



Instituto Tecnológico
GeoMinero de España

ESTUDIO HIDROGEOLOGICO MEDIANTE S.E.V.
EN LA ZONA DE EPILA (ZARAGOZA).
Julio - 1990.



MINISTERIO DE INDUSTRIA Y ENERGIA

40367

**ESTUDIO HIDROGEOLOGICO MEDIANTE S.E.V. EN LA ZONA DE
EPILA (ZARAGOZA).**

Como complemento a los estudios hidrogeológicos que la Subdirección General de Aguas Subterráneas del ITGE (Of. Reg. de Zaragoza) está realizando en la Provincia de Zaragoza, y a propuesta de la misma, se ha llevado a cabo una campaña de 27 Sondeos Electricos Verticales (SEV), con objeto de aportar información sobre la disposición y potencia, en profundidad, de los diferentes niveles que, por su contraste de resistividad, puedan corresponder a niveles diferentes.

La ejecución en campo se ha realizado en los meses de Abril y Mayo de 1990 dividiéndose el trabajo en dos zonas (Epila y Belchite).

El presente informe corresponde a la zona de Epila la cual presenta 27 SEV dispuestos en 5 perfiles (Fig.1). Estos representan los cortes geoelectricos en profundidad, resultado de la interpretación a través de programa de ordenador RESIX-IP.

Han intervenido en la ejecución de esta prospección J.P. Carrión como operador, I. Arbe y F.M. Rubio en la planificación y R. Campos en la interpretación y redacción del presente informe.

El equipo de material empleado fué el de patente Geotrón, los estadillos resultado de las mediciones así como las curvas interpretadas se presentan en el Anexo I.

Geográficamente el área prospectada se sitúa al Sur de la localidad de Epila (Zaragoza) en la Hoja del M.T.N escala 1/50.000 nº 382 (26-15) del mismo nombre.

Los 27 SEV se han agrupado en 5 perfiles (I, II, III, IV, y V) de dirección NE-SW para la realización de los cortes geoelectricos.

La longitud de la línea AB/2 varió entre 400 y 1000 m. según las dificultades presentadas, acequias, riegos,.... Su presentación planimétrica se incluye al final de este informe.

INTERPRETACION.

La interpretación de los SEV se ha realizado con ordenador HP. Vectra US/16 mediante el programa RESIX-IP (1988).

Los resultados aparecen reflejados en el plano de cortes geoelectricos que se incluye en el informe. Para el dibujo, se ha elegido a efectos de representación la escala 1/25.000 en la horizontal y 1/4.000 en la vertical.

La delimitación de niveles en profundidad se ha realizado de acuerdo con sus valores de resistividad y profundidad.

De la observación de estas secciones geoelectricas se pueden diferenciar cuatro horizontes de distintas características que de techo a muro son las siguientes:

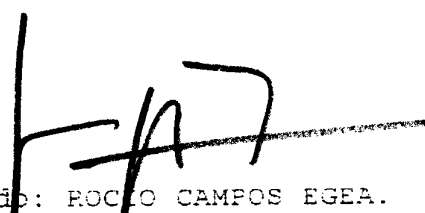
- (A) - Alternancia de resistivos y conductores con potencias pequeñas. Aunque constituye en la mayoría de los casos una alternancia, presenta una característica común en todos los SEV y es la de presentar en su tramo más profundo siempre baja resistividad (15-25 ohm. m.).

- (B) - Nivel potente de resistividad baja-media situado por debajo de los niveles alternantes. Este nivel presenta unas resistividades medias de 35 ohm. m. y espesores máximos de 150 m. Se caracteriza de igual forma por presentar horizontes discontinuos de materiales más resistivos (60-70 ohm. m.) los cuales probablemente constituyen cambios laterales de facies.

Este nivel, probablemente el más importante desde el punto de vista hidrogeológico se correlaciona bien en todos los perfiles, con potencias y resistividades equiparables. Solo llamar la atención en el Perfil V, (Sondeos 25, 26 y 27) en el cual aparece un horizonte intercalado entre (A) y (B) de materiales más resistivos y que no separamos como una unidad independiente dada su escasa representación.

(C) y (D) - Por último dos niveles C y D situados por debajo del anterior los que constituyen el sustrato resistivo del mismo. El primero (C), el cual aparece en todos los perfiles, está caracterizado por una resistividad media de 120-130 ohm. m. y potencia comprendida entre 50 y 100 m. El segundo (D), más resistivo que el anterior, se alcanza en todos los perfiles excepto en el perfil V.

Estos dos niveles probablemente constituyen un único sustrato resistivo, con un aumento gradual de su resistividad en profundidad (ver plano adjunto).



Fdp: ROCIO CAMPOS EGEA.
Julio-1990.

ANEXO I
CURVAS DE INTERPRETACION DE LOS S.E.V.

DATA SET: EP1LA1

CLIENT: zaragoza	DATE: junio-90
LOCATION: epila	SOUNDING: 1
COUNTY: espa a	AZIMUTH: 353
PROJECT: sev	EQUIPMENT: geotron
ELEVATION: 320.00	
SOUNDING COORDINATES: X: 643125.0000 Y: 4605325.0000	

Schlumberger Configuration

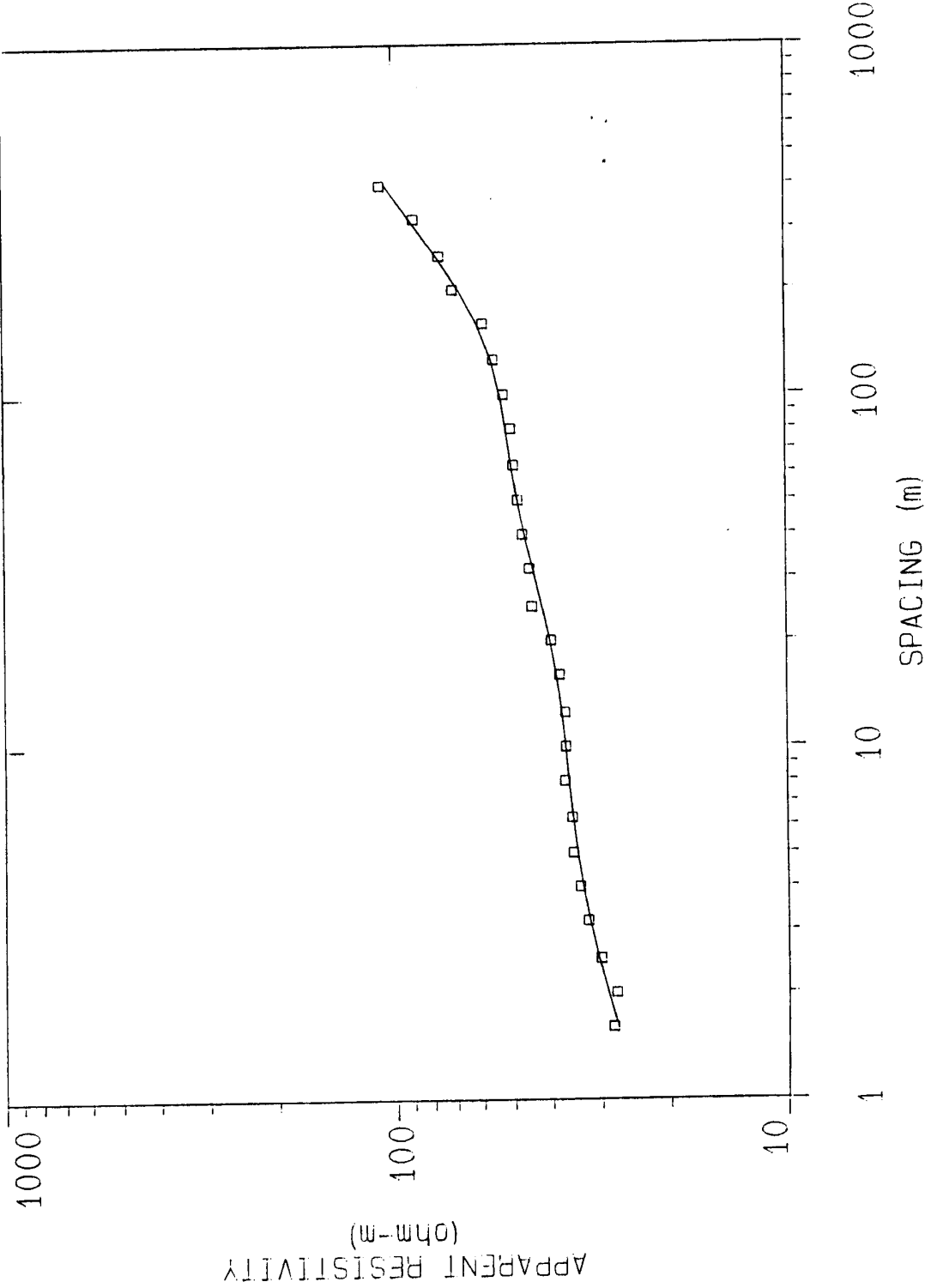
FITTING ERROR: 2.545 PERCENT

L =	RESISTIVITY (ohm-m)	CHARGEABILITY (pfe)	THICKNESS (meters)	ELEVATION (meters)	CONDUCTANCE (Siemens)
				320.0	
1	22.*1		0.725	319.2	0.0322
2	37.*0		12.63	306.6	0.340
3	59.*7		28.51	278.1	0.476
4	39.*9		49.*1	129.1	1.23
5	118.*		86.*0	143.1	0.725
6	270.0				

"*" INDICATES FIXED PARAMETER

NO.	Spacing (m)	PA (ohm-m)		DIFFERENCE (percent)
		DATA	SYNTHETIC	
1	1.00	28.05	27.38	-2.38
2	2.00	27.51	28.21	-5.07
3	3.00	30.08	30.49	-1.37
4	4.00	32.44	32.12	0.983
5	5.00	33.94	33.39	1.61
6	6.00	35.33	34.45	2.47
7	8.00	37.04	35.37	0.489
8	10.00	36.83	36.13	-1.33
9	12.50	36.93	36.91	-0.216
10	16.00	38.16	37.73	-2.17
11	20.00	40.10	38.93	-2.02
12	25.00	44.81	40.39	-0.726
13	32.00	45.42	42.24	5.72
14	40.00	47.26	44.60	1.80
15	50.00	48.51	46.76	1.06
16	63.00	49.65	48.70	-0.402
17	80.00	50.37	50.36	-1.43
18	100.0	52.44	51.85	-2.92
19	126.0	55.55	53.52	-2.04
20	160.0	59.08	56.32	-1.37
21	200.0	70.60	61.24	-3.65
22	250.0	76.30	68.22	3.35
23	320.0	88.40	77.64	-1.76
24	400.0	107.9	90.67	-2.57
25	400.0		104.4	3.15

EPI1A1



DATA SET: EPILAZ

CLIENT: ITGE
 LOCATION: CARINENA
 COUNTY: ZARAGOZA
 PROJECT: RESISTIVIDAD
 ELEVATION: 330.00
 SOUNDING COORDINATES: X: 644800.0000 Y: 4606100.0000

DATE: 8-5-90
 SOUNDING: 1
 AZIMUTH: 316
 EQUIPMENT: GEOTRON

Schlumberger Configuration

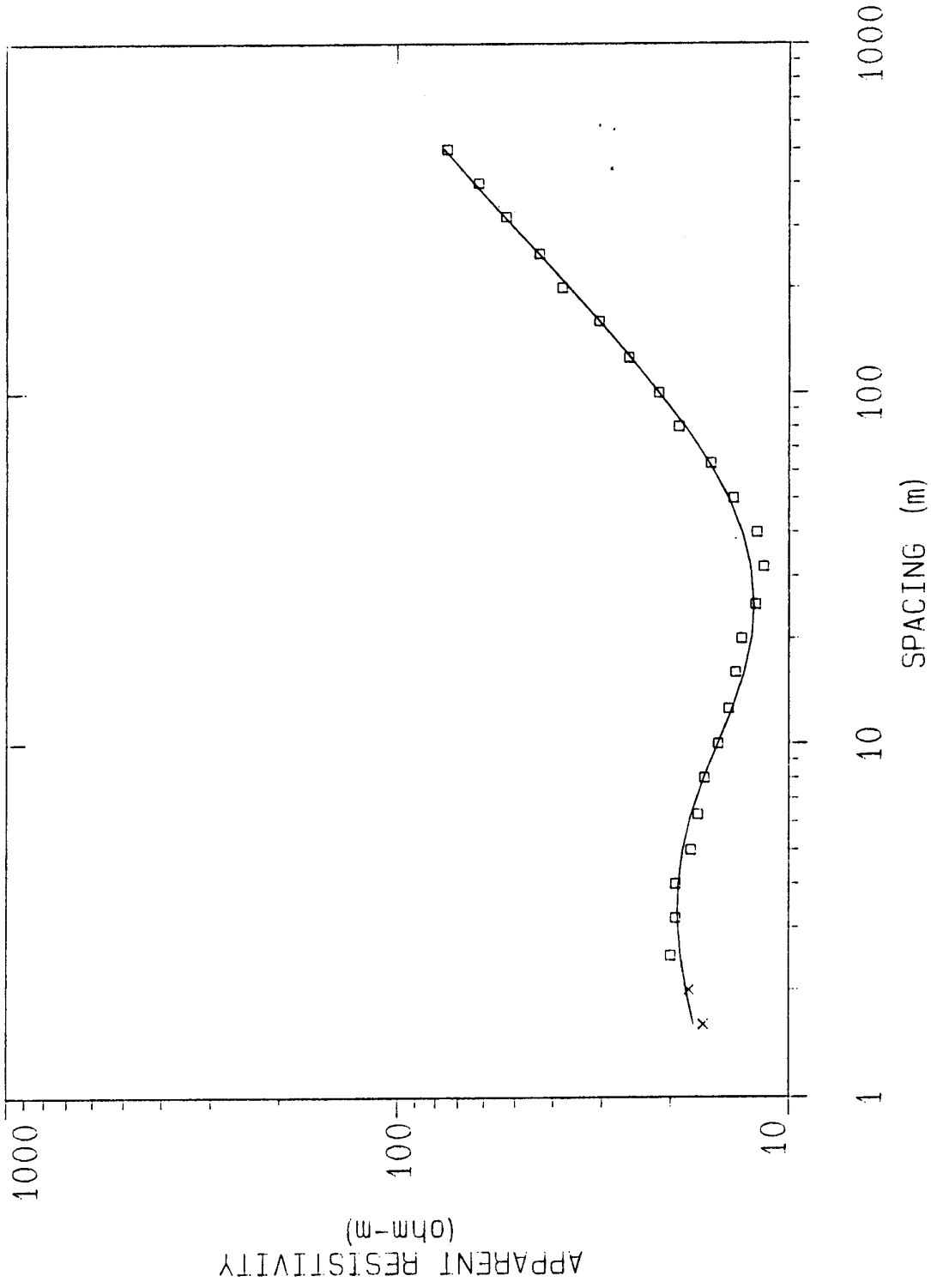
FITTING ERROR: 3.737 PERCENT

L #	RESISTIVITY (ohm-m)	CHARGEABILITY (pfe)	THICKNESS (meters)	ELEVATION (meters)	CONDUCTANCE (Siemens)
				330.0	
1	9.72		0.299	329.7	0.0308
2	21.59		3.22	326.4	0.149
3	11.02		29.30	297.1	2.65
4	24.84		18.71	278.4	0.753
5	43.*4		53.75	224.6	1.23
6	150.*		74.68	150.0	0.497
7	300.*				

"*" INDICATES FIXED PARAMETER

No.	Spacing (m)	DATA	PA (ohm-m) SYNTHETIC	DIFFERENCE (percent)
1	1.60	16.50	17.49	-5.95
2	2.00	17.97	18.30	-1.93
3	2.50	19.99	18.92	5.37
4	3.20	19.44	19.23	1.02
5	4.00	19.44	19.15	1.47
6	5.00	17.79	18.67	-4.95
7	6.30	17.05	17.75	-4.07
8	8.00	15.41	16.46	-0.269
9	10.00	15.13	15.14	-0.0482
10	12.60	14.21	13.89	2.20
11	16.00	13.64	12.93	5.20
12	20.00	13.18	12.41	5.81
13	25.00	12.15	12.25	-0.825
14	32.00	11.59	12.49	-7.76
15	40.00	12.06	13.12	-8.83
16	50.00	13.33	14.23	-5.34
17	63.00	15.81	15.95	-0.895
18	80.00	19.10	18.42	3.55
19	100.0	21.46	21.43	0.105
20	126.0	25.60	25.36	0.927
21	160.0	30.49	30.46	0.118
22	200.0	37.90	36.37	4.02
23	250.0	43.40	43.60	-0.461
24	320.0	52.20	53.32	-0.996
25	400.0	62.00	63.85	-2.94
26	500.0	74.75	76.03	-1.79

EPIILA2



DATA SET: EPILAS

CLIENT: ITGE
 LOCATION: CARINENA
 COUNTY: ZARAGOZA
 PROJECT: RESISTIVIDAD
 ELEVATION: 325.00
 SOUNDING COORDINATES: X: 642550.0000 Y: 4603525.0000

DATE: 26-4-90
 SOUNDING: 3
 AZIMUTH: 342
 EQUIPMENT: GEOTRON

Schlumberger Configuration

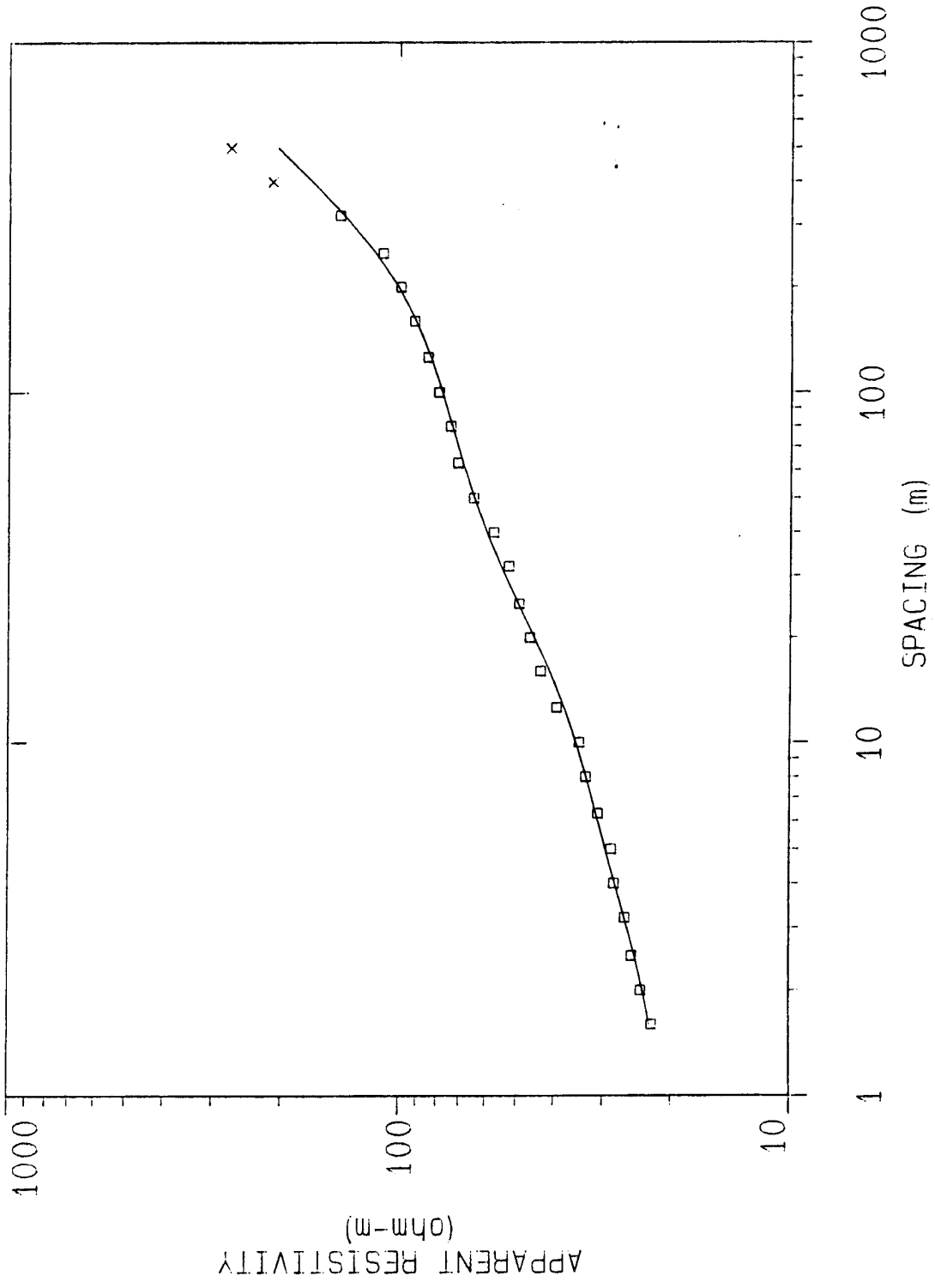
FITTING ERROR: 2.599 PERCENT

L =	RESISTIVITY (ohm-m)	CHARGEABILITY (pfe)	THICKNESS (meters)	ELEVATION (meters)	CONDUCTANCE (Siemens)
				325.0	
1	21.09		1.27	323.7	0.0604
2	34.39		7.86	315.8	1.228
3	81.78		100.8	214.9	1.23
4	114.1		89.69	125.2	0.785
5	3399.*				

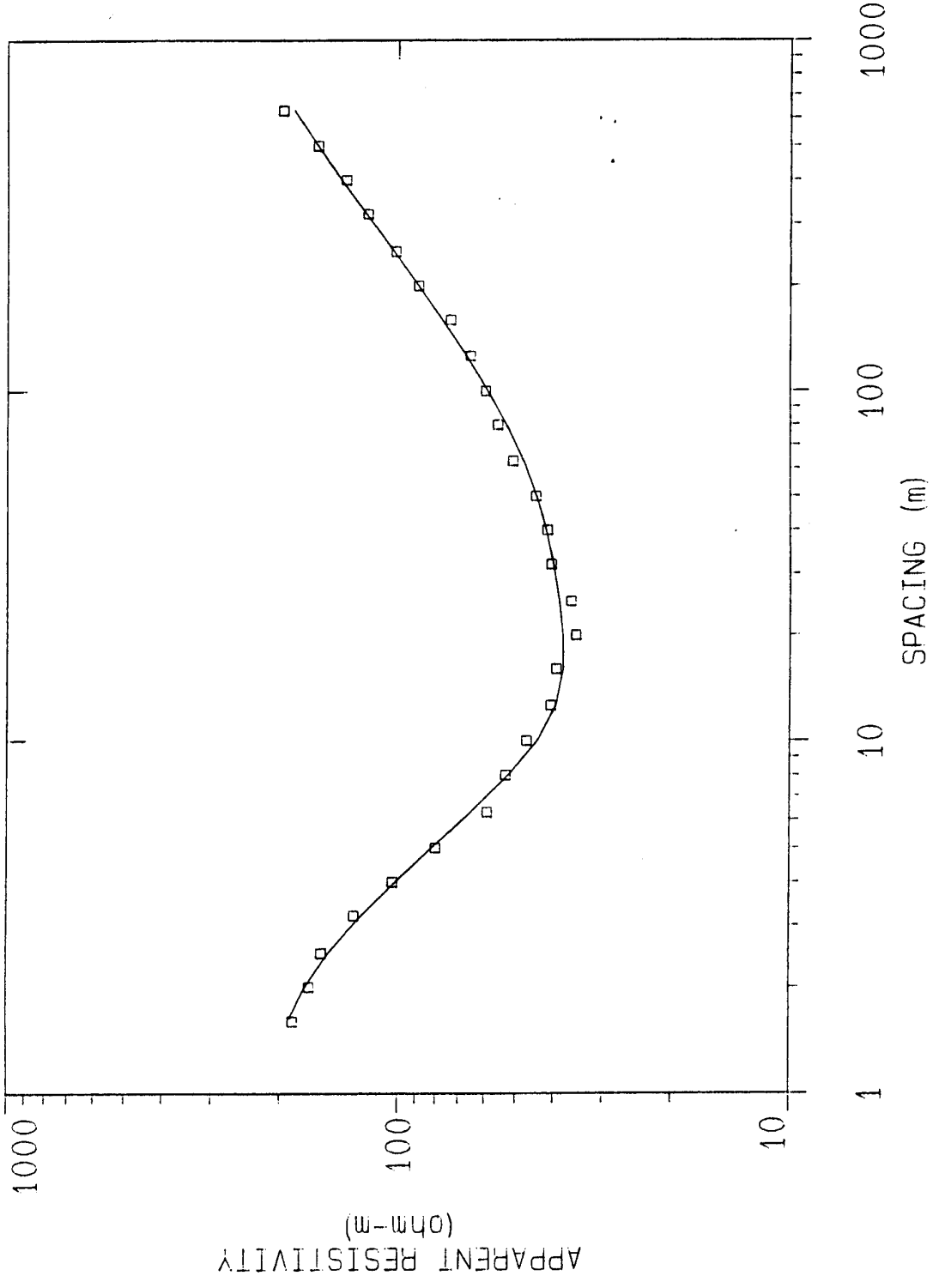
"*" INDICATES FIXED PARAMETER

No.	Spacing (m)	DATA	PA (ohm-m) SYNTHETIC	DIFFERENCE (percent)
1	1.60	22.39	22.68	-1.30
2	2.00	23.92	23.62	1.35
3	2.50	25.30	24.94	1.81
4	3.20	26.39	26.45	-0.222
5	4.00	28.14	28.02	0.395
6	5.00	28.64	29.63	-3.43
7	6.30	30.97	31.32	-1.11
8	8.00	33.23	33.15	0.149
9	10.00	34.53	35.19	-1.90
10	12.60	39.50	37.79	4.33
11	16.00	43.49	41.23	5.20
12	20.00	46.32	45.16	2.50
13	25.00	49.32	49.64	-0.658
14	32.00	53.38	54.93	-4.62
15	40.00	57.38	59.74	-4.10
16	50.00	64.65	64.35	0.417
17	63.00	71.02	68.84	2.92
18	80.00	74.10	73.49	0.829
19	100.0	79.31	77.91	1.75
20	125.0	84.72	83.31	1.66
21	160.0	91.76	90.91	1.05
22	200.0	99.70	100.9	-1.22
23	250.0	110.7	115.5	-4.39
24	320.0	142.3	138.9	2.43
25	400.0	211.6	168.0	20.59
26	500.0	271.6	205.6	24.26

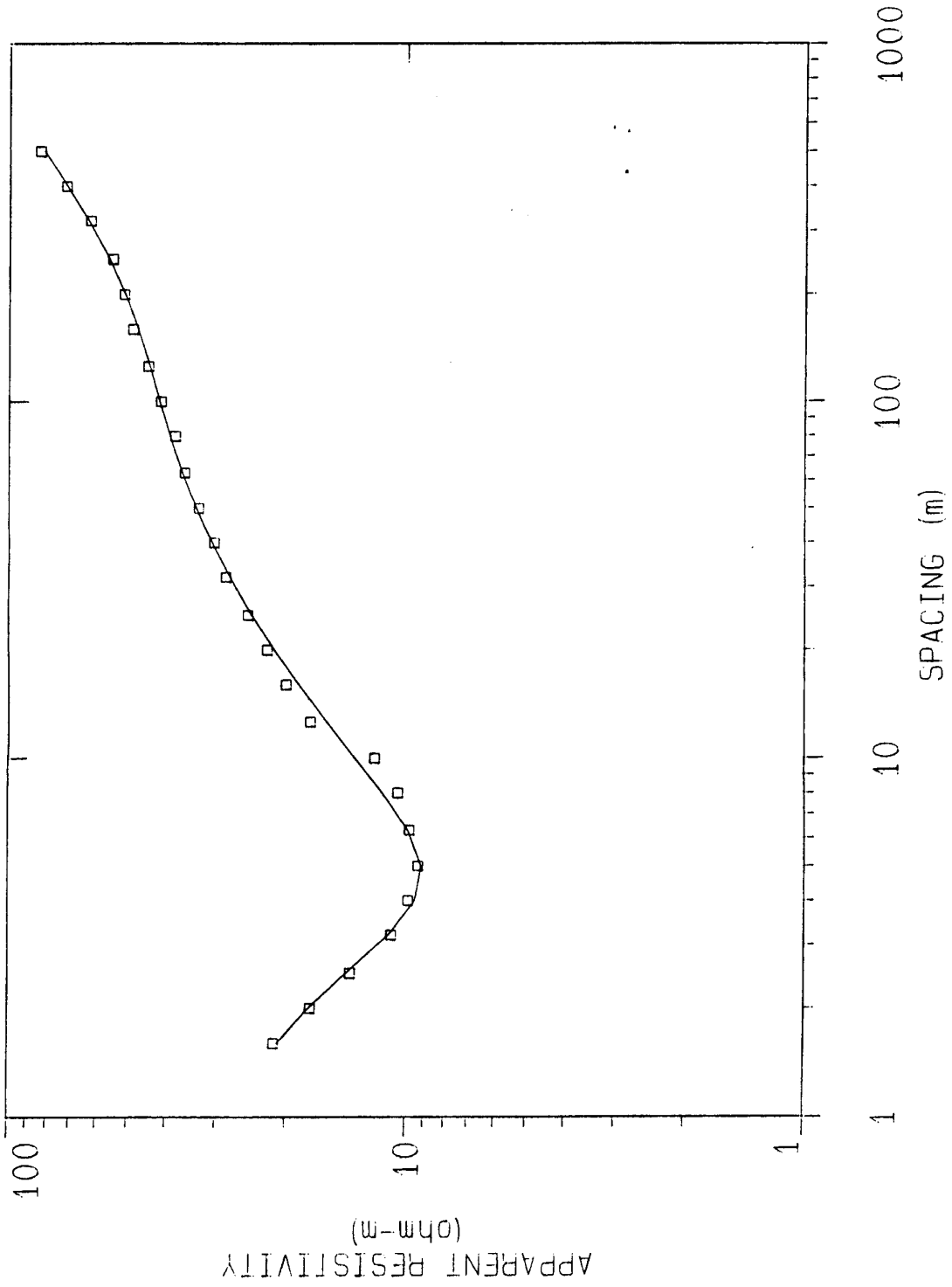
EPILA3



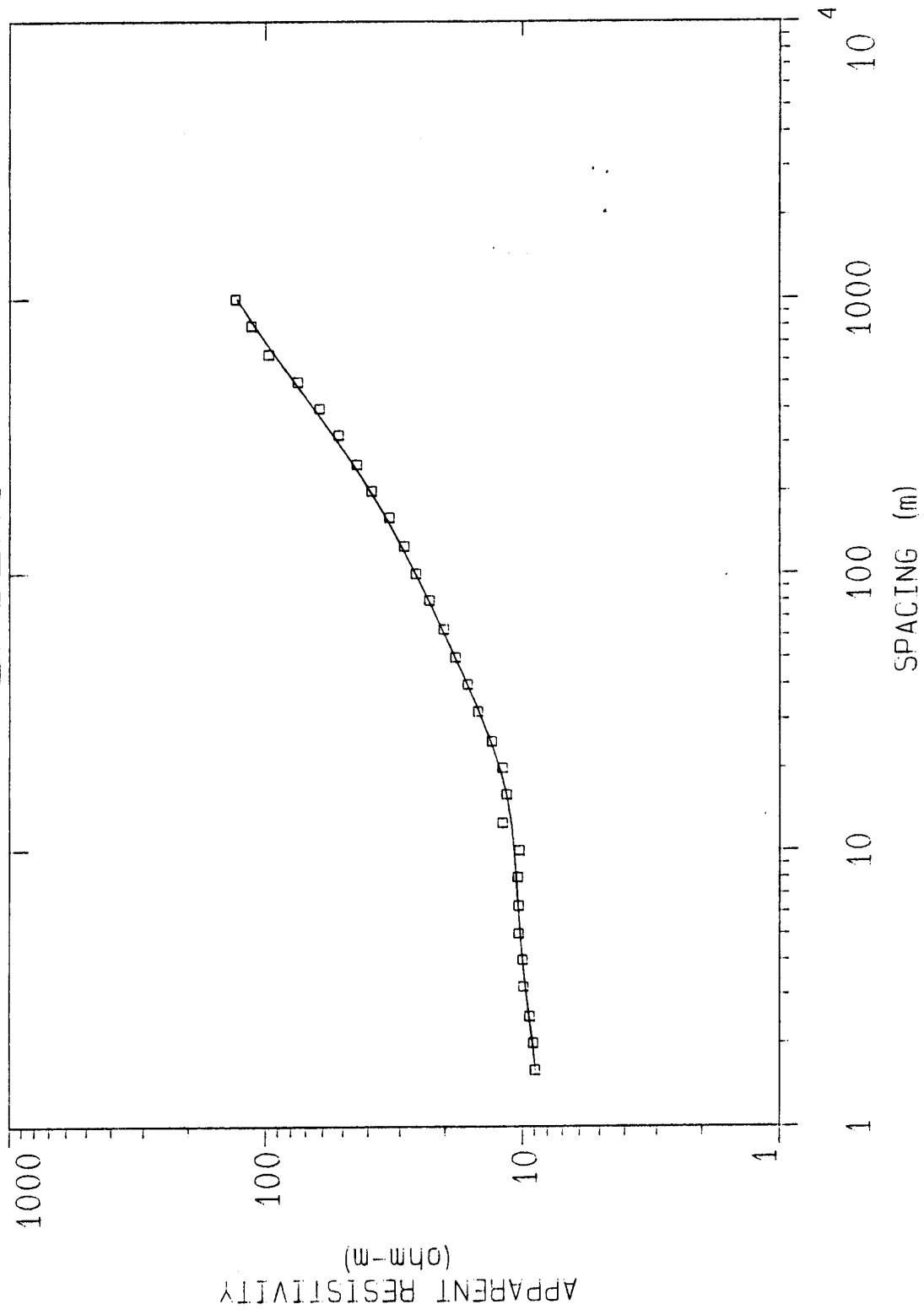
EPIILA4



EPILA5



EPILA6



DATA SET: EPILA7

CLIENT: ITGE
 LOCATION: CARINENA
 COUNTY: ZARAGOZA
 PROJECT: RESISTIVIDAD
 ELEVATION: 350.00
 SOUNDING COORDINATES: X: 641075.0000 Y: 4600575.0000

DATE: 26-4-90
 SOUNDING: 7
 AZIMUTH: 354
 EQUIPMENT: GEOTRON

Schlumberger Configuration

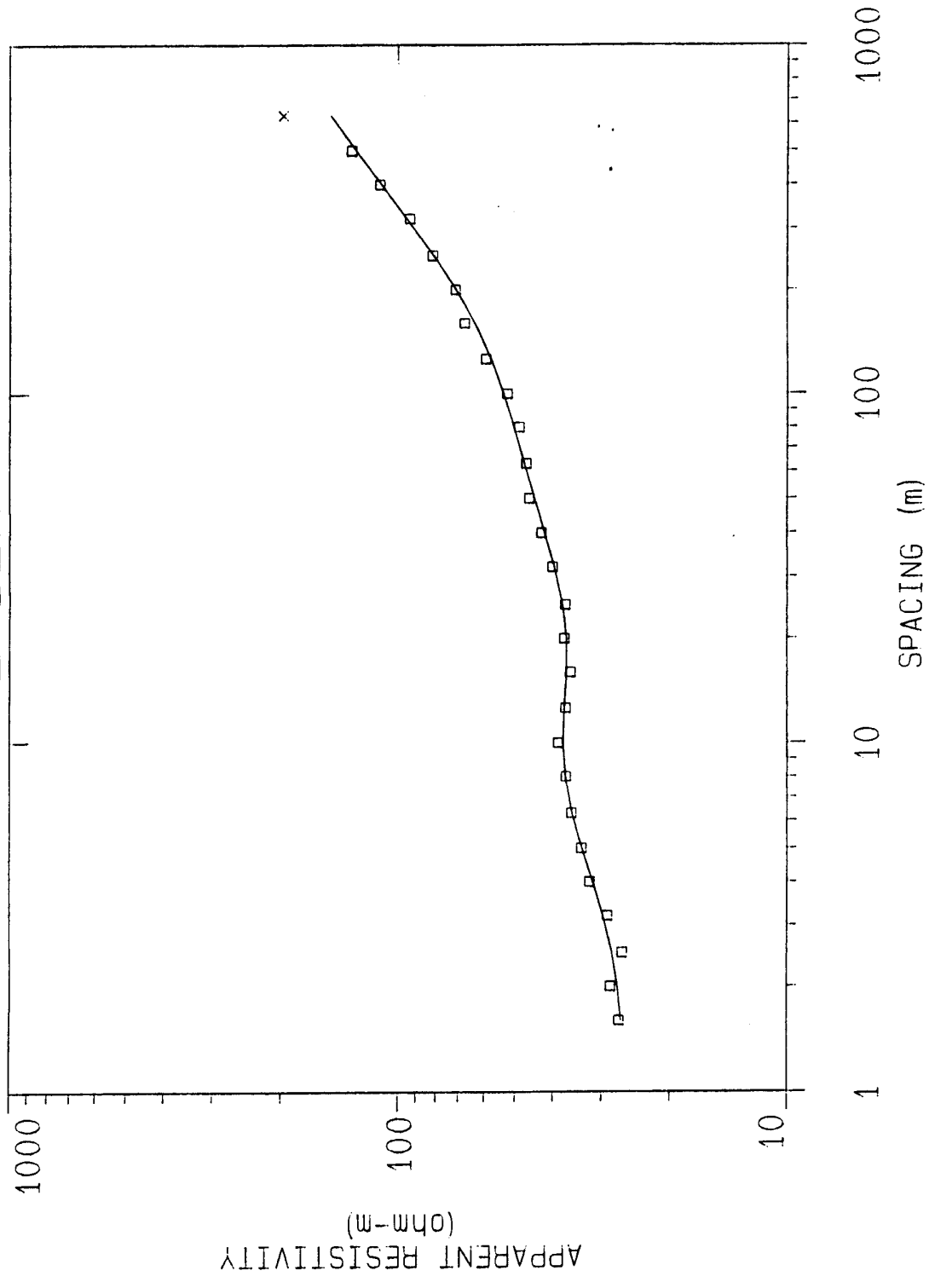
FITTING ERROR: 2.637 PERCENT

L =	RESISTIVITY (ohm-m)	CHARGEABILITY (pfe)	THICKNESS (meters)	ELEVATION (meters)	CONDUCTANCE (Siemens)
				350.0	
1	25.93		2.43	347.5	0.0937
2	79.04		2.03	345.5	0.0257
3	23.26		6.70	338.8	0.288
4	53.77		100.6	238.2	1.87
5	150.9		88.20	150.0	0.584
6	350.0				

ALL PARAMETERS ARE FREE

No.	Spacing (m)	PA DATA	(ohm-m) SYNTHETIC	DIFFERENCE (percent)
1	1.60	26.98	26.64	1.27
2	2.00	28.40	27.20	4.24
3	2.50	26.46	28.11	-6.21
4	3.20	28.92	29.65	-2.54
5	4.00	32.15	31.52	1.94
6	5.00	33.69	33.63	0.195
7	6.30	35.76	35.65	0.302
8	8.00	36.92	37.08	-0.425
9	10.00	38.73	37.56	3.02
10	12.60	36.98	37.32	-0.930
11	16.00	35.92	36.86	-2.59
12	20.00	37.33	36.85	1.28
13	25.00	37.10	37.70	-1.61
14	32.00	40.03	39.64	0.985
15	40.00	42.73	42.00	1.72
16	50.00	45.97	44.58	3.01
17	63.00	46.78	47.33	-1.17
18	80.00	48.74	50.28	-3.16
19	100.0	52.32	53.43	-2.11
20	126.0	59.37	57.55	3.06
21	160.0	67.45	63.39	6.01
22	200.0	71.20	70.95	0.346
23	250.0	81.50	80.96	0.652
24	320.0	93.30	95.12	-1.95
25	400.0	111.5	110.6	0.781
26	500.0	131.6	128.4	2.38
27	630.0	197.3	149.0	24.51

EPILA7



DATA SET: EPILAS

CLIENT: ITGE
 LOCATION: CARINENA
 COUNTY: ZARAGOZA
 PROJECT: RESISTIVIDAD
 ELEVATION: 360.00
 SOUNDING COORDINATES: X: 642200.0000 Y: 4601200.0000

DATE: 21-4-90
 SOUNDING: 8
 AZIMUTH: 293
 EQUIPMENT: GEOTRON

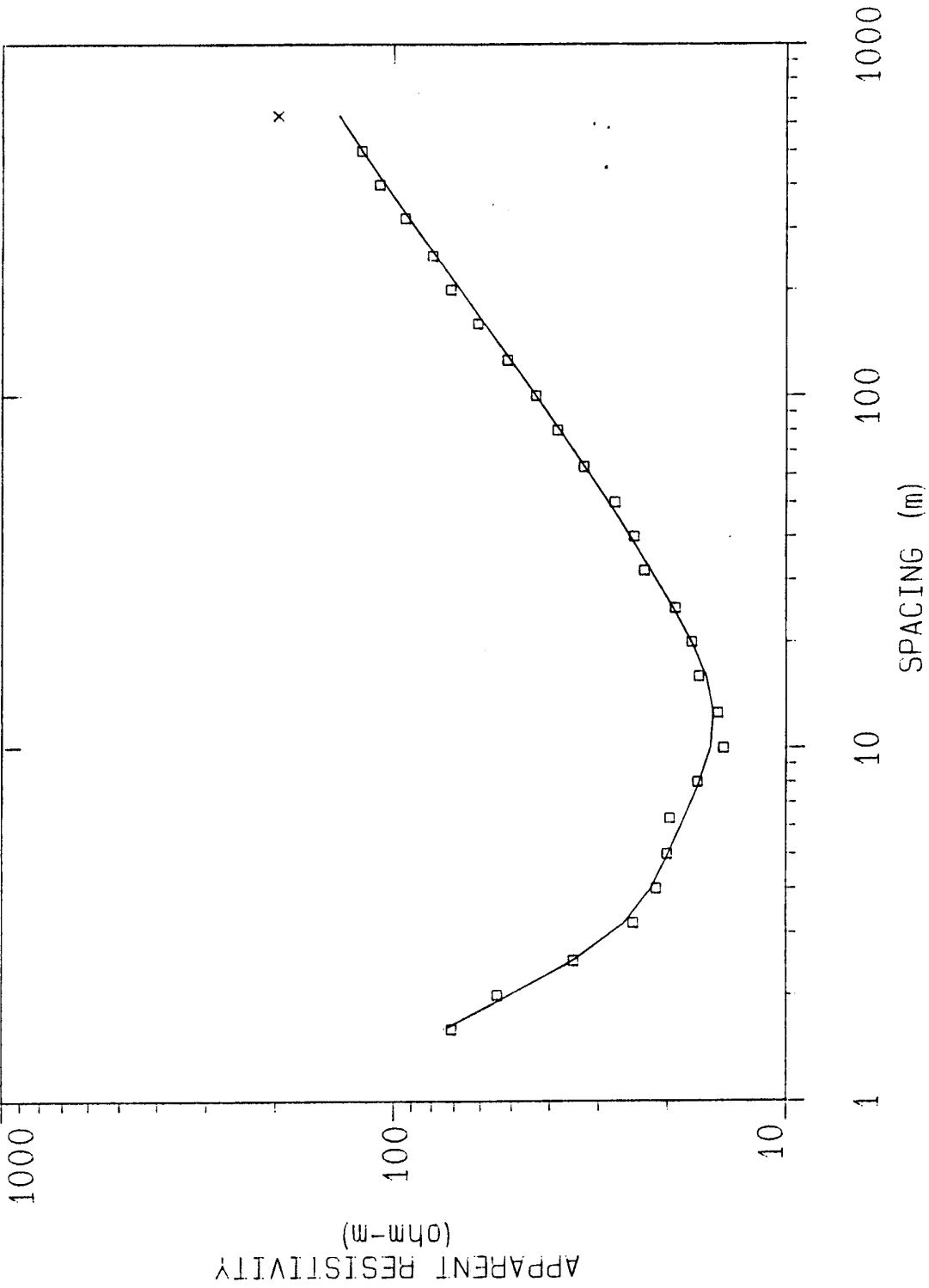
Schlumberger Configuration

L =	RESISTIVITY (ohm-m)	CHARGEABILITY (pie)	THICKNESS (meters)	ELEVATION (meters)	CONDUCTANCE (Siemens)
1	212.9		0.614	360.0	0.00289
2	21.12		3.66	359.3	0.173
3	8.25		4.32	351.3	0.523
4	29.36		22.13	329.2	0.753
5	73.00		48.86	280.3	0.669
6	138.5		113.4	166.9	0.319
7	278.6				

ALL PARAMETERS ARE FREE

No.	Spacing (m)	PA DATA	(ohm-m) SYNTHETIC	DIFFERENCE (percent)
1	1.60	71.19		
2	2.00	54.33		
3	2.50	34.69		
4	3.20	24.46		
5	4.00	21.35		
6	5.00	20.04		
7	6.30	19.72		
8	8.00	16.77		
9	10.00	14.40		
10	12.60	14.91		
11	16.00	16.68		
12	20.00	17.38		
13	25.00	19.15		
14	32.00	22.94		
15	40.00	24.36		
16	50.00	27.34		
17	63.00	32.74		
18	80.00	38.23		
19	100.0	43.44		
20	126.0	51.25		
21	160.0	61.02		
22	200.0	71.70		
23	250.0	79.70		
24	320.0	93.70		
25	400.0	109.0		
26	500.0	121.0		
27	630.0	137.3		

EPIILA8



DATA SET: EPILA9

CLIENT: ITGE
 LOCATION: CARINENA
 COUNTY: ZARAGOZA
 PROJECT: RESISTIVIDAD
 ELEVATION: 340.00
 SOUNDING COORDINATES: X: 643475.0000 Y: 4602025.0000

DATE: 8-5-90
 SOUNDING: 9
 AZIMUTH: 18
 EQUIPMENT: GEOTRON

Schlumberger Configuration

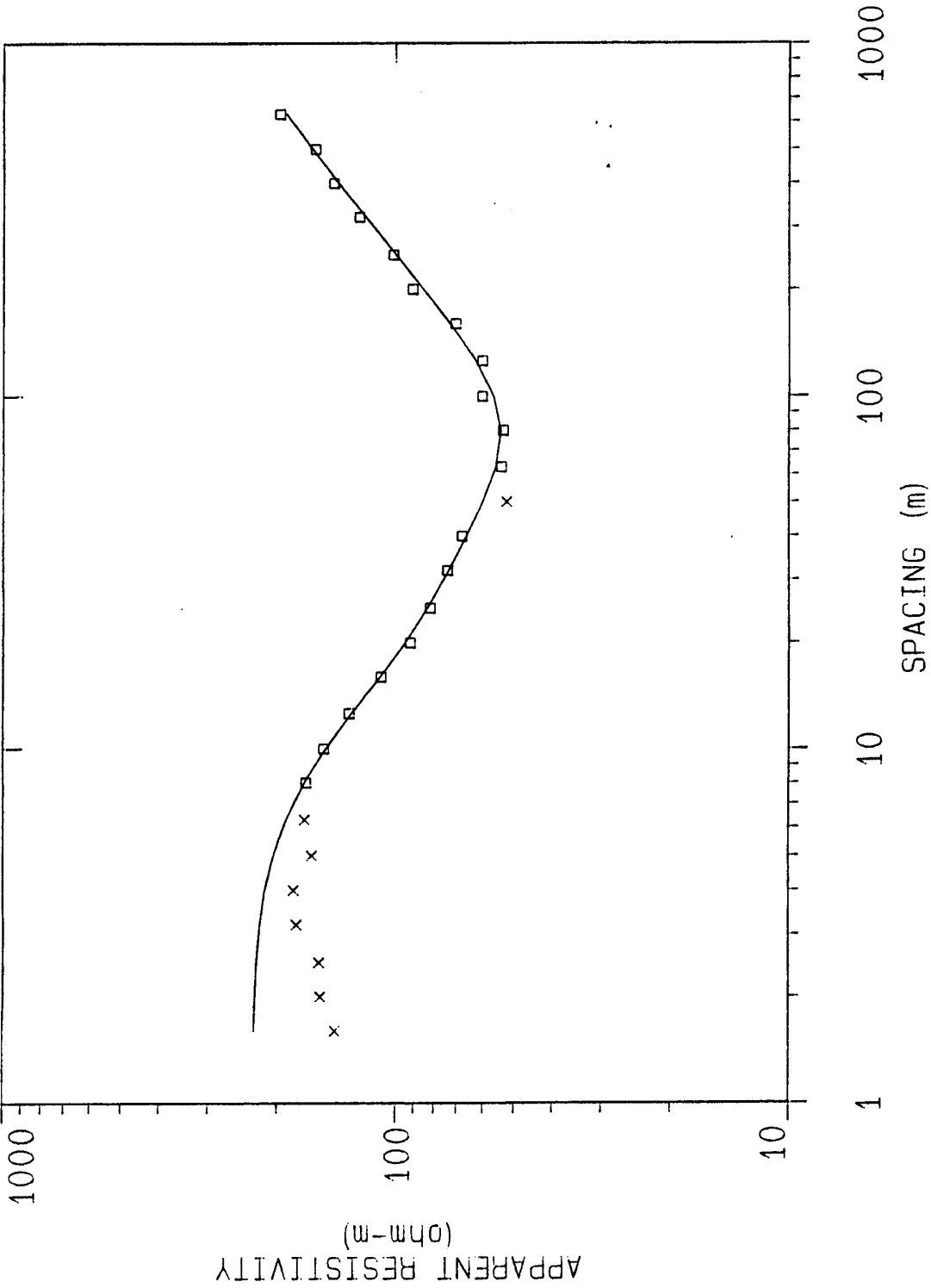
FITTING ERROR: 3.168 PERCENT

L #	RESISTIVITY (ohm-m)	CHARGEABILITY (pfe)	THICKNESS (meters)	ELEVATION (meters)	CONDUCTANCE (Siemens)
				340.0	
1	230.2		1.65	338.3	0.00718
2	233.4		1.54	336.8	0.00662
3	155.3		3.04	333.7	0.0196
4	74.00		20.84	312.9	0.281
5	32.23		41.29	271.6	1.28
6	167.3		110.5	161.0	0.660
7	460.1				

ALL PARAMETERS ARE FREE

No.	Spacing (m)	DATA	PA (ohm-m) SYNTHETIC	DIFFERENCE (percent)
1	1.60	142.2	228.9	-60.92
2	2.00	155.0	227.7	-46.84
3	2.50	156.3	225.5	-44.32
4	3.20	178.7	221.2	-23.79
5	4.00	181.8	214.5	-17.98
6	5.00	163.3	204.4	-25.15
7	6.30	170.5	189.8	-11.26
8	8.00	169.1	170.7	-0.941
9	10.00	152.1	150.5	1.09
10	12.60	131.1	129.2	1.41
11	16.00	108.9	109.3	-0.328
12	20.00	91.79	94.23	-2.65
13	25.00	81.51	82.74	-1.51
14	32.00	73.77	73.12	0.873
15	40.00	67.72	65.99	2.55
16	50.00	52.06	59.93	-15.11
17	63.00	53.65	55.39	-3.24
18	80.00	53.12	53.85	-1.38
19	100.0	60.18	56.18	5.54
20	126.0	60.10	62.53	-4.03
21	160.0	70.42	72.72	-3.27
22	200.0	90.50	85.06	6.01
23	250.0	101.4	99.89	1.48
24	320.0	123.8	119.3	3.58
25	400.0	143.7	139.9	-1.53
26	500.0	169.3	163.2	-1.76
27	630.0	197.3	190.0	3.73

EPIILA9



DATA SET: EPILA10

CLIENT: ITGE	DATE: 19-5-90
LOCATION: CARINENA	SOUNDING: 10
COUNTY: ZARAGOZA	AZIMUTH: 354
PROJECT: RESISTIVIDAD	EQUIPMENT: GEOTRON
ELEVATION: 365.00	
SOUNDING COORDINATES: X: 645125.0000 Y: 4602900.0000	

Schlumberger Configuration

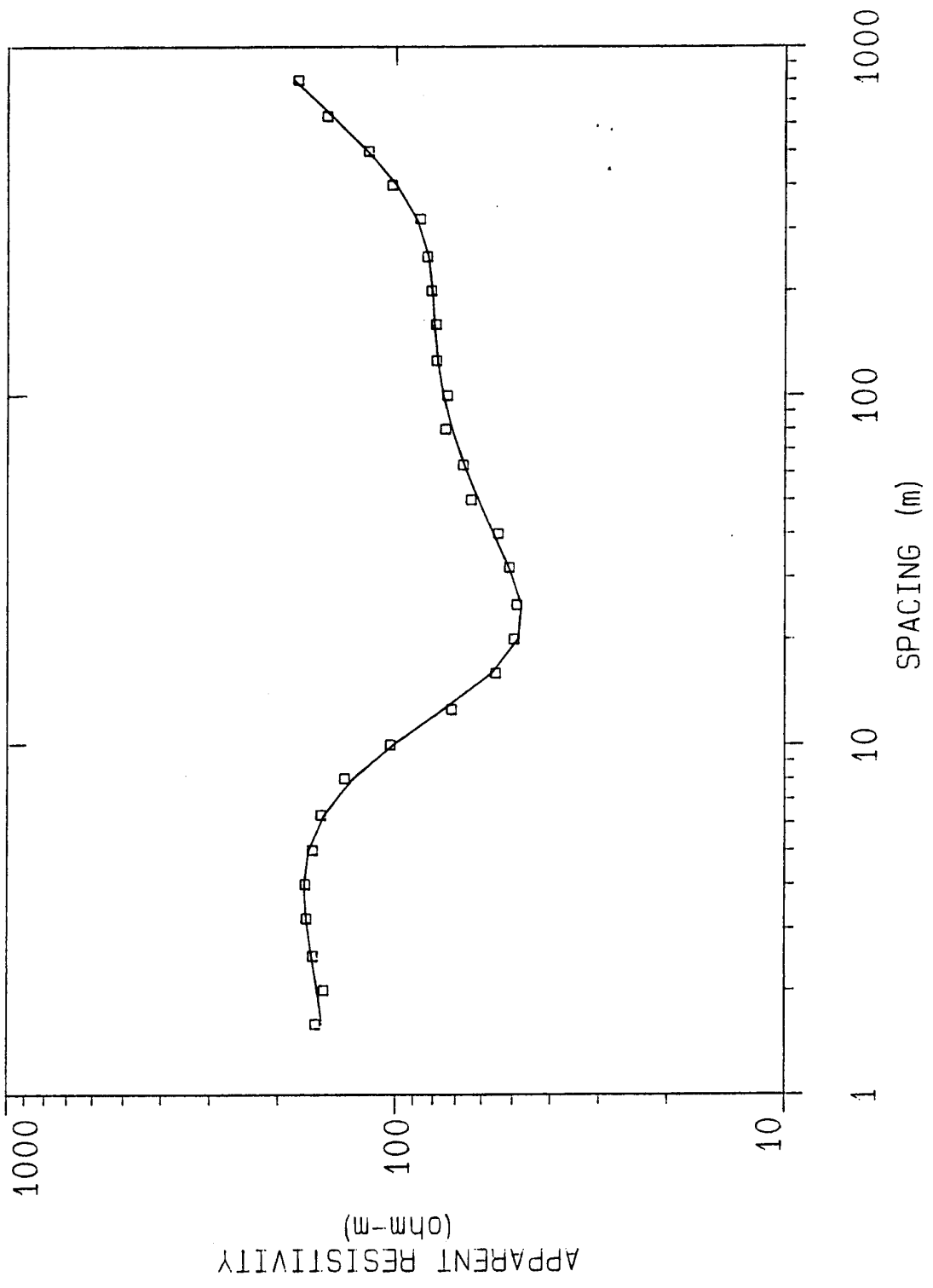
FITTING ERROR: 2.576 PERCENT

L #	RESISTIVITY (ohm-m)	CHARGEABILITY (pfe)	THICKNESS (meters)	ELEVATION (meters)	CONDUCTANCE (Siemens)
				365.0	
1	147.1		1.65	363.3	0.0112
2	355.9		1.75	361.5	0.00493
3	16.95		4.03	357.5	0.238
4	55.07		10.79	346.7	0.196
5	96.54		97.92	248.8	1.01
6	16.53		34.36	214.4	2.07
7	101.0		67.47	146.9	0.667
8	4868.5				

ALL PARAMETERS ARE FREE

No.	Spacing (m)	PA DATA	(ohm-m) SYNTHETIC	DIFFERENCE (percent)
1	1.60	160.7	154.4	3.89
2	2.00	152.8	158.9	-3.95
3	2.50	163.2	164.4	-0.747
4	3.20	169.7	170.2	-0.293
5	4.00	170.8	172.0	-0.663
6	5.00	163.5	167.2	-2.25
7	6.30	155.6	153.8	1.69
8	8.00	135.3	128.7	4.83
9	10.00	103.2	101.5	1.71
10	12.60	71.88	75.28	-4.72
11	16.00	55.30	56.49	-2.14
12	20.00	49.59	48.39	2.40
13	25.00	48.79	47.53	2.59
14	32.00	51.01	51.17	-0.302
15	40.00	54.43	56.09	-3.05
16	50.00	64.05	61.42	4.10
17	63.00	67.11	66.84	0.408
18	80.00	74.64	71.86	3.71
19	100.0	73.85	75.62	-2.39
20	126.0	78.66	78.29	0.477
21	160.0	78.84	79.79	-1.20
22	200.0	81.07	80.67	0.494
23	250.0	83.16	82.56	0.722
24	320.0	86.69	88.54	-2.13
25	400.0	102.4	99.97	2.45
26	500.0	117.8	118.6	-0.623
27	630.0	150.5	146.6	2.95
28	800.0	179.0	183.3	-2.41

EPILA10



DATA SET: EPILA11

CLIENT: ITGE
 LOCATION: CARINENA
 COUNTY: ZARAGOZA
 PROJECT: RESISTIVIDAD
 ELEVATION: 370.00
 SOUNDING COORDINATES: X: 646150.0000 Y: 4603525.0000

DATE: 10-5-90
 SOUNDING: 11
 AZIMUTH: 339
 EQUIPMENT: GEOTRON

Schlumberger Configuration

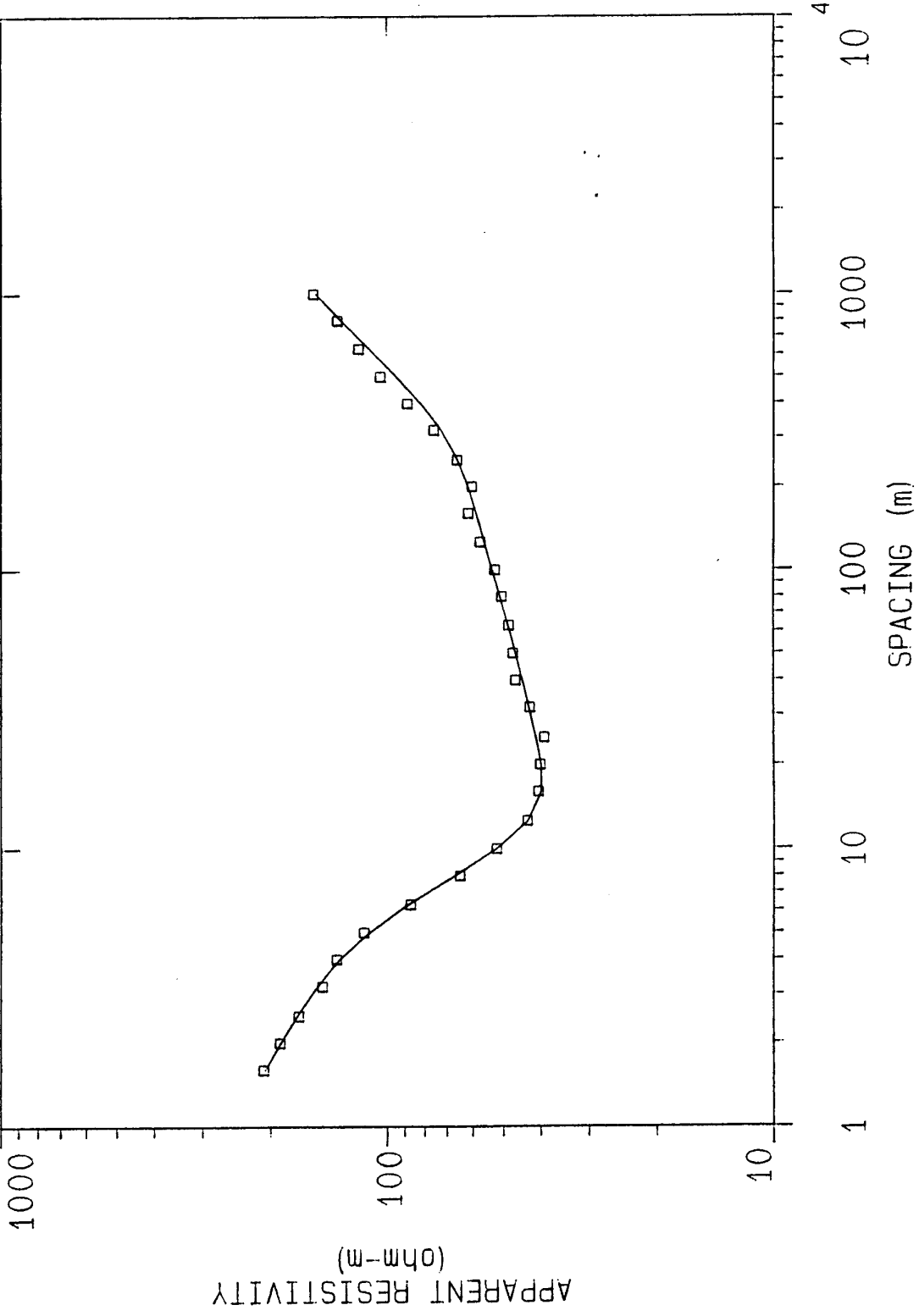
FITTING ERROR: 3.486 PERCENT

L #	RESISTIVITY (ohm-m)	CHARGEABILITY (pfe)	THICKNESS (meters)	ELEVATION (meters)	CONDUCTANCE (Siemens)
1	283.1		0.607	370.0	
2	160.7		2.49	369.3	0.00214
3	28.33		5.90	366.8	0.0155
4	47.12		33.12	360.9	0.208
5	66.54		96.10	327.8	0.702
6	23.87		37.90	231.7	1.44
7	91.55		32.23	193.8	1.58
8	368.6			161.6	0.352

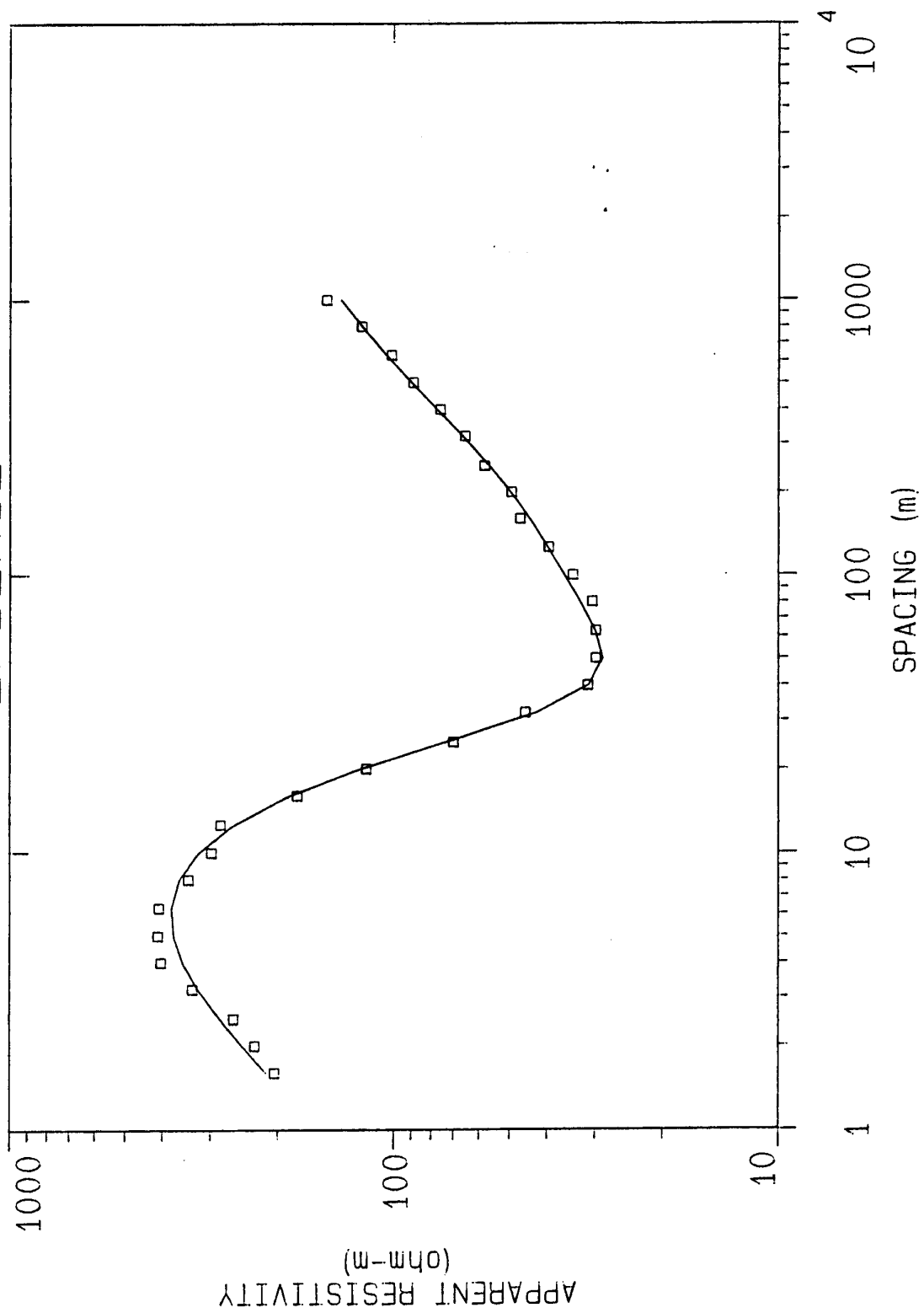
ALL PARAMETERS ARE FREE

NO.	Spacing (m)	PA (ohm-m)		DIFFERENCE (percent)
		DATA	SYNTHETIC	
1	1.60	208.8	206.9	0.907
2	2.00	189.3	188.5	0.433
3	2.50	169.3	170.9	-0.913
4	3.20	146.9	151.5	-3.15
5	4.00	134.8	132.5	1.70
6	5.00	114.9	111.3	3.13
7	6.30	86.93	88.21	-1.47
8	8.00	64.81	66.64	-2.82
9	10.00	51.97	51.82	0.276
10	12.60	43.31	43.11	0.445
11	16.00	40.56	39.88	1.66
12	20.00	40.14	39.92	0.545
13	25.00	39.18	41.19	-5.12
14	32.00	42.76	42.99	-0.551
15	40.00	46.61	44.73	4.02
16	50.00	47.25	46.58	1.42
17	63.00	48.47	48.68	-0.438
18	80.00	50.53	51.07	-1.05
19	100.0	52.60	53.45	-1.62
20	126.0	57.34	56.01	2.32
21	160.0	61.59	58.75	4.61
22	200.0	60.23	61.68	-2.40
23	250.0	65.87	65.65	0.334
24	320.0	75.66	72.45	4.24
25	400.0	88.54	81.79	7.62
26	500.0	104.0	94.57	9.13
27	630.0	118.5	111.2	6.15
28	800.0	134.3	131.4	2.15
29	1000.0	154.8	152.4	1.58

EPILA11



EPI1A12



DATA SET: EPILA13

CLIENT: ITGE
 LOCATION: CARINENA
 COUNTY: ZARAGOZA
 PROJECT: RESISTIVIDAD
 ELEVATION: 380.00
 SOUNDING COORDINATES: X: 642550.0000 Y: 4599125.0000

DATE: 25-4-90
 SOUNDING: 13
 AZIMUTH: 343
 EQUIPMENT: GEOTRON

Schlumberger Configuration

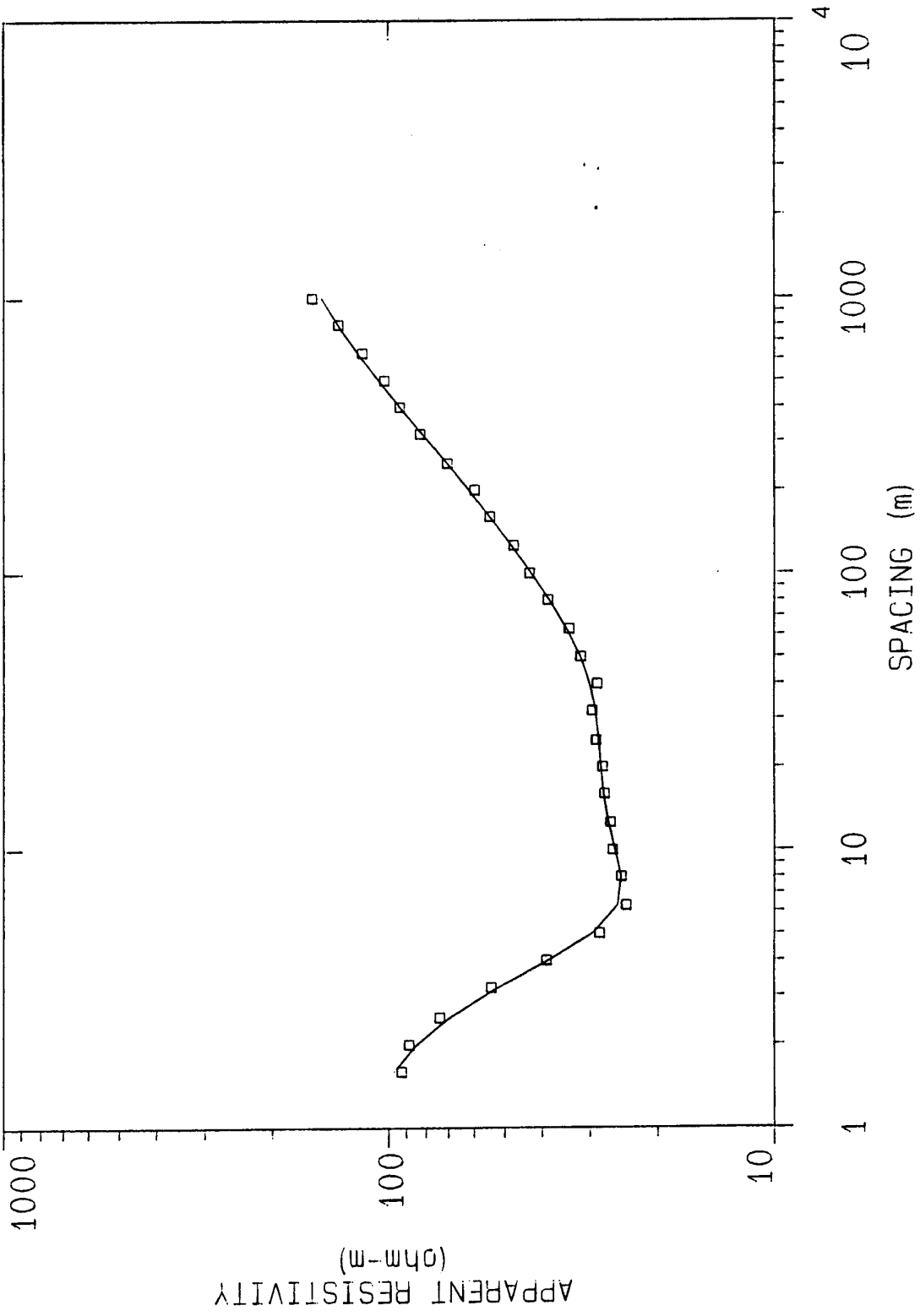
FITTING ERROR: 2.906 PERCENT

L #	RESISTIVITY (ohm-m)	CHARGEABILITY (pfe)	THICKNESS (meters)	ELEVATION (meters)	CONDUCTANCE (Siemens)
				380.0	
1	118.2		1.37	378.6	0.0116
2	11.28		1.68	376.9	0.149
3	37.87		4.35	372.5	0.114
4	25.82		25.79	346.7	0.998
5	61.19		70.69	276.0	1.15
6	113.8		77.33	198.7	0.679
7	221.0				

ALL PARAMETERS ARE FREE

No.	Spacing (m)	DATA	PA (ohm-m)	SYNTHETIC	DIFFERENCE (percent)
1	1.60	92.49	96.85		-4.71
2	2.00	88.42	84.74		4.16
3	2.50	73.74	69.63		5.58
4	3.20	54.13	51.95		4.03
5	4.00	38.97	38.40		1.46
6	5.00	28.36	29.59		-4.00
7	6.30	24.17	25.42		-5.18
8	8.00	24.91	24.93		-0.0984
9	10.00	26.26	25.88		1.47
10	12.60	26.61	26.97		-1.36
11	16.00	27.58	27.76		-0.630
12	20.00	27.91	28.20		-1.04
13	25.00	29.00	28.55		1.55
14	32.00	29.65	29.12		1.78
15	40.00	28.78	30.13		-4.68
16	50.00	31.75	31.87		-0.379
17	63.00	34.00	34.59		-1.72
18	80.00	38.61	38.38		0.608
19	100.0	43.12	42.75		0.846
20	126.0	47.40	48.11		-1.51
21	160.0	54.60	54.68		-0.137
22	200.0	59.79	61.97		-3.65
23	250.0	70.48	70.61		-0.173
24	320.0	82.81	81.85		1.15
25	400.0	93.40	93.50		-0.103
26	500.0	102.5	106.3		-3.65
27	630.0	117.1	120.4		-2.86
28	800.0	134.8	135.4		-0.411
29	1000.0	157.8	149.2		5.45

EPIILA13



DATA SET: EPILA14

CLIENT: ITGE DATE: 24-4-90
 LOCATION: CARINENA SOUNDING: 14
 COUNTY: ZARAGOZA AZIMUTH: 298
 PROJECT: RESISTIVIDAD EQUIPMENT: GEOTRON
 ELEVATION: 370.00
 SOUNDING COORDINATES: X: 643700.0000 Y: 4599750.0000

Schlumberger Configuration

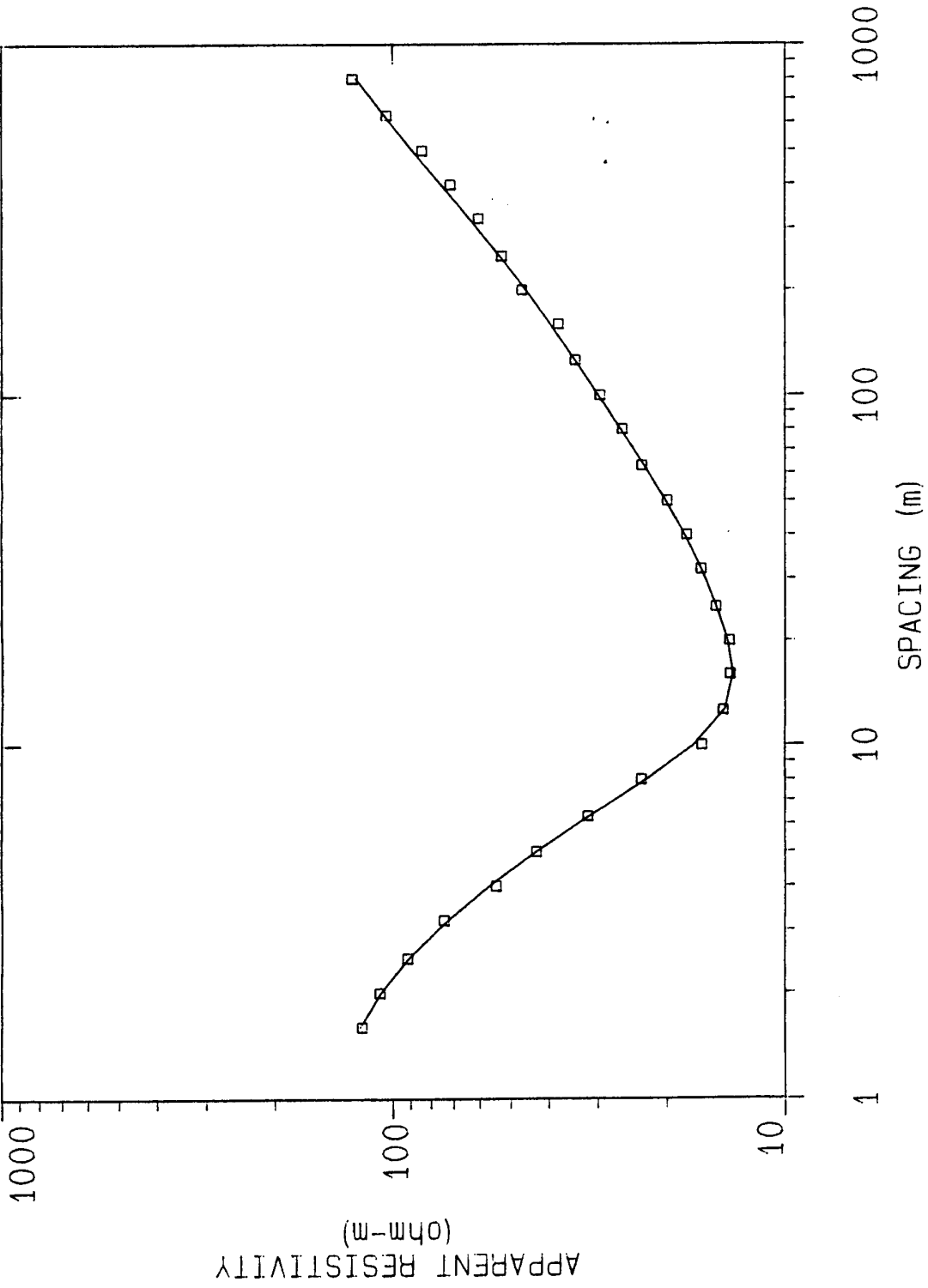
FITTING ERROR: 2.682 PERCENT

L =	RESISTIVITY (ohm-m)	CHARGEABILITY (pfe)	THICKNESS (meters)	ELEVATION (meters)	CONDUCTANCE (Siemens)
				370.0	
1	148.7		1.13	368.8	0.00763
2	48.55		2.30	366.5	0.0473
3	8.67		5.14	361.4	0.592
4	16.59		21.95	339.4	1.32
5	50.55		110.1	229.3	2.17
6	110.0		24.00	205.3	0.218
7	315.8				

ALL PARAMETERS ARE FREE

No.	Spacing (m)	PA DATA	(ohm-m) SYNTHETIC	DIFFERENCE (percent)
1	1.60	119.9	121.2	-1.08
2	2.00	108.0	107.4	0.619
3	2.50	91.73	91.12	0.661
4	3.20	74.04	72.36	2.26
5	4.00	54.46	56.63	-3.97
6	5.00	43.04	43.03	0.0333
7	6.30	31.76	31.46	0.928
8	8.00	23.19	22.46	3.13
9	10.00	16.29	17.02	-4.44
10	12.60	14.34	14.21	0.905
11	16.00	13.76	13.52	1.78
12	20.00	13.84	13.98	-1.05
13	25.00	15.00	14.94	0.347
14	32.00	16.37	16.37	0.0128
15	40.00	17.82	18.03	-1.19
16	50.00	19.94	20.15	-1.04
17	63.00	23.13	22.86	1.14
18	80.00	25.95	26.24	-1.11
19	100.0	29.58	29.90	-1.08
20	126.0	34.18	34.29	-0.321
21	160.0	37.74	39.65	-5.07
22	200.0	46.78	45.75	2.19
23	250.0	52.65	53.31	-1.24
24	320.0	60.32	63.79	-5.74
25	400.0	71.31	75.40	-5.74
26	500.0	84.19	89.09	-5.81
27	630.0	103.8	105.3	-1.46
28	800.0	126.8	124.0	2.16

EPILA14



DATA SET: EPILA15

CLIENT: ITGE
 LOCATION: CARINENA
 COUNTY: ZARAGOZA
 PROJECT: RESISTIVIDAD
 ELEVATION: 380.00
 SOUNDING COORDINATES: X: 644750.0000 Y: 4600350.0000

DATE: 24-4-90
 SOUNDING: 15
 AZIMUTH: 305
 EQUIPMENT: GEOTRON

Schlumberger Configuration

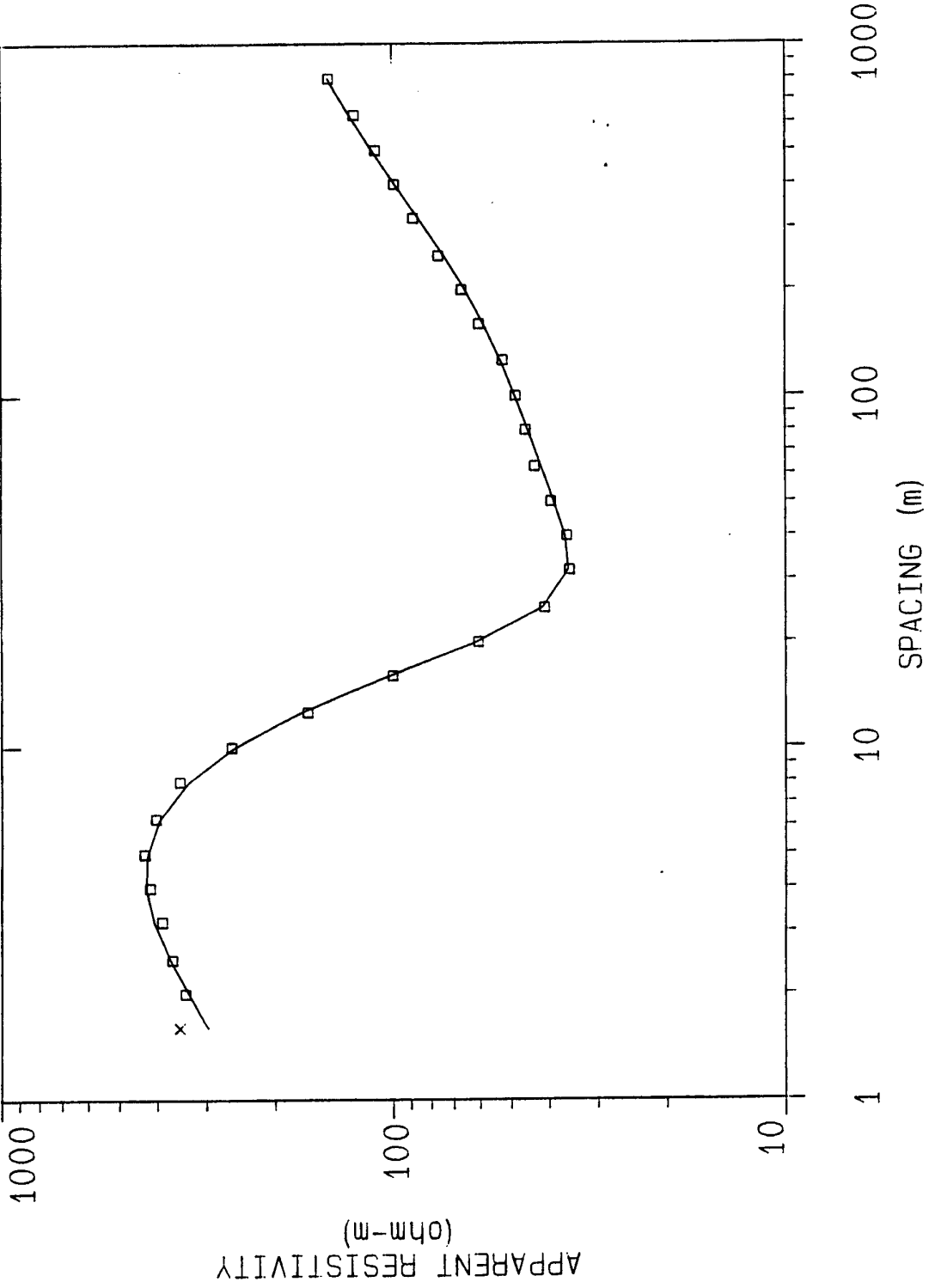
FITTING ERROR: 2.441 PERCENT

L =	RESISTIVITY (ohm-m)	CHARGEABILITY (pfe)	THICKNESS (meters)	ELEVATION (meters)	CONDUCTANCE (Siemens)
				380.0	
1	212.0		0.939	379.0	0.00443
2	1177.2		1.58	377.4	0.00135
3	129.5		1.45	376.0	0.0112
4	24.64		14.91	361.1	0.605
5	52.93		87.64	273.4	1.65
6	98.13		63.45	210.0	0.646
7	250.0				

ALL PARAMETERS ARE FREE

No.	Spacing (m)	PA DATA	(ohm-m) SYNTHETIC	DIFFERENCE (percent)
1	1.60	349.9	296.8	15.19
2	2.00	339.2	333.0	1.83
3	2.50	366.9	371.4	-1.23
4	3.20	388.5	408.1	-5.03
5	4.00	417.7	427.0	-2.23
6	5.00	431.6	424.4	1.67
7	6.30	402.7	393.3	2.33
8	8.00	349.3	331.0	5.22
9	10.00	258.4	254.0	1.71
10	12.60	165.3	171.4	-3.69
11	16.00	100.2	101.9	-1.72
12	20.00	60.56	60.98	-0.685
13	25.00	41.04	41.49	-1.08
14	32.00	35.39	35.59	-0.559
15	40.00	35.93	36.36	-1.18
16	50.00	39.49	38.85	1.63
17	63.00	43.53	41.91	3.71
18	80.00	45.87	45.35	1.14
19	100.0	48.59	48.87	-0.564
20	126.0	52.35	53.10	-1.43
21	160.0	60.13	58.61	2.52
22	200.0	66.65	65.34	1.96
23	250.0	76.39	73.98	3.14
24	320.0	88.41	85.92	2.80
25	400.0	98.94	98.71	0.231
26	500.0	110.5	113.0	-2.22
27	630.0	125.2	128.9	-3.01
28	800.0	145.2	146.0	-0.590

EPILA15



DATA SET: EPILA16

CLIENT: ITGE
 LOCATION: CARINENA
 COUNTY: ZARAGOZA
 PROJECT: RESISTIVIDAD
 ELEVATION: 395.00
 SOUNDING COORDINATES: X: 645900.0000 Y: 4601750.0000

DATE: 10-5-90
 SOUNDING: 16
 AZIMUTH: 287
 EQUIPMENT: GEOTRON

Schlumberger Configuration

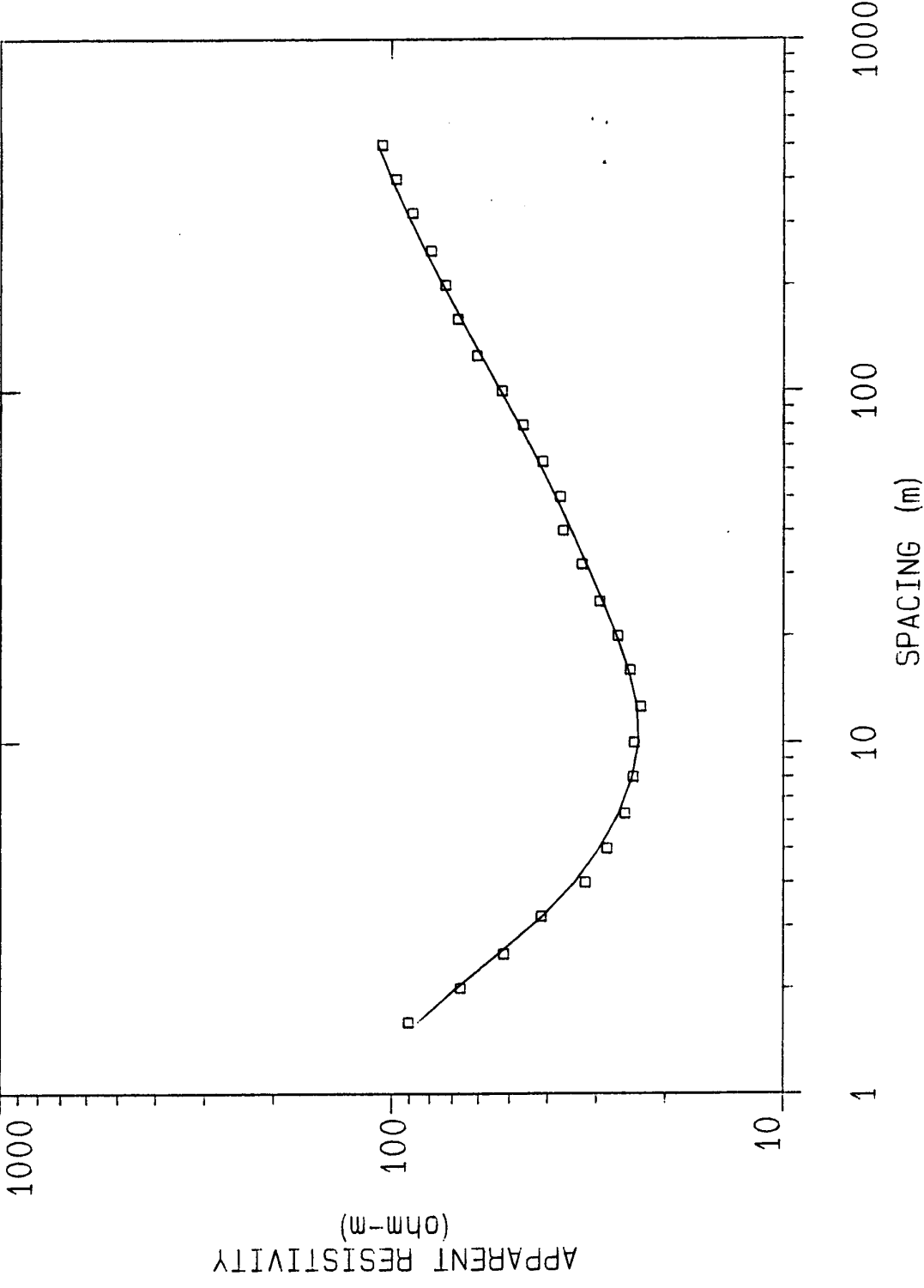
FITTING ERROR: 3.024 PERCENT

L #	RESISTIVITY (ohm-m)	CHARGEABILITY (pfe)	THICKNESS (meters)	ELEVATION (meters)	CONDUCTANCE (Siemens)
				395.0	
1	143.2		0.788	394.2	0.00550
2	31.44		2.26	391.9	0.0719
3	18.00		6.12	385.8	0.339
4	38.97		27.13	358.6	0.696
5	79.95		45.33	313.3	0.566
6	111.7		68.35	245.0	0.611
7	149.8				

ALL PARAMETERS ARE FREE

No.	Spacing (m)	DATA	PA (ohm-m) SYNTHETIC	DIFFERENCE (percent)
1	1.60	90.44	85.53	5.42
2	2.00	66.71	68.30	-2.38
3	2.50	51.66	53.26	-3.10
4	3.20	41.49	41.08	0.976
5	4.00	32.00	33.98	-6.20
6	5.00	28.20	29.43	-4.36
7	6.30	25.35	26.30	-3.74
8	8.00	24.13	24.25	-0.489
9	10.00	24.00	23.39	2.51
10	12.60	23.09	23.60	-2.19
11	16.00	24.58	24.83	-1.02
12	20.00	26.44	26.68	-0.900
13	25.00	29.42	28.97	1.53
14	32.00	32.65	31.86	2.41
15	40.00	36.50	34.80	4.64
16	50.00	37.06	38.17	-2.99
17	63.00	41.14	42.28	-2.77
18	80.00	46.23	47.31	-2.34
19	100.0	52.24	52.77	-1.02
20	126.0	60.59	59.18	2.31
21	160.0	67.82	66.57	1.83
22	200.0	73.00	74.11	-1.53
23	250.0	79.40	82.20	-3.53
24	320.0	88.50	91.59	-3.49
25	400.0	97.60	100.2	-2.68
26	500.0	105.9	108.6	-2.61

EPILA16



DATA SET: EPILA17

CLIENT: ITGE
 LOCATION: CARINENA
 COUNTY: ZARAGOZA
 PROJECT: RESISTIVIDAD
 ELEVATION: 400.00
 SOUNDING COORDINATES: X: 0.0000 Y: 0.0000

DATE: 20-5-90
 SOUNDING: 17
 AZIMUTH: 304
 EQUIPMENT: GEOTRON

Schlumberger Configuration

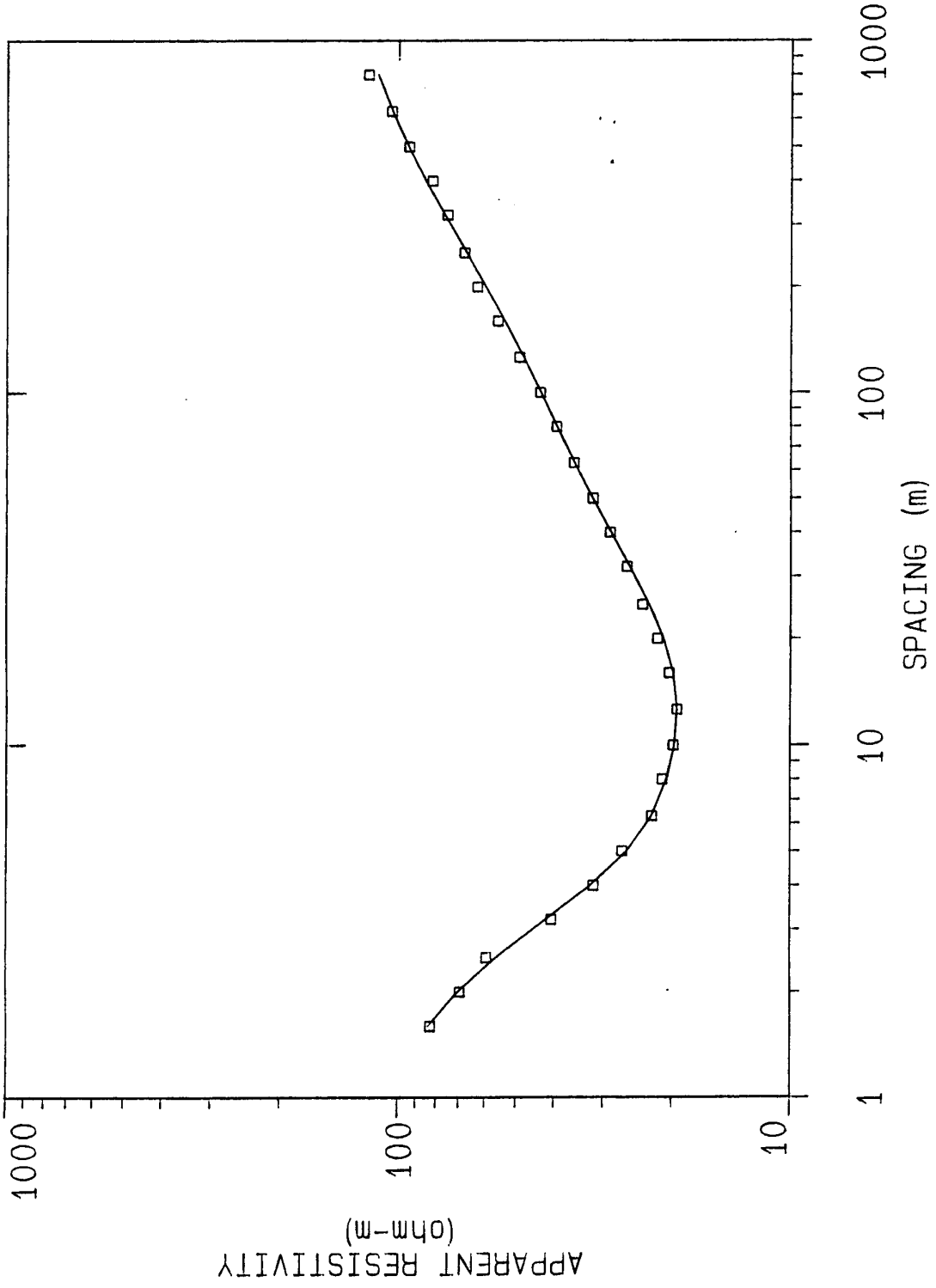
FITTING ERROR: 2.676 PERCENT

L #	RESISTIVITY (ohm-m)	CHARGEABILITY (pfe)	THICKNESS (meters)	ELEVATION (meters)	CONDUCTANCE (Siemens)
				400.0	
1	112.1		1.08	398.9	0.00966
2	20.80		3.39	395.5	0.163
3	16.00		10.11	385.4	0.632
4	49.91		77.08	308.3	1.54
5	105.8		58.32	250.0	0.551
6	150.0				

ALL PARAMETERS ARE FREE

No.	Spacing (m)	PA DATA	(ohm-m) SYNTHETIC	DIFFERENCE (percent)
1	1.60	82.51	83.42	-1.10
2	2.00	69.46	70.34	-1.26
3	2.50	59.28	56.13	5.32
4	3.20	40.48	41.82	-3.32
5	4.00	31.63	32.15	-1.63
6	5.00	26.76	25.99	2.87
7	6.30	22.45	22.47	-0.109
8	8.00	21.12	20.59	2.50
9	10.00	19.79	19.69	0.545
10	12.60	19.39	19.39	0.0132
11	16.00	20.31	19.82	2.40
12	20.00	21.77	20.98	3.63
13	25.00	23.78	22.87	3.83
14	32.00	26.07	25.68	1.48
15	40.00	28.81	28.69	0.441
16	50.00	31.89	31.96	-0.206
17	63.00	35.60	35.53	0.213
18	80.00	39.51	39.42	0.213
19	100.0	43.51	43.37	0.322
20	126.0	49.12	47.99	2.31
21	160.0	55.79	53.63	3.86
22	200.0	63.03	59.93	4.91
23	250.0	68.04	67.27	1.12
24	320.0	75.25	76.46	-1.60
25	400.0	82.17	85.43	-3.96
26	500.0	94.20	94.65	-0.479
27	630.0	104.5	104.0	0.409
28	800.0	119.7	113.2	5.37

EPILA17



DATA SET: EPILA18

CLIENT: ITGE
 LOCATION: CARINENA
 COUNTY: ZARAGOZA
 PROJECT: RESISTIVIDAD
 ELEVATION: 405.00
 SOUNDING COORDINATES: X: 648150.0000 Y: 4602375.0000

DATE: 25-4-90
 SOUNDING: 18
 AZIMUTH: 303
 EQUIPMENT: GEOTRON

Schlumberger Configuration

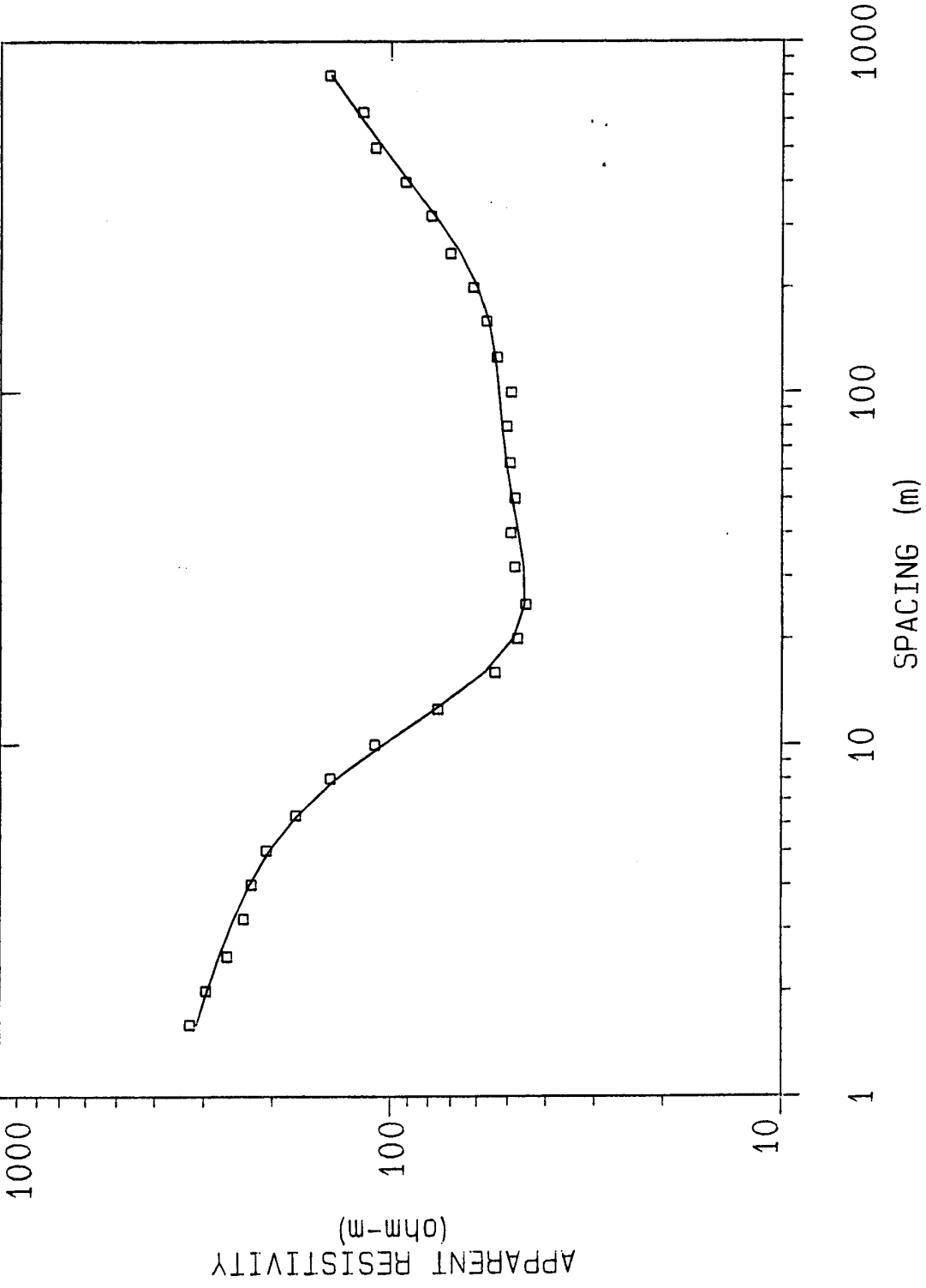
FITTING ERROR: 3.669 PERCENT

L #	RESISTIVITY (ohm-m)	CHARGEABILITY (pie)	THICKNESS (meters)	ELEVATION (meters)	CONDUCTANCE (Siemens)
				405.0	
1	359.7		0.864	404.1	0.00240
2	236.1		3.39	400.7	0.0143
3	36.51		14.11	386.6	0.386
4	59.91		40.08	346.5	0.668
5	41.70		81.49	265.0	1.95
6	102.2		49.22	215.8	0.481
7	307.4				

ALL PARAMETERS ARE FREE

No.	Spacing (m)	DATA	PA (ohm-m) SYNTHETIC	DIFFERENCE (percent)
				3.91
1	1.60	325.6	312.8	0.655
2	2.00	296.4	294.4	-4.86
3	2.50	261.7	274.4	-5.89
4	3.20	237.3	251.3	-1.06
5	4.00	226.7	229.1	1.78
6	5.00	207.7	204.0	0.968
7	6.30	175.0	173.3	3.49
8	8.00	142.6	137.6	4.64
9	10.00	109.8	104.7	-1.03
10	12.60	75.83	76.61	-6.37
11	16.00	54.05	57.50	-2.42
12	20.00	47.36	48.51	-0.706
13	25.00	45.13	45.45	5.26
14	32.00	48.21	45.67	4.43
15	40.00	49.38	47.19	-1.71
16	50.00	48.18	49.01	-2.18
17	63.00	49.62	50.70	-2.99
18	80.00	50.50	52.02	-7.41
19	100.0	49.28	52.94	-1.01
20	126.0	53.49	54.03	1.31
21	160.0	56.93	56.18	2.40
22	200.0	61.56	60.08	5.77
23	250.0	70.68	66.60	2.23
24	320.0	79.04	77.28	2.22
25	400.0	91.97	89.92	4.44
26	500.0	109.8	104.9	-3.56
27	630.0	118.3	122.5	1.02
28	800.0	143.8	142.3	

EPILA18



DATA SET: EPILA19

CLIENT: ITGE
 LOCATION: CARI ENA
 COUNTY: ZARAGOZA
 PROJECT: RESISTIVIDAD
 ELEVATION: 0.00
 SOUNDING COORDINATES: X: 0.0000 Y: 0.0000

DATE: 3-4-90
 SOUNDING: 19
 AZIMUTH: 308
 EQUIPMENT: GEOTRON

Schlumberger Configuration

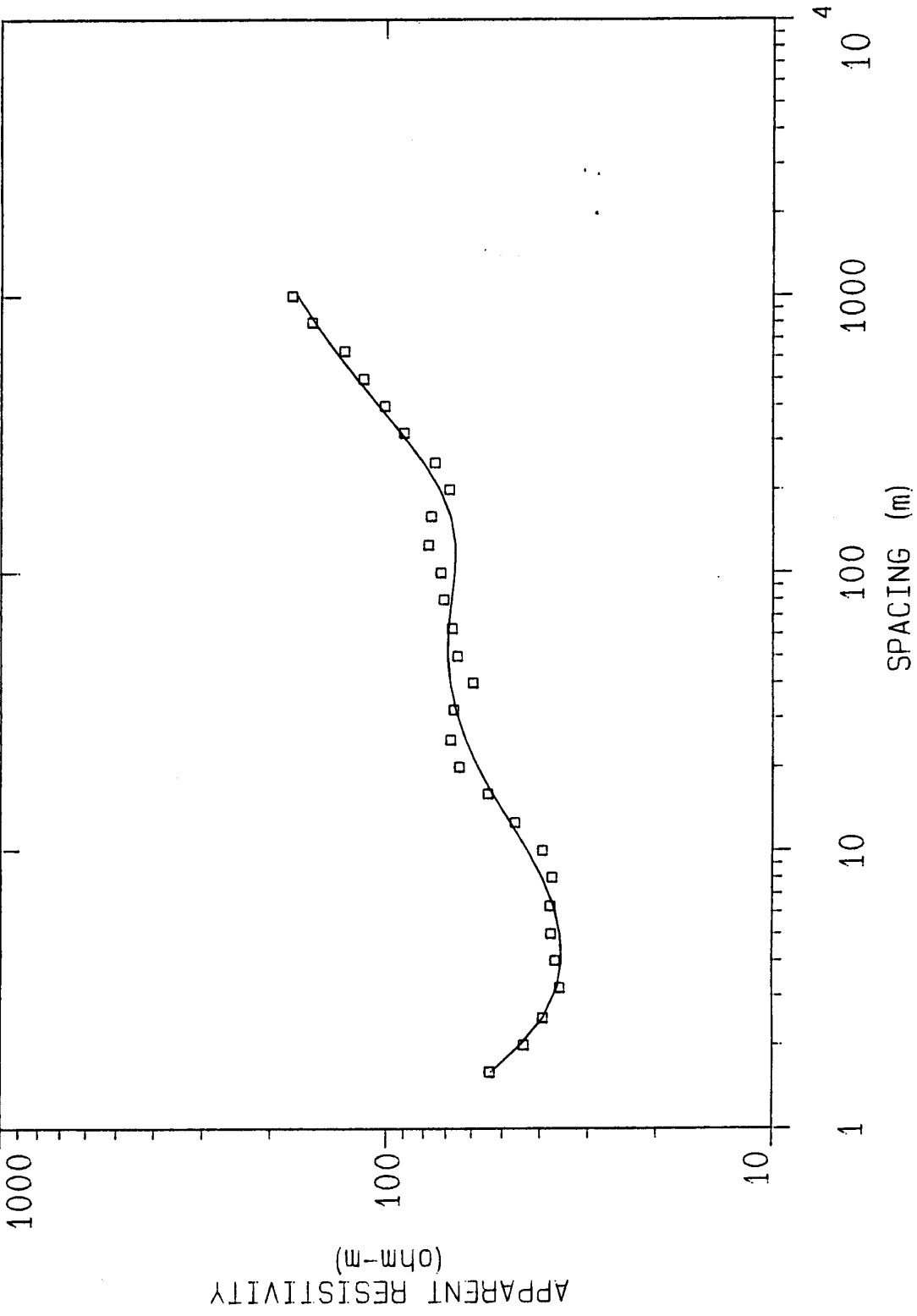
FITTING ERROR: 6.877 PERCENT

L #	RESISTIVITY (ohm-m)	CHARGEABILITY (pfe)	THICKNESS (meters)	ELEVATION (meters)	CONDUCTANCE (Siemens)
1	110.2		0.552	0.0	
2	31.49		5.00	-0.552	0.00501
3	89.42		16.51	-5.56	0.159
4	67.86		24.37	-22.07	0.184
5	45.62		47.22	-46.44	0.359
6	87.20		87.24	-93.67	1.03
7	259.8			-180.9	1.00

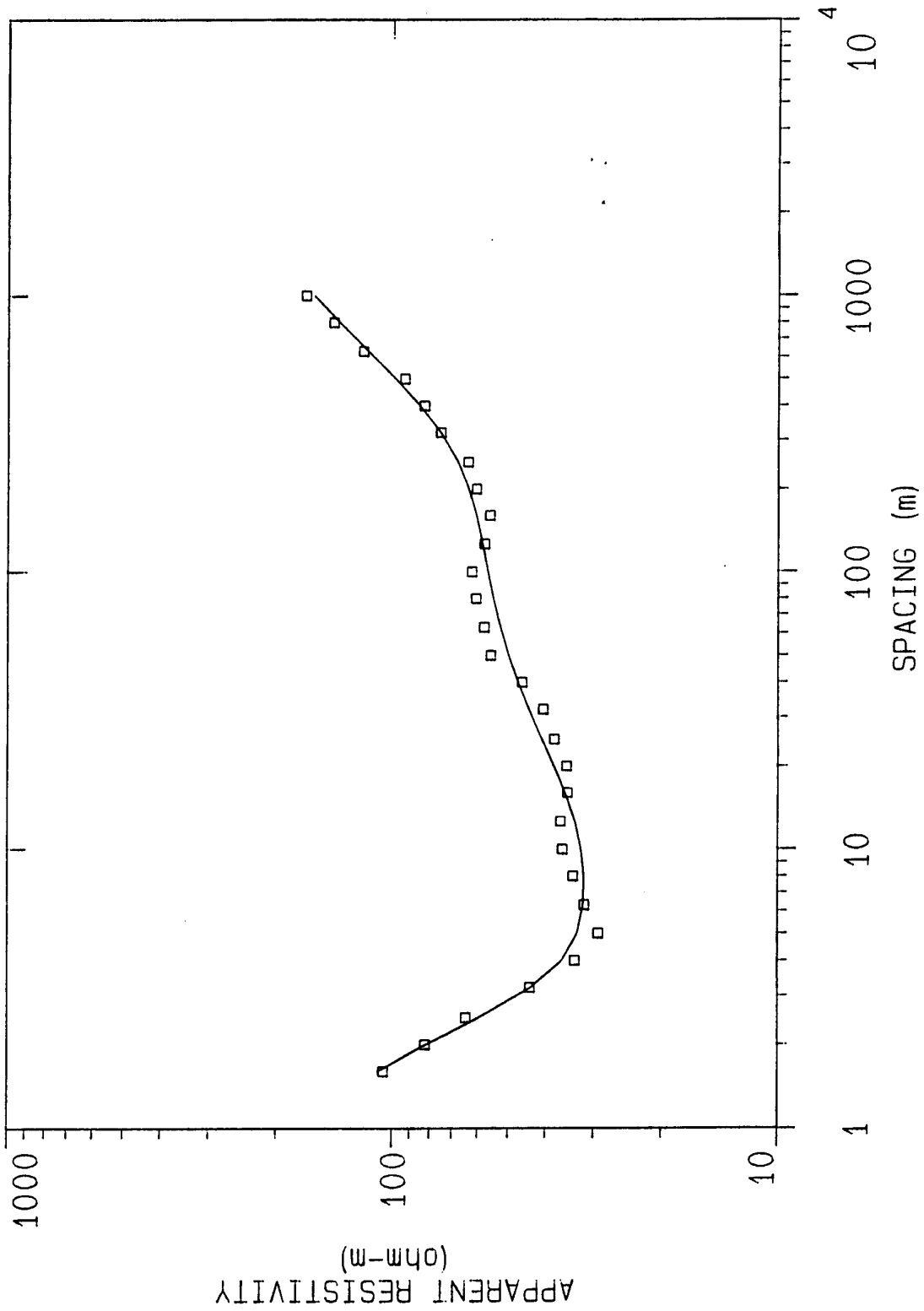
ALL PARAMETERS ARE FREE

No.	Spacing (m)	PA DATA	(ohm-m) SYNTHETIC	DIFFERENCE (percent)
1	1.60	53.86	53.37	0.896
2	2.00	44.01	44.79	-1.77
3	2.50	39.23	39.19	0.102
4	3.20	35.43	36.01	-1.62
5	4.00	36.42	35.05	3.74
6	5.00	37.40	35.35	5.48
7	6.30	37.54	36.79	2.00
8	8.00	37.12	39.50	-6.41
9	10.00	39.37	43.13	-9.54
10	12.60	46.42	47.76	-2.87
11	16.00	54.53	53.03	2.73
12	20.00	64.81	57.94	10.60
13	25.00	68.24	62.39	8.57
14	32.00	66.99	66.31	1.01
15	40.00	59.67	68.61	-14.99
16	50.00	65.57	69.58	-6.11
17	63.00	67.61	69.26	-2.43
18	80.00	71.22	67.97	4.55
19	100.0	72.47	66.69	7.98
20	126.0	77.96	66.36	14.88
21	160.0	76.71	68.27	11.00
22	200.0	68.74	72.86	-5.99
23	250.0	75.04	80.40	-7.13
24	320.0	90.22	91.97	-1.94
25	400.0	101.1	104.9	-3.66
26	500.0	114.8	119.6	-4.15
27	630.0	128.8	136.1	-5.66
28	800.0	156.3	153.7	1.60
29	1000.0	176.0	170.2	3.25

EPILA19



EPIILA20



DATA SET: EPILA21

CLIENT: ITGE
 LOCATION: CARINENA
 COUNTY: ZARAGOZA
 PROJECT: RESISTIVIDAD
 ELEVATION: 380.00
 SOUNDING COORDINATES: X: 643825.0000 Y: 4597475.0000

DATE: 27-4-90
 SOUNDING: 21
 AZIMUTH: 50
 EQUIPMENT: GEOTRON

Schlumberger Configuration

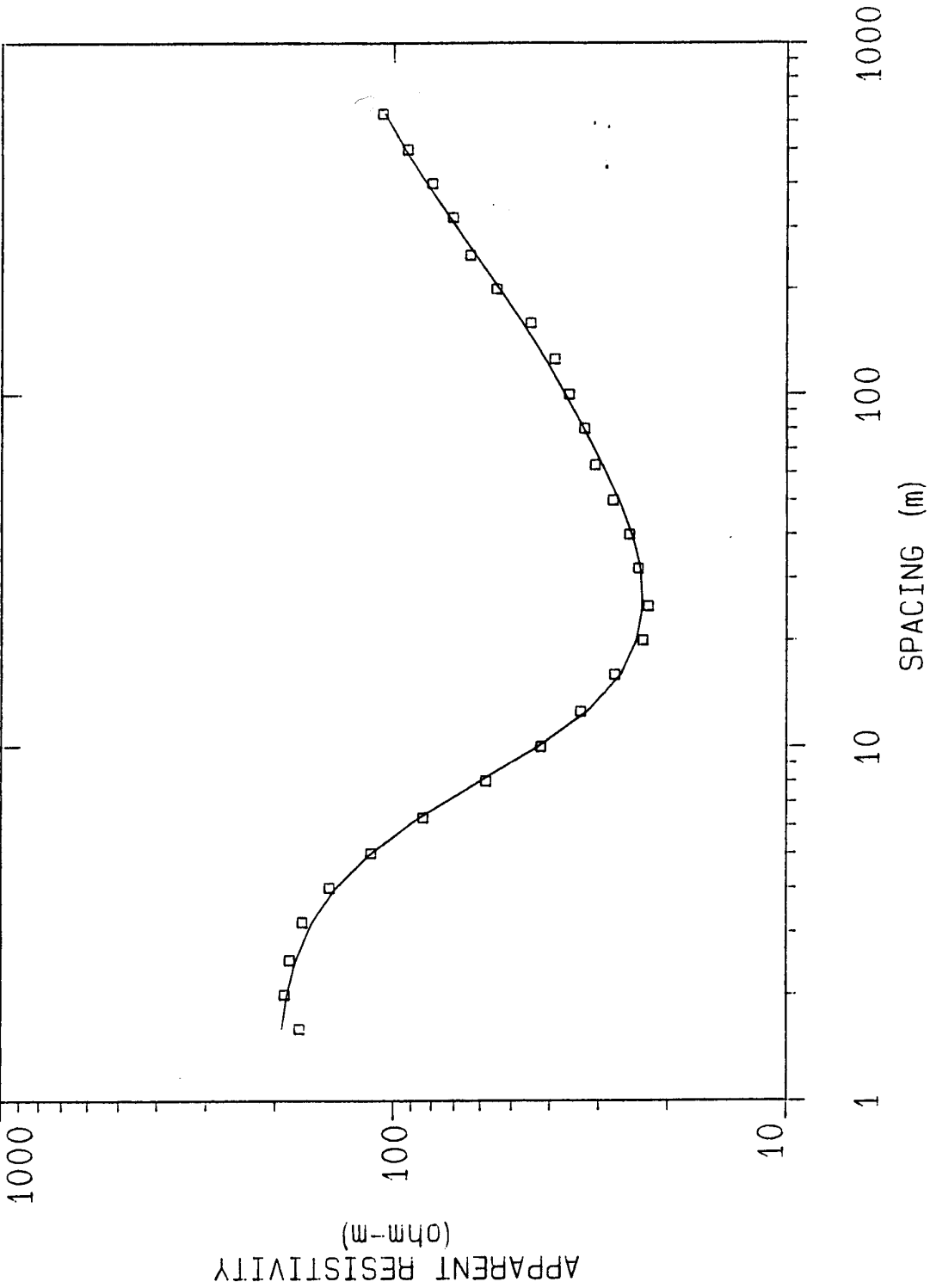
FITTING ERROR: 3.767 PERCENT

L #	RESISTIVITY (ohm-m)	CHARGEABILITY (pfe)	THICKNESS (meters)	ELEVATION (meters)	CONDUCTANCE (Siemens)
				380.0	
1	199.1		2.62	377.3	0.0132
2	27.08		5.08	372.2	0.187
3	19.07		19.46	352.8	1.02
4	44.74		81.66	271.1	1.82
5	176.3				

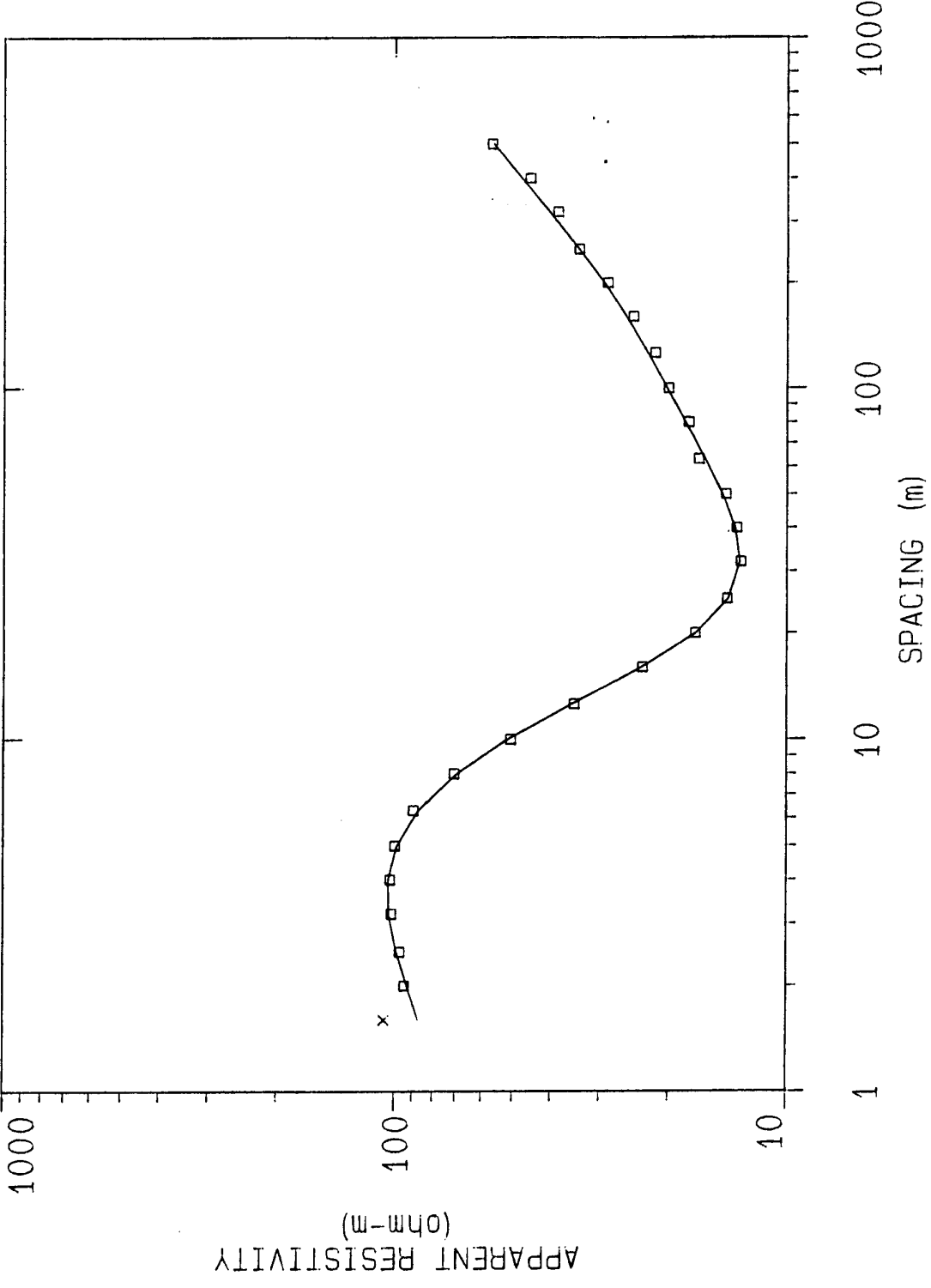
ALL PARAMETERS ARE FREE

No.	Spacing (m)	PA (ohm-m)		DIFFERENCE (percent)
		DATA	SYNTHETIC	
1	1.60	173.4	192.3	-10.90
2	2.00	189.1	186.7	1.26
3	2.50	183.9	177.4	3.54
4	3.20	170.6	161.0	5.57
5	4.00	145.3	140.0	3.65
6	5.00	114.1	114.1	-0.0502
7	6.30	83.97	85.84	-2.22
8	8.00	58.11	60.13	-3.47
9	10.00	42.12	42.80	-1.60
10	12.60	33.30	31.99	3.94
11	16.00	27.33	26.37	3.49
12	20.00	23.12	24.01	-3.86
13	25.00	22.43	23.17	-3.28
14	32.00	23.80	23.46	1.41
15	40.00	25.08	24.69	1.54
16	50.00	27.65	26.69	3.47
17	63.00	30.69	29.42	4.13
18	80.00	32.66	32.83	-0.525
19	100.0	35.71	36.57	-2.42
20	126.0	38.93	41.18	-5.78
21	160.0	44.83	47.04	-4.92
22	200.0	54.70	53.80	1.63
23	250.0	63.90	61.90	3.12
24	320.0	70.90	72.30	-1.98
25	400.0	80.00	82.74	-3.42
26	500.0	92.30	93.80	-1.63
27	630.0	106.9	105.5	1.25

EPILA21



EPIILA22



DATA SET: EPILA23

CLIENT: ITGE
 LOCATION: CARINENA
 COUNTY: ZARAGOZA
 PROJECT: RESISTIVIDAD
 ELEVATION: 400.00
 SOUNDING COORDINATES: X: 646050.0000 Y: 4598825.0000

DATE: 3-5-90
 SOUNDING: 23
 AZIMUTH: 61
 EQUIPMENT: GEOTRON

Schlumberger Configuration

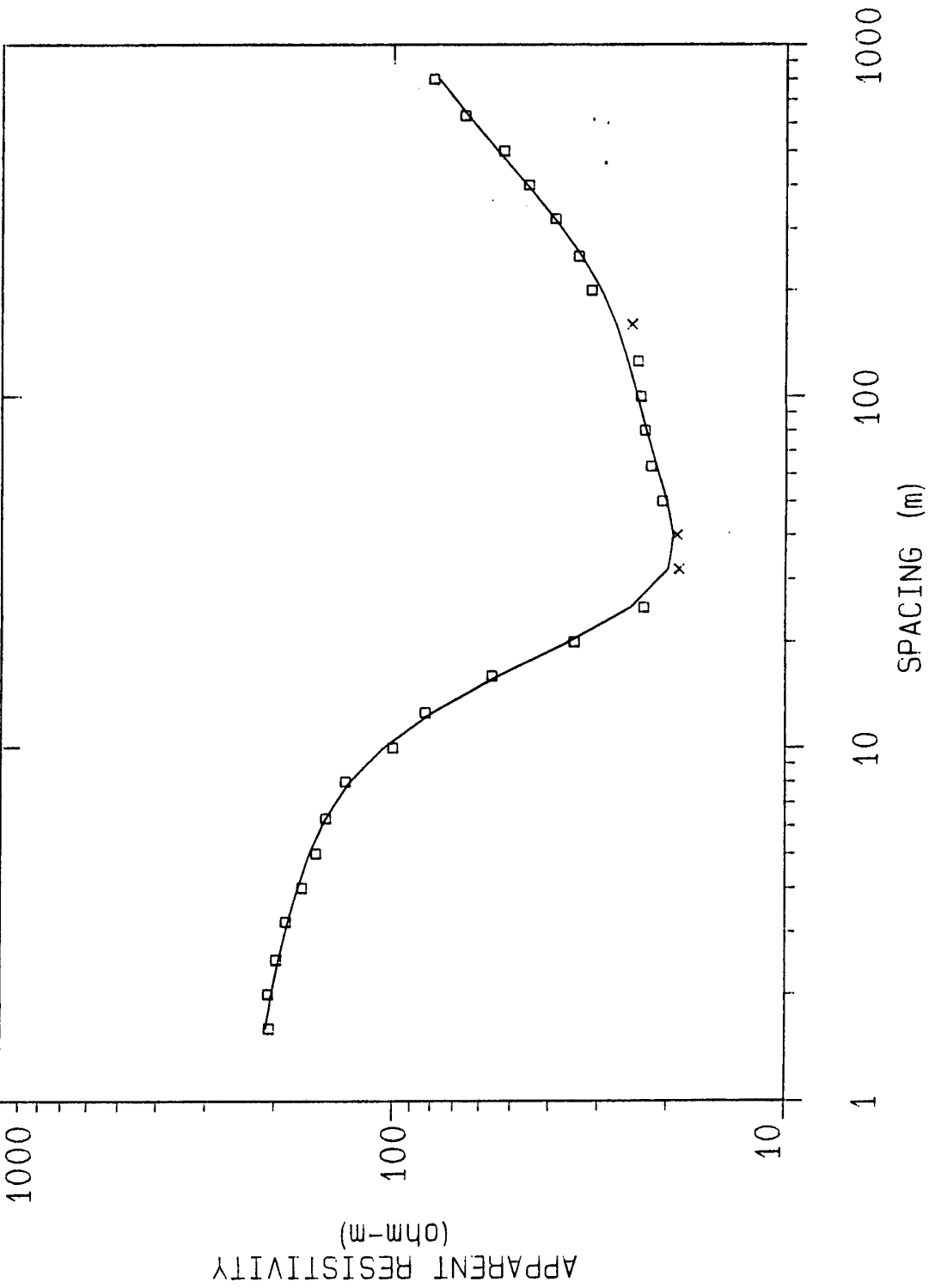
FITTING ERROR: 3.445 PERCENT

L #	RESISTIVITY (ohm-m)	CHARGEABILITY (pfe)	THICKNESS (meters)	ELEVATION (meters)	CONDUCTANCE (Siemens)
1	222.6		1.13	400.0	
2	165.6		5.11	398.8	0.00510
3	13.04		15.06	393.7	0.0308
4	26.85		47.48	378.6	1.15
5	23.75		105.2	331.1	1.76
6	223.7			225.9	4.43

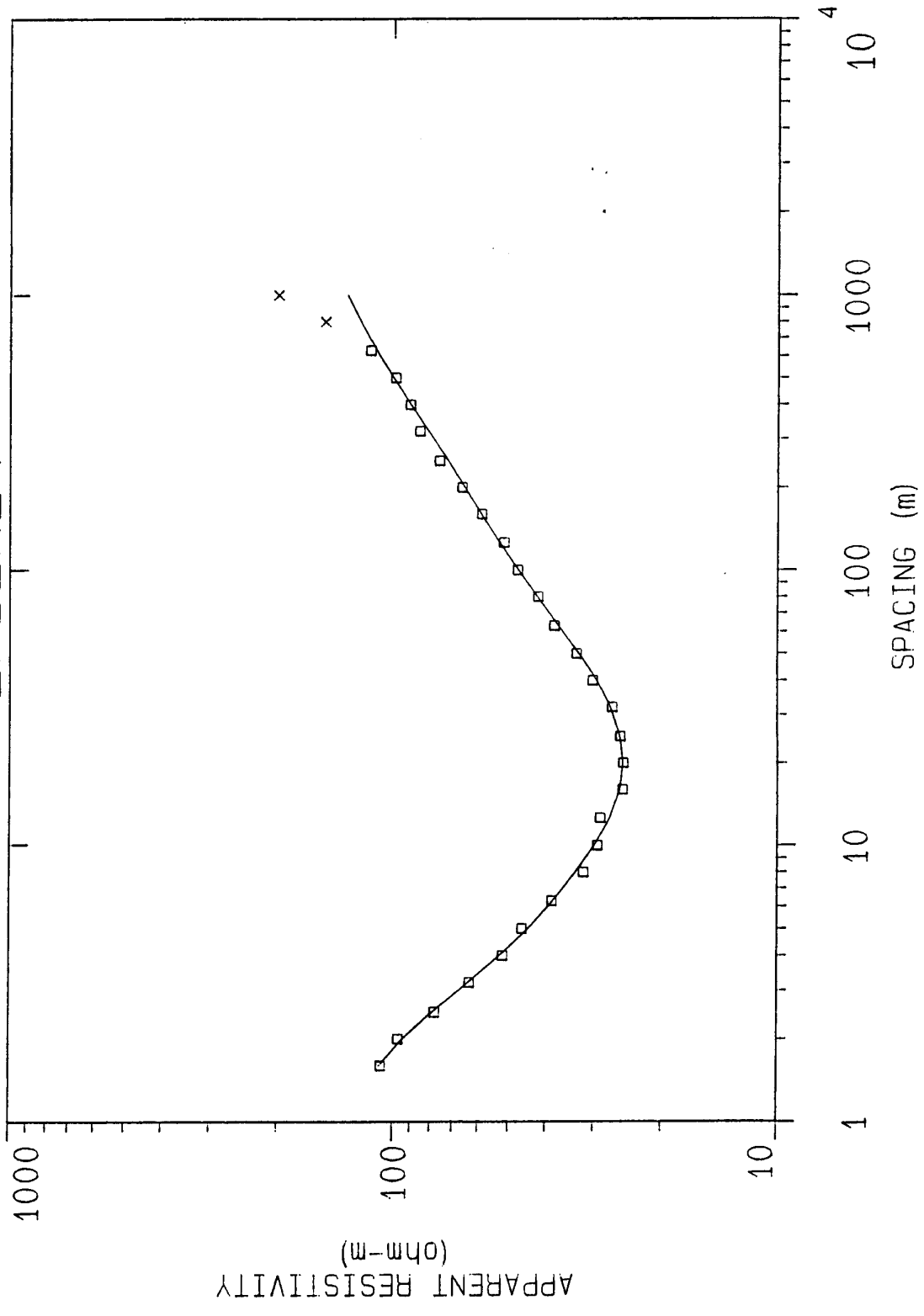
ALL PARAMETERS ARE FREE

No.	Spacing (m)	DATA	PA (ohm-m) SYNTHETIC	DIFFERENCE (percent)
1	1.60	205.9	209.8	-1.89
2	2.00	207.0	203.1	1.86
3	2.50	197.9	195.0	1.46
4	3.20	187.0	184.6	1.24
5	4.00	170.1	174.3	-2.46
6	5.00	156.6	162.7	-3.88
7	6.30	147.9	148.0	-0.0728
8	8.00	131.7	128.4	2.53
9	10.00	99.86	105.6	-5.75
10	12.60	82.68	79.29	4.10
11	16.00	55.83	53.70	3.80
12	20.00	34.46	35.55	-3.15
13	25.00	22.93	24.72	-7.78
14	32.00	18.65	19.88	-6.63
15	40.00	18.89	19.27	-2.03
16	50.00	20.58	20.08	2.41
17	63.00	22.02	21.31	3.21
18	80.00	22.80	22.63	0.758
19	100.0	23.39	23.87	-2.04
20	126.0	23.79	25.27	-6.22
21	160.0	24.64	27.09	-9.96
22	200.0	31.27	29.54	5.52
23	250.0	33.75	33.14	1.81
24	320.0	38.72	38.88	-0.403
25	400.0	45.34	45.80	-1.01
26	500.0	52.42	54.34	-3.64
27	630.0	65.90	64.72	1.77
28	800.0	79.20	76.95	2.82

EPIILA23



EPIILA24



DATA SET: EPILA25

CLIENT: ITGE DATE: 5-5-90
 LOCATION: CARINENA SOUNDING: 25
 COUNTY: ZARAGOZA AZIMUTH: 54
 PROJECT: RESISTIVIDAD EQUIPMENT: GEOTRON
 ELEVATION: 430.00
 SOUNDING COORDINATES: X: 647950.0000 Y: 4599975.0000

Schlumberger Configuration

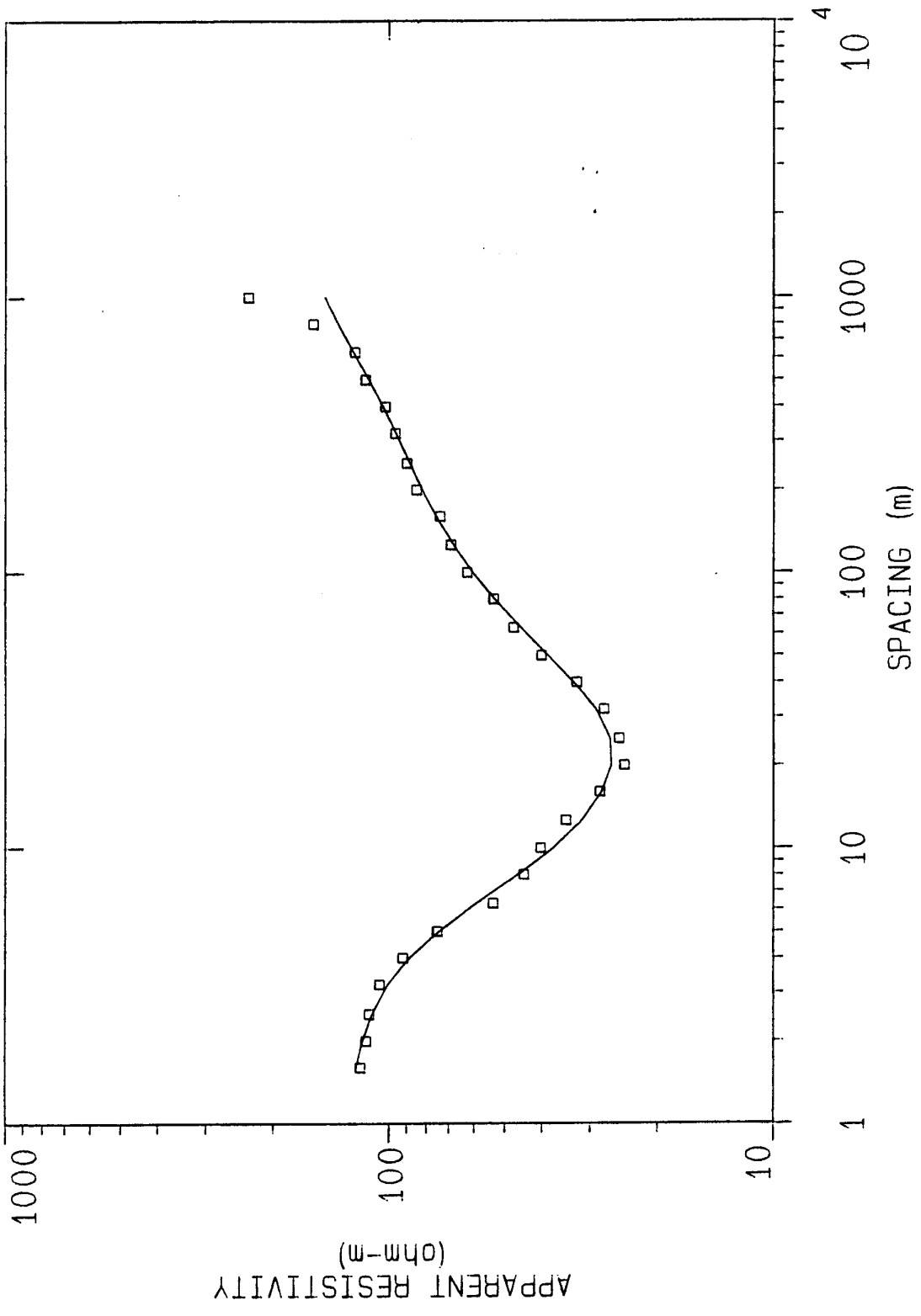
FITTING ERROR: 4.435 PERCENT

L #	RESISTIVITY (ohm-m)	CHARGEABILITY (pfe)	THICKNESS (meters)	ELEVATION (meters)	CONDUCTANCE (Siemens)
				430.0	
1	142.6		0.283	429.7	0.00199
2	123.4		2.17	427.5	0.0176
3	29.08		7.66	419.8	0.263
4	13.25		9.76	410.0	0.736
5	161.1		48.23	361.8	0.299
6	68.70		99.32	262.5	1.44
7	196.4				

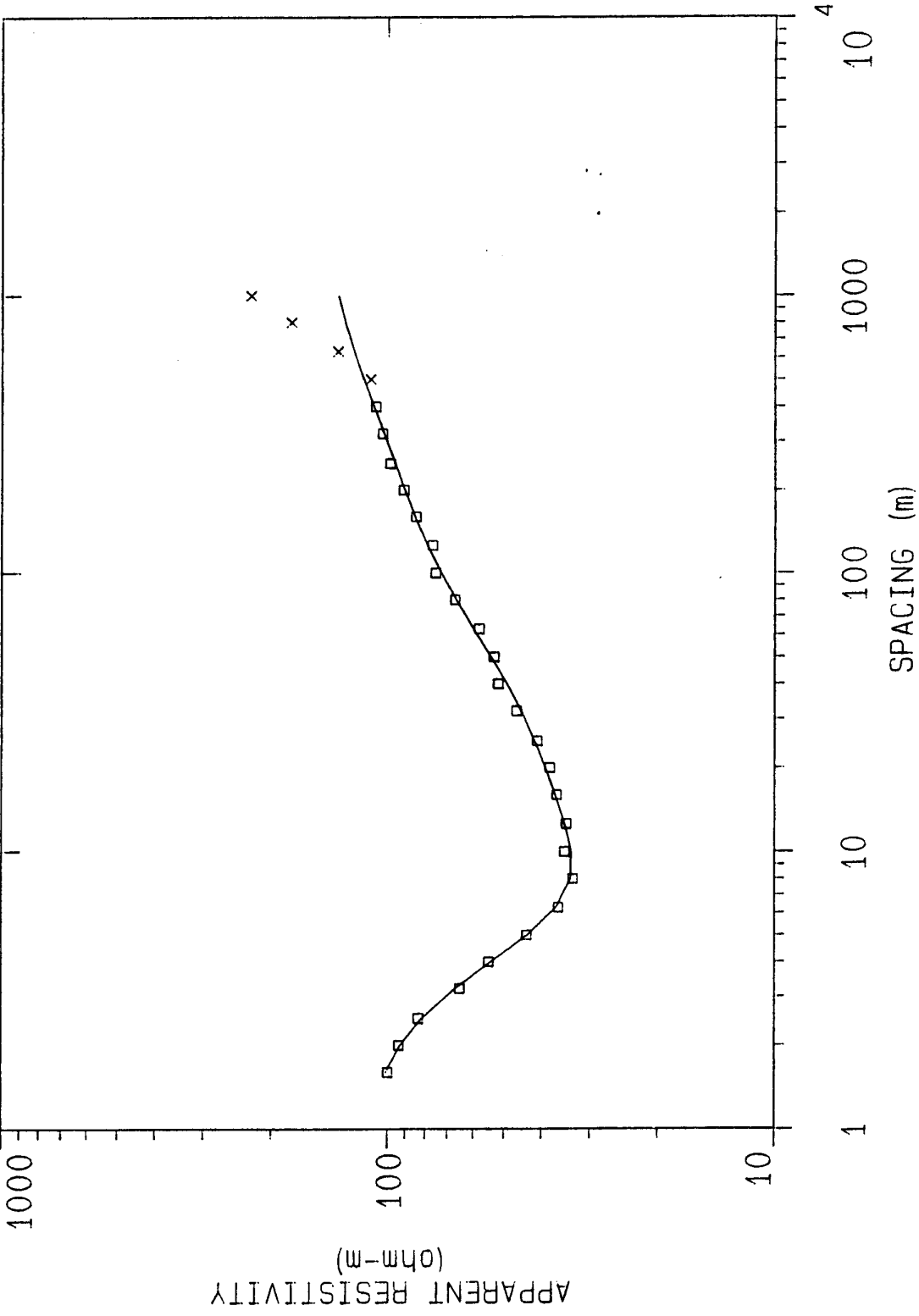
ALL PARAMETERS ARE FREE

No.	Spacing (m)	PA DATA	PA (ohm-m) SYNTHETIC	DIFFERENCE (percent)
1	1.60	118.8	121.8	-2.51
2	2.00	114.9	117.4	-2.20
3	2.50	112.7	111.1	1.39
4	3.20	105.8	101.0	4.50
5	4.00	91.98	88.84	3.40
6	5.00	74.84	74.50	0.453
7	6.30	53.50	59.47	-11.14
8	8.00	44.60	46.25	-3.69
9	10.00	40.32	37.34	7.39
10	12.60	34.59	31.44	9.09
11	16.00	28.24	27.94	1.05
12	20.00	24.39	26.41	-8.28
13	25.00	25.26	26.58	-5.22
14	32.00	27.61	28.96	-4.91
15	40.00	32.47	33.07	-1.84
16	50.00	40.12	38.65	3.67
17	63.00	47.45	45.48	4.14
18	80.00	53.38	53.19	0.349
19	100.0	62.64	60.63	3.22
20	126.0	69.13	68.21	1.33
21	160.0	73.77	75.62	-2.51
22	200.0	84.87	82.08	3.28
23	250.0	89.76	88.37	1.54
24	320.0	96.28	95.83	0.460
25	400.0	102.3	103.7	-1.33
26	500.0	115.1	113.0	1.85
27	630.0	122.8	123.9	-0.943
28	800.0	157.5	135.8	13.73
29	1000.0	232.1	146.7	36.75

EPIILA25



EPIILA26



DATA SET: EPILA27

CLIENT: ITGE
 LOCATION: CARKINENA
 COUNTY: ZARAGOZA
 PROJECT: RESISTIVIDAD
 ELEVATION: 430.00
 SOUNDING COORDINATES: X: 650075.0000 Y: 4601150.0000

DATE: 7-5-90
 SOUNDING: 27
 AZIMUTH: 354
 EQUIPMENT: GEOTRON

Schlumberger Configuration

FITTING ERROR: 5.304 PERCENT

L #	RESISTIVITY (ohm-m)	CHARGEABILITY (pF)	THICKNESS (meters)	ELEVATION (meters)	CONDUCTANCE (Siemens)
				430.0	
1	540.3		1.31	428.6	0.0024
2	452.2		2.76	425.9	0.0061
3	61.60		3.93	421.9	0.0463
4	94.40		26.32	395.6	0.273
5	74.04		52.31	343.3	0.706
6	154.9				

ALL PARAMETERS ARE FREE

NO.	Spacing (m)	PA (ohm-m)		DIFFERENCE (percent)
		DATA	SYNTHETIC	
1	1.60	493.7	522.5	-5.81
2	2.00	523.3	511.0	2.35
3	2.50	504.7	494.0	2.12
4	3.20	467.1	467.1	0.0116
5	4.00	473.2	433.9	8.20
6	5.00	375.7	390.0	-3.96
7	6.30	285.2	334.3	-17.36
8	8.00	261.3	269.3	-3.03
9	10.00	234.7	209.5	10.75
10	12.60	155.7	158.9	-2.09
11	16.00	124.4	124.6	-0.153
12	20.00	98.51	107.6	-9.23
13	25.00	101.1	99.69	1.42
14	32.00	99.03	95.69	3.37
15	40.00	95.75	93.45	2.40
16	50.00	89.52	91.57	-2.28
17	63.00	89.52	89.99	-0.523
18	80.00	91.32	89.23	2.28
19	100.0	86.94	89.99	-3.51
20	126.0	94.30	92.90	1.49
21	160.0	98.79	98.33	0.465
22	200.0	101.7	105.1	-3.39
23	250.0	116.6	112.8	3.20
24	320.0	125.6	121.4	3.32
25	400.0	122.8	128.5	-4.70
26	500.0	132.1	134.2	-2.07
27	630.0	144.2	140.2	2.76

EPILA27

