	76
51		255.40-256.40	1.00	< 0.1	50	27	40
52		256.40-256.83	0.43	< 0.1	60	22	84
53		256.83-256.91	0.08	0.1	880	36	180
54		256.91-257.75	0.84	< 0.1	40	25	46
55	MJZ-10	143.90-144.52	0.62	0.2	20	24	28
56		145.90-146.40	0.50	0.1	128	30	150
57		146.40-147.40	1.00	0.1	500	32	320
58		147.40-148.40	1.00	0.1	320	64	400
59		148.40-149.70	1.30	0.1	172	76	460
60		284.76-285.06	0.30	0.7	320	56	200
61	MJZ-10	287.95-288.43	0.48	0.7	1040	48	300
62		289.40-290.14	0.74	0.5	640	56	200
63		290.14-290.85	0.71	0.6	1200	68	108
64		291.40-292.40	1.00	1.2	1480	44	240
65		292.40-293.02	0.62	1.0	1260	60	200
66		293.02-293.75	0.73	1.6	1600	52	112
67		298.70-299.30	0.60	0.6	2000	52	200
68	MJZ-11	125.75-126.40	0.65	0.1	12	56	72
69		126.40-127.50	1.10	0.1	18	46	50
70		145.03-145.40	0.37	0.1	220	60	184
71		169.63-170.18	0.55	0.3	44	176	44
72		170.86-171.23	0.37	0.1	40	60	108
73		212.40-213.70	1.30	0.1	76	120	148
74		272.05-272.30	0.25	0.1	64	84	148
75		272.76-272.98	0.22	< 0.1	52	96	76
76	MJZ-12	20.40- 20.61	0.21	< 0.1	5	30	58
77		68.90- 69.35	0.45	< 0.1	10	64	76

AP.Table 10 The Results of Microscopic Observation of the Polished Section (1~2)

No.	Sample	Locality	Kind of Ore	Mineral Constituents												Remarks
				Cp	Di	Cc	Cv	Bo	Mal	Sp	Py	He	Go	Gn	Te	
1	MJZ-7 128.16m	Sable Antelope(Blue Jacket 2	fine Py disseminated along bedding delomitic arenaceous rock								○			◎		cubic or granular Py , veinlet
2	Ditto 129.60m	ditto	fine Py veinlet/dolomitic arenaceous rock								o			◎		cubic or granular Py , veinlet or dissemination
3	MJZ-8 3.50m	ditto	Mal, Go disseminated with siderite/ sandstone			·?	·		○				o	◎		massive Mal or Mal veinlet
4	Ditto 107.00m	ditto	Cp disseminated delomitic veinlet/ dolomitic arenaceous rock	○	o						·			◎	?	massive Cp or Cp veinlet, Py disseminated Gn
5	Ditto 107.00m	ditto	Bo,Cp vein /dolomitic arenaceous rock	○	○	?		○			·			○	○	Bo ,Cp exsolution paragenesis, Cp associated with Te
6	Ditto 126.60m	ditto	Cp disseminated dolomitic veinlets/ dolomitic arenaceous rock	o							·			◎		Cp associated with massive or cubic Py
7	MJZ-9 136.50m	Kamiyobo	Cp,Mal,Py calcite vein/black shale	·	?				o		o		o	◎	o?	fine grained Cp, vein Mal, colloformed Py
8	Ditto 157.92m	ditto	Cp, Py disseminated/Py calcite veinlet/conglomeratic black shale	·							○			◎		fine grained Cp, associated cubic or massive Py
9	Ditto 197.16m	ditto	Cp disseminated, Py bedded or veinlets, black shale	·			·				○			◎	·?	fine grained Cp , cubic Py, vein or irregular Py
10	Ditto 243.52m	ditto	Py disseminated/ conglomeratic black shale	·							○			◎		cubic Py associated with fine grained Cp
11	Ditto 253.26m	ditto	Py disseminated/conglomerate								○			◎		cubic or granular Py, disseminated
12	MJZ-10 84.10m	ditto	Go caleite vein/chert									o	◎	o		colloformed Go or He
13	Ditto 143.90m	ditto	Py, Go disseminated quartz vein/chert								o		o	◎		cubic Py rimmed by Go
14	Ditto 208.30m	ditto	Cp,Cv,Py calcite veinlet/conglomeratic black shale	·			o				o			◎		cv associated with Cp and Py, cubic or granular Py
15	Ditto 290.55m	ditto	Cp,Cc calcite veinlet/ conglomeratic black shale	o		o	·				o			◎		massive or vein Cc, associated with Cp and Py

No.	Sample	Locality	Kind of Ore	Mineral Constituents												Remarks
				Cp	Di	Cc	Cv	Bo	Mal	Sp	Py	He	Go	Gn	Te	
16	MJZ-11 145.40m	Sable Antelope	Py disseminated vein/dolomitic arenaceous rock								○			◎		cubic Py, disseminated
17	Ditto 169.73m	ditto	Py disseminated network/dolomitic arenaceous rock								○			◎		massive or disseminated
18	Ditto 180.80m	ditto	Py veinlet/fine dolomitic arenaceous rock	o			·			o	o			◎		Sp associated with Cp and Py, cubic or granular Py
19	Ditto 213.85m	ditto	Py disseminated/fine dolomitic arenaceous rock								o			◎		vein or cubic Py, disseminated
20	MJZ-12 20.60m	ditto	Py disseminated/dolomitic sand stone								o			◎		cubic Py, disseminated

Abbreviation

Cp	: Chalcopyrite	◎	:	Abundant
Di	: Digenite	○	:	Common
Cc	: Chalcocite	o	:	Few
Bo	: Bornite	·	:	Rare
Mal	: Malachite			
Py	: Pyrite			
Go	: Gothite			
He	: Hematite			
Te	: Tennantcite			
Cv	: Covelline			
Sp	: Sphalerite			
Gn	: Gangue			

AP.Table 11 The Results of X-ray Diffractive Analysis (1~2)

No.	Sample	Locality	Kind of Ore and Rock	Detected Minerals																	
				Cp	Di	Cc	Bo	Te	Mal	Py	Ca	Do	Se	K	Gy	Go	Lep	He	Q	Kf	Pl	Am
1	MJZ-7 24.30m	Sable Antelope(Blue Jacket)	Sideritic arenaceous rock						o?		○	○	·?	·		o						
2	Ditto 128.16m	ditto	Py disseminated along bedding/ dolomitic arenaceous rock		?					o	o	◎										
3	Ditto 129.60m	ditto	fine Py veinlet/dolomitic arenaceous rock		·?	?				o	○	o	o[1)]						◎	o		
4	Ditto 131.75m	ditto	ditto		·?	·?					○	·	o						○	o		
5	Ditto 137.50m	ditto	Py disseminated/calcite veinlet/ dolomitic arenaceous rock		·						o	○	o						○			
6	Ditto 149.50m	ditto	ditto								◎	○	·	·								
7	Ditto 213.50m	ditto	brecciated dolomitic arenaceous rock								o	◎	·								o?	
8	Ditto 255.93m	ditto	Cp disseminated dolomitic arenaceous rock	·	o?			o?				◎		o								-?
9	MJZ-8 3.50m	ditto	Mal, Go disseminated with siderite/sand stone		o	o?			○		○	○	·	-?		o						
10	Ditto 11.00m	ditto	Cp disseminated dolomitic arenaceous rock		·	?					○	◎	·			o	-?		-?			
11	Ditto 107.00m	ditto	Cp disseminated dolomitic veinlet/dolomitic arenaceous rock	o	·	?	o	o			o	◎							o		?	
12	Ditto 116.60m	ditto	Sideritic brown limestone			·					◎	○	o			o			o			
13	Ditto 126.60m	ditto	Cp calcite veinlet/dolomitic arenaceous rock			·			-?		◎	○	o	·		o			o			
14	Ditto 255.40m	ditto	ditto		o	-?				·	o	◎										
15	MJZ-9 136.50m	Kamiyobo	Cp,Mal, Py calcite vein/black shale	o	o			o	·		o	◎	o	·					○	o		

Abbreviation

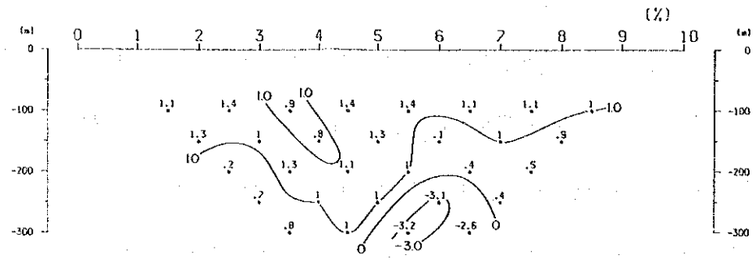
Cp : Chalcopyrite
Di : Digenite
Cc : Chalcocite
Bo : Bornite
Mal : Malachite
Py : Pyrite
Ca : Calcite
Do : Dolomite
Se : Sericite
K : Kaoline
Gy : Gypsum
Go : Gothite
Lep : Lepidocrosite
He : Hematite
Q : Quartz
Kf : Potash felolspar
Pl : Plagioclase
Am : Amphibole
Te : Tennantite

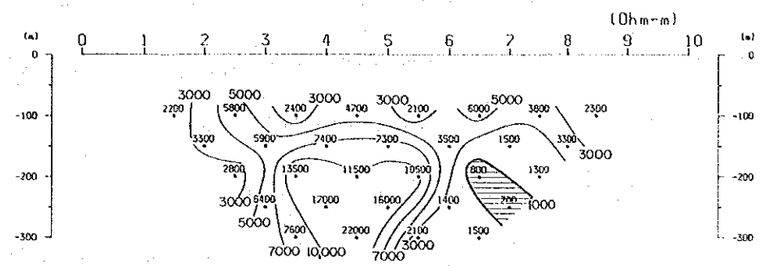
1) : 2M, type sericite
◎ : Abundant
○ : Common
o : Few
· : Rare

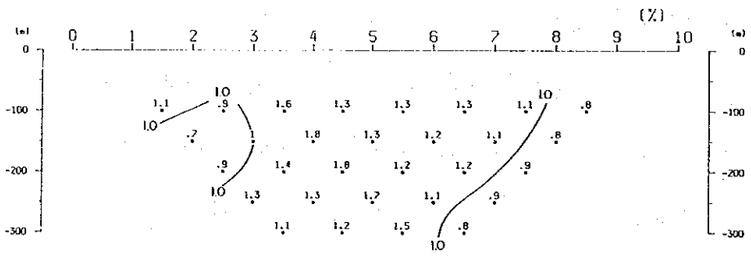
No.	Sample	Locality	Kind of Ore and Rock	Detected Minerals																		
				Cp	Di	Cc	Bo	Te	Mal	Py	Ca	Do	Se	K	Gy	Go	Lep	He	Q	Kf	Pl	Am
16	MJZ-9 157.92m	Kamiyobo	Cp, Cy disseminated/Py calcite veinlet/conglomeratic black shale	·		o?						◎	o						○	o		·
17	Ditto 198.48m	ditto	Py calcite veinlet/conglomeratic black shale		?					o	o?	◎							o	o	?	
18	Ditto 243.20m	ditto	Py disseminated/conglomeratic black shale							o		○	o[1]		·				○			
19	Ditto 243.52m	ditto	Py disseminated/conglomeratic black shale		?					o		○	o[1]						○			
20	Ditto 250.12m	ditto	Py disseminated dolomitic calcite vein								o	◎	·								o	
21	Ditto 253.26m	ditto	Py disseminated/conglomerate							o	o	◎	o						○		o?	
22	MJZ-10 84.10m	ditto	Go calcite vein/chert													◎	o	o	?			
23	Ditto 143.90m	ditto	Py, Go disseminated quartz vein/ chert								○	◎	·	·		o			o		o	
24	Ditto 148.13m	ditto	Limonite calcite vein/chert								◎	o	·	·		o	o		○			
25	Ditto 290.55m	ditto	Cp, Cc, calcite veinlet/ conglomeratic black shale	o		o				o		◎	o	·					○	·	o	
26	MJZ-11 169.73m	Sable Antelope	Py disseminated network/dolomitic arenaceous rock							o	o	◎									o	
27	Ditto 170.99m	ditto	ditto							o	o	◎								·	o	
28	Ditto 180.80m	ditto	Py veinlet/fine dolomitic arenaceous rock								o	◎									o?	
29	Ditto 213.85m	ditto	Py disseminated/fine dolomitic arenaceous rock							o	◎	o										
30	MJZ-12 20.60m	ditto	Py disseminated/dolomitic sand stone							·	o	◎									o	

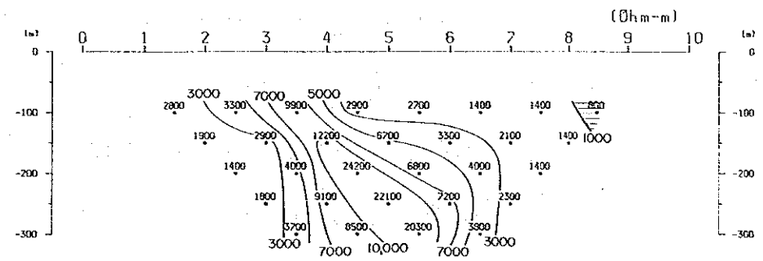
REPORT ON THE MINERAL EXPLORATION OF KARENDA AREA, THE REPUBLIC OF ZAMBIA PHASE III

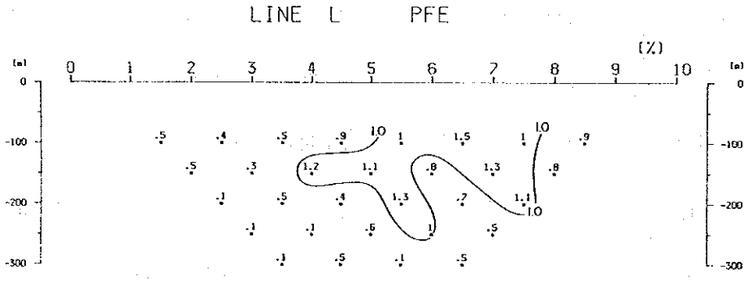
PSEUDO-SECTION OF PFE & AR LINE J, K, L

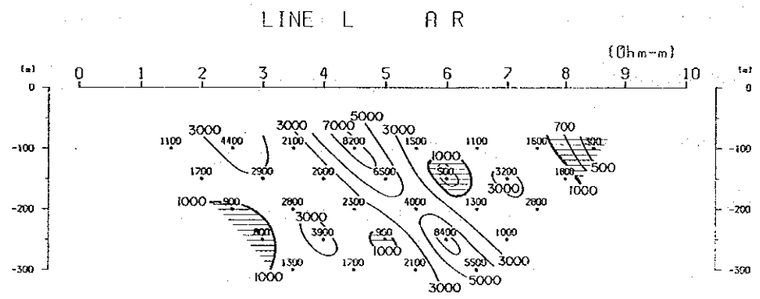


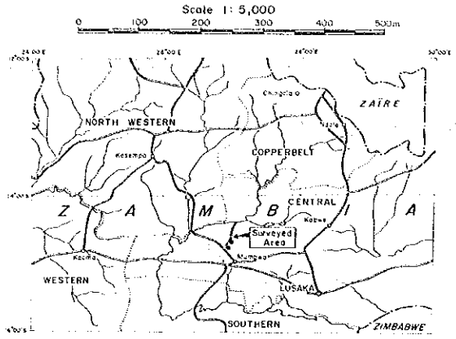












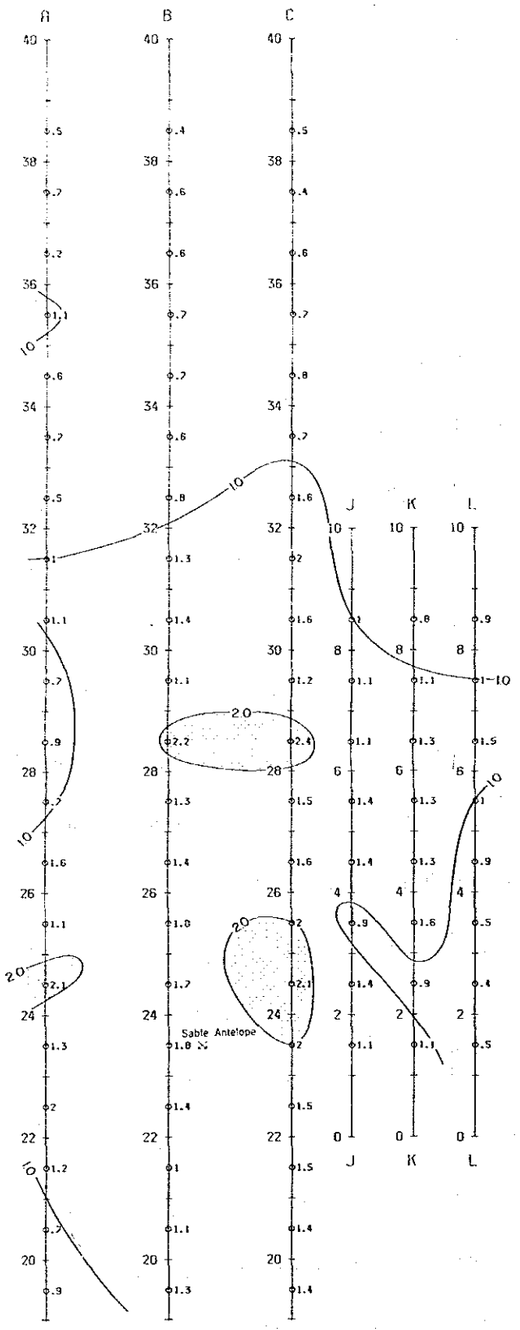
JANUARY - 1987

JAPAN INTERNATIONAL COOPERATION AGENCY
METAL MINING AGENCY OF JAPAN

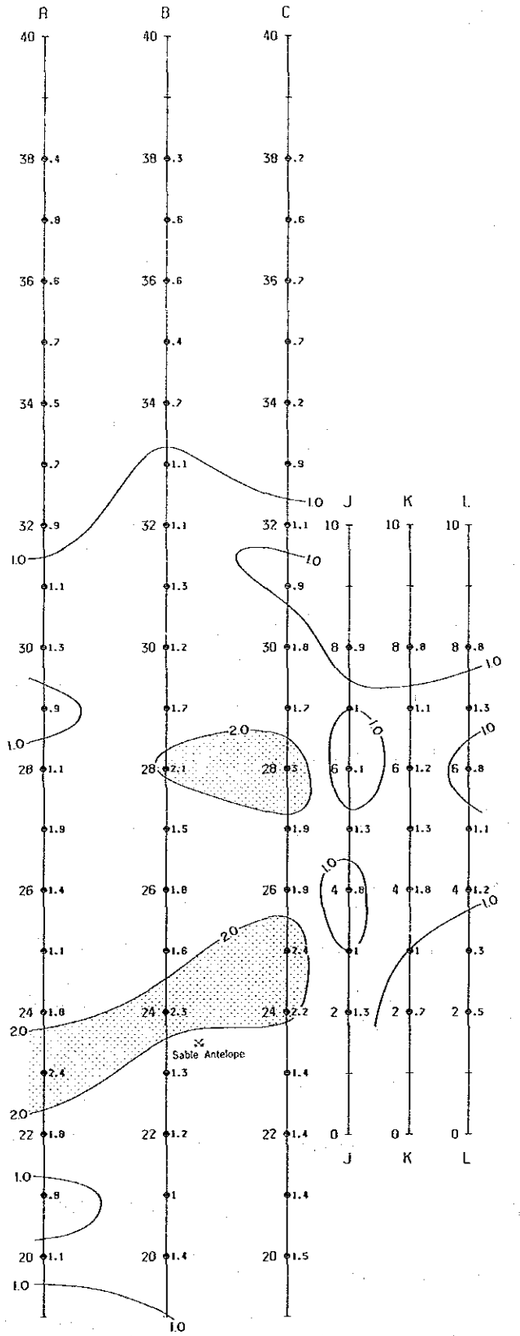
LEGEND

- Percent Frequency Effect (%)
- Contour Interval ·····0, 1, 2,·····
- Apparent Resistivity (ohm-m)
- Contour Interval ·····1000, 3000, 5000, 7000, 10000·····
- <1000 ohm-m

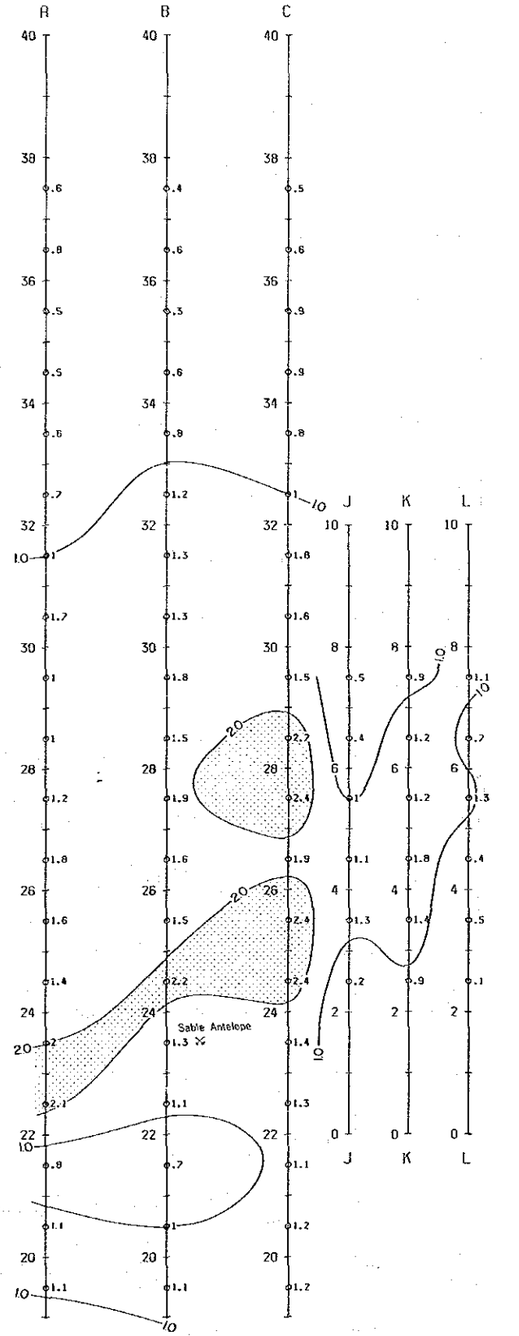
N= 1


A
B
C
J
K
L
Sable Antelope

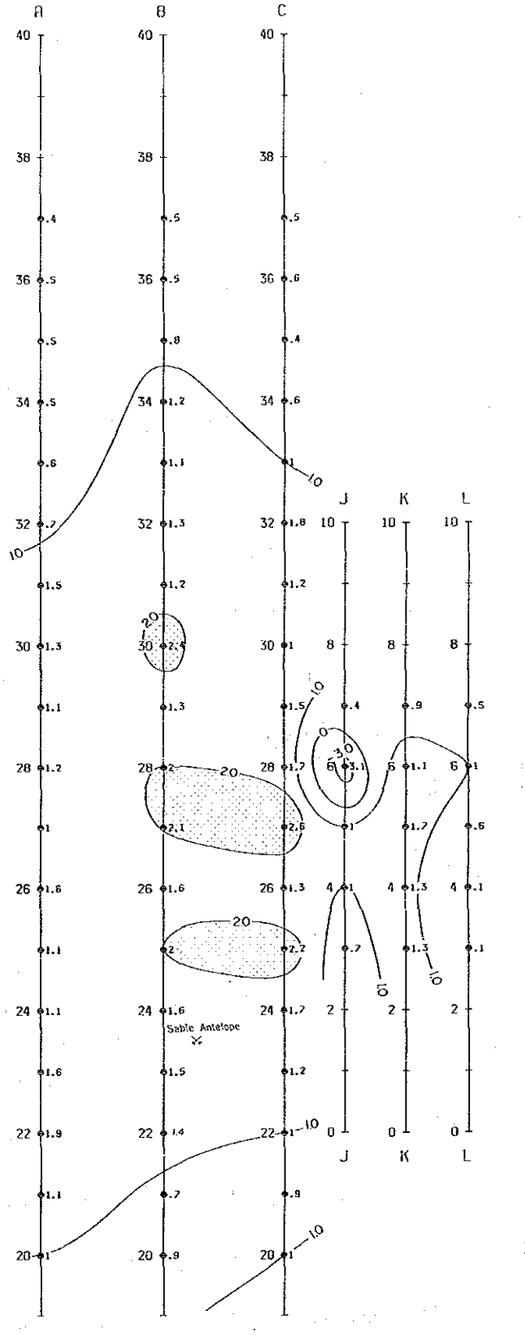
N= 2

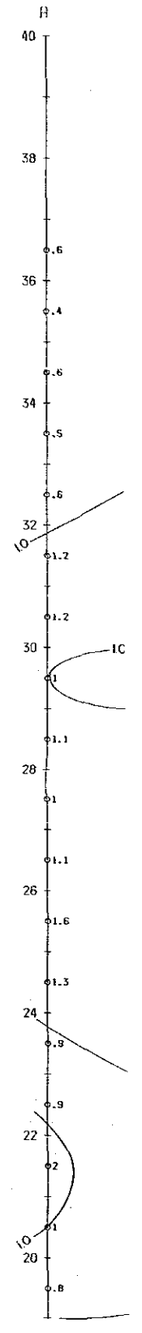

A
B
C
J
K
L
Sable Antelope

N= 3


A
B
C
J
K
L
Sable Antelope

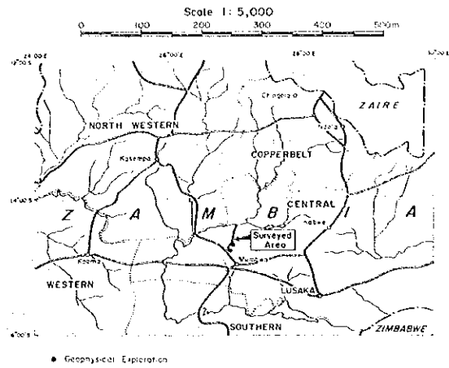
N= 4


A
B
C
J
K
L
Sable Antelope


A

REPORT ON THE MINERAL EXPLORATION OF KARENDA AREA, THE REPUBLIC OF ZAMBIA PHASE II

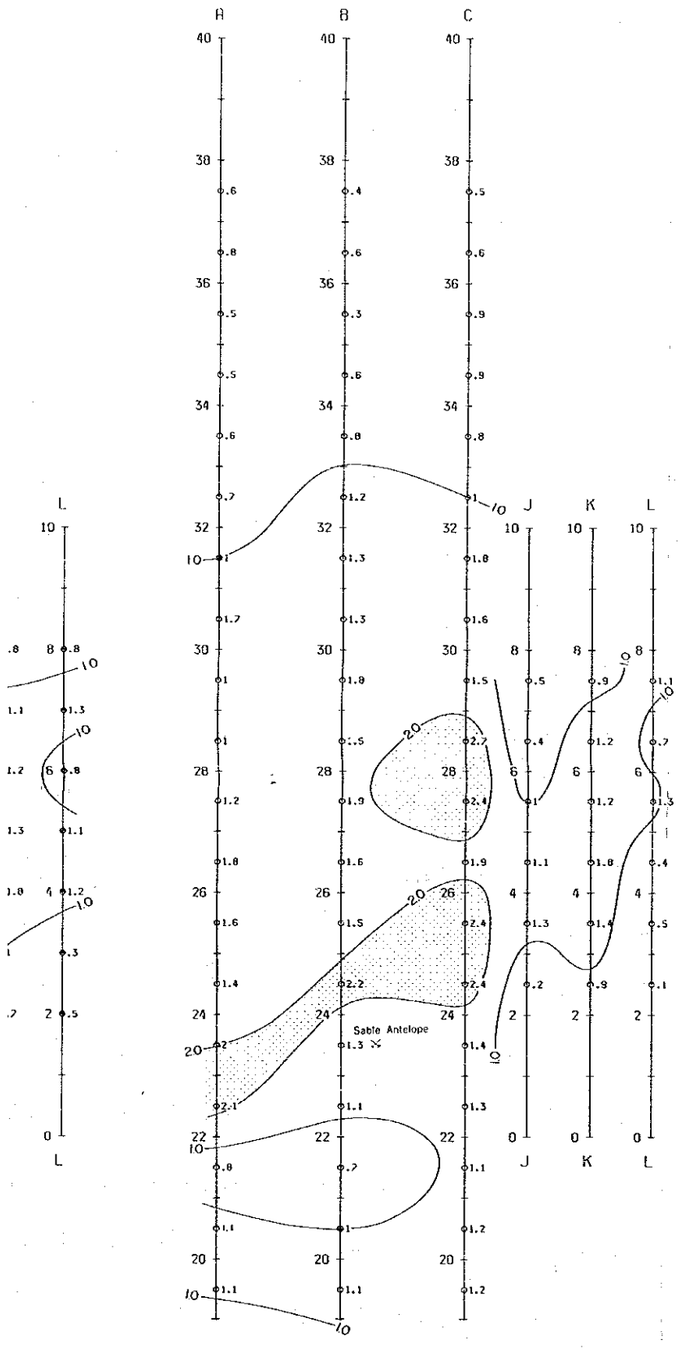
PLAN MAP OF PFE [0.125~1.0Hz] (N=1~5)



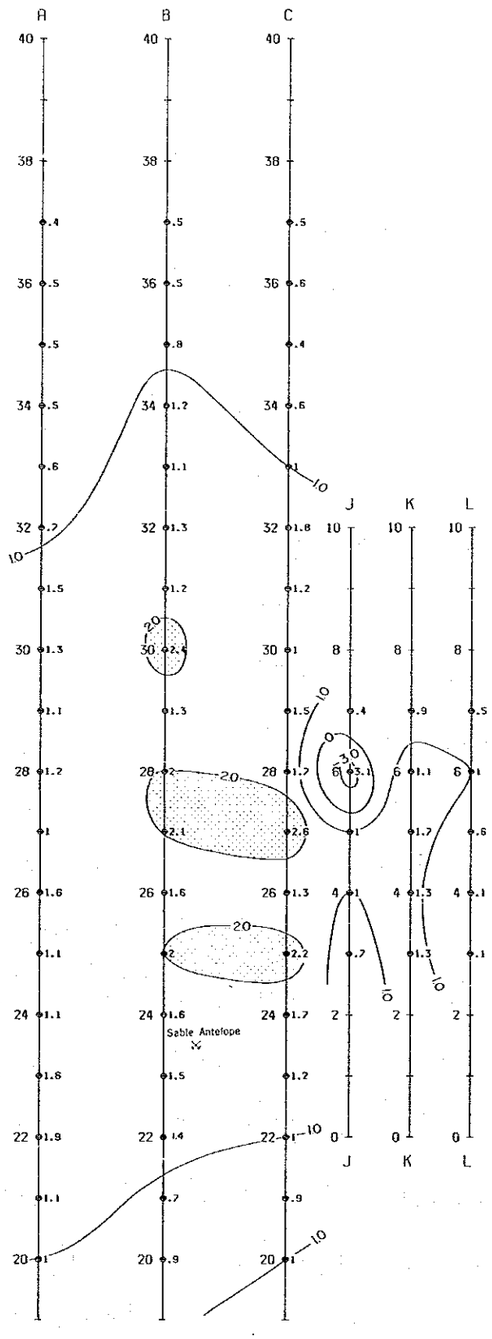
JANUARY 1987

JAPAN INTERNATIONAL COOPERATION AGENCY
METAL MINING AGENCY OF JAPAN

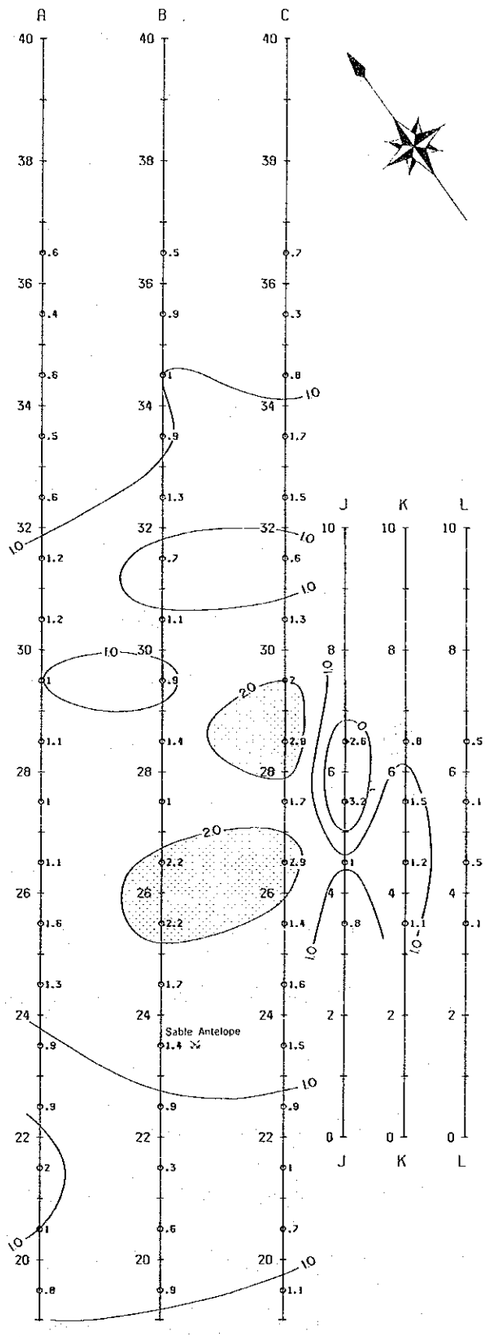
N= 3



N= 4

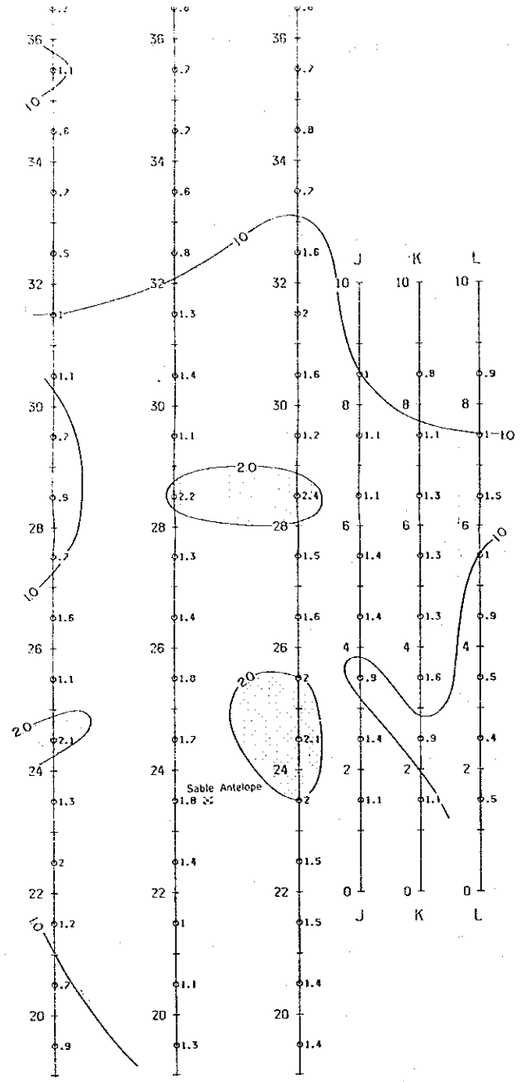


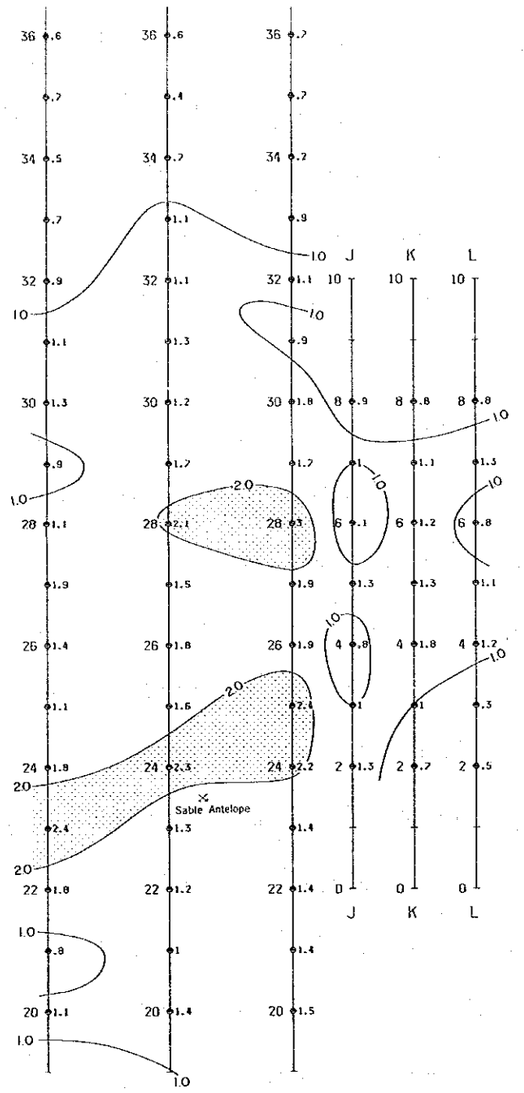
N= 5

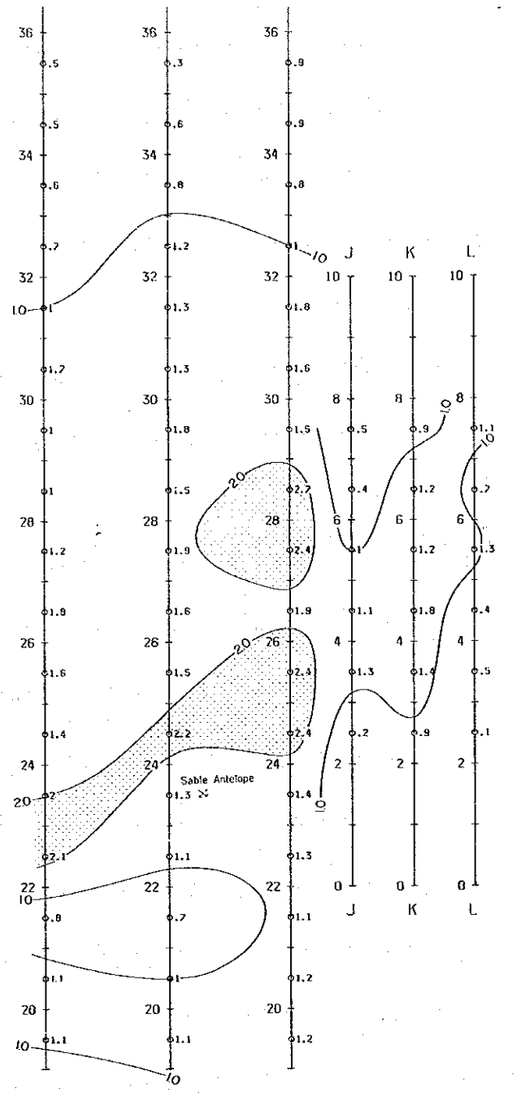


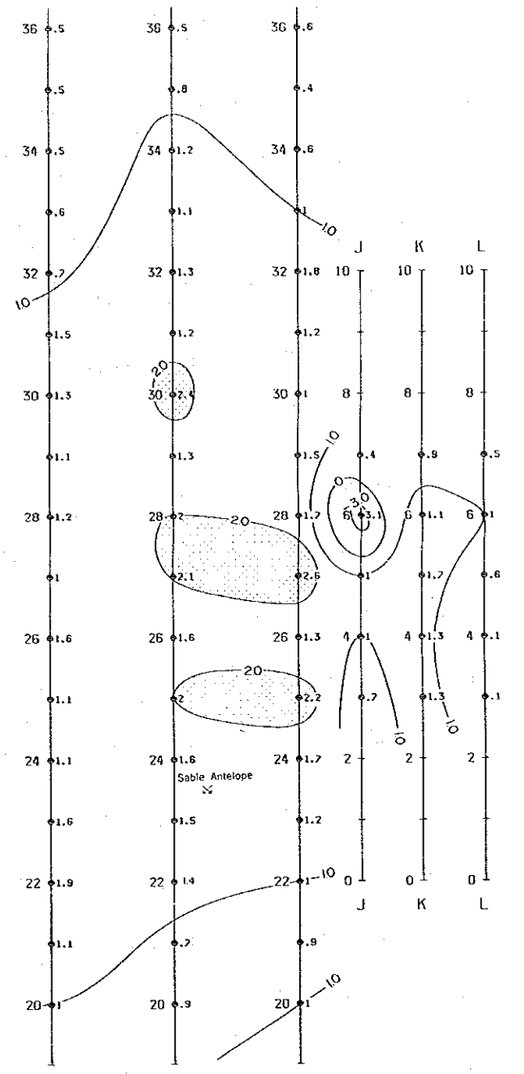
LEGEND

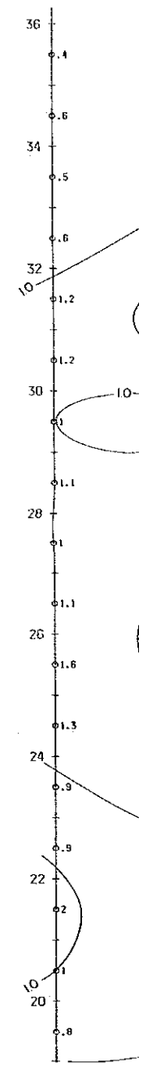
- A~C IP Line (Phase II)
- J~L SIP Line (Phase III)
- Percent Frequency Effect (%)
- Contour Interval ·····0, 1, 2, ·····
- >2 %

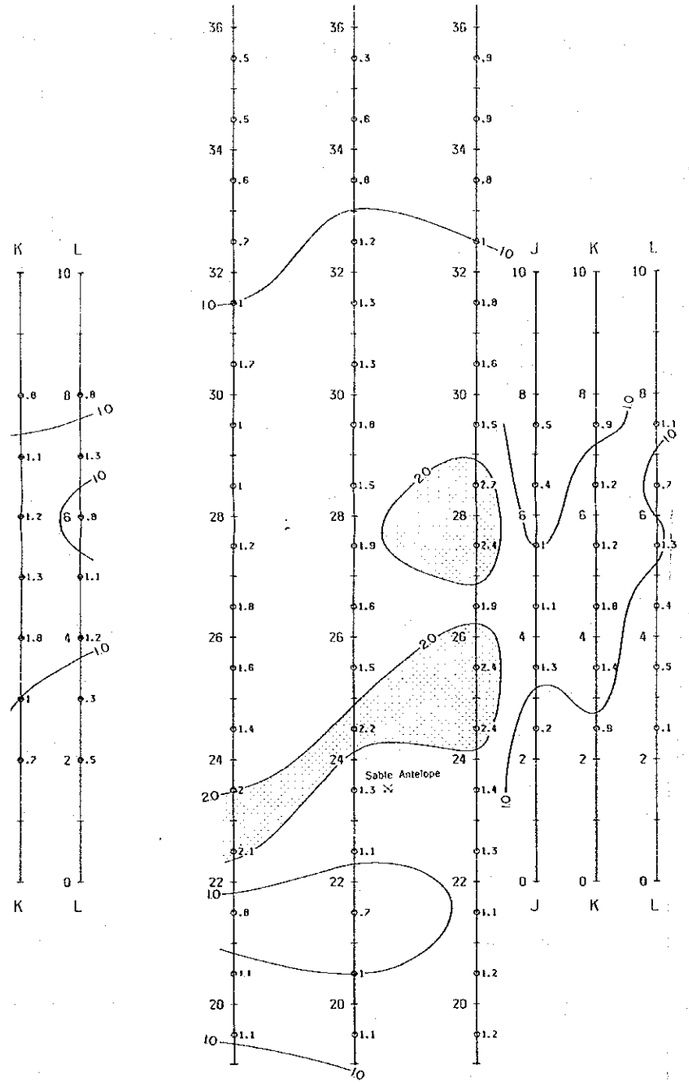

J
K
L
Sable Antelope

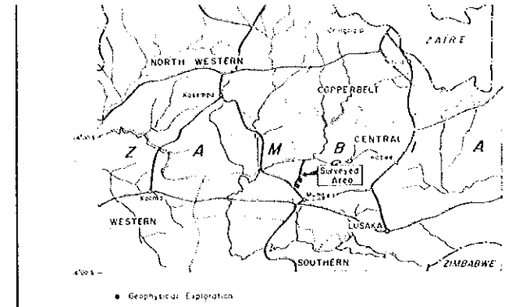

J
K
L
Sable Antelope


J
K
L
Sable Antelope


J
K
L
Sable Antelope







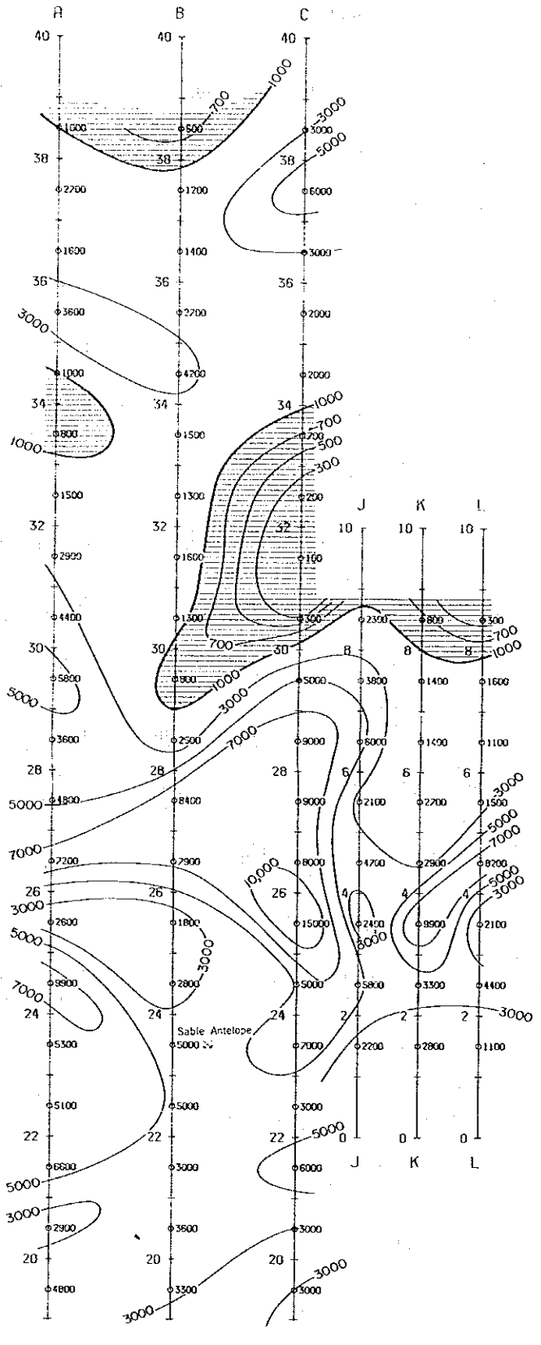
JANUARY 1987

JAPAN INTERNATIONAL COOPERATION AGENCY
METAL MINING AGENCY OF JAPAN

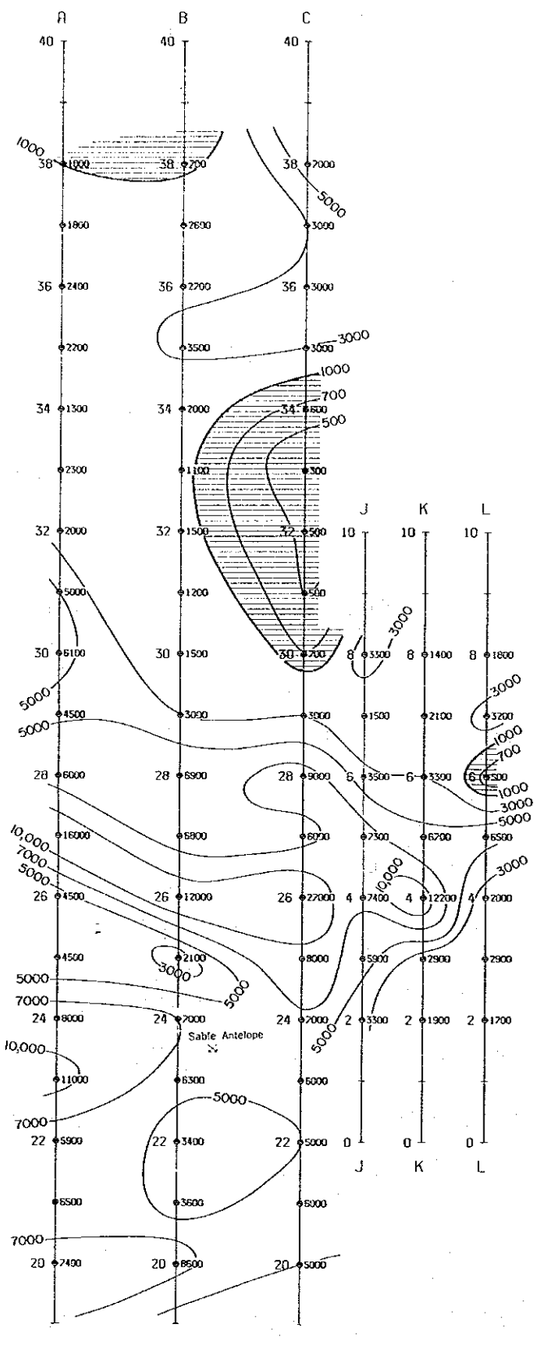
LEGEND

- A - C IP Line (Phase II)
- J - L SIP Line (Phase III)
- Percent Frequency Effect (%)
- Contour Interval ……0, 1, 2, ……
- >2 %

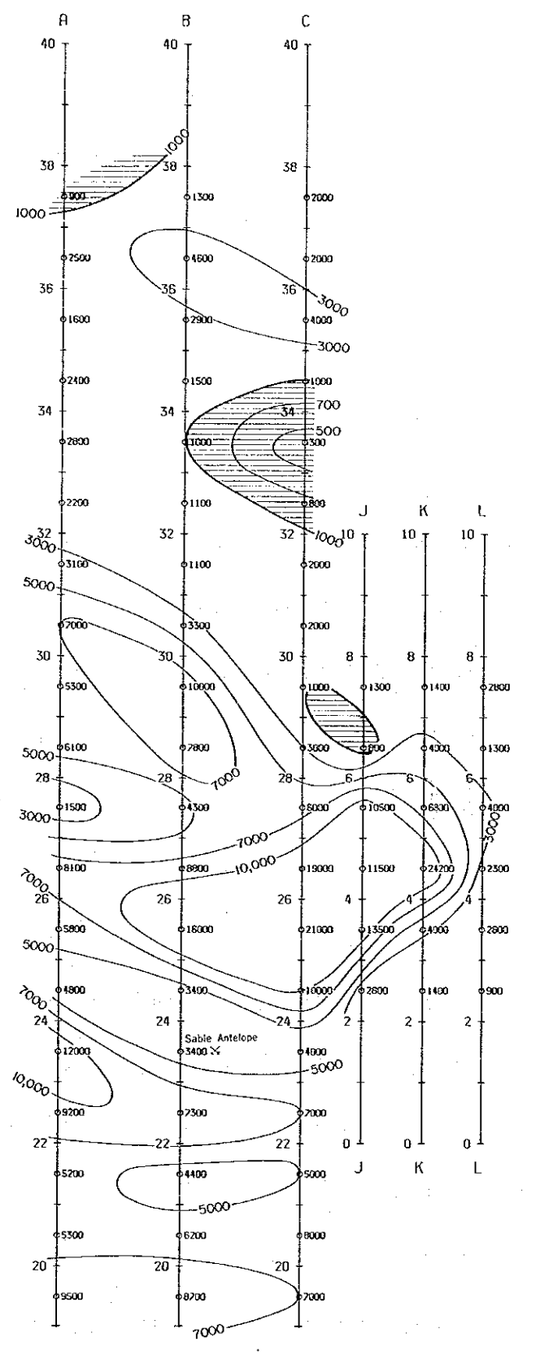
N= 1


A
B
C
J
K
L
Sable Antelope

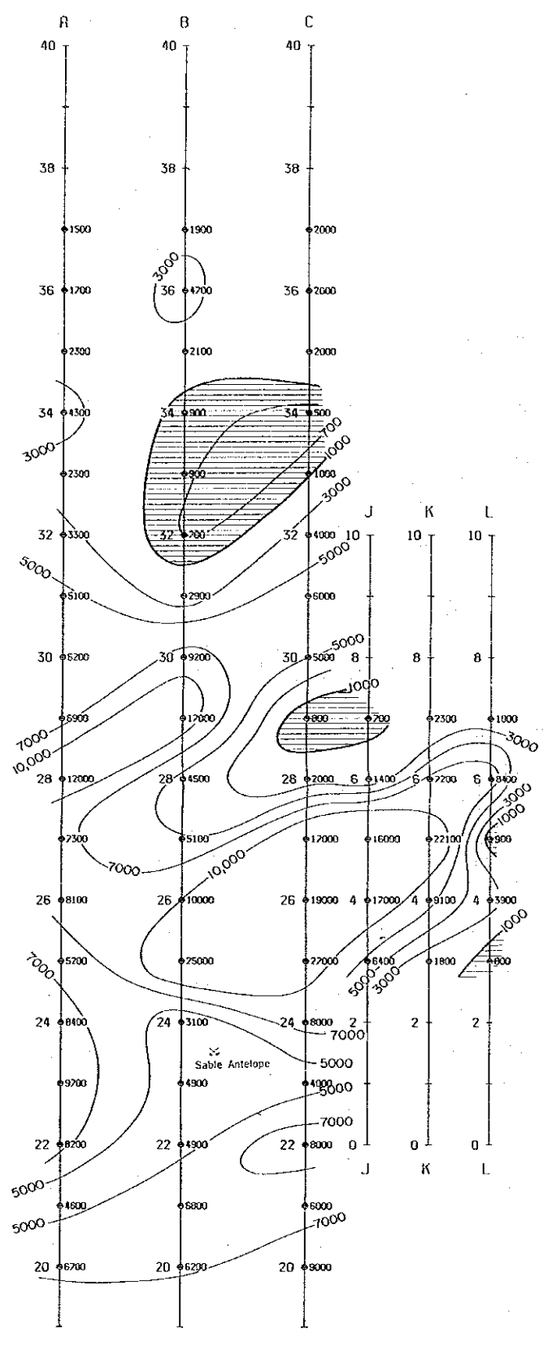
N= 2


A
B
C
J
K
L
Sable Antelope

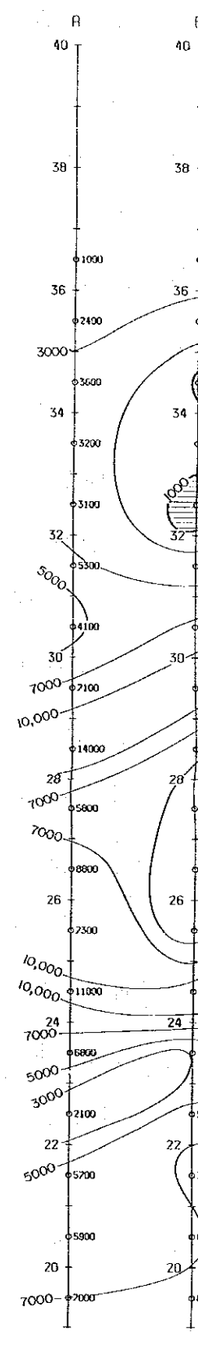
N= 3

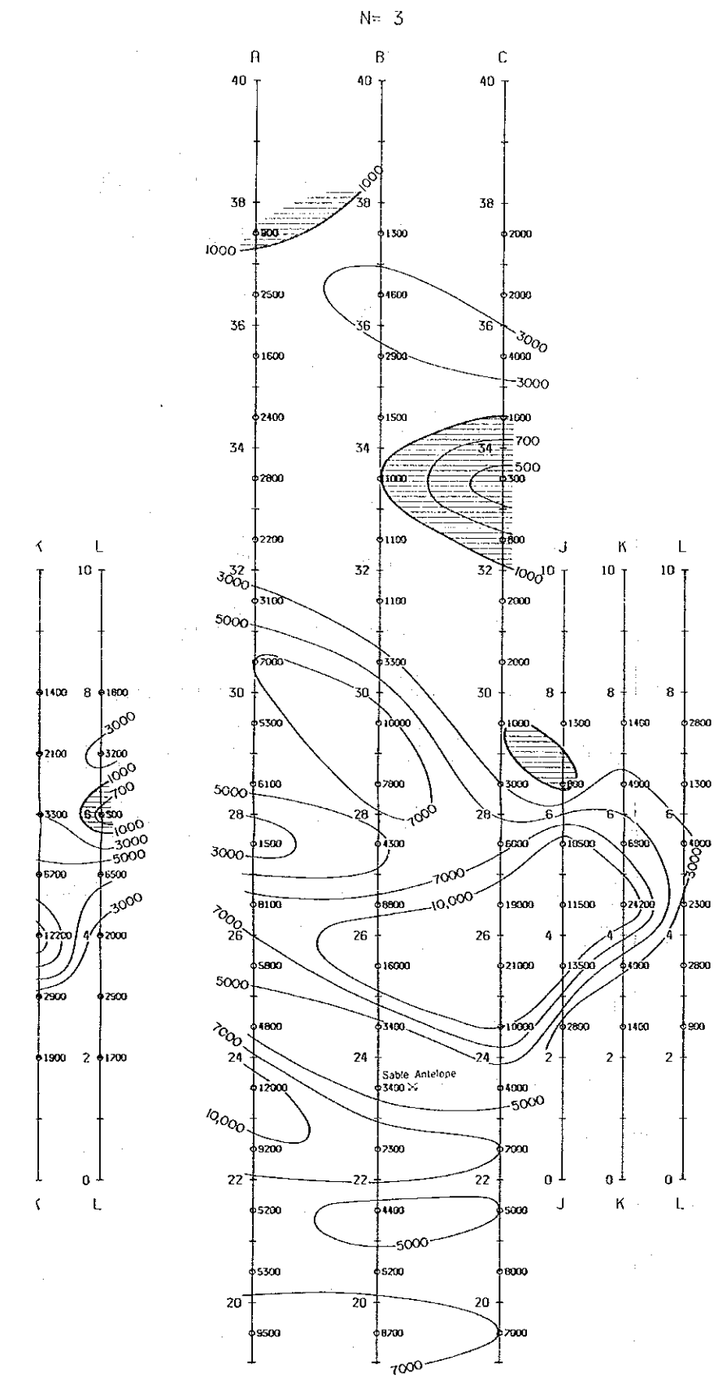

A
B
C
J
K
L
Sable Antelope

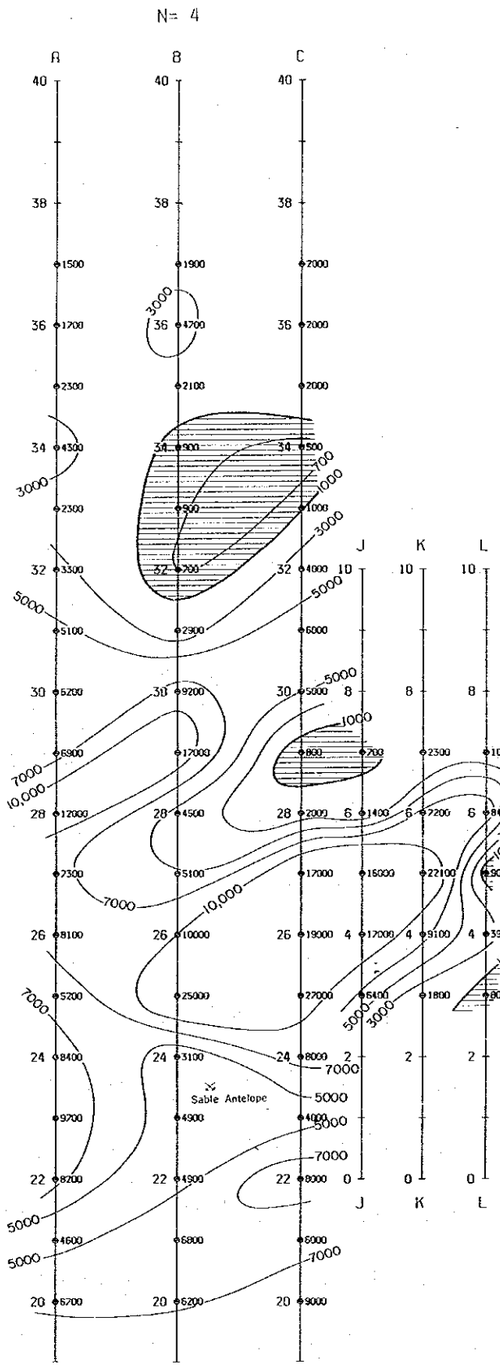
N= 4

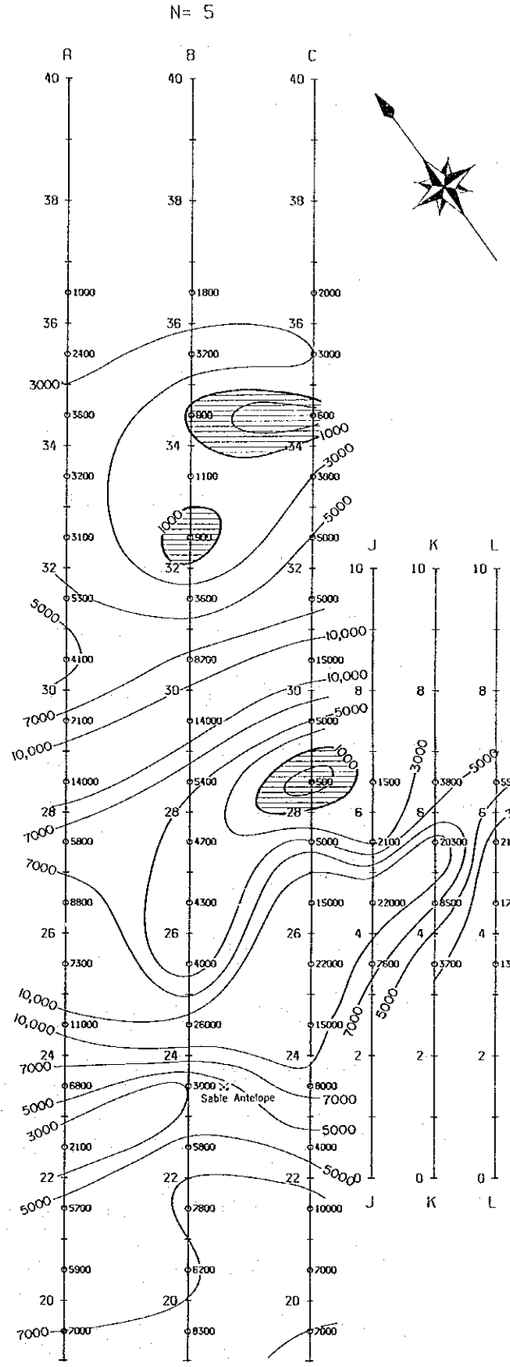

A
B
C
J
K
L
Sable Antelope

N=


A
B
C



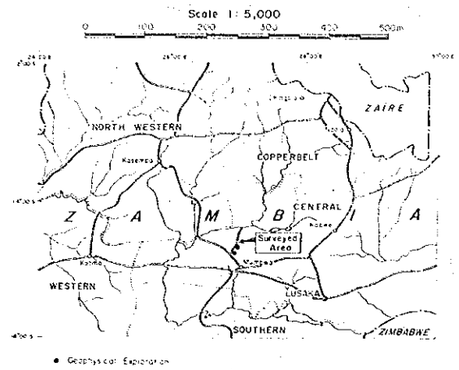




PL 3

REPORT ON THE MINERAL EXPLORATION OF KARENDA AREA, THE REPUBLIC OF ZAMBIA PHASE III

PLAN MAP OF AR [0.125Hz] (N=1~5)

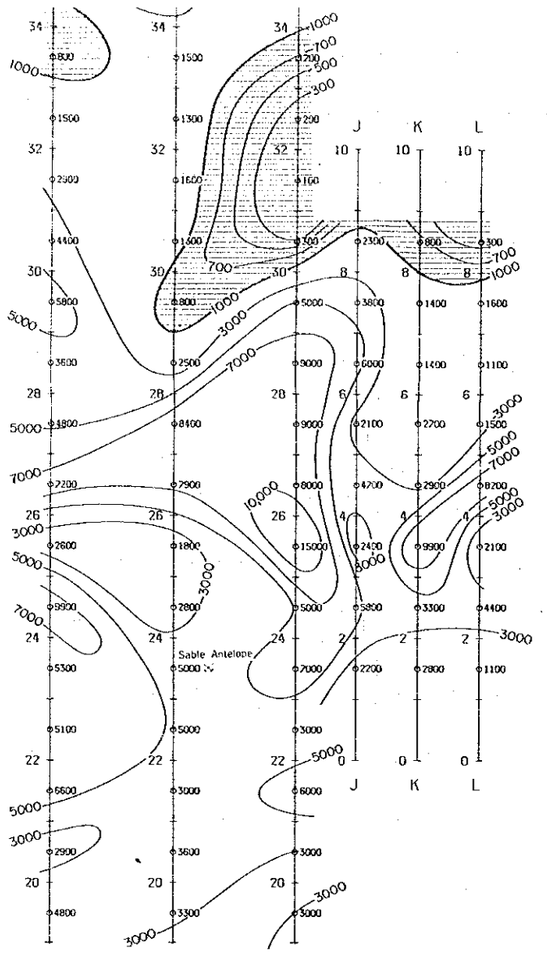


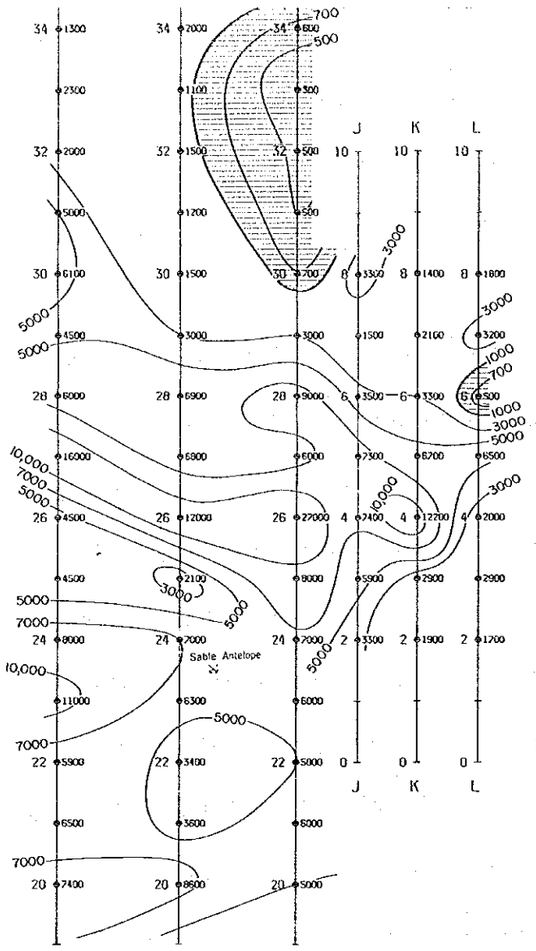
JANUARY 1987

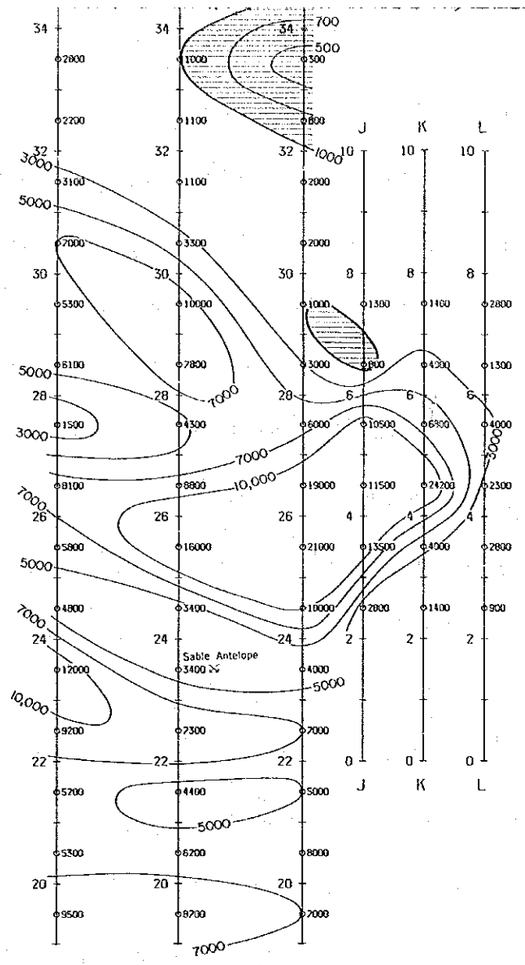
JAPAN INTERNATIONAL COOPERATION AGENCY
METAL MINING AGENCY OF JAPAN

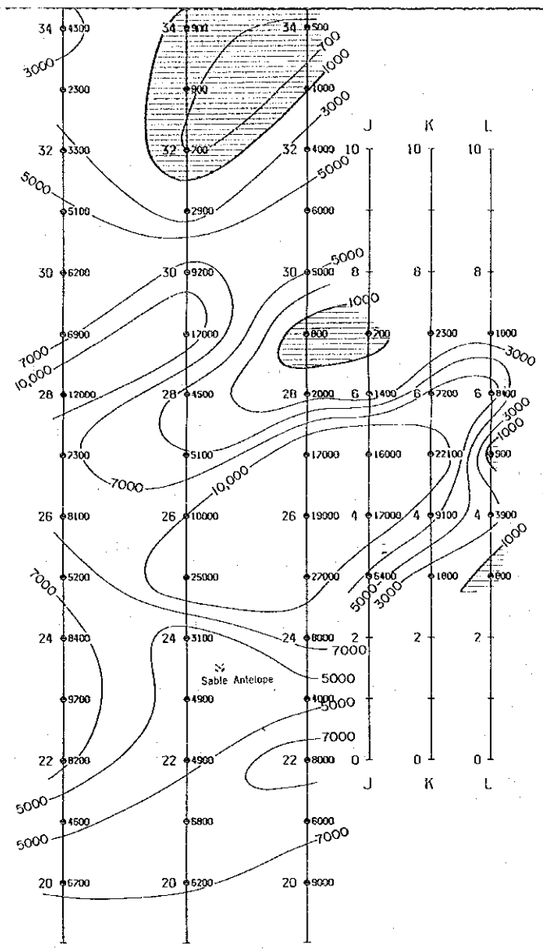
LEGEND

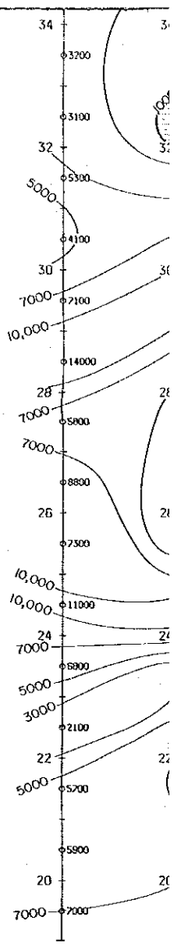
- A~C IP Line (Phase II)
- J~L SIP Line (Phase III)
- Apparent Resistivity (ohm-m)
- Contour Interval ·····1000, 3000, 5000, 7000, 10000 ·····
- <1000 ohm-m

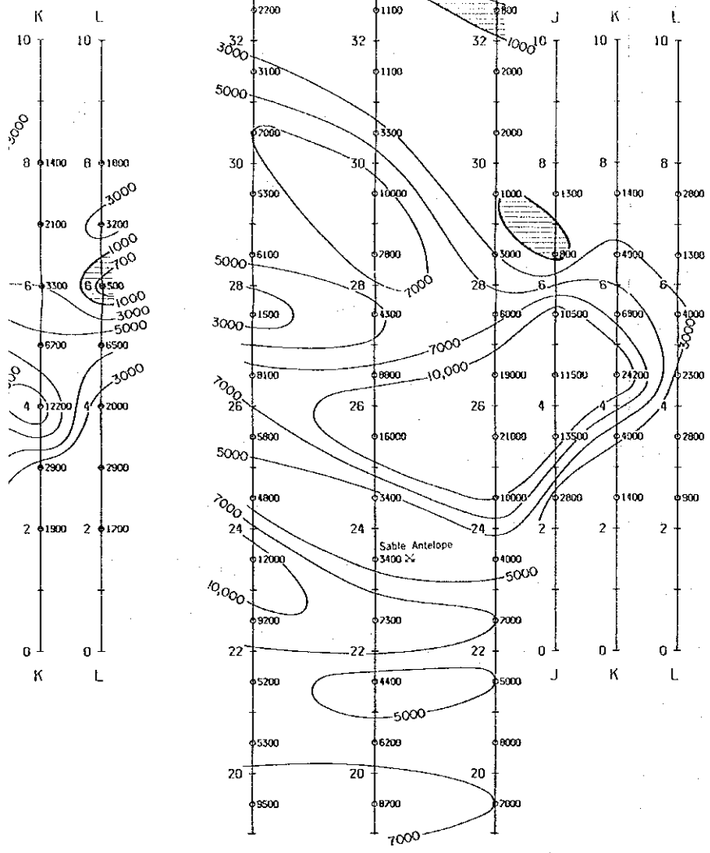

J K L
Sable Antelope

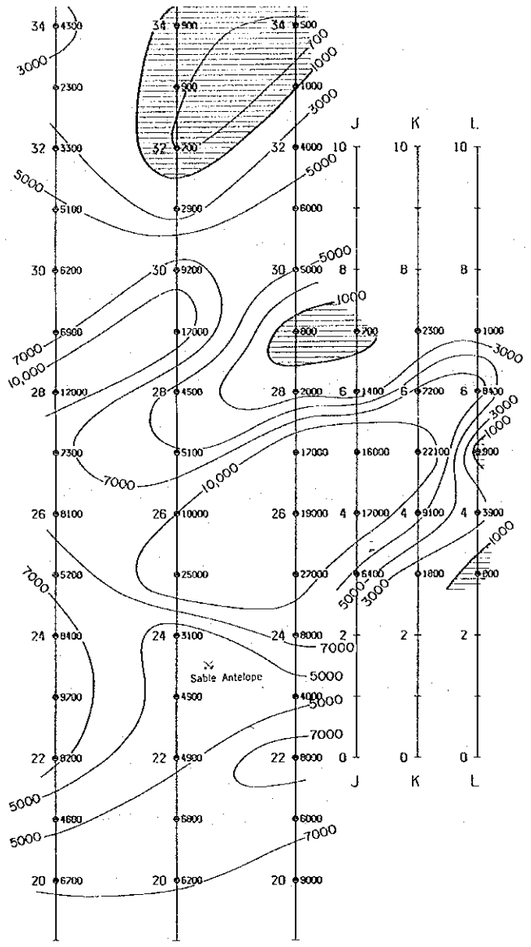

J K L
Sable Antelope

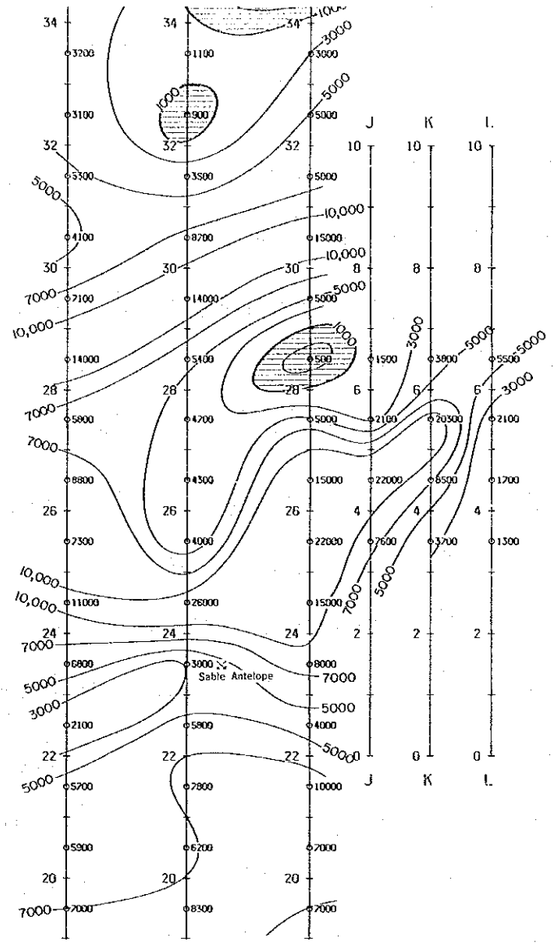

J K L
Sable Antelope

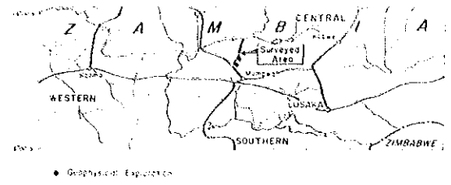

J K L
Sable Antelope









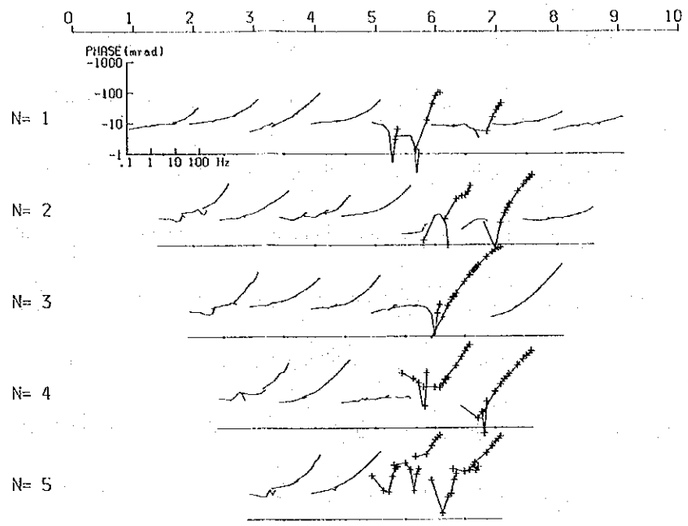


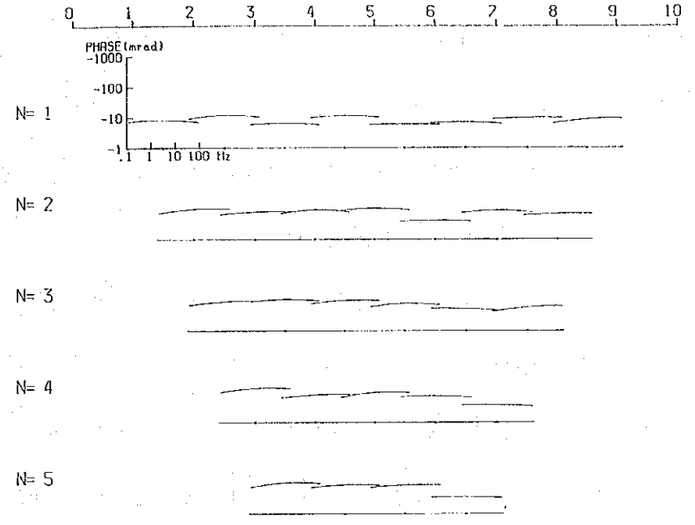
JANUARY 1987

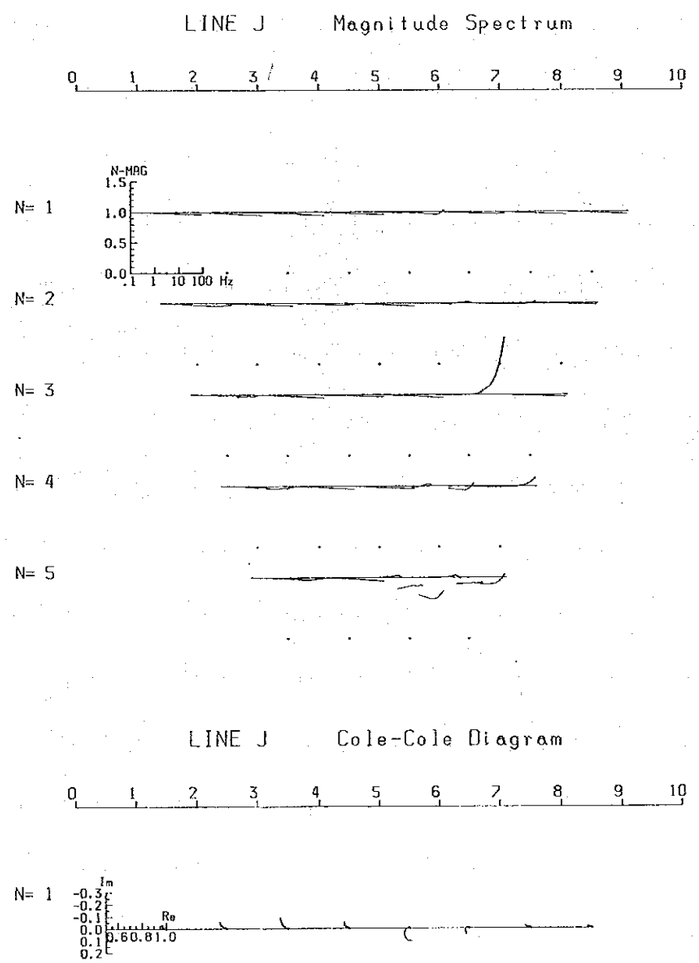
JAPAN INTERNATIONAL COOPERATION AGENCY
METAL MINING AGENCY OF JAPAN

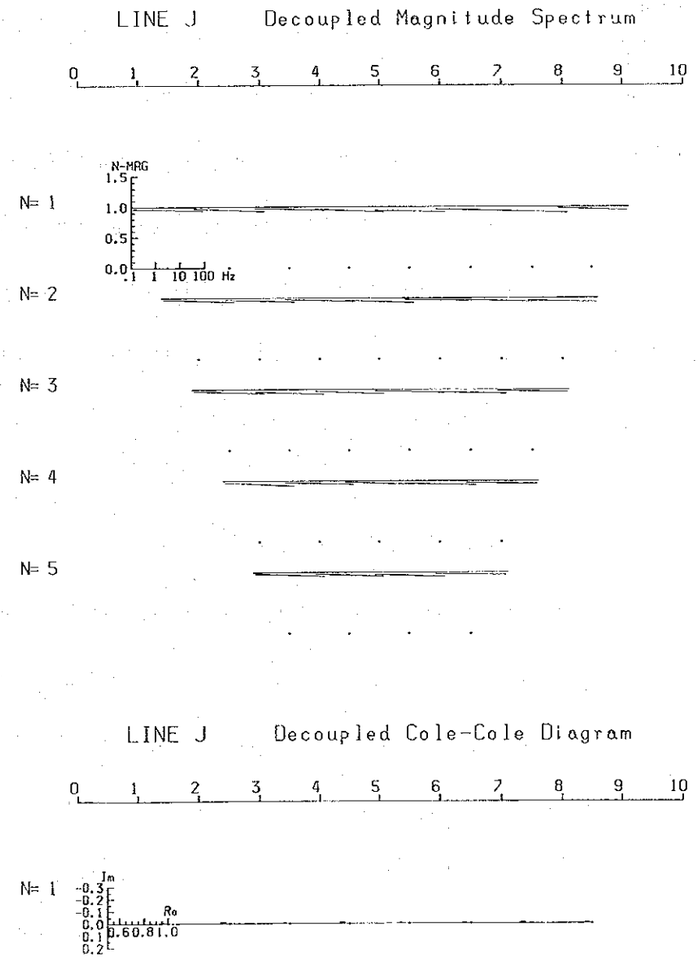
LEGEND

- A - C IP Line (Phase II)
- J - L SIP Line (Phase III)
- 1300 Apparent Resistivity (ohm-m)
- 400 Contour Interval ·····1000, 3000, 5000, 7000, 10000·····
- <1000 ohm-m





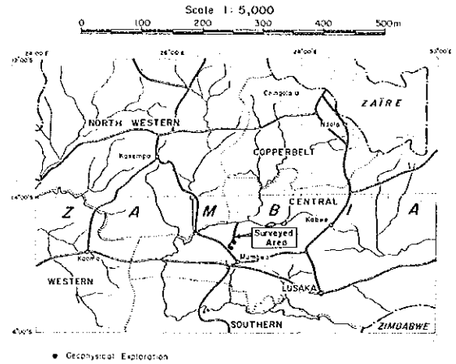




PL 4

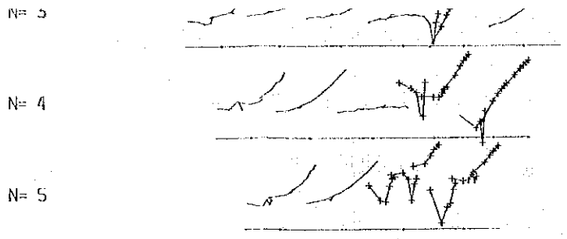
REPORT ON THE MINERAL EXPLORATION
OF KARENDA AREA, THE REPUBLIC OF ZAMBIA
PHASE Ⅲ

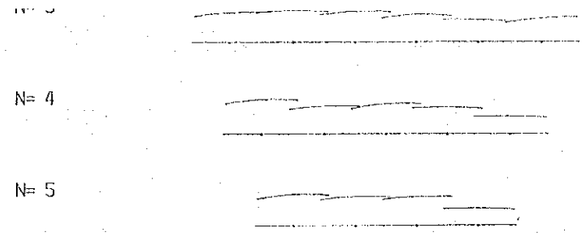
PHASE, MAGNITUDE & COLE-COLE SPECTRUM LINE J

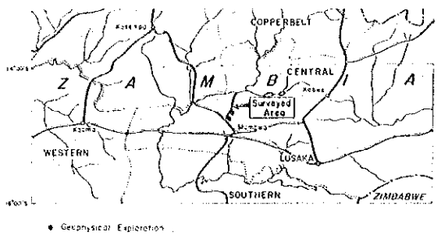


JANUARY 1987

JAPAN INTERNATIONAL COOPERATION AGENCY
METAL MINING AGENCY OF JAPAN



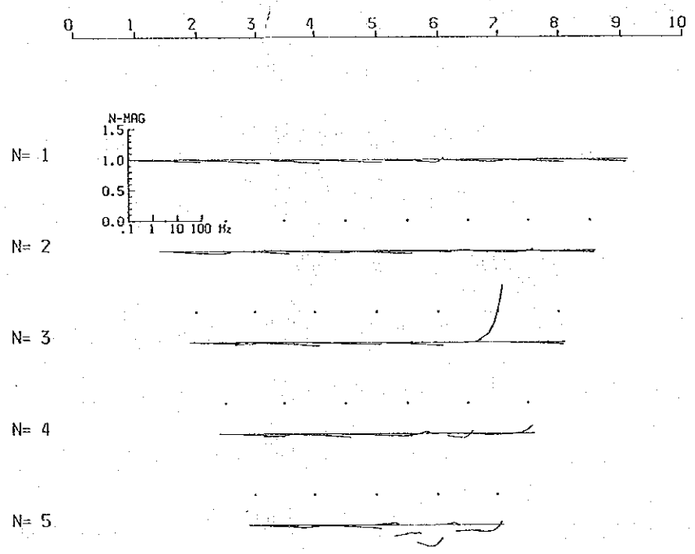




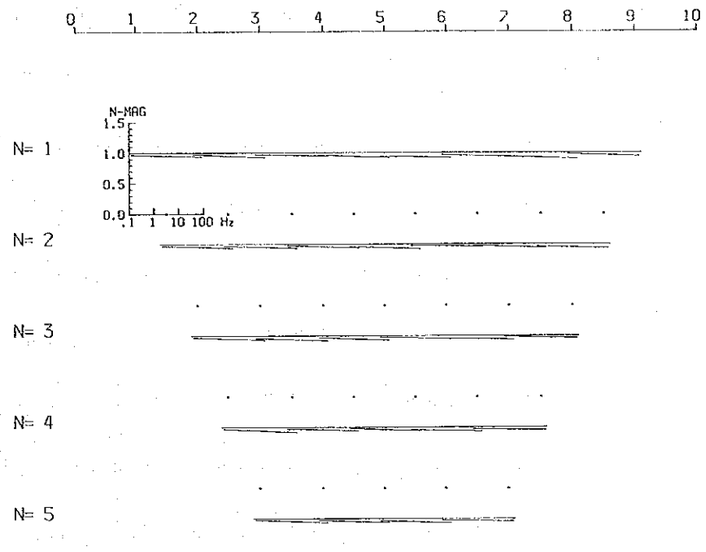
JANUARY · 1987

JAPAN INTERNATIONAL COOPERATION AGENCY
METAL MINING AGENCY OF JAPAN

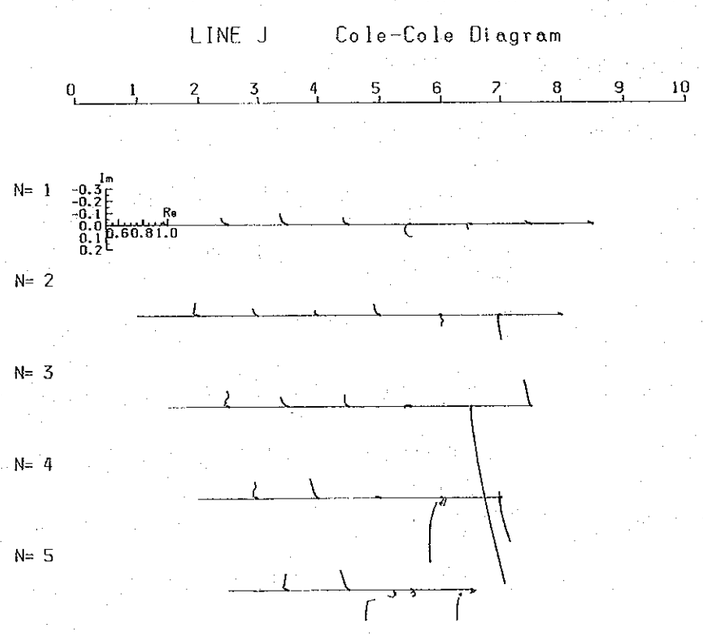
LINE J Magnitude Spectrum



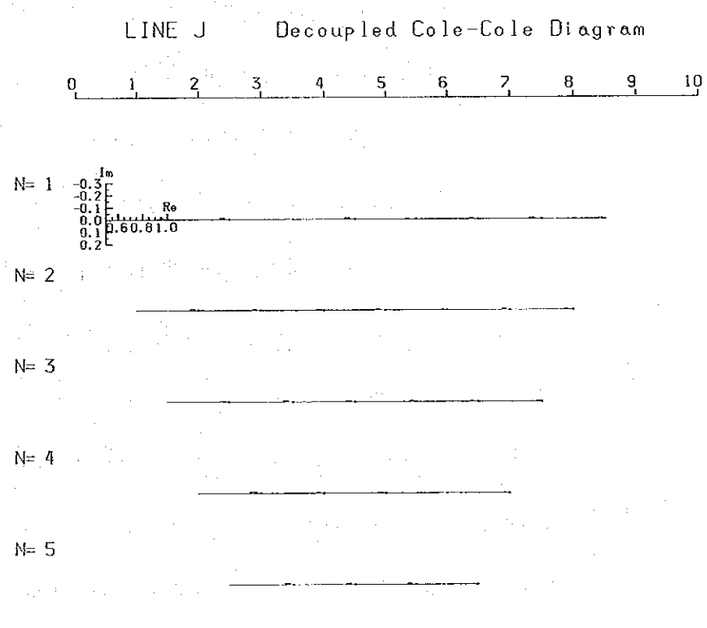
LINE J Decoupled Magnitude Spectrum



LINE J Cole-Cole Diagram

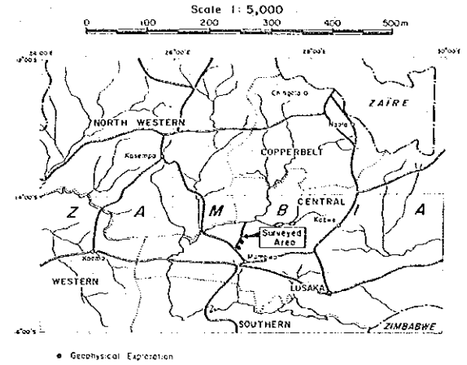


LINE J Decoupled Cole-Cole Diagram



REPORT ON THE MINERAL EXPLORATION
OF KARENDA AREA, THE REPUBLIC OF ZAMBIA
PHASE II

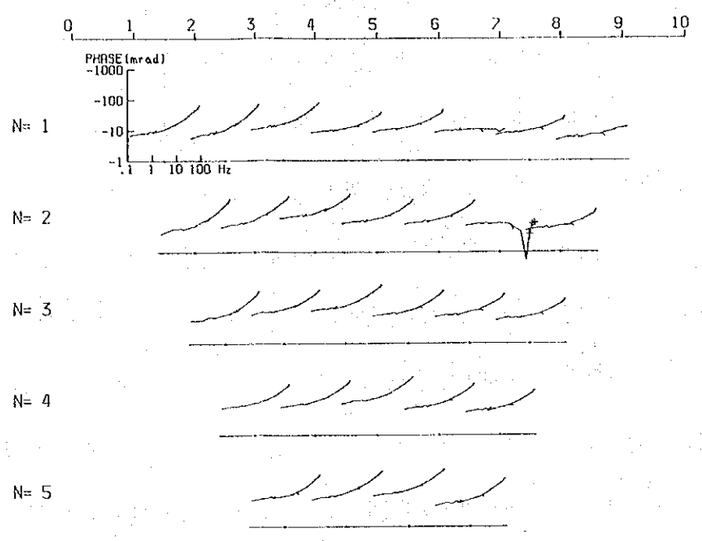
PHASE, MAGNITUDE & COLE-COLE SPECTRUM LINE K



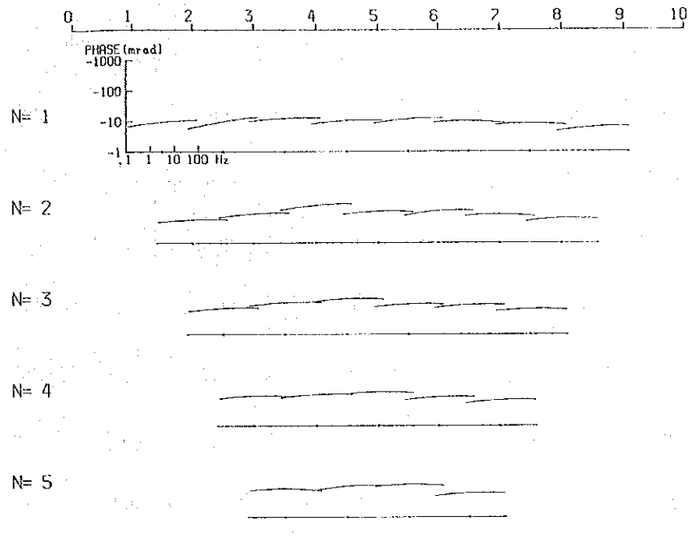
JANUARY · 1987

JAPAN INTERNATIONAL COOPERATION AGENCY
METAL MINING AGENCY OF JAPAN

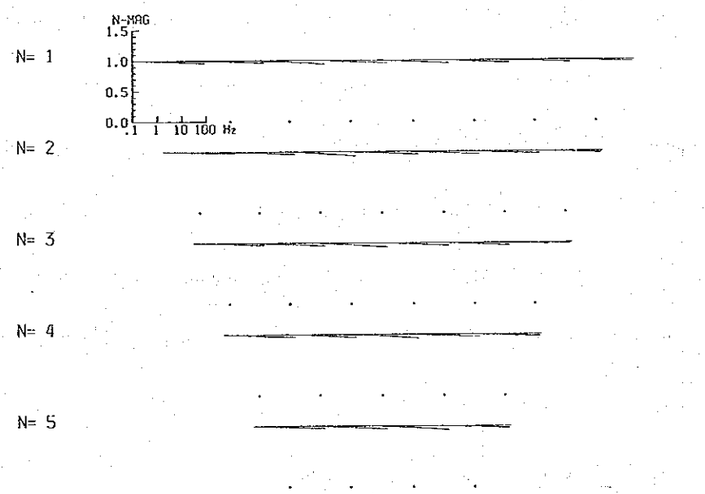
LINE K Phase Spectrum



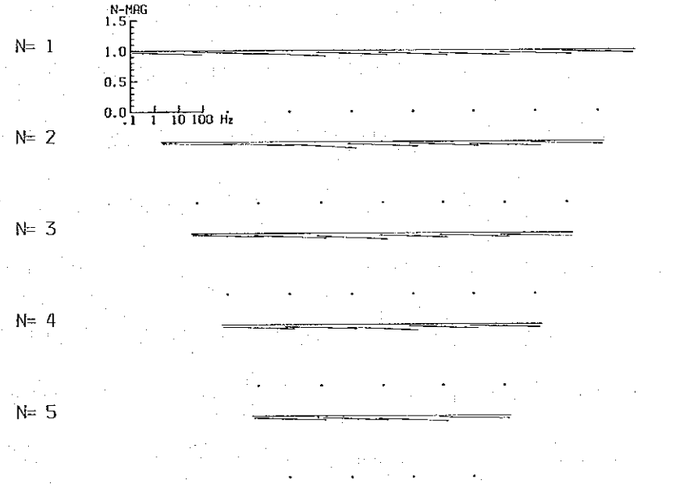
LINE K Decoupled Phase Spectrum



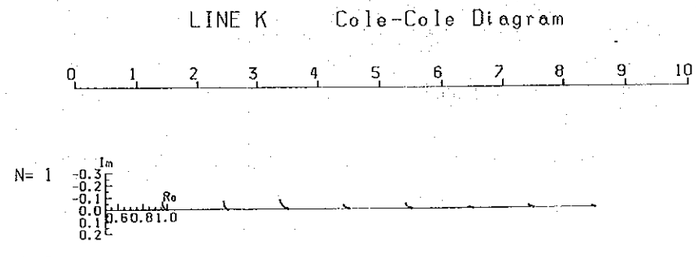
LINE K Magnitude Spectrum



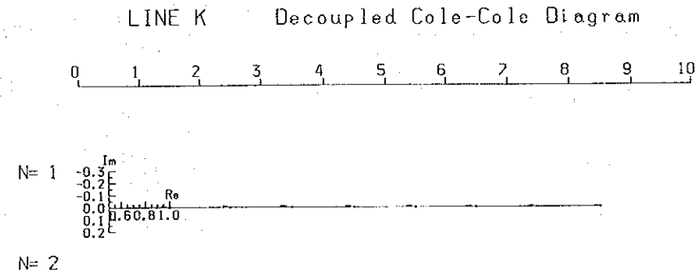
LINE K Decoupled Magnitude Spectrum

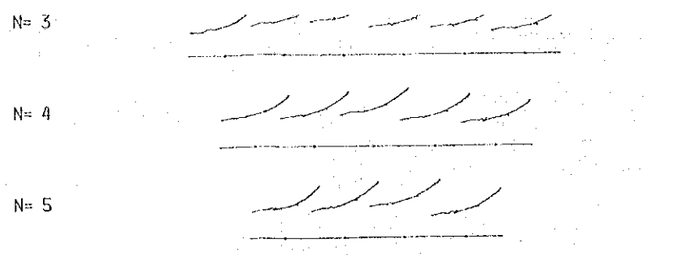


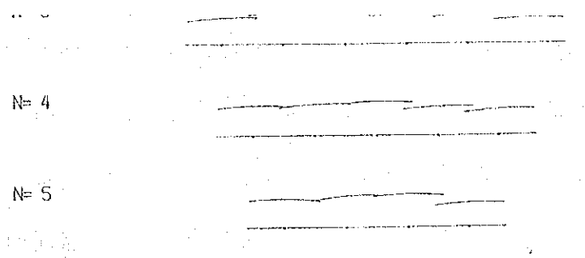
LINE K Cole-Cole Diagram

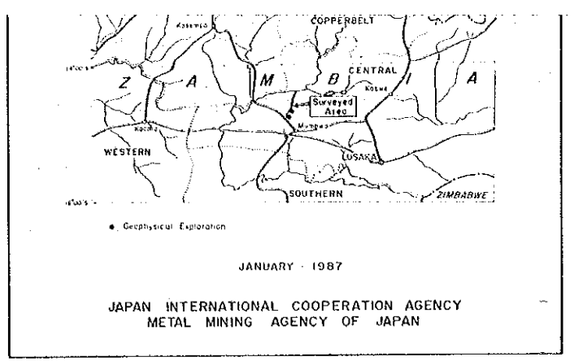


LINE K Decoupled Cole-Cole Diagram

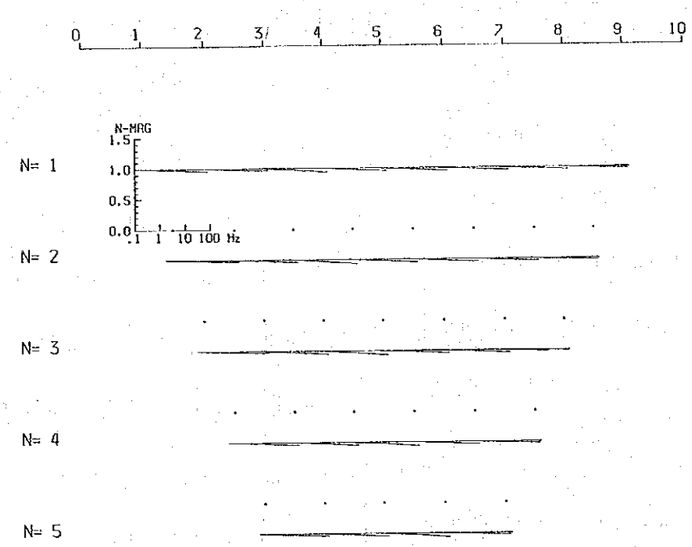




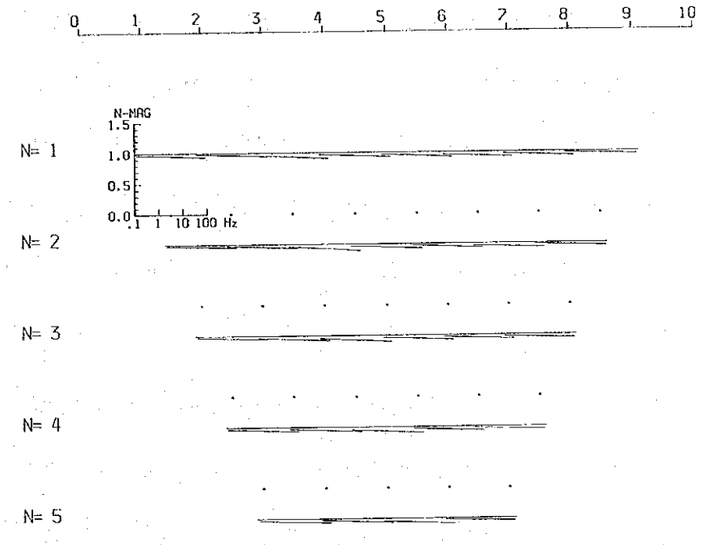




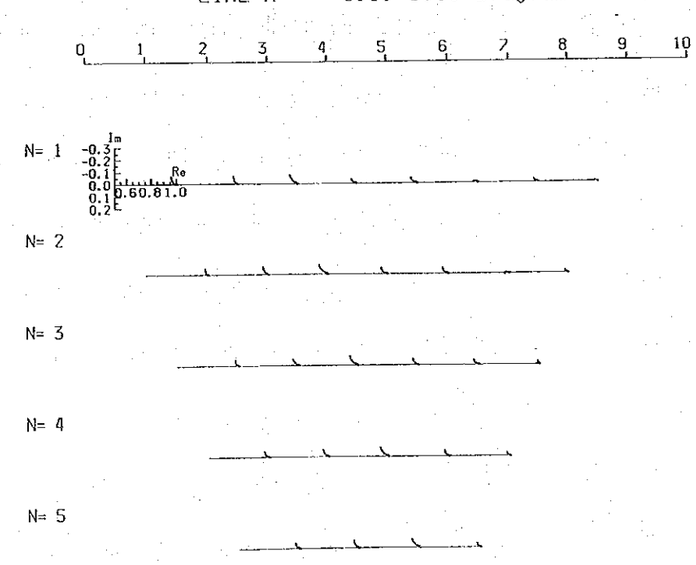
LINE K Magnitude Spectrum



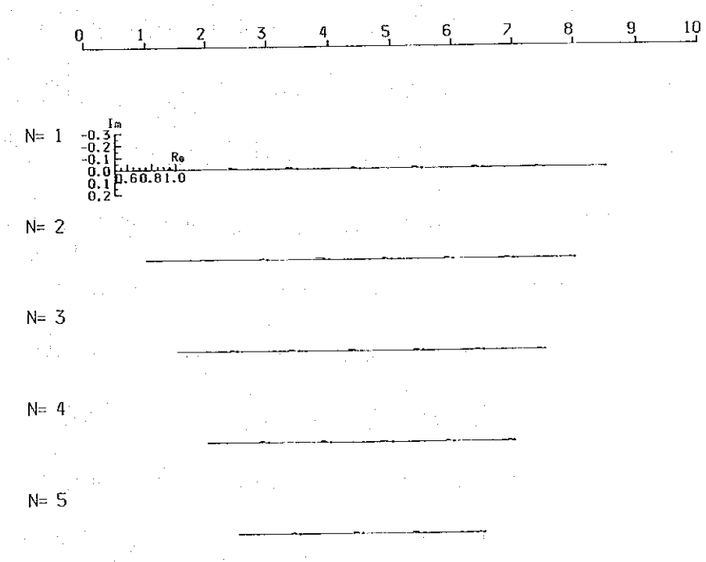
LINE K Decoupled Magnitude Spectrum



LINE K Cole-Cole Diagram

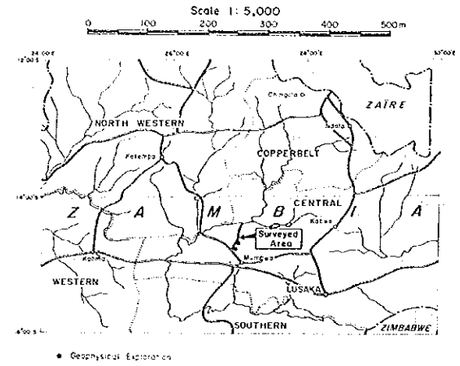


LINE K Decoupled Cole-Cole Diagram



REPORT ON THE MINERAL EXPLORATION
OF KARENDA AREA, THE REPUBLIC OF ZAMBIA
PHASE Ⅲ

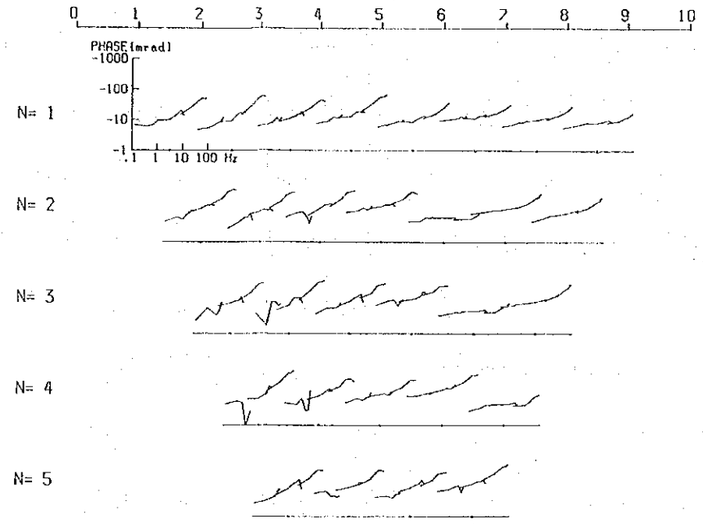
PHASE, MAGNITUDE & COLE-COLE SPECTRUM LINE L



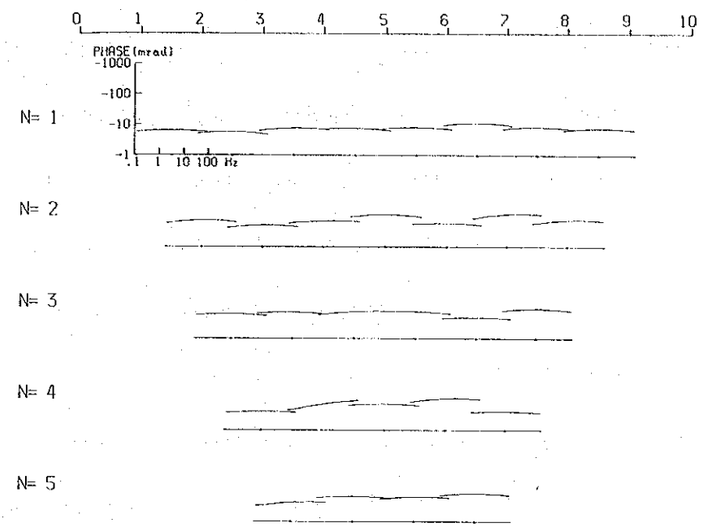
JANUARY 1987

JAPAN INTERNATIONAL COOPERATION AGENCY
METAL MINING AGENCY OF JAPAN

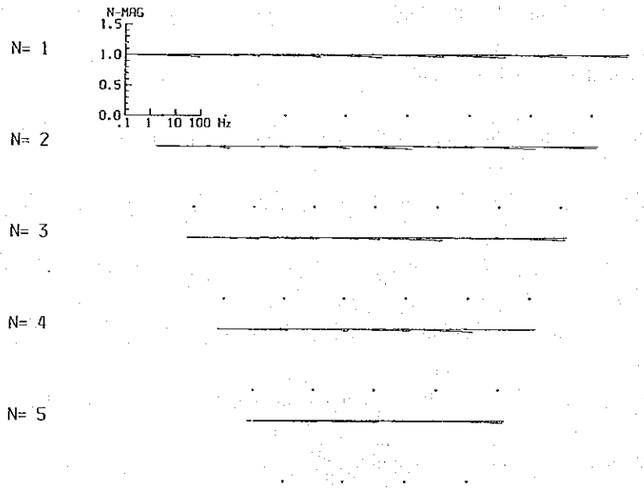
LINE L Phase Spectrum



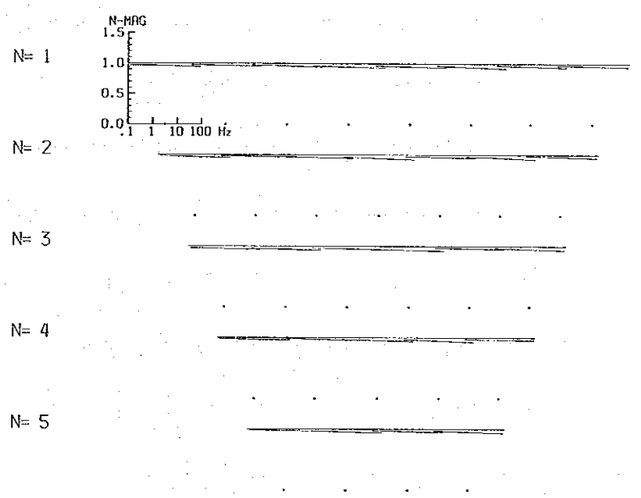
LINE L Decoupled Phase Spectrum



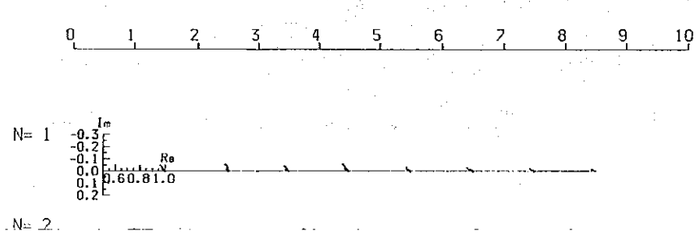
LINE L Magnitude Spectrum



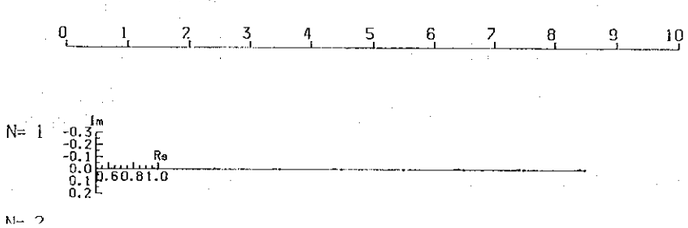
LINE L Decoupled Magnitude Spectrum



LINE L Cole-Cole Diagram



LINE L Decoupled Cole-Cole Diagram

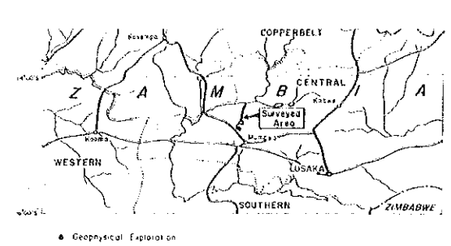


N= 4

N= 5

N= 4

N= 5



● Geophysical Exploration

JANUARY - 1987

JAPAN INTERNATIONAL COOPERATION AGENCY
METAL MINING AGENCY OF JAPAN

LINE L Magnitude Spectrum

LINE L Decoupled Magnitude Spectrum

0 1 2 3 4 5 6 7 8 9 10

N-MAG 1.5 1.0 0.5 0.0 .1 1 10 100 Hz

N= 1

N= 2

N= 3

N= 4

N= 5

LINE L Cole-Cole Diagram

LINE L Decoupled Cole-Cole Diagram

Im -0.3 -0.2 -0.1 0.0 0.1 0.2 Re 0.6 0.8 1.0

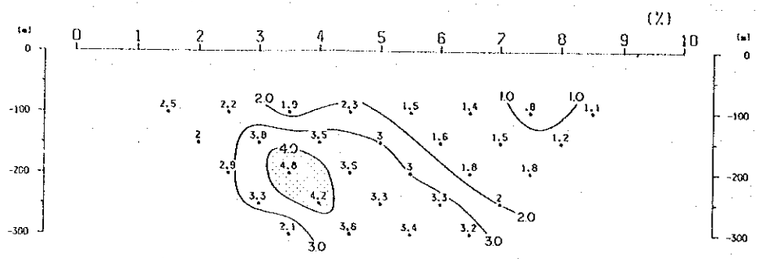
N= 1

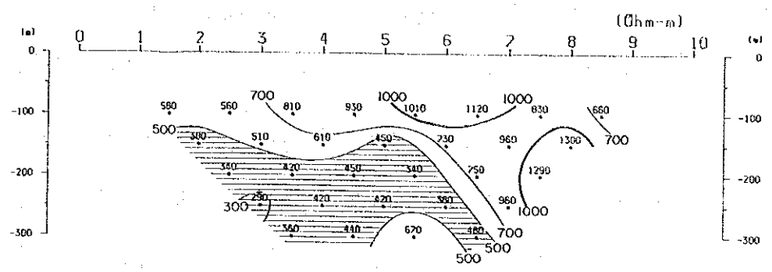
N= 2

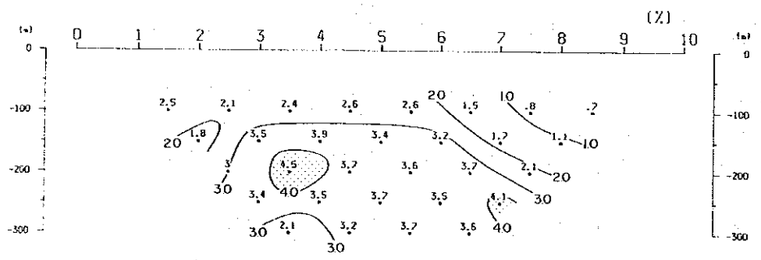
N= 3

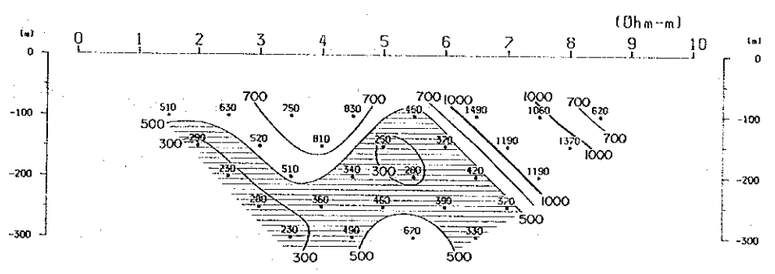
N= 4

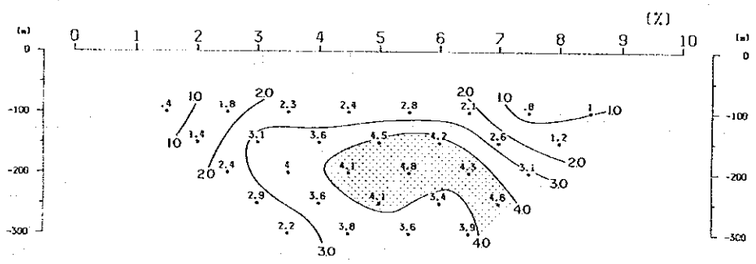
N= 5

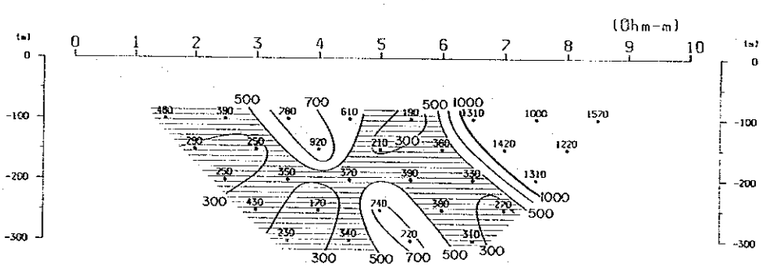












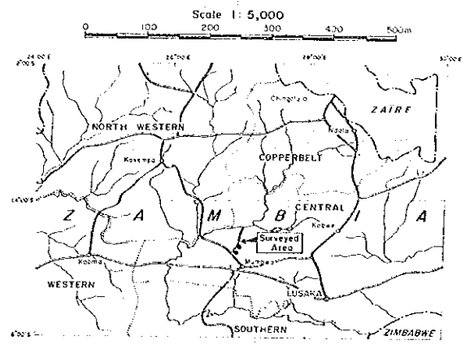
LEGEND

- Percent Frequency Effect (%)
- Contour Interval ·····1, 2, 3, 4,·····
- >4 %
- Apparent Resistivity (ohm-m)
- Contour Interval ·····300, 500, 700, 1000·····
- < 500 (ohm-m)

PL. 7

REPORT ON THE MINERAL EXPLORATION
OF KARENDA AREA, THE REPUBLIC OF ZAMBIA
PHASE III

PSEUDO-SECTION OF PFE & AR LINE M, N, O

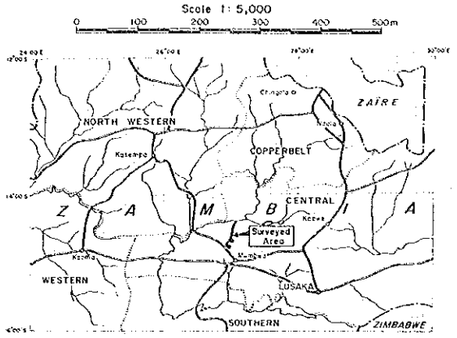


JANUARY · 1987

JAPAN INTERNATIONAL COOPERATION AGENCY
METAL MINING AGENCY OF JAPAN

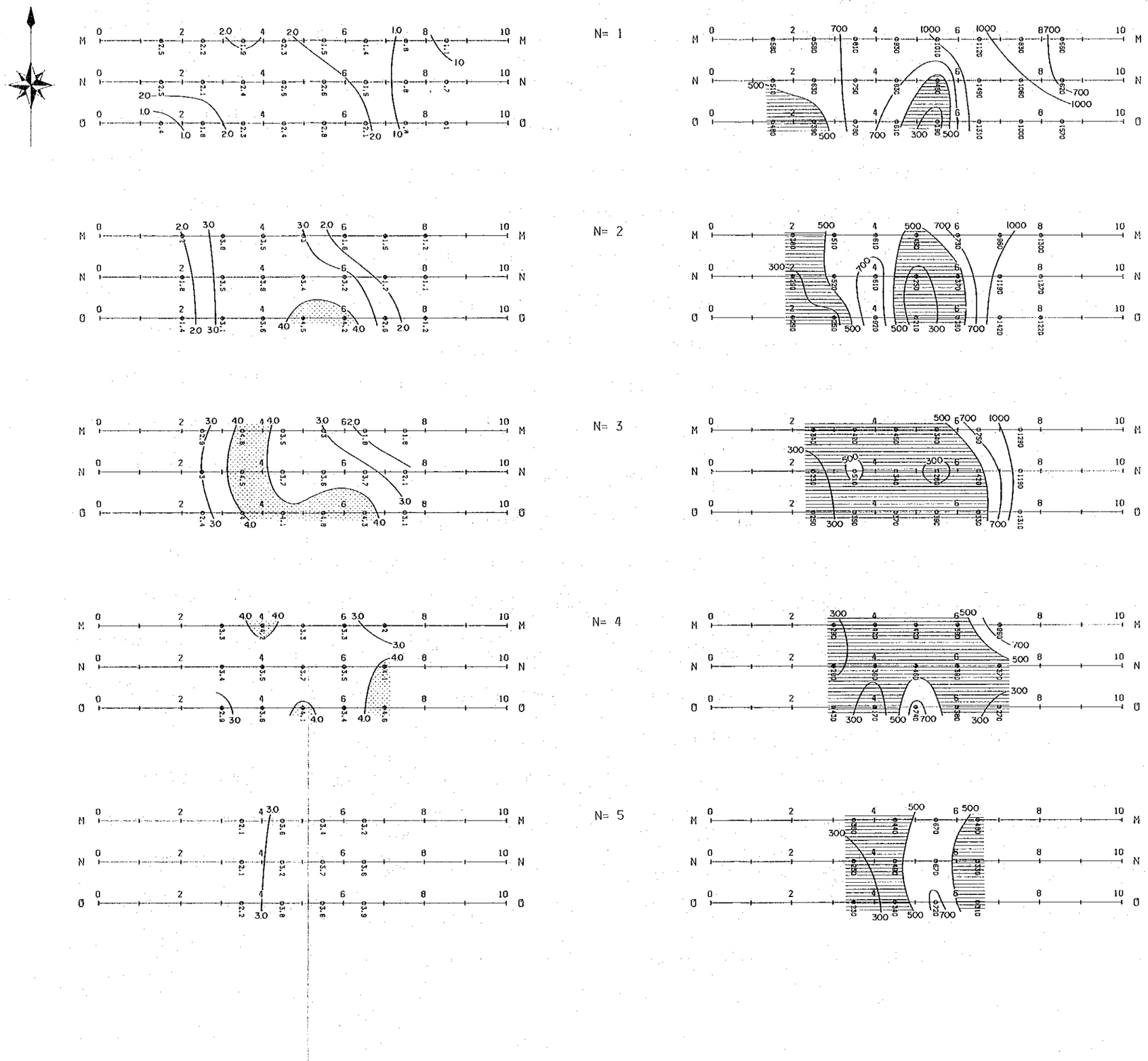
REPORT ON THE MINERAL EXPLORATION OF KARENDA AREA, THE REPUBLIC OF ZAMBIA PHASE Ⅲ

PLAN MAP OF PFE [0.125-1.0Hz] & AR [0.125Hz] (n=1~5)



JANUARY - 1987

JAPAN INTERNATIONAL COOPERATION AGENCY
METAL MINING AGENCY OF JAPAN

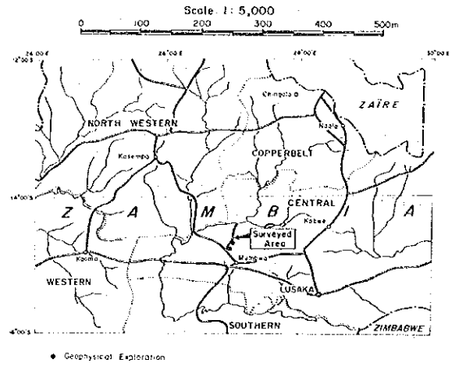


LEGEND

- M~O SIP Line
- 20 — Percent Frequency Effect (%)
- 4.0 — Contour Interval ……1, 2, 3, 4, ……
- >4 %
- 540 — Apparent Resistivity (ohm-m)
- 500 — Contour Interval ……300, 500, 700, 1000……
- <500 (ohm-m)

REPORT ON THE MINERAL EXPLORATION
OF KARENDA AREA, THE REPUBLIC OF ZAMBIA
PHASE Ⅲ

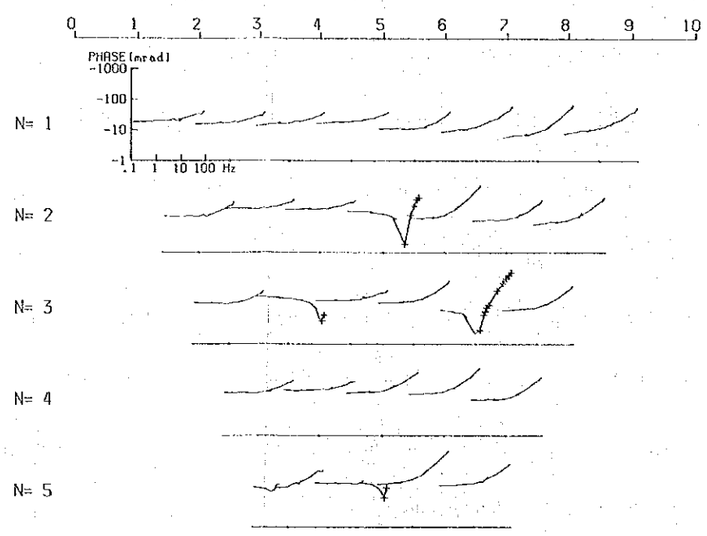
PHASE, MAGNITUDE & COLE-COLE SPECTRUM LINE M



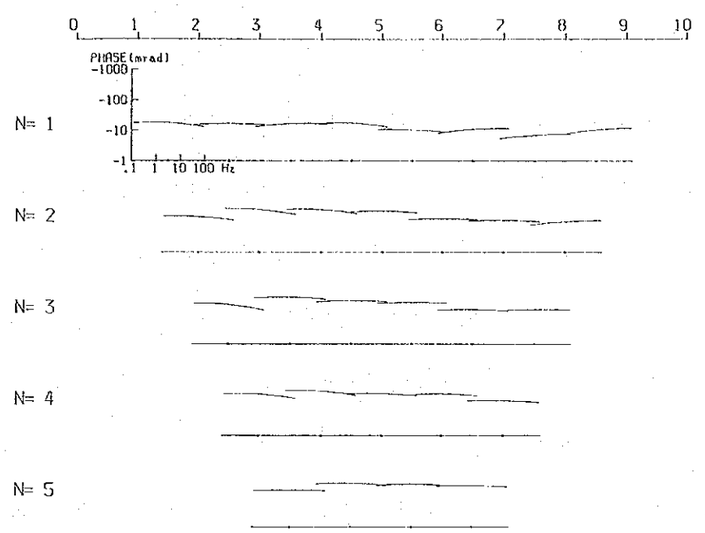
JANUARY · 1987

JAPAN INTERNATIONAL COOPERATION AGENCY
METAL MINING AGENCY OF JAPAN

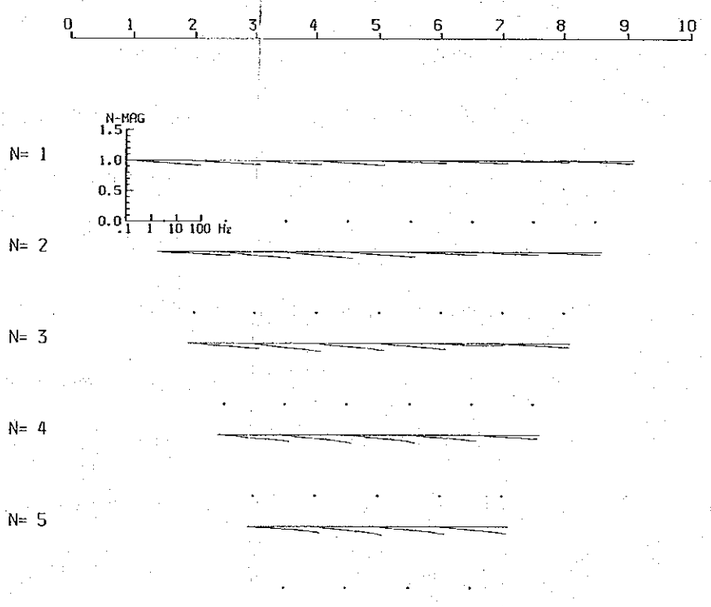
LINE M Phase Spectrum



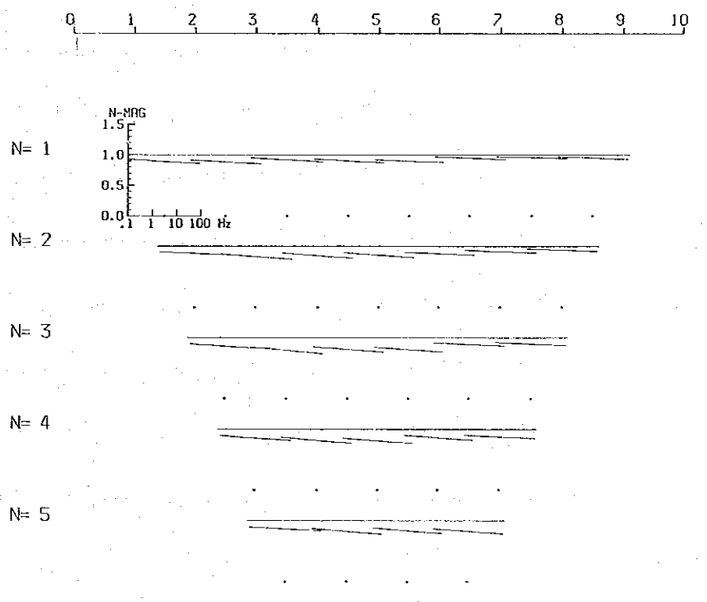
LINE M Decoupled Phase Spectrum



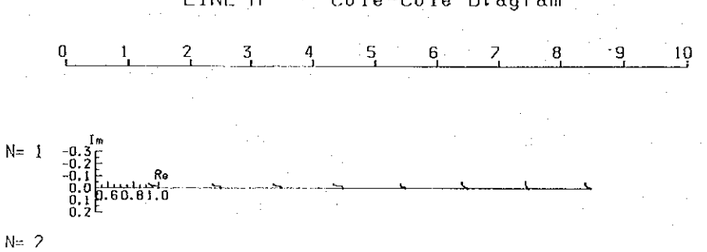
LINE M Magnitude Spectrum



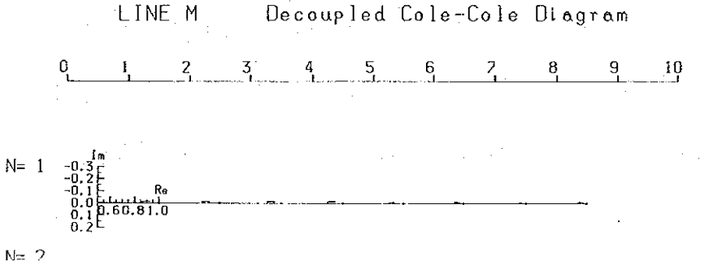
LINE M Decoupled Magnitude Spectrum

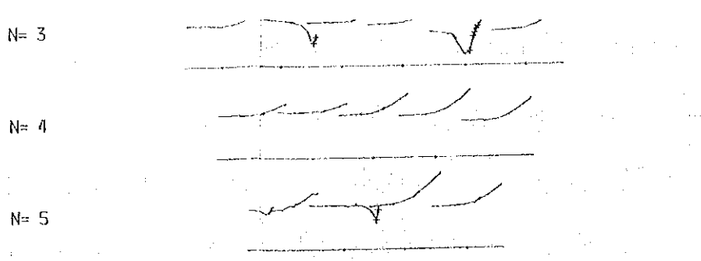


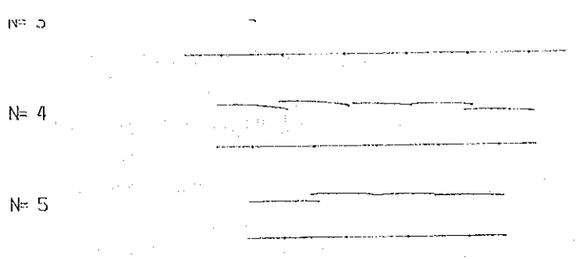
LINE M Cole-Cole Diagram

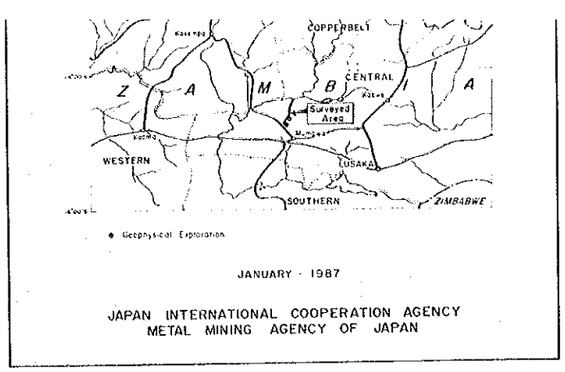


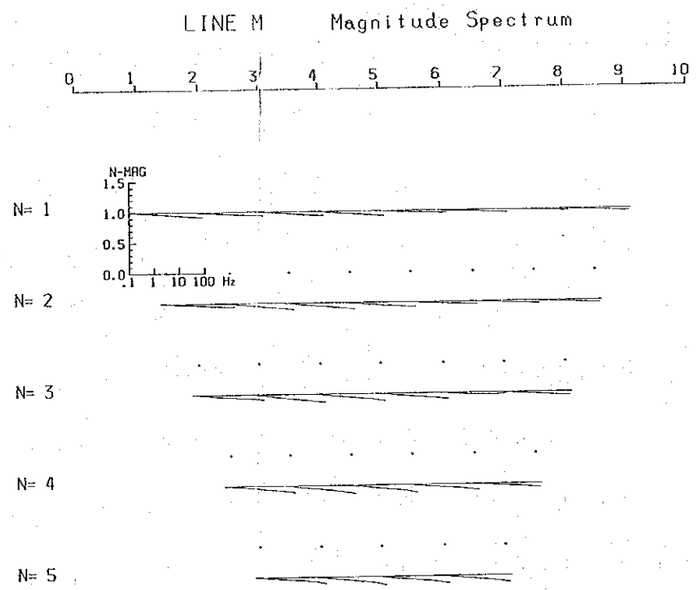
LINE M Decoupled Cole-Cole Diagram

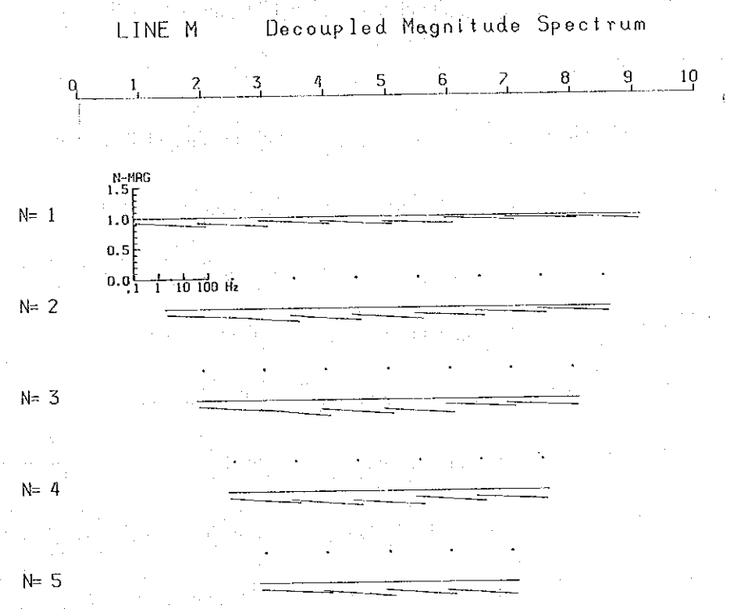


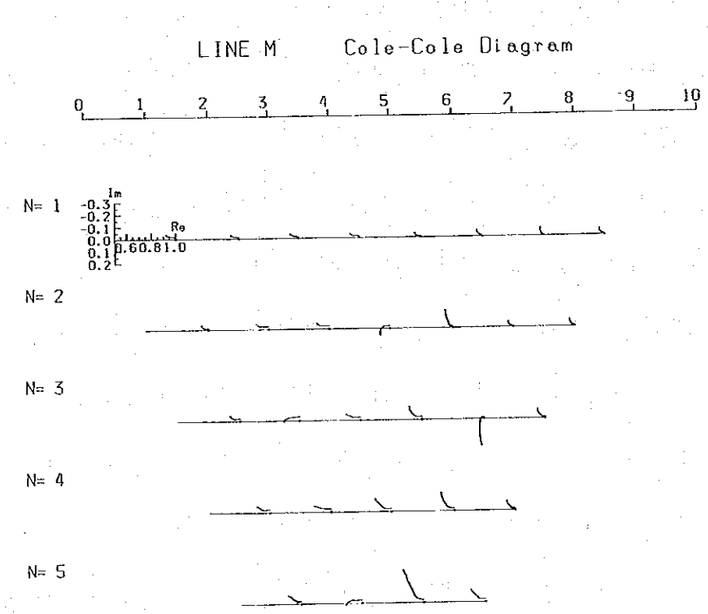

N= 3
N= 4
N= 5

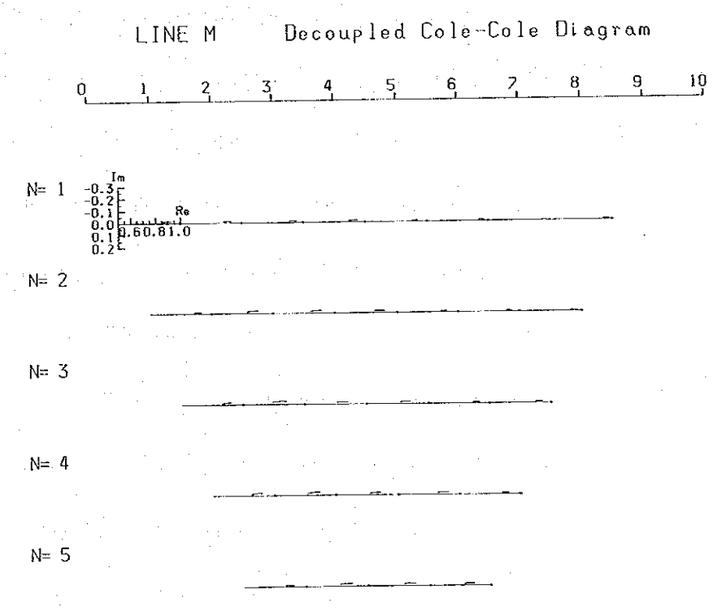

N= 3
N= 4
N= 5

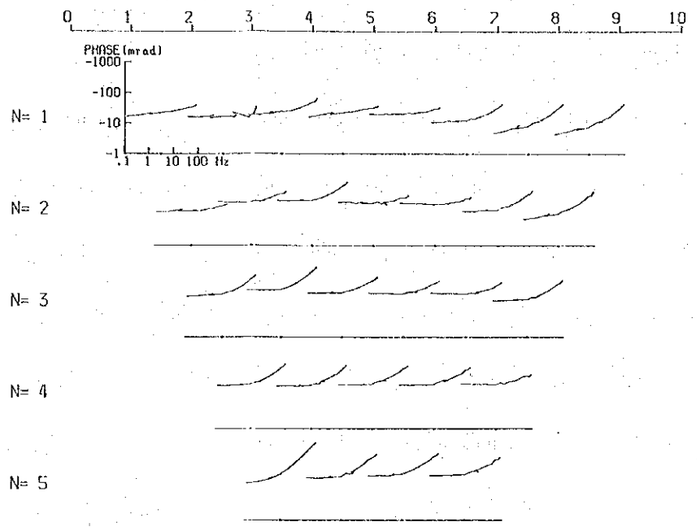

COPPERBELT
CENTRAL
Z A M B I A
Surveyed Area
WESTERN
LUSAKA
SOUTHERN
ZIMBABWE
Geophysical Exploration
JANUARY · 1987
JAPAN INTERNATIONAL COOPERATION AGENCY
METAL MINING AGENCY OF JAPAN

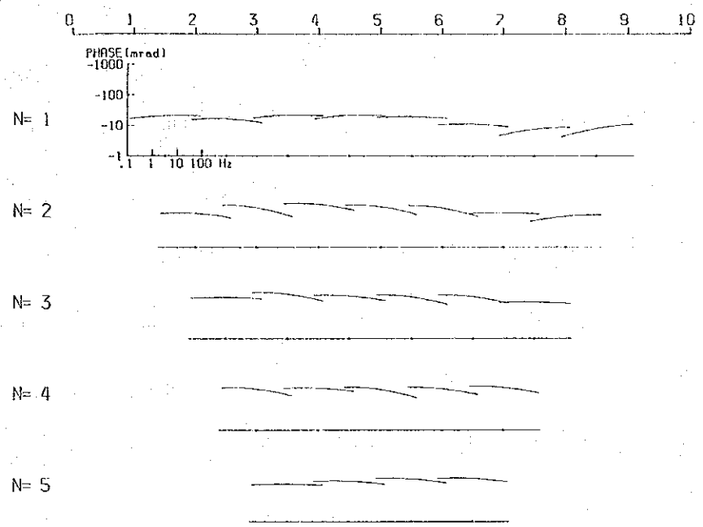

LINE M Magnitude Spectrum
0 1 2 3 4 5 6 7 8 9 10
N-MAG
1.5
1.0
0.5
0.0
.1 1 10 100 Hz
N= 1
N= 2
N= 3
N= 4
N= 5

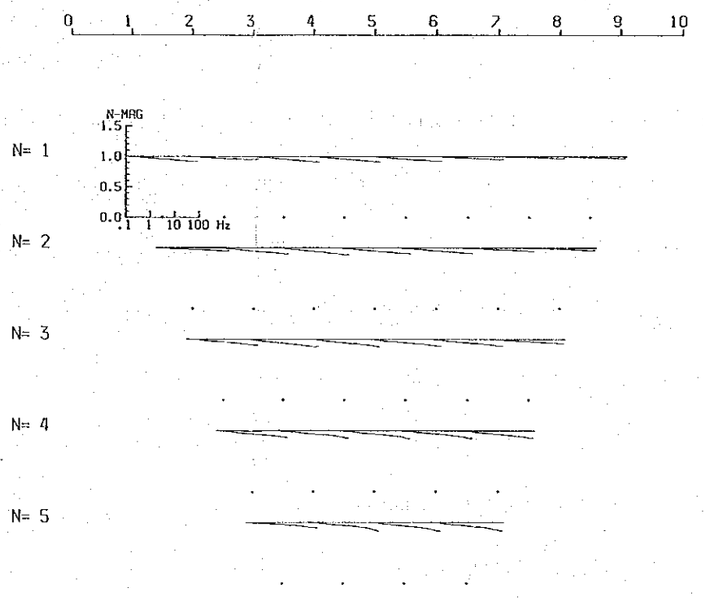

LINE M Decoupled Magnitude Spectrum
0 1 2 3 4 5 6 7 8 9 10
N-MAG
1.5
1.0
0.5
0.0
.1 1 10 100 Hz
N= 1
N= 2
N= 3
N= 4
N= 5

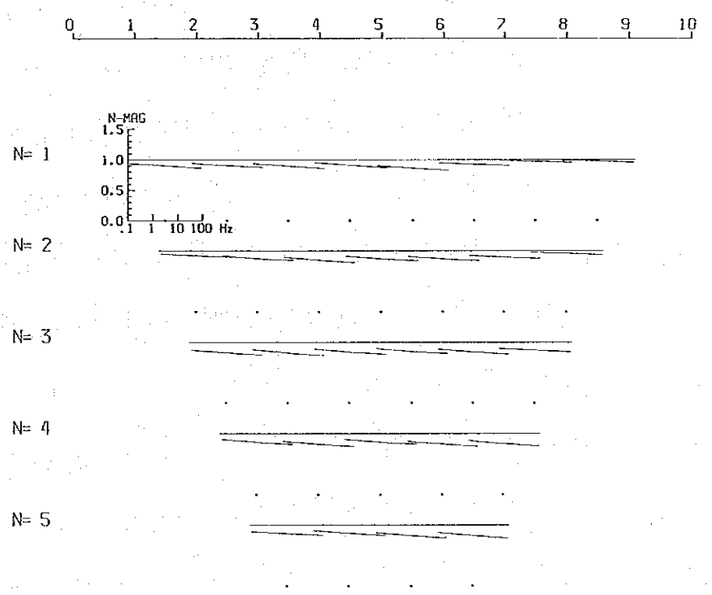

LINE M Cole-Cole Diagram
0 1 2 3 4 5 6 7 8 9 10
Im
-0.3
-0.2
-0.1
0.0
0.1
0.2
Re
0.6 0.8 1.0
N= 1
N= 2
N= 3
N= 4
N= 5

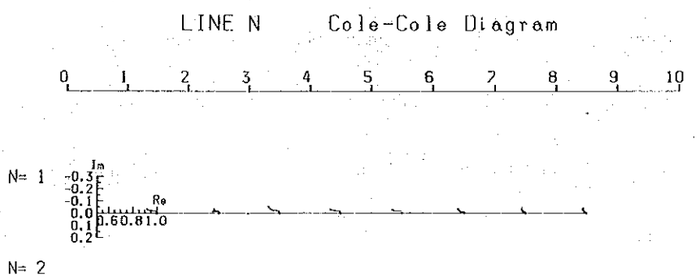

LINE M Decoupled Cole-Cole Diagram
0 1 2 3 4 5 6 7 8 9 10
Im
-0.3
-0.2
-0.1
0.0
0.1
0.2
Re
0.6 0.8 1.0
N= 1
N= 2
N= 3
N= 4
N= 5

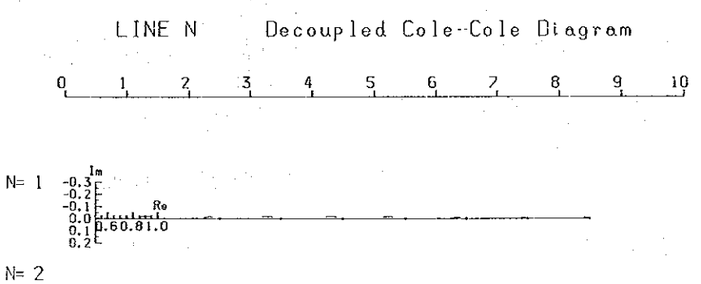








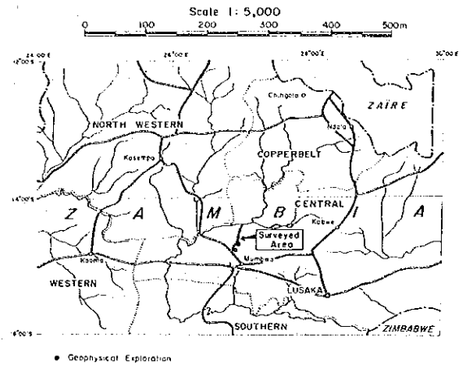




PL. 10

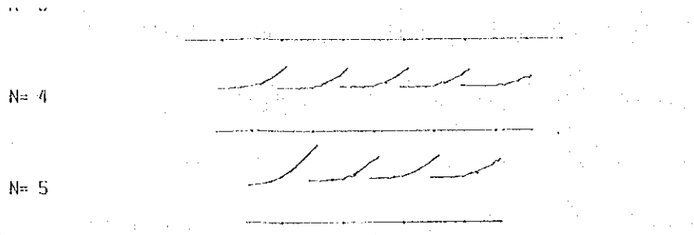
REPORT ON THE MINERAL EXPLORATION
OF KARENDA AREA, THE REPUBLIC OF ZAMBIA
PHASE III

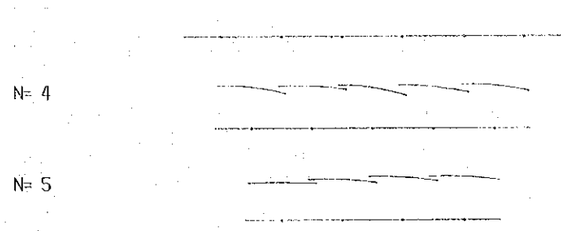
PHASE, MAGNITUDE & COLE-COLE SPECTRUM LINE N

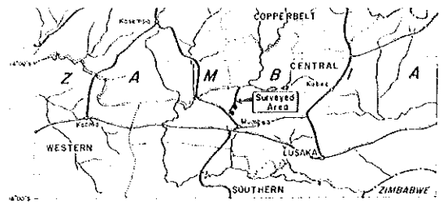


JANUARY 1987

JAPAN INTERNATIONAL COOPERATION AGENCY
METAL MINING AGENCY OF JAPAN





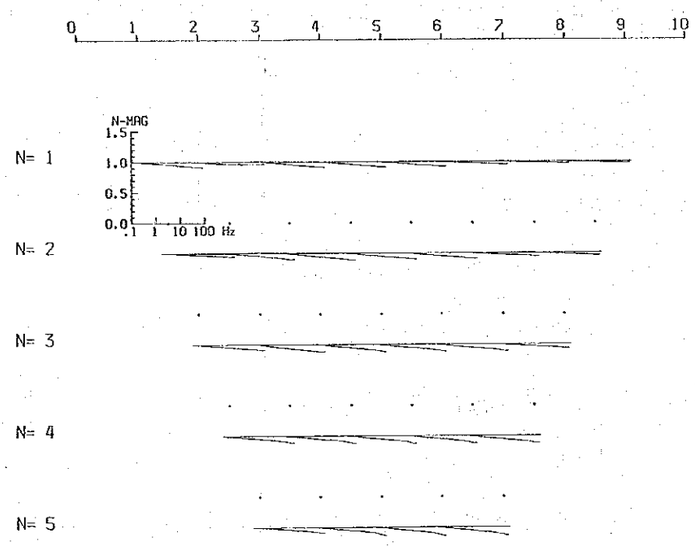


• Geophysical Exploration

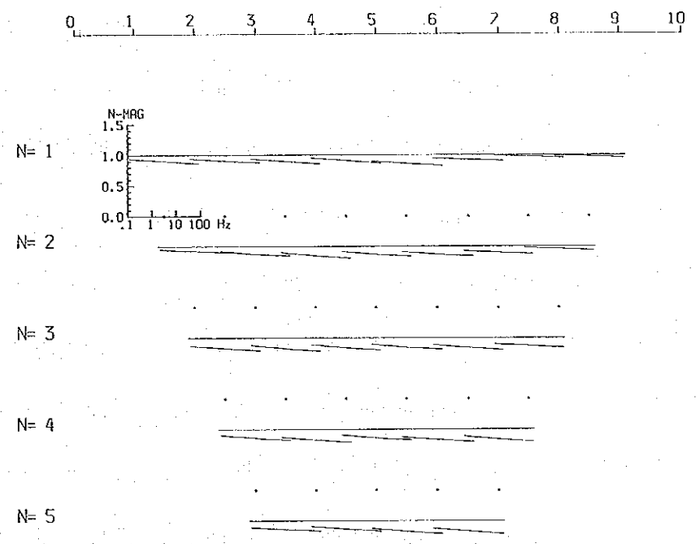
JANUARY · 1987

JAPAN INTERNATIONAL COOPERATION AGENCY
METAL MINING AGENCY OF JAPAN

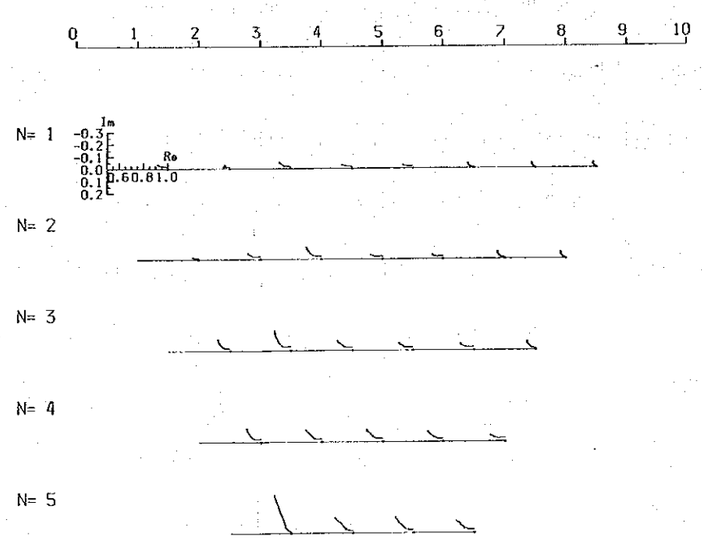
LINE N Magnitude Spectrum



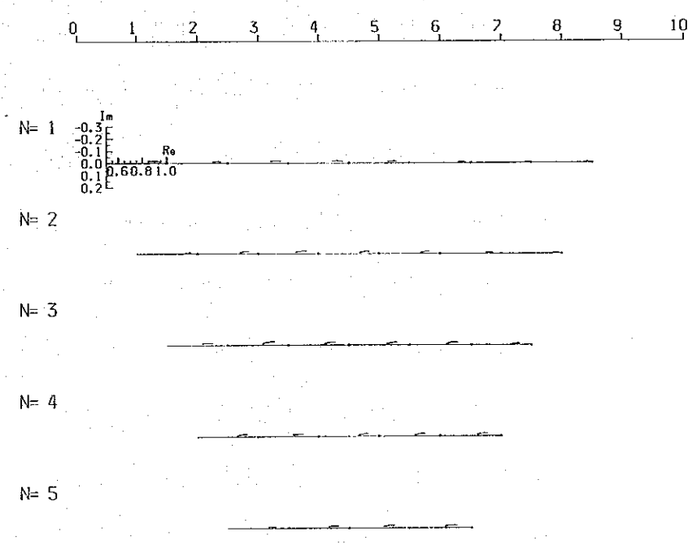
LINE N Decoupled Magnitude Spectrum

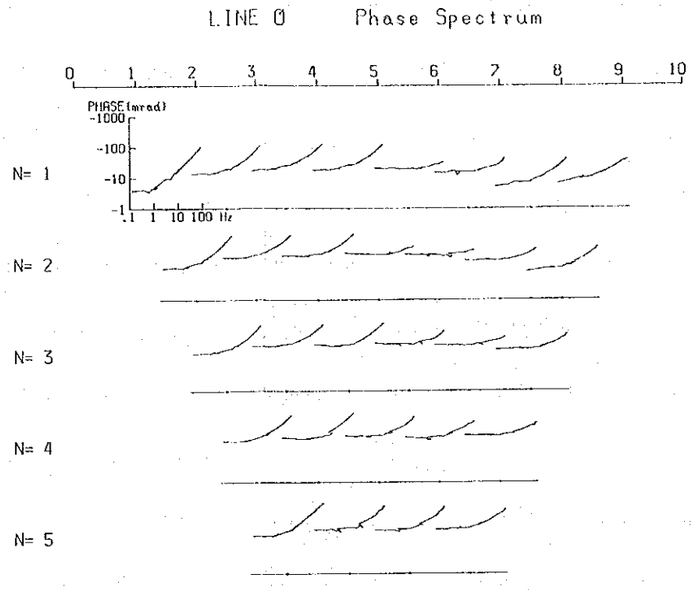


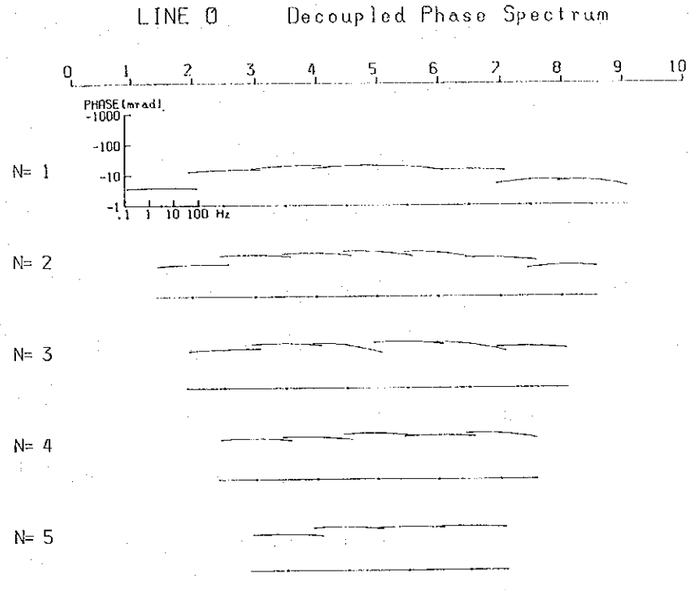
LINE N Cole-Cole Diagram

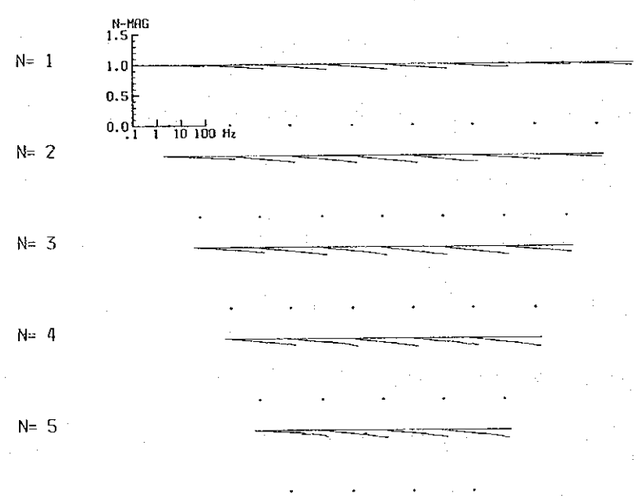


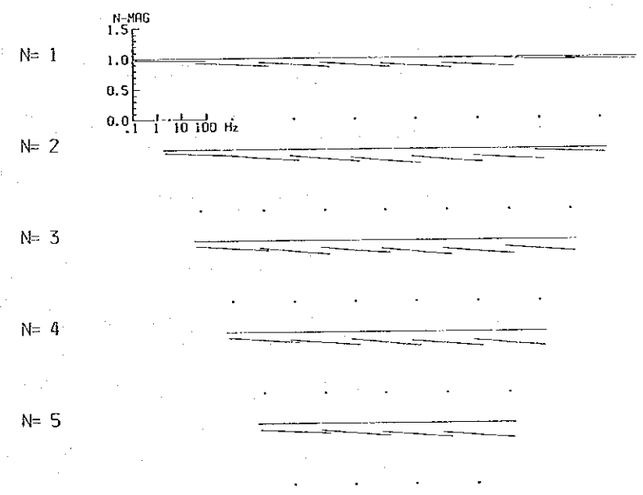
LINE N Decoupled Cole-Cole Diagram

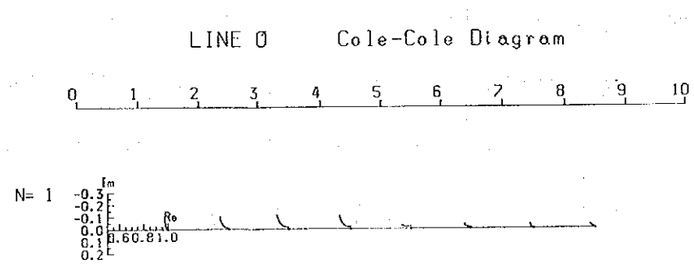


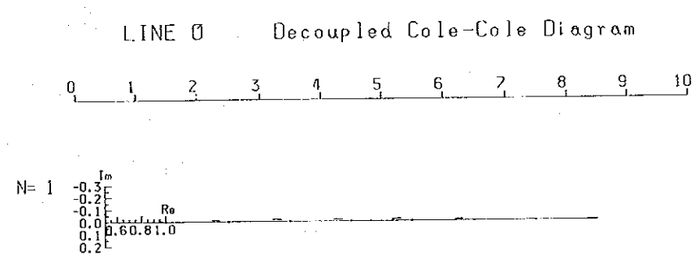






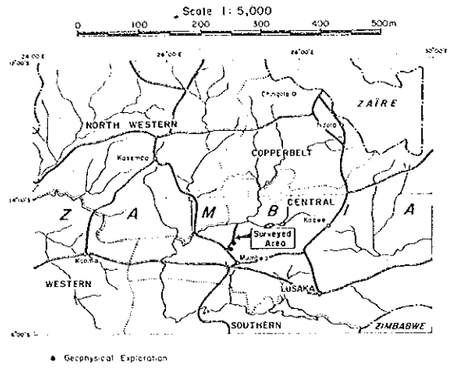






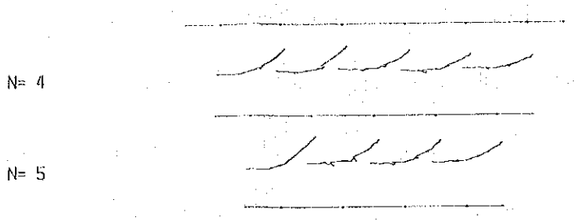
REPORT ON THE MINERAL EXPLORATION
OF KARENDA AREA, THE REPUBLIC OF ZAMBIA
PHASE III

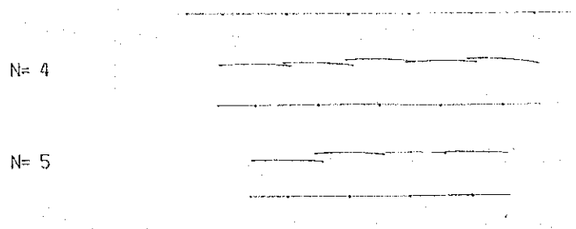
PHASE, MAGNITUDE & COLE-COLE SPECTRUM LINE 0

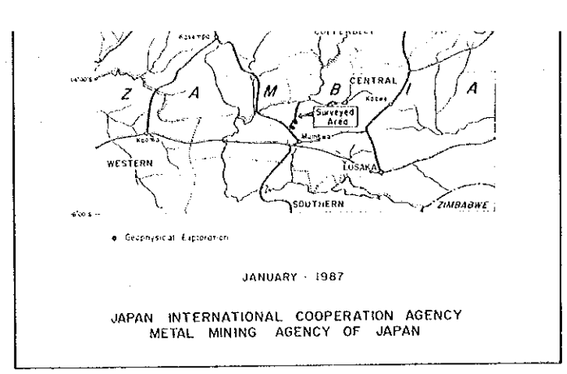


JANUARY 1987

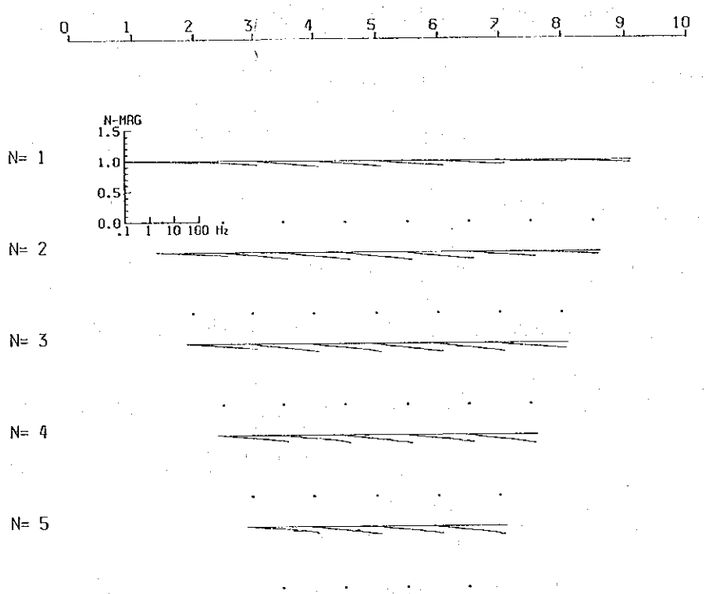
JAPAN INTERNATIONAL COOPERATION AGENCY
METAL MINING AGENCY OF JAPAN



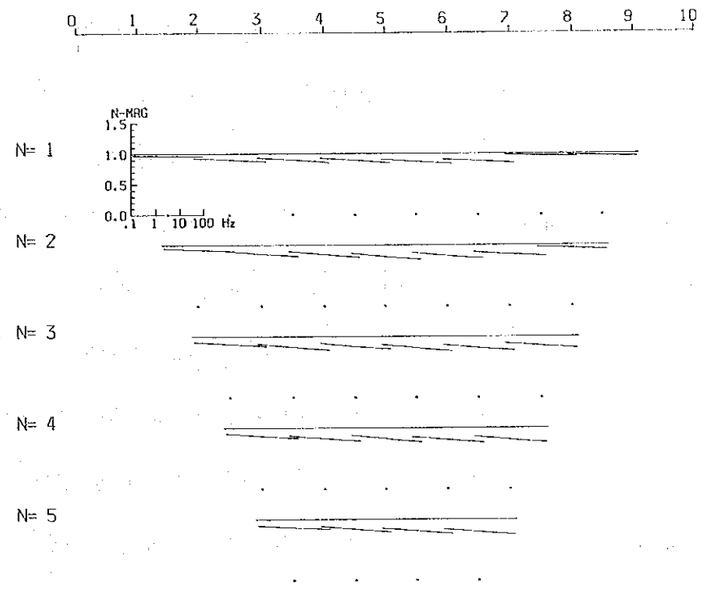




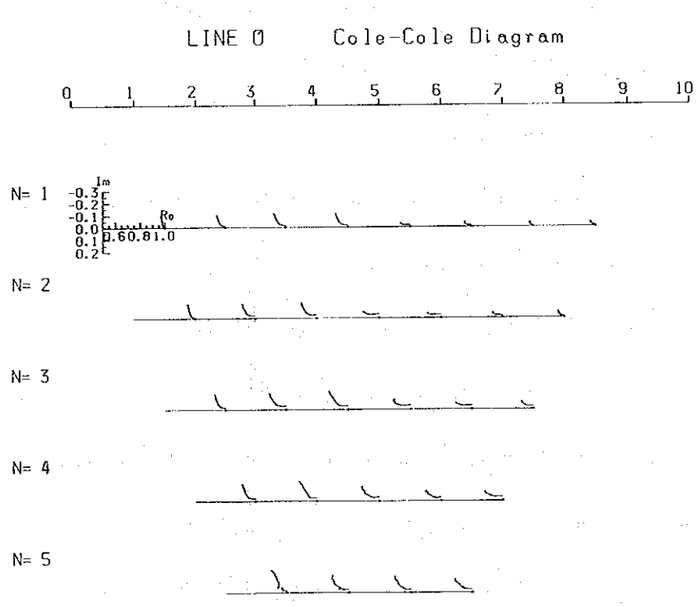
LINE 0 Magnitude Spectrum



LINE 0 Decoupled Magnitude Spectrum



LINE 0 Cole-Cole Diagram



LINE 0 Decoupled Cole-Cole Diagram