UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

More Time-Domain Electromagnetic Soundings of Newberry Volcano, Deschutes County, Oregon

by

David V. Fitterman, Deborah K. Neev, Jerry A. Bradley, and Clark T. Grose

Open-File Report 85-451

29 July 1985

Introduction

This report describes the results of a time-domain electromagnetic (TDEM) survey of Newberry Volcano, Deschutes County, Oregon, which was performed during July 1984 to determine the geoelectrical structure of the volcano. Twenty-three TDEM soundings were made using a central induction loop configuration. This was our second field season at Newberry Volcano. During the previous field season 18 soundings were made (Fitterman, 1983). Figure 1 shows the locations of the 1983 and 1984 soundings.

This research project was funded by the Department of Energy in conjunction with the USGS Geothermal Program.

Field Procedure and Equipment

TDEM measurements were made using a SIROTEM II system (Buselli and O'Neill, 1977). The SIROTEM system injects a bipolar, square-wave current into a transmitter loop. When the current is turned off, the voltage induced in a receiving coil located at the center of the transmitter loop is recorded. The SIROTEM system records and stacks the transients from a large number of current turn-offs, and reports the averaged voltage-current ratios.

Square transmitter loops 305 m on a side were used. The receiver coil was an eight turn 38 m x 38 m loop (receiver coil moment M_r = 11,613 turn-m^2) situated at the center of the transmitter loop. Four to six runs, consisting of 2,048 transients per run, were made at each site. The polarity of the receiver coil was reversed on alternate runs to reduce instrumental noise.

At all 1984 locations except NB-41, an external transmitter built by the USGS was used to increase transmitter current to about 20 amperes. The higher current made it possible to obtain useful signals at later times, thereby collecting information from greater depths. At NB-41 a single loop (L=305 m) was used for the transmitter and receiver with the lower power internal SIROTEM transmitter.

At most locations VLF resistivity data were collected at 25 m intervals along one leg of the transmitter loop using a Geonics EM16R. This information was used to determine near surface resistivities for use in inversion of the TDEM sounding. The geometric mean of thirteen measurements from each site are given in Table 1.

Data Preparation

The recorded voltage-current ratios were converted to late stage apparent resistivity (Kaufmann and Keller, 1983, p. 457) using the formula

$$\rho = \frac{\mu_o}{4\pi t}\left(\frac{2\mu_o L^2 M_r}{5t\ V/I}\right)^{2/3}$$

where μ_o is the free space permeability, L is the length of a side of the transmitter loop, M_r is the receiver loop moment, t is time since current shutoff, and V/I is the voltage-current ratio (all in SI units). Data from

Table 1. VLF apparent resistivities from transient sounding sites. The data were obtained using the 24.8 kHz VLF station at Jim Creek, WA. The results are the geometric mean of 13 data points spaced along a 300 m long line.

Station	Apparent Resistivity (ohm-m)
NB-19	1700
NB-20	1500
NB-21	1200
NB-22	2800
NB-25	1400
NB-26	2200
NB-27	1400
NB-28	1200
NB-29	560
NB-30	930
NB-31	1000
NB-32	880
NB-33	2600
NB-34	780
NB-35	1200
NB-36	1700
NB-37	2600
NB-38	900
NB-39	1600
NB-40	4700
NB-41	1600

several runs were averaged and converted to apparent resistivity. Data from the first two SIROTEM channels were not used because they appeared to be noisy. Late-time data were rejected when the data appeared to be noisy and the apparent resistivity curves no longer behaved smoothly. Data obtained using the external transmitter were combined with data from the internal transmitter to obtain longer data records with less noise.

Inversion of Soundings

Initial models for the data were obtained by curve matching using a catalog of two-layer models (Kaufmann and Keller, 1983). These models served as starting points for a non-linear least squares inversion by computer (Anderson, 1982). Best-fit two and three layer models were found for each sounding. If the three layer model did not provide a significantly better fit than the two-layer model, then the three-layer model was rejected. Initial estimates of first layer resistivity were made using the VLF apparent resistivities. The first layer thickness was taken as the VLF skin depth. The first layer parameters were usually held fixed. If an acceptable fit was not obtained with these values, the first layer parameters were allowed to vary.

Results

Results of the inversions are presented in Figures 2 through 24. Figures 2a through 24a contain the output from the inversion program. This consists of the name of the inversion program used, the sounding title, and the effective transmitter loop radius ($A=\pi^{-1/2}L$).

The first table contains the observation time (seconds), the observed apparent resistivity (ohm-m), the estimated standard deviation in the observation, the computed model resistivity, and the percent error in the fit. The estimated standard deviation is based upon the statistics of several runs. Following these data are the RMS error in the fit and the convergence criterion which terminated the inversion. See Dennis et al. (1981) for a discussion of the convergence criteria.

The next table gives the parameter correlation matrix for the unconstrained parameters. This provides a measure of the interdependence of the model parameter estimates. A high correlation between parameters indicates that only their ratio can be determined, while a high inverse correlation between parameters means that only their product can be resolved. Only the lower half of the symmetric correlation matrix is shown. The column integers at the left gives the parameter number. These numbers are seen to the left of the third table and under the "P" heading in the "FINAL INVERSION MODEL" table. As an example, the second entry in the first column of any correlation matrix will be the correlation between the second and first unconstrained model parameters.

The third table gives the unconstrained model parameter estimates, the standard deviation in the parameter estimates, the relative error (the standard deviation divided by the model parameter), and the percentage relative error in the parameter estimates. This information is provided for the unconstrained parameters. The parameter error estimates are based on nonlinear statistics, and as such cannot be taken as actual parameter

uncertainties. It is necessary to do a sensitivity analysis to determine the actual bounds on allowable models.

The last table gives the resistivity, conductivity, thickness, and depth to the top of each layer. The column marked "P" gives the model parameter number. An astericks under the column marked "F" indicates that the model parameter was fixed in the inversion.

Figures 2b through 24b contain the apparent resistivity sounding curve (circles) plotted as a function of $(2\pi t)^{1/2}$. The data error estimates are indicated by vertical bars on the data points. The solid line is the calculated sounding curve based upon the final inversion model.

The final inversion model is shown in Figures 2c through 24c. The interpreted layer resistivities are plotted as a function of depth. Solid lines represent layer resistivities and thicknesses which were allowed to vary during inversion. Dashed lines represent model parameters which were constrained during inversion.

Discussion

The data are similar in nature to the previous survey results (Fitterman, 1983). The geoelectrical section is resistive near the surface, becoming conductive with depth. All soundings described in this report were made outside the caldera rim. The first layer resistivities range from 370 ohm-m to 2800 ohm-m. These values are often not well determined. Some values were constrained based upon the VLF resistivity data. The basement resistivities ranged from 19 ohm-m to 73 ohm-m. A second layer of intermediate resistivity was required for most interpretations.

Figure 25 shows a contour map of depth to the conductive basement based upon all soundings made to date. Depth to the conductive basement ranges from 370 m to 810 m. After the intra-caldera region, the shallowest conductive zones lie to the west of the caldera where depths as shallow as 410 m are seen. This region has been the focus of commercial drilling activity.

Inside the caldera, the conductor is associated with high-temperature fluids as confirmed by drilling. The cause of the conductor outside the caldera is not as clear. The conductor could be due to conductive rocks that predate Newberry such as Tertiary ash flows or sedimentary rocks. Pre-Newberry rocks would be expected at an elevation of below 1280 m (N.S. MacCleod, personal communication, 1985). The elevation of the conductor varies from 640 m to 1580 m, and is lower away from the caldera. Thus, in some regions the pre-Newberry rock hypothesis is supported, whereas in others it is contradicted. The conductor could also be due to the water table. Dry, near surface, Newberry rocks are exceedingly resistive. Saturating these same rocks should significantly reduce their resistivity. The deepening of the conductor away from the volcano is in accord with the idea of ground water flowing downward and outward from the caldera. Increased saturation of Newberry, or possibly pre-Newberry, rocks with depth could account for the conductive layer we have detected. There are no publically available well data in the vicinity of the volcano to unambiguously unravel the cause of the conductor, however, the regional water table elevations are about 1280 m (Black, 1983). We suspect that the conductor is caused by increased saturation with depth, and that in places the conductor may be pre-Newberry rocks.

Acknowledgements

This work was funded by the Department of Energy under Interagency Agreement DE-AI01-79RA50294. Permission to conduct the field work was granted by the Deschutes National Forest, Bend, Oregon.

References

Anderson, W. L., 1982, Nonlinear least-squares inversion of transient soundings for a central induction loop system (Program NLSTCI): U.S. Geological Survey Open-File Report 82-1129, 85 p.

Black, Gerald L., 1983, Newberry hydrology, in Priest, G. R., Voyt, B. F., and Black, G. L., editors, Survey of potential geothermal exploration sites of Newberry Volcano, Deschutes County, Oregon: Oregon Department of Geology and Mineral Industries, Open-File Report 0-83-3, p. 28-44.

Buselli, G., and O'Neill, G., 1977, SIROTEM--a new portable instrument for multichannel electromagnetic measurements: Bull. Aust. Soc. Expl. Geophys., 8, 82-87.

Dennis, J. E., Gay, D. M., and Welsch, R. E., 1981, An adaptive nonlinear least-squares algorithm: ACM Trans. Math. Software, 7, 348-368.

Fitterman, D. V., 1983, Time-domain electromagnetic soundings of Newberry Volcano, Deschutes County, Oregon: U.S. Geological Survey Open-File Report 83-832, 57 p.

Kaufman, A. A., and Keller, G. R., 1983, Frequency and Transient Sounding: Amsterdam, Elsevier, 687 p.

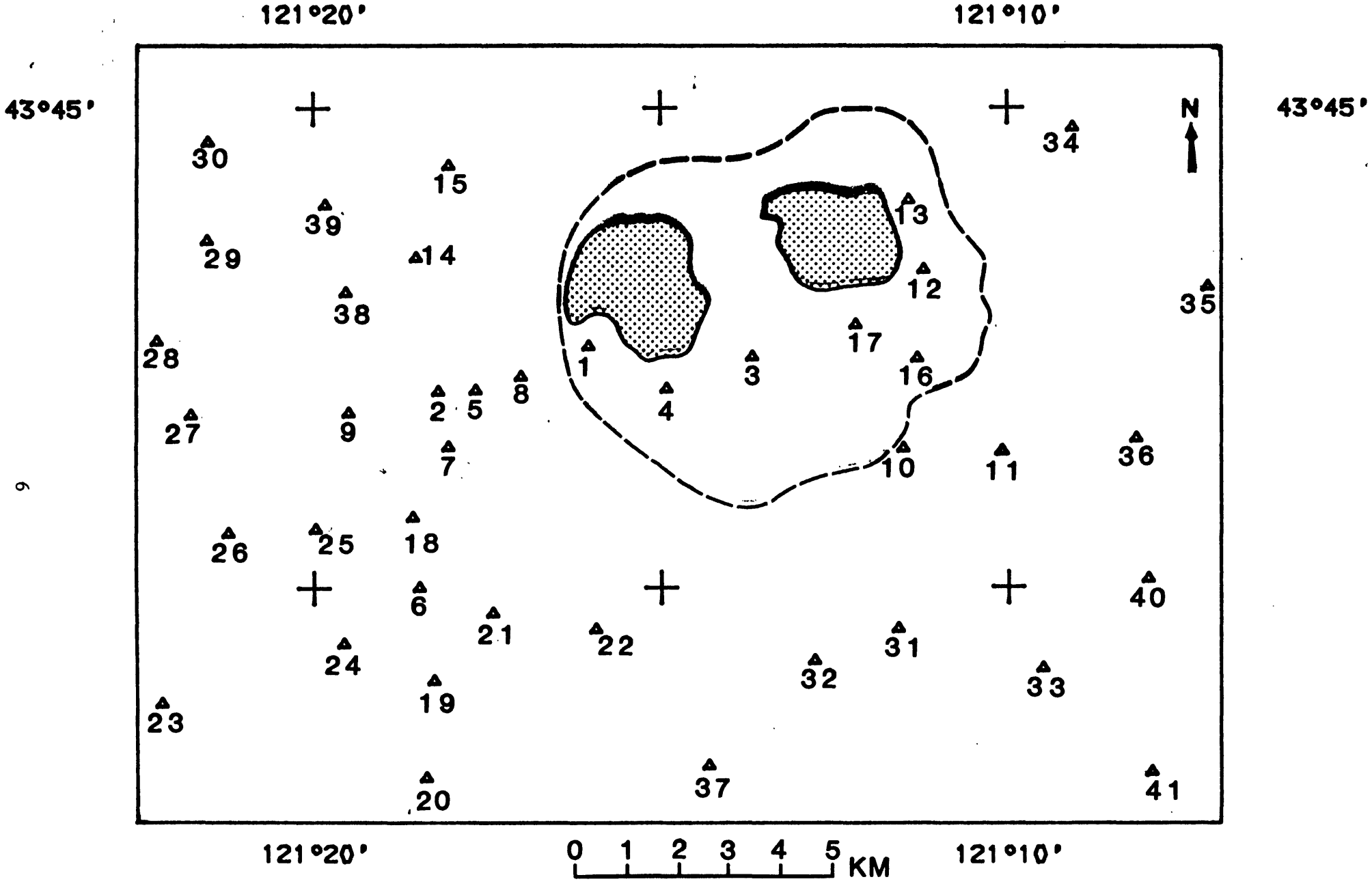

121°20'
121°10'
43°45'
N
30
15
39
29
14
38
28
1
3
17
13
12
35
16
4
2
5
8
27
9
7
10
11
36
26
25
18
6
21
22
31
40
24
32
33
19
23
20
37
41
0 1 2 3 4 5 KM

Figure 1

Figure 2a

<NLSTCI>: Newberry Volcano NBE-19
LOOP RADIUS= 172.0

I	TIME(s)	OBSERVED RESISTIVITY	STANDARD DEVIATION	COMPUTED RESISTIVITY	PERCENT ERROR
1	0.0016000	450.4	6.6	450.3	0.0
2	0.0020000	382.6	9.2	382.3	0.1
3	0.0026000	315.0	7.4	316.9	-0.6
4	0.0034000	265.6	6.3	265.0	0.2
5	0.0042000	232.4	9.0	230.3	0.9
6	0.0050000	209.8	8.9	207.0	1.4
7	0.0058000	191.3	11.3	189.7	0.8
8	0.0070000	168.9	10.8	170.4	-0.9
9	0.0086000	147.3	8.9	152.4	-3.4
10	0.0102000	135.9	5.7	139.8	-2.8
11	0.0118000	127.7	3.9	130.3	-2.0
12	0.0134000	129.5	6.2	123.0	5.3
13	0.0158000	115.9	12.7	114.3	1.4
14	0.0190000	104.1	10.1	105.9	-1.7
15	0.0222000	94.0	17.6	99.6	-5.6
16	0.0254000	95.4	23.7	94.6	0.9
17	0.0286000	93.6	29.1	90.4	3.5
18	0.0334000	80.1	26.1	85.6	-6.5
19	0.0398000	87.7	43.2	80.9	8.4

RMS ERROR= 3.841 X-CONVERGENCE

CORRELATION MATRIX

	2	3	5
2	1.000		
3	-0.208	1.000	
5	0.502	0.418	1.000

	PARAMETER ESTIMATE	STANDARD ERROR	RELATIVE ERROR	PERCENT ERROR
2	0.1966E-02	0.6308E-04	0.3209E-01	3.2
3	0.2299E-01	0.1920E-03	0.8353E-02	0.8
5	0.4657E+03	0.1465E-02	0.3145E-05	0.0

FINAL INVERSION MODEL

LAYER	RESISTIVITY	P	F	CONDUCTIVITY	P	F	THICKNESS	DEPTH
1	1652.9	1	*	0.60500001E-03	4	*	130.0	0.0
2	508.7	2		0.19659291E-02	5		465.7	130.0
3	43.5	3		0.22991039E-01				595.7

P - parameter number
F - * indicates fixed parameter

Figure 2b

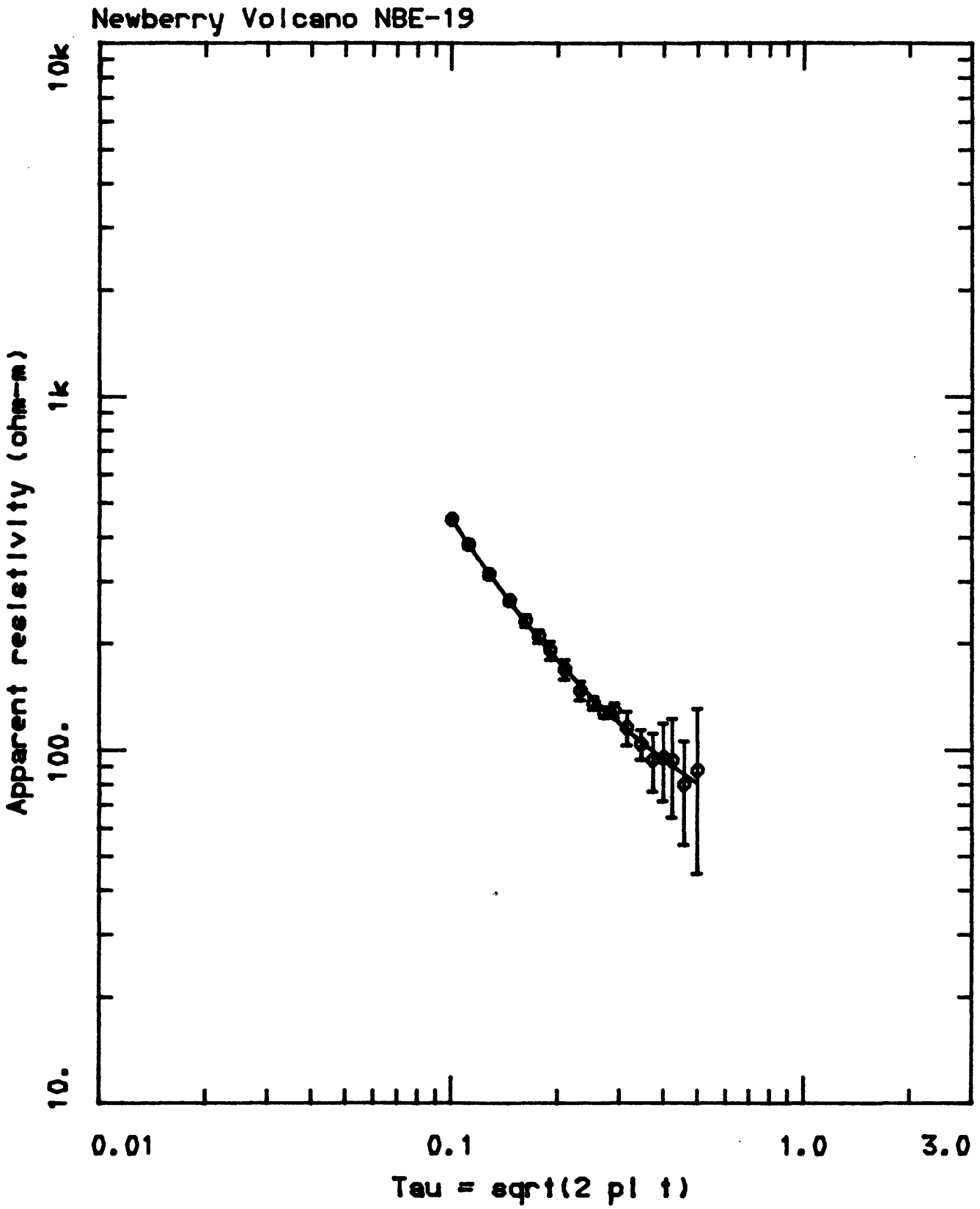

Newberry Volcano NBE-19
Apparent resistivity (ohm-m)
10k
1k
100.
10.
0.01
0.1
1.0
3.0
Tau = sqrt(2 pi t)

Figure 2c

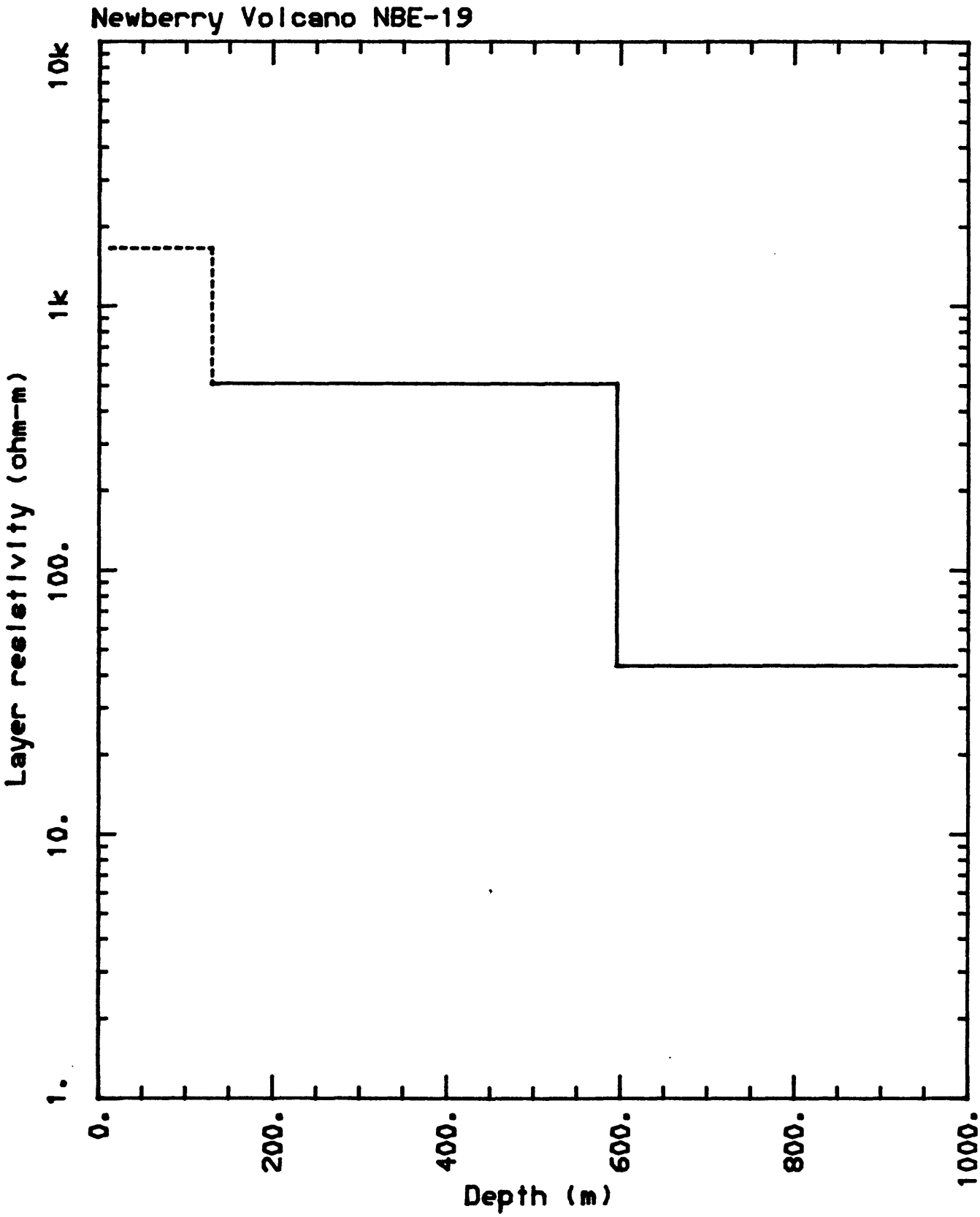

Newberry Volcano NBE-19
Layer resistivity (ohm-m)
10k
1k
100.
10.
1.
0.
200.
400.
600.
800.
1000.
Depth (m)

Figure 3a

```
<NLSTCI>:     Newberry Volcano NBE-20
LOOP RADIUS= 172.0
```

I	TIME(s)	OBSERVED RESISTIVITY	STANDARD DEVIATION	COMPUTED RESISTIVITY	PERCENT ERROR
1	0.0016000	530.7	2.6	501.5	5.8
2	0.0020000	456.5	3.2	456.9	-0.1
3	0.0026000	386.9	1.7	398.4	-2.9
4	0.0034000	329.6	2.1	334.0	-1.3
5	0.0042000	287.9	2.0	285.7	0.8
6	0.0050000	258.6	5.4	251.4	2.9
7	0.0058000	237.3	8.7	226.6	4.7
8	0.0070000	204.8	3.8	198.0	3.4
9	0.0086000	193.3	9.6	171.0	13.0
10	0.0102000	175.4	7.1	152.8	14.8
11	0.0118000	169.5	11.3	139.2	21.8
12	0.0134000	151.3	4.9	128.3	17.9
13	0.0158000	136.0	11.3	116.1	17.1
14	0.0190000	108.7	4.3	104.5	4.0
15	0.0222000	100.0	5.9	95.9	4.3
16	0.0254000	91.9	4.8	89.2	3.0
17	0.0286000	84.9	4.8	84.1	1.0
18	0.0334000	74.4	3.3	78.0	-4.6
19	0.0398000	72.6	5.2	71.9	1.0

RMS ERROR= 17.17 X-CONVERGENCE

CORRELATION MATRIX

	1	2	3	4	5
1	1.000				
2	-0.422	1.000			
3	-0.326	0.450	1.000		
4	-0.264	-0.417	0.030	1.000	
5	-0.301	0.627	0.064	-0.764	1.000

	PARAMETER ESTIMATE	STANDARD ERROR	RELATIVE ERROR	PERCENT ERROR
1	0.1179E-02	0.1011E-03	0.8575E-01	8.6
2	0.2801E-02	0.2381E-03	0.8500E-01	8.5
3	0.3832E-01	0.1289E-02	0.3363E-01	3.4
4	0.1325E+03	0.6219E-02	0.4693E-04	0.0
5	0.6392E+03	0.9625E-02	0.1506E-04	0.0

FINAL INVERSION MODEL

LAYER	RESISTIVITY	P	F	CONDUCTIVITY	P	F	THICKNESS	DEPTH
1	848.2	1		0.11789675E-02	4		132.5	0.0
2	357.0	2		0.28009799E-02	5		639.2	132.5
3	26.1	3		0.38316090E-01				771.8

P - parameter number
F - * indicates fixed parameter

Figure 3b

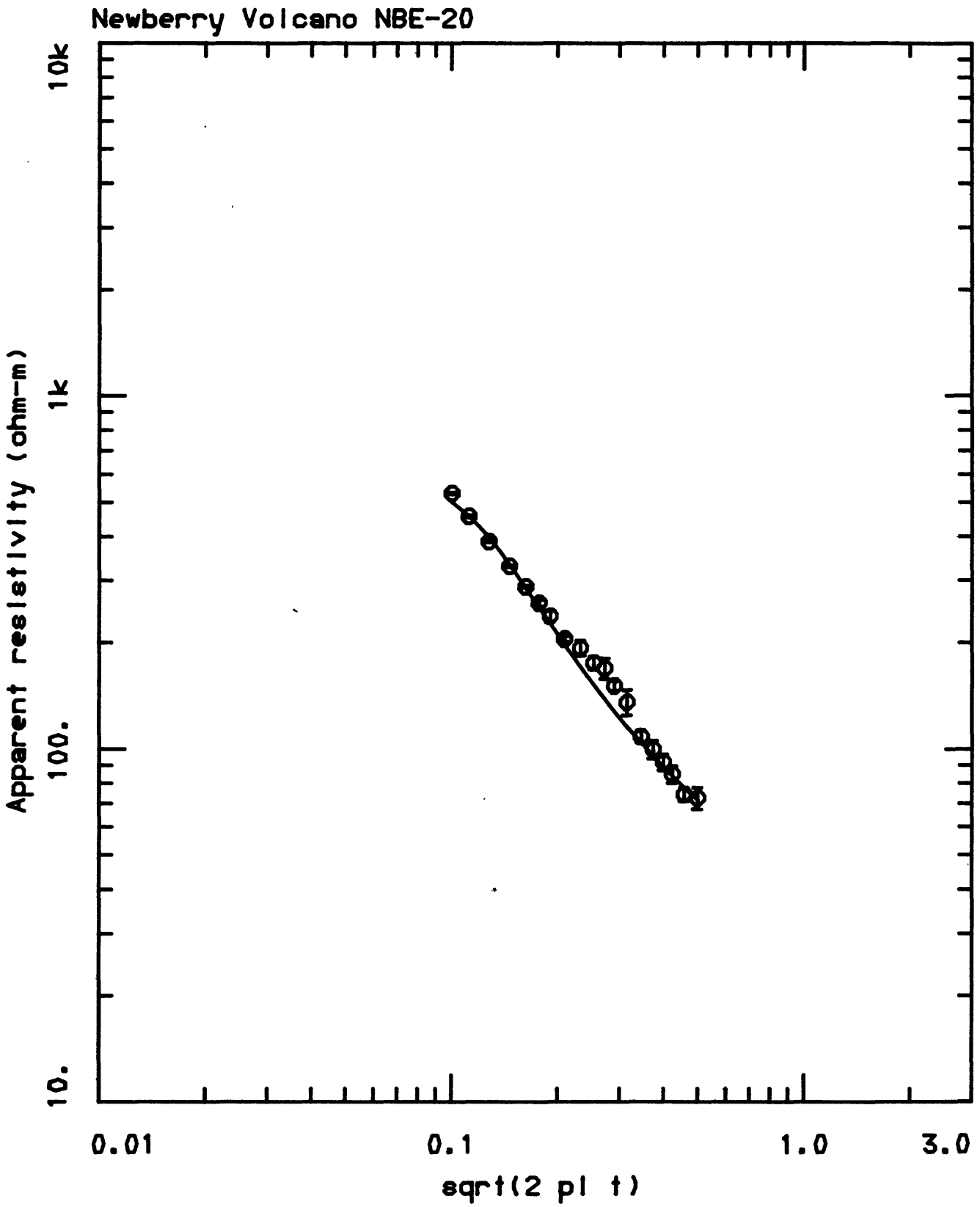

Newberry Volcano NBE-20
Apparent resistivity (ohm-m)
10k
1k
100.
10.
0.01
0.1
1.0
3.0
sqrt(2 pi t)

Figure 3c

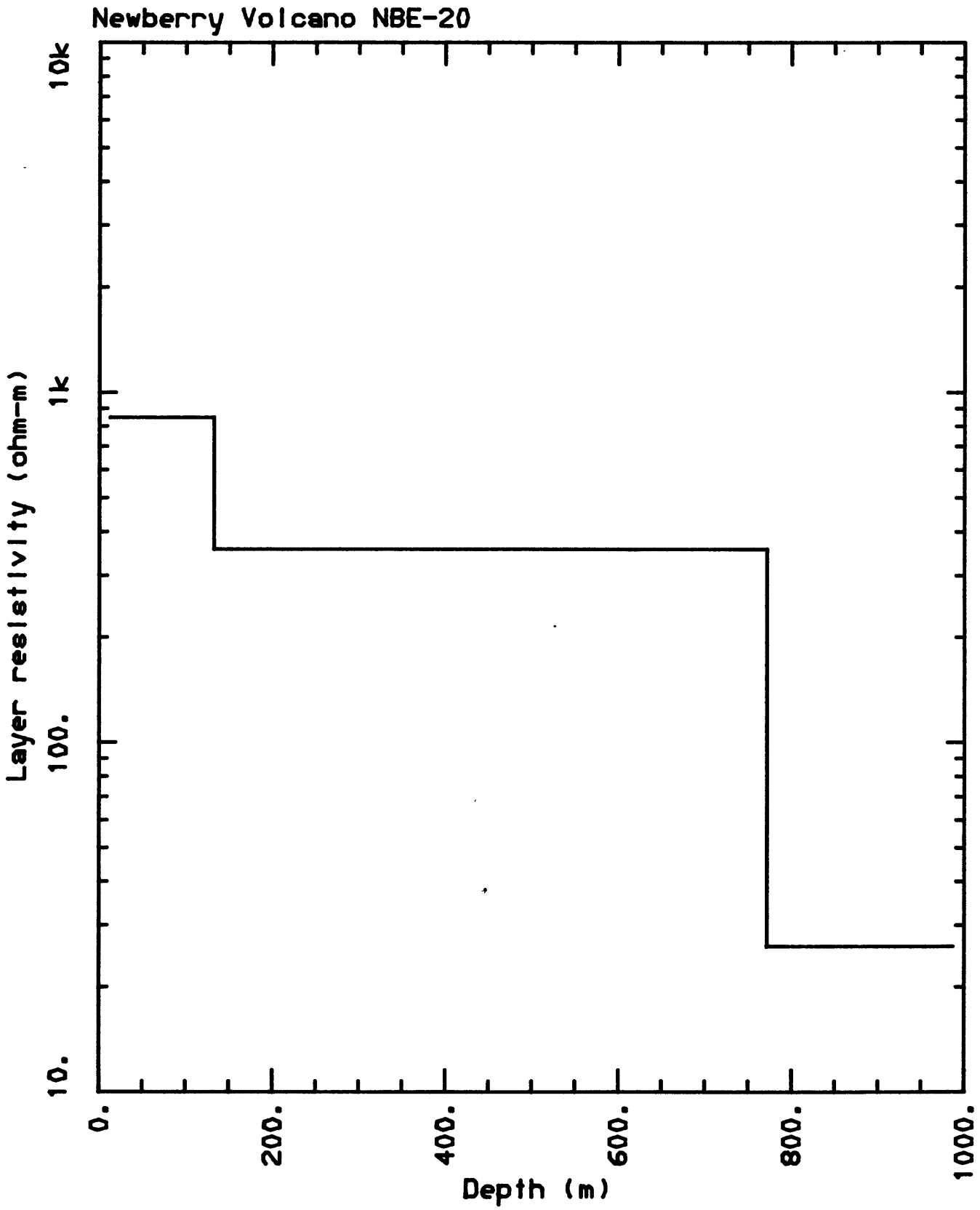

Newberry Volcano NBE-20
Layer resistivity (ohm-m)
10k
1k
100.
10.
0.
200.
400.
600.
800.
1000.
Depth (m)

Figure 4a

<NLSTCI>: Newberry Volcano NBE-21
LOOP RADIUS= 172.0

I	TIME(s)	OBSERVED RESISTIVITY	STANDARD DEVIATION	COMPUTED RESISTIVITY	PERCENT ERROR
1	0.0016000	474.7	1.8	461.7	2.8
2	0.0020000	399.5	3.0	399.6	0.0
3	0.0026000	328.5	1.6	336.3	-2.3
4	0.0034000	274.6	0.7	279.1	-1.6
5	0.0042000	244.2	3.5	240.3	1.6
6	0.0050000	216.6	28.9	213.5	1.5
7	0.0058000	205.0	3.2	193.8	5.8
8	0.0070000	180.2	1.3	171.3	5.2
9	0.0086000	155.2	1.3	150.2	3.3
10	0.0102000	139.6	1.2	135.4	3.1
11	0.0118000	128.3	1.9	124.1	3.4
12	0.0134000	115.6	3.1	115.1	0.4
13	0.0158000	106.8	1.7	104.5	2.2
14	0.0190000	95.1	2.3	93.9	1.3
15	0.0222000	91.9	4.9	85.7	7.2
16	0.0254000	82.5	5.6	79.1	4.3
17	0.0286000	75.8	2.2	73.8	2.7
18	0.0334000	69.8	2.6	67.2	3.8
19	0.0398000	61.8	4.4	60.8	1.7

RMS ERROR= 6.592 X-CONVERGENCE

CORRELATION MATRIX

	1	2	3	4	5
1	1.000				
2	-0.383	1.000			
3	-0.303	0.122	1.000		
4	0.002	0.173	-0.474	1.000	
5	-0.470	0.265	0.434	-0.740	1.000

	PARAMETER ESTIMATE	STANDARD ERROR	RELATIVE ERROR	PERCENT ERROR
1	0.2003E-03	0.4305E-04	0.2149E+00	21.5
2	0.3324E-02	0.2112E-03	0.6354E-01	6.4
3	0.2943E-01	0.4798E-03	0.1630E-01	1.6
4	0.1692E+03	0.4116E-02	0.2433E-04	0.0
5	0.5045E+03	0.3917E-02	0.7765E-05	0.0

FINAL INVERSION MODEL

LAYER	RESISTIVITY	P	F	CONDUCTIVITY	P	F	THICKNESS	DEPTH
1	4992.2	1		0.20031395E-03	4		169.2	0.0
2	300.8	2		0.33240221E-02	5		504.5	169.2
3	34.0	3		0.29433116E-01				673.7

P - parameter number
F - * indicates fixed parameter

Figure 4b

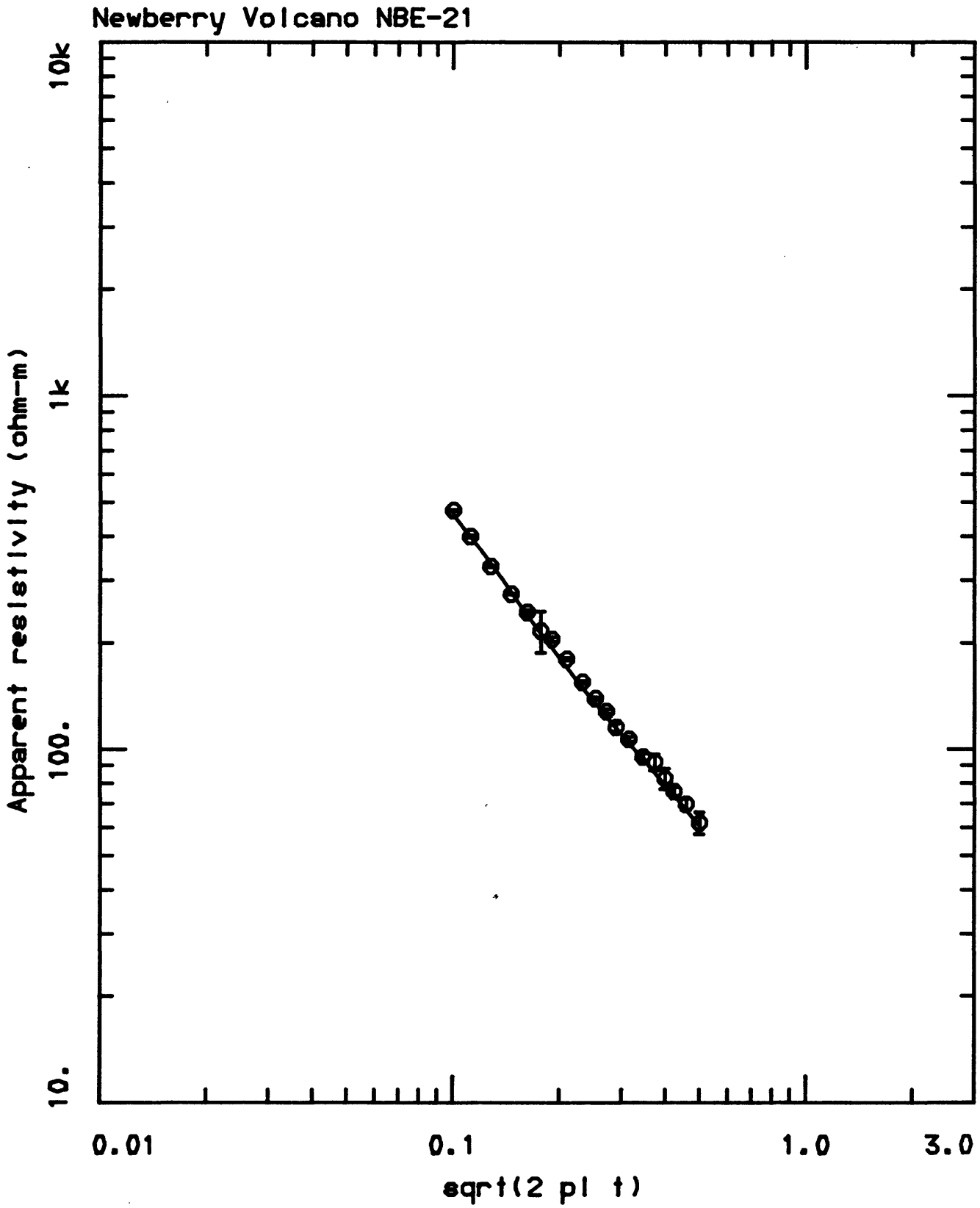

Newberry Volcano NBE-21
Apparent resistivity (ohm-m)
10k
1k
100.
10.
0.01
0.1
1.0
3.0
sqrt(2 pi t)

Figure 4c

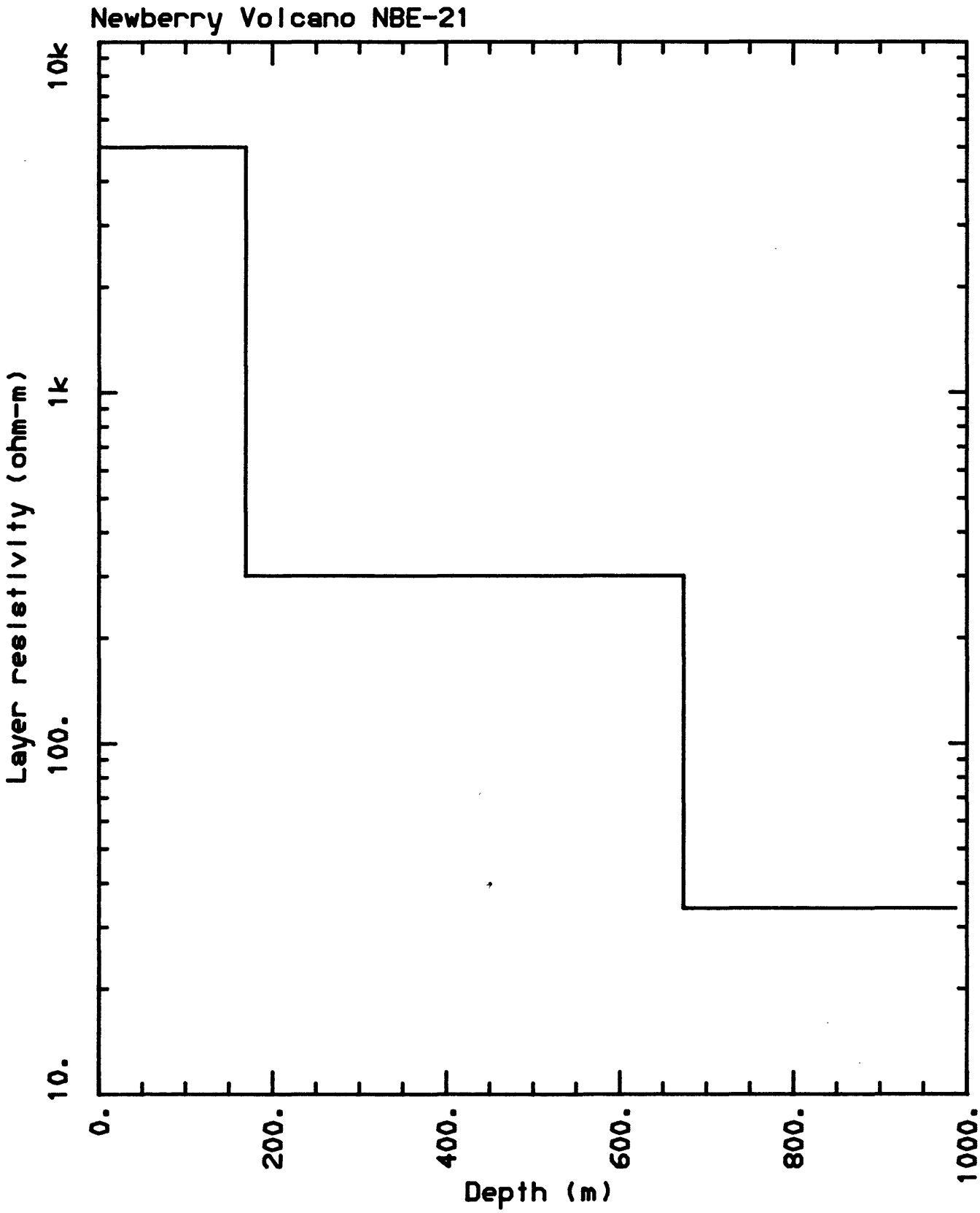

Newberry Volcano NBE-21
Layer resistivity (ohm-m)
10k
1k
100.
10.
0.
200.
400.
600.
800.
1000.
Depth (m)

Figure 5a

<NLSTCI>: Newberry Volcano NBE-22
LOOP RADIUS= 172.0

I	TIME(s)	OBSERVED RESISTIVITY	STANDARD DEVIATION	COMPUTED RESISTIVITY	PERCENT ERROR
1	0.0016000	550.3	4.3	536.9	2.5
2	0.0020000	458.6	2.5	464.7	-1.3
3	0.0026000	377.2	3.4	388.1	-2.8
4	0.0034000	315.2	2.0	317.0	-0.6
5	0.0042000	270.5	2.4	269.9	0.2
6	0.0050000	242.3	2.6	238.2	1.7
7	0.0058000	218.2	3.7	214.3	1.8
8	0.0070000	193.5	1.6	187.2	3.4
9	0.0086000	165.3	3.7	162.8	1.5
10	0.0102000	144.1	5.6	145.9	-1.2
11	0.0118000	127.6	3.9	133.1	-4.1
12	0.0134000	117.0	6.3	123.2	-5.1
13	0.0158000	106.8	4.8	112.1	-4.7
14	0.0190000	99.8	3.0	101.2	-1.4
15	0.0222000	92.2	6.1	93.2	-1.1
16	0.0254000	87.4	4.9	86.9	0.5
17	0.0296000	80.3	3.0	82.0	-2.0
18	0.0334000	72.7	3.2	76.1	-4.5
19	0.0398000	64.3	3.7	70.2	-8.3

RMS ERROR= 6.360 X-CONVERGENCE

CORRELATION MATRIX

	1	2	3	4	5
1	1.000				
2	-0.790	1.000			
3	0.520	-0.378	1.000		
4	0.544	-0.657	0.188	1.000	
5	-0.716	0.805	-0.266	-0.902	1.000

	PARAMETER ESTIMATE	STANDARD ERROR	RELATIVE ERROR	PERCENT ERROR
1	0.5920E-03	0.2397E-04	0.4049E-01	4.0
2	0.2707E-02	0.1511E-03	0.5581E-01	5.6
3	0.3538E-01	0.4582E-03	0.1295E-01	1.3
4	0.1657E+03	0.3282E-02	0.1980E-04	0.0
5	0.5588E+03	0.4209E-02	0.7532E-05	0.0

FINAL INVERSION MODEL

LAYER	RESISTIVITY	P	F	CONDUCTIVITY	P	F	THICKNESS	DEPTH
1	1689.1	1		0.59203734E-03	4		165.7	0.0
2	369.4	2		0.27069722E-02	5		558.8	165.7
3	28.3	3		0.35377163E-01				724.5

P - parameter number
F - * indicates fixed parameter

Figure 5b

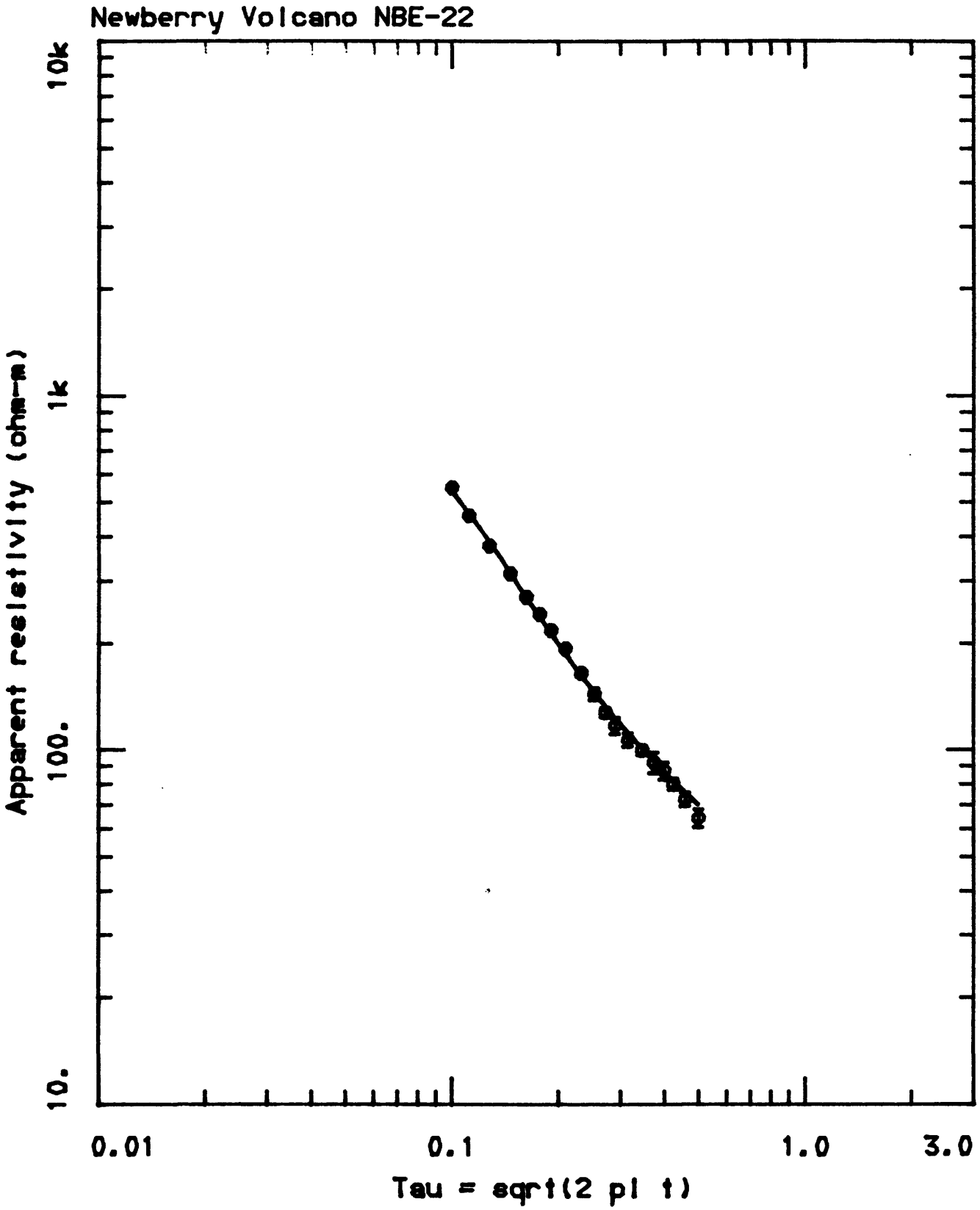

Newberry Volcano NBE-22
10k
1k
100.
10.
Apparent resistivity (ohm-m)
0.01
0.1
1.0
3.0
Tau = sqrt(2 pi t)

Figure 5c

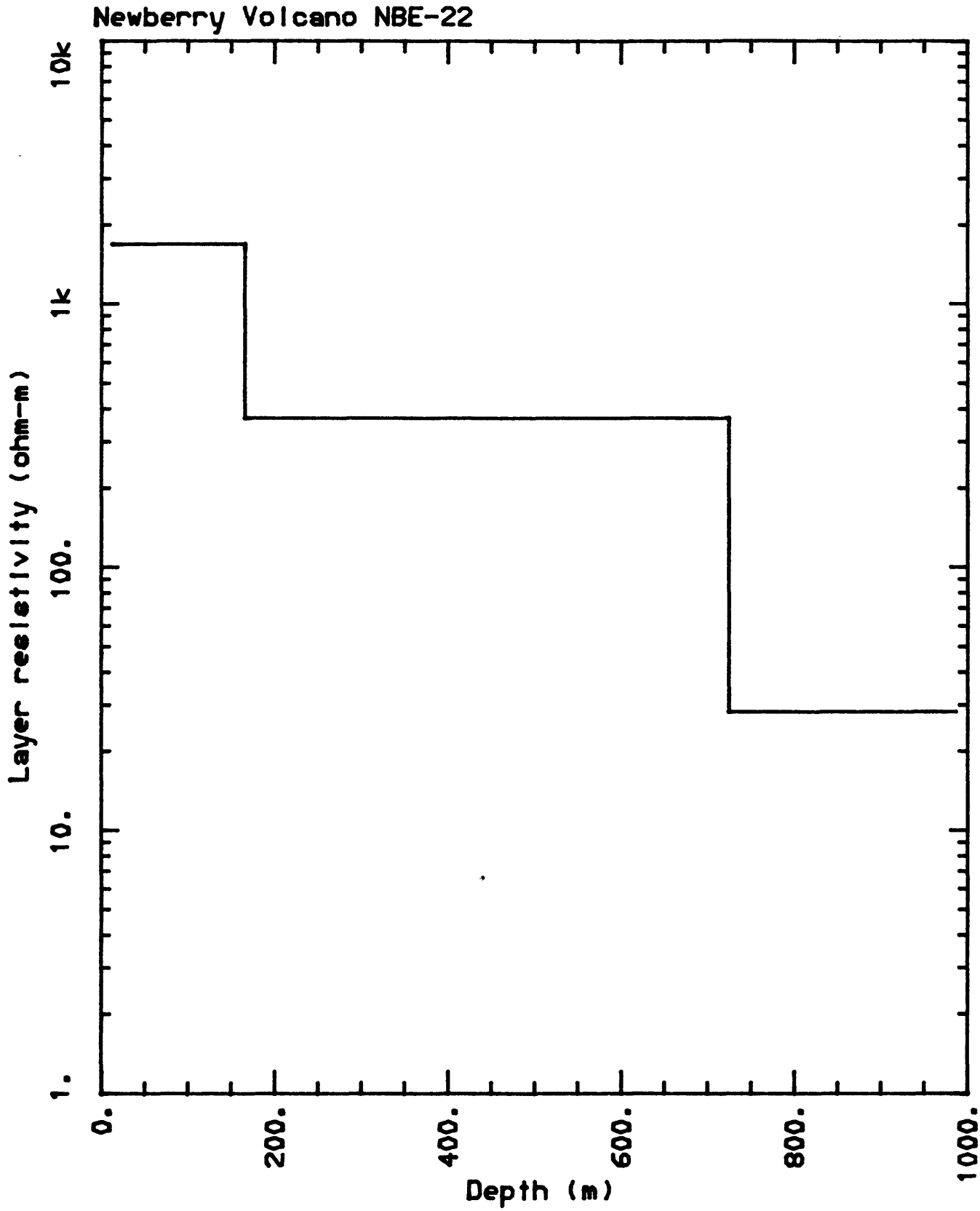

Newberry Volcano NBE-22
Layer resistivity (ohm-m)
10k
1k
100.
10.
1.
0.
200.
400.
600.
800.
1000.
Depth (m)

Figure 6a

<NLSTCI>: Newberry Volcano NBE-23
LOOP RADIUS= 172.0

I	TIME(s)	OBSERVED RESISTIVITY	STANDARD DEVIATION	COMPUTED RESISTIVITY	PERCENT ERROR
1	0.0016000	803.5	9.4	789.2	1.8
2	0.0020000	676.0	4.3	665.8	1.5
3	0.0026000	546.2	3.5	545.6	0.1
4	0.0034000	443.2	4.4	448.5	-1.2
5	0.0042000	379.4	8.3	383.9	-1.2
6	0.0050000	339.8	24.4	341.3	-0.4
7	0.0058000	300.7	11.6	309.3	-2.8
8	0.0070000	268.4	5.0	273.5	-1.9
9	0.0086000	234.4	6.1	241.0	-2.7
10	0.0102000	218.4	7.3	218.2	0.1
11	0.0118000	198.6	6.2	201.3	-1.4
12	0.0134000	181.5	11.1	188.5	-3.7
13	0.0158000	163.5	6.8	173.2	-5.6
14	0.0190000	148.0	2.1	158.3	-6.5
15	0.0222000	133.0	13.5	147.4	-9.8
16	0.0254000	118.3	11.9	138.8	-14.8
17	0.0286000	126.3	8.7	132.0	-4.3

RMS ERROR= 10.0o X-CONVERGENCE

CORRELATION MATRIX

	1	2	3
1	1.000		
2	0.061	1.000	
3	-0.124	-0.065	1.000

	PARAMETER ESTIMATE	STANDARD ERROR	RELATIVE ERROR	PERCENT ERROR
1	0.1049E-02	0.7331E-05	0.6992E-02	0.7
2	0.1667E-01	0.1478E-03	0.7913E-02	0.8
3	0.8130E+03	0.1248E-02	0.1535E-05	0.0

FINAL INVERSION MODEL

LAYER	RESISTIVITY	P	F	CONDUCTIVITY	P	F	THICKNESS	DEPTH
1	953.7	1		0.10485020E-02	3		813.0	0.0
2	53.6	2		0.18673740E-01				813.0

P - parameter number
F - * indicates fixed parameter

Figure 6b

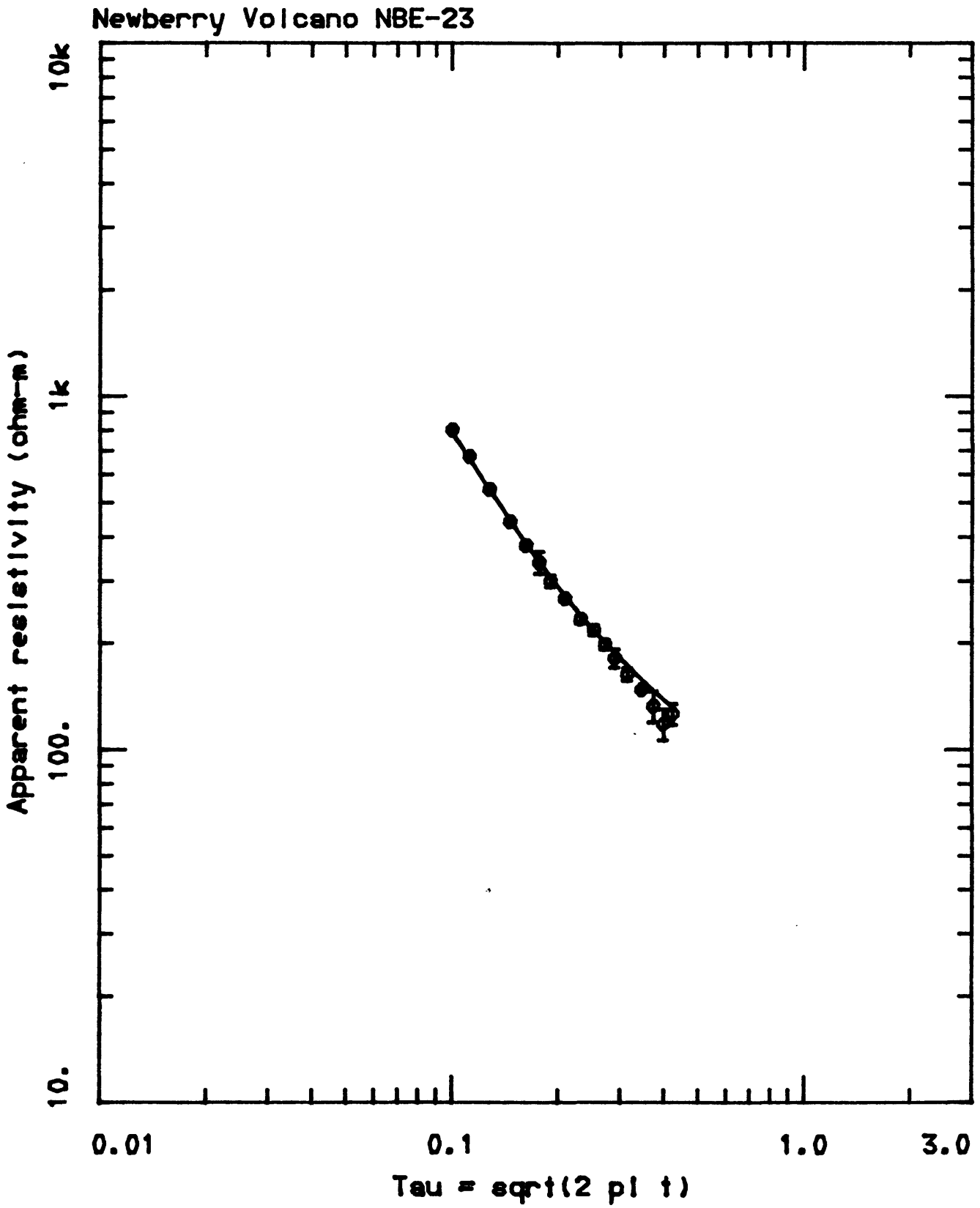

Newberry Volcano NBE-23
10k
1k
100.
10.
Apparent resistivity (ohm-m)
0.01
0.1
1.0
3.0
Tau = sqrt(2 pi t)

Figure 6c

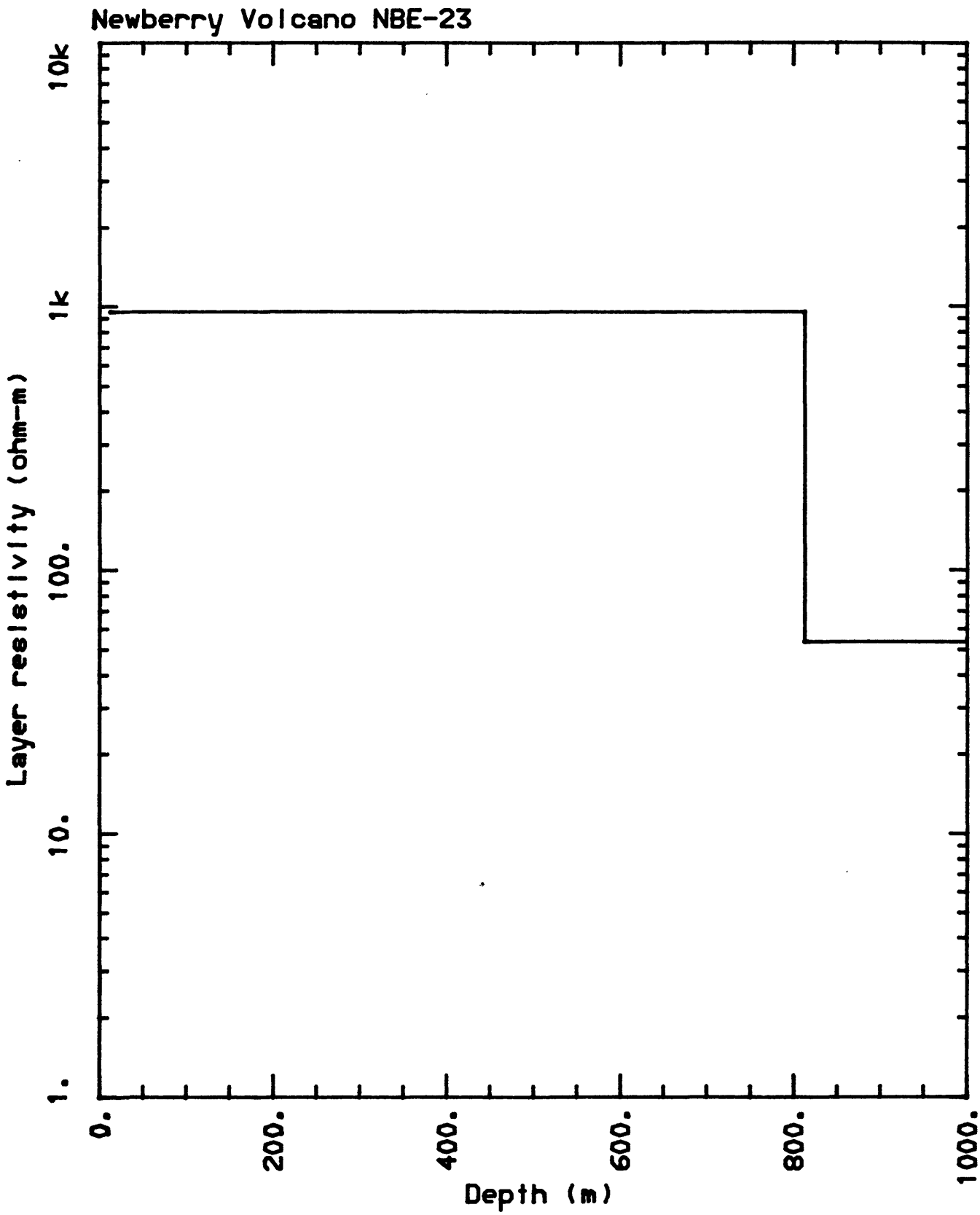

Newberry Volcano NBE-23
Layer resistivity (ohm-m)
10k
1k
100.
10.
1.
0.
200.
400.
600.
800.
1000.
Depth (m)

Figure 7a

<NLSTCI>: Newberry Volcano NBE-24
LOOP RADIUS= 172.0

I	TIME(s)	OBSERVED RESISTIVITY	STANDARD DEVIATION	COMPUTED RESISTIVITY	PERCENT ERROR
1	0.0016000	494.7	7.2	509.8	-3.0
2	0.0020000	445.0	7.3	460.0	-3.3
3	0.0026000	376.3	5.7	394.7	-4.7
4	0.0034000	327.1	2.1	335.5	-2.5
5	0.0042000	296.3	4.5	291.7	1.6
6	0.0050000	263.3	39.1	261.4	0.7
7	0.0058000	246.4	1.0	240.2	2.6
8	0.0070000	220.4	5.2	215.2	2.4
9	0.0086000	196.6	3.4	190.9	3.0
10	0.0102000	165.0	4.2	174.3	-5.3
11	0.0118000	152.0	6.9	161.6	-5.9
12	0.0134000	136.6	3.7	151.3	-9.7
13	0.0158000	139.1	4.8	139.6	-0.4
14	0.0190000	122.2	5.8	128.4	-4.8
15	0.0222000	133.9	18.9	120.1	11.5
16	0.0254000	132.1	24.8	113.8	16.1
17	0.0286000	104.2	11.3	108.8	-4.2

RMS ERROR= 11.84 X-CONVERGENCE

CORRELATION MATRIX

	1	2	3
1	1.000		
2	0.270	1.000	
3	-0.929	-0.253	1.000

	PARAMETER ESTIMATE	STANDARD ERROR	RELATIVE ERROR	PERCENT ERROR
1	0.2069E-02	0.4261E-04	0.2059E-01	2.1
2	0.2177E-01	0.4253E-03	0.1954E-01	2.0
3	0.7416E+03	0.2596E-02	0.3500E-05	0.0

FINAL INVERSION MODEL

LAYER	RESISTIVITY	P	F	CONDUCTIVITY	P	F	THICKNESS	DEPTH
1	483.3	1		0.20692274E-02	3		741.6	0.0
2	45.9	2		0.21765832E-01				741.6

P - parameter number
F - * indicates fixed parameter

Figure 7b

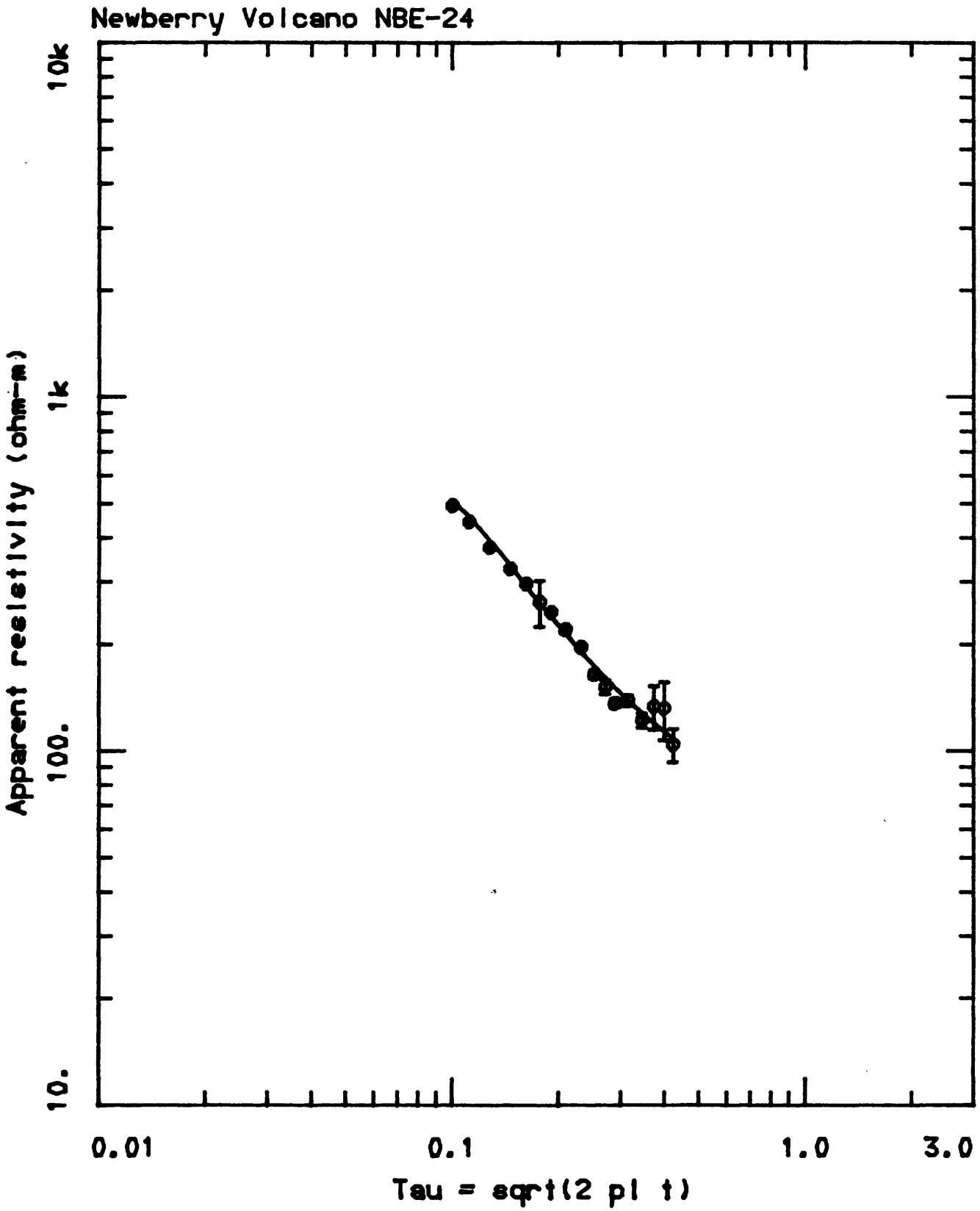

Newberry Volcano NBE-24
10k
1k
100.
10.
Apparent resistivity (ohm-m)
0.01
0.1
1.0
3.0
Tau = sqrt(2 pi t)

Figure 7c

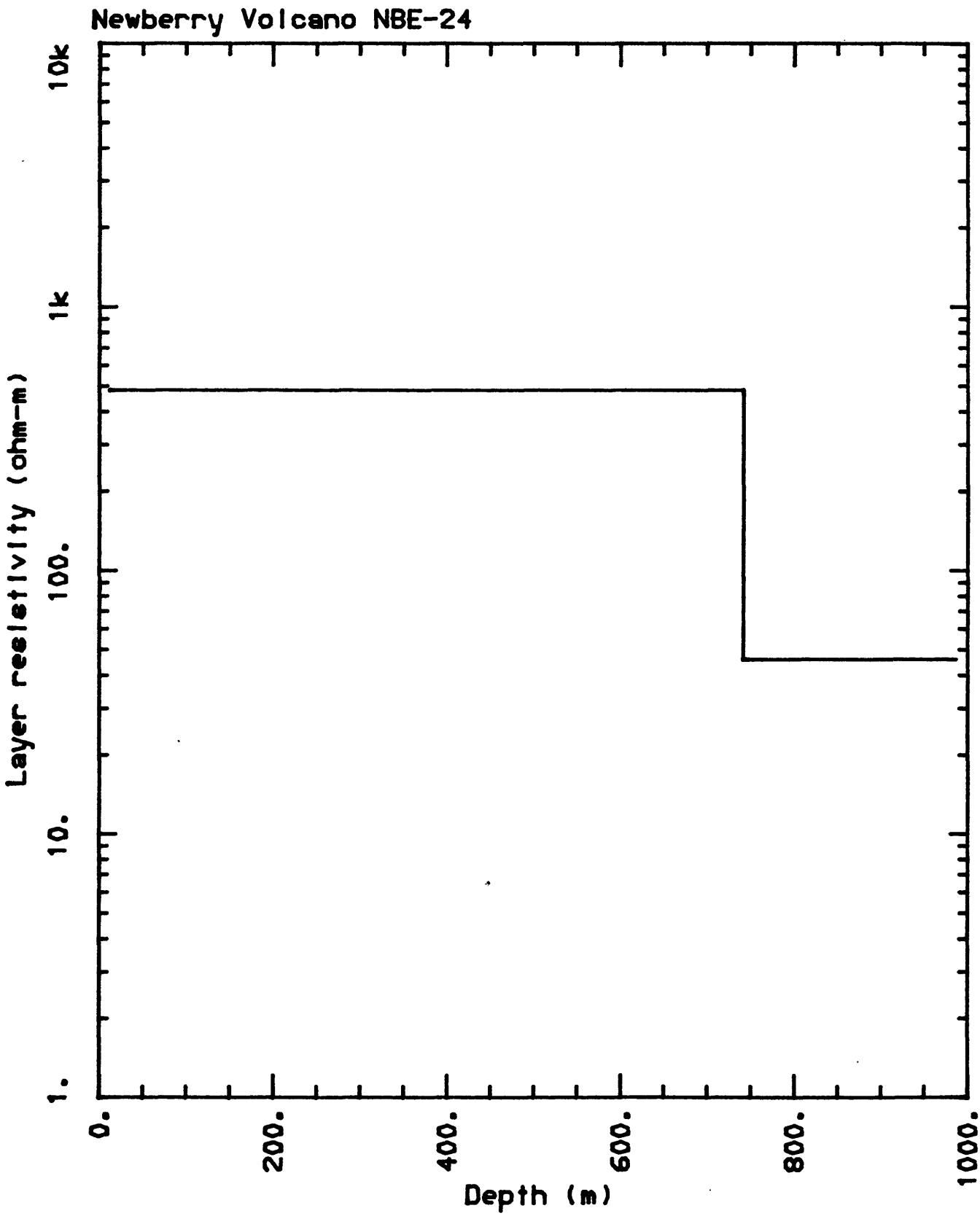

Newberry Volcano NBE-24
Layer resistivity (ohm-m)
10k
1k
100.
10.
1.
0.
200.
400.
600.
800.
1000.
Depth (m)

Figure 8a

<NLSTCI>: Newberry Volcano NBE-25
LOOP RADIUS= 172.0

I	TIME(s)	OBSERVED RESISTIVITY	STANDARD DEVIATION	COMPUTED RESISTIVITY	PERCENT ERROR
1	0.0016000	418.7	0.9	417.9	0.2
2	0.0020000	379.4	0.7	379.4	0.0
3	0.0026000	323.5	2.6	332.4	-2.7
4	0.0034000	279.4	1.7	280.7	-0.5
5	0.0042000	242.6	1.7	243.1	-0.2
6	0.0050000	217.0	1.6	216.5	0.2
7	0.0058000	199.6	3.4	196.7	1.5
8	0.0070000	175.1	2.6	173.6	0.8
9	0.0086000	156.6	3.9	152.1	3.0
10	0.0102000	137.9	3.9	137.3	0.5
11	0.0118000	128.6	1.9	125.9	2.1
12	0.0134000	119.6	5.0	116.7	2.5
13	0.0158000	107.0	4.1	106.3	0.6
14	0.0190000	97.2	2.7	96.2	1.0
15	0.0222000	94.0	5.4	88.6	6.0
16	0.0254000	83.1	3.8	82.6	0.6
17	0.0286000	77.2	3.5	77.6	-0.6
18	0.0334000	69.1	4.3	71.7	-3.6
19	0.0398000	62.8	0.8	65.4	-3.9

RMS ERROR= 3.261 X-CONVERGENCE

CORRELATION MATRIX

	2	3	5
2	1.000		
3	-0.719	1.000	
5	-0.055	-0.034	1.000

	PARAMETER ESTIMATE	STANDARD ERROR	RELATIVE ERROR	PERCENT ERROR
2	0.3576E-02	0.3268E-04	0.9138E-02	0.9
3	0.3362E-01	0.3090E-03	0.9194E-02	0.9
5	0.5893E+03	0.7973E-03	0.1353E-05	0.0

FINAL INVERSION MODEL

LAYER	RESISTIVITY	P	F	CONDUCTIVITY	P	F	THICKNESS	DEPTH
1	2770.1	1	*	0.36100001E-03	4	*	120.0	0.0
2	279.6	2		0.35759581E-02	5		589.3	120.0
3	29.7	3		0.33615280E-01				709.3

P - parameter number
F - * indicates fixed parameter

Figure 8b

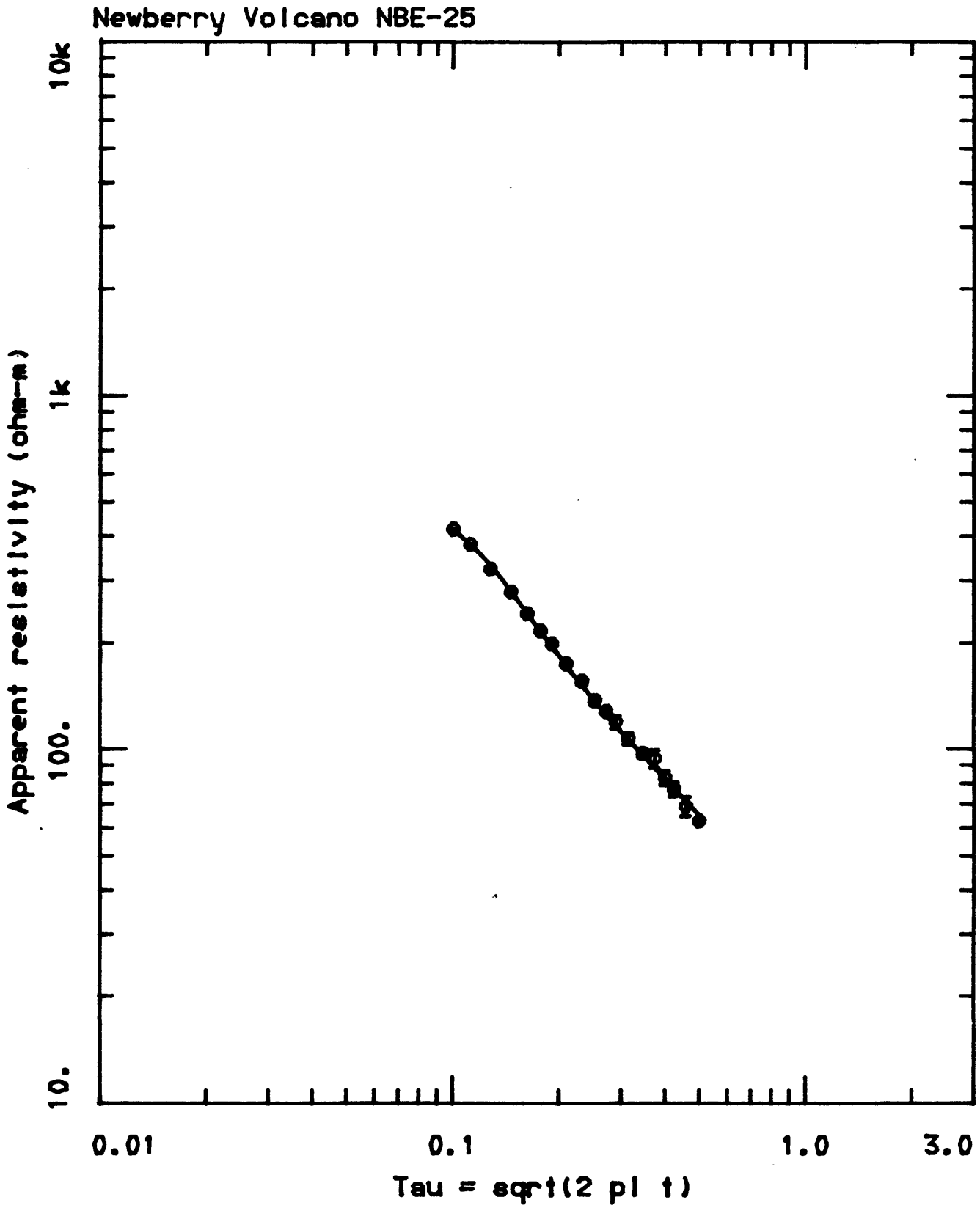

Newberry Volcano NBE-25
Apparent resistivity (ohm-m)
10k
1k
100.
10.
0.01
0.1
1.0
3.0
Tau = sqrt(2 pi t)

Figure 8c

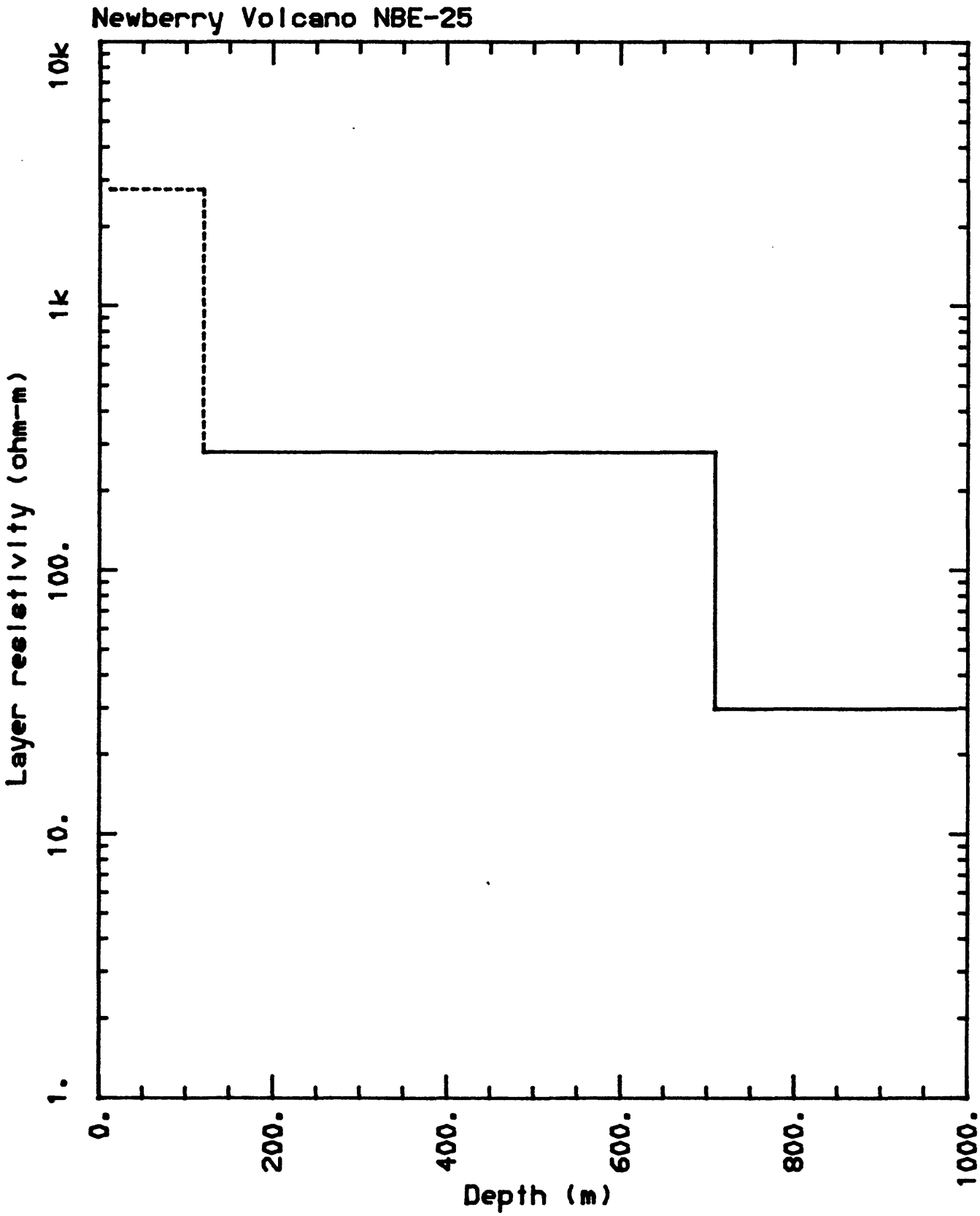

Newberry Volcano NBE-25
Layer resistivity (ohm-m)
10k
1k
100.
10.
1.
0.
200.
400.
600.
800.
1000.
Depth (m)

Figure 9a

<NLSTCI>: Newberry Volcano NBE-26 '
LOOP RADIUS= 172.0

1	TIME(s)	OBSERVED RESISTIVITY	STANDARD DEVIATION	COMPUTED RESISTIVITY	PERCENT ERROR
1	0.0016000	569.5	1.1	568.4	0.2
2	0.0020000	493.4	5.0	506.0	-2.5
3	0.0026000	418.7	5.8	425.9	-1.7
4	0.0034000	348.7	5.4	352.8	-1.2
5	0.0042000	307.4	3.5	303.6	1.2
6	0.0050000	258.7	48.0	267.0	-3.1
7	0.0058000	244.6	11.2	239.9	2.0
8	0.0070000	212.5	3.9	211.2	0.6
9	0.0086000	184.9	3.1	184.1	0.4
10	0.0102000	173.2	2.7	164.7	5.2
11	0.0118000	155.3	5.5	150.6	3.2
12	0.0134000	142.8	6.2	139.5	2.3
13	0.0158000	127.1	2.1	126.6	0.4
14	0.0190000	112.9	3.9	113.9	-0.9
15	0.0222000	102.5	1.4	104.7	-2.1
16	0.0254000	95.0	1.8	97.5	-2.6
17	0.0286000	100.7	11.2	91.7	9.8
18	0.0334000	84.8	4.5	84.8	0.0
19	0.0398000	68.7	5.2	77.8	-11.7

RMS ERROR= 6.208 X-CONVERGENCE

CORRELATION MATRIX

	2	3	5
2	1.000		
3	0.069	1.000	
5	-0.910	0.050	1.000

	PARAMETER ESTIMATE	STANDARD ERROR	RELATIVE ERROR	PERCENT ERROR
2	0.2575E-02	0.4734E-04	0.1839E-01	1.8
3	0.3062E-01	0.1544E-03	0.5044E-02	0.5
5	0.6267E+03	0.1218E-02	0.1944E-05	0.0

FINAL INVERSION MODEL

LAYER	RESISTIVITY	P	F	CONDUCTIVITY	P	F	THICKNESS	DEPTH
1	2232.1	1	*	0.44800001E-03	4	*	150.0	0.0
2	388.4	2		0.25747700E-02	5		626.7	150.0
3	32.7	3		0.30615348E-01				776.7

P - parameter number
F - * indicates fixed parameter

Figure 9b

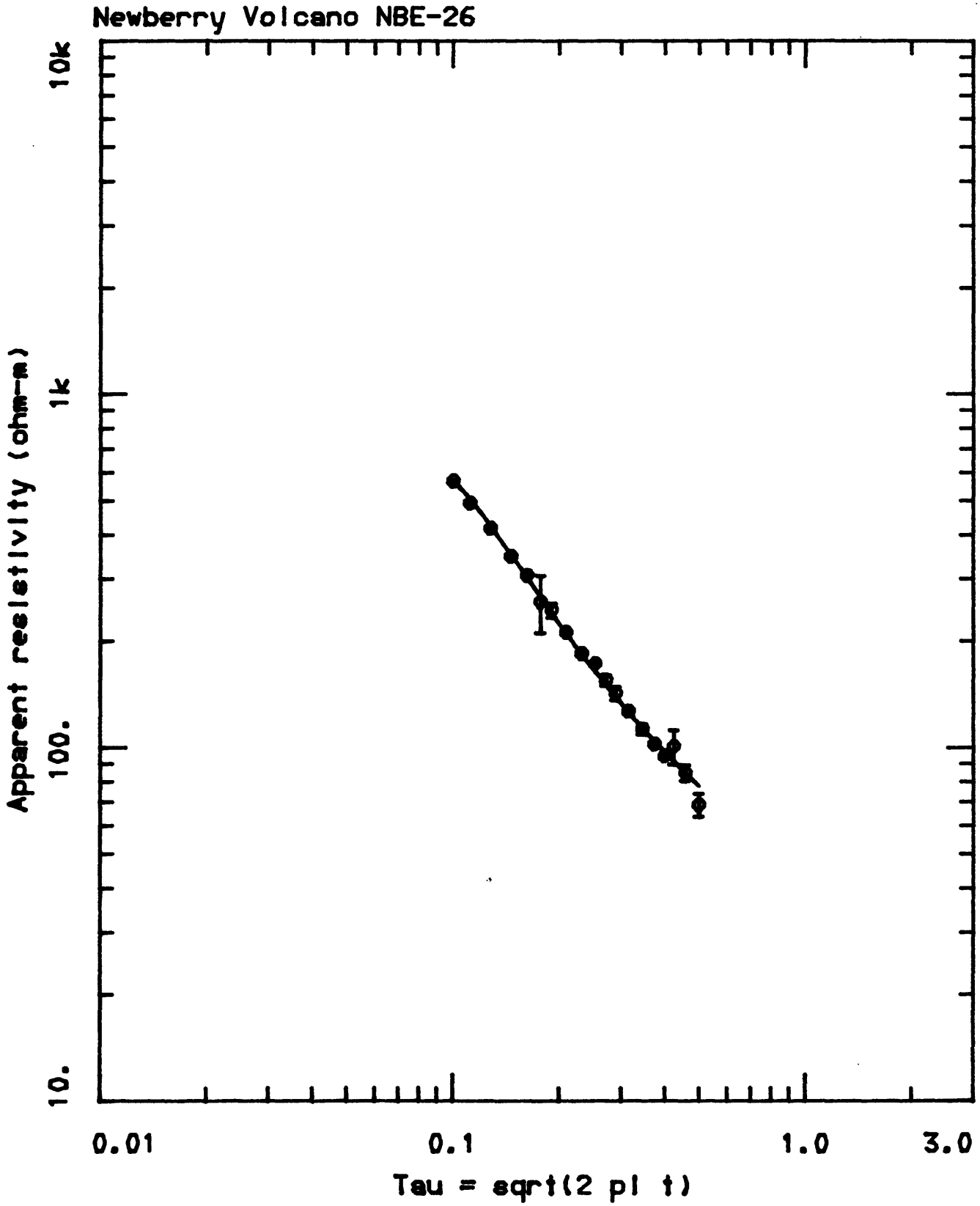

Newberry Volcano NBE-26
Apparent resistivity (ohm-m)
10k
1k
100.
10.
0.01
0.1
1.0
3.0
Tau = sqrt(2 pi t)

Figure 9c

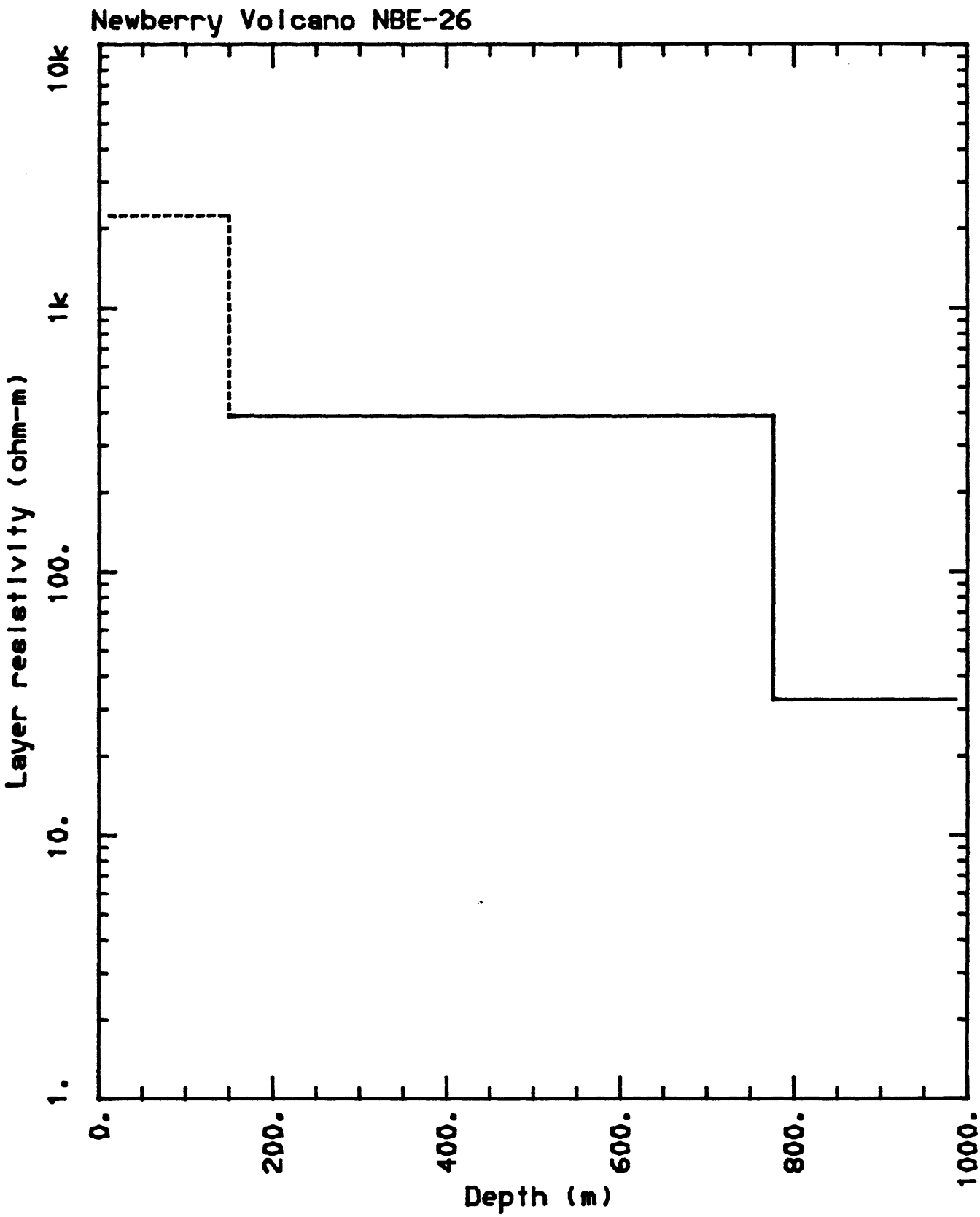

Newberry Volcano NBE-26
Layer resistivity (ohm-m)
10k
1k
100.
10.
1.
0.
200.
400.
600.
800.
1000.
Depth (m)

Figure 10a

<NLSTCI>: Newberry Volcano NBE-27
LOOP RADIUS= 172.0

I	TIME(s)	OBSERVED RESISTIVITY	STANDARD DEVIATION	COMPUTED RESISTIVITY	PERCENT ERROR
1	0.0016000	343.8	0.3	339.8	1.2
2	0.0020000	313.0	0.5	324.2	-3.5
3	0.0026000	280.6	1.7	294.8	-4.8
4	0.0034000	255.2	0.9	257.0	-0.7
5	0.0042000	233.7	1.3	227.5	2.7
6	0.0050000	207.6	18.2	203.9	1.8
7	0.0058000	196.0	16.9	185.1	5.9
8	0.0070000	181.1	10.0	164.0	10.4
9	0.0086000	155.8	0.8	144.8	7.6
10	0.0102000	139.2	0.7	130.4	6.7
11	0.0118000	128.8	2.0	119.3	8.0
12	0.0134000	117.0	3.2	110.7	5.7
13	0.0158000	101.8	0.5	101.1	0.7
14	0.0190000	87.5	1.2	91.5	-4.4
15	0.0222000	82.5	1.9	84.4	-2.2
16	0.0254000	82.5	4.0	78.9	4.6
17	0.0286000	73.7	7.0	74.4	-0.9
18	0.0334000	63.9	1.1	69.1	-7.5
19	0.0398000	58.8	2.8	63.6	-7.5

RMS ERROR= 9.332 X-CONVERGENCE

CORRELATION MATRIX

	1	2	3	4	5
1	1.000				
2	-0.850	1.000			
3	0.392	-0.512	1.000		
4	-0.762	0.882	-0.326	1.000	
5	0.457	-0.586	-0.160	-0.786	1.000

	PARAMETER ESTIMATE	STANDARD ERROR	RELATIVE ERROR	PERCENT ERROR
1	0.5405E-03	0.8094E-04	0.1498E+00	15.0
2	0.4576E-02	0.2847E-03	0.6221E-01	6.2
3	0.3784E-01	0.1361E-02	0.3597E-01	3.6
4	0.1223E+03	0.5348E-02	0.4372E-04	0.0
5	0.5957E+03	0.7033E-02	0.1181E-04	0.0

FINAL INVERSION MODEL

LAYER	RESISTIVITY	P	F	CONDUCTIVITY	P	F	THICKNESS	DEPTH
1	1850.2	1		0.54047536E-03	4		122.3	0.0
2	218.5	2		0.45763673E-02	5		595.7	122.3
3	26.4	3		0.37836563E-01				718.1

P - parameter number
F - * indicates fixed parameter

Figure 10b

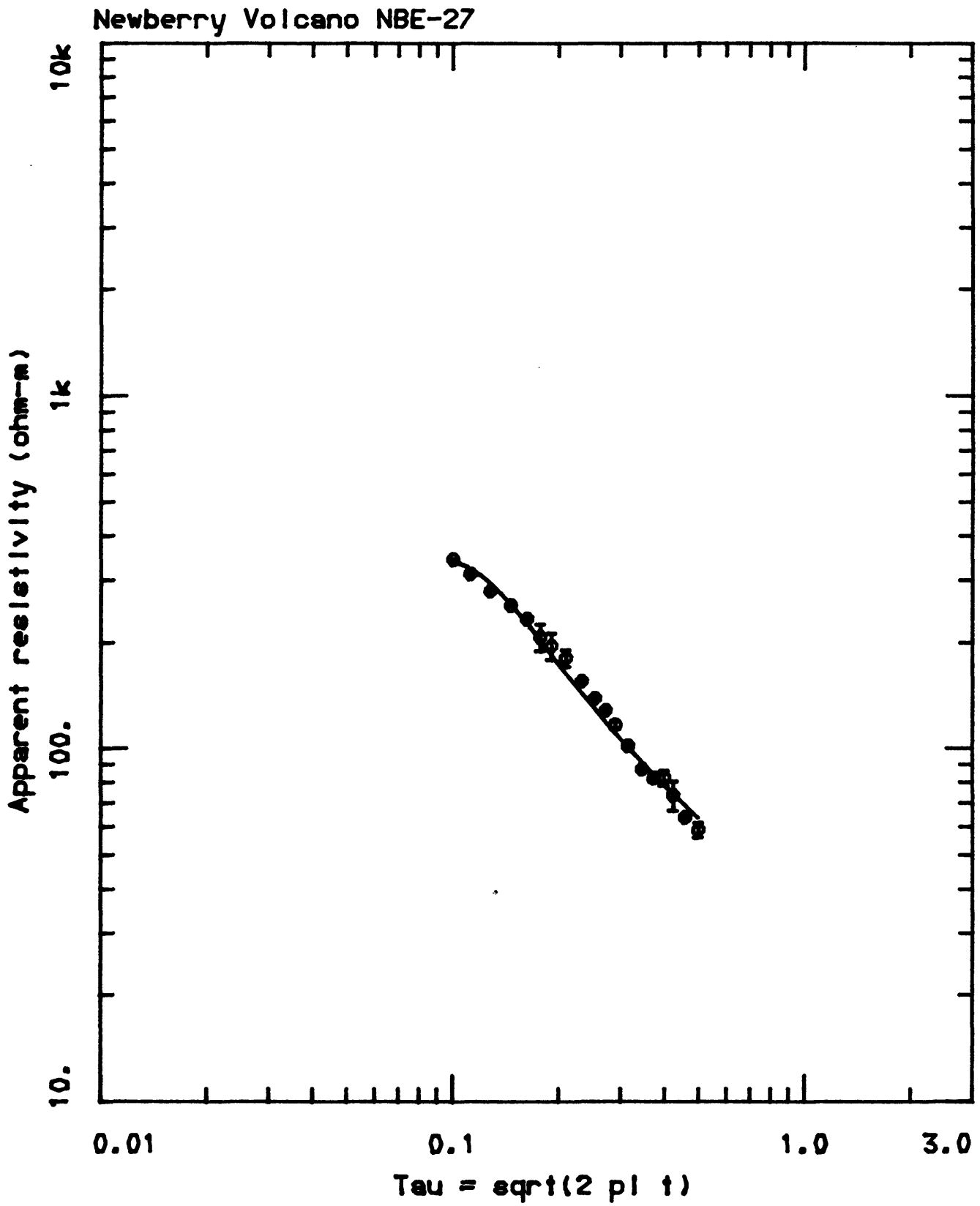

Newberry Volcano NBE-27
Apparent resistivity (ohm-m)
10k
1k
100.
10.
0.01
0.1
1.0
3.0
Tau = sqrt(2 pi t)

Figure 10c

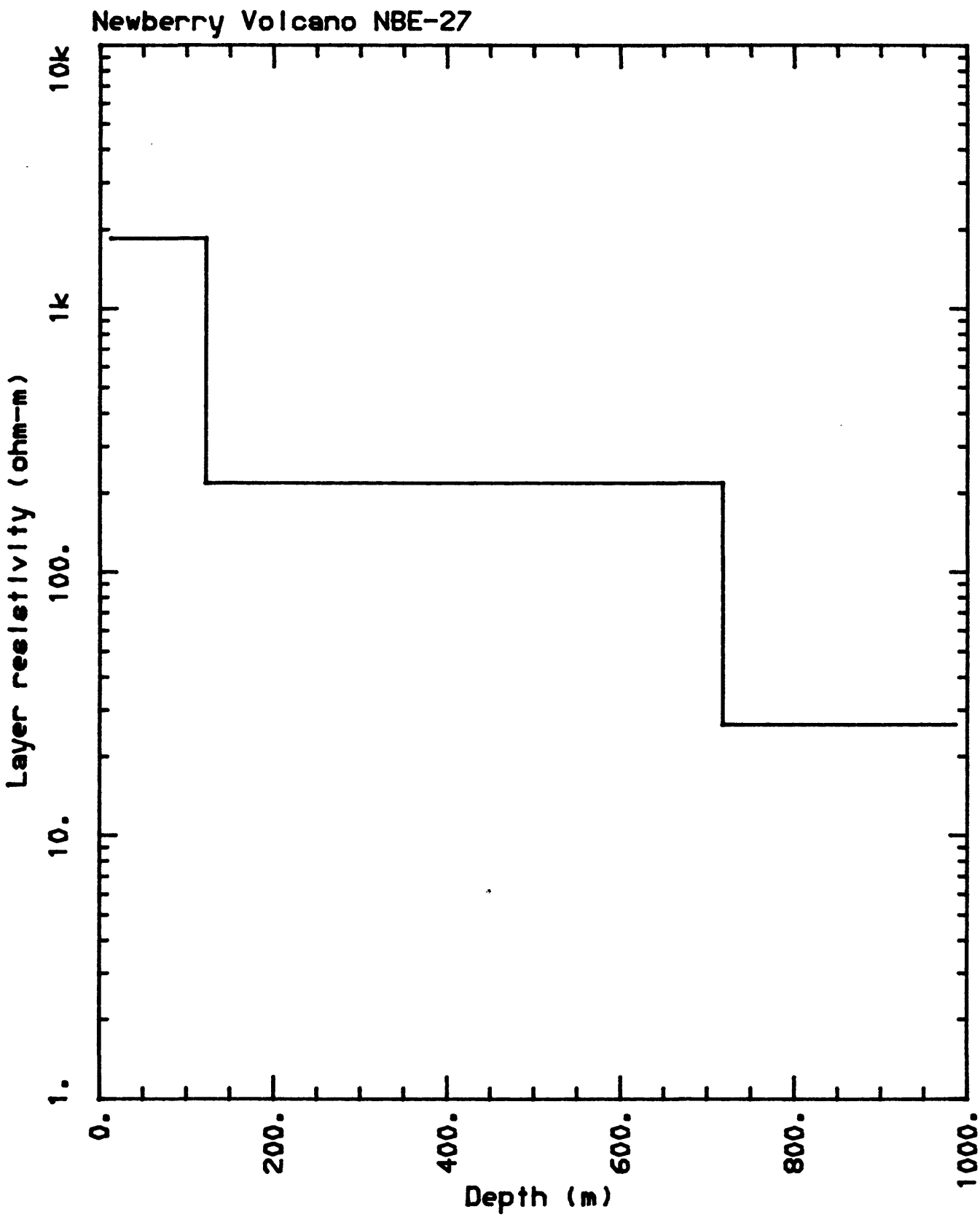

Newberry Volcano NBE-27
Layer resistivity (ohm-m)
10k
1k
100.
10.
1.
0.
200.
400.
600.
800.
1000.
Depth (m)

Figure 11a

<NLSTCI>: Newberry Volcano NBE-28
LOOP RADIUS= 172.0

I	TIME(s)	OBSERVED RESISTIVITY	STANDARD DEVIATION	COMPUTED RESISTIVITY	PERCENT ERROR
1	0.0016000	429.5	11.1	412.6	4.1
2	0.0020000	389.6	7.7	391.5	-0.5
3	0.0026000	343.2	3.4	352.7	-2.7
4	0.0034000	292.6	12.3	304.4	-3.9
5	0.0042000	267.5	8.4	263.3	1.6
6	0.0050000	253.7	15.9	231.7	9.5
7	0.0058000	195.6	49.5	208.0	-6.0
8	0.0070000	159.5	61.3	182.0	-12.4
9	0.0086000	177.7	7.8	156.6	13.4
10	0.0102000	160.7	18.2	138.9	15.7
11	0.0118000	156.9	11.6	126.1	24.5
12	0.0134000	138.8	16.9	116.0	19.7
13	0.0158000	163.0	40.7	104.2	56.4
14	0.0190000	167.9	81.1	92.8	80.8
15	0.0222000	121.1	65.5	84.7	43.0

RMS ERROR= 38.07 X-CONVERGENCE

CORRELATION MATRIX

	1	2	3	4	5
1	1.000				
2	-0.824	1.000			
3	0.514	-0.296	1.000		
4	-0.913	0.970	-0.299	1.000	
5	0.453	-0.795	-0.142	-0.708	1.000

	PARAMETER ESTIMATE	STANDARD ERROR	RELATIVE ERROR	PERCENT ERROR
1	0.7732E-03	0.3808E-03	0.4925E+00	49.3
2	0.3727E-02	0.1125E-02	0.3018E+00	30.2
3	0.4854E-01	0.2960E-02	0.6097E-01	6.1
4	0.1197E+03	0.1992E-01	0.1664E-03	0.0
5	0.6447E+03	0.1234E-01	0.1914E-04	0.0

FINAL INVERSION MODEL

LAYER	RESISTIVITY	P	F	CONDUCTIVITY	P	F	THICKNESS	DEPTH
1	1293.3	1		0.77318924E-03	4		119.7	0.0
2	268.3	2		0.37266919E-02	5		644.7	119.7
3	20.6	3		0.48544604E-01				764.4

P - parameter number
F - * indicates fixed parameter

Figure 11b

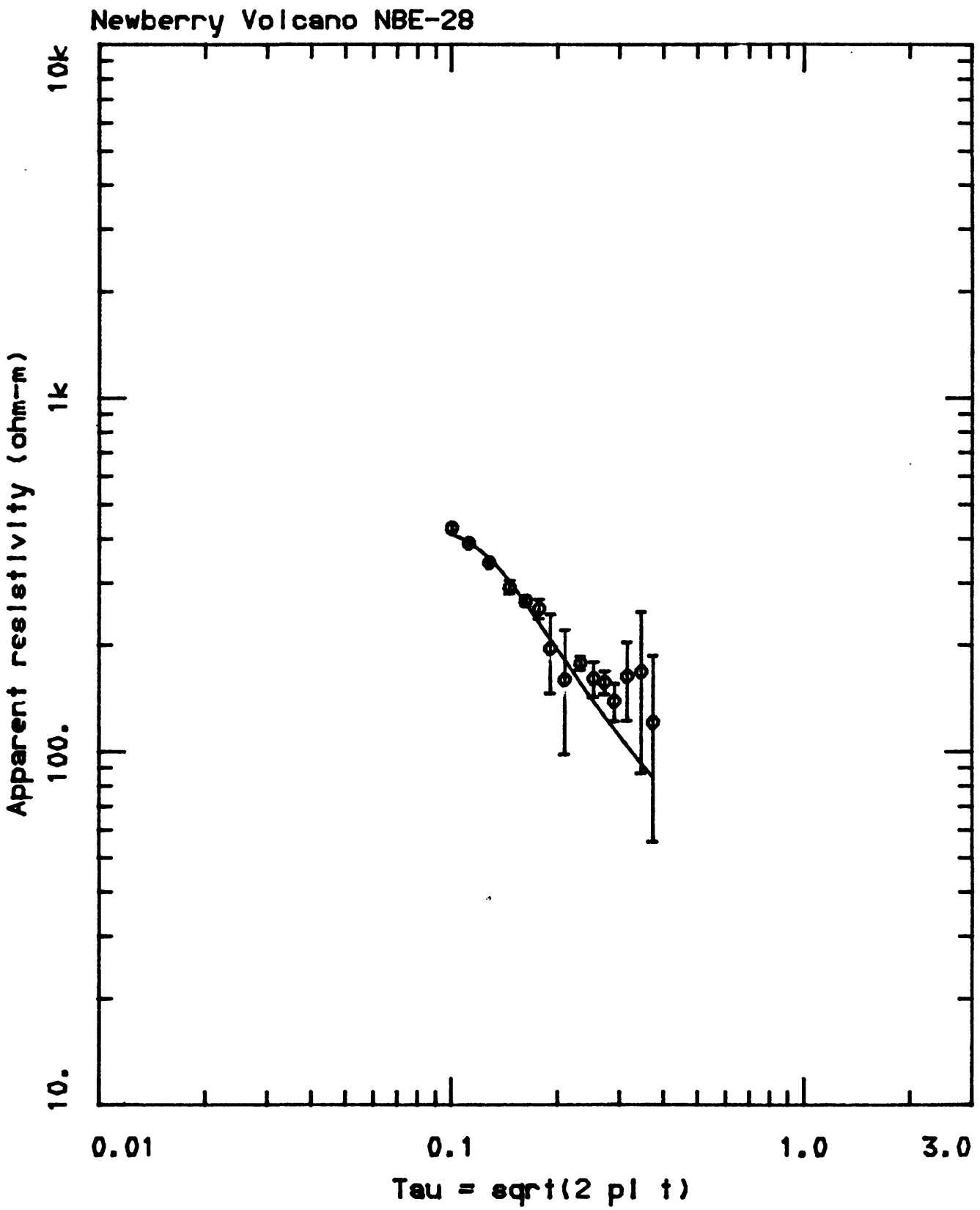

Newberry Volcano NBE-28
10k
1k
100.
10.
Apparent resistivity (ohm-m)
0.01
0.1
1.0
3.0
Tau = sqrt(2 pi t)

Figure 11c

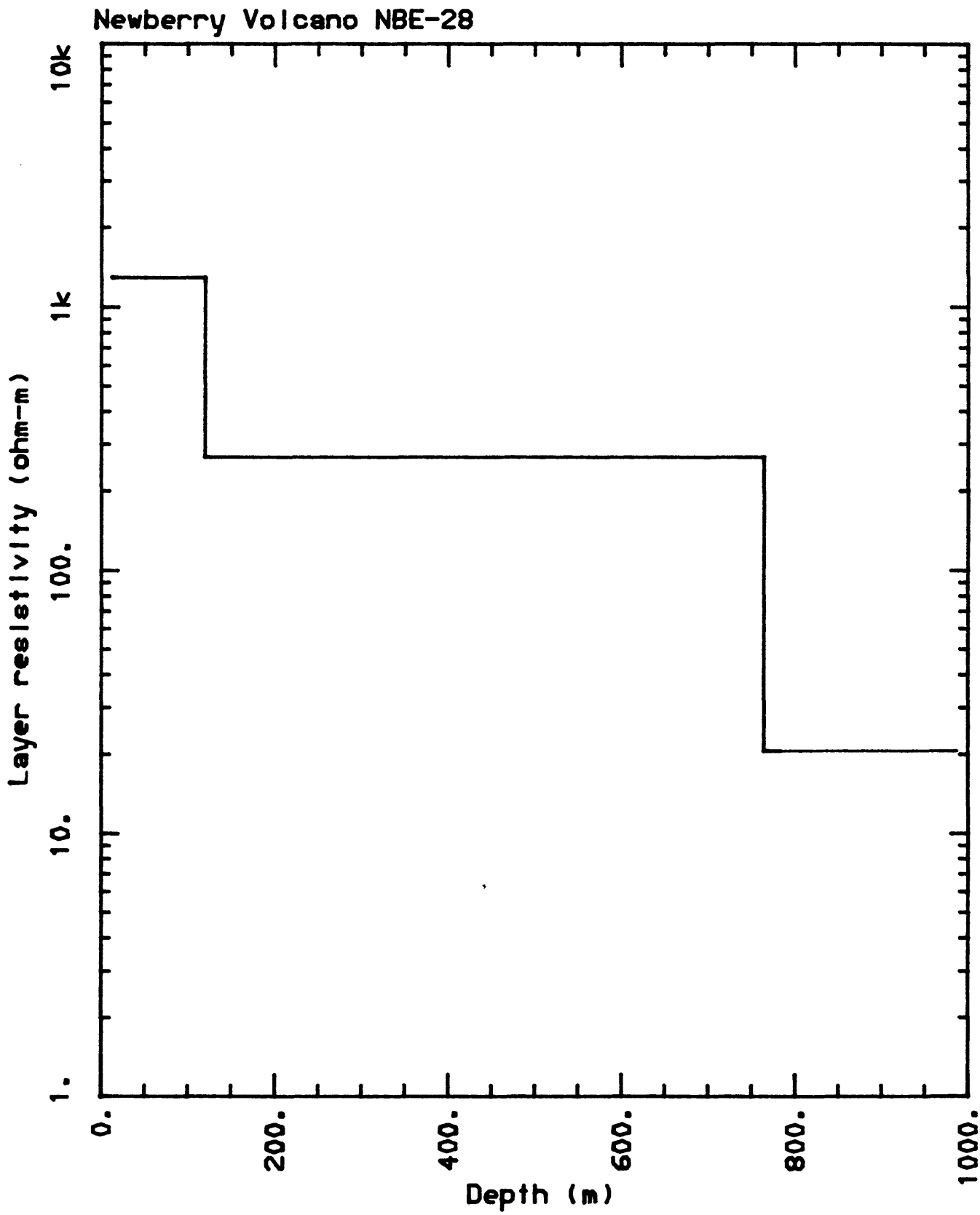

Newberry Volcano NBE-28
Layer resistivity (ohm-m)
10k
1k
100.
10.
1.
0.
200.
400.
600.
800.
1000.
Depth (m)

Figure 12a

<NLSTCI>: Newberry Volcano NBE-29
LOOP RADIUS= 172.0

I	TIME(s)	OBSERVED RESISTIVITY	STANDARD DEVIATION	COMPUTED RESISTIVITY	PERCENT ERROR
1	0.0016000	520.8	7.1	498.9	4.4
2	0.0020000	461.7	5.1	468.5	-1.4
3	0.0026000	396.5	3.0	412.6	-3.9
4	0.0034000	343.1	4.5	347.9	-1.4
5	0.0042000	305.3	4.8	298.7	2.2
6	0.0050000	285.3	144.6	260.5	9.5
7	0.0058000	232.0	22.8	232.8	-0.4
8	0.0070000	239.2	33.0	203.2	17.7
9	0.0086000	192.7	4.2	174.5	10.4
10	0.0102000	171.5	5.5	154.3	11.1
11	0.0118000	153.2	9.3	139.9	9.5
12	0.0134000	142.9	12.3	128.7	11.1
13	0.0158000	130.8	9.8	115.7	13.1
14	0.0190000	116.7	4.3	103.3	13.0
15	0.0222000	108.0	4.9	94.4	14.4
16	0.0254000	93.9	6.4	87.6	7.2
17	0.0286000	87.2	4.3	82.2	6.1

RMS ERROR= 17.79 X-CONVERGENCE

CORRELATION MATRIX

	1	2	3
1	1.000		
2	-0.050	1.000	
3	-0.254	0.112	1.000

	PARAMETER ESTIMATE	STANDARD ERROR	RELATIVE ERROR	PERCENT ERROR
1	0.2418E-02	0.5334E-04	0.2205E-01	2.2
2	0.4384E-01	0.8804E-03	0.2008E-01	2.0
3	0.7916E+03	0.4801E-02	0.6065E-05	0.0

FINAL INVERSION MODEL

LAYER	RESISTIVITY	P	F	CONDUCTIVITY	P	F	THICKNESS	DEPTH
1	413.5	1		0.24184240E-02	3		791.6	0.0
2	22.8	2		0.43841951E-01				791.6

P - parameter number
F - * indicates fixed parameter

Figure 12b

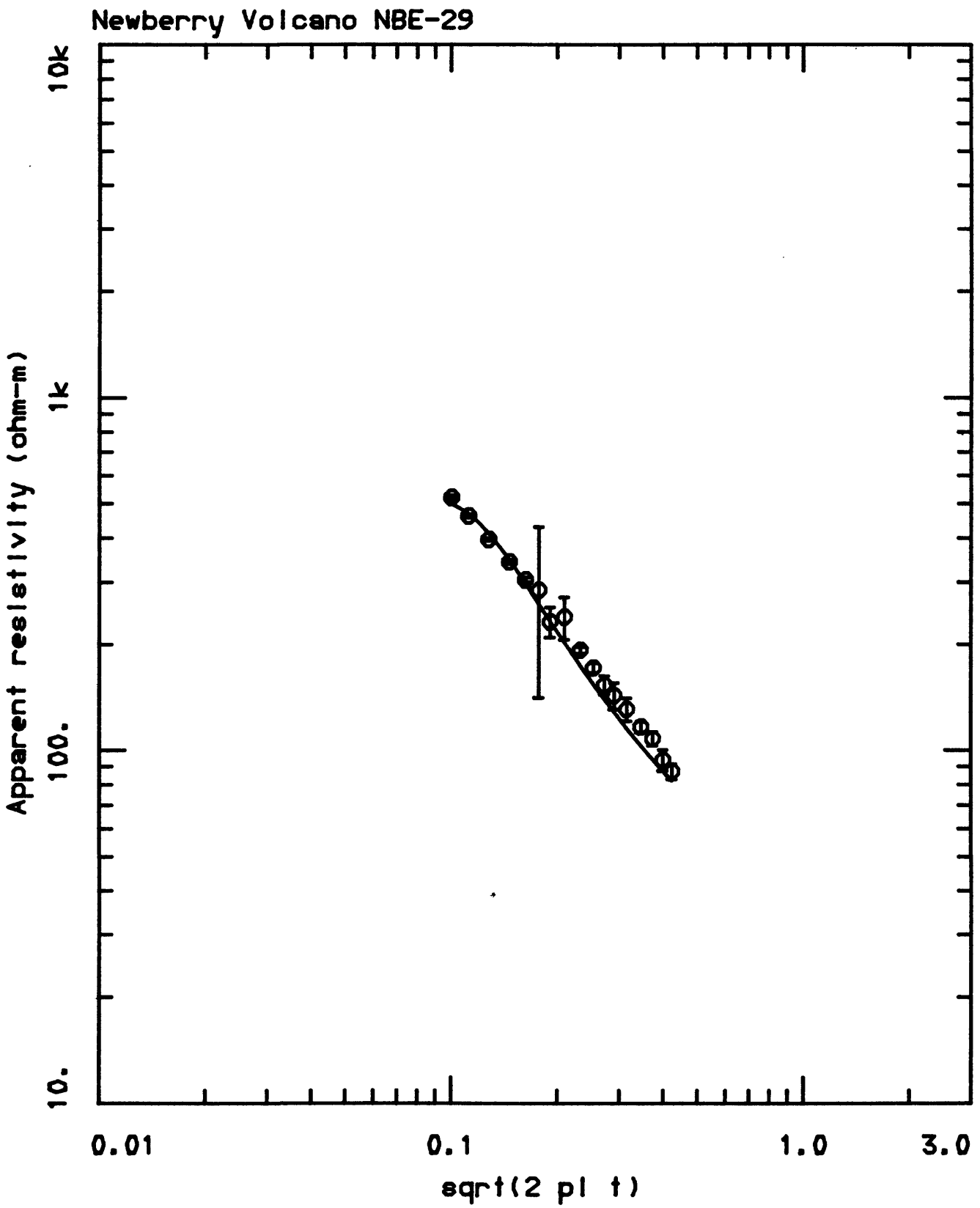

Newberry Volcano NBE-29
Apparent resistivity (ohm-m)
10k
1k
100.
10.
0.01
0.1
1.0
3.0
sqrt(2 pi t)

Figure 12c

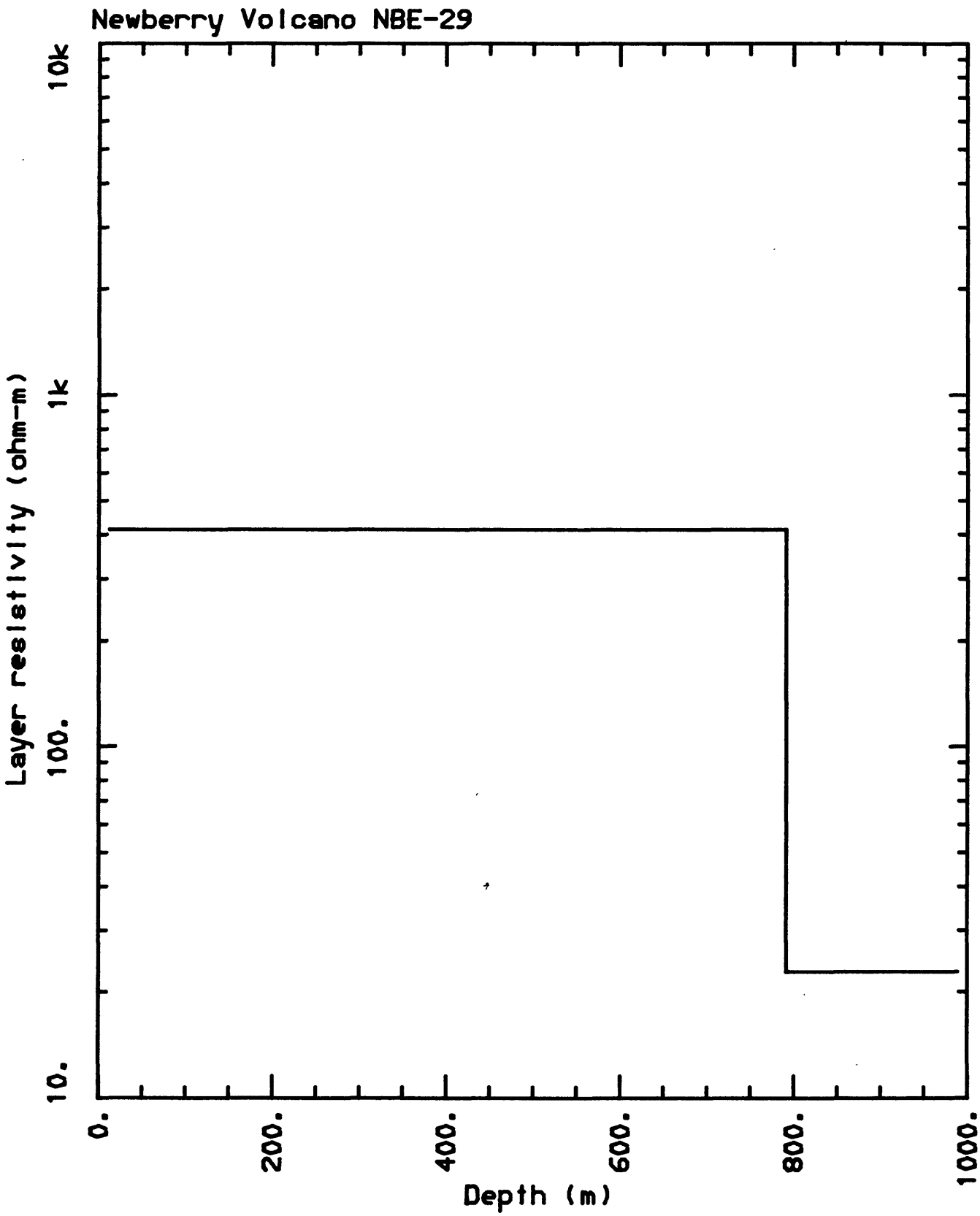

Newberry Volcano NBE-29
Layer resistivity (ohm-m)
10k
1k
100.
10.
0.
200.
400.
600.
800.
1000.
Depth (m)

Figure 13a

<NLSTCI>: Newberry Volcano NBE-30
LOOP RADIUS= 172.0

I	TIME(s)	OBSERVED RESISTIVITY	STANDARD DEVIATION	COMPUTED RESISTIVITY	PERCENT ERROR
1	0.0016000	476.1	2.0	437.8	8.8
2	0.0020000	433.5	4.6	432.2	0.3
3	0.0026000	384.1	4.8	411.5	-6.7
4	0.0034000	340.3	4.2	365.8	-7.0
5	0.0042000	304.4	3.3	324.4	-6.2
6	0.0050000	278.9	26.9	288.2	-3.2
7	0.0058000	254.7	14.9	259.3	-1.8
8	0.0070000	223.0	5.8	228.7	-2.5
9	0.0086000	201.8	5.9	199.0	1.4
10	0.0102000	179.4	5.7	176.7	1.5
11	0.0118000	167.2	4.4	160.6	4.1
12	0.0134000	155.9	7.4	148.6	4.9
13	0.0158000	143.0	6.1	134.1	6.6
14	0.0190000	125.4	4.3	119.7	4.8
15	0.0222000	115.9	9.0	109.3	6.0
16	0.0254000	98.0	0.6	101.5	-3.4
17	0.0286000	96.3	1.9	95.3	1.1

RMS ERROR= 16.25 X-CONVERGENCE

CORRELATION MATRIX

	1	2	3
1	1.000		
2	0.281	1.000	
3	0.162	0.476	1.000

	PARAMETER ESTIMATE	STANDARD ERROR	RELATIVE ERROR	PERCENT ERROR
1	0.2704E-02	0.5341E-04	0.1975E-01	2.0
2	0.3716E-01	0.8861E-03	0.2385E-01	2.4
3	0.8678E+03	0.7882E-02	0.9083E-05	0.0

FINAL INVERSION MODEL

LAYER	RESISTIVITY	P	F	CONDUCTIVITY	P	F	THICKNESS	DEPTH
1	369.8	1		0.27038516E-02	3		867.8	0.0
2	26.9	2		0.37156533E-01				867.8

P - parameter number
F - * indicates fixed parameter

Figure 13b

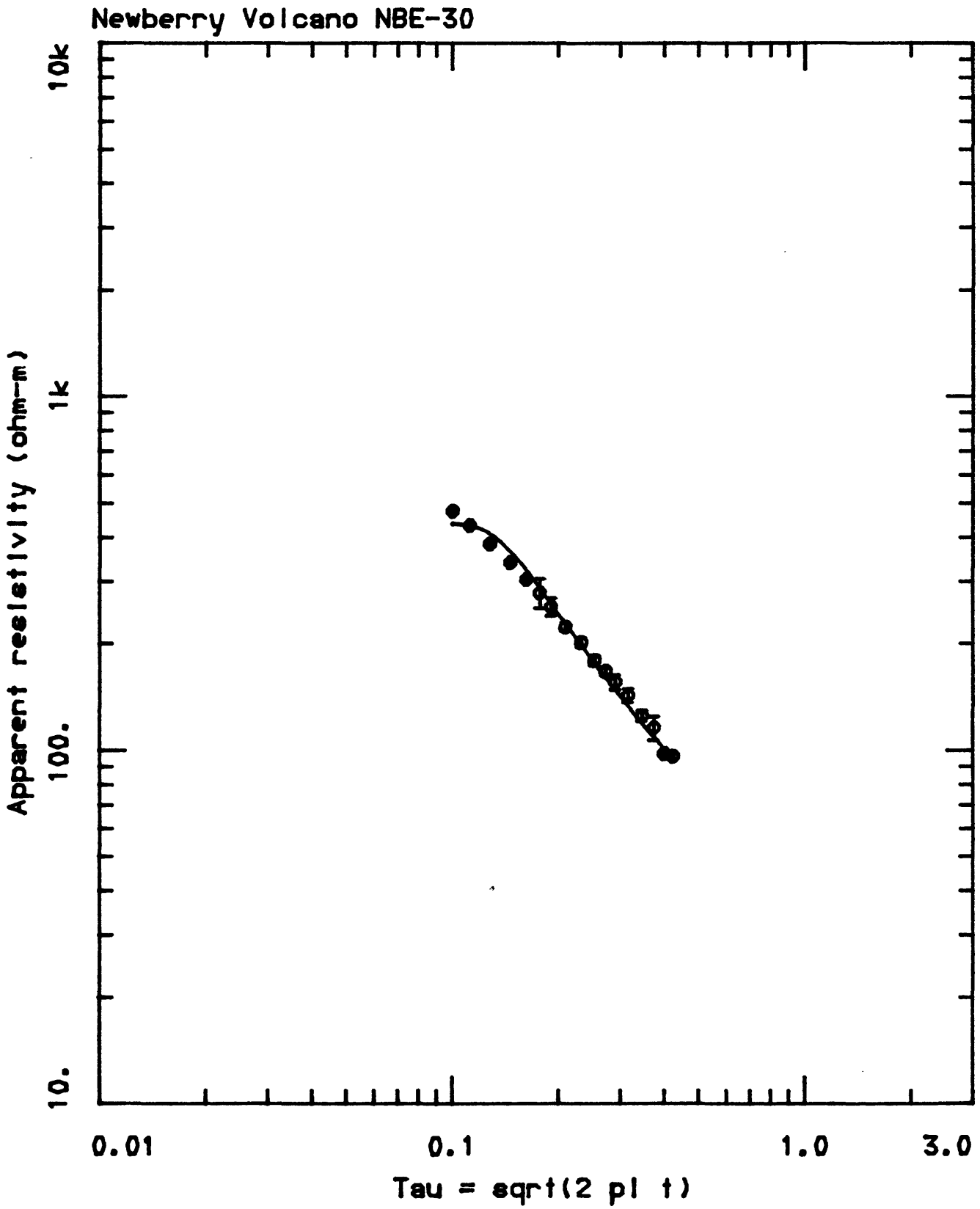

Newberry Volcano NBE-30
Apparent resistivity (ohm-m)
10k
1k
100.
10.
0.01
0.1
1.0
3.0
Tau = sqrt(2 pi t)

Figure 13c

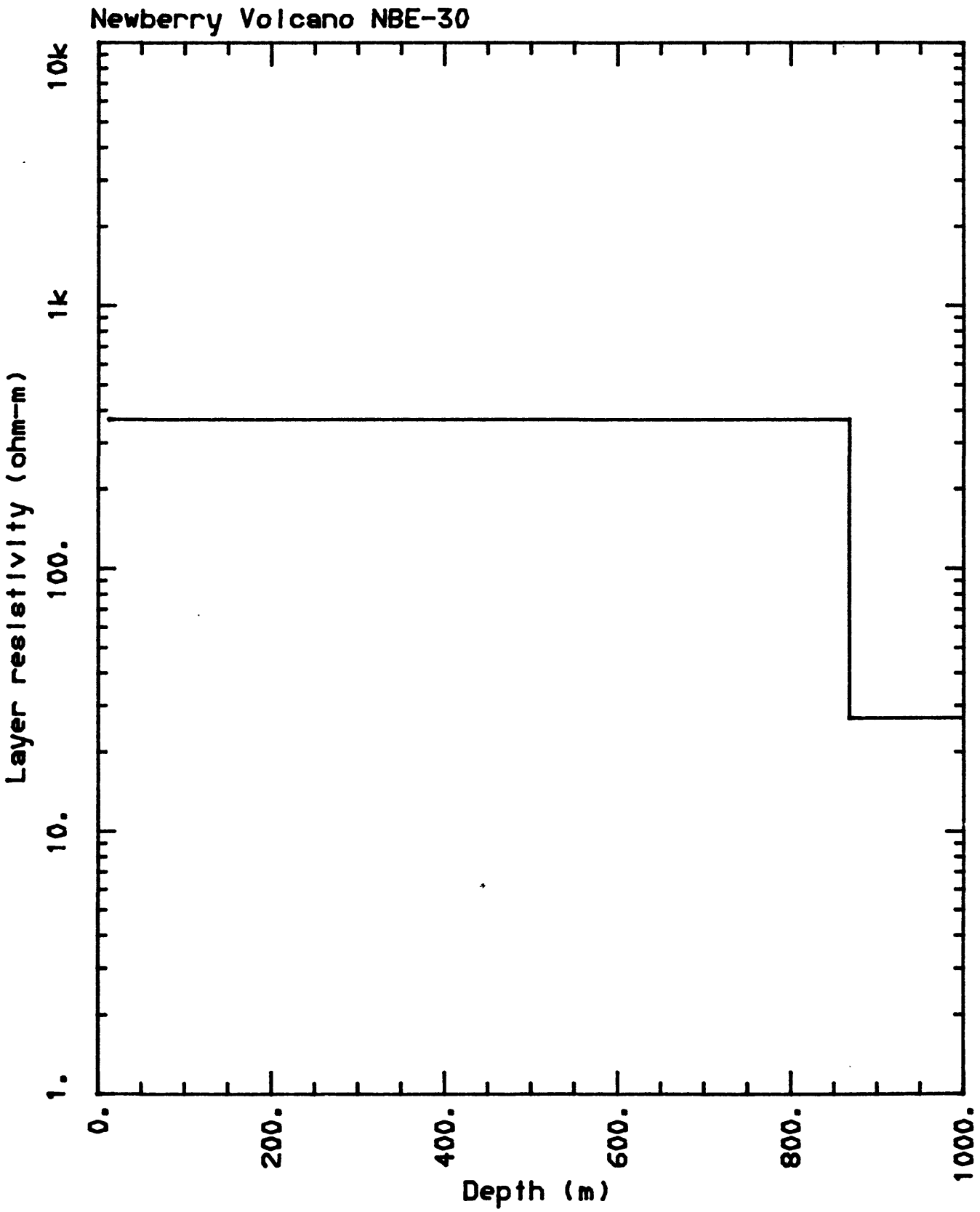

Newberry Volcano NBE-30
Layer resistivity (ohm-m)
10k
1k
100.
10.
1.
0.
200.
400.
600.
800.
1000.
Depth (m)

Figure 14a

<NLSTC1>: Newberry Volcano NBE-31
LOOP RADIUS= 172.0

I	TIME(s)	OBSERVED RESISTIVITY	STANDARD DEVIATION	COMPUTED RESISTIVITY	PERCENT ERROR
1	0.0016000	426.3	1.4	420.5	1.4
2	0.0020000	373.0	1.9	370.0	0.8
3	0.0026000	318.8	0.6	319.8	-0.3
4	0.0034000	276.6	1.8	273.8	1.0
5	0.0042000	246.0	2.7	242.8	1.3
6	0.0050000	229.2	28.0	222.2	3.2
7	0.0058000	201.2	14.5	205.7	-2.2
8	0.0070000	184.3	2.1	186.8	-1.4
9	0.0086000	167.6	2.2	169.7	-1.2
10	0.0102000	155.4	3.3	157.4	-1.3
11	0.0118000	153.0	5.3	148.0	3.4
12	0.0134000	145.6	1.7	140.6	3.5
13	0.0158000	129.5	3.0	132.1	-2.0
14	0.0190000	113.8	3.8	123.8	-8.1
15	0.0222000	100.1	5.4	117.6	-14.9
16	0.0254000	92.5	5.9	112.5	-17.8
17	0.0286000	96.0	5.2	108.4	-11.4

RMS ERROR= 9.113 X-CONVERGENCE

CORRELATION MATRIX

	2	3	5
2	1.000		
3	-0.209	1.000	
5	0.342	-0.301	1.000

	PARAMETER ESTIMATE	STANDARD ERROR	RELATIVE ERROR	PERCENT ERROR
2	0.2482E-02	0.8234E-04	0.3317E-01	3.3
3	0.1757E-01	0.2441E-03	0.1390E-01	1.4
5	0.5207E+03	0.9011E-03	0.1730E-05	0.0

FINAL INVERSION MODEL

LAYER	RESISTIVITY	P	F	CONDUCTIVITY	P	F	THICKNESS	DEPTH
1	1015.2	1	*	0.98500005E-03	4	*	100.0	0.0
2	402.9	2		0.24823032E-02	5		520.7	100.0
3	56.9	3		0.17567847E-01				620.7

P - parameter number
F - * indicates fixed parameter

Figure 14b

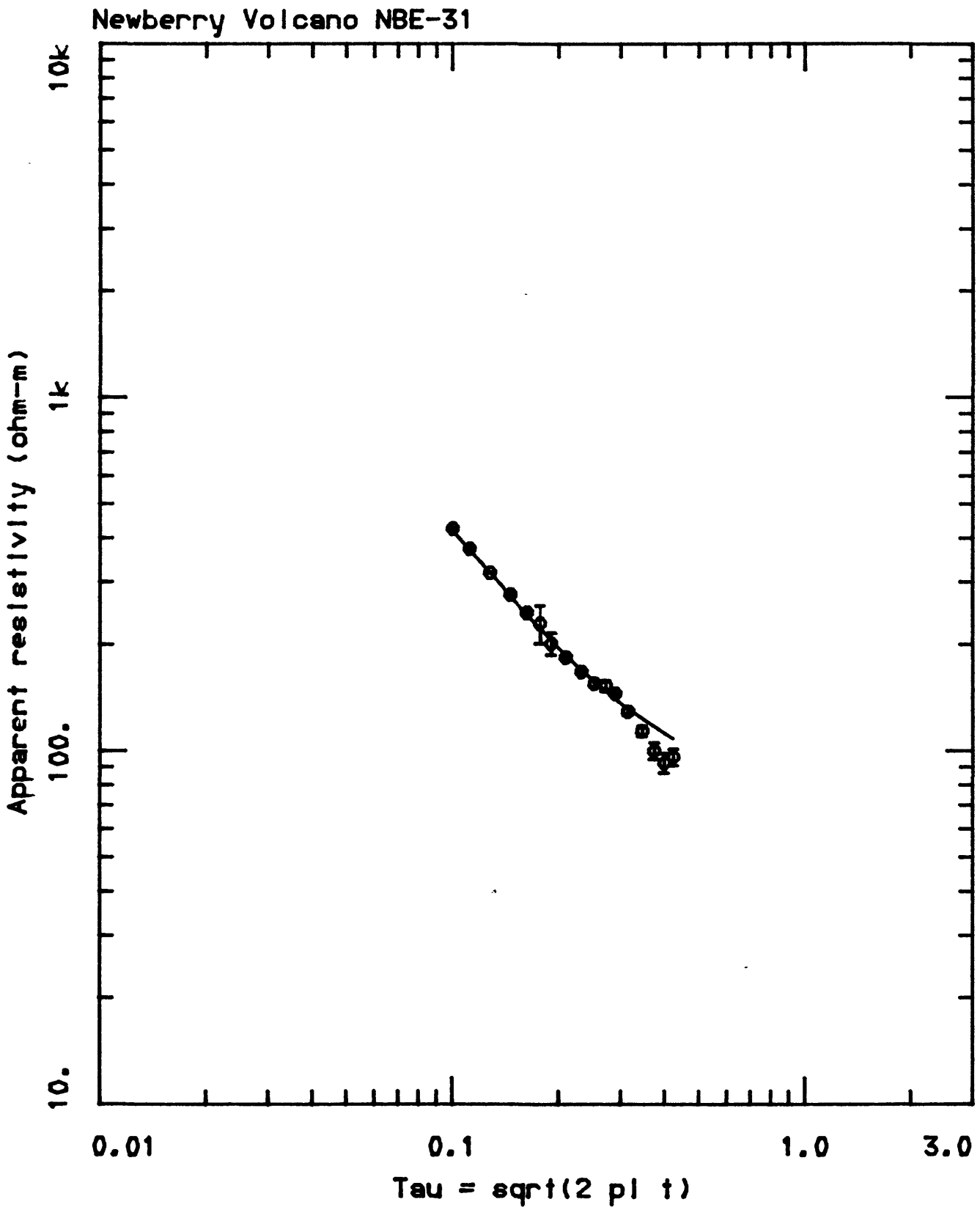

Newberry Volcano NBE-31
10k
1k
100.
10.
Apparent resistivity (ohm-m)
0.01
0.1
1.0
3.0
Tau = sqrt(2 pi t)

Figure 14c

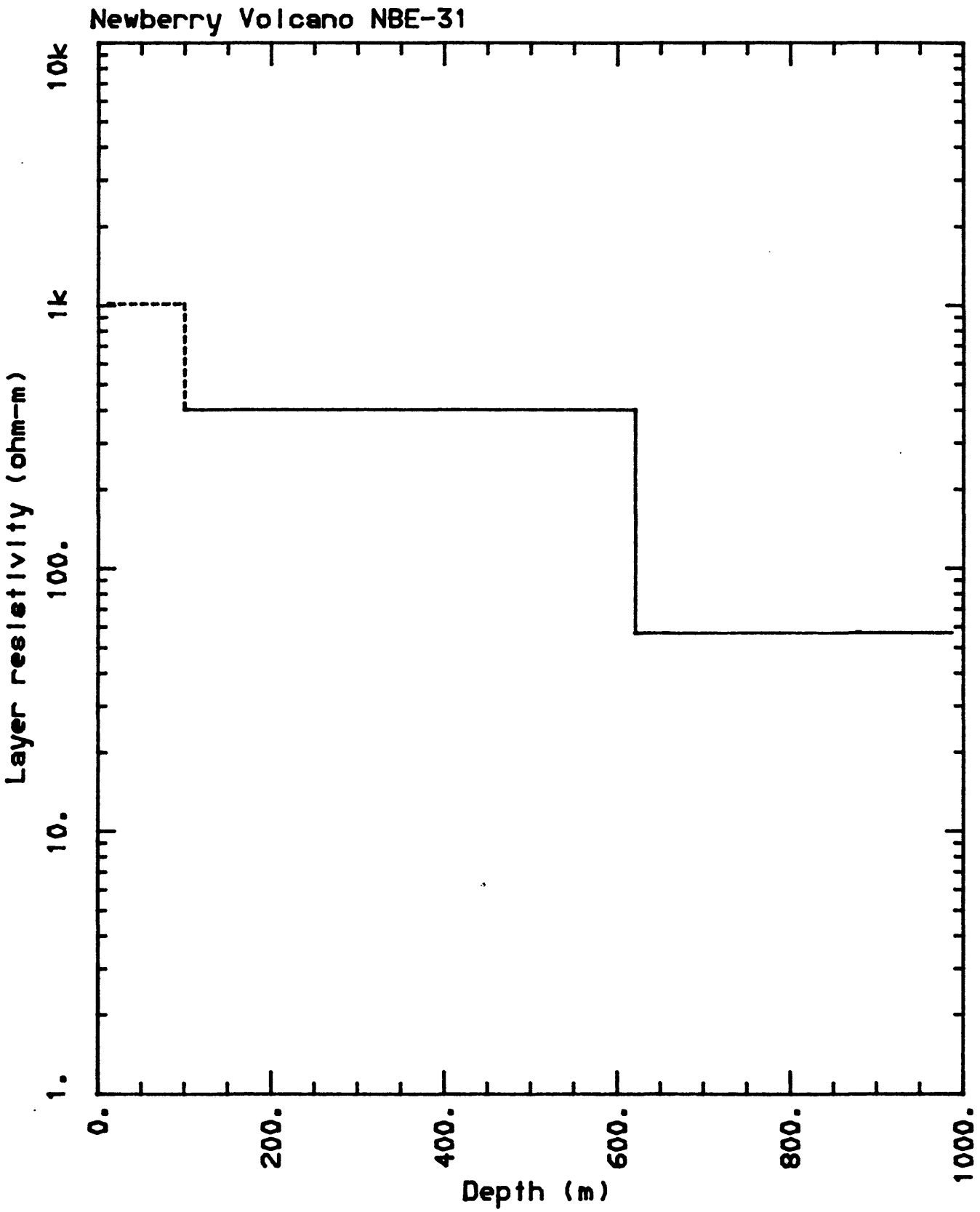

Newberry Volcano NBE-31
Layer resistivity (ohm-m)
10k
1k
100.
10.
1.
0.
200.
400.
600.
800.
1000.
Depth (m)

Figure 15a

<NLSTCI>: Newberry Volcano NBE-32
LOOP RADIUS= 172.0

I	TIME(s)	OBSERVED RESISTIVITY	STANDARD DEVIATION	COMPUTED RESISTIVITY	PERCENT ERROR
1	0.0016000	523.9	3.4	513.2	2.1
2	0.0020000	466.0	7.4	476.0	-2.1
3	0.0026000	399.0	6.9	417.3	-4.4
4	0.0034000	346.4	5.4	357.3	-3.0
5	0.0042000	308.2	10.3	310.3	-0.7
6	0.0050000	278.1	35.7	275.8	0.8
7	0.0058000	259.3	10.6	251.7	3.0
8	0.0070000	226.8	9.2	223.8	1.3
9	0.0086000	201.6	10.1	196.3	2.7
10	0.0102000	178.9	9.9	177.7	0.7
11	0.0118000	165.1	12.9	163.9	0.7
12	0.0134000	151.3	11.8	152.6	-0.9
13	0.0158000	134.5	8.7	139.8	-3.8
14	0.0190000	121.3	4.8	127.4	-4.8
15	0.0222000	115.0	9.6	118.4	-2.8
16	0.0254000	112.7	9.3	111.3	1.2
17	0.0286000	106.1	14.6	105.8	0.2

RMS ERROR= 7.813 X-CONVERGENCE

CORRELATION MATRIX

	1	2	3
1	1.000		
2	0.616	1.000	
3	0.379	0.733	1.000

	PARAMETER ESTIMATE	STANDARD ERROR	RELATIVE ERROR	PERCENT ERROR
1	0.2192E-02	0.3582E-04	0.1634E-01	1.6
2	0.2526E-01	0.6069E-03	0.2403E-01	2.4
3	0.7932E+03	0.6278E-02	0.7915E-05	0.0

FINAL INVERSION MODEL

LAYER	RESISTIVITY	P	F	CONDUCTIVITY	P	F	THICKNESS	DEPTH
1	456.2	1		0.21921159E-02	3		793.2	0.0
2	39.6	2		0.25256963E-01				793.2

P - parameter number
F - * indicates fixed parameter

Figure 15b

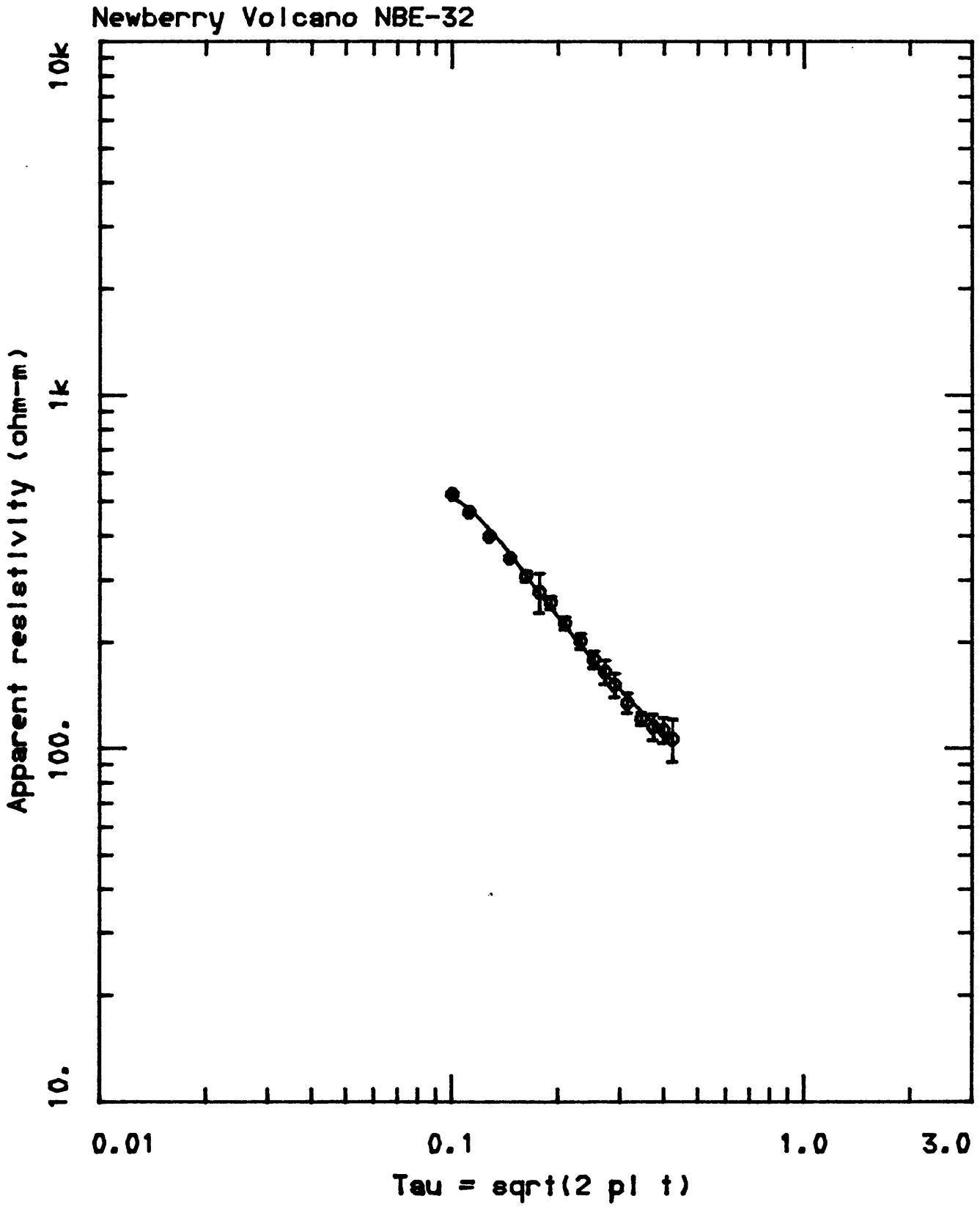

Newberry Volcano NBE-32
Apparent resistivity (ohm-m)
10k
1k
100.
10.
0.01
0.1
1.0
3.0
Tau = sqrt(2 pi t)

Figure 15c

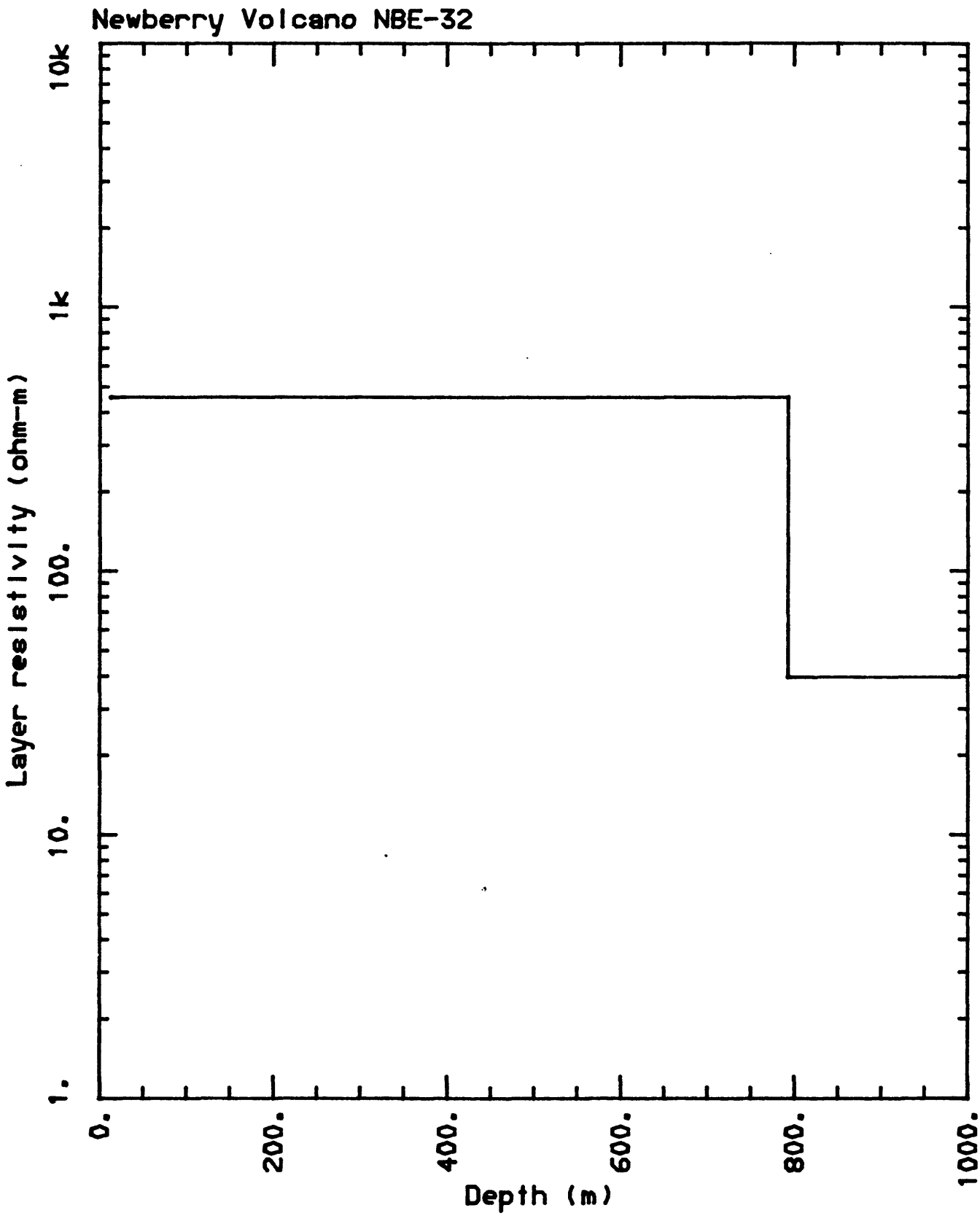

Newberry Volcano NBE-32
Layer resistivity (ohm-m)
10k
1k
100.
10.
1.
0.
200.
400.
600.
800.
1000.
Depth (m)

Figure 16a

<NLSTCI>: Newberry Volcano NBE-33
LOOP RADIUS= 172.0

I	TIME(s)	OBSERVED RESISTIVITY	STANDARD DEVIATION	COMPUTED RESISTIVITY	PERCENT ERROR
1	0.0016000	588.1	2.8	594.4	-1.1
2	0.0020000	497.3	3.6	499.5	-0.4
3	0.0026000	412.7	1.5	410.0	0.6
4	0.0034000	342.1	1.7	338.5	1.1
5	0.0042000	298.6	1.7	293.7	1.7
6	0.0050000	266.8	5.9	262.5	1.7
7	0.0058000	240.7	4.9	239.5	0.5
8	0.0070000	209.9	2.4	214.4	-2.1
9	0.0086000	191.6	2.0	191.6	0.0
10	0.0102000	174.3	6.6	175.4	-0.6
11	0.0118000	173.4	6.9	163.3	6.2
12	0.0134000	158.1	10.4	153.8	2.8
13	0.0158000	141.2	3.8	142.9	-1.2
14	0.0190000	125.6	4.0	131.9	-4.8
15	0.0222000	108.5	3.8	124.1	-12.6
16	0.0254000	103.8	5.6	118.1	-12.1
17	0.0286000	107.4	11.1	113.2	-5.1

RMS ERROR= 7.445 VARIABILITY CONVERGENCE

CORRELATION MATRIX

	1	2	3
1	1.000		
2	-0.029	1.000	
3	-0.216	-0.228	1.000

	PARAMETER ESTIMATE	STANDARD ERROR	RELATIVE ERROR	PERCENT ERROR
1	0.7330E-03	0.9701E-05	0.1324E-01	1.3
2	0.1871E-01	0.3472E-03	0.1856E-01	1.9
3	0.6481E+03	0.6665E-03	0.1028E-05	0.0

FINAL INVERSION MODEL

LAYER	RESISTIVITY	P	F	CONDUCTIVITY	P	F	THICKNESS	DEPTH
1	1364.3	1		0.73295023E-03	3		648.1	0.0
2	53.4	2		0.18710205E-01				648.1

P - parameter number
F - * indicates fixed parameter

Figure 16b

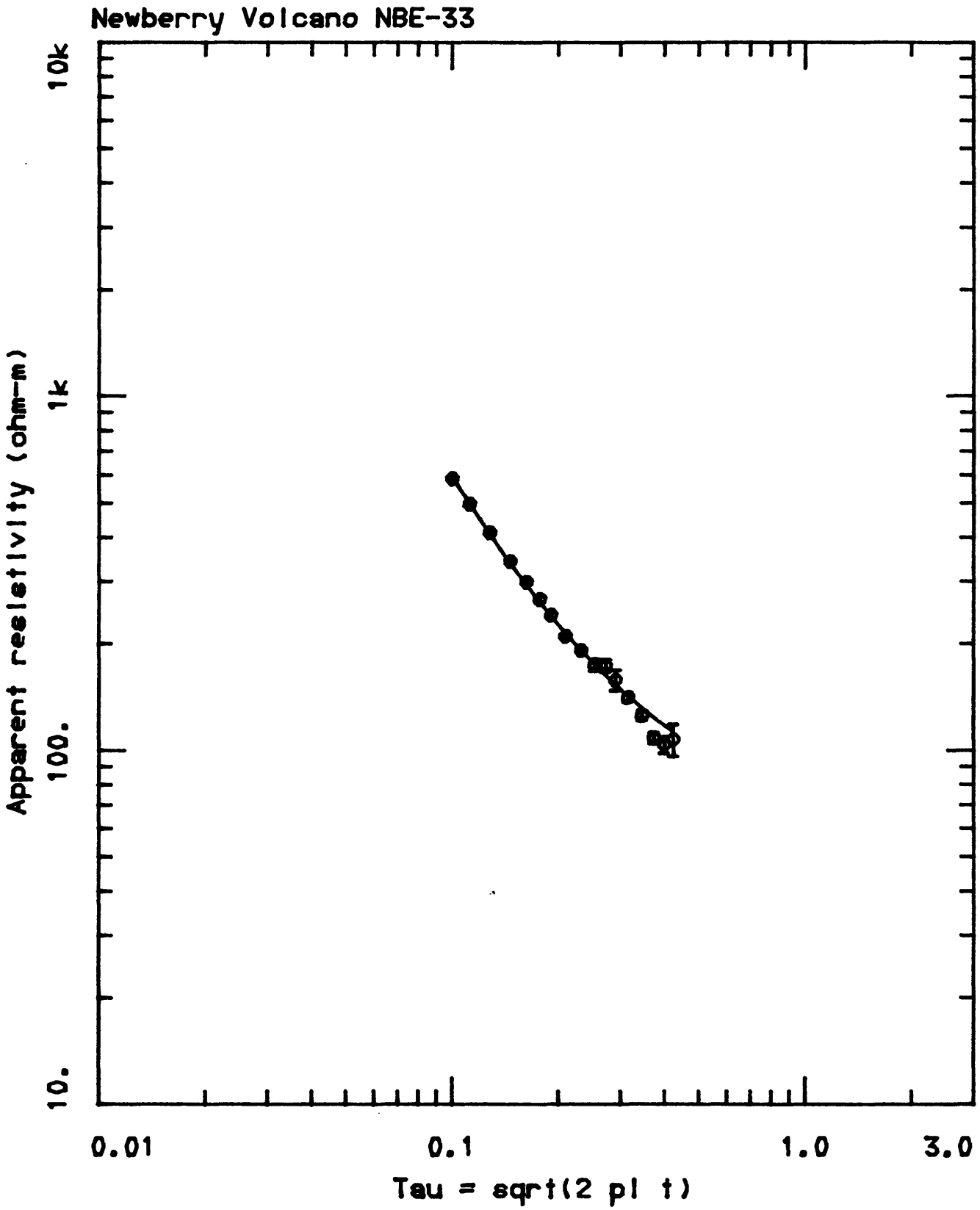

Newberry Volcano NBE-33
Apparent resistivity (ohm-m)
10k
1k
100.
10.
0.01
0.1
1.0
3.0
Tau = sqrt(2 pi t)

Figure 16c

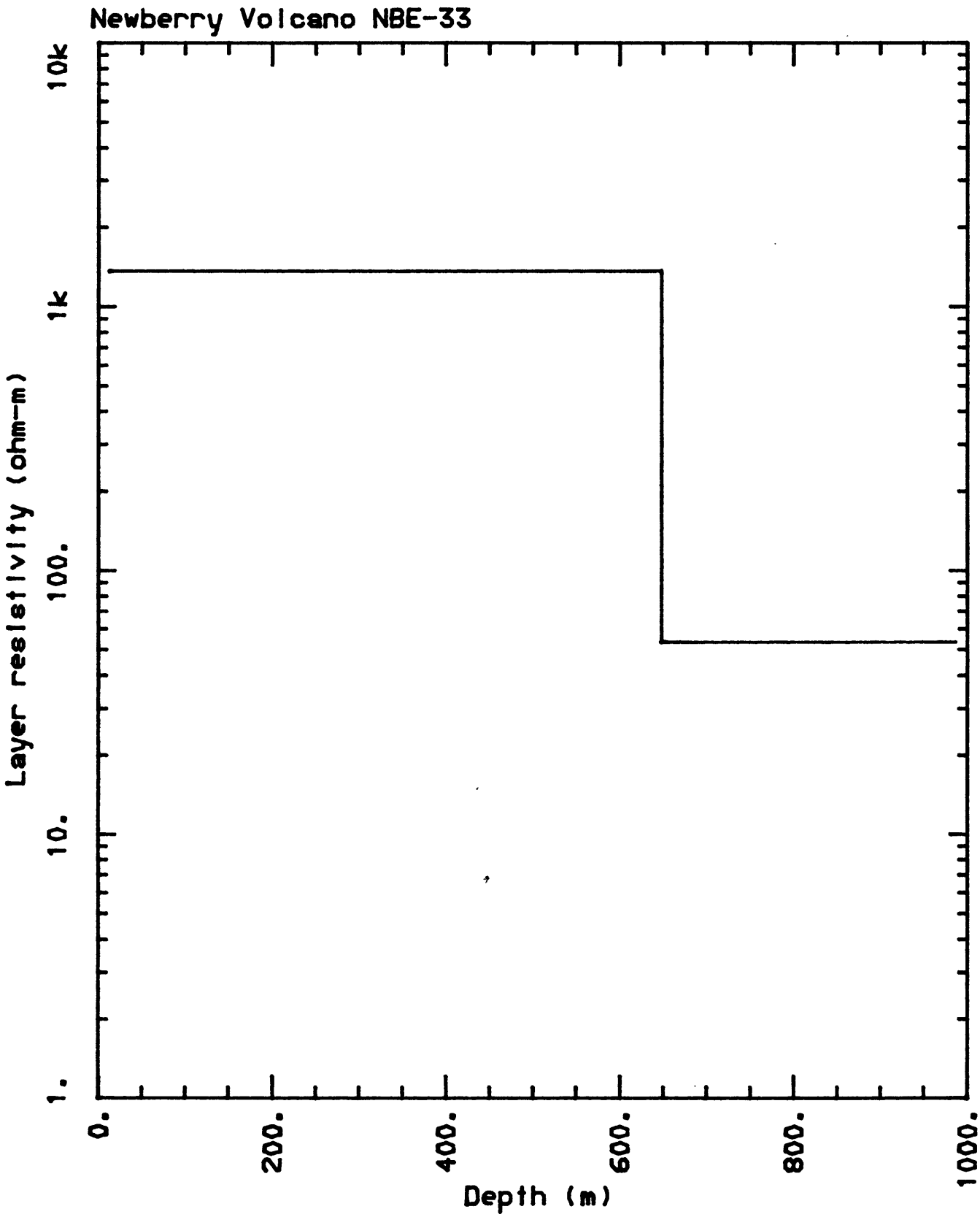

Newberry Volcano NBE-33
Layer resistivity (ohm-m)
10k
1k
100.
10.
1.
0.
200.
400.
600.
800.
1000.
Depth (m)

Figure 17a

<NLSTCI>: Newberry Volcano NBE-34
LOOP RADIUS= 172.0

I	TIME(s)	OBSERVED RESISTIVITY	STANDARD DEVIATION	COMPUTED RESISTIVITY	PERCENT ERROR
1	0.0016000	347.7	1.2	345.3	0.7
2	0.0020000	307.1	1.9	309.7	-0.9
3	0.0026000	265.1	1.1	267.5	-0.9
4	0.0034000	228.6	1.0	229.9	-0.5
5	0.0042000	205.5	0.8	203.2	1.1
6	0.0050000	188.5	12.7	183.1	3.0
7	0.0058000	172.4	5.9	168.8	2.1
8	0.0070000	154.2	2.7	152.9	0.9
9	0.0086000	138.0	4.7	137.2	0.6
10	0.0102000	126.6	4.3	126.1	0.4
11	0.0118000	113.1	3.1	117.9	-4.1
12	0.0134000	105.5	2.4	111.3	-5.2
13	0.0158000	98.8	2.0	103.8	-4.8
14	0.0190000	90.4	3.3	96.3	-6.1
15	0.0222000	85.5	5.6	90.8	-5.8
16	0.0254000	84.8	6.7	86.5	-2.0
17	0.0286000	79.3	2.0	83.0	-4.5

RMS ERROR= 4.052 X-CONVERGENCE

CORRELATION MATRIX

	2	3	5
2	1.000		
3	0.385	1.000	
5	0.481	0.717	1.000

	PARAMETER ESTIMATE	STANDARD ERROR	RELATIVE ERROR	PERCENT ERROR
2	0.3430E-02	0.8874E-04	0.2587E-01	2.6
3	0.2546E-01	0.3837E-03	0.1507E-01	1.5
5	0.5133E+03	0.1213E-02	0.2363E-05	0.0

FINAL INVERSION MODEL

LAYER	RESISTIVITY	P	F	CONDUCTIVITY	P	F	THICKNESS	DEPTH
1	775.2	1	*	0.12900000E-02	4	*	90.0	0.0
2	291.5	2		0.34304564E-02	5		513.3	90.0
3	39.3	3		0.25457317E-01				603.3

P - parameter number
F - * indicates fixed parameter

Figure 17b

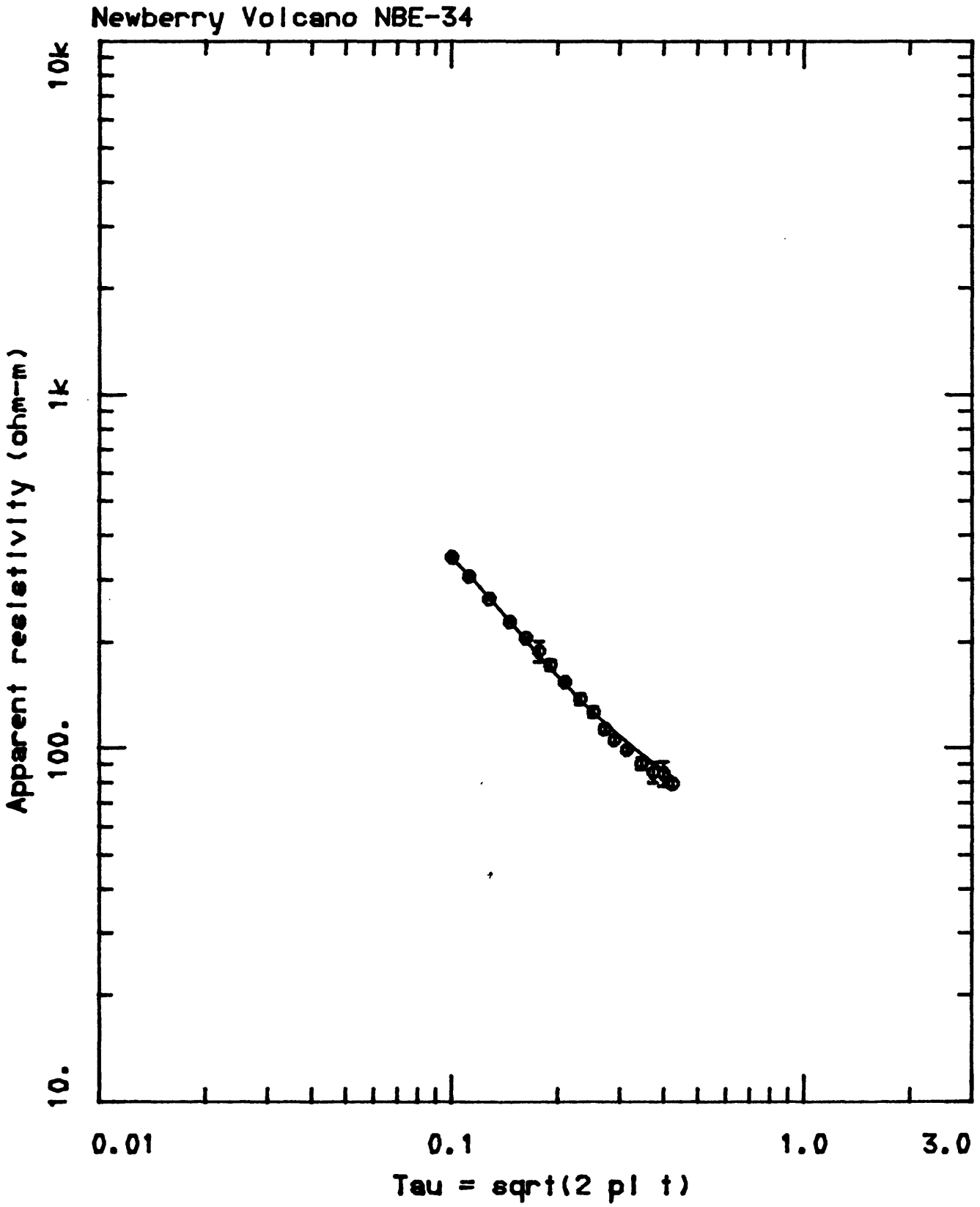

Newberry Volcano NBE-34
10k
1k
100.
10.
Apparent resistivity (ohm-m)
0.01
0.1
1.0
3.0
Tau = sqrt(2 pi t)

Figure 17c

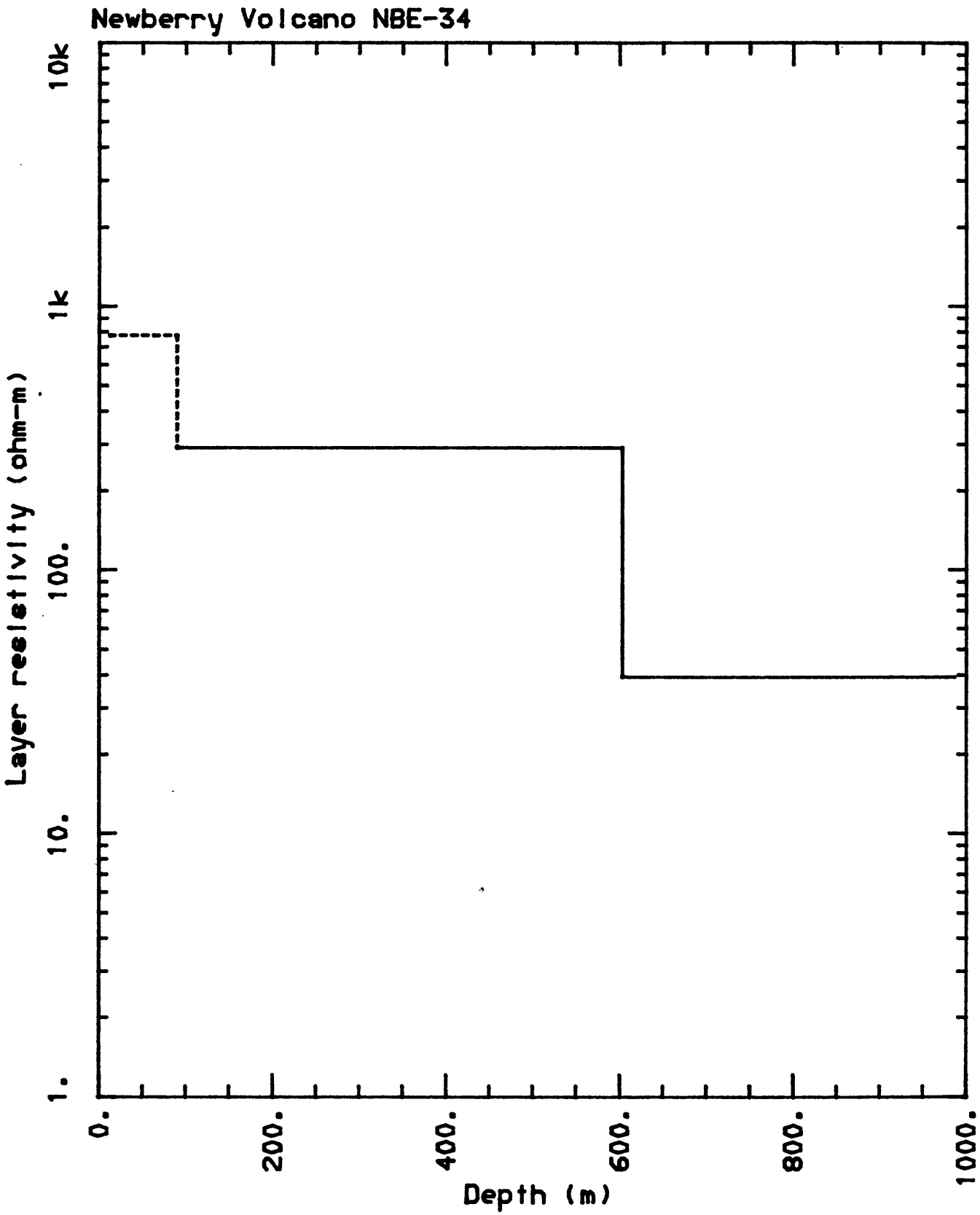

Newberry Volcano NBE-34
Layer resistivity (ohm-m)
10k
1k
100.
10.
1.
0.
200.
400.
600.
800.
1000.
Depth (m)

Figure 18a

<NLSTCI>: Newberry Volcano NBE-35
LOOP RADIUS= 172.0

I	TIME(s)	OBSERVED RESISTIVITY	STANDARD DEVIATION	COMPUTED RESISTIVITY	PERCENT ERROR
1	0.0016000	604.5	1.8	617.1	-2.0
2	0.0020000	518.0	4.3	524.1	-1.2
3	0.0026000	433.2	1.4	434.3	-0.3
4	0.0034000	373.9	2.7	362.8	3.1
5	0.0042000	330.1	5.2	317.4	4.0
6	0.0050000	301.6	23.2	285.7	5.6
7	0.0058000	285.5	11.7	262.2	8.9
8	0.0070000	254.4	11.7	236.8	7.4
9	0.0086000	230.3	5.7	213.2	8.0
10	0.0102000	211.8	1.8	196.4	7.8
11	0.0118000	207.9	17.3	183.9	13.1
12	0.0134000	192.6	14.7	174.1	10.6
13	0.0158000	174.9	8.2	162.8	7.5
14	0.0190000	160.1	5.9	151.1	5.9
15	0.0222000	137.0	8.7	142.6	-4.0
16	0.0254000	130.1	10.4	136.2	-4.5
17	0.0286000	120.4	10.6	130.8	-8.0

RMS ERROR= 15.68 VARIABILITY CONVERGENCE

CORRELATION MATRIX

	1	2	3
1	1.000		
2	-0.533	1.000	
3	-0.727	0.603	1.000

	PARAMETER ESTIMATE	STANDARD ERROR	RELATIVE ERROR	PERCENT ERROR
1	0.7022E-03	0.8988E-04	0.1280E+00	12.8
2	0.1499E-01	0.4855E-03	0.3238E-01	3.2
3	0.6537E+03	0.2675E-02	0.4092E-05	0.0

FINAL INVERSION MODEL

LAYER	RESISTIVITY	P	F	CONDUCTIVITY	P	F	THICKNESS	DEPTH
1	1424.1	1		0.70220424E-03	3		653.7	0.0
2	66.7	2		0.14993451E-01				653.7

P - parameter number
F - * indicates fixed parameter

Figure 18b

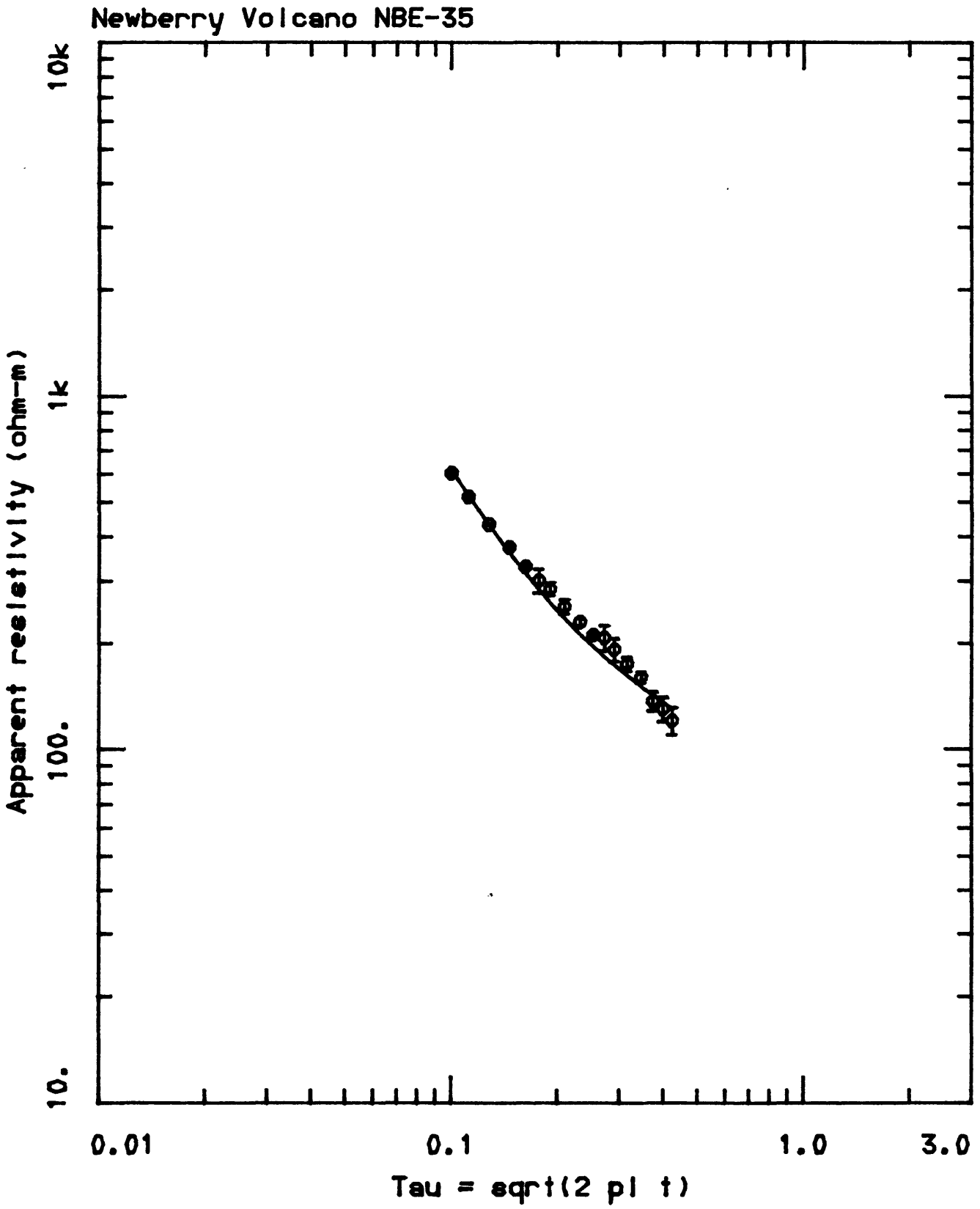

Newberry Volcano NBE-35
Apparent resistivity (ohm-m)
10k
1k
100.
10.
0.01
0.1
1.0
3.0
Tau = sqrt(2 pi t)

Figure 18c

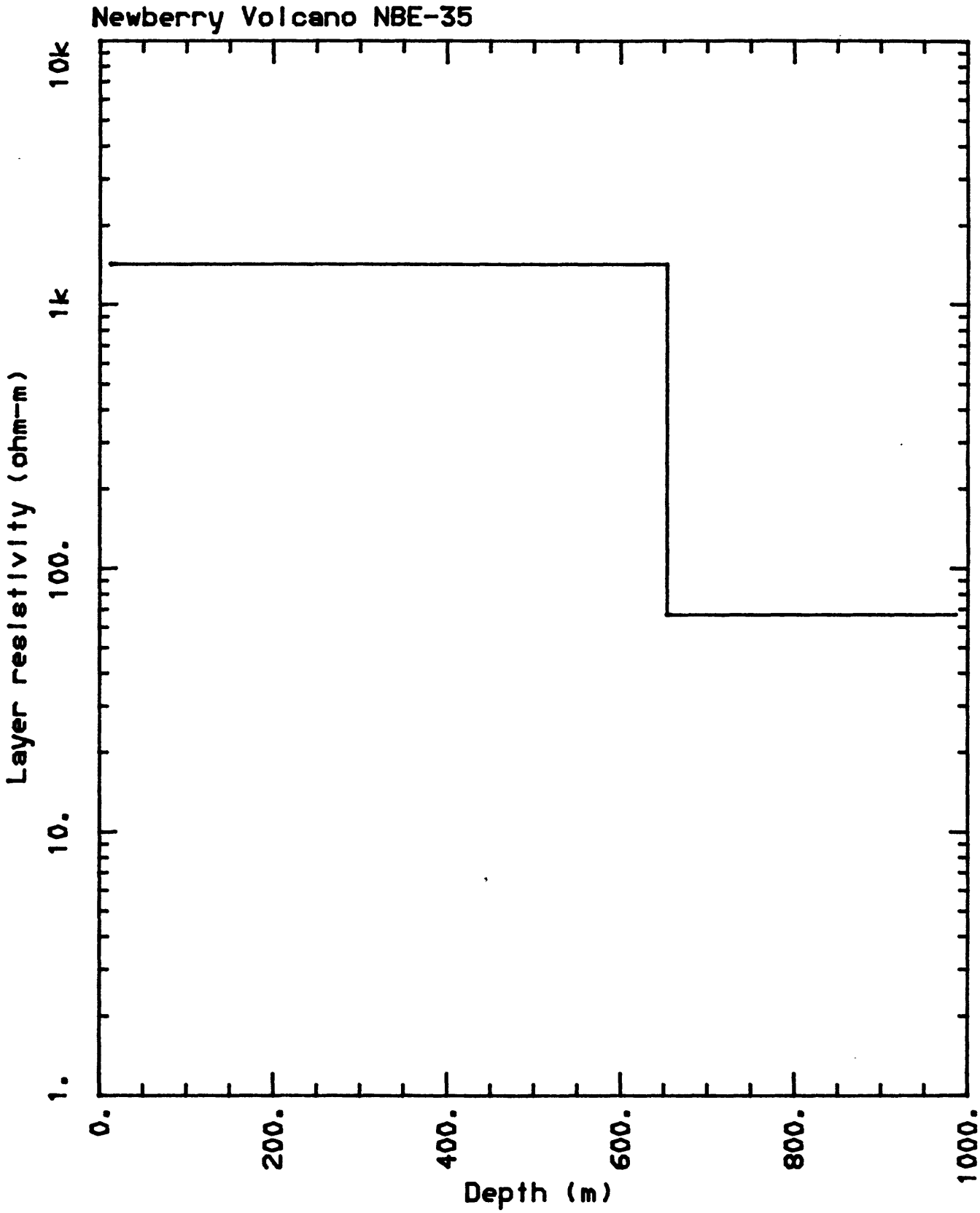

Newberry Volcano NBE-35
Layer resistivity (ohm-m)
10k
1k
100.
10.
1.
0.
200.
400.
600.
800.
1000.
Depth (m)

Figure 19a

<NLSTCI>: Newberry Volcano NBE-36
LOOP RADIUS= 172.0

I	TIME(s)	OBSERVED RESISTIVITY	STANDARD DEVIATION	COMPUTED RESISTIVITY	PERCENT ERROR
1	0.0016000	667.0	9.7	697.9	-4.4
2	0.0020000	564.6	2.9	576.7	-2.1
3	0.0026000	456.8	2.4	466.6	-2.1
4	0.0034000	381.4	3.9	379.8	0.4
5	0.0042000	333.5	20.0	326.2	2.2
6	0.0050000	290.2	21.1	289.0	0.4
7	0.0058000	273.1	4.8	262.1	4.2
8	0.0070000	234.2	1.3	232.9	0.6
9	0.0086000	213.6	2.2	206.0	3.7
10	0.0102000	198.8	4.8	187.2	6.2
11	0.0118000	186.4	1.1	173.1	7.7
12	0.0134000	177.0	5.1	162.1	9.2
13	0.0158000	152.2	2.4	149.4	1.9
14	0.0190000	135.2	0.6	136.9	-1.2
15	0.0222000	120.9	2.2	127.6	-5.2
16	0.0254000	109.0	2.6	120.3	-9.4
17	0.0286000	110.9	6.7	114.4	-3.1

RMS ERROR= 12.44 X-CONVERGENCE

CORRELATION MATRIX

	1	2	3
1	1.000		
2	-0.145	1.000	
3	0.250	-0.349	1.000

	PARAMETER ESTIMATE	STANDARD ERROR	RELATIVE ERROR	PERCENT ERROR
1	0.4449E-03	0.3395E-04	0.7632E-01	7.6
2	0.1950E-01	0.3188E-03	0.1635E-01	1.6
3	0.6921E+03	0.1692E-02	0.2445E-05	0.0

FINAL INVERSION MODEL

LAYER	RESISTIVITY	P	F	CONDUCTIVITY	P	F	THICKNESS	DEPTH
1	2247.8	1		0.44488852E-03	3		692.1	0.0
2	51.3	2		0.19498365E-01				692.1

P - parameter number
F - * indicates fixed parameter

Figure 19b

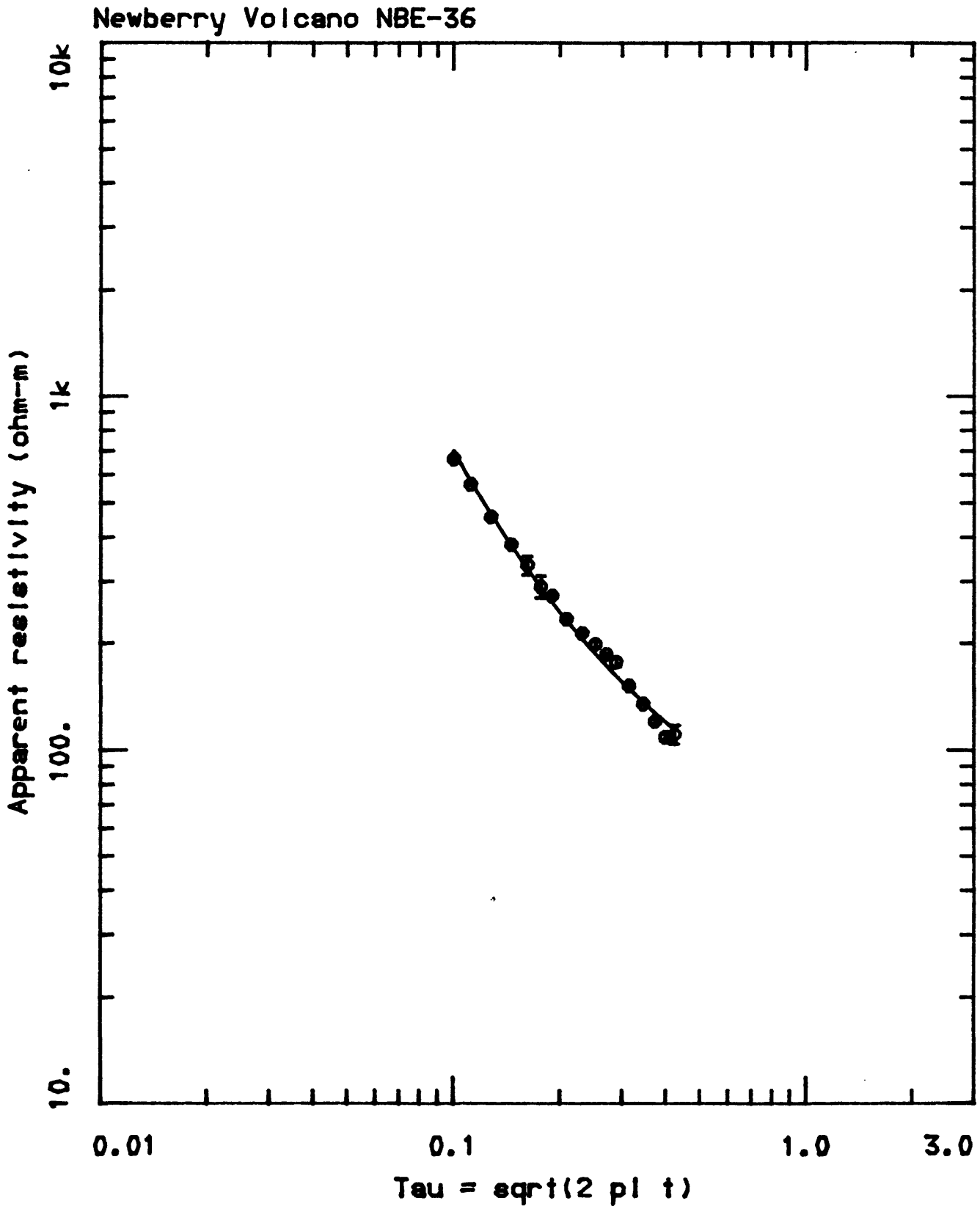

Newberry Volcano NBE-36
10k
1k
100.
10.
Apparent resistivity (ohm-m)
0.01
0.1
1.0
3.0
Tau = sqrt(2 pi t)

Figure 19c

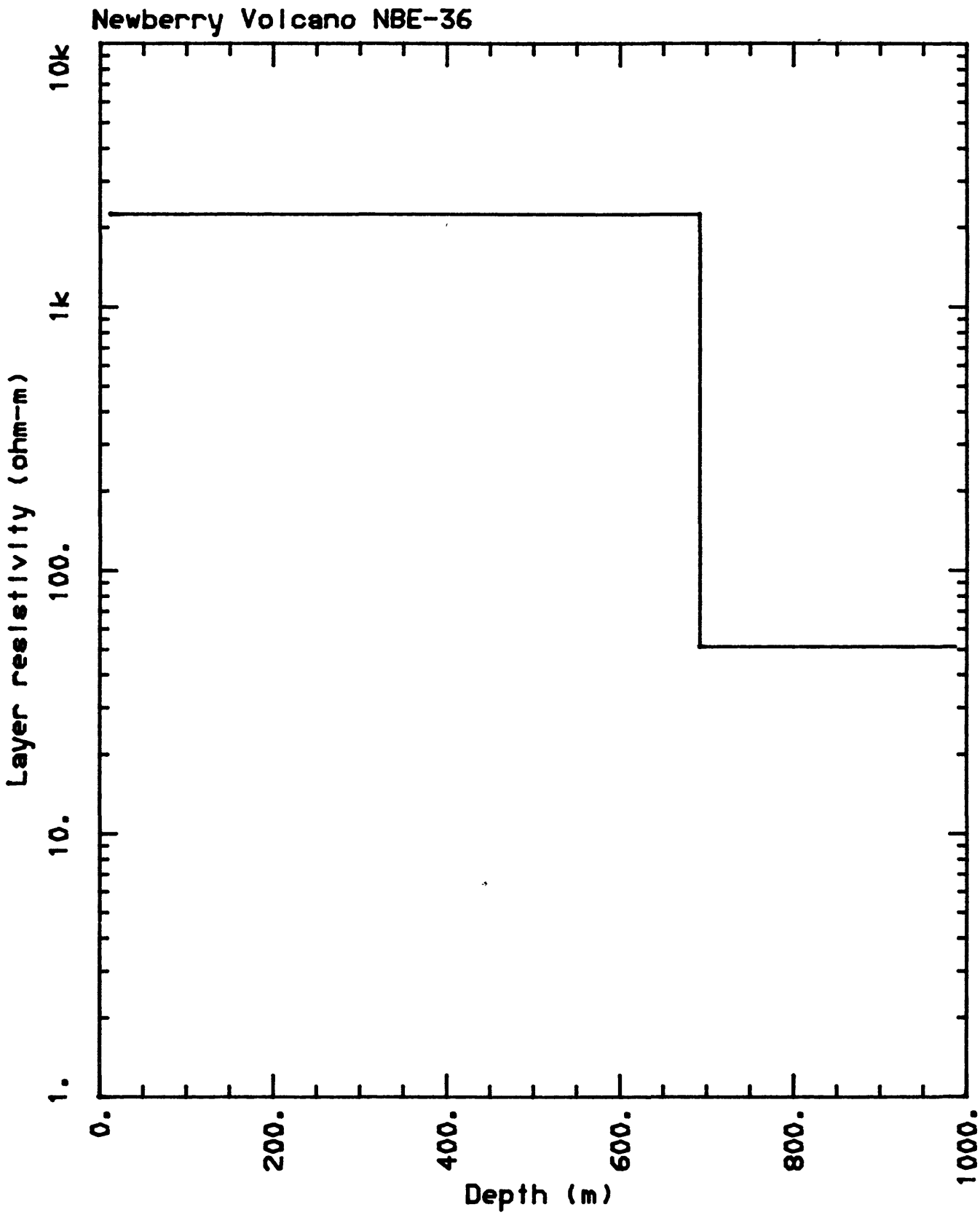

Newberry Volcano NBE-36
Layer resistivity (ohm-m)
10k
1k
100.
10.
1.
0.
200.
400.
600.
800.
1000.
Depth (m)

Figure 20a

<NLSTCI>: Newberry Volcano NBE-37
LOOP RADIUS= 172.0

I	TIME(s)	OBSERVED RESISTIVITY	STANDARD DEVIATION	COMPUTED RESISTIVITY	PERCENT ERROR
1	0.0016000	738.9	6.9	767.0	-3.7
2	0.0020000	606.1	4.1	616.9	-1.8
3	0.0026000	472.4	2.8	479.9	-1.6
4	0.0034000	379.9	5.0	375.6	1.1
5	0.0042000	318.0	10.0	312.0	1.9
6	0.0050000	279.1	8.4	269.3	3.6
7	0.0058000	246.0	1.7	238.5	3.2
8	0.0070000	217.0	1.8	205.4	5.6
9	0.0086000	183.2	5.4	175.7	4.3
10	0.0102000	163.4	7.6	155.3	5.2
11	0.0118000	150.2	9.3	140.2	7.1
12	0.0134000	136.8	11.0	128.6	6.4
13	0.0158000	122.9	3.2	115.5	6.4
14	0.0190000	109.8	5.4	102.9	6.8
15	0.0222000	103.2	7.5	93.5	10.3
16	0.0254000	94.9	2.9	86.3	10.0
17	0.0286000	83.4	5.4	80.4	3.8
18	0.0334000	76.2	8.3	73.4	3.8
19	0.0398000	70.1	10.1	66.2	5.9

RMS ERROR= 10.89 X-CONVERGENCE

CORRELATION MATRIX

	1	2	3
1	1.000		
2	0.090	1.000	
3	-0.829	-0.167	1.000

	PARAMETER ESTIMATE	STANDARD ERROR	RELATIVE ERROR	PERCENT ERROR
1	0.3674E-03	0.1351E-04	0.3678E-01	3.7
2	0.3824E-01	0.5269E-03	0.1378E-01	1.4
3	0.7260E+03	0.2827E-02	0.3894E-05	0.0

FINAL INVERSION MODEL

LAYER	RESISTIVITY	P	F	CONDUCTIVITY	P	F	THICKNESS	DEPTH
1	2721.9	1		0.36739412E-03	3		726.0	0.0
2	26.2	2		0.38237121E-01				726.0

P - parameter number
F - * indicates fixed parameter

Figure 20b

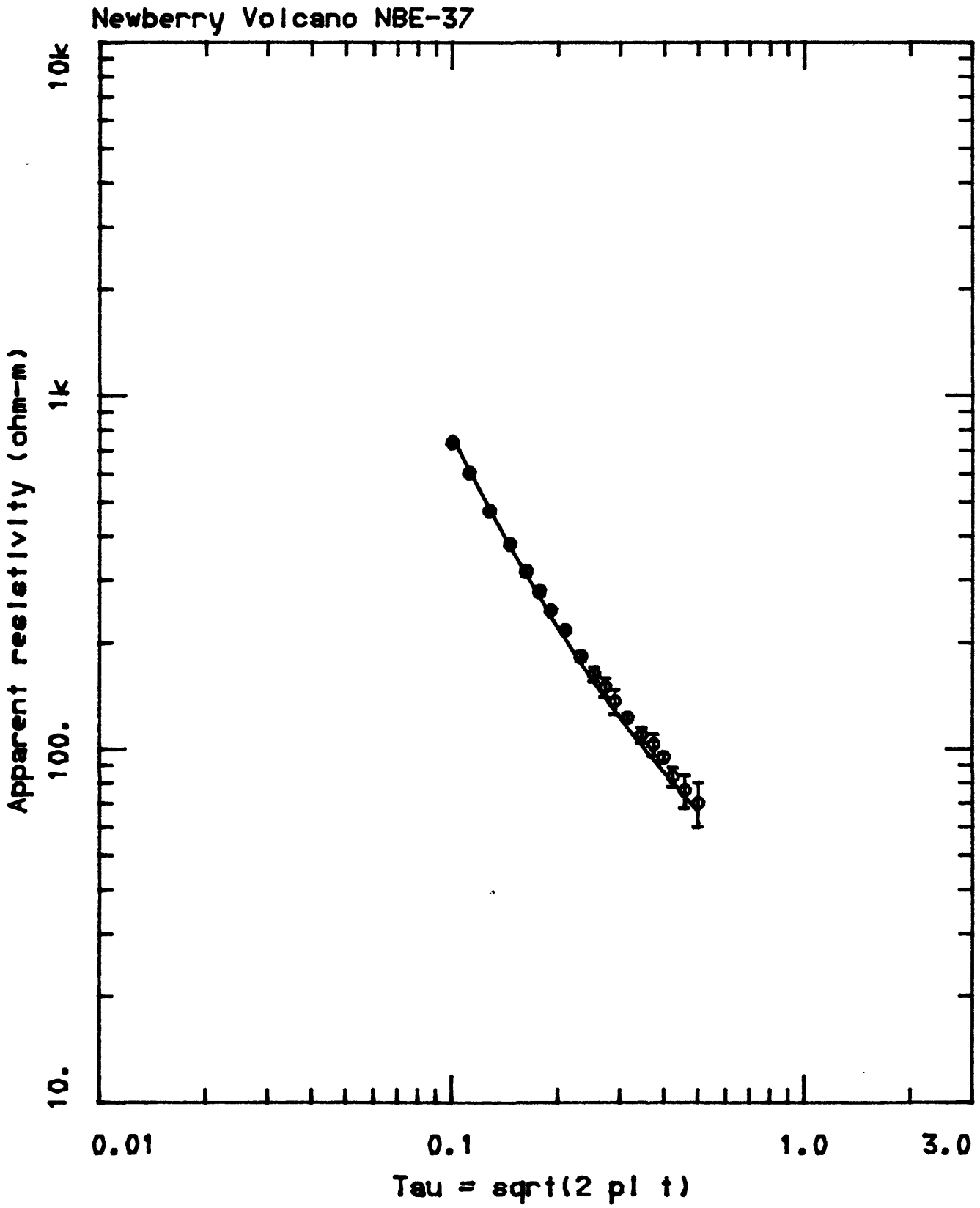

Newberry Volcano NBE-37
10k
1k
100.
10.
Apparent resistivity (ohm-m)
0.01
0.1
1.0
3.0
Tau = sqrt(2 pi t)

Figure 20c

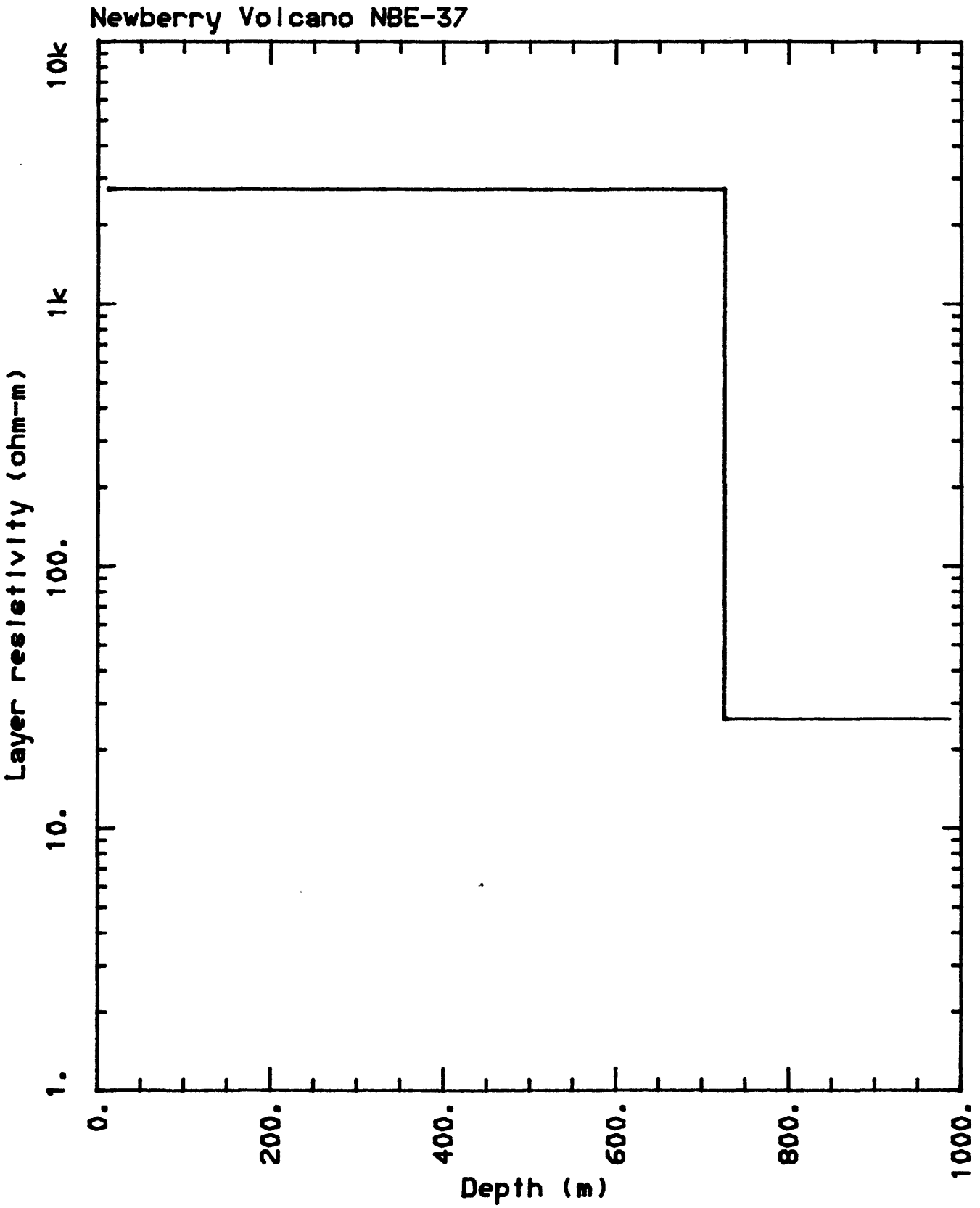

Newberry Volcano NBE-37
Layer resistivity (ohm-m)
10k
1k
100.
10.
1.
0.
200.
400.
600.
800.
1000.
Depth (m)

Figure 21a

<NLSTCI>: Newberry Volcano NBE-38
LOOP RADIUS= 172.0

I	TIME(s)	OBSERVED RESISTIVITY	STANDARD DEVIATION	COMPUTED RESISTIVITY	PERCENT ERROR
1	0.0016000	318.5	1.7	315.0	1.1
2	0.0020000	291.0	2.0	294.4	-1.2
3	0.0026000	251.5	2.5	264.0	-4.7
4	0.0034000	214.2	2.0	224.8	-4.7
5	0.0042000	189.4	2.5	195.4	-3.1
6	0.0050000	170.4	11.1	174.3	-2.2
7	0.0058000	147.2	8.4	157.9	-6.8
8	0.0070000	150.2	14.6	138.6	8.4
9	0.0086000	124.8	1.5	120.9	3.2
10	0.0102000	112.6	1.6	108.7	3.5
11	0.0118000	105.6	3.2	99.4	6.3
12	0.0134000	99.2	1.7	91.9	7.9
13	0.0158000	92.4	1.1	83.7	10.4
14	0.0190000	82.0	2.6	75.7	8.3
15	0.0222000	73.2	5.6	69.8	4.9
16	0.0254000	65.1	6.5	65.2	-0.2
17	0.0286000	64.5	8.6	61.6	4.8

RMS ERROR= 7.802 X-CONVERGENCE

CORRELATION MATRIX

	2	3	5
2	1.000		
3	-0.164	1.000	
5	0.240	0.049	1.000

	PARAMETER ESTIMATE	STANDARD ERROR	RELATIVE ERROR	PERCENT ERROR
2	0.4634E-02	0.1662E-03	0.3586E-01	3.6
3	0.4895E-01	0.1039E-02	0.2122E-01	2.1
5	0.5499E+03	0.3706E-02	0.6739E-05	0.0

FINAL INVERSION MODEL

LAYER	RESISTIVITY	P	F	CONDUCTIVITY	P	F	THICKNESS	DEPTH
1	909.1	1	*	0.11000000E-02	4	*	100.0	0.0
2	215.8	2		0.46335631E-02	5		549.9	100.0
3	20.4	3		0.48954826E-01				649.9

P - parameter number
F - * indicates fixed parameter

Figure 21b

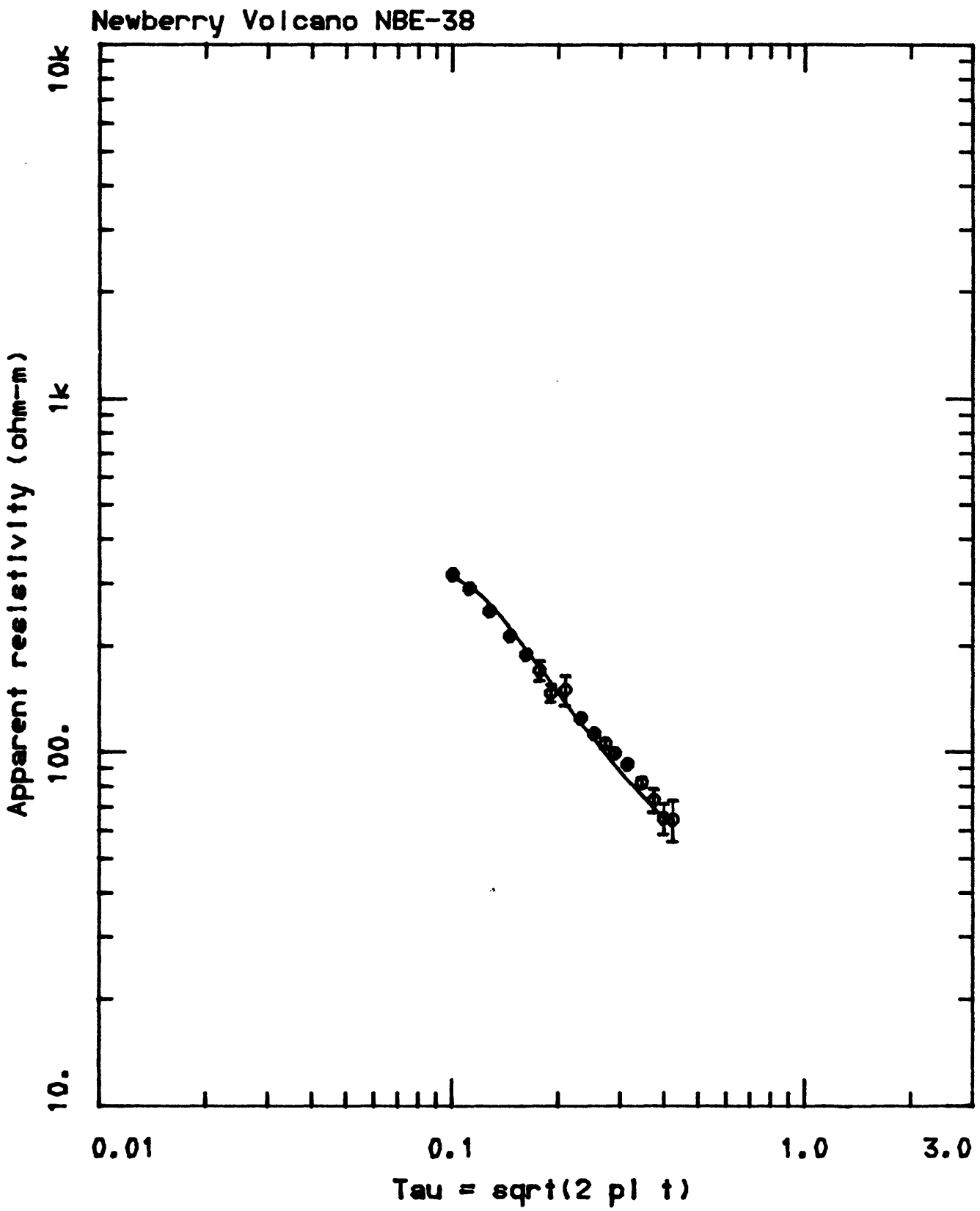

Newberry Volcano NBE-38
Apparent resistivity (ohm-m)
10k
1k
100.
10.
0.01
0.1
1.0
3.0
Tau = sqrt(2 pi t)

Figure 21c

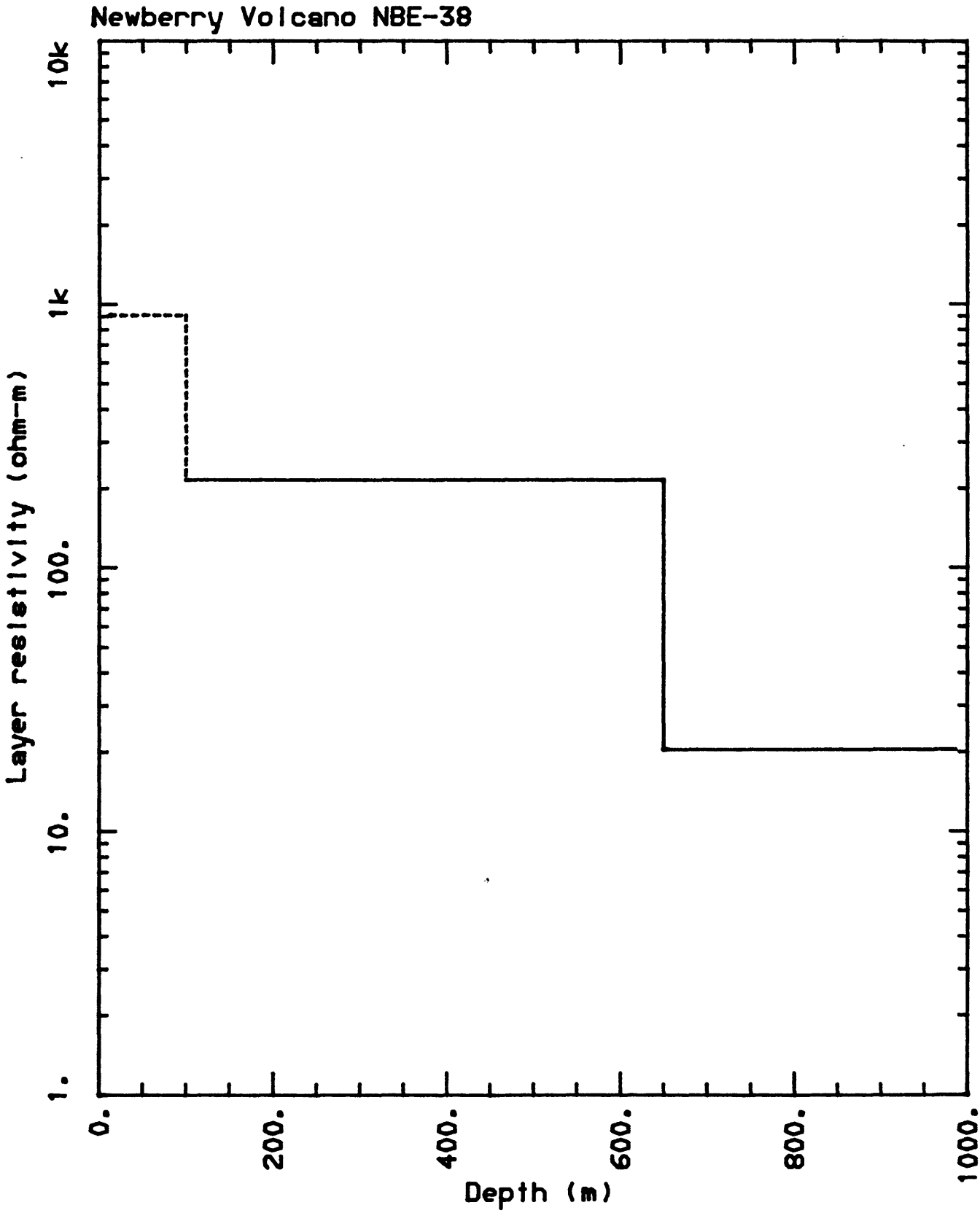

Newberry Volcano NBE-38
Layer resistivity (ohm-m)
10k
1k
100.
10.
1.
0.
200.
400.
600.
800.
1000.
Depth (m)

Figure 22a

<NLSTCI>: Newberry Volcano NBE-39
LOOP RADIUS= 172.0

	TIME(s)	OBSERVED RESISTIVITY	STANDARD DEVIATION	COMPUTED RESISTIVITY	PERCENT ERROR
1	0.0016000	429.4	1.1	427.9	0.4
2	0.0020000	376.0	2.1	380.0	-1.0
3	0.0026000	316.5	1.6	325.3	-2.7
4	0.0034000	268.1	2.0	270.1	-0.7
5	0.0042000	234.5	2.2	231.4	1.4
6	0.0050000	208.3	10.7	204.5	1.8
7	0.0058000	199.3	11.7	184.8	7.8
8	0.0070000	162.9	4.0	162.1	0.5
9	0.0086000	146.4	1.3	141.3	3.6
10	0.0102000	130.9	1.6	127.0	3.1
11	0.0118000	117.9	1.5	116.1	1.5
12	0.0134000	109.7	3.3	107.6	2.0
13	0.0158000	97.4	2.6	97.9	-0.5
14	0.0190000	84.7	2.0	88.5	-4.3
15	0.0222000	79.8	1.5	81.6	-2.3
16	0.0254000	74.6	1.7	76.3	-2.2
17	0.0286000	68.4	2.6	72.0	-4.9

RMS ERROR= 5.465 X-CONVERGENCE

CORRELATION MATRIX

	2	3	5
2	1.000		
3	-0.576	1.000	
5	0.552	-0.645	1.000

	PARAMETER ESTIMATE	STANDARD ERROR	RELATIVE ERROR	PERCENT ERROR
2	0.3456E-02	0.1456E-03	0.4213E-01	4.2
3	0.3974E-01	0.2940E-03	0.7398E-02	0.7
5	0.5514E+03	0.1842E-02	0.3341E-05	0.0

FINAL INVERSION MODEL

LAYER	RESISTIVITY	P	F	CONDUCTIVITY	P	F	THICKNESS	DEPTH
1	1589.6	1	*	0.62900002E-03	4	*	130.0	0.0
2	289.4	2		0.34558526E-02	5		551.4	130.0
3	25.2	3		0.39743692E-01				681.4

P - parameter number
F - * indicates fixed parameter

Figure 22b

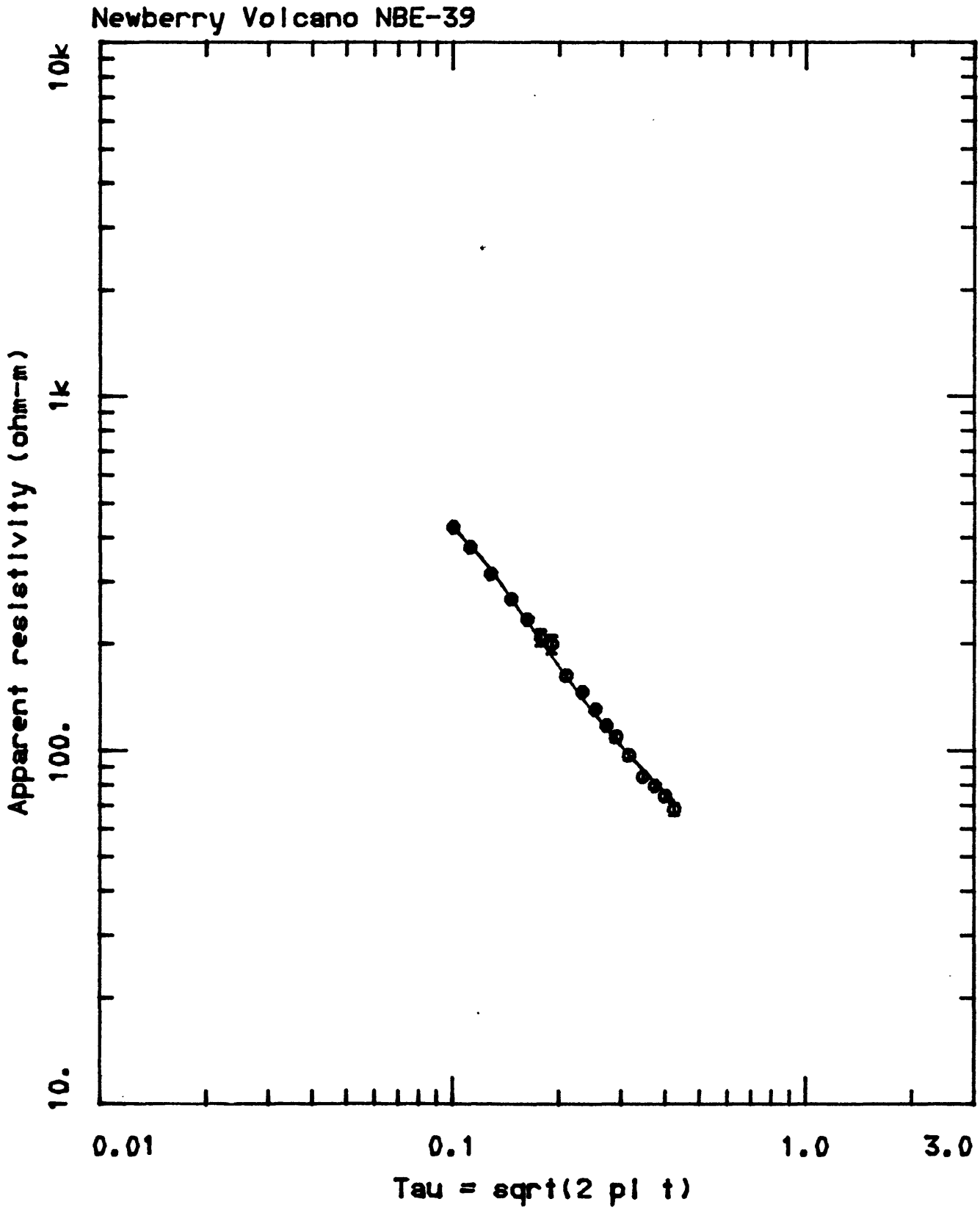

Newberry Volcano NBE-39
10k
1k
100.
10.
Apparent resistivity (ohm-m)
0.01
0.1
1.0
3.0
Tau = sqrt(2 pi t)

Figure 22c

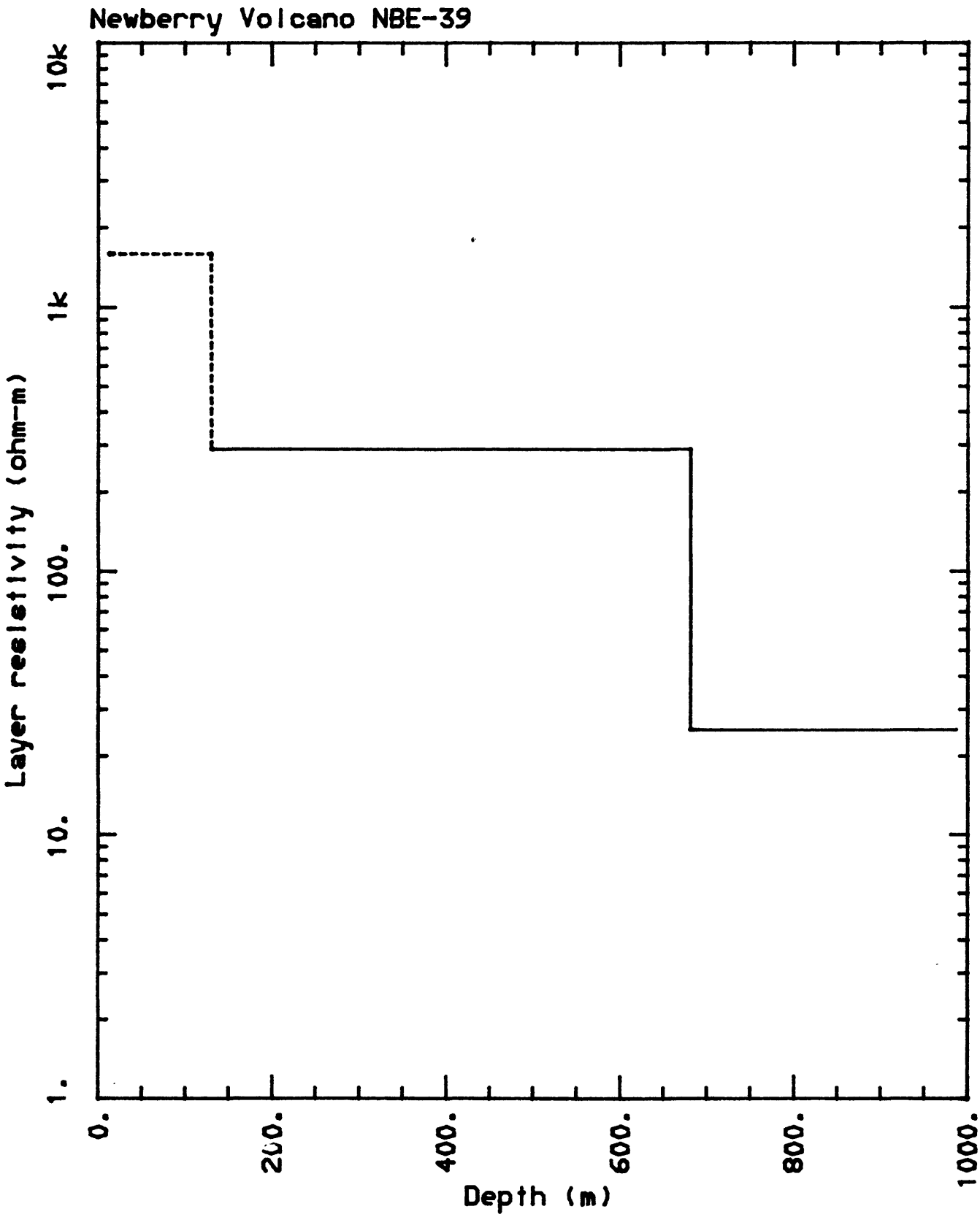

Newberry Volcano NBE-39
Layer resistivity (ohm-m)
10k
1k
100.
10.
1.
0.
200.
400.
600.
800.
1000.
Depth (m)

Figure 23a

<NLSTCI>: Newberry Volcano NBE-40
LOOP RADIUS= 172.0

I	TIME(s)	OBSERVED RESISTIVITY	STANDARD DEVIATION	COMPUTED RESISTIVITY	PERCENT ERROR
1	0.0016000	677.5	2.9	679.1	-0.2
2	0.0020000	573.9	4.1	571.4	0.4
3	0.0026000	474.6	2.8	474.1	0.1
4	0.0034000	395.9	2.7	395.2	0.2
5	0.0042000	348.0	2.5	345.3	0.8
6	0.0050000	311.2	21.9	310.6	0.2
7	0.0058000	287.3	8.1	285.2	0.7
8	0.0070000	251.8	10.1	257.3	-2.1
9	0.0086000	227.8	6.1	231.6	-1.7
10	0.0102000	209.1	2.4	213.5	-2.1
11	0.0118000	195.5	6.4	199.7	-2.1
12	0.0134000	186.0	4.3	188.9	-1.5
13	0.0158000	166.5	12.2	176.3	-5.6
14	0.0190000	151.3	24.9	164.1	-7.8
15	0.0222000	147.3	35.0	155.0	-4.9

RMS ERROR= 5.773 X-CONVERGENCE

CORRELATION MATRIX

	2	3
2	1.000	
3	-0.185	1.000

	PARAMETER ESTIMATE	STANDARD ERROR	RELATIVE ERROR	PERCENT ERROR
2	0.1373E-01	0.3015E-04	0.2196E-02	0.2
3	0.6727E+03	0.3161E-03	0.4700E-06	0.0

FINAL INVERSION MODEL

LAYER	RESISTIVITY	P	F	CONDUCTIVITY	P	F	THICKNESS	DEPTH
1	1956.2	1	*	0.51119964E-03	3		672.7	0.0
2	72.8	2		0.13732332E-01				672.7

P - parameter number
F - * indicates fixed parameter

Figure 23b

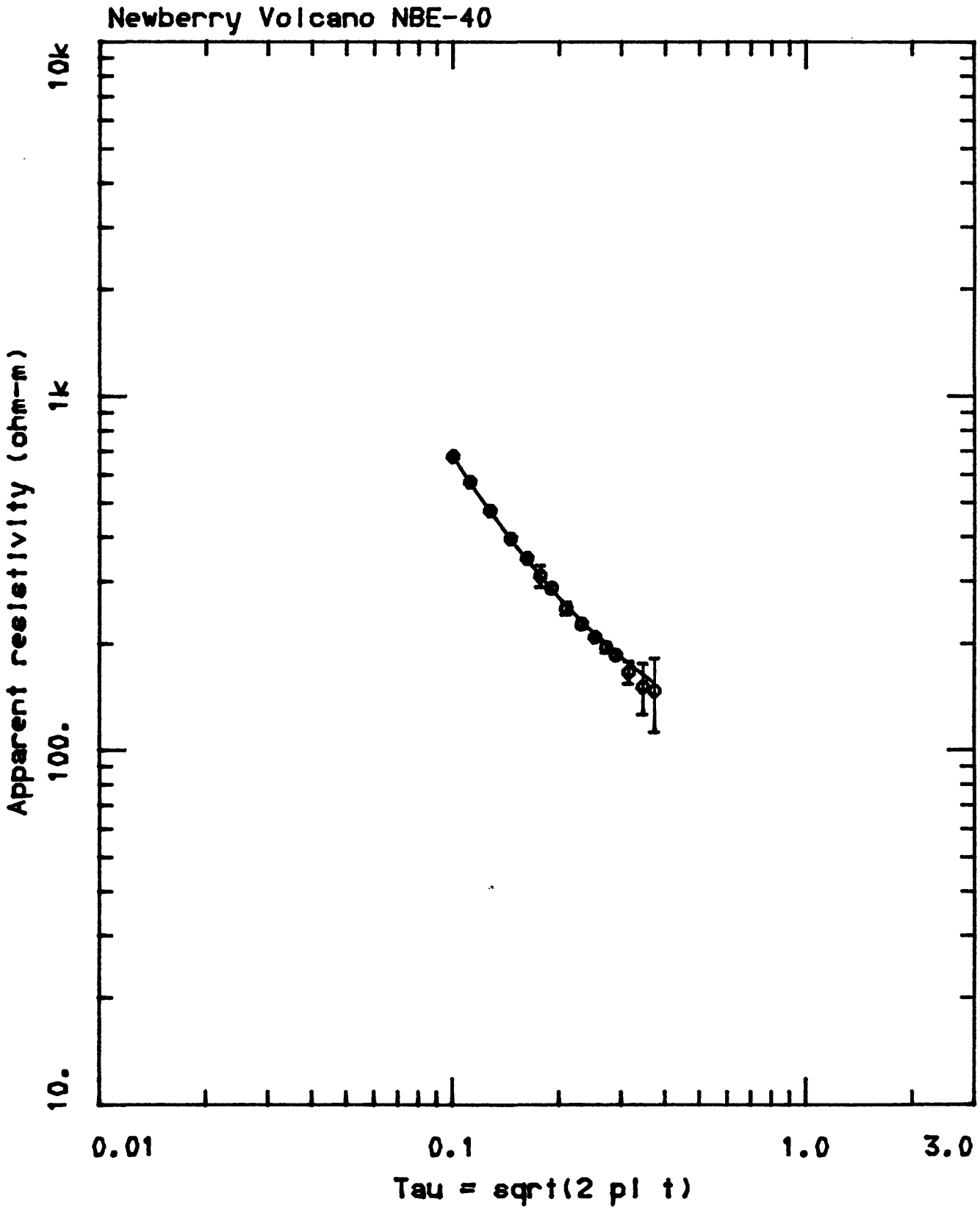

Newberry Volcano NBE-40
10k
1k
100.
10.
Apparent resistivity (ohm-m)
0.01
0.1
1.0
3.0
Tau = sqrt(2 pi t)

Figure 23c

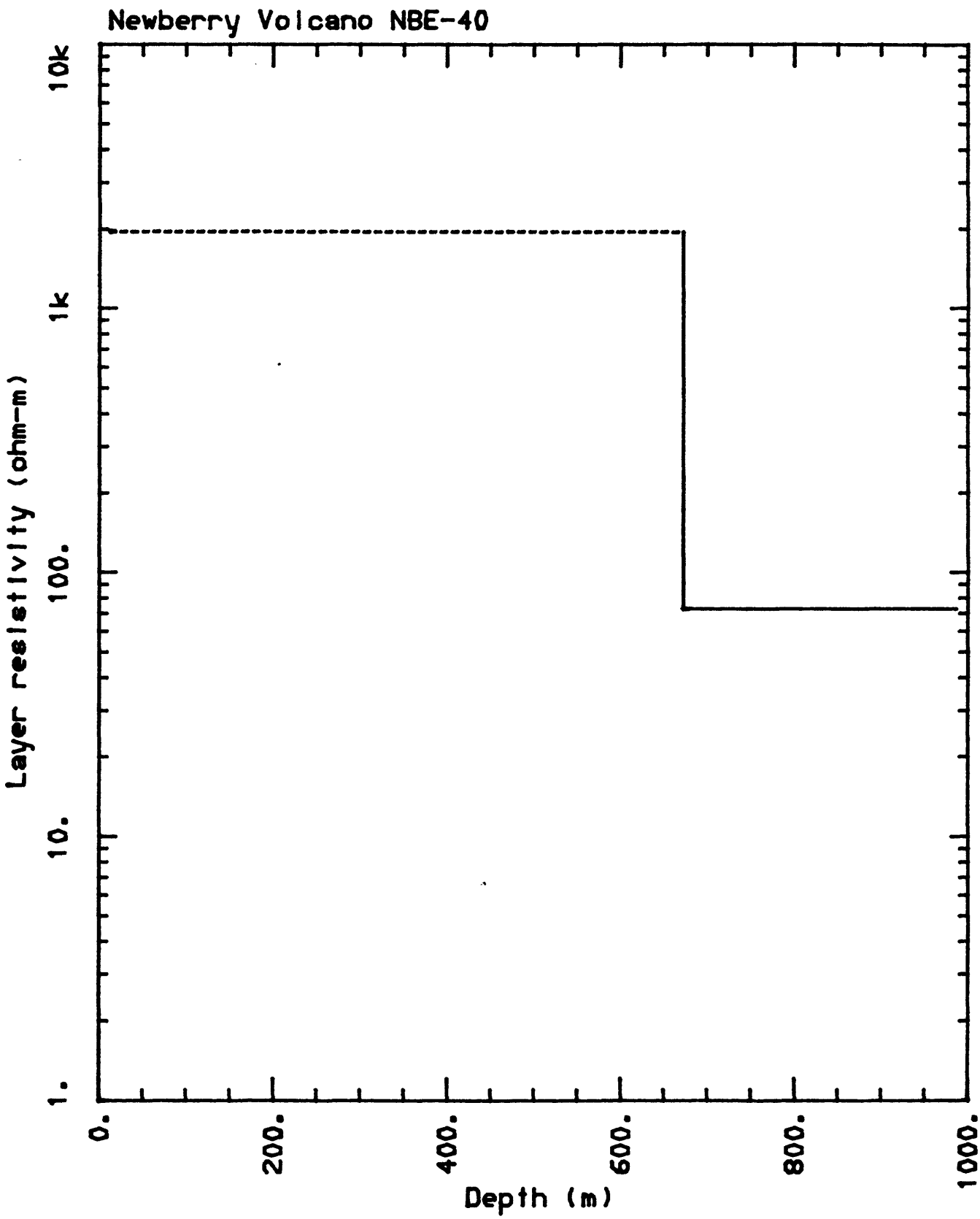

Newberry Volcano NBE-40
Layer resistivity (ohm-m)
10k
1k
100.
10.
1.
0.
200.
400.
600.
800.
1000.
Depth (m)

Figure 24a

<NLSTCI>: Newberry Volcano NBS-41
LOOP RADIUS= 172.0

I	TIME(s)	OBSERVED RESISTIVITY	STANDARD DEVIATION	COMPUTED RESISTIVITY	PERCENT ERROR
1	0.0012000	646.0	7.5	648.2	-0.3
2	0.0016000	523.3	9.9	521.0	0.4
3	0.0020000	451.6	8.5	446.0	1.3
4	0.0026000	377.5	11.3	374.2	0.9
5	0.0034000	313.0	7.6	316.2	-1.0
6	0.0042000	273.2	7.2	279.6	-2.3
7	0.0050000	257.1	15.3	254.2	1.2
8	0.0058000	236.2	16.3	235.2	0.4
9	0.0070000	210.7	12.8	214.4	-1.7
10	0.0086000	192.7	34.3	195.1	-1.2
11	0.0102000	172.9	18.0	181.1	-4.5
12	0.0118000	163.6	24.1	170.3	-4.0
13	0.0134000	149.3	62.9	162.1	-7.9
14	0.0158000	129.0	14.6	152.7	-15.5
15	0.0190000	144.8	93.6	143.1	1.2
16	0.0222000	112.6	53.1	135.9	-17.2

RMS ERROR= 10.80 X-CONVERGENCE

CORRELATION MATRIX

	1	2	3
1	1.000		
2	-0.030	1.000	
3	0.288	0.422	1.000

	PARAMETER ESTIMATE	STANDARD ERROR	RELATIVE ERROR	PERCENT ERROR
1	0.7312E-03	0.1473E-04	0.2014E-01	2.0
2	0.1439E-01	0.1651E-03	0.1147E-01	1.1
3	0.5617E+03	0.1251E-02	0.2151E-05	0.0

FINAL INVERSION MODEL

LAYER	RESISTIVITY	P	F	CONDUCTIVITY	P	F	THICKNESS	DEPTH
1	1367.6	1		0.73121284E-03	3		581.7	0.0
2	69.5	2		0.14385572E-01				581.7

P - parameter number
F - * indicates fixed parameter

Figure 24b

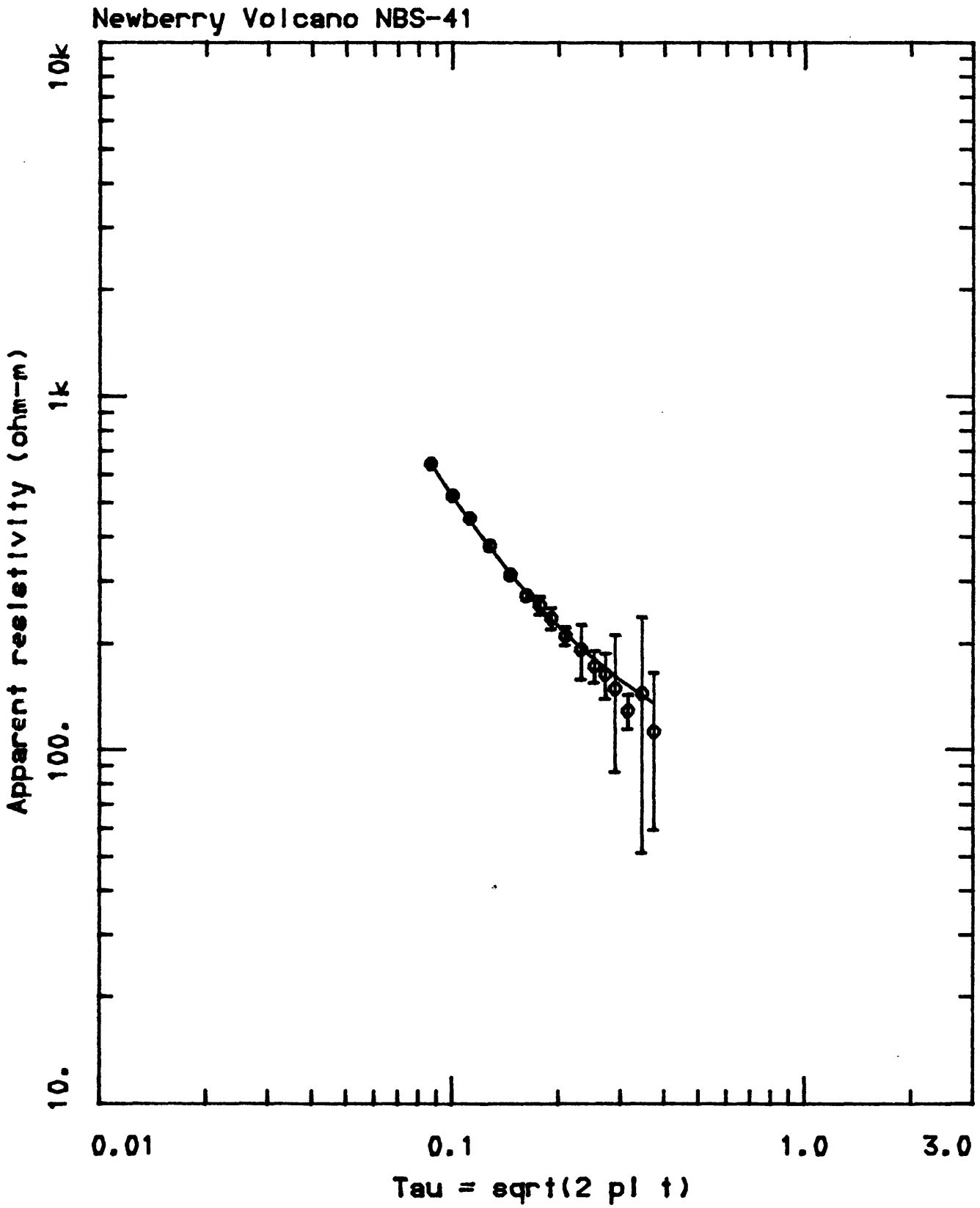
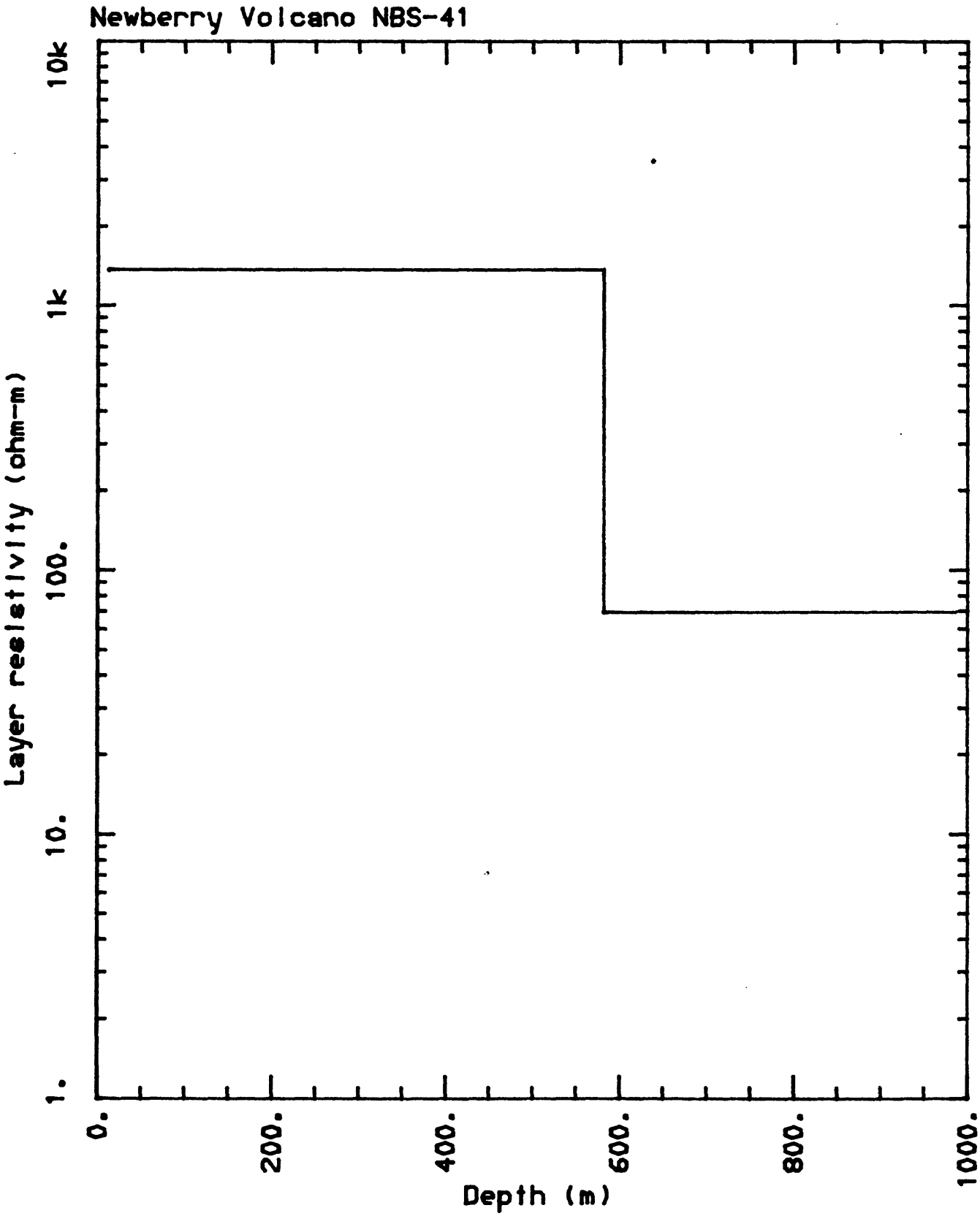

Newberry Volcano NBS-41
Apparent resistivity (ohm-m)
10k
1k
100.
10.
0.01
0.1
1.0
3.0
Tau = sqrt(2 pi t)

Figure 24c


Newberry Volcano NBS-41
Layer resistivity (ohm-m)
10k
1k
100.
10.
1.
0.
200.
400.
600.
800.
1000.
Depth (m)

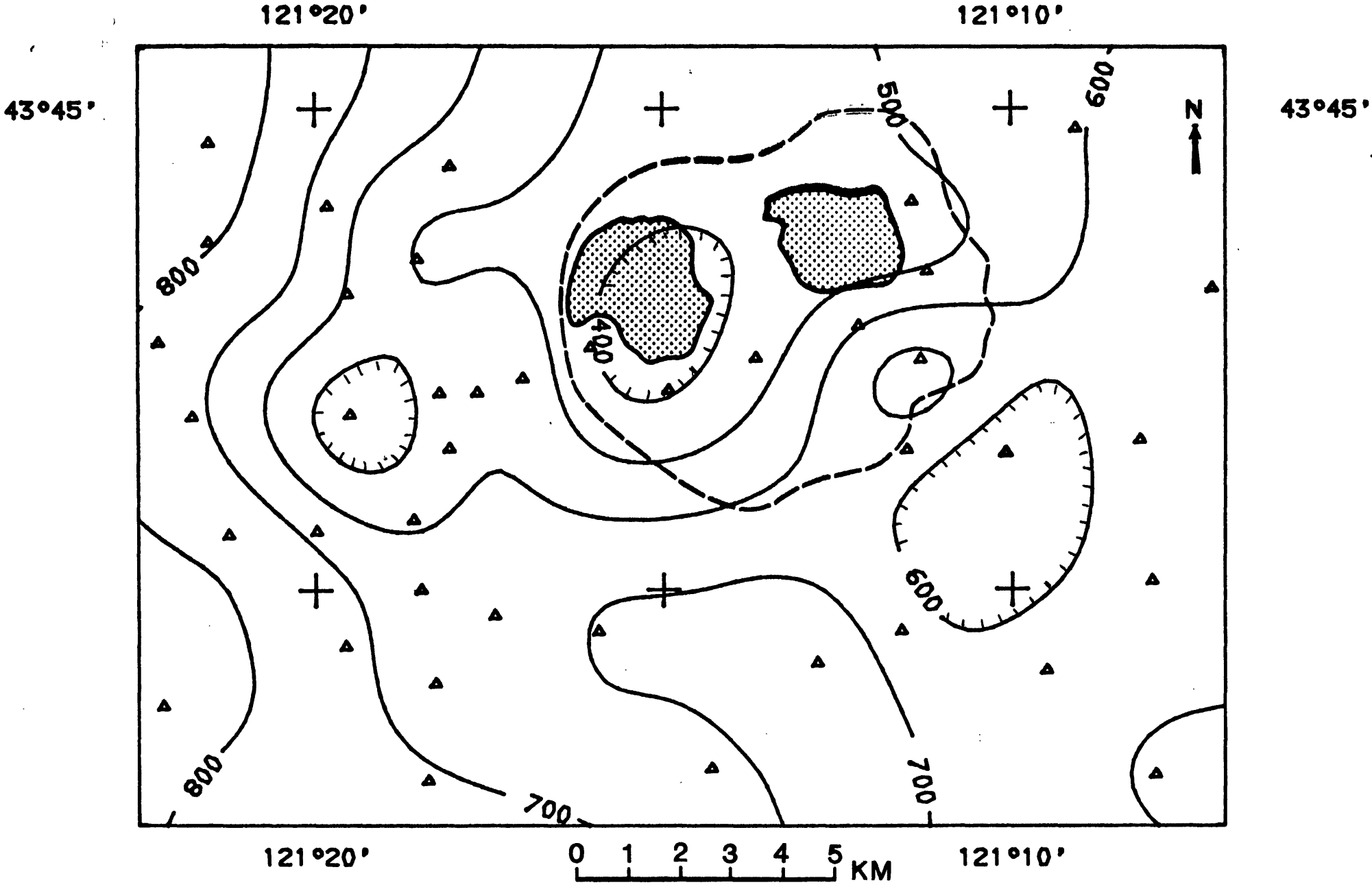

121°20'
121°10'
43°45'
43°45'
N
800
500
600
400
600
800
700
700
121°20'
0 1 2 3 4 5 KM
121°10'

Figure 25