UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

SCHLUMBERGER SOUNDINGS ON THE SNAKE RIVER PLAIN NEAR NAMPA, IDAHO.

BY

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INTRODUCTION

In 1980 the U.S. Geological Survey made 23 Schlumberger soundings on the Snake River Plain near Nampa, Idaho (fig. 1). The soundings were made to delineate possible areas of potable water as an aid in the Regional Aquifer Study Area program. The area of the Snake River Plain covered in this study consist primarily of Pliocene age basalt flows, Pliocene age Lake Bed deposits, Pleistocene age terrace gravels, and recent age alluvium (Lindgren, 1898, and Lindgren and others, 1904). In general the basalt is the principal aquifer and in some areas can yield 3000 gpm of water (Mundorff and others, 1964). Therefore determining the the location and thickness of the basalt would be of benefit for the groundwater study.

The purpose of this report is to release the Schlumberger sounding data. Automatic inversions and a geoelectric cross section are also given and discussed.

SCHLUMBERGER SOUNDINGS

Figure 2 is a map showing the location, identifying number, and direction of expansion of the Schlumberger soundings. The Schlumberger soundings are numbered consecutively from Nampa 1 to Nampa 23. All the sounding data were automatically processed and

Figure 1. Map of Idaho showing the Schlumberger Sounding study area (stipled pattern).

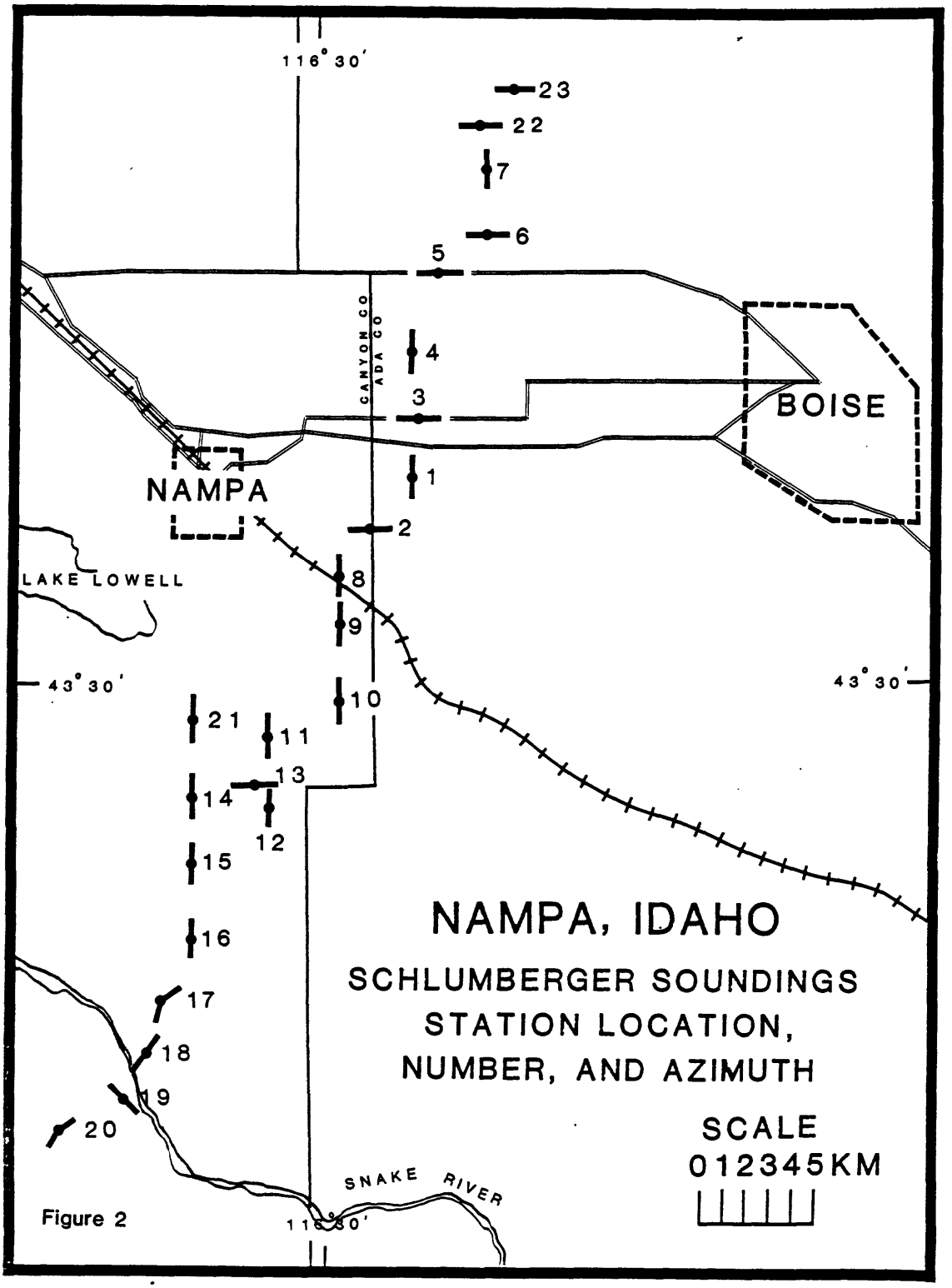
116°30'
23
22
7
6
5
CANYON CO
ADA CO
4
3
BOISE
NAMPA
1
2
LAKE LOWELL
8
9
43°30'
43°30'
10
21
11
13
14
12
15
16
17
18
19
20
SNAKE RIVER
116°30'
NAMPA, IDAHO
SCHLUMBERGER SOUNDINGS
STATION LOCATION,
NUMBER, AND AZIMUTH
SCALE
012345KM

Figure 2

interpreted (Zohdy, 1973, and 1975) as shown in the graphs in the Appendix. The curves were interpreted on a Hewlett-Packard (HP) 9845B desk top computer using a program based on the program of Zohdy (1973). The HP program was modified to use O'Neill coefficients (O'Neill, 1975) in place of Ghosh coefficients (Ghosh, 1971).

For each sounding, the data in the Appendix include:

1) A log-log plot of the field data points, in which the "O"'s represent the individual data points. The AB/2 electrode spacings, which were measured in feet, have been converted to meters. Each set of data points that was made with the same potential electrode spacing (MN) is connected with a solid line. Measurements were made at the fixed MN/2 spacings of 2, 6, 20, 60, 200, and 600 feet.

2) A tabulation of the AB/2 electrode spacings in meters and the corresponding apparent resistivities in ohm-m.

3) A log-log plot of the output of the automatic inversion program in which:

   a) The continuous curve represents the shifted-digitized field curve (Bisdorf and Zohdy, 1979).

   b) The step-function curve represents the distribution of interpreted-true resistivity with depth.

   c) The plus (+) signs represent points on the theoretical sounding curve for the given distribution of resistivity with depth. These points are given to show how well the interpreted model fits the shifted-digitized curve.

4) A tabulation of the interpreted depths in meters and the interpreted resistivities in ohm-m.

Because the area of the study is mostly light suburban in

nature some problems were encountered with cultural features. Metal fences although generally short (<0.5mi), overhead power lines and transformer boxes, buried telephone cables, and electrified fences made sounding site selection a difficult procedure. Whenever possible sites were chosen that did not have any visible cultural features. In order to maintain data continuity some sites were chosen that were less than ideal. Soundings 1, 7, 9, 11, 12, and 16 had cusps that were obviously caused by cultural factors. These cusps were manualy smoothed before interpretation. Soundings 9, 10, 13, 15, 19, and 21 had cusps and other features such as too rapid of a turn around from a maximum, which could not be attributed to horizontal layering. These features were manually smoothed so that the inversion program could better fit the undistorted portions of the soundings. Smoothed soundings will have a -S after the title on the sounding interpretation plot in the appendix. Sounding 12 was not expanded to the originally planned AB/2 spacing due to the effects of a buried telephone cable and the cross section line was offset 1 mile west to avoid the cable. Sounding 12 was not included in the cross section.

GEOELECTRIC CROSS SECTION

Figure 3 shows a geoelectric cross section constructed from the Schlumberger sounding data. The figure consists of two parts, a non vertically exaggerated cross section, and the same cross section vertically exaggerated four times. The cross sections were generated in a manner similar to that described in Bisdorf, 1982 pages 5 to 7. On the right hand side of the figure a scale is presented which relates interpreted resistivities with shades of gray. Darker shades indicate higher resistivities and lighter shades indicate lower

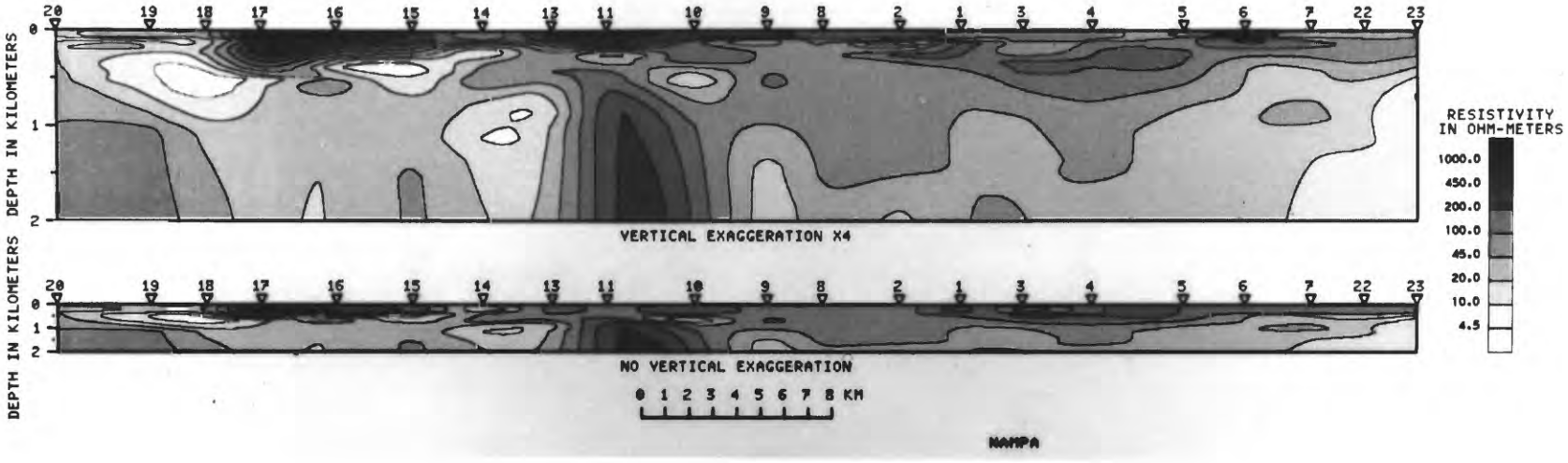

Figure 3. Computer-generated geoelectric cross section. Top and Bottom parts are vertically exaggerated 4 and 1 times respectively.

resisitivities. Triangles at the top of the cross sections indicate sounding locations and the numbers above the triangles are the sounding numbers.

From sounding 23 to sounding 1 there appears to be a layer which is probably fresh water saturated sand and gravel (terrace gravel) or fresh water saturated basalt. This layer has a resistivity range of 45 to 100 ohm-m and is interpreted to attain a maximum thickness of of about 500m at sounding 4. From sounding 2 through 17, with the exception of sounding 14, the cross section shows that basalt is present at or near (upper 40m) the surface. This basalt layer, characterized by resistivities of greater than 100 ohm-m, is 100 to 200m thick except under sounding 17 where it is about 400m thick.

Zones with resistivities of less than 10 ohm-m are present in the cross section and could represent either clay rich sediments or salt-water saturated sediments. Areas that have resistivities of less than 10 ohm-m near possible faults have geothermal potential. The area from sounding 13 to 19 and the area from soundings 7 to 23 could have some geothermal potential.

A zone of resistivities of greater than 45 ohm-m is present under soundings 10 and 11 from a depth of about 700 m. This zone appears to contunue to the depth of the cross section. Soundings 10 and 11 were not expanded to a sufficiently large AB/2 spacing to be able to detect layers to 2 km. Therefore it is possible that this resistive zone is underlain by less resistive sediments.

SUMMARY

Basalt, which is the primary aquifer in most portions of the Snake River Plain in Idaho, is present in the studied area. The basalt layer, as interpreted from the cross section, is generally

only about 100 to 200 m thick. A thicker layer of what is probably fresh water saturated terrace gravels is present in part of the study area. This layer is 300 to 400 m thick and buried under about 50 to 100 m of overburden. This layer represents a significant possible source of ground water. Low resistivity material near the edges of the study area indicate the possibility of geothermal resources.

REFERENCES

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Mundorff, M. J., Crosthwaite, E. G., and Kiburn, Chabot, 1964, Ground water for irrigation in the Snake River Basin in Idaho: U.S. Geological Survey water supply paper 1654, 216 p., 6 pl.

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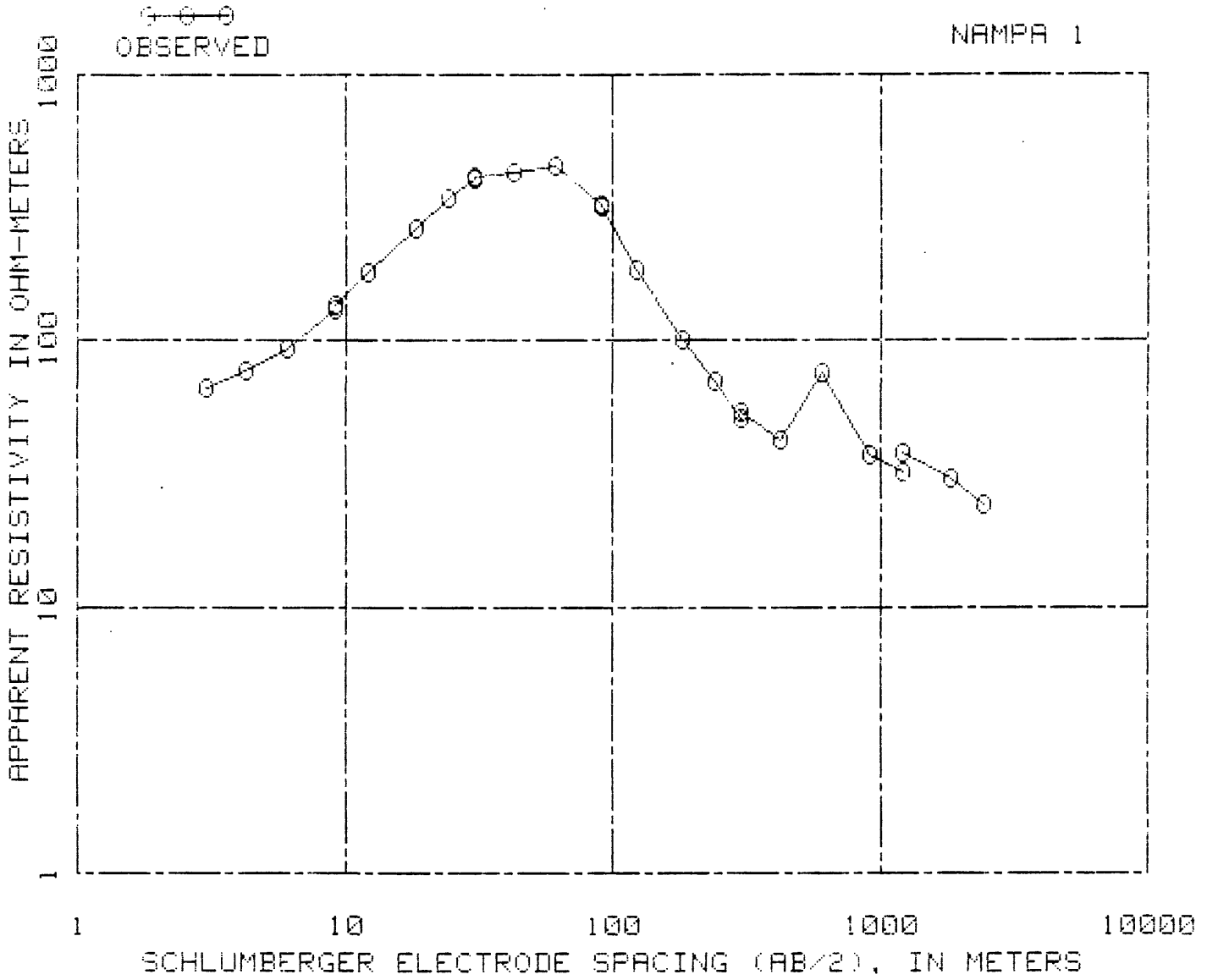
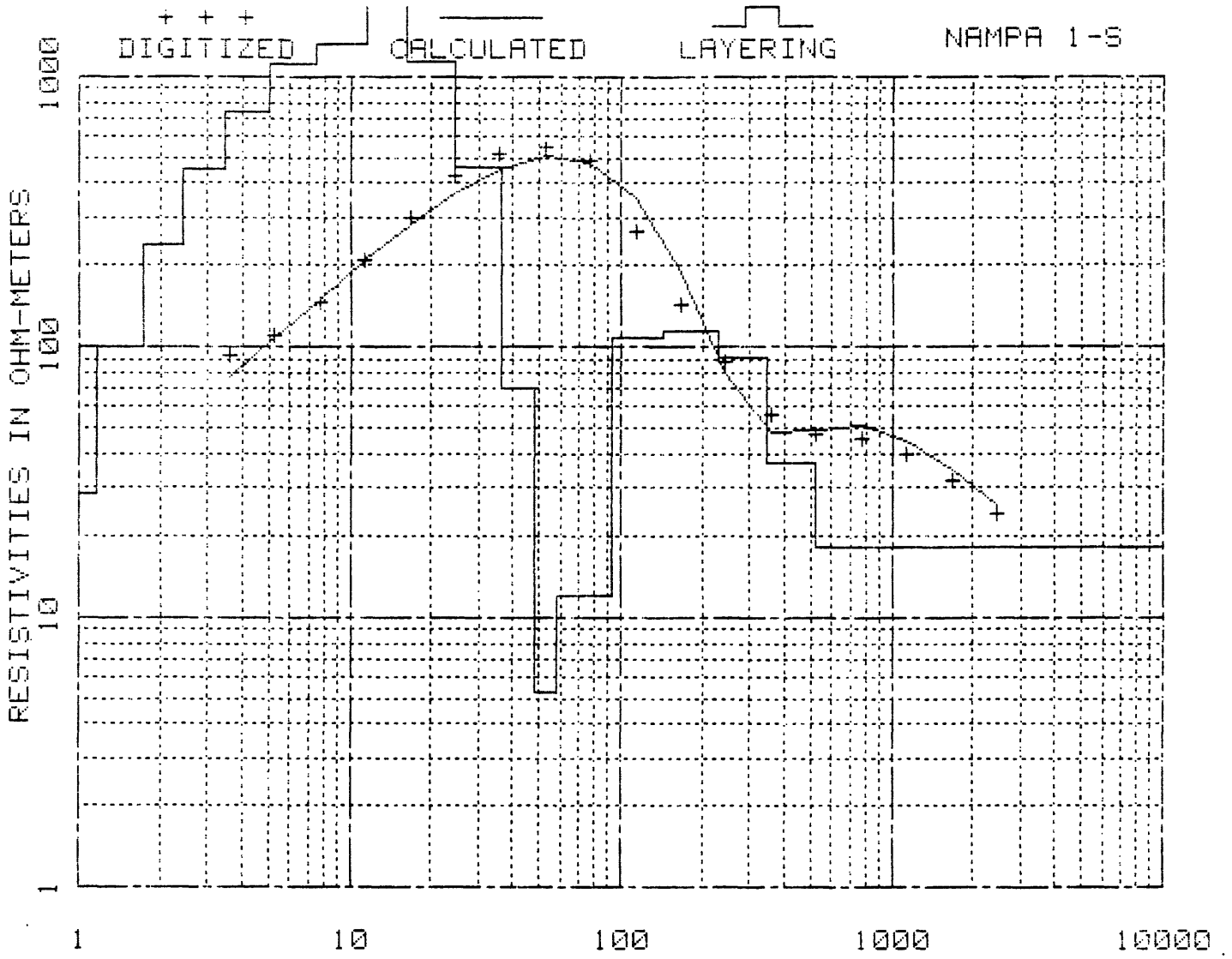
_____, 1975, Automatic interpretation of Schlumberger sounding curves using modified Dar Zarrouk functions: U.S. Geol. Survey Bull. 1313-E, 39p.

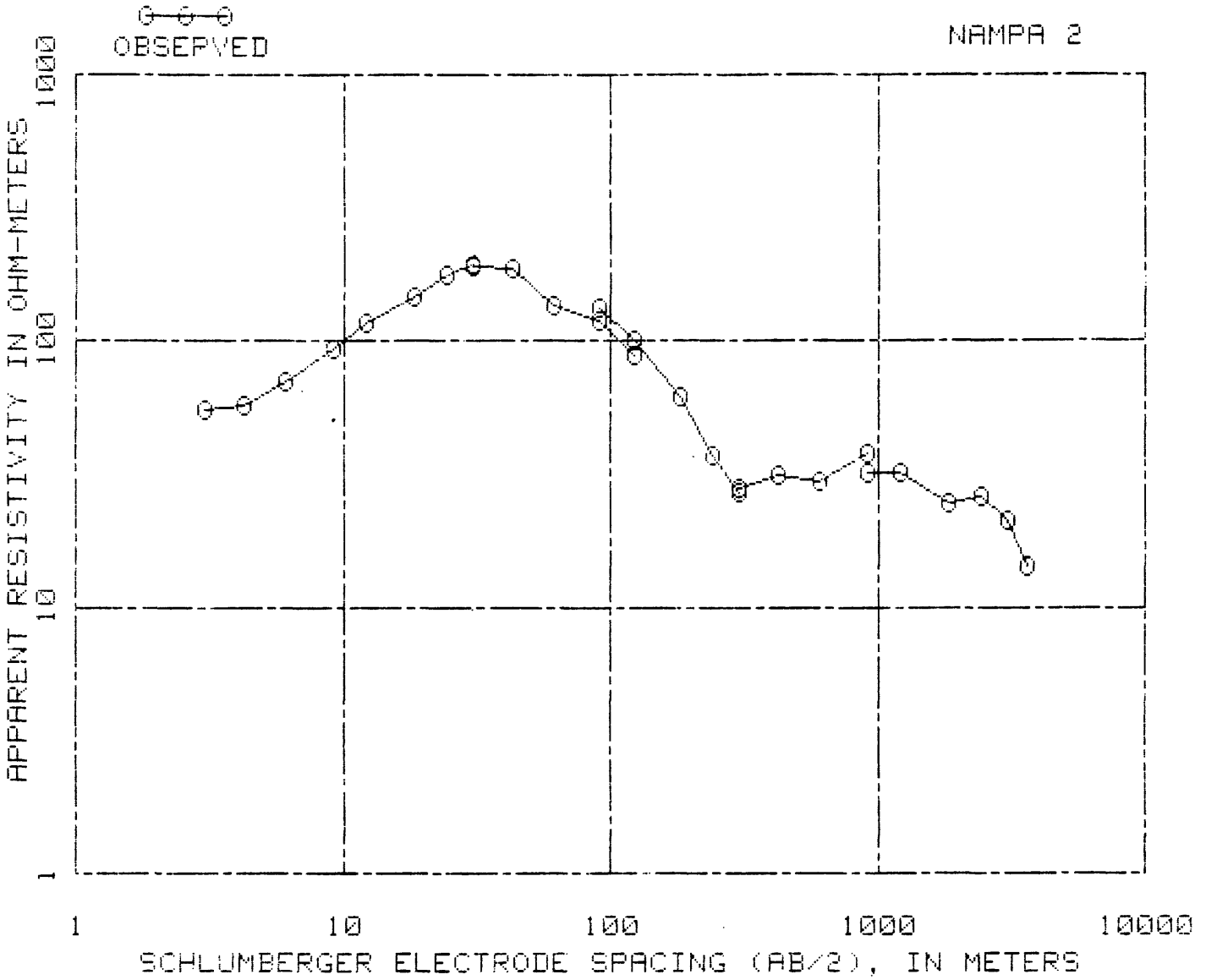
APPENDIX



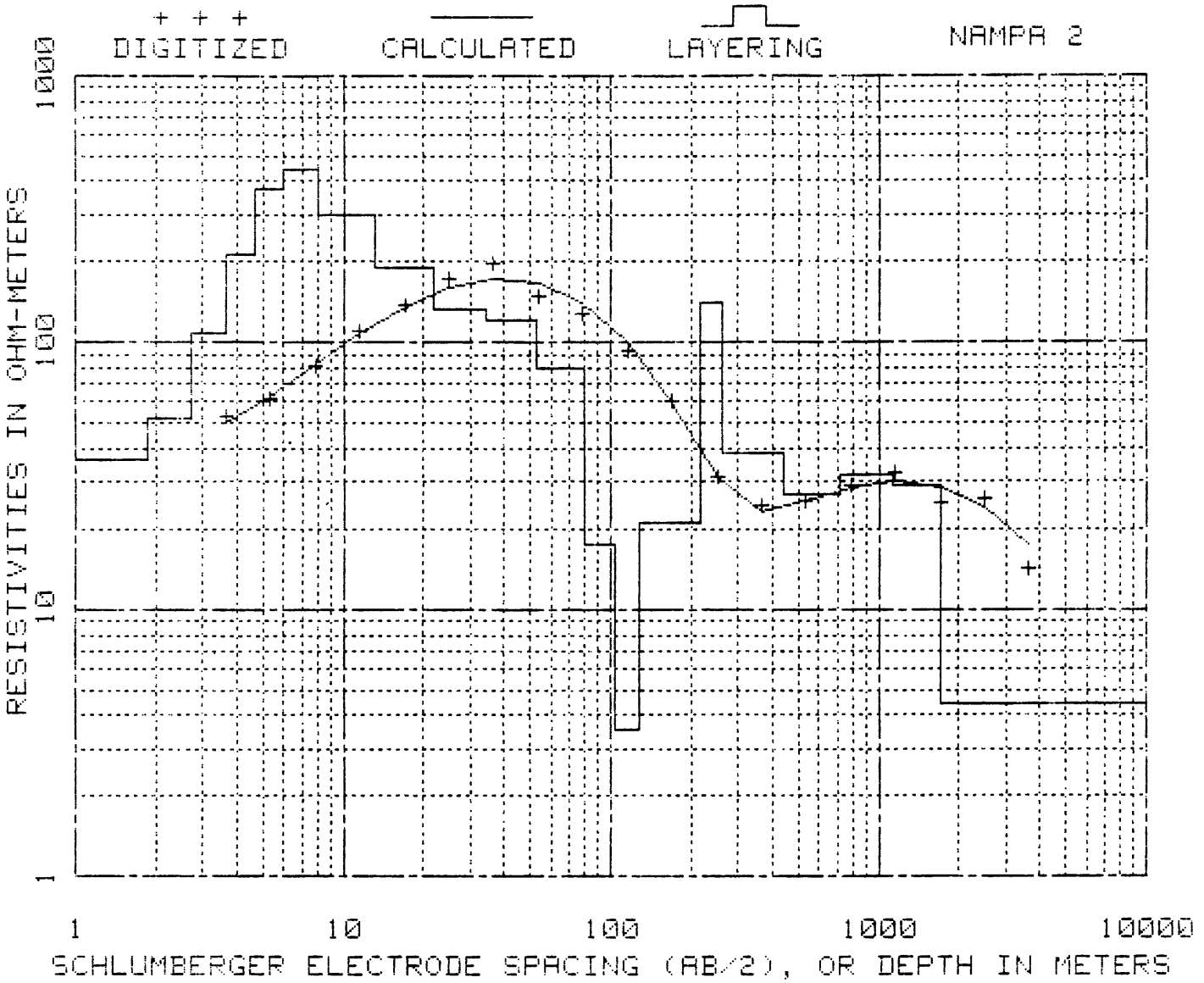
AB/2 IN METERS	OBSERVED RESISTIVITY IN OHM-METERS	AB/2 IN METERS	OBSERVED RESISTIVITY IN OHM-METERS
3.05	67.00	91.44	315.00
4.27	77.00	121.92	185.00
6.10	93.00	182.88	100.00
9.14	131.00	243.84	70.00
9.14	135.00	304.80	51.50
12.19	180.00	304.80	54.50
18.29	260.00	426.72	42.50
24.38	340.00	609.60	76.00
30.48	400.00	914.40	37.00
30.48	410.00	1219.20	32.00
42.67	425.00	1219.20	38.00
60.96	452.00	1828.80	30.00
91.44	322.00	2438.40	24.00



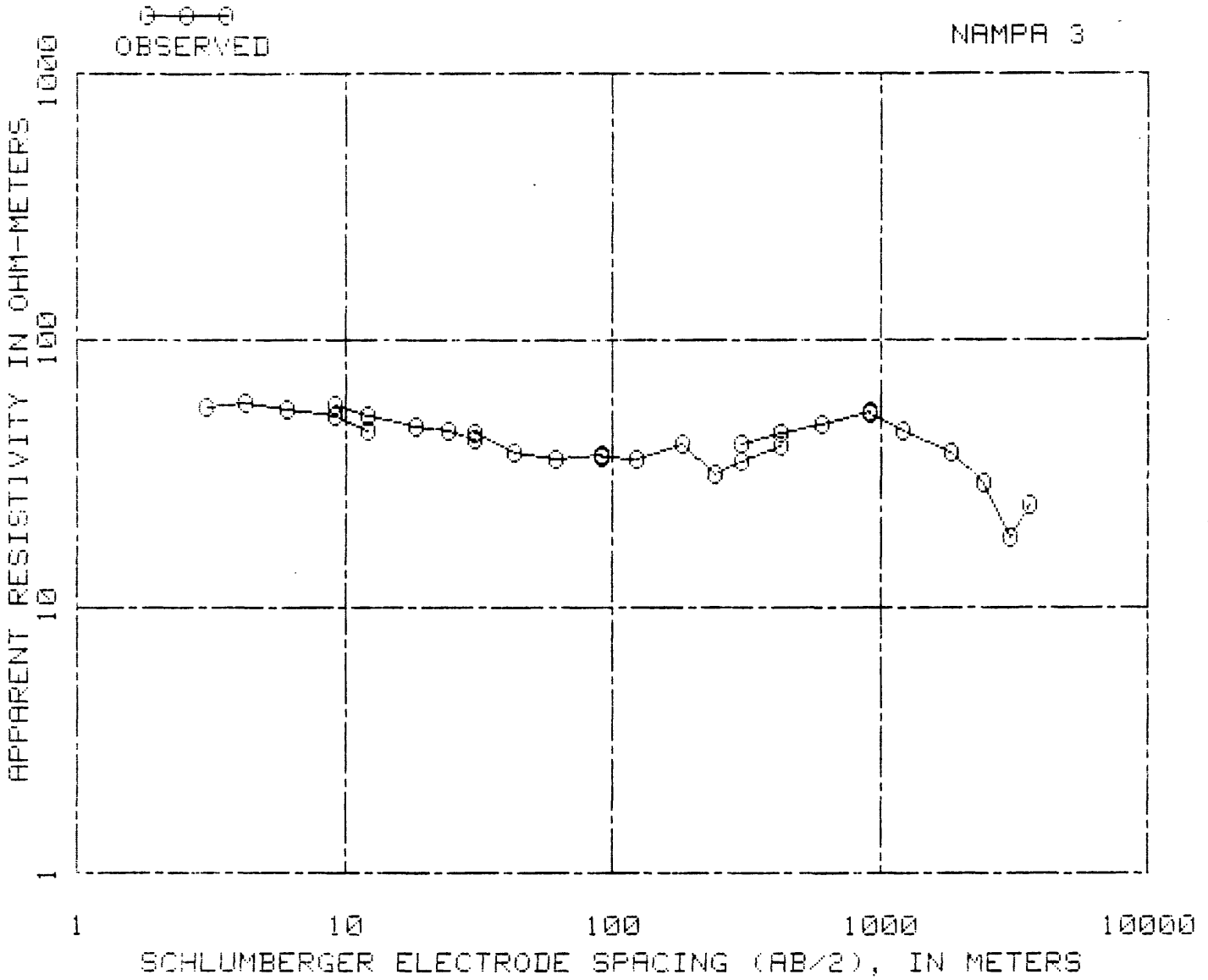
DEPTH IN METERS	RESISTIVITY IN OHM-METERS	DEPTH IN METERS	RESISTIVITY IN OHM-METERS
.12	46.78	11.52	1321.50
.18	29.14	16.06	1876.07
.24	112.06	24.42	1137.06
.36	133.34	36.07	461.04
.54	60.89	48.07	69.86
.77	19.43	57.88	5.21
1.16	28.48	92.79	11.98
1.71	100.30	142.57	108.01
2.42	237.47	227.91	115.43
3.45	450.32	347.71	91.92
5.04	738.09	521.30	37.15
7.48	1112.02	1000520.30	18.15



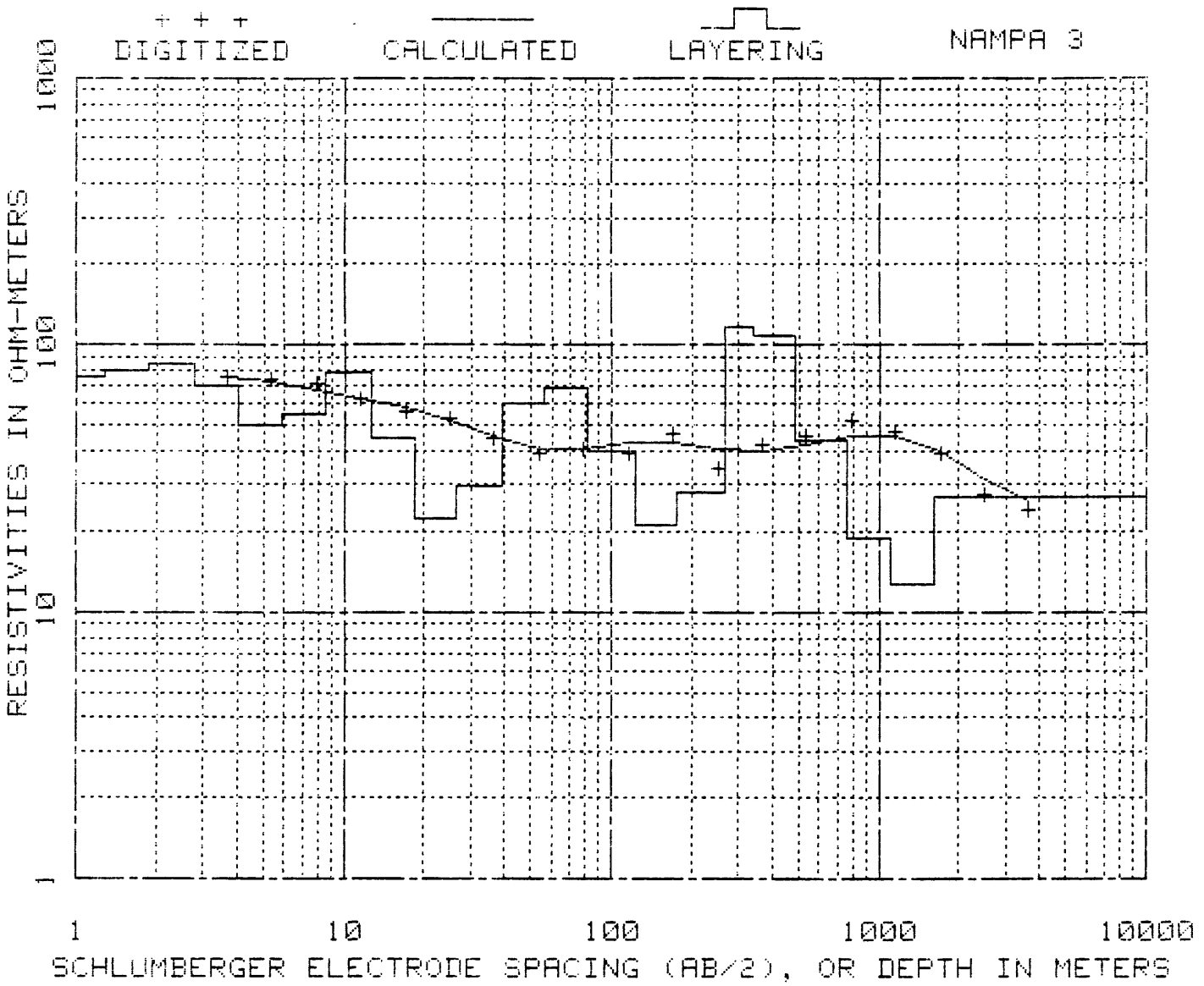
AB/2 IN METERS	OBSERVED RESISTIVITY IN OHM-METERS	AB/2 IN METERS	OBSERVED RESISTIVITY IN OHM-METERS
3.05	55.00	91.44	132.00
4.27	57.00	121.92	100.00
6.10	70.00	182.88	62.00
9.14	94.00	243.84	37.20
9.14	93.00	304.80	27.00
12.19	117.00	304.80	28.00
18.29	147.00	426.72	31.50
24.38	175.00	609.60	29.50
30.48	195.00	914.40	37.60
30.48	190.00	914.40	32.00
42.67	186.00	1219.20	32.00
60.96	135.00	1828.80	24.50
91.44	120.00	2438.40	26.00
121.92	88.00	3048.00	21.00
		3657.60	14.30



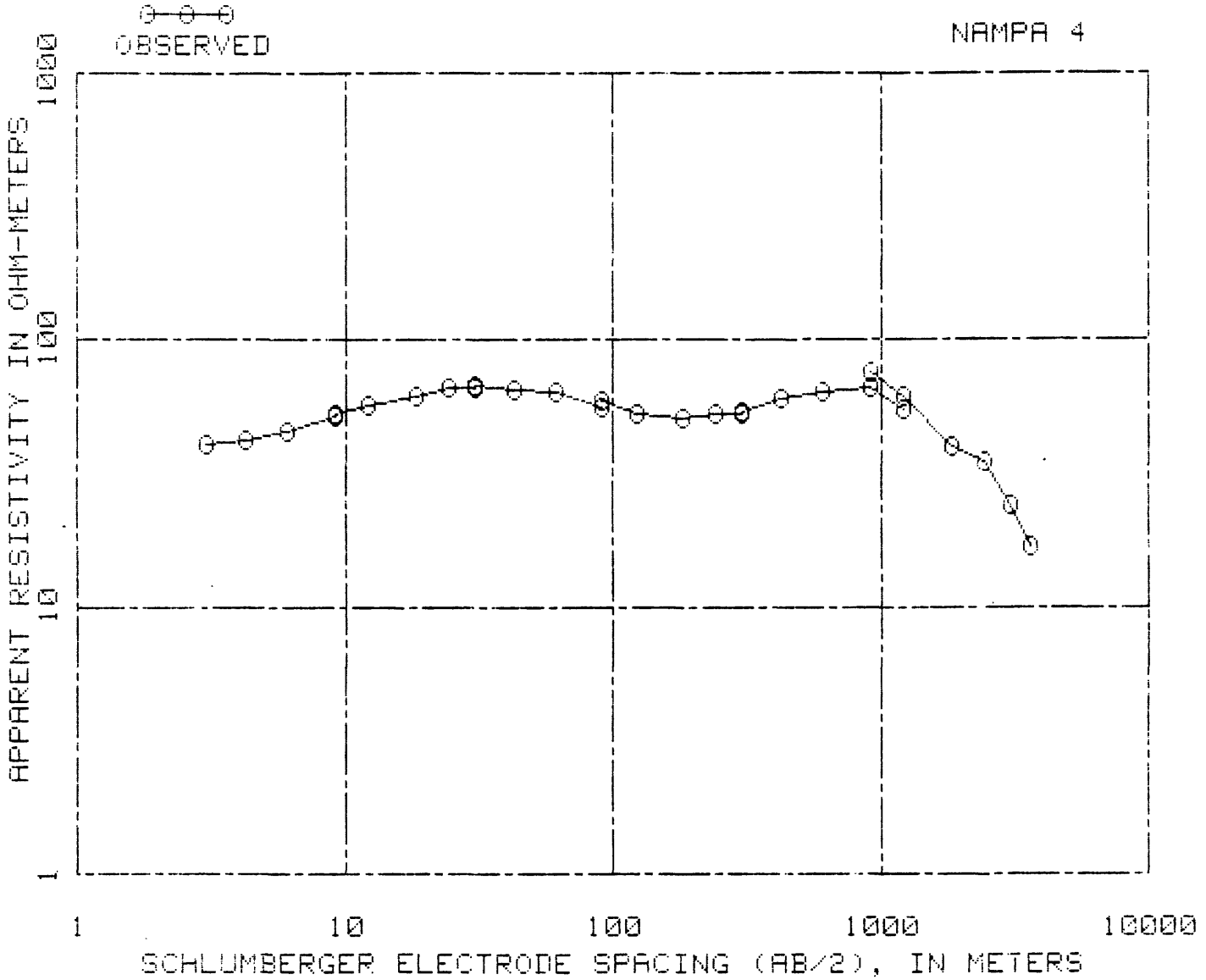
DEPTH IN METERS	RESISTIVITY IN OHM-METERS	DEPTH IN METERS	RESISTIVITY IN OHM-METERS
.27	37.50	21.75	190.35
.40	37.42	34.42	134.34
.59	37.67	53.02	121.09
.87	37.74	79.25	79.99
1.27	36.46	104.68	17.35
1.87	36.66	128.36	3.56
2.71	51.61	215.78	21.13
3.66	107.79	260.91	141.71
4.69	212.55	445.58	38.54
5.94	372.77	720.63	26.92
8.03	445.71	1126.29	31.65
13.02	298.48	1721.38	28.87
		1001720.38	4.41



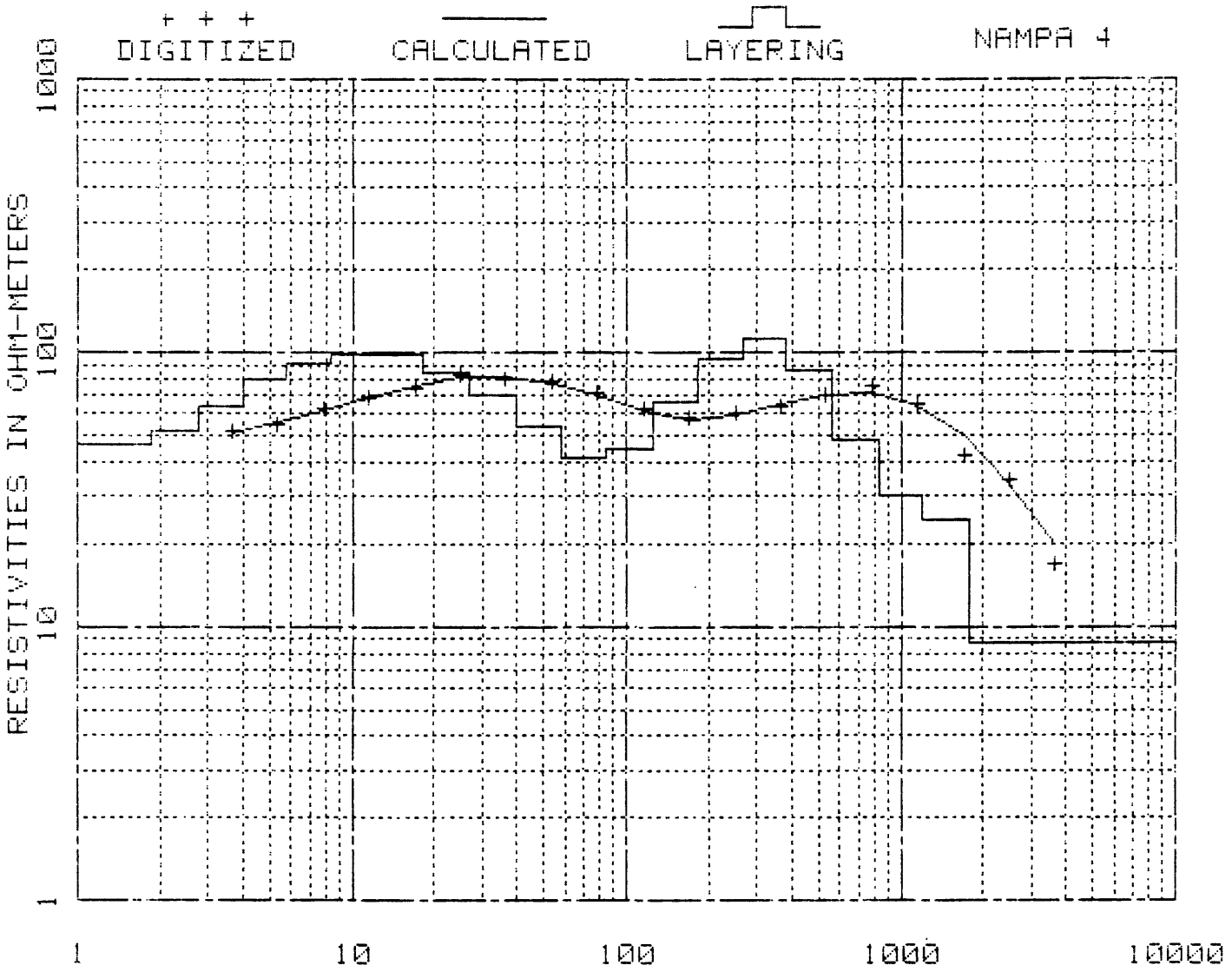
AB/2 IN METERS	OBSERVED RESISTIVITY IN OHM-METERS	AB/2 IN METERS	OBSERVED RESISTIVITY IN OHM-METERS
3.05	56.00	121.92	36.00
4.27	58.00	182.88	41.00
6.10	55.00	243.84	31.50
9.14	52.00	304.80	35.00
12.19	46.00	426.72	40.00
9.14	57.00	304.80	41.00
12.19	52.00	426.72	45.00
18.29	47.00	609.60	48.50
24.38	45.50	914.40	54.00
30.48	42.00	914.40	53.00
30.48	45.00	1219.20	46.00
42.67	37.50	1828.80	38.00
60.96	36.00	2438.40	29.00
91.44	36.80	3048.00	18.00
91.44	36.50	3657.60	24.00



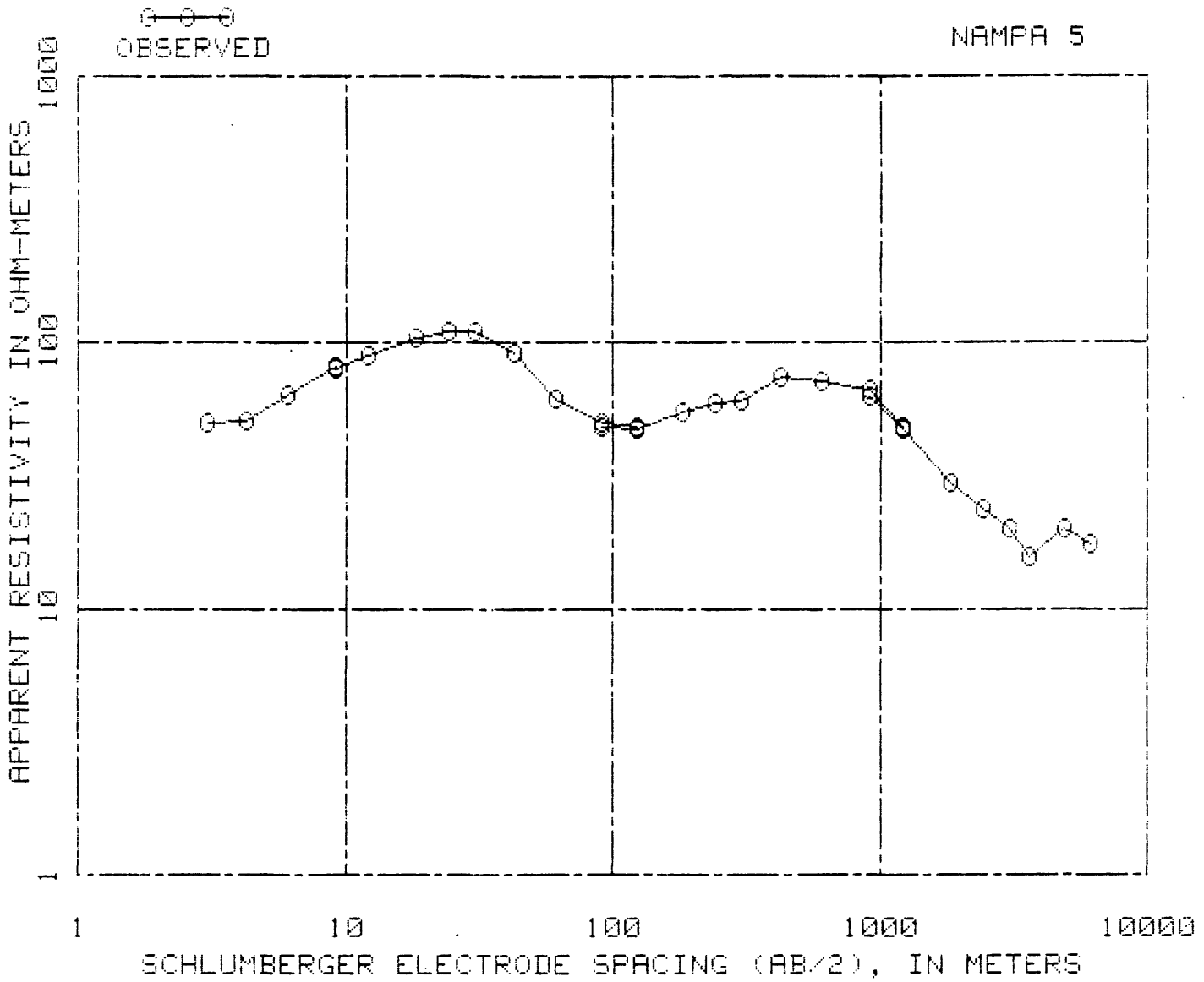
DEPTH IN METERS	RESISTIVITY IN OHM-METERS	DEPTH IN METERS	RESISTIVITY IN OHM-METERS
.27	75.13	26.15	22.43
.40	75.22	38.79	29.59
.59	75.00	56.08	60.86
.87	74.55	81.65	69.45
1.27	75.36	121.99	40.37
1.87	80.53	176.70	20.95
2.74	85.12	263.52	27.84
4.02	70.11	339.31	117.39
5.86	49.70	483.63	108.38
8.60	54.92	757.77	44.14
12.58	78.92	1111.92	18.94
18.40	44.57	1628.42	12.79
		1001627.42	26.86



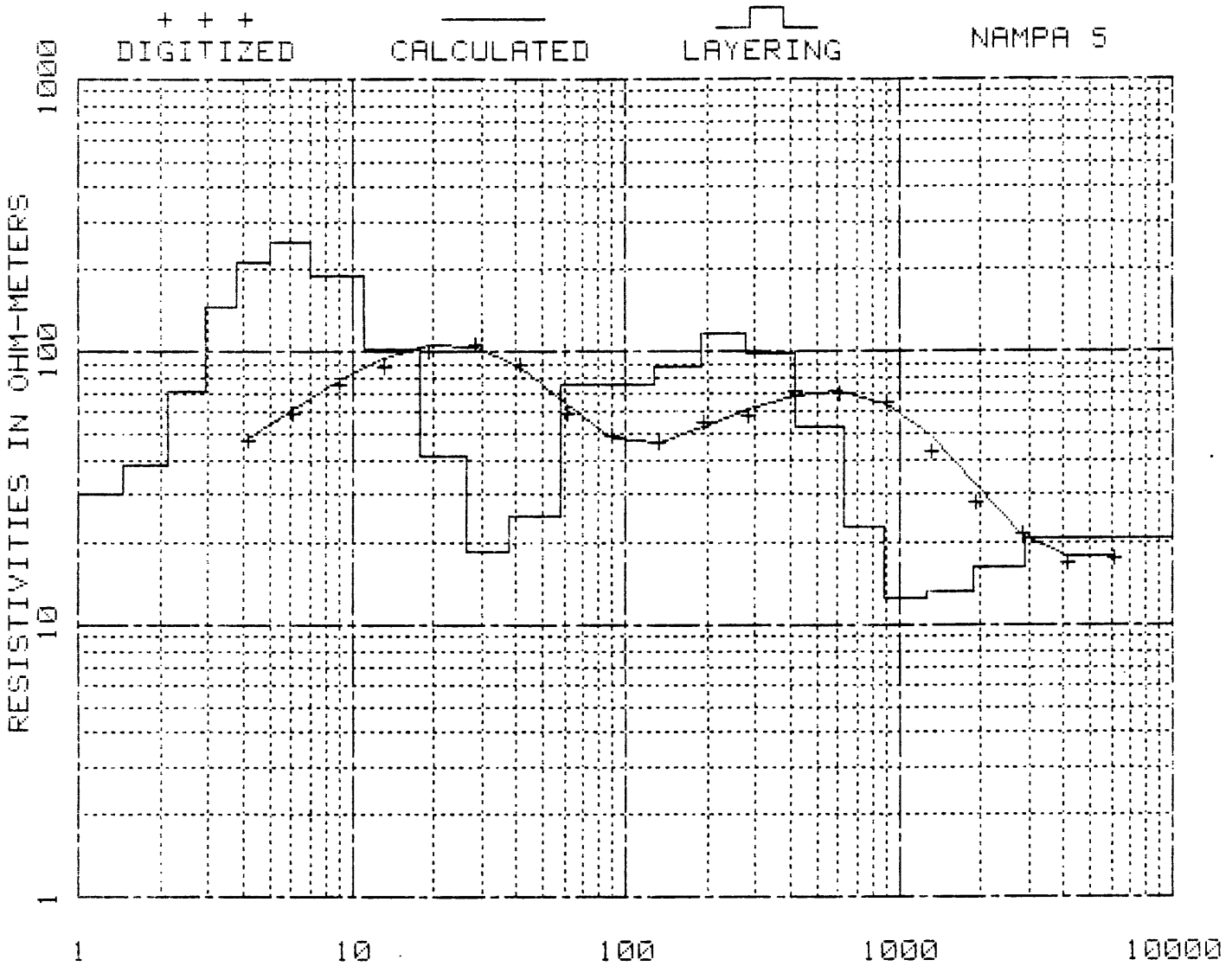
AB/2 IN METERS	OBSERVED RESISTIVITY IN OHM-METERS	AB/2 IN METERS	OBSERVED RESISTIVITY IN OHM-METERS
3.05	41.00	121.92	53.50
4.27	42.00	182.88	51.00
6.10	46.00	243.84	53.00
9.14	52.00	304.80	53.00
9.14	53.00	304.80	54.00
12.19	57.00	426.72	60.00
18.29	62.00	609.60	64.00
24.38	67.00	914.40	66.00
30.48	67.00	1219.20	55.00
30.48	68.00	914.40	76.00
42.67	65.00	1219.20	62.00
60.96	64.00	1828.80	40.00
91.44	56.00	2438.40	35.00
91.44	59.00	3048.00	24.00
		3657.60	17.00



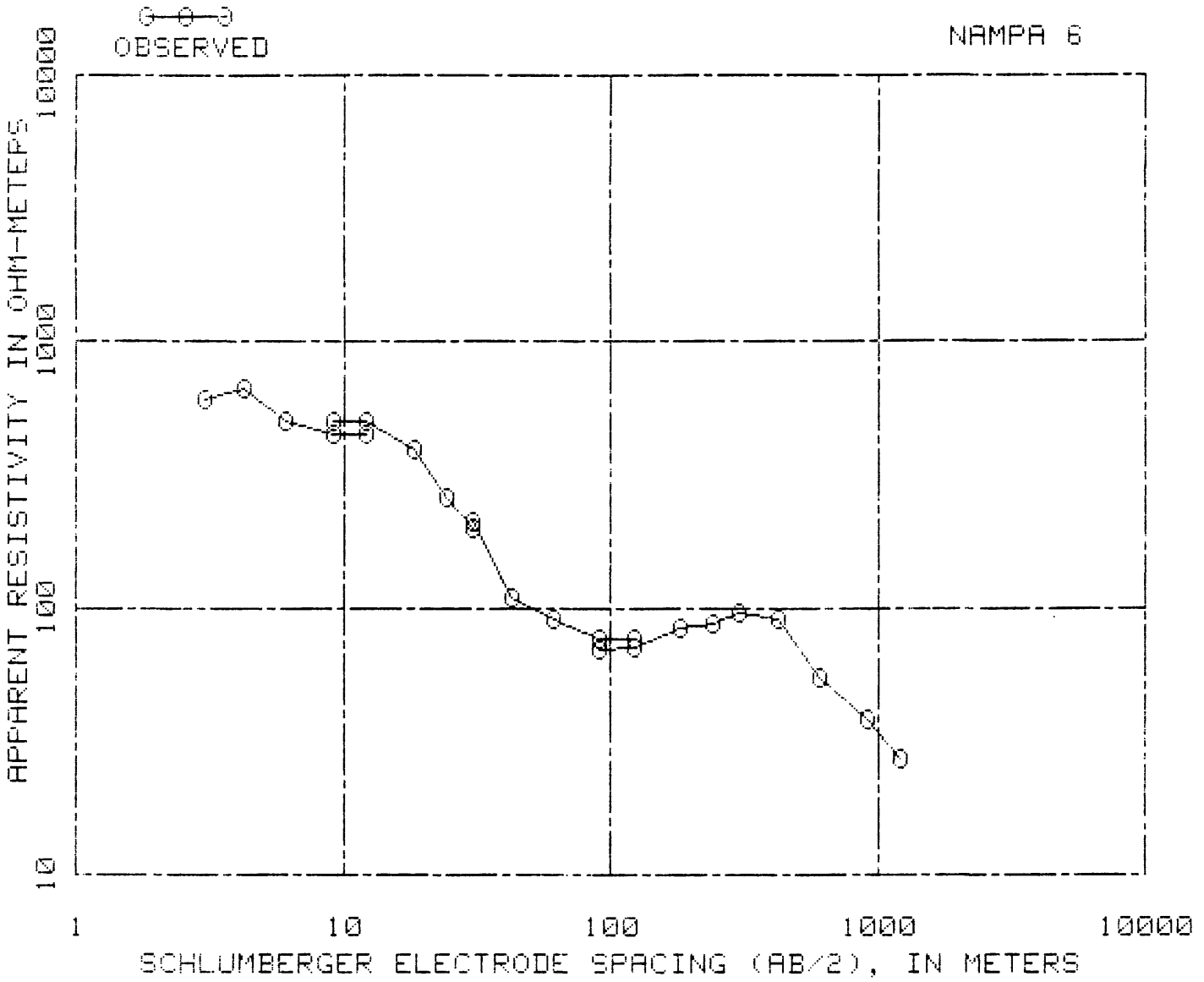
DEPTH IN METERS	RESISTIVITY IN OHM-METERS	DEPTH IN METERS	RESISTIVITY IN OHM-METERS
.27	46.76	26.82	85.62
.40	46.86	39.58	70.29
.59	46.87	58.02	53.60
.87	46.61	84.70	41.68
1.27	46.21	124.93	45.18
1.87	46.82	183.52	66.55
2.74	51.83	263.53	95.57
3.99	64.27	380.46	113.07
5.76	80.16	568.25	86.19
8.37	91.49	834.75	48.27
12.24	99.14	1206.43	30.11
18.08	98.00	1762.27	24.71
		1001761.27	8.76



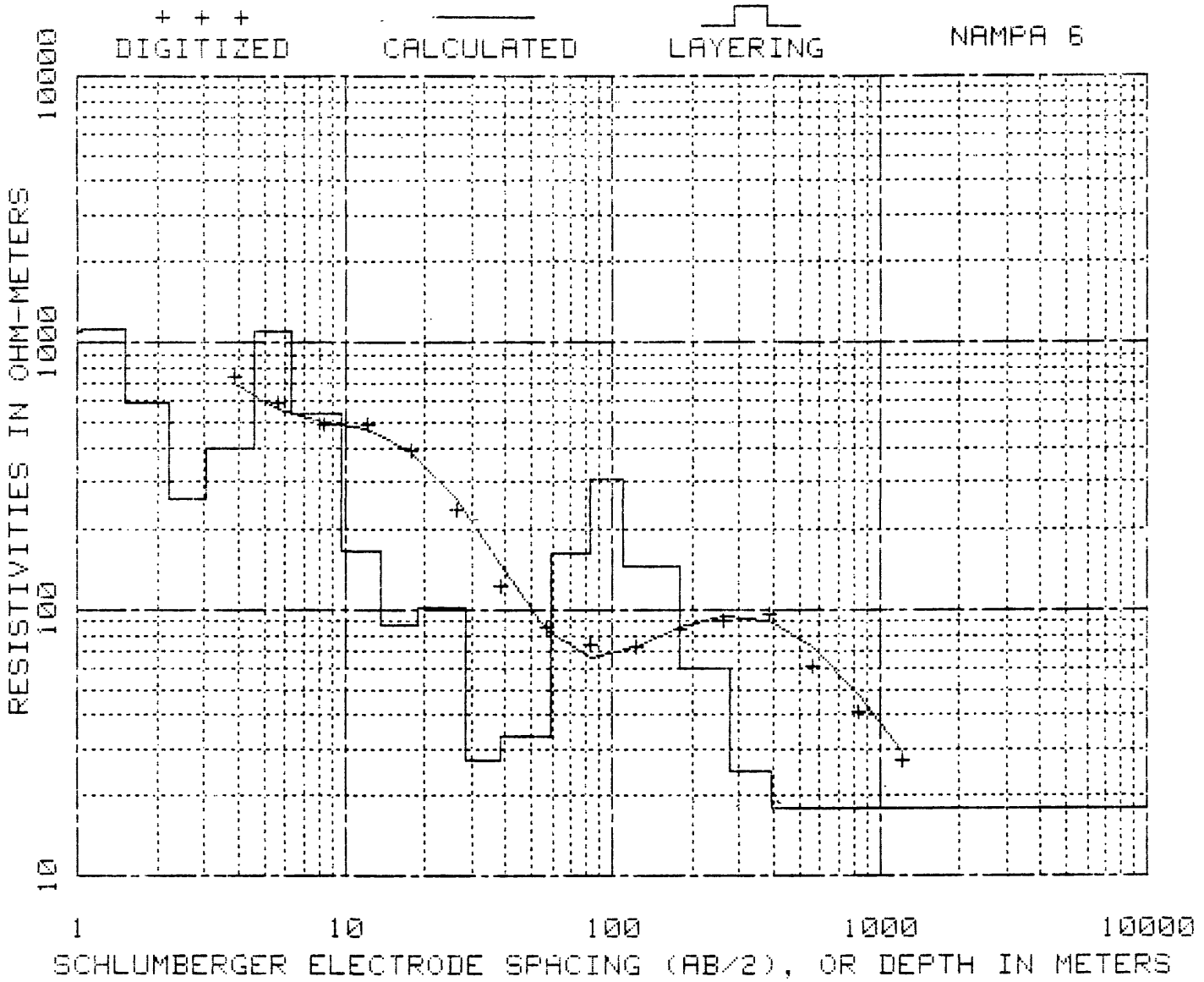
AB/2 IN METERS	OBSERVED RESISTIVITY IN OHM-METERS	AB/2 IN METERS	OBSERVED RESISTIVITY IN OHM-METERS
3.05	50.00	182.88	55.00
4.27	51.00	243.84	59.50
6.10	63.50	304.80	61.00
9.14	81.00	304.80	61.00
9.14	79.50	426.72	74.00
12.19	89.00	609.60	72.00
18.29	104.00	914.40	66.00
24.38	111.00	1219.20	48.00
30.48	110.00	914.40	62.50
30.48	110.00	1219.20	47.00
42.67	91.00	1828.80	29.50
60.96	61.50	2438.40	23.50
91.44	50.50	3048.00	19.80
121.92	48.00	3657.60	15.50
91.44	48.00	4876.80	20.00
121.92	47.00	6096.00	17.50



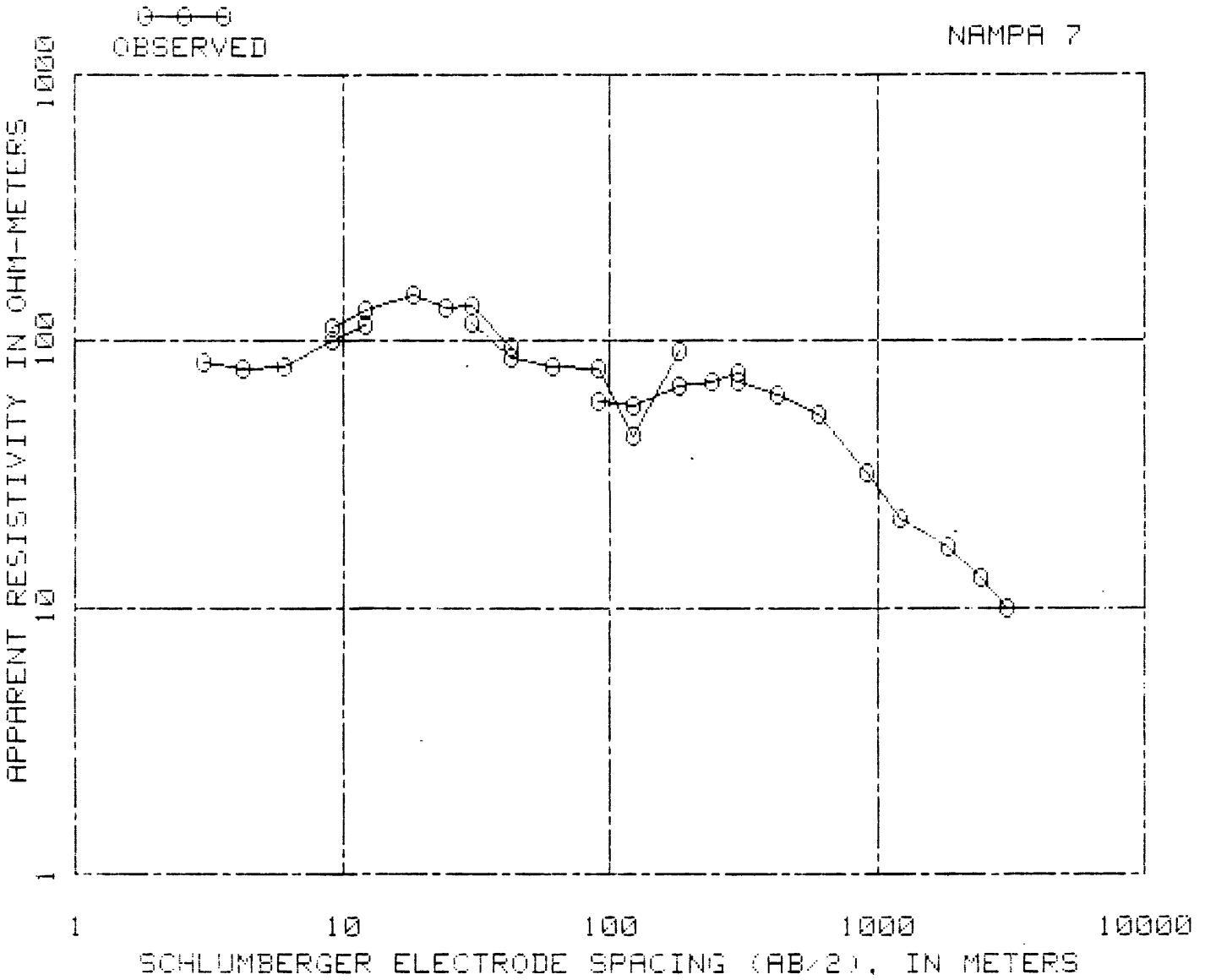
DEPTH IN METERS	RESISTIVITY IN OHM-METERS	DEPTH IN METERS	RESISTIVITY IN OHM-METERS
.31	31.38	37.45	18.44
.46	31.67	57.75	24.98
.67	31.54	84.34	75.36
.98	30.56	126.53	76.22
1.45	30.42	188.73	87.85
2.11	38.74	275.53	116.91
2.92	71.93	417.52	98.71
3.81	145.14	625.83	52.81
5.02	215.09	890.42	22.56
7.02	252.72	1258.61	12.51
11.09	190.52	1884.11	13.31
17.82	101.93	2865.68	16.32
26.42	41.19	1002864.68	20.66



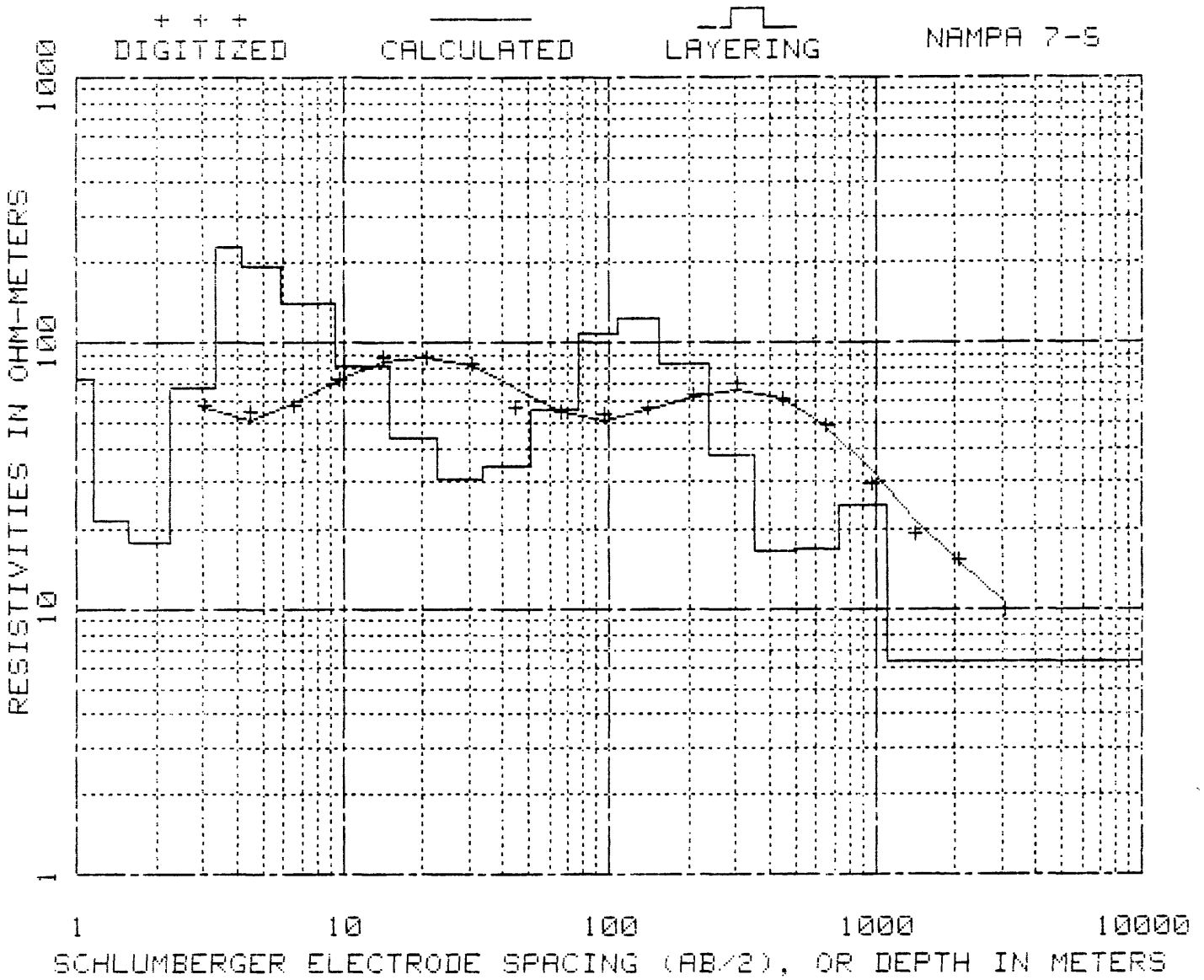
AB/2 IN METERS	OBSERVED RESISTIVITY IN OHM-METERS	AB/2 IN METERS	OBSERVED RESISTIVITY IN OHM-METERS
3.05	600.00	91.44	76.00
4.27	665.00	121.92	77.00
6.10	500.00	91.44	69.00
9.14	445.00	121.92	71.50
12.19	445.00	182.88	84.00
9.14	505.00	243.84	88.00
12.19	500.00	304.80	95.00
18.29	390.00	304.80	95.50
24.38	260.00	426.72	90.00
30.48	200.00	609.60	55.00
30.48	212.00	914.40	38.00
42.67	110.00	914.40	38.00
60.96	90.00	1219.20	27.00



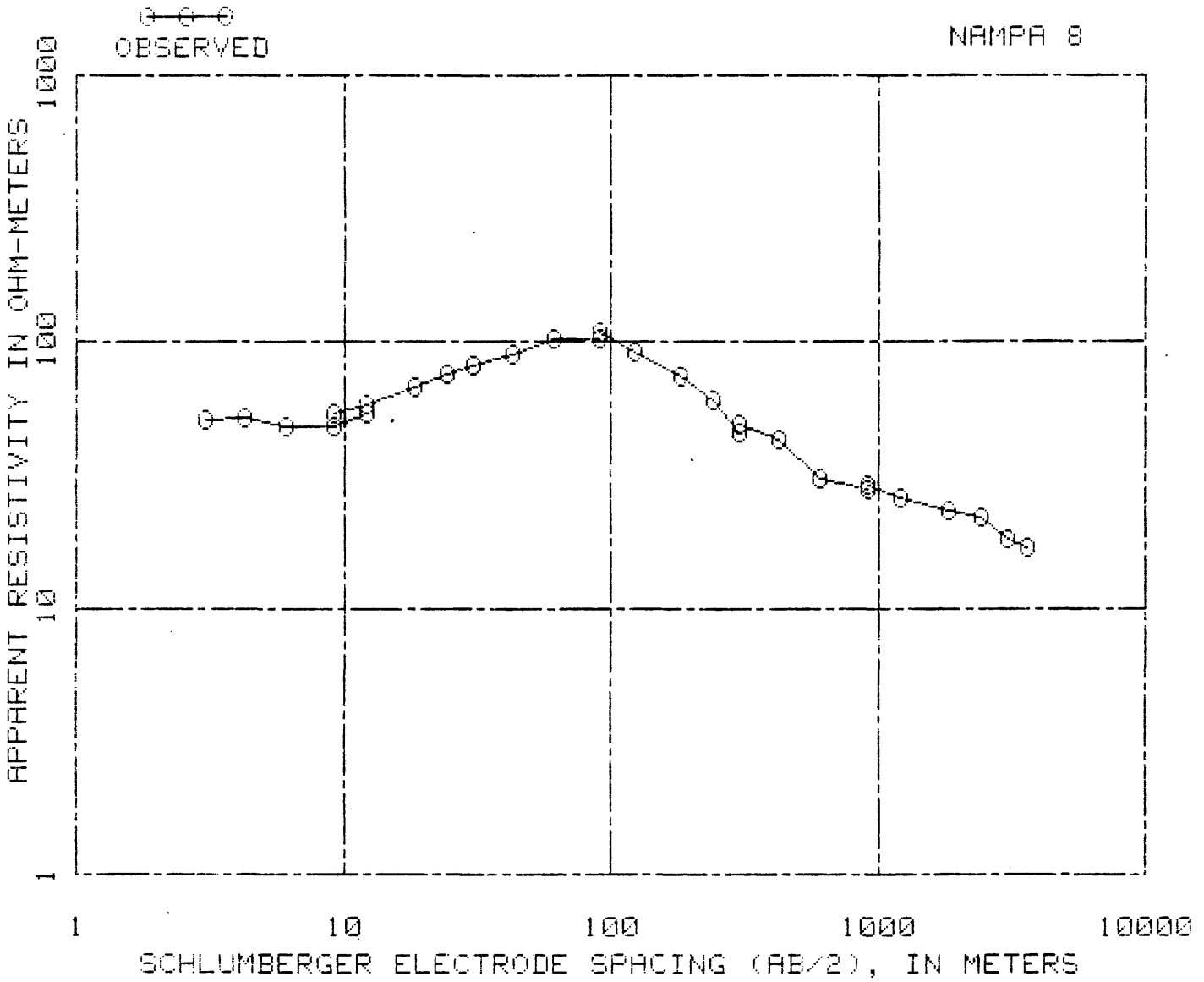
DEPTH IN METERS	RESISTIVITY IN OHM-METERS	DEPTH IN METERS	RESISTIVITY IN OHM-METERS
.22	1030.87	13.53	163.89
.33	1048.50	18.93	86.80
.48	1008.36	28.57	101.48
.70	991.41	38.68	27.12
1.03	1109.41	58.71	33.50
1.51	1127.11	82.51	162.69
2.19	594.98	109.54	305.32
3.05	257.94	178.27	145.98
4.55	399.21	275.96	60.35
6.36	1105.97	397.29	24.81
9.64	535.60	1000396.29	17.86



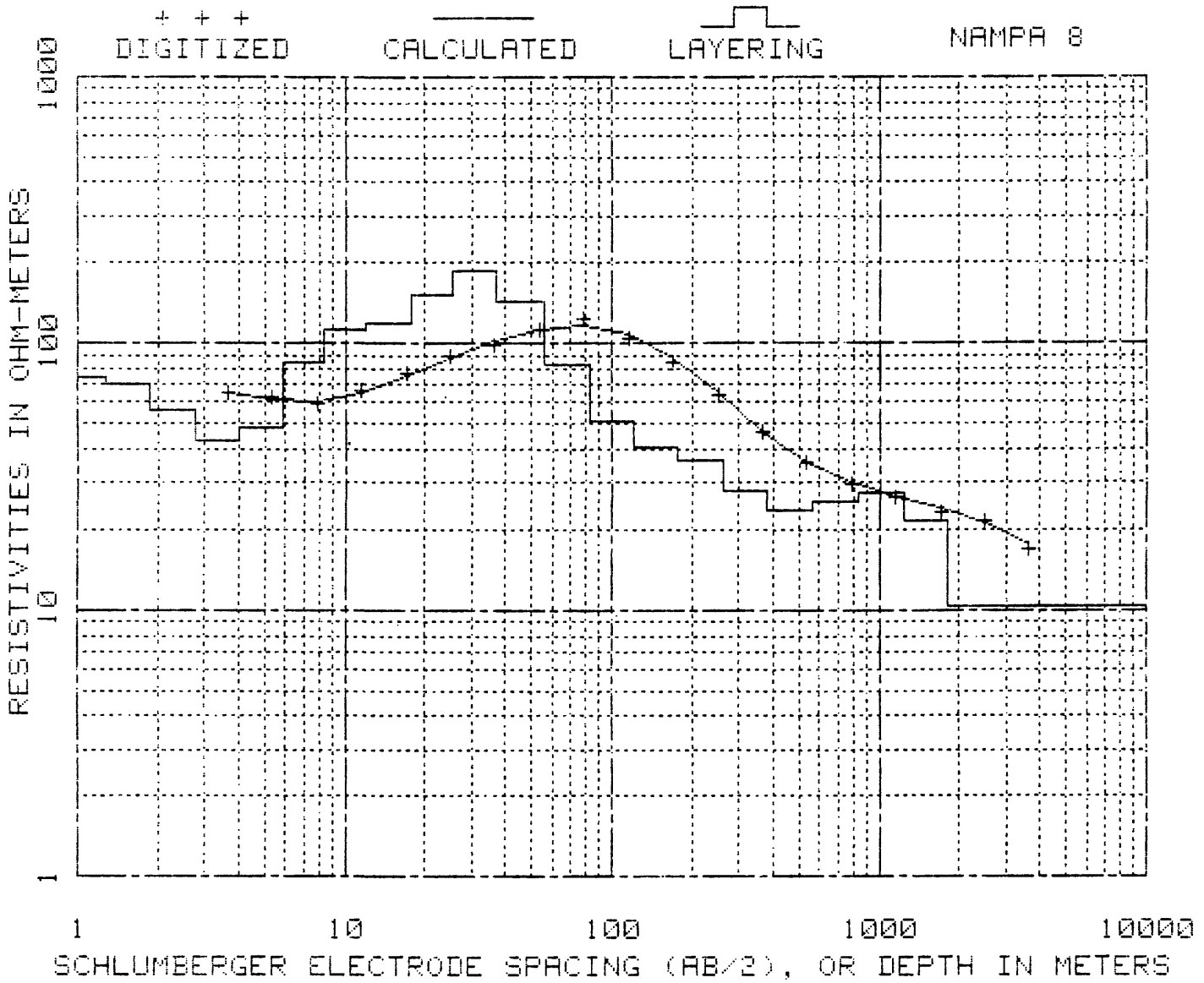
AB/2 IN METERS	OBSERVED RESISTIVITY IN OHM-METERS	AB/2 IN METERS	OBSERVED RESISTIVITY IN OHM-METERS
3.05	83.00	121.92	44.00
4.27	78.50	182.88	92.00
6.10	80.00	91.44	59.50
9.14	100.00	121.92	57.00
12.19	115.00	182.88	68.00
9.14	112.00	243.84	70.00
12.19	131.00	304.80	75.50
18.29	148.00	304.80	70.00
24.38	134.00	426.72	63.00
30.48	135.00	609.60	53.00
42.67	95.00	914.40	32.00
30.48	117.00	914.40	32.00
42.67	86.00	1219.20	21.40
60.96	80.00	1828.80	17.00
91.44	79.00	2438.40	13.00
		3048.00	10.00



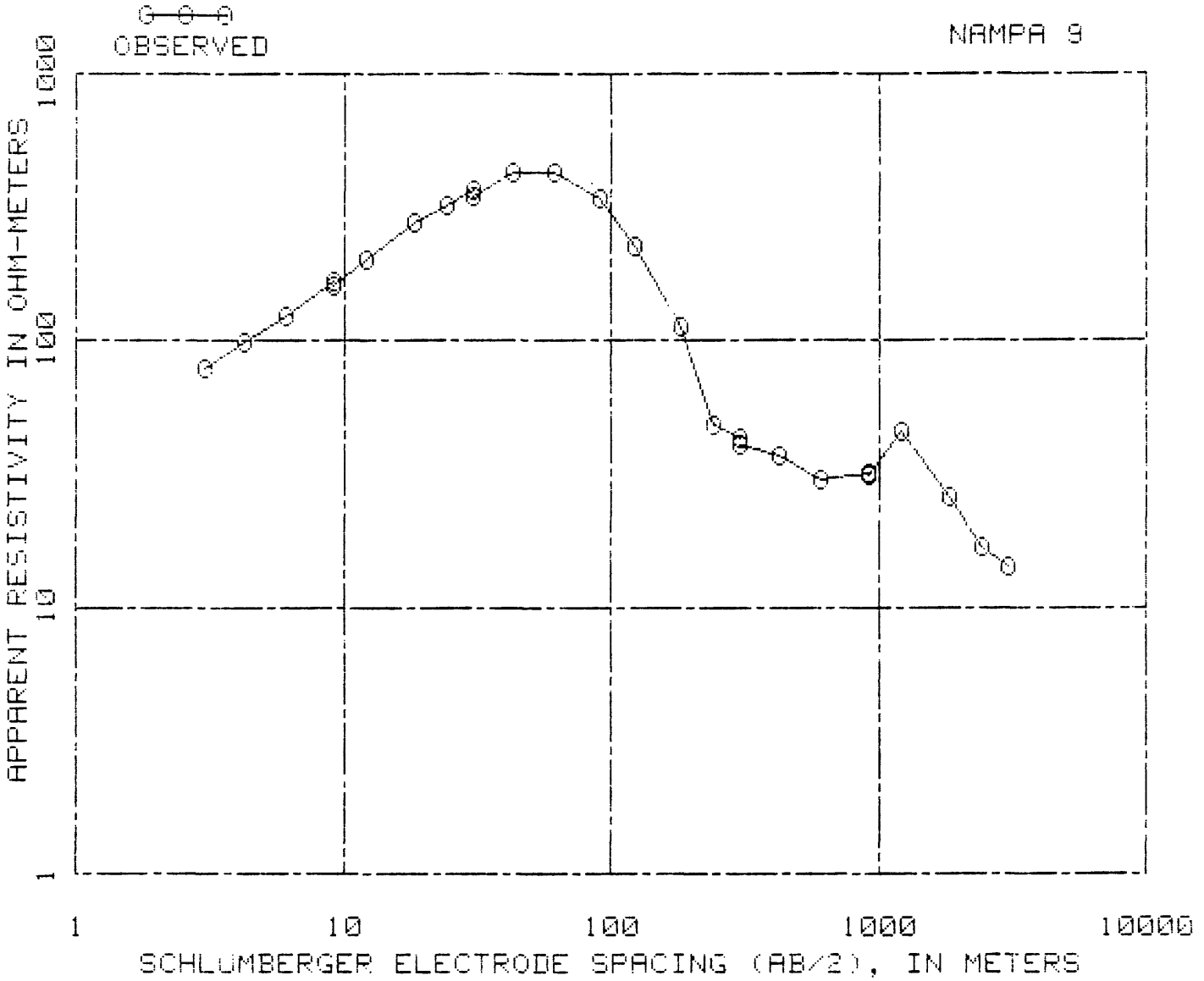
DEPTH IN METERS	RESISTIVITY IN OHM-METERS	DEPTH IN METERS	RESISTIVITY IN OHM-METERS
.18	139.41	15.01	82.42
.26	137.17	22.63	44.35
.38	147.70	33.60	30.81
.55	164.79	50.87	34.25
.81	147.96	76.48	56.43
1.17	73.25	107.42	106.05
1.56	21.55	154.73	124.56
2.24	17.92	236.72	82.99
3.32	68.33	349.50	38.10
4.14	228.52	492.23	16.67
5.90	194.55	730.95	16.84
9.43	139.61	1111.40	24.46
		1001110.40	6.34



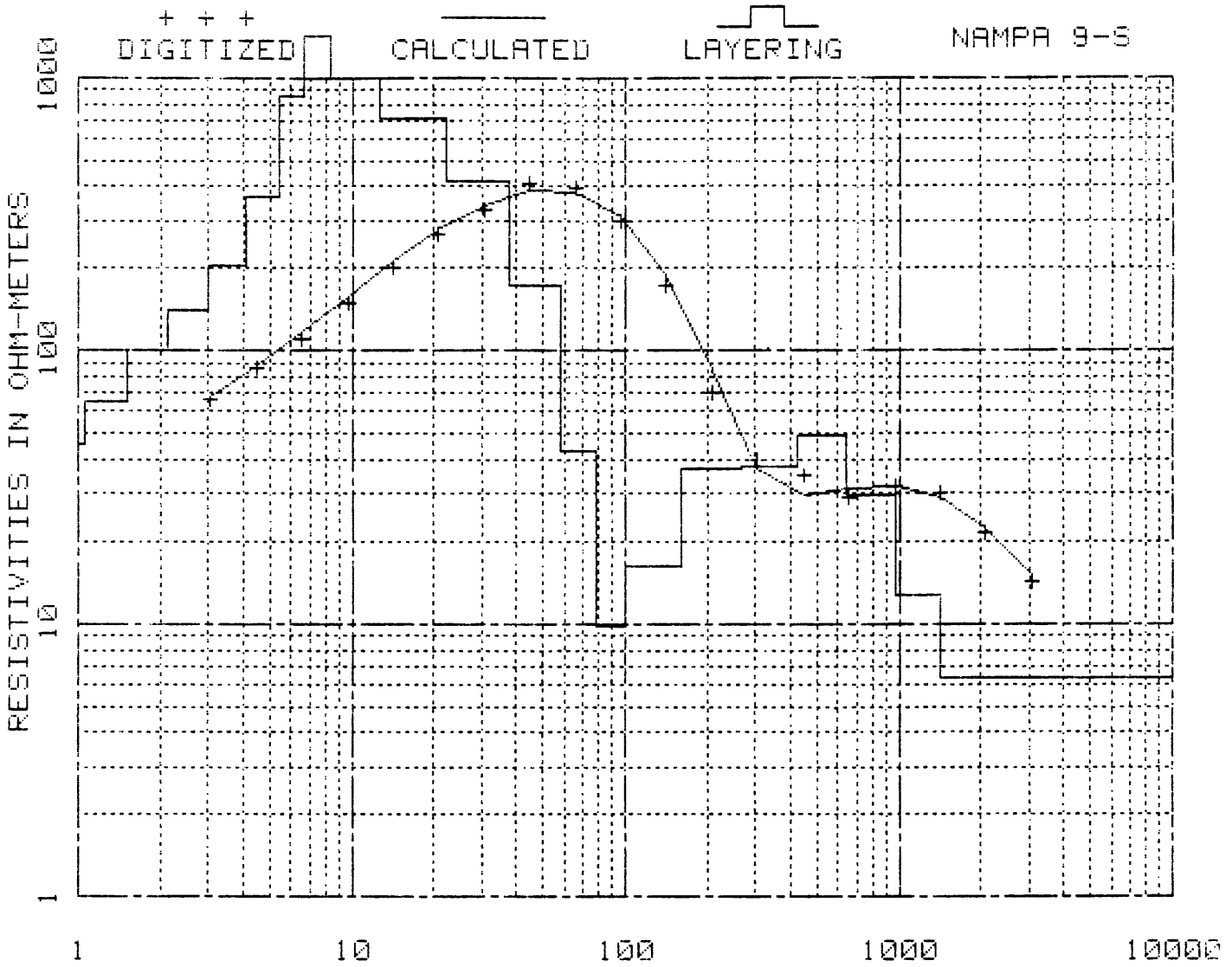
AB/2 IN METERS	OBSERVED RESISTIVITY IN OHM-METERS	AB/2 IN METERS	OBSERVED RESISTIVITY IN OHM-METERS
3.05	51.00	91.44	108.00
4.27	52.00	121.92	91.00
6.10	48.00	182.88	73.80
9.14	48.00	243.84	60.00
12.19	54.00	304.80	46.00
9.14	53.80	304.80	49.00
12.19	58.00	426.72	43.00
18.29	68.00	609.60	31.00
24.38	75.50	914.40	28.00
30.48	81.00	914.40	29.00
30.48	82.00	1219.20	25.90
42.67	89.00	1828.80	23.00
60.96	102.00	2438.40	22.00
91.44	103.00	3048.00	18.00
		3657.60	17.00



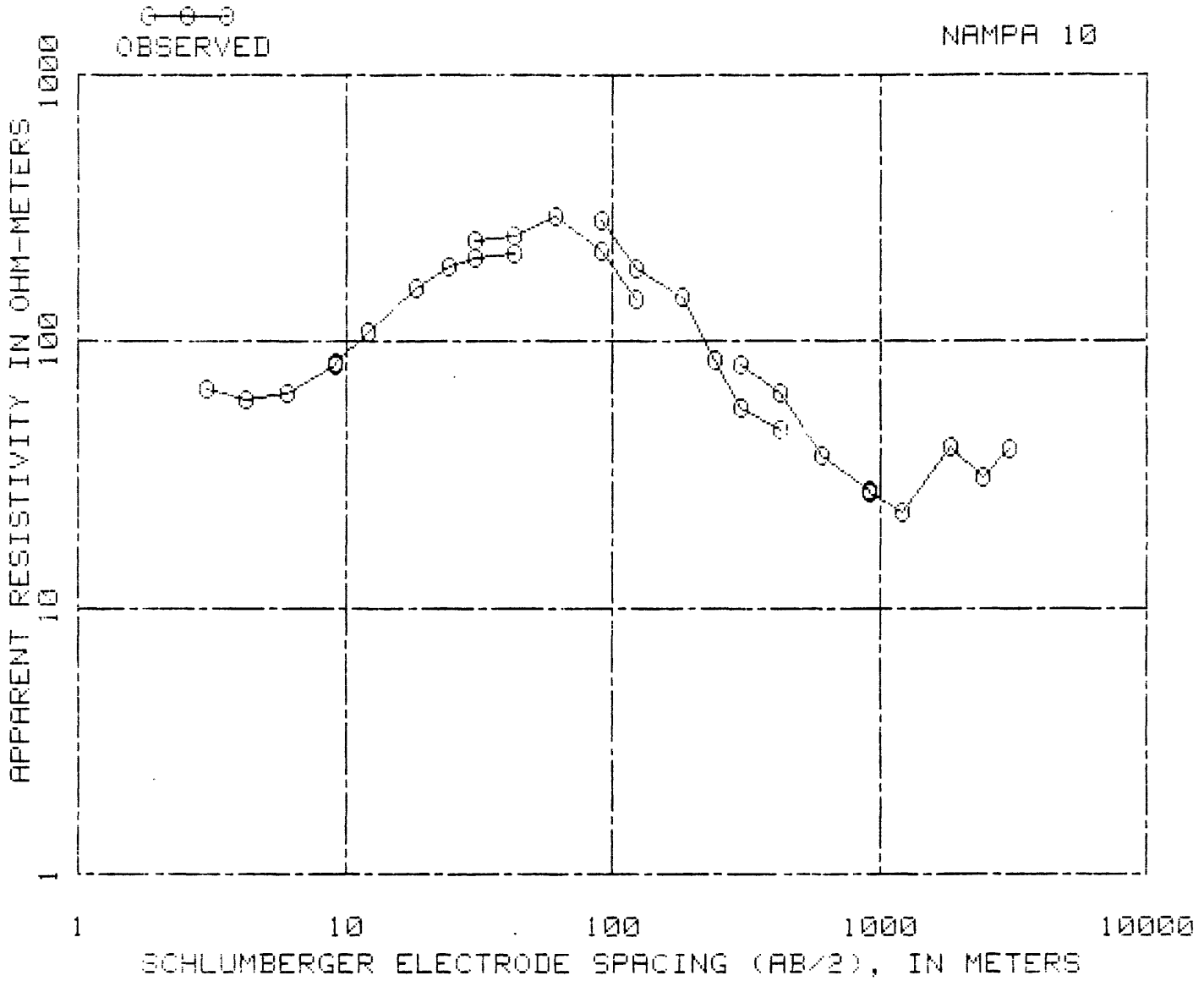
DEPTH IN METERS	RESISTIVITY IN OHM-METERS	DEPTH IN METERS	RESISTIVITY IN OHM-METERS
.27	72.96	25.42	151.69
.40	72.78	36.77	186.45
.59	73.02	55.42	144.42
.87	73.84	82.34	82.98
1.27	74.46	119.74	50.79
1.87	70.18	175.28	40.72
2.74	56.51	258.79	36.45
3.99	43.29	380.08	27.98
5.86	48.38	559.99	23.80
8.44	85.01	832.74	25.31
12.05	112.84	1237.42	27.57
17.59	118.43	1823.94	21.44
		1001822.94	10.29



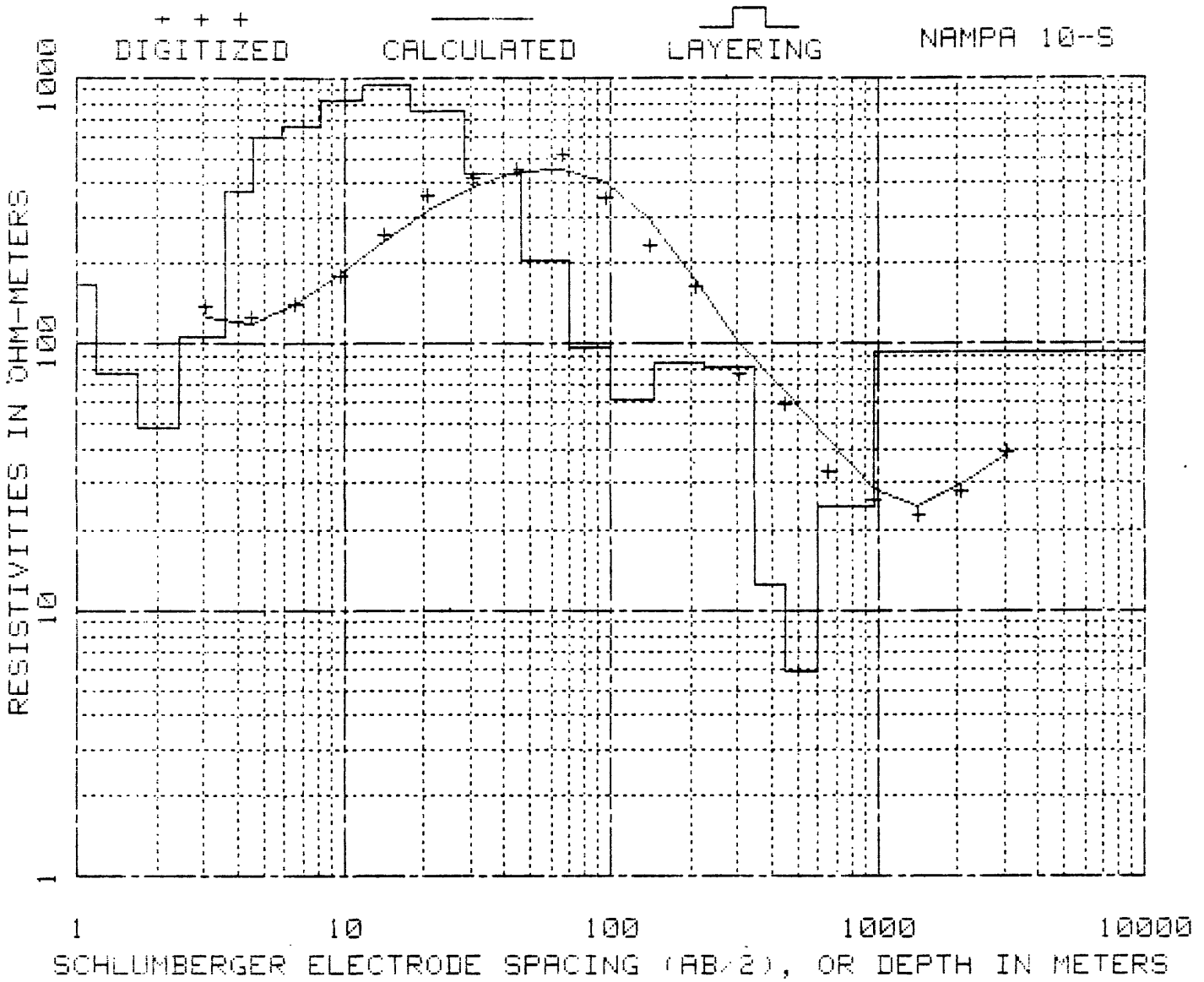
AB/2 IN METERS	OBSERVED RESISTIVITY IN OHM-METERS	AB/2 IN METERS	OBSERVED RESISTIVITY IN OHM-METERS
3.05	78.00	91.44	340.00
4.27	98.00	121.92	225.00
6.10	123.00	182.88	112.00
9.14	168.00	243.84	48.00
9.14	162.00	304.80	43.00
12.19	200.00	304.80	41.00
18.29	278.00	426.72	37.00
24.38	325.00	609.60	30.00
30.48	370.00	914.40	32.00
30.48	350.00	914.40	31.50
42.67	430.00	1219.20	45.50
60.96	430.00	1828.80	26.00
91.44	340.00	2438.40	17.00
		3048.00	14.30



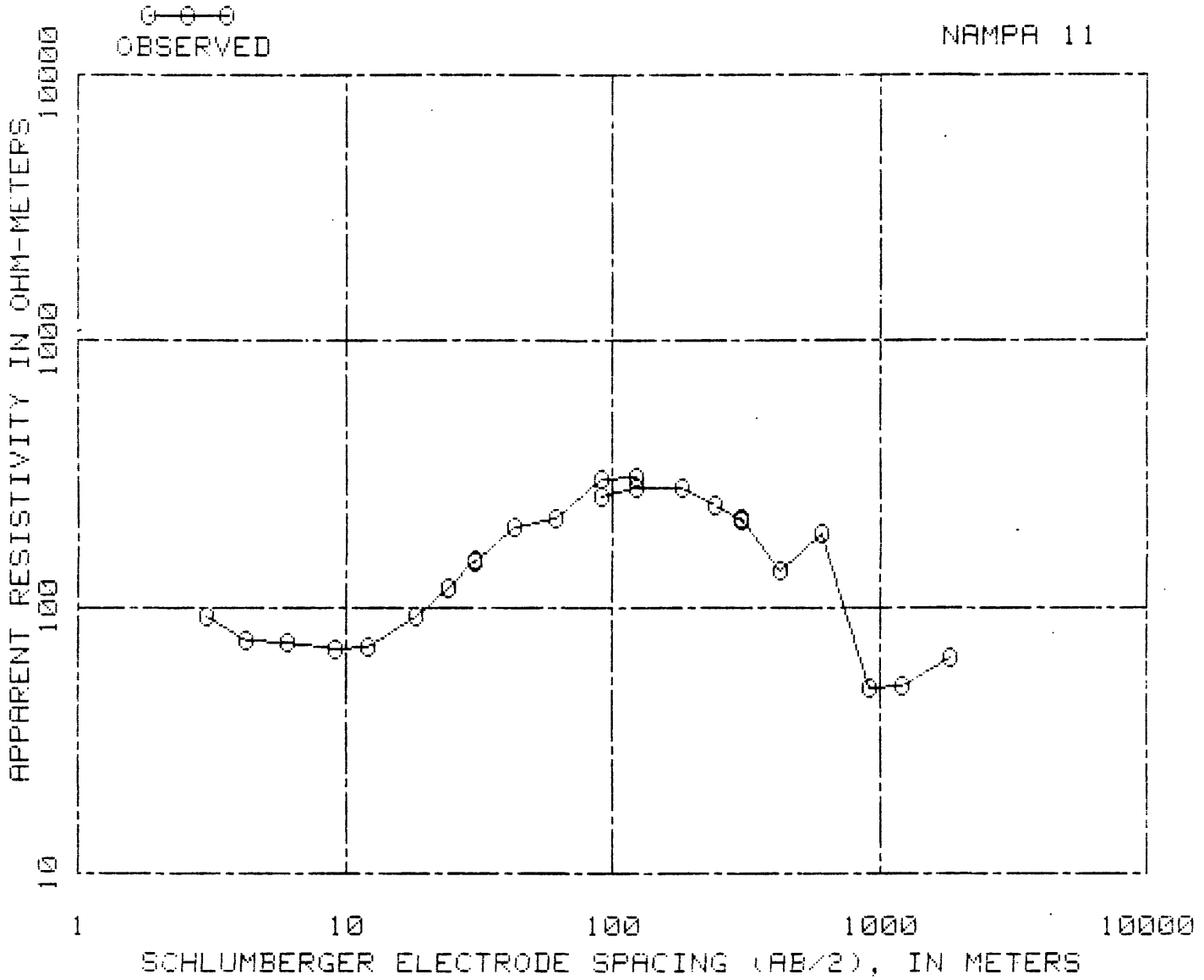
DEPTH IN METERS	RESISTIVITY IN OHM-METERS	DEPTH IN METERS	RESISTIVITY IN OHM-METERS
.23	41.07	12.64	992.94
.34	40.76	22.03	703.64
.49	40.05	37.71	418.92
.72	40.16	58.16	171.97
1.06	45.80	78.73	42.81
1.53	64.87	99.27	9.80
2.13	100.46	158.97	16.21
2.97	141.27	265.81	37.16
4.10	205.23	422.62	37.80
5.44	366.07	646.06	49.21
6.68	864.26	979.97	29.59
8.29	1412.97	1408.91	12.68
		1001407.91	6.37



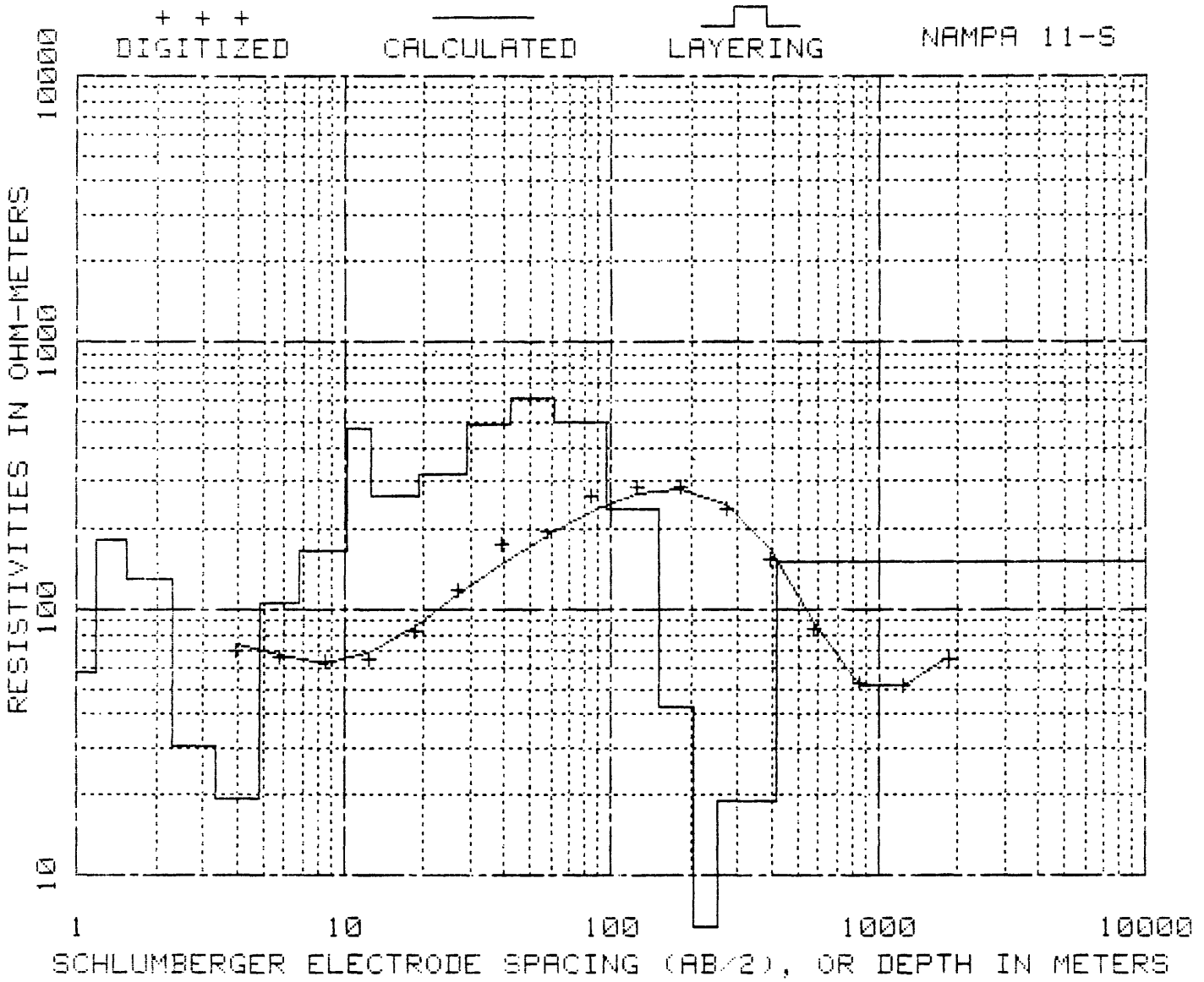
AB/2 IN METERS	OBSERVED RESISTIVITY IN OHM-METERS	AB/2 IN METERS	OBSERVED RESISTIVITY IN OHM-METERS
3.05	66.00	91.44	285.00
4.27	60.00	121.92	187.00
6.10	64.20	182.88	146.00
9.14	82.00	243.84	85.00
9.14	84.00	304.80	56.20
12.19	109.00	426.72	46.10
18.29	159.00	304.80	81.00
24.38	192.00	426.72	64.00
30.48	205.00	609.60	37.00
42.67	215.00	914.40	27.50
30.48	240.00	914.40	27.00
42.67	250.00	1219.20	22.80
60.96	295.00	1828.80	40.00
91.44	217.00	2438.40	31.00
121.92	144.00	3048.00	39.50



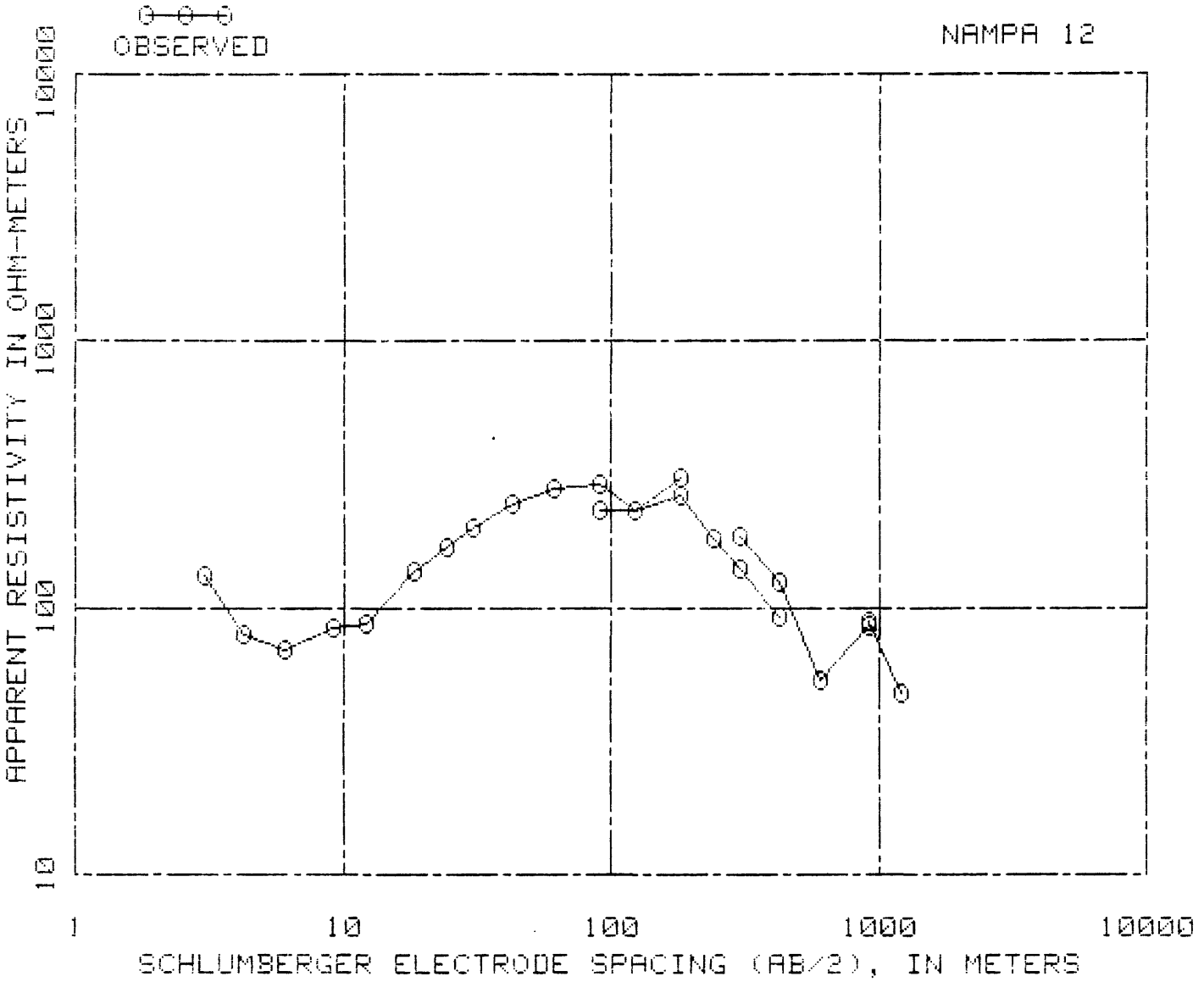
DEPTH IN METERS	RESISTIVITY IN OHM-METERS	DEPTH IN METERS	RESISTIVITY IN OHM-METERS
.18	188.26	11.76	825.66
.26	179.33	17.60	946.52
.38	179.00	28.61	750.30
.56	195.17	46.25	431.79
.81	216.44	69.77	205.87
1.19	167.66	100.23	96.86
1.70	76.80	145.47	61.35
2.41	48.17	225.20	85.43
3.61	105.68	343.81	81.50
4.61	373.46	445.64	12.48
5.89	604.34	597.42	5.86
8.19	655.90	977.13	24.58
		1000976.13	92.71



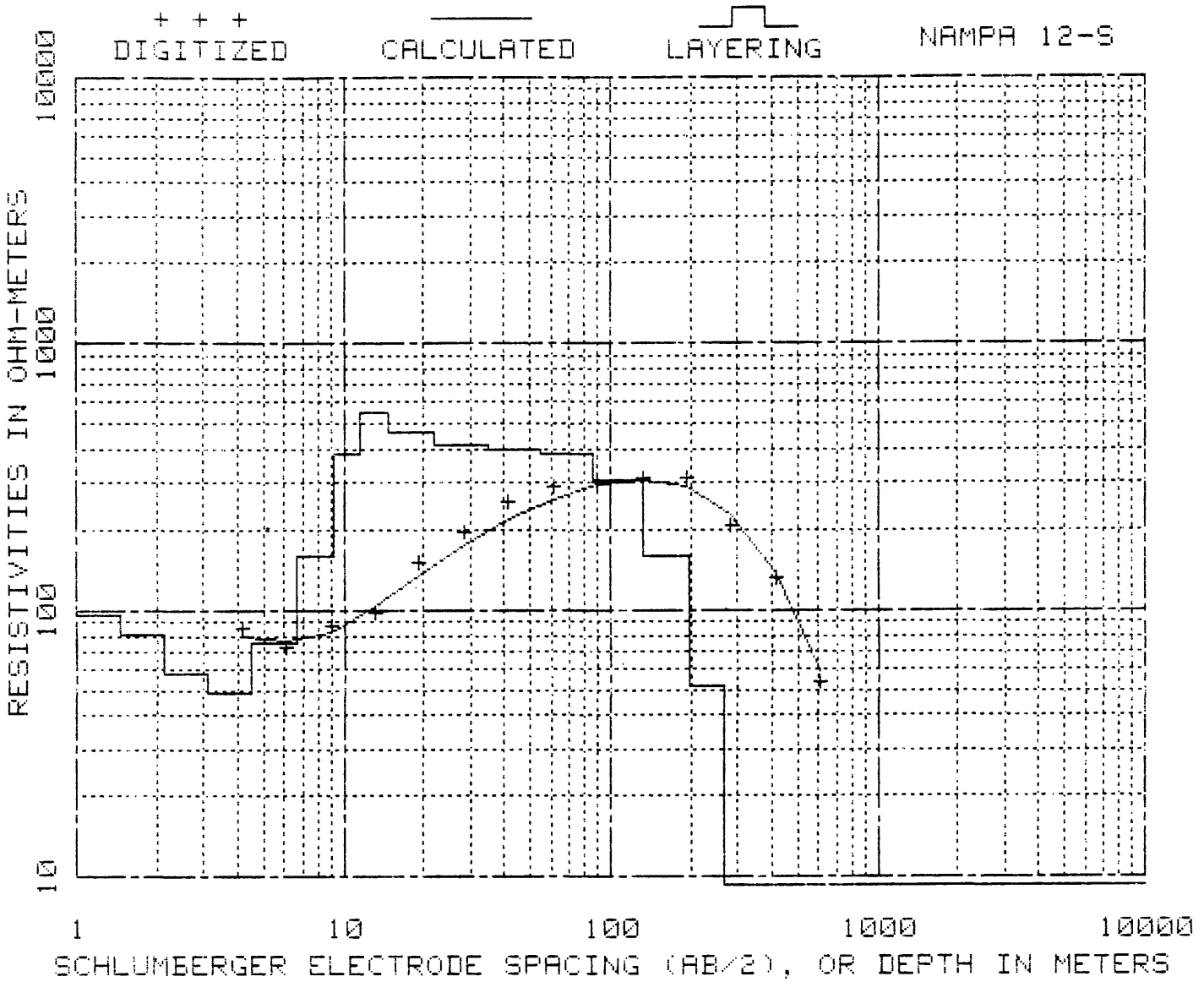
AB/2 IN METERS	OBSERVED RESISTIVITY IN OHM-METERS	AB/2 IN METERS	OBSERVED RESISTIVITY IN OHM-METERS
3.05	92.00	91.44	300.00
4.27	75.50	121.92	310.00
6.10	74.00	91.44	262.00
9.14	70.00	121.92	280.00
9.14	69.00	182.88	279.00
12.19	71.00	243.84	242.00
18.29	91.50	304.80	212.00
24.38	118.00	304.80	217.00
30.48	150.00	426.72	136.00
30.48	147.00	609.60	190.00
42.67	198.00	914.40	50.00
60.96	216.00	1219.20	51.00
		1828.80	65.00



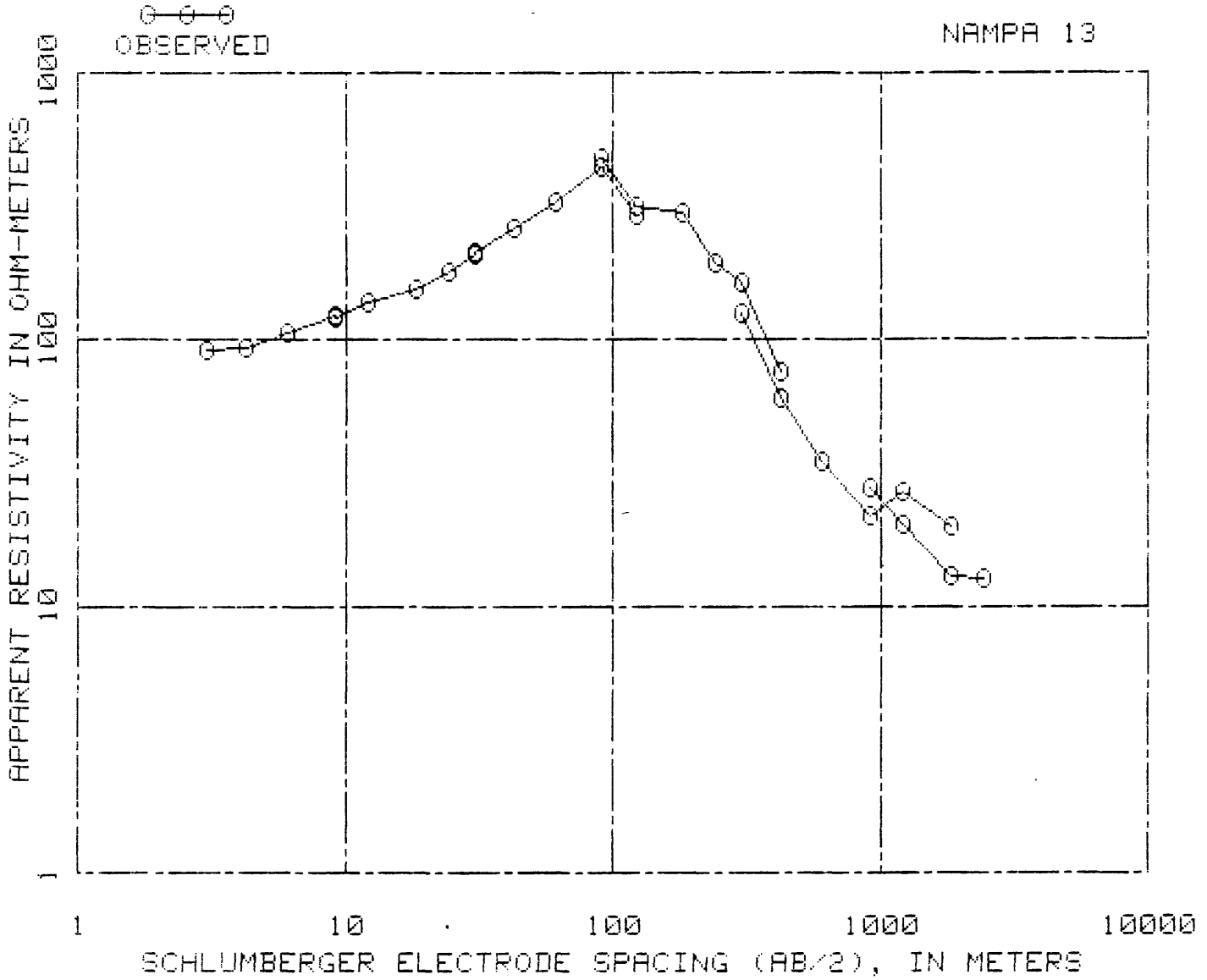
DEPTH IN METERS	RESISTIVITY IN OHM-METERS	DEPTH IN METERS	RESISTIVITY IN OHM-METERS
.17	61.70	10.29	165.58
.26	76.26	12.59	469.71
.37	90.73	19.17	266.42
.55	67.48	29.07	319.43
.80	43.77	41.99	491.13
1.18	58.02	61.36	615.75
1.55	182.42	96.59	498.45
2.30	129.32	151.22	237.18
3.35	30.36	205.28	42.60
4.88	19.51	252.52	6.39
6.77	104.57	417.79	19.17
		1000416.79	150.12



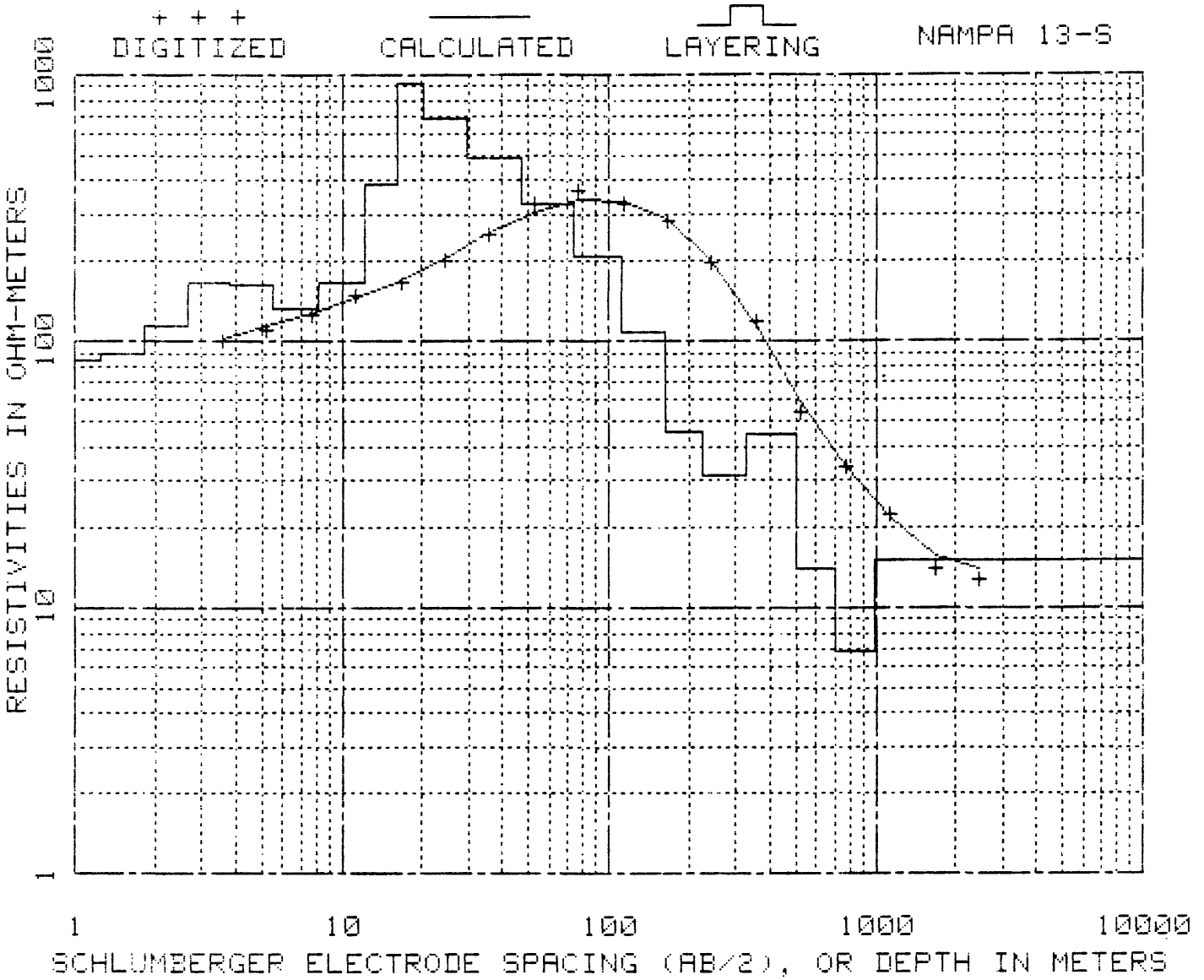
AB/2 IN METERS	OBSERVED RESISTIVITY IN OHM-METERS	AB/2 IN METERS	OBSERVED RESISTIVITY IN OHM-METERS
3.05	131.00	121.92	230.00
4.27	79.00	182.88	310.00
6.10	69.00	91.44	230.00
9.14	84.00	121.92	234.00
9.14	84.00	182.88	265.00
12.19	88.00	243.84	180.00
18.29	136.00	304.80	140.00
24.38	170.00	426.72	92.00
30.48	198.00	304.80	184.00
30.48	200.00	426.72	125.00
42.67	247.00	609.60	54.00
60.96	280.00	914.40	85.00
91.44	290.00	914.40	89.00
		1219.20	48.00



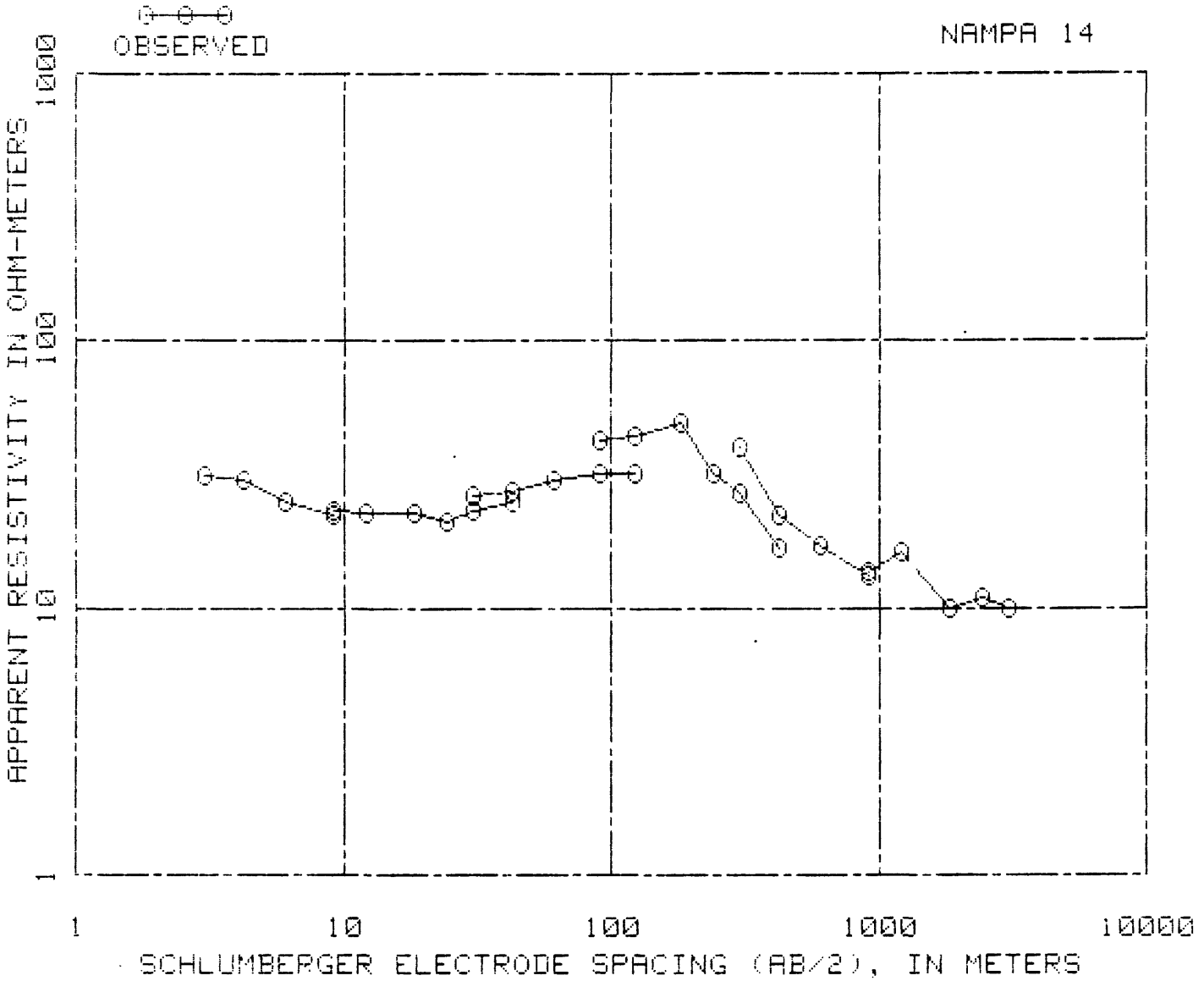
DEPTH IN METERS	RESISTIVITY IN OHM-METERS	DEPTH IN METERS	RESISTIVITY IN OHM-METERS
.31	95.23	11.44	385.43
.46	95.44	14.80	549.56
.67	96.41	21.94	464.21
.98	97.92	34.69	417.69
1.45	95.72	54.94	400.61
2.12	80.61	85.69	387.68
3.08	57.46	131.73	305.80
4.50	49.10	195.07	159.56
6.62	75.55	266.99	51.43
9.11	160.50	1000265.99	9.24



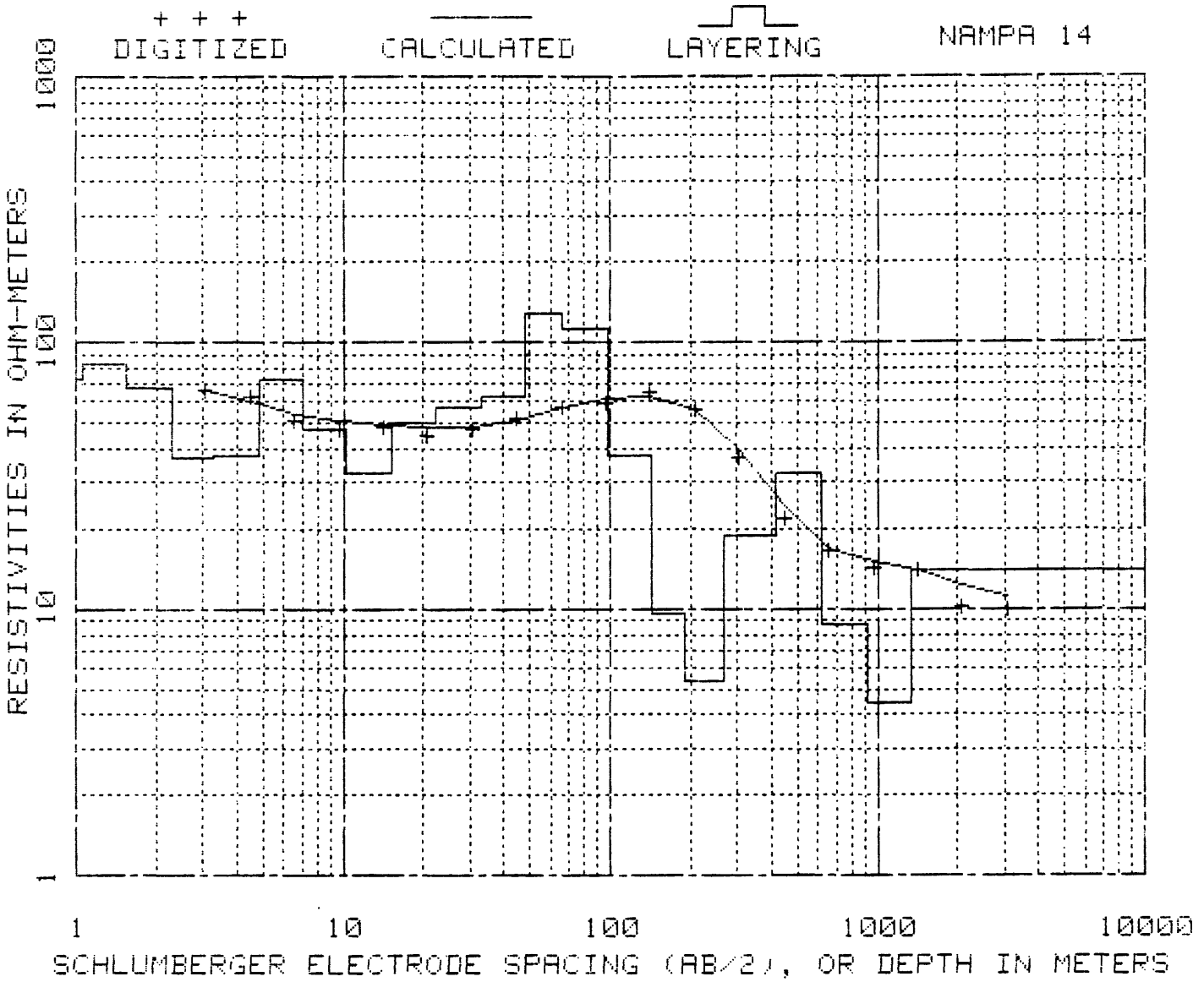
AB/2 IN METERS	OBSERVED RESISTIVITY IN OHM-METERS	AB/2 IN METERS	OBSERVED RESISTIVITY IN OHM-METERS
3.05	91.50	121.92	317.00
4.27	94.00	182.88	300.00
6.10	106.00	243.84	195.00
9.14	124.00	304.80	165.00
9.14	122.00	426.72	76.00
12.19	139.00	304.80	127.00
18.29	154.00	426.72	60.00
24.38	180.00	609.60	35.00
30.48	208.00	914.40	21.80
30.48	212.00	1219.20	27.00
42.67	260.00	1828.80	20.00
60.96	326.00	914.40	28.00
91.44	445.00	1219.20	20.50
121.92	295.00	1828.80	13.00
91.44	475.00	2438.40	12.70



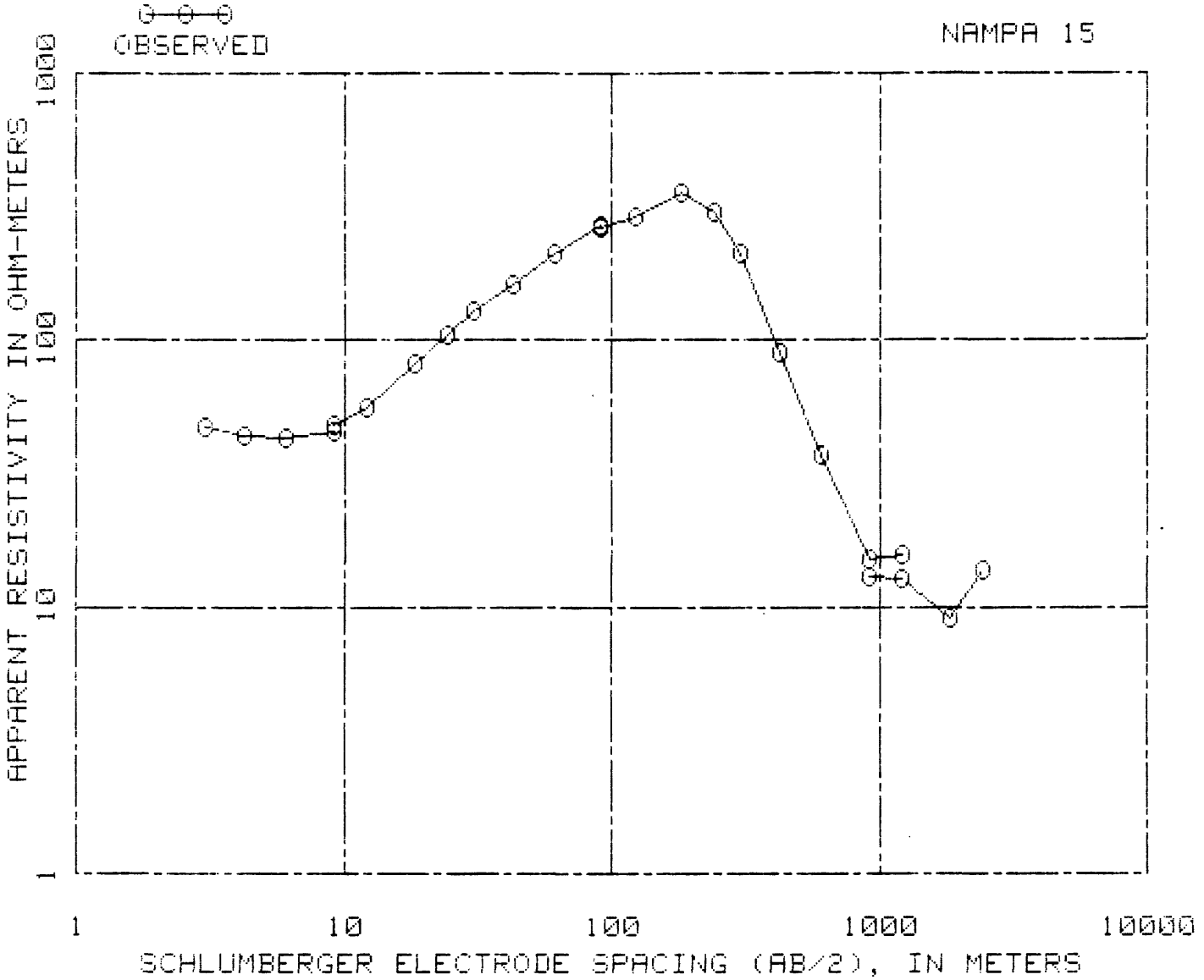
DEPTH IN METERS	RESISTIVITY IN OHM-METERS	DEPTH IN METERS	RESISTIVITY IN OHM-METERS
.27	87.92	20.15	930.24
.39	88.23	29.35	684.75
.58	88.15	46.95	484.72
.85	87.03	73.93	331.36
1.25	85.14	111.99	207.73
1.83	89.22	162.80	107.88
2.66	115.58	226.41	45.27
3.80	165.60	326.40	31.28
5.56	163.19	505.16	44.84
8.26	133.58	709.48	14.01
12.13	168.35	989.78	6.78
16.30	385.79	1000988.78	15.06



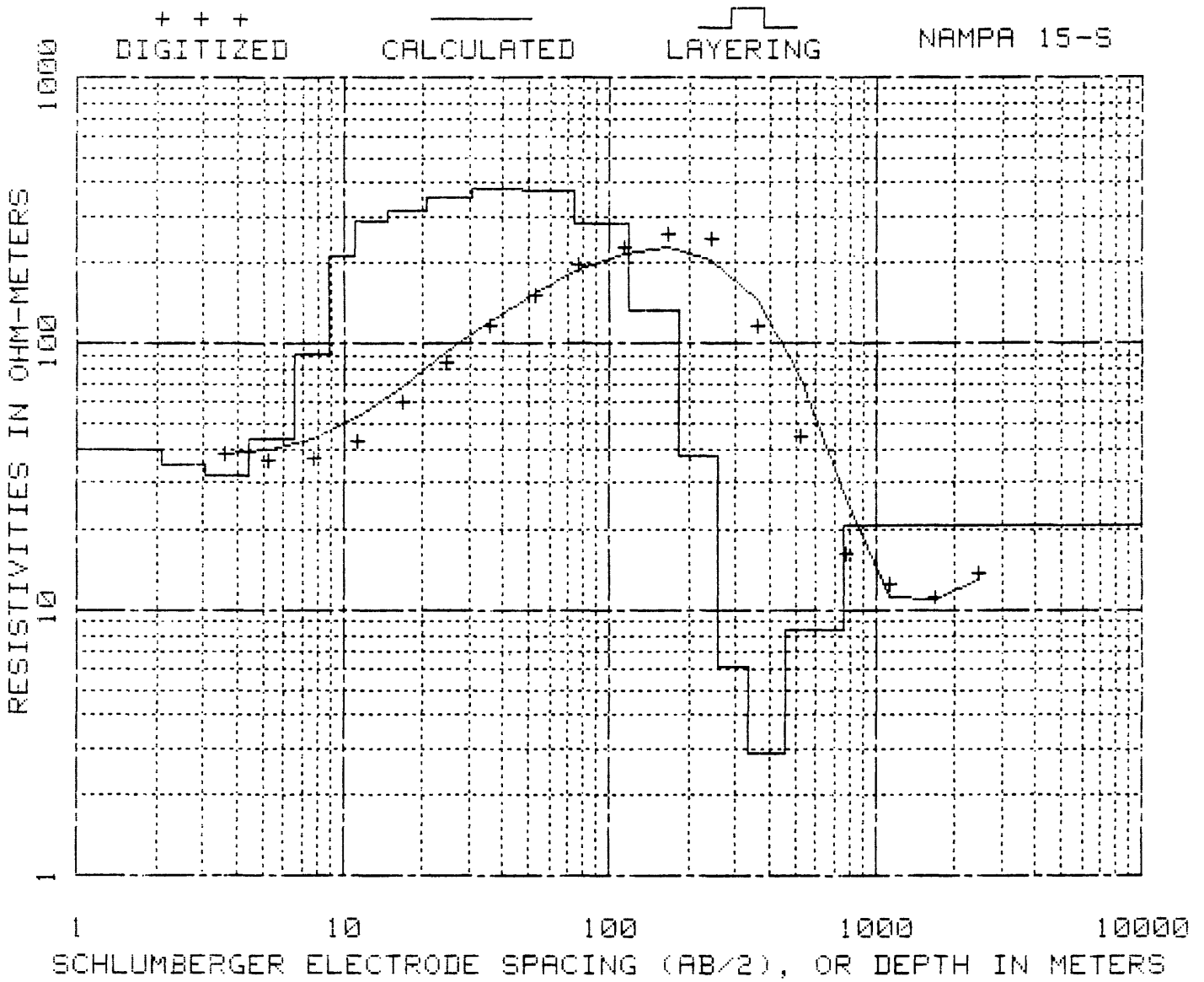
AB/2 IN METERS	OBSERVED RESISTIVITY IN OHM-METERS	AB/2 IN METERS	OBSERVED RESISTIVITY IN OHM-METERS
3.05	31.50	91.44	42.00
4.27	30.00	121.92	44.00
6.10	25.00	182.88	49.00
9.14	22.50	243.84	32.00
9.14	23.00	304.80	27.00
12.19	22.80	426.72	17.00
18.29	22.80	304.80	40.00
24.38	21.00	426.72	22.40
30.48	23.00	609.60	17.20
42.67	25.00	914.40	13.20
30.48	26.50	914.40	13.70
42.67	27.50	1219.20	16.20
60.96	30.00	1828.80	10.00
91.44	32.00	2438.40	11.00
121.92	32.00	3048.00	10.00



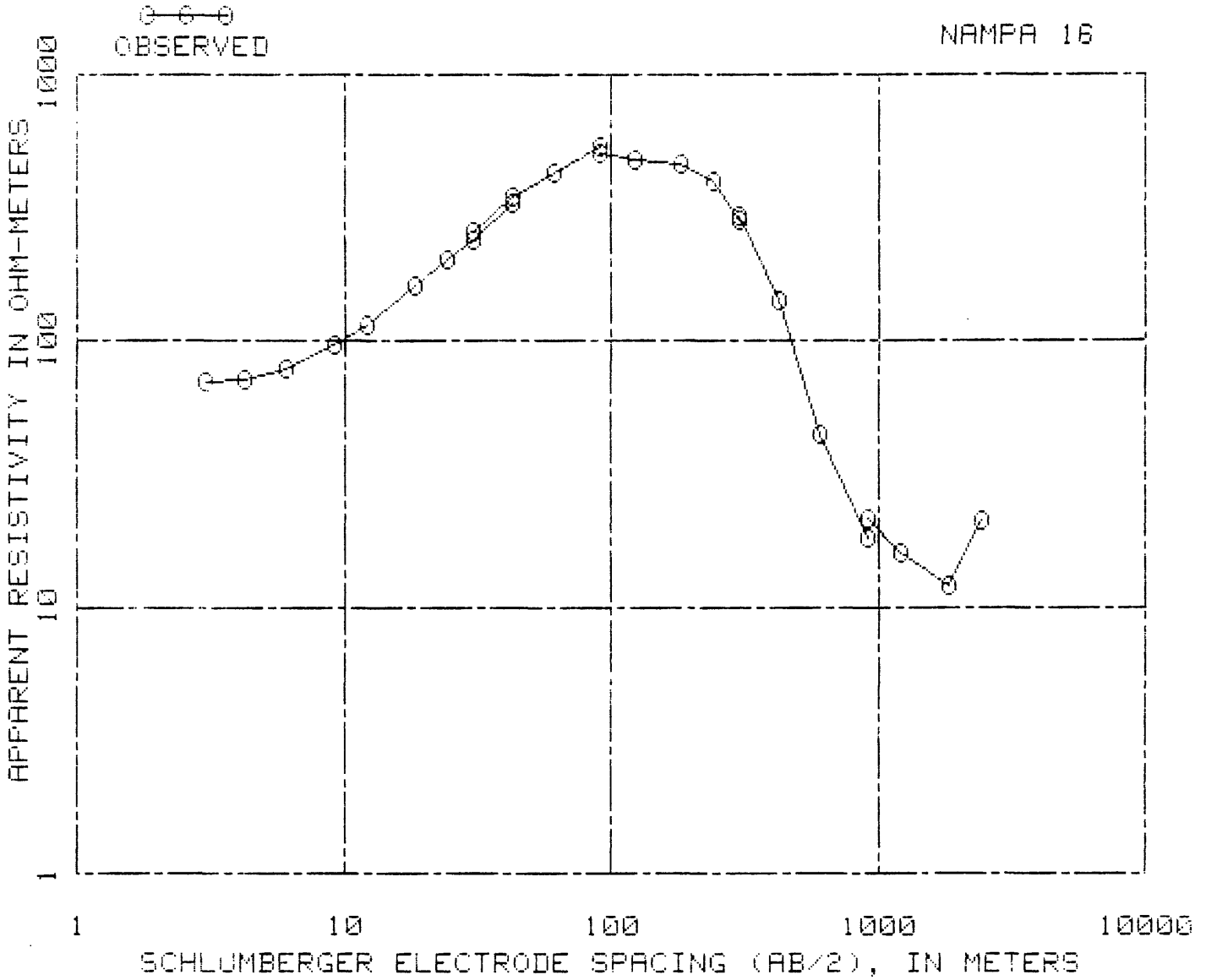
DEPTH IN METERS	RESISTIVITY IN OHM-METERS	DEPTH IN METERS	RESISTIVITY IN OHM-METERS
.23	69.11	22.43	50.44
.34	69.29	32.97	57.30
.49	68.60	48.35	63.26
.72	68.02	66.31	127.54
1.06	72.59	97.32	113.17
1.55	83.01	143.40	37.83
2.28	67.88	190.81	9.66
3.29	37.43	263.30	5.34
4.82	37.59	418.79	18.92
7.01	72.63	618.07	32.44
10.38	47.05	925.05	8.72
15.18	32.59	1332.53	4.41
		1001331.53	13.94



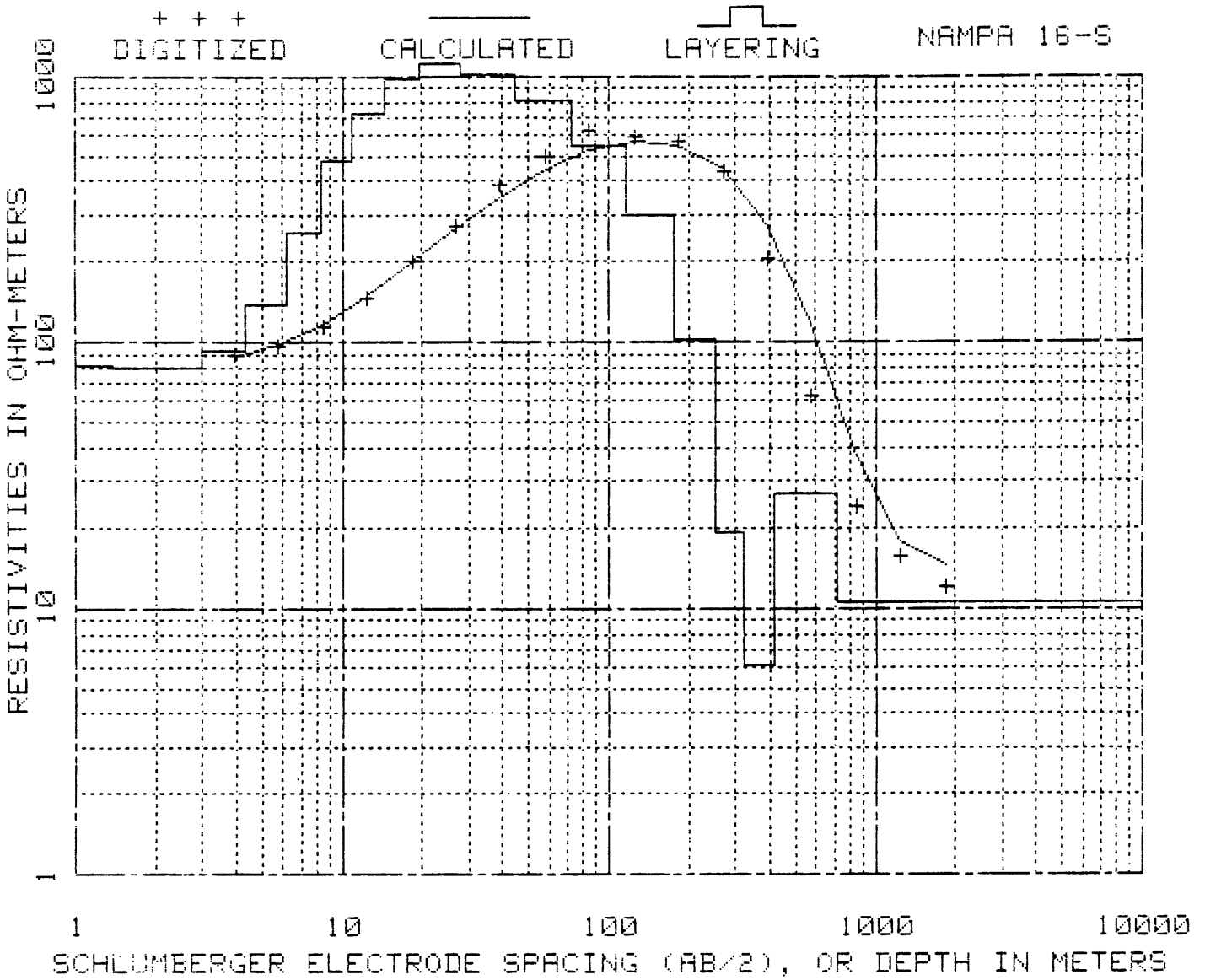
AB/2 IN METERS	OBSERVED RESISTIVITY IN OHM-METERS	AB/2 IN METERS	OBSERVED RESISTIVITY IN OHM-METERS
3.05	47.00	91.44	260.00
4.27	44.00	121.92	287.00
6.10	43.00	182.88	355.00
9.14	46.00	243.84	300.00
9.14	48.00	304.80	210.00
12.19	56.00	304.80	210.00
18.29	81.00	426.72	90.00
24.38	104.00	609.60	37.00
30.48	129.00	914.40	15.00
30.48	129.00	1219.20	15.50
42.67	162.00	914.40	13.00
60.96	210.00	1219.20	12.80
91.44	265.00	1828.80	9.00
		2438.40	13.80



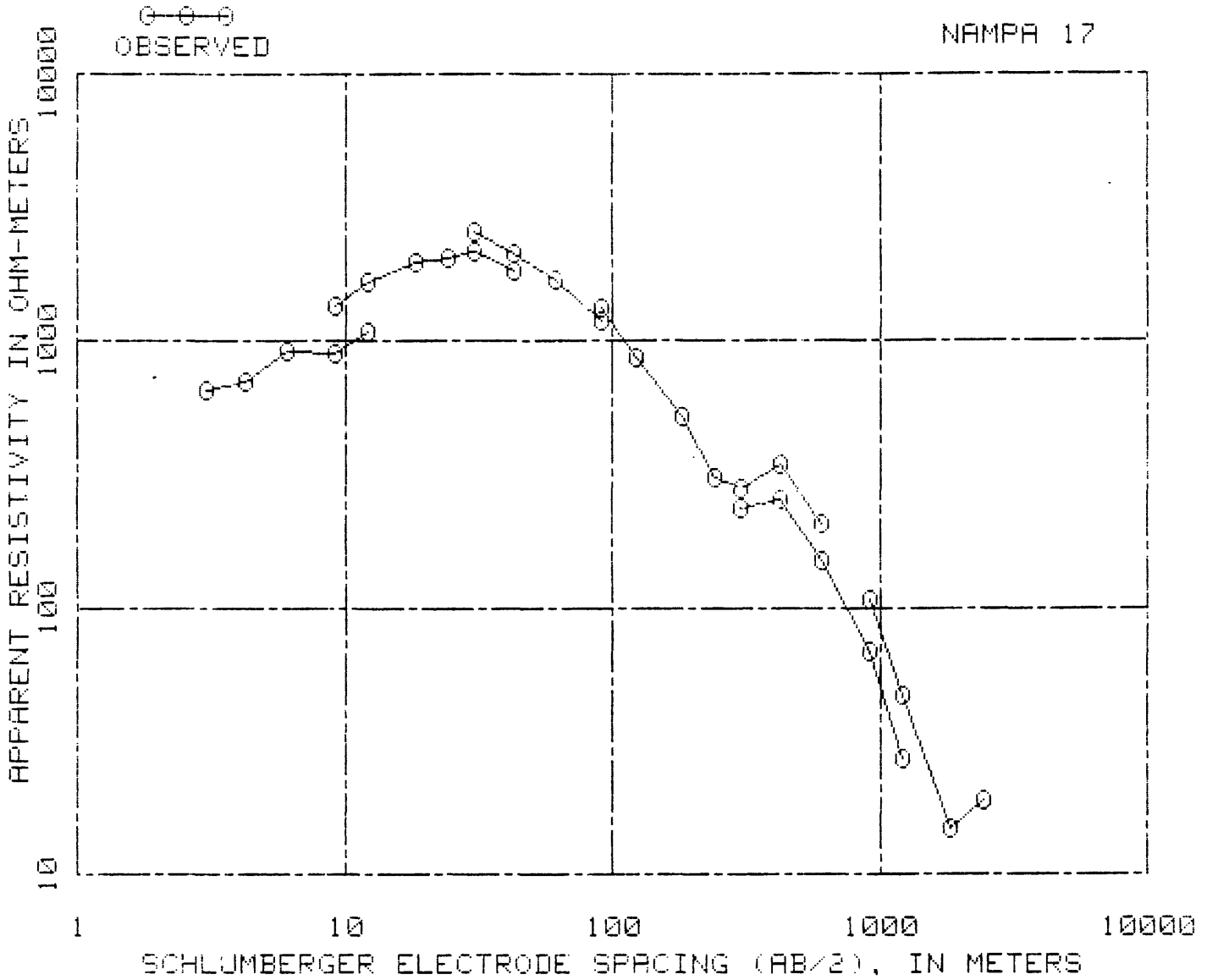
DEPTH IN METERS	RESISTIVITY IN OHM-METERS	DEPTH IN METERS	RESISTIVITY IN OHM-METERS
.21	38.52	14.57	289.71
.30	38.49	20.57	316.90
.44	38.05	30.66	350.98
.65	37.62	47.23	380.25
.96	38.15	74.54	372.63
1.41	39.88	119.15	281.25
2.06	39.75	182.30	134.29
3.03	34.80	257.39	37.93
4.44	32.03	331.07	6.12
6.49	43.74	462.20	2.90
8.87	90.71	765.82	8.42
11.16	211.24	1000764.82	20.76



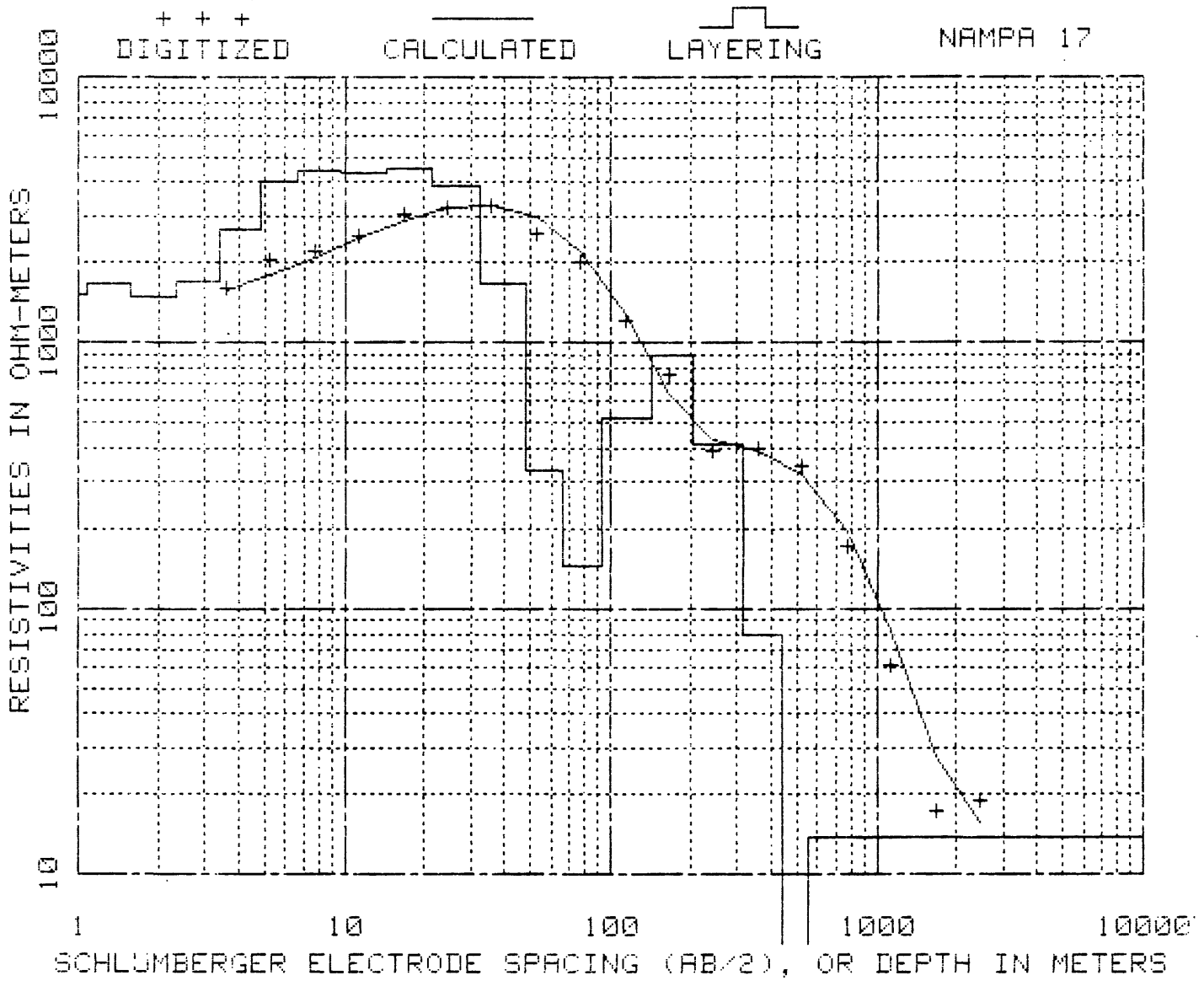
AB/2 IN METERS	OBSERVED RESISTIVITY IN OHM-METERS	AB/2 IN METERS	OBSERVED RESISTIVITY IN OHM-METERS
3.05	70.00	91.44	510.00
4.27	72.00	121.92	480.00
6.10	78.00	182.88	460.00
9.14	96.00	243.84	395.00
12.19	115.00	304.80	285.00
18.29	160.00	304.80	295.00
24.38	200.00	426.72	140.00
30.48	240.00	609.60	45.00
42.67	330.00	914.40	18.00
30.48	255.00	914.40	21.50
42.67	350.00	1219.20	16.00
60.96	430.00	1828.80	12.00
91.44	532.00	2438.40	21.00



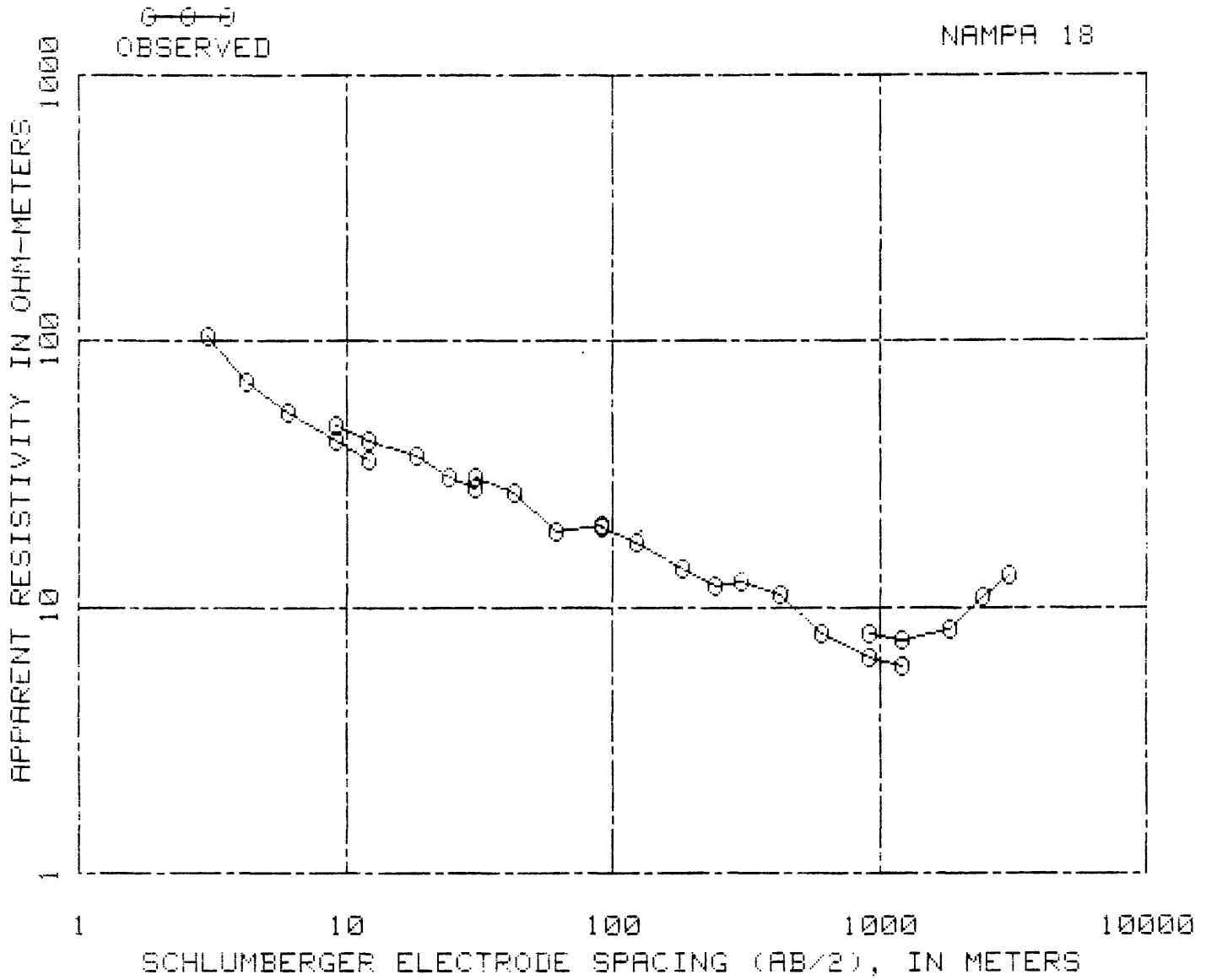
DEPTH IN METERS	RESISTIVITY IN OHM-METERS	DEPTH IN METERS	RESISTIVITY IN OHM-METERS
.30	81.62	14.31	727.28
.43	81.63	19.46	972.20
.64	81.78	28.10	1122.60
.93	82.01	44.36	1021.39
1.37	81.78	72.94	805.59
2.01	80.51	116.51	548.55
2.95	80.78	177.06	296.89
4.33	93.15	250.63	103.00
6.20	138.63	320.45	19.06
8.40	256.99	418.48	6.08
10.90	482.38	715.65	27.00
		1000714.65	10.56



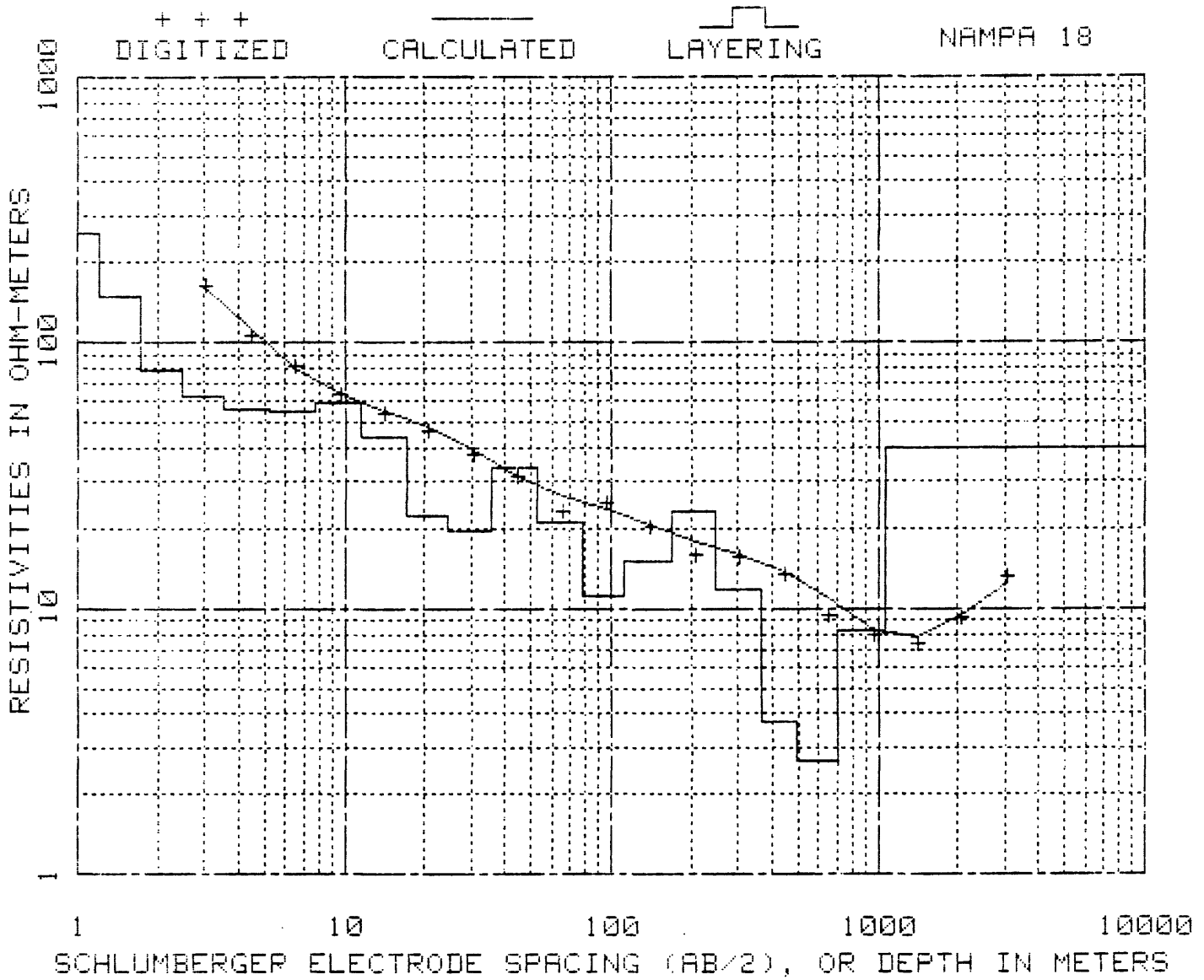
AB/2 IN METERS	OBSERVED RESISTIVITY IN OHM-METERS	AB/2 IN METERS	OBSERVED RESISTIVITY IN OHM-METERS
3.05	658.00	91.44	1320.00
4.27	697.00	121.92	860.00
6.10	915.00	182.88	525.00
9.14	900.00	243.84	310.00
12.19	1080.00	304.80	280.00
9.14	1360.00	426.72	345.00
12.19	1670.00	609.60	207.00
18.29	1960.00	304.80	235.00
24.38	2040.00	426.72	255.00
30.48	2180.00	609.60	150.00
42.67	1850.00	914.40	68.00
30.48	2560.00	1219.20	27.00
42.67	2120.00	914.40	108.00
60.96	1700.00	1219.20	47.00
91.44	1200.00	1828.80	15.00
		2438.40	19.00



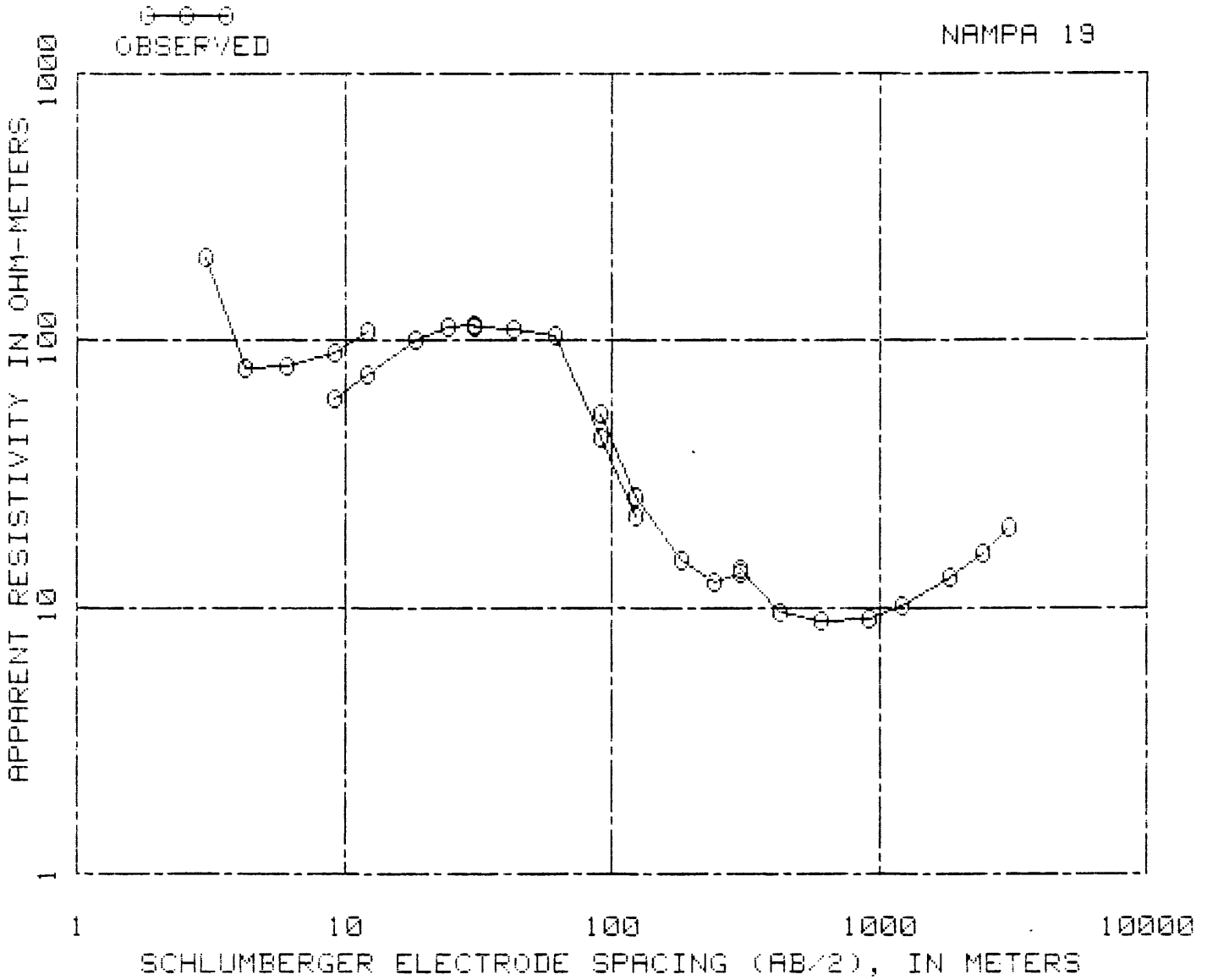
DEPTH IN METERS	RESISTIVITY IN OHM-METERS	DEPTH IN METERS	RESISTIVITY IN OHM-METERS
.16	1218.36	14.38	4385.94
.23	1282.90	21.48	4539.39
.34	1207.42	32.36	3897.46
.50	1117.49	47.73	1670.78
.74	1191.12	65.74	331.32
1.08	1508.99	93.13	144.56
1.57	1661.90	142.89	516.15
2.31	1500.79	205.52	905.00
3.39	1699.26	314.01	412.06
4.83	2669.98	444.20	79.00
6.71	4020.43	552.37	4.95
9.68	4407.53	1000551.37	13.82



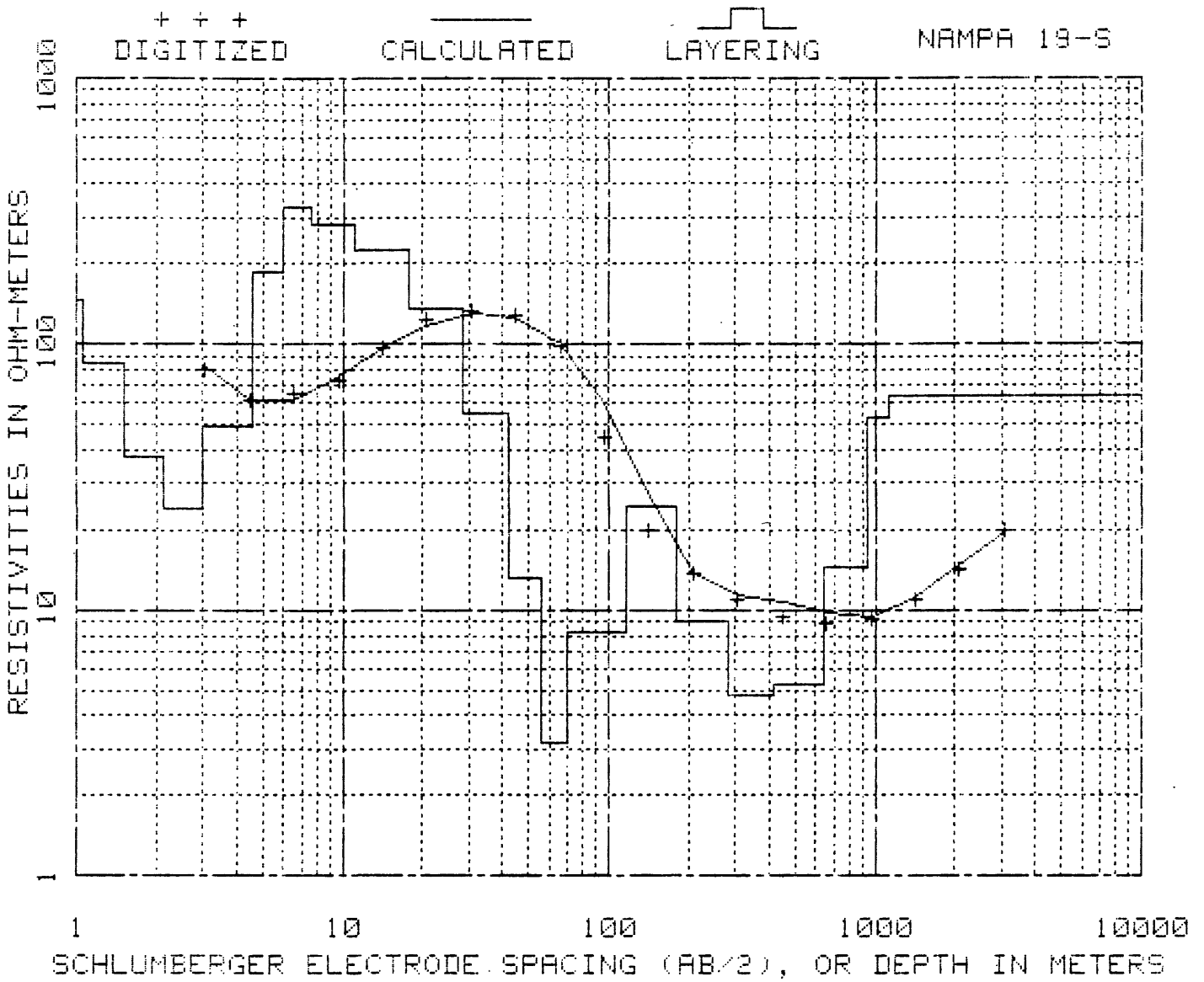
AB/2 IN METERS	OBSERVED RESISTIVITY IN OHM-METERS	AB/2 IN METERS	OBSERVED RESISTIVITY IN OHM-METERS
3.05	104.00	91.44	20.00
4.27	70.00	121.92	17.50
6.10	54.00	182.88	14.00
9.14	42.00	243.84	12.00
12.19	36.00	304.80	12.50
9.14	48.00	304.80	12.50
12.19	42.00	426.72	11.20
18.29	37.00	609.60	8.00
24.38	31.00	914.40	6.50
30.48	28.00	1219.20	6.00
30.48	31.00	914.40	8.00
42.67	27.00	1219.20	7.50
60.96	19.30	1828.80	8.20
91.44	20.50	2438.40	11.00
		3048.00	13.30



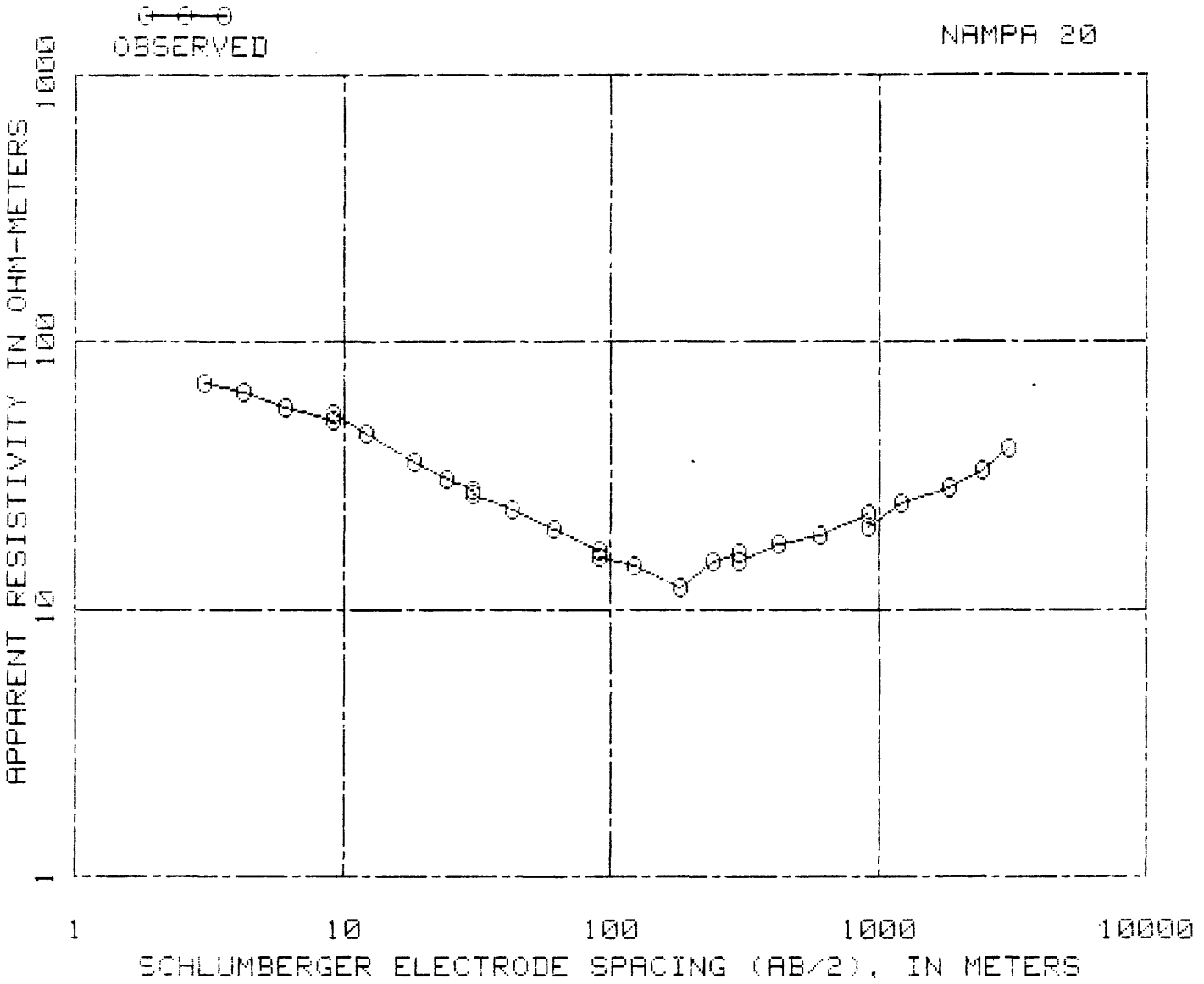
DEPTH IN METERS	RESISTIVITY IN OHM-METERS	DEPTH IN METERS	RESISTIVITY IN OHM-METERS
.18	270.37	16.97	44.13
.26	264.70	24.22	22.35
.38	262.79	35.43	19.72
.56	274.19	53.13	33.73
.82	293.79	78.51	21.30
1.20	256.82	112.53	11.09
1.73	149.15	167.96	15.12
2.45	79.15	248.58	23.27
3.54	63.27	364.94	11.75
5.20	56.60	497.93	3.71
7.73	54.64	709.43	2.70
11.52	59.42	1077.20	8.29
		1001076.20	39.86



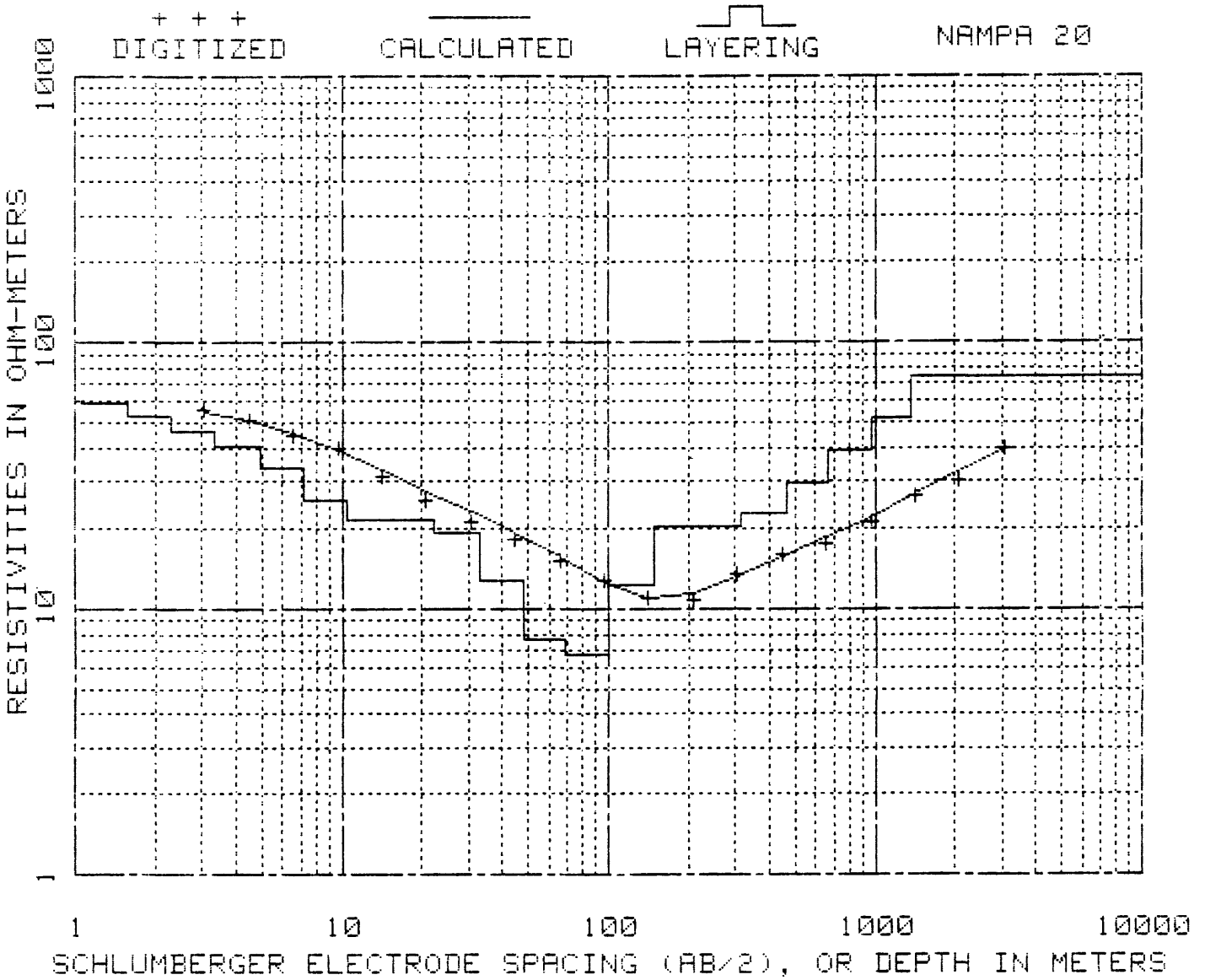
AB/2 IN METERS	OBSERVED RESISTIVITY IN OHM-METERS	AB/2 IN METERS	OBSERVED RESISTIVITY IN OHM-METERS
3.05	205.00	121.92	22.00
4.27	79.00	91.44	53.50
6.10	80.00	121.92	26.00
9.14	90.00	182.88	15.00
12.19	108.00	243.84	12.50
9.14	61.00	304.80	13.50
12.19	74.00	304.80	14.00
18.29	100.00	426.72	9.50
24.38	112.00	609.60	8.90
30.48	115.00	914.40	9.10
30.48	113.00	914.40	9.10
42.67	110.00	1219.20	10.10
60.96	105.00	1828.80	13.00
91.44	43.00	2438.40	16.00
		3048.00	20.00



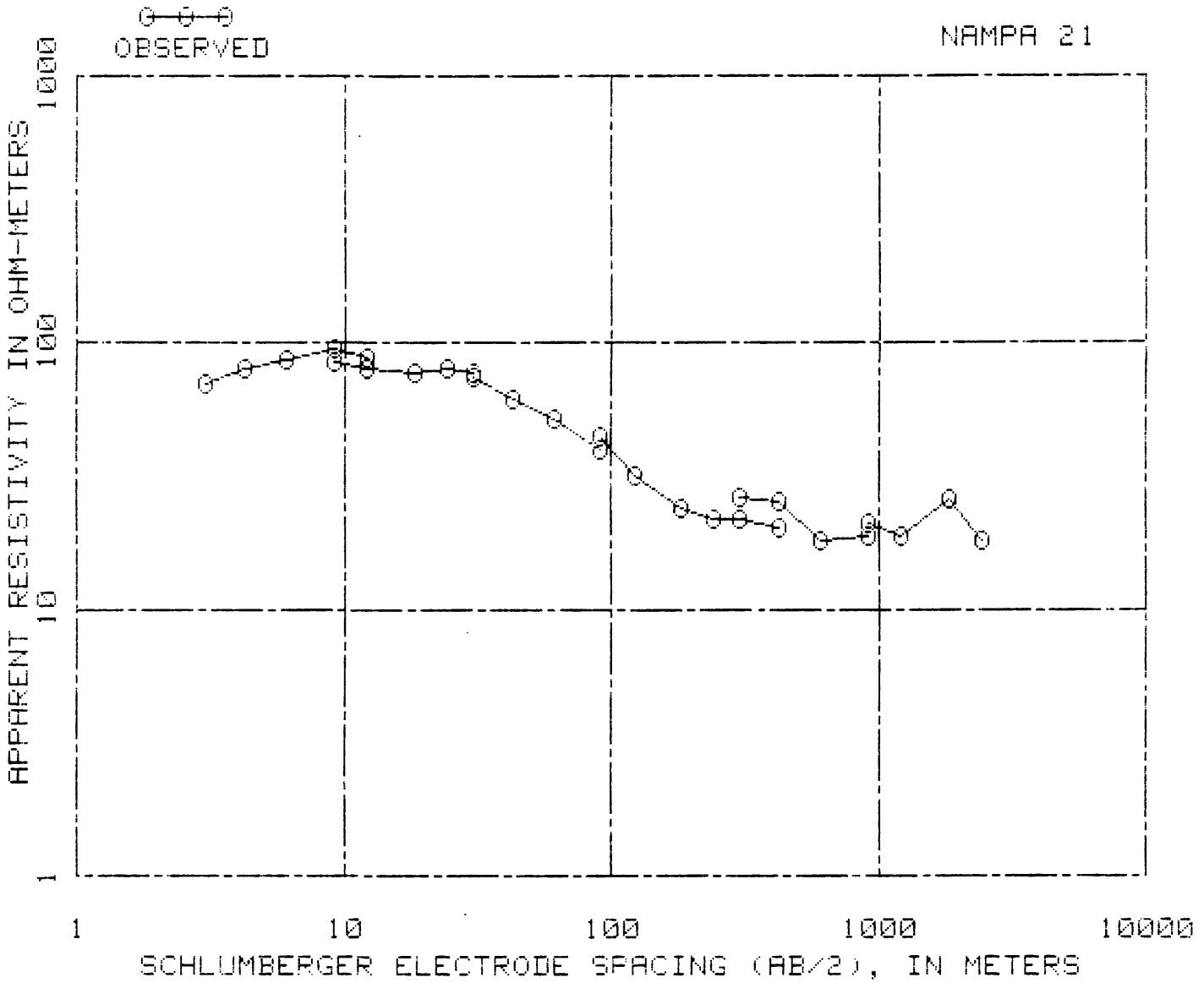
DEPTH IN METERS	RESISTIVITY IN OHM-METERS	DEPTH IN METERS	RESISTIVITY IN OHM-METERS
.23	175.22	17.60	224.31
.34	178.80	28.26	135.76
.49	182.29	42.07	55.16
.72	178.33	55.71	13.25
1.06	146.12	69.80	3.18
1.53	85.55	115.64	8.29
2.12	37.81	180.36	24.58
2.99	24.12	282.51	9.11
4.56	49.40	419.18	4.78
5.93	185.90	640.09	5.27
7.56	327.97	932.63	14.56
11.01	283.54	1132.60	52.76
		1001131.60	64.39



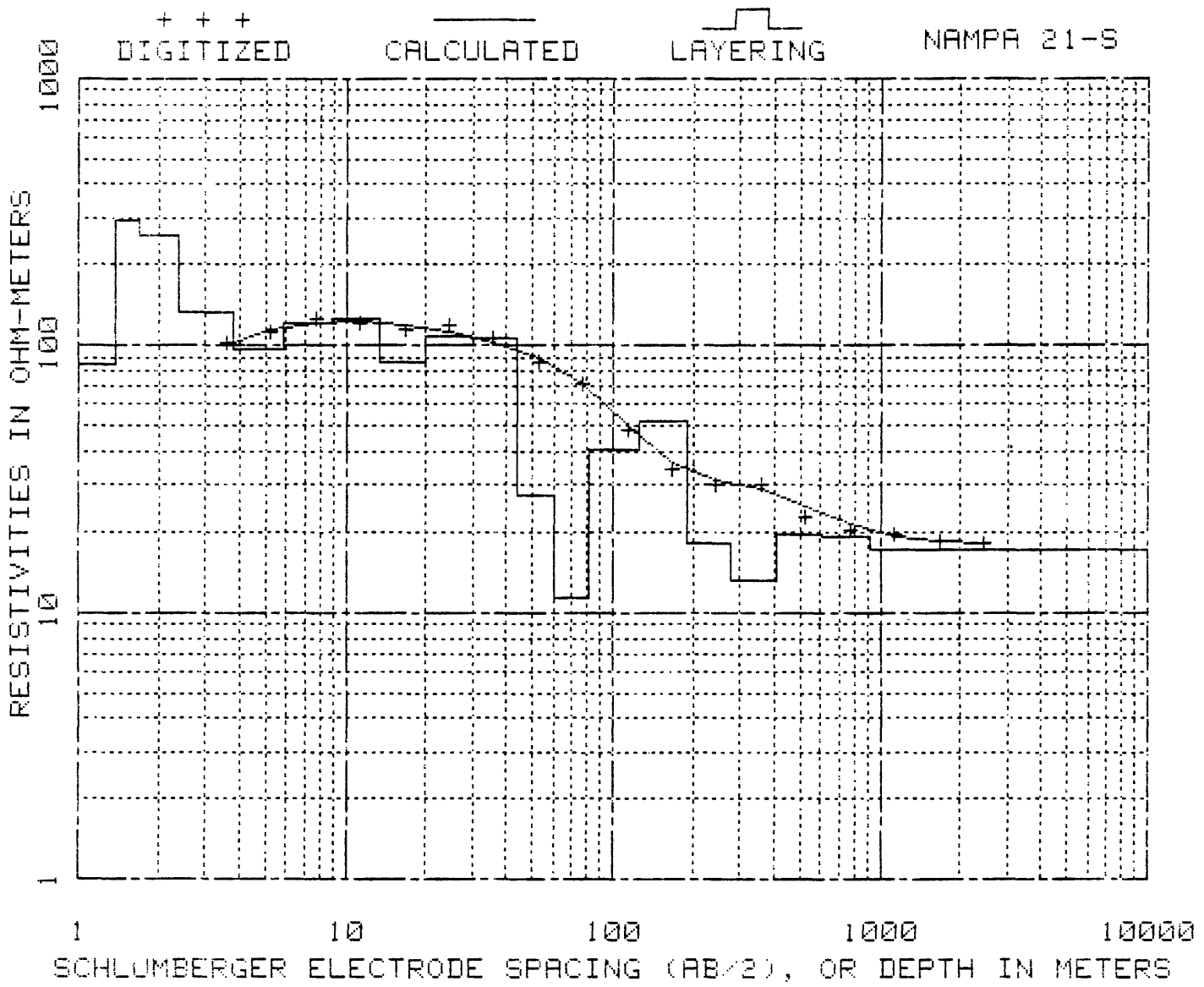
AB/2 IN METERS	OBSERVED RESISTIVITY IN OHM-METERS	AB/2 IN METERS	OBSERVED RESISTIVITY IN OHM-METERS
3.05	70.00	91.44	15.60
4.27	65.00	121.92	14.60
6.10	57.00	182.88	12.00
9.14	51.00	243.84	15.00
9.14	54.00	304.80	16.30
12.19	45.50	304.80	15.00
18.29	36.00	426.72	17.50
24.38	31.00	609.60	19.00
30.48	28.00	914.40	22.80
30.48	27.00	914.40	20.50
42.67	23.50	1219.20	24.80
60.96	20.00	1828.80	28.50
91.44	16.50	2438.40	33.00
		3048.00	40.00



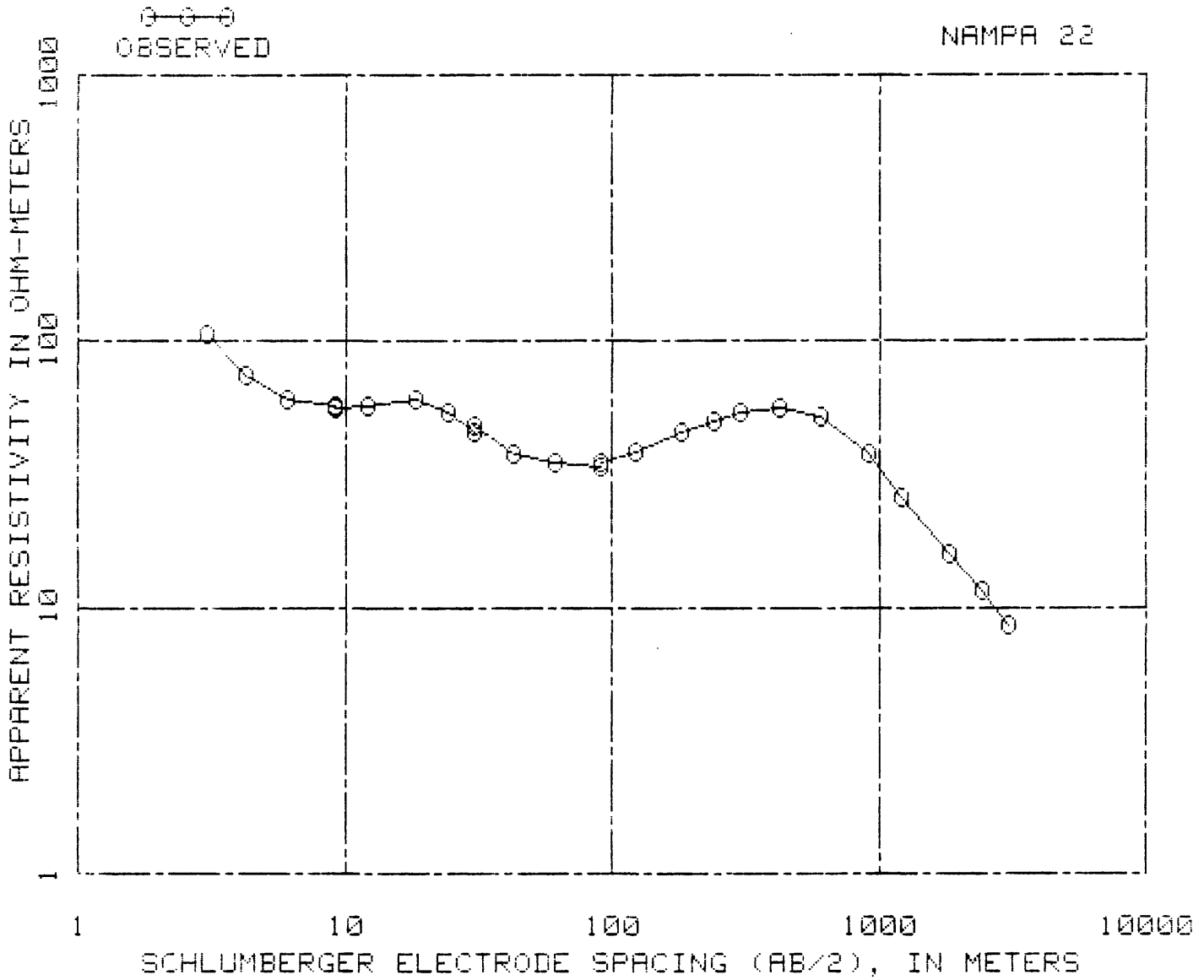
DEPTH IN METERS	RESISTIVITY IN OHM-METERS	DEPTH IN METERS	RESISTIVITY IN OHM-METERS
.23	60.63	22.37	21.57
.34	60.65	32.89	19.05
.49	60.77	47.74	12.70
.72	61.02	68.29	7.60
1.06	60.90	99.83	6.68
1.56	58.83	149.15	12.19
2.28	53.29	213.77	20.15
3.35	46.29	314.16	20.42
4.90	40.64	462.89	22.56
7.16	33.98	671.02	29.66
10.42	25.67	963.11	39.13
15.20	21.55	1374.49	51.97
		1001373.49	74.46



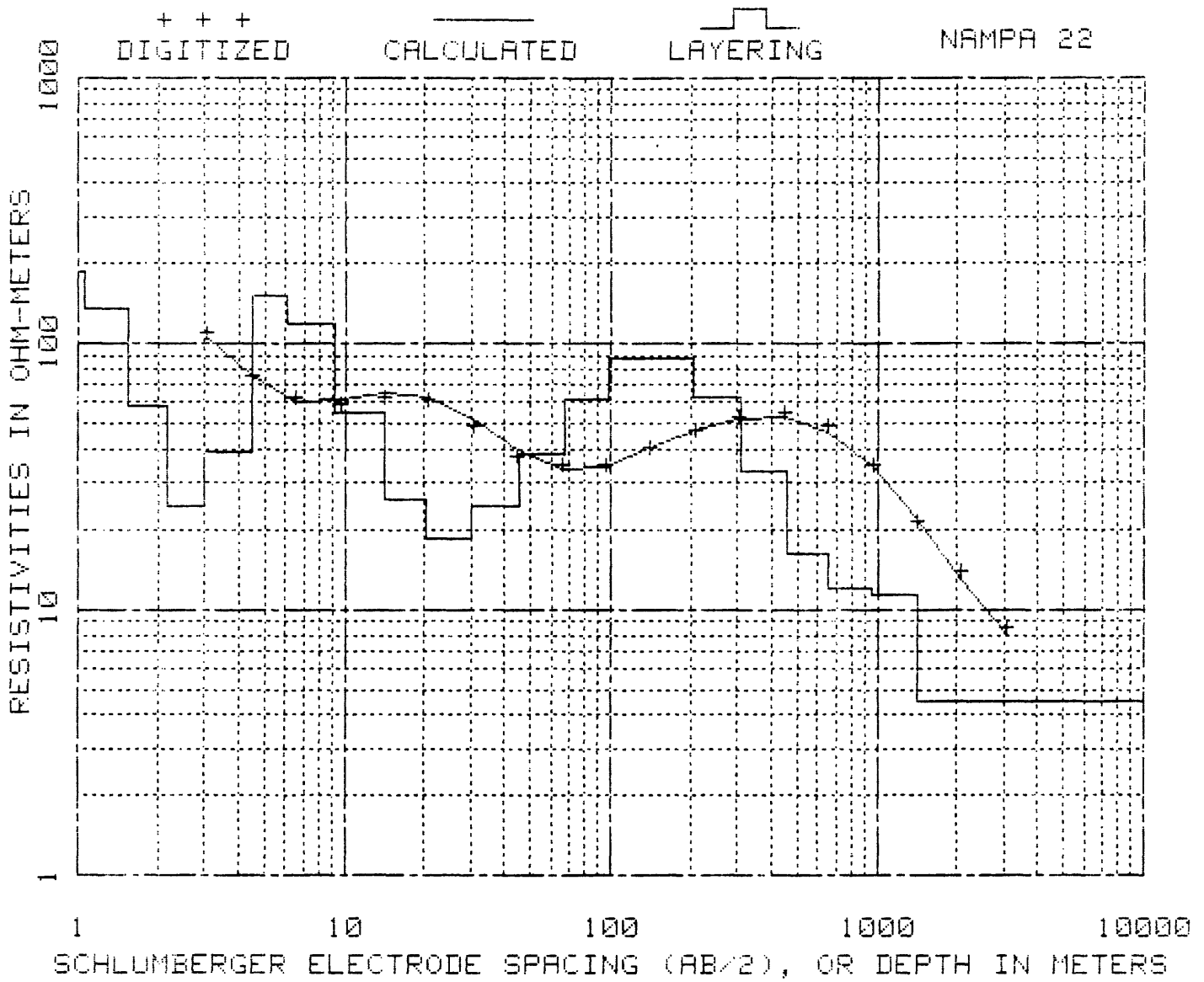
AB/2 IN METERS	OBSERVED RESISTIVITY IN OHM-METERS	AB/2 IN METERS	OBSERVED RESISTIVITY IN OHM-METERS
3.05	70.00	91.44	45.00
4.27	80.00	121.92	32.00
6.10	87.00	182.88	24.00
9.14	95.00	243.84	22.00
12.19	88.00	304.80	21.80
9.14	85.00	426.72	20.50
12.19	80.00	304.80	26.50
18.29	77.00	426.72	25.50
24.38	80.00	609.60	18.00
30.48	77.00	914.40	19.00
30.48	74.00	914.40	21.00
42.67	62.00	1219.20	19.00
60.96	52.00	1828.80	26.00
91.44	40.00	2438.40	18.00



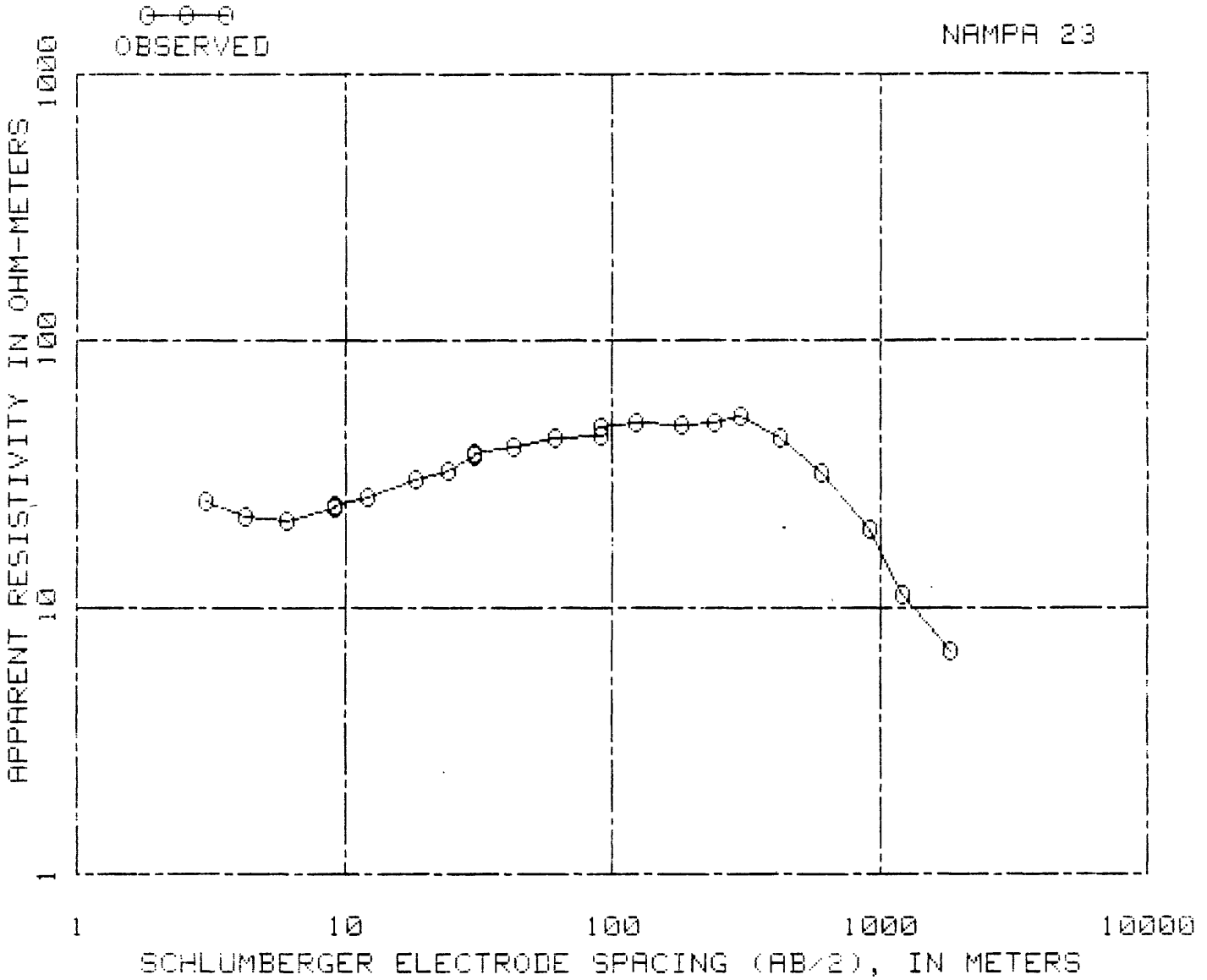
DEPTH IN METERS	RESISTIVITY IN OHM-METERS	DEPTH IN METERS	RESISTIVITY IN OHM-METERS
.21	59.68	19.86	86.41
.30	61.83	29.52	107.36
.44	63.87	43.70	105.58
.65	56.27	60.08	27.54
.96	51.43	80.88	11.36
1.38	85.49	125.21	40.44
1.71	290.87	187.79	52.52
2.38	257.04	276.42	18.08
3.79	132.63	405.68	13.18
5.86	96.21	612.99	19.40
8.91	122.18	917.70	19.06
13.38	127.04	1000916.70	17.31



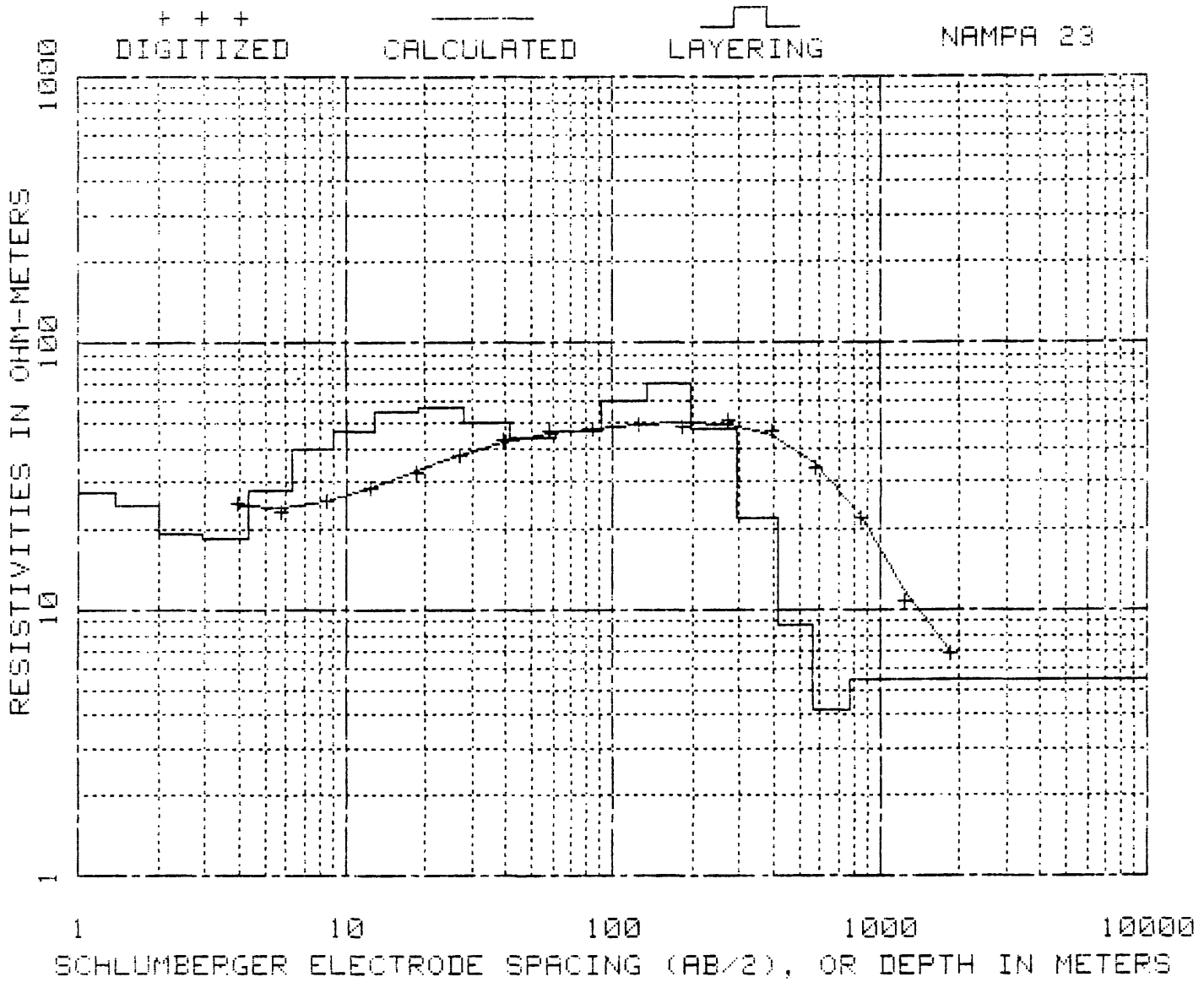
AB/2 IN METERS	OBSERVED RESISTIVITY IN OHM-METERS	AB/2 IN METERS	OBSERVED RESISTIVITY IN OHM-METERS
3.05	106.00	91.44	35.00
4.27	75.00	121.92	38.60
6.10	61.00	182.88	46.00
9.14	57.00	243.84	50.00
9.14	56.00	304.80	54.00
12.19	57.00	304.80	54.00
18.29	60.00	426.72	55.60
24.38	54.00	609.60	52.00
30.48	46.00	914.40	38.00
30.48	48.00	914.40	37.50
42.67	38.00	1219.20	26.00
60.96	35.00	1828.80	16.00
91.44	33.90	2438.40	11.50
		3048.00	8.50



DEPTH IN METERS	RESISTIVITY IN OHM-METERS	DEPTH IN METERS	RESISTIVITY IN OHM-METERS
.23	181.71	20.38	25.83
.34	180.31	29.76	18.37
.49	181.71	45.19	24.46
.72	187.96	67.85	38.40
1.06	186.31	97.46	61.85
1.55	134.79	137.79	87.51
2.18	57.86	203.09	87.96
2.97	24.31	309.87	62.97
4.49	39.22	459.09	32.89
6.11	151.19	654.93	16.10
9.20	119.61	951.93	12.10
14.05	55.22	1416.99	11.31
		1001415.99	4.52



AB/2 IN METERS	OBSERVED RESISTIVITY IN OHM-METERS	AB/2 IN METERS	OBSERVED RESISTIVITY IN OHM-METERS
3.05	25.00	91.44	44.00
4.27	22.00	91.44	47.50
6.10	21.00	121.92	49.00
9.14	23.70	182.88	48.00
9.14	24.00	243.84	49.00
12.19	26.00	304.80	52.00
18.29	30.00	304.80	52.00
24.38	32.50	426.72	43.30
30.48	37.00	609.60	32.00
30.48	37.50	914.40	19.50
42.67	40.00	1219.20	11.20
60.96	43.50	1828.80	6.80



DEPTH IN METERS	RESISTIVITY IN OHM-METERS	DEPTH IN METERS	RESISTIVITY IN OHM-METERS
.30	27.44	18.86	54.54
.43	27.42	27.77	56.94
.64	27.60	41.47	50.56
.93	27.95	61.76	44.16
1.37	27.57	91.53	46.27
2.01	24.32	134.01	60.66
2.94	19.23	195.49	70.88
4.31	18.65	289.23	47.33
6.30	27.86	413.78	21.81
9.02	39.89	566.29	8.68
13.00	46.75	775.56	4.19
		1000774.56	5.50