Energy Research and Development Division
FINAL PROJECT REPORT

MT SURVEY FOR RESOURCE ASSESSMENT AND ENVIRONMENTAL MITIGATION AT THE GLASS MOUNTAIN KGRA

APPENDICES F-H

Prepared for: California Energy Commission – Geothermal Resources Development Account
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California Energy Commission
Geothermal Resources Development Account

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PREFACE

The California Legislature created the Geothermal Resources Development Account (GRDA) and the Geothermal Program in 1980. Funding comes from revenues paid to the United States government by geothermal developers for leases on federal land in California. Under the Geothermal Program, the California Energy Commission has assisted numerous eligible private entities and local jurisdictions in geothermal research, development, demonstration, commercialization, planning, mitigations, and environmental enhancement projects related to geothermal energy. The purpose of the program is to enhance and promote geothermal development in California. For more information on the Geothermal Program, please visit the California Energy Commission's Web site at. http://www.energy.ca.gov/geothermal/index.html

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MT Survey for Resource Assessment and Environmental Mitigation in the Glass Mountain KGRA is the final report for the Geothermal Reserouces Development Account contract number GEO-02-007 conducted by GSY-USA, Inc. The information from this project contributes to Energy Research and Development Division's Renewable Program.

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ABSTRACT

The objectives of this project were to use non-invasive methods to indirectly image the permeable geothermal reservoir geometry and mitigate the drilling costs and environmental impact of future geothermal development at Glass Mountain Known Geothermal Resource Area. This was done by more efficiently focusing exploration wells on the most promising target zones. Significant advances were achieved in three dimensional magnetotelluric imaging, allowing three dimensional imaging to be given greater weight than two dimensional imaging in interpreting the data. Magnetotellurics is a geophysical investigation technique that images the earth's subsurface by measuring natural variations of electric and magnetic fields at the surface. Magnetotelluric resistivity patterns were correlated with detailed data on subsurface temperatures, downhole resistivity logging, patterns of rock alteration zones and water entry zones from wells along geologic cross-sections. This confirmed that reservoir interpretation based on correlating magnetotelluric resistivity with temperature sensitive clay alteration was feasible. The magnetotelluric resistivity maps and cross-sections extended these correlations to undrilled areas, revealing the likely geometry of the geothermal system.

Conceptual models based on the resistivity images indicated that major northeast trending structures and the Medicine Lake Volcano rim structure form permeable zones and reservoir boundaries in the Glass Mountain Known Geothermal Resource Area. Several areas that appear to host a relatively shallow permeable reservoir were identified. The magnetotelluric interpretation also indicated that a significant part of the Medicine Lake Volcano was unlikely to host a developable geothermal resource. Depending on the resource development strategy and supporting studies, follow-up magnetotelluric surveys could be justified. The conceptual resource model derived from this study's integrated interpretation illustrates well-targeting strategies that can be reviewed with respect to engineering and environmental issues. By more efficiently directing well targeting, magnetotelluric resistivity imaging can reduce dry hole costs, as well as focus planning efforts and mitigate the environmental impacts of resource development.

Keywords: electromagnetic survey, geothermal exploration, geophysics resistivity, magnetotellurics, petrography, Medicine Lake, Glass Mountain Known Geothermal Resource Area

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APPENDIX H: Transient electromagnetic depth sounding test survey at Glass Mountain - Medicine Lake, Northern California; Report #8246 Prepared for: Occidental Geothermal, Inc. Bakersfield, CA H-1

APPENDIX F:
TEM Survey Medicine Lake California. Prepared for Unocal Geothermal Division. Job # G85143

Attachment V

CEC-500-2007-XXX-ATV

TEM Survey Medicine Lake California. Prepared for Unocal Geothermal Division. Job # G85143

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TEM SURVEY
MEDICINE LAKE, CALIFORNIA

GM38806

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November 15, 1985
G85143

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1.0 INTRODUCTION

This report contains the results of a transient electromagnetic survey performed near Medicine Lake, California in the Modoc National Forest. A total of 108 soundings were measured in the center of 300m by 300m loops. In addition, measurements of the horizontal fields were made at every other station, and measurements of background noise were made three times a day. The locations of the loops are shown in Figure 1-1.

The work was authorized by Master Agreement for Geoscientific Services #3285b between Union Oil of California and The Earth Technology Corporation.

2.0 LOGISTICS AND DATA ACQUISITION

2.1 FIELD CREW

A crew of six people was used to perform the field work. This crew consisted of a geophysical crew chief, three geophysical technicians, one surveyor and a data processor. The loop corners and centers were surveyed using a compass and hip chain.

2.2 GEOPHYSICAL SURVEY

Measurements were made of the time derivative of the vertical magnetic field in the center of 108 transmitter loops. Measurements were also made of the time derivative of the horizontal magnetic field in the center of 59 transmitter loops. Measurements of background noise were also taken. Summaries of the measurements made at each site are shown in Tables 2-1 through 2-7. Measurements were made using the Geonics EM-37 at base frequencies of 30 hz and 3 hz. The manufacturer's specifications for the EM-37 are given in Appendix A.

The transmitter loop used was 10 gauge copper wire. Two different receiver coils were used with effective areas of $100m^2$ and $1,000m^2$. A summary of field activities is given in Table 2-7.

TABLE 2-1

MEASUREMENTS MADE AT EACH STATION
LINE 1

Station #	Vertical	Horizontal	Noise
1	X	X	
2	X		
3	X	X	
4	X		
5	X	X	
6	X		
7	X	X	
8	X		
9	X	X	
10	X	X	
11	X	X	
12	X		
13	X	X	X
14	X		
15	X	X	
16	X	X	X
17	X		
Totals	17	10	2

TABLE 2-2

MEASUREMENTS MADE AT EACH STATION
LINE 2

Station #	Vertical	Horizontal	Noise
1	X	X	
2			
3	X	X	X
4	X		
5	X	X	X
6	X		
7	X	X	
8	X		
9	X	X	
10	X	X	X
11	X	X	X
12	X		
13	X	X	
14	X		
15	X	X	X
16	X		
Totals	15	9	5

TABLE 2-3

MEASUREMENTS MADE AT EACH STATION
LINE 3

Station #	Vertical	Horizontal	Noise
1	X	X	
2	X		
3	X	X	
4	X		X
5	X	X	X
6	X		
7	X	X	
8	X		X
9	X	X	
10	X		
11	X	X	X
12	X	X	X
13	X	X	
14	X		
Totals	14	8	5

TABLE 2-4

MEASUREMENTS MADE AT EACH STATION
LINE 4

Station #	Vertical	Horizontal	Noise
1	X	X	X
2	X		
3	X	X	
4	X		
5	X	X	X
6	X		X
7	X	X	
8	X		
9	X	X	X
10	X		
11	X	X	
12	X		
13	X	X	
14	X		
15	X	X	X
16	X		
17	X	X	X
18	X		
Totals	18	9	6

TABLE 2-5

MEASUREMENTS MADE AT EACH STATION
LINE 5

Station #	Vertical	Horizontal	Noise
1	X		
2	X	X	
3	X		X
4	X	X	X
5	X		
6	X	X	
7	X		
8	X	X	X
9	X		
10	X	X	
11	X		
12	X	X	X
13	X		X
14	X	X	
15	X	X	
16	X	X	
17	X		
18	X	X	X
19	X		
20	X	X	
21	X		
22	X	X	X
23	X		X
24	X	X	
Totals	24	13	8

TABLE 2-6

MEASUREMENTS MADE AT EACH STATION
LINE 6

Station #	Vertical	Horizontal	Noise
1	X	X	X
2	X		
3	X	X	
4	X		X
5	X		
6	X	X	X
7	X	X	
8	X		
9	X	X	X
10	X		
11	X	X	X
12	X		
13	X	X	
14	X		
15	X	X	X
16	X		
17	X	X	
18	X		
19	X	X	
20	X		
Totals	20	10	6

TABLE 2-7

DAILY FIELD LOG

Date	Field Work Performed
10/6/85	Mobilize from Denver to Mt. Shasta, California.
10/7/85	Began surveying in Line 1, tested equipment. Read five loops on Line 1: Line 1, Stations 1-5
10/8/85	Read seven loops on Line 1: Line 1, Stations 6-12
10/9/85	Read a total of five loops: Line 1, Stations 13-16 Line 2, Station 1
10/10/85	Read eight loops on Line 2: Line 2, Stations 3-10
10/11/85	Read six loops on Line 2: Line 2, Stations 11-16
10/12/85	Repeated station 15 on Line 2, read 4 loops on Line 3: Line 2, Station 15 Line 3, Stations 1-4
10/13/85	Read seven loops on Line 3: Line 3, Stations 5-11
10/14/85	Read a total of eight loops: Line 3, Stations 12-14 Line 4, Stations 1-5
10/15/85	Read ten loops on Line 4: Line 4, Stations 6-15
10/16/85	Read a total of six loops: Line 4, Stations 15-18 Line 5, Stations 24, 23
10/17/85	Read ten loops on Line 5: Line 5, Stations 22-13
10/18/85	Read nine loops on Line 5: Line 5, Stations 12-14

TABLE 2-7

DAILY FIELD LOG
(Continued)

Date	Field Work Performed
10/19/85	Read a total of seven loops: Line 5, Stations 3-1 Line 6, Stations 1-4
10/20/85	Read a total of six loops: Line 6, Stations 5-10
10/21/85	Read a total of eight loops: Line 6, Stations 11-17, 20
10/22/85	Read a total of three loops: Line 6, Stations 18, 19 Line 1, Station 17
10/23/85	Demobilized from Mt. Shasta, California to Denver

3.0 INVERSIONS OF TDEM DATA

The processing of TDEM data consists of the following steps:

a) Correction for Ramp Turn-Off Time

The system waveform used in the Geonics EM 37 is shown in Figure 3-1. Two base frequencies were used in collection of the UNOCAL data, 30 Hz and 3 Hz. The turn-off is a linear ramp, and the ramp time was recorded for each sounding. The measured electromotive forces are deconvoluted for the turn-off ramp. At the present time our forward modeling and inversion programs use a perfect step turn-off, so that the experimental data is corrected to correspond to a step function.

The correction factor K(t) applied to the data is:

$$K(t) = \frac{R(t)}{Q(t)}$$

where R(t) is the response for a finite linear ramp turn-off
Q(t) is the response for a step turn-off

The response measured in the field corresponds to R(t). The response used for inversion and for comparison with forward models is:

$$Q(t) = \frac{R(t)}{K(t)}$$

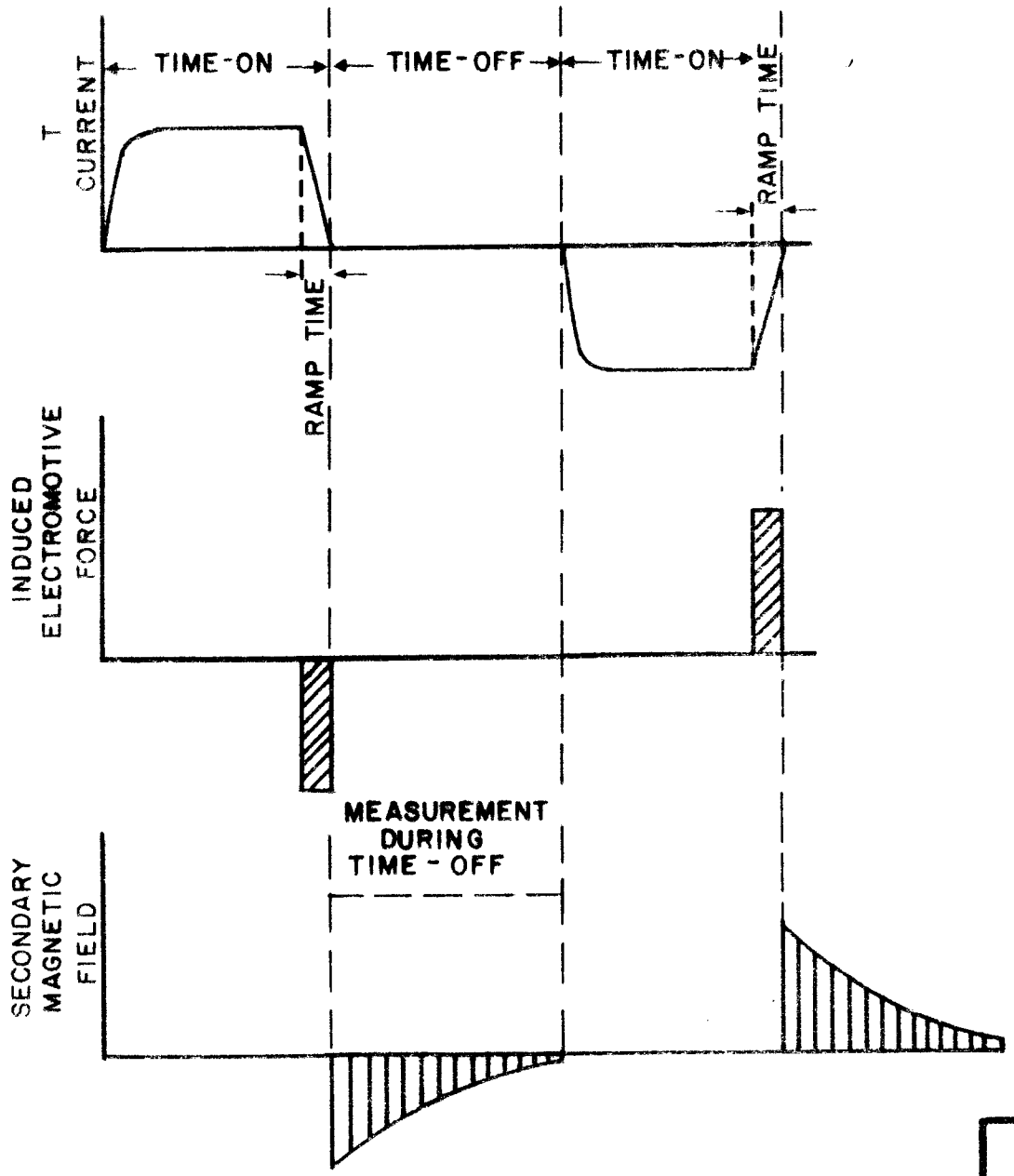
At late time, this correction for the ramp turn-off approaches a decay of $t^{-5/2}$.

The above deconvolution procedure for the turn-off ramp has proven more accurate than incorporating the deconvolution into the inversion program.

b) Computation of Apparent Resistivities. The equations for the calculation of apparent resistivities are discussed in Appendix B.

c) Early time apparent resistivities are entered in the ARRTI inversion program. The input required for this program are number of layers and first guess solutions. Subsequent iterations preserves the number of layers, but the resistivities and thicknesses of each layer can freely float or some values can be fixed. In the solution of this report all values were allowed to float. In Section 4.0 the influence of freezing certain parameters is investigated. The solution is somewhat influenced by the parameters of the first guess solution, therefore albums of forward model curves are used for arriving at the first guess solution.

d) Final inversion solutions are plotted along geoelectric cross-sections. These cross-sections are shown for Lines 1-6 in Figures 3-2 through 3-7, respectively. The inversion tables and the observed apparent resistivity data, superimposed on the apparent resistivity model curve computed for the inverted solution, are given for every station in Attachment A.



a) CURRENT IN TRANSMITTER LOOP

b) INDUCED ELECTROMOTIVE FORCE CAUSED BY T CURRENT

c) SECONDARY MAGNETIC FIELD CAUSED BY EDDY CURRENTS

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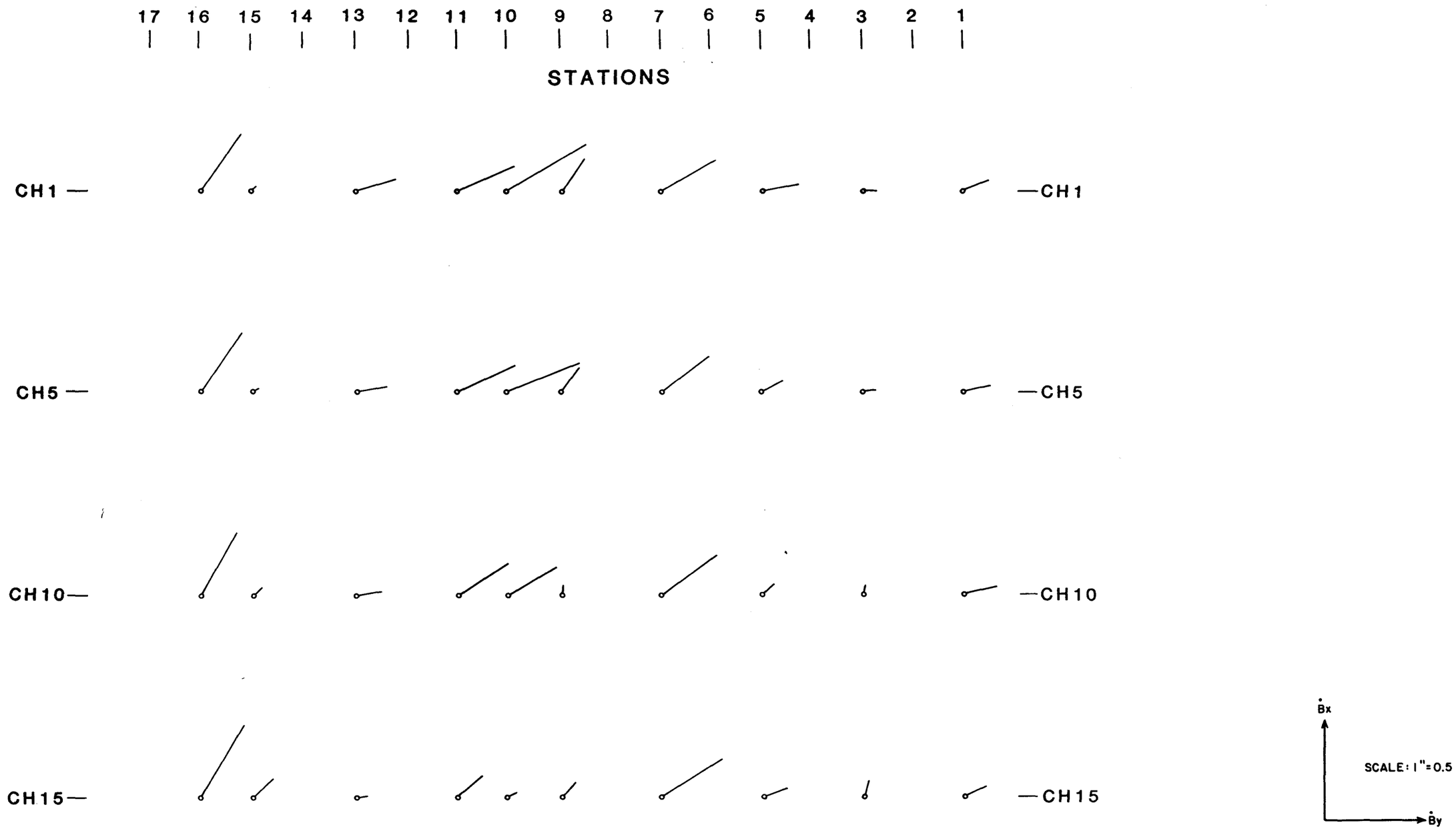
UNOCAL GEOTHERMAL

TRANSMITTER CURRENT WAVEFORM

FIGURE 5



MAGNITUDE OF HORIZONTAL RESULTANT $\left(\frac{\dot{B}r}{\dot{B}z}\right)$

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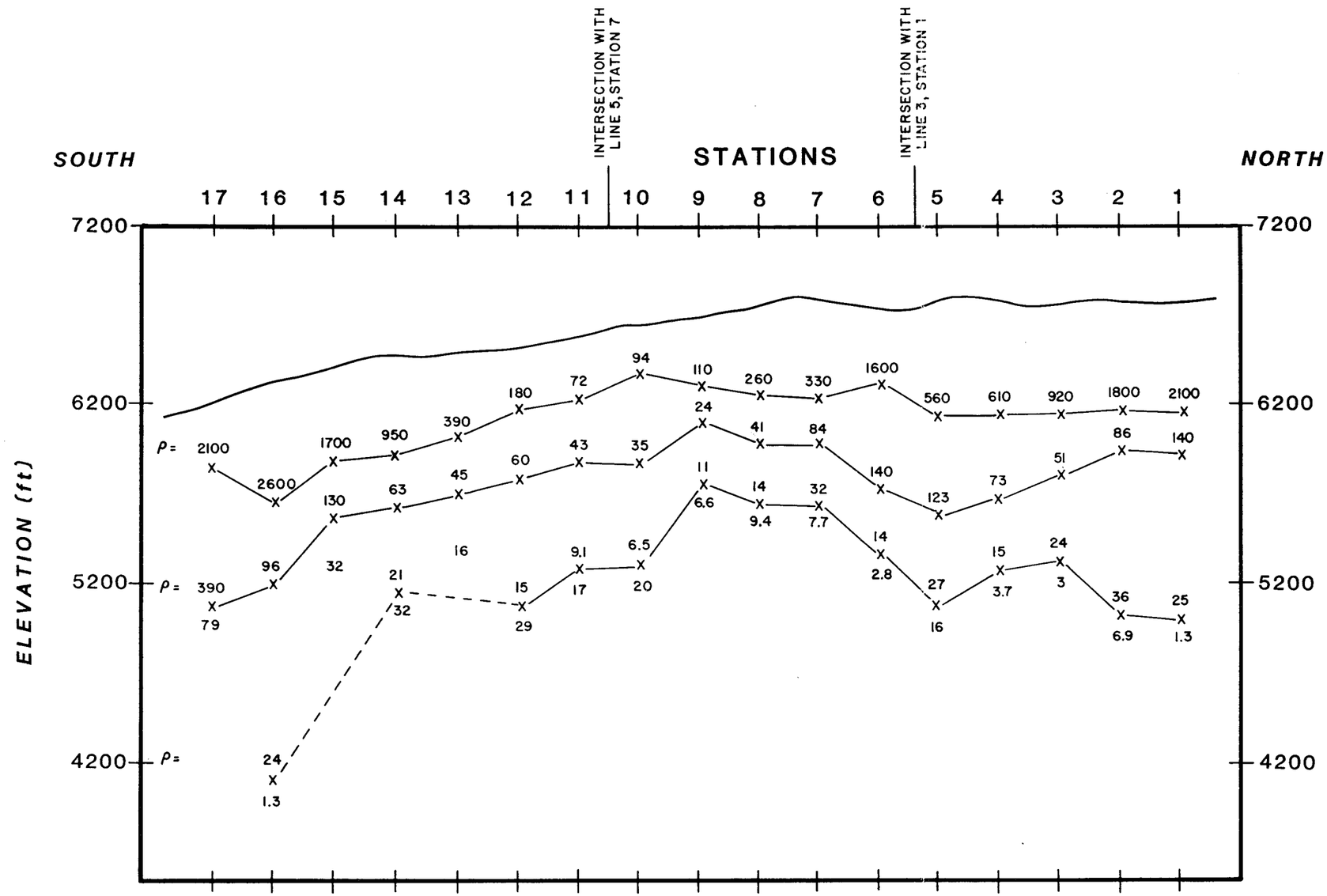
UNOCAL GEOTHERMAL

HORIZONTAL RESULTANT

LINE 1

FIGURE 3-2a



2000 0 2000 4000
HORIZONTAL 1" = 2000'

0 667 1334 2001
VERTICAL 1" = 667'

ρ IS RESISTIVITY, OHM-M

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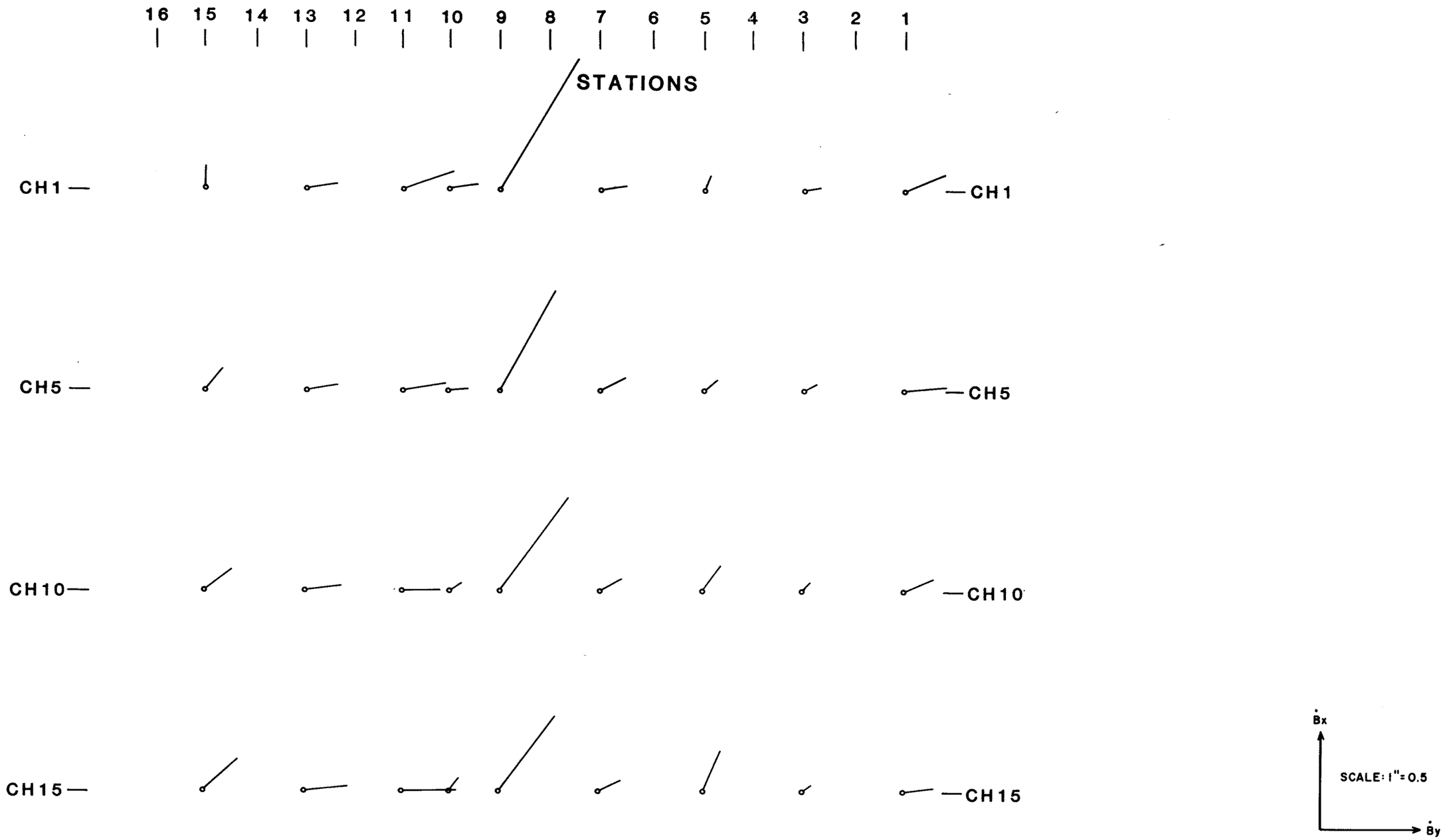
UNOCAL GEOTHERMAL

GEOELECTRIC SECTION
MEDICINE LAKE, CA
LINE 1

FIGURE 3.2



MAGNITUDE OF HORIZONTAL RESULTANT $\left(\frac{\dot{B}r}{\dot{B}z}\right)$

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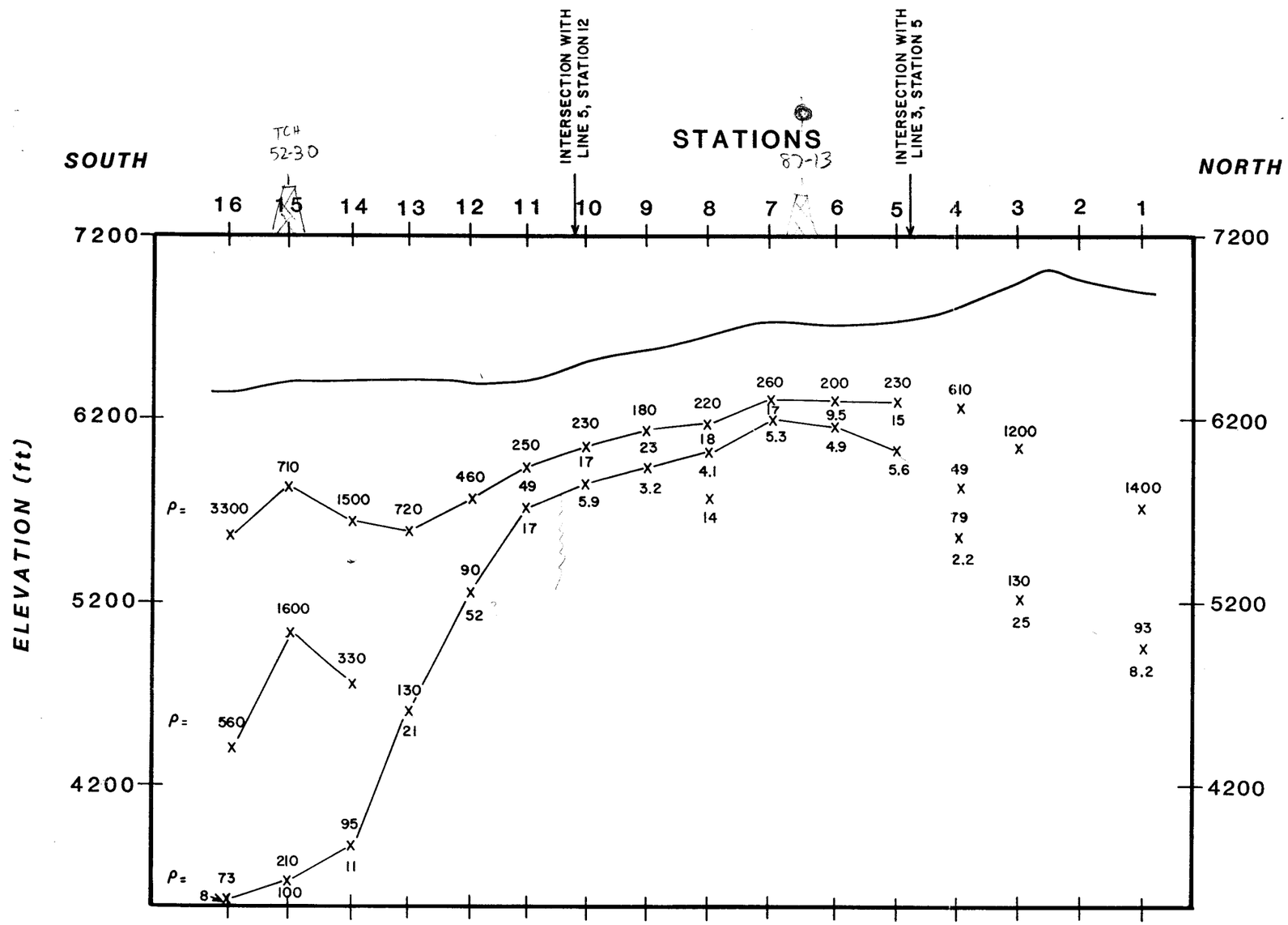
HORIZONTAL RESULTANT
LINE 2

FIGURE 3-3a



2000 0 2000 4000
HORIZONTAL 1" = 2000'

0 667 1334 2001
VERTICAL 1" = 667'

ρ IS RESISTIVITY, OHM-M

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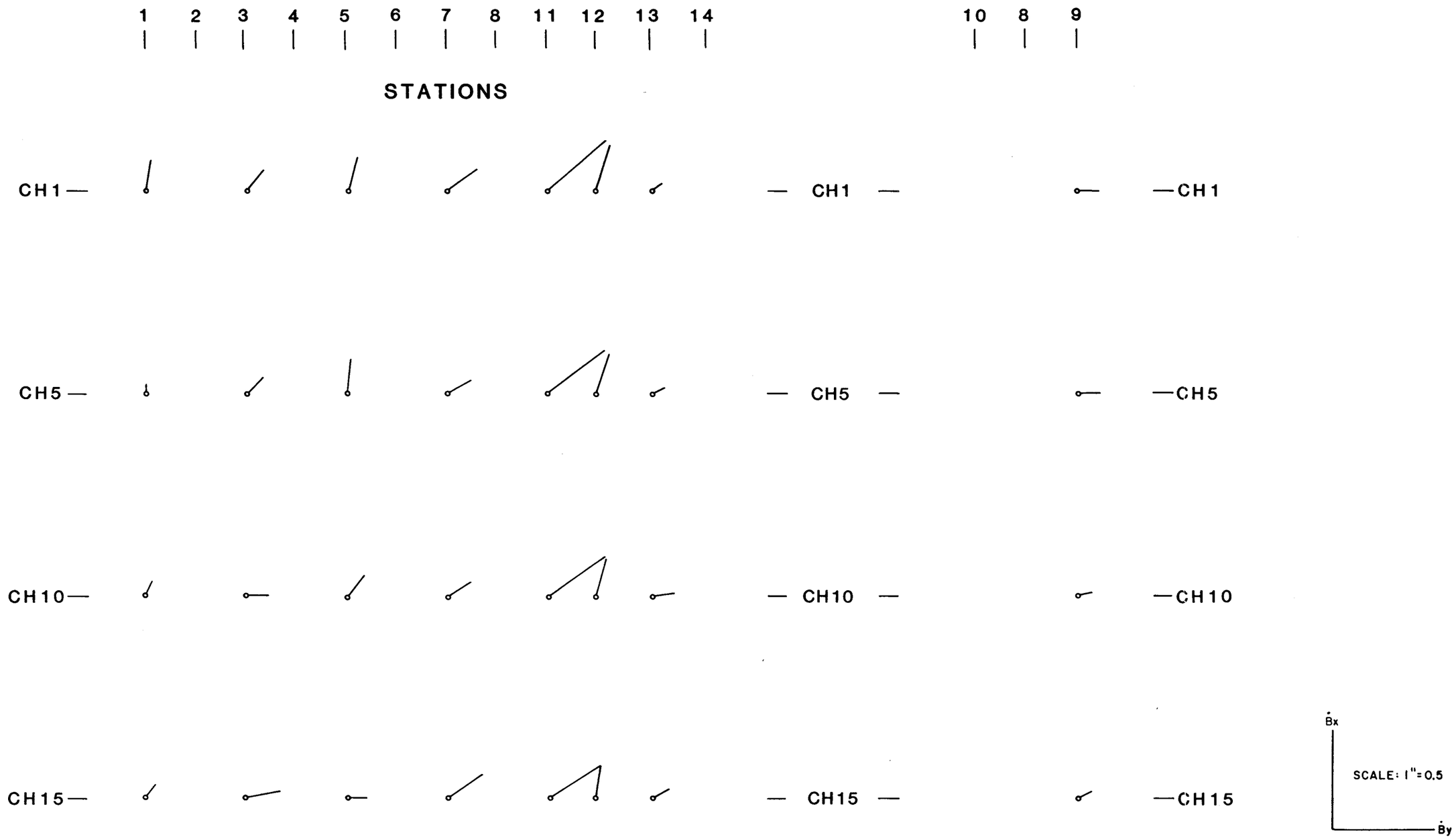
UNOCAL GEOTHERMAL

GEOELECTRIC SECTION
MEDICINE LAKE, CA
LINE 2

FIGURE 3-3



MAGNITUDE OF HORIZONTAL RESULTANT $\left(\frac{\dot{B}r}{\dot{B}z}\right)$

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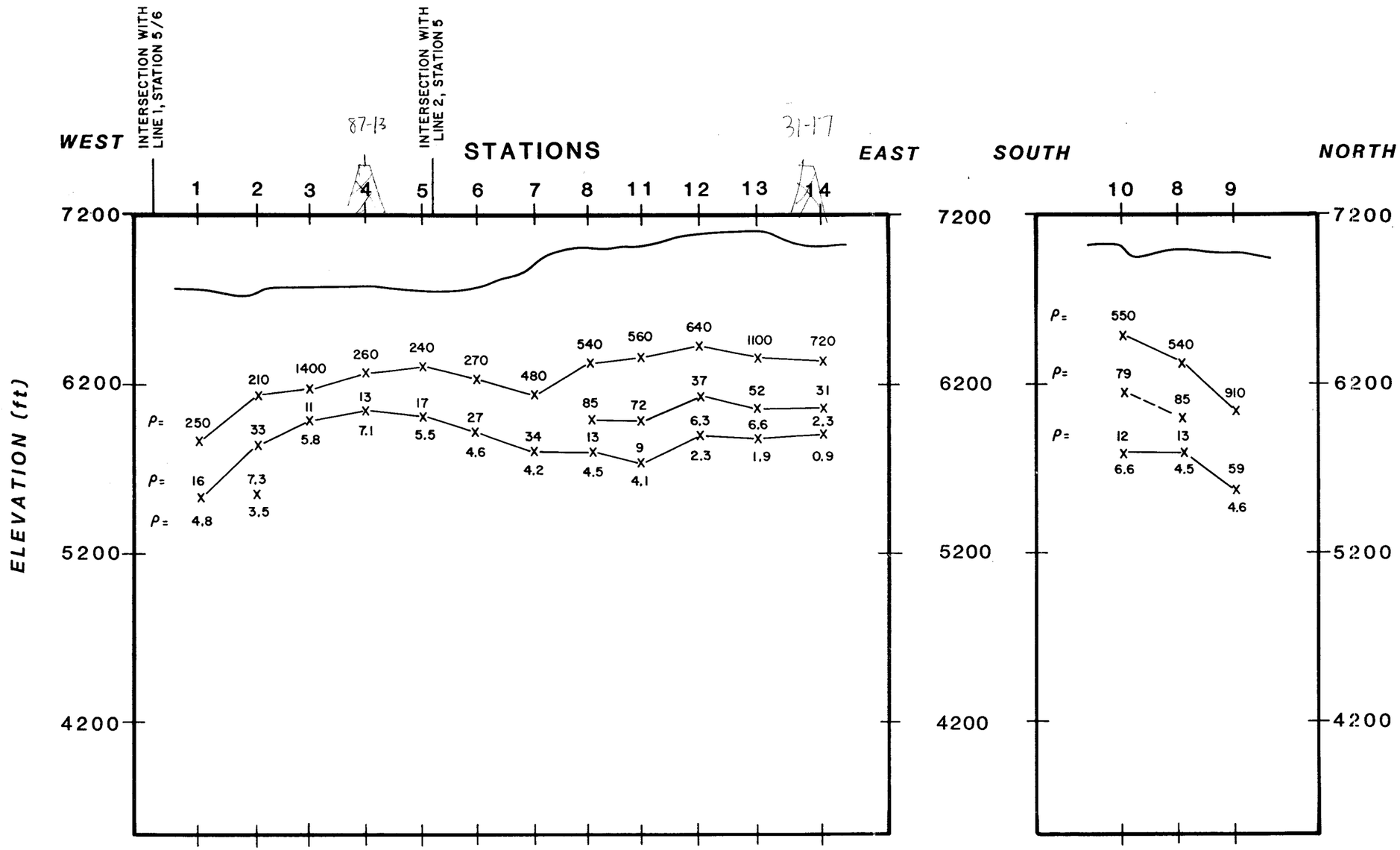
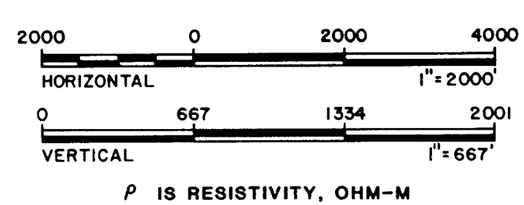
UNOCAL GEOTHERMAL

HORIZONTAL RESULTANT
LINE 3

FIGURE 3-4a





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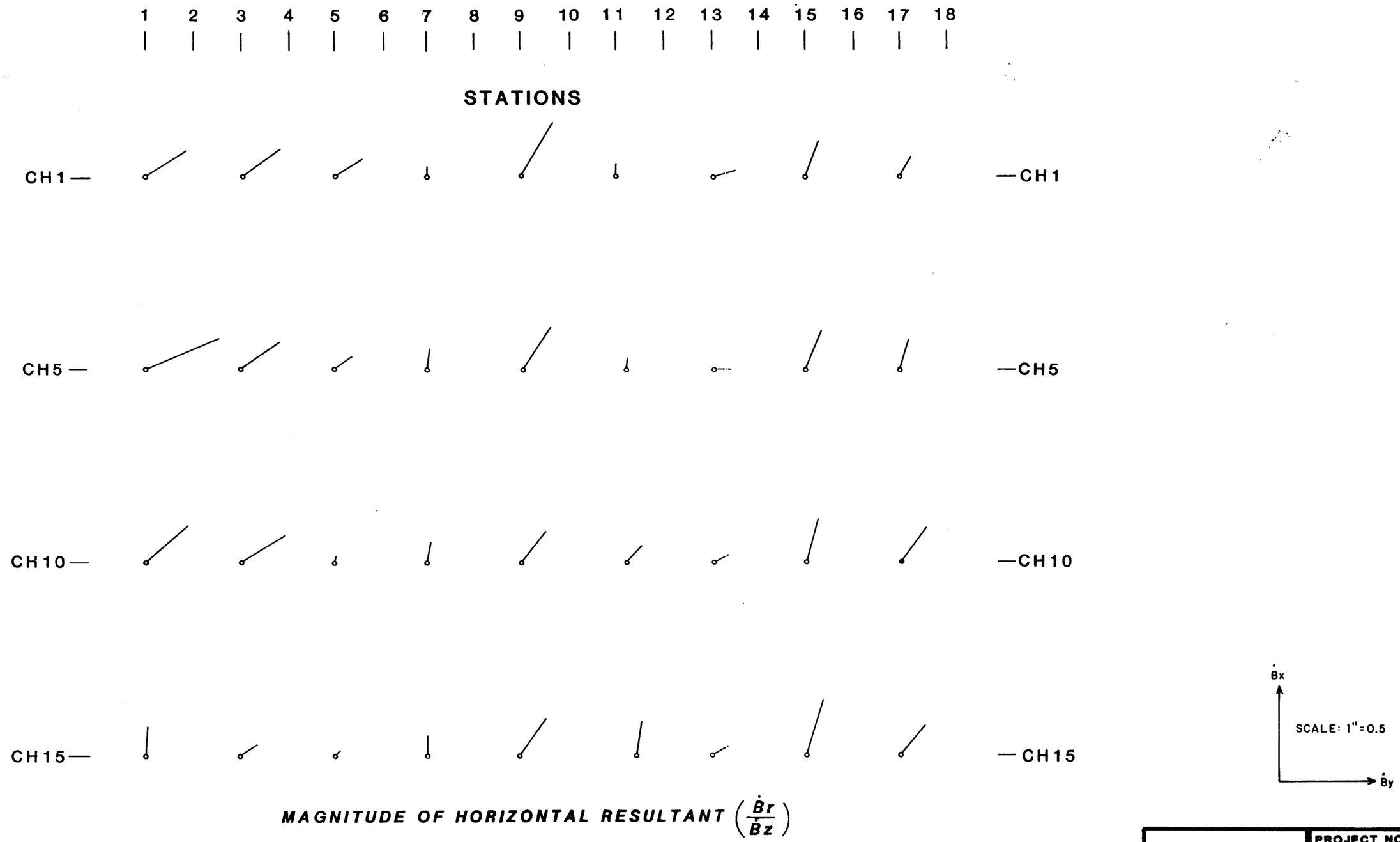
UNOCAL GEOTHERMAL

GEOELECTRIC SECTION
MEDICINE LAKE, CA
LINE 3

FIGURE 3-4



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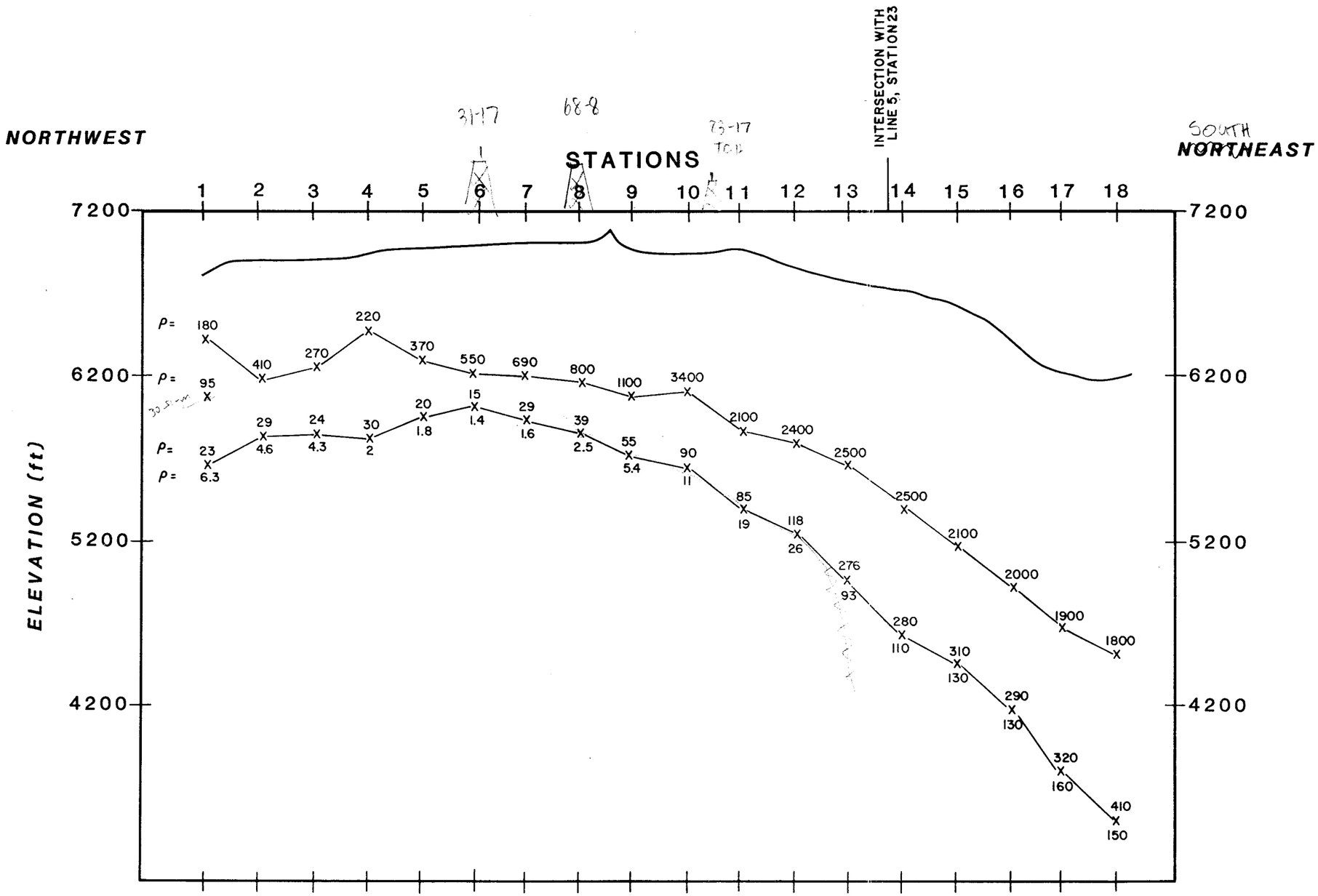
UNOCAL GEOTHERMAL

HORIZONTAL RESULTANT
LINE 4

FIGURE 3-5a



2000 0 2000 4000
HORIZONTAL 1" = 2000'

0 667 1334 2001
VERTICAL 1" = 667'

ρ IS RESISTIVITY, OHM-M

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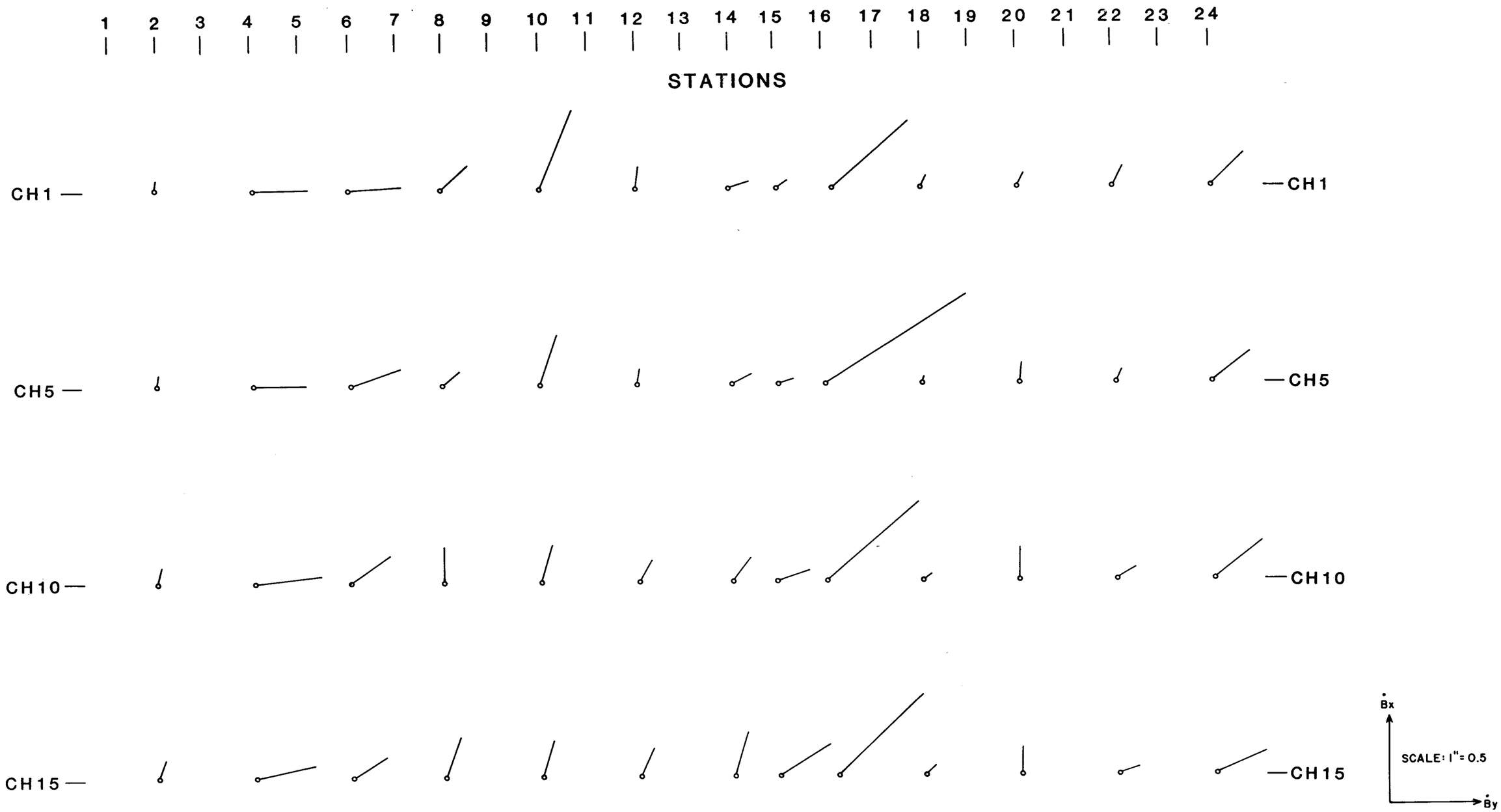
UNOCAL GEOTHERMAL

GEOELECTRIC SECTION
MEDICINE LAKE, CA
LINE 4

FIGURE 3-5



MAGNITUDE OF HORIZONTAL RESULTANT $\left(\frac{\dot{B}r}{\dot{B}z}\right)$

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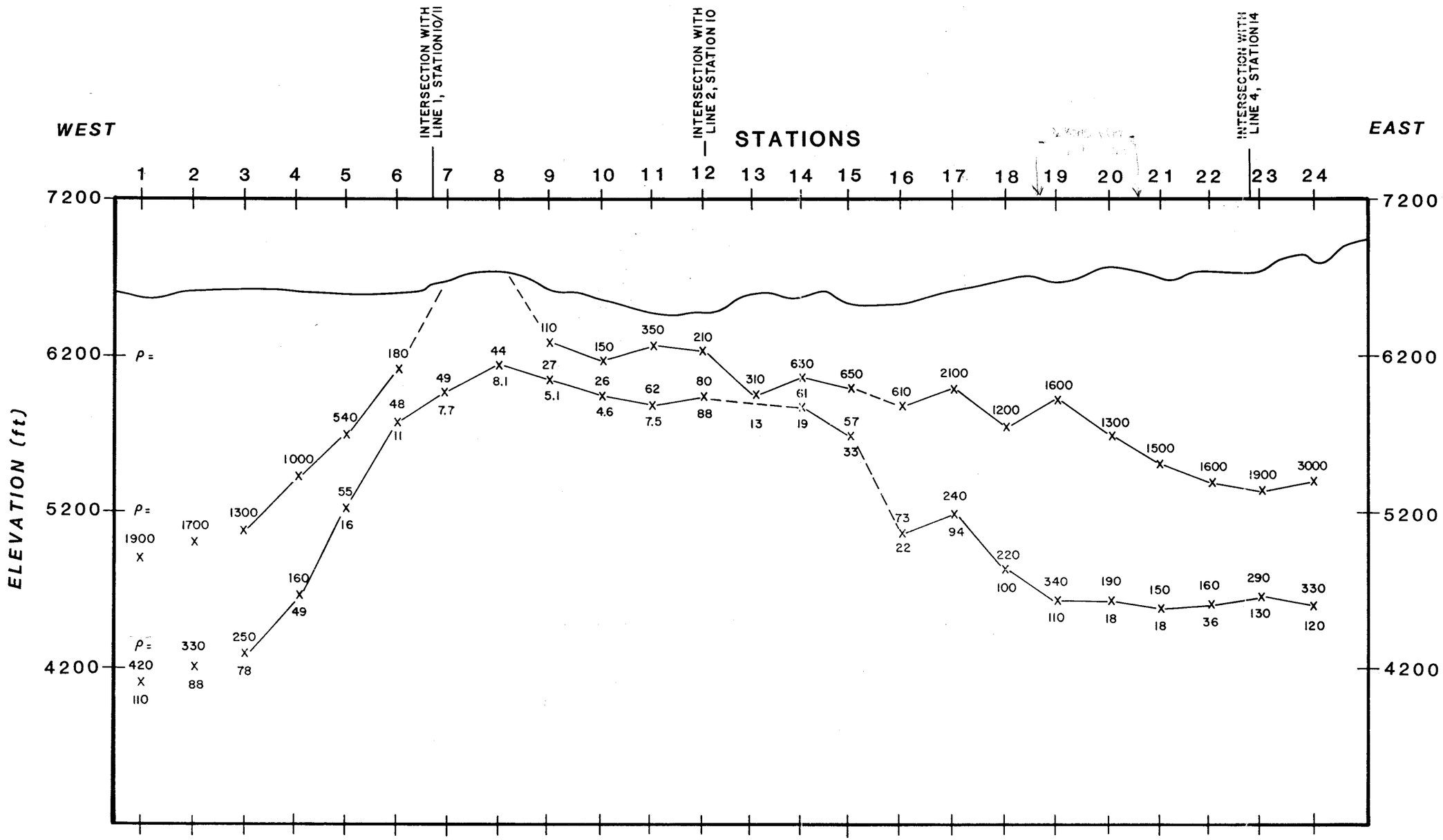
UNOCAL GEOTHERMAL

HORIZONTAL RESULTANT

LINE 5

FIGURE 3-6a



2000 0 2000 4000
HORIZONTAL 1" = 2000'

0 667 1334 2001
VERTICAL 1" = 667'

ρ IS RESISTIVITY, OHM-M

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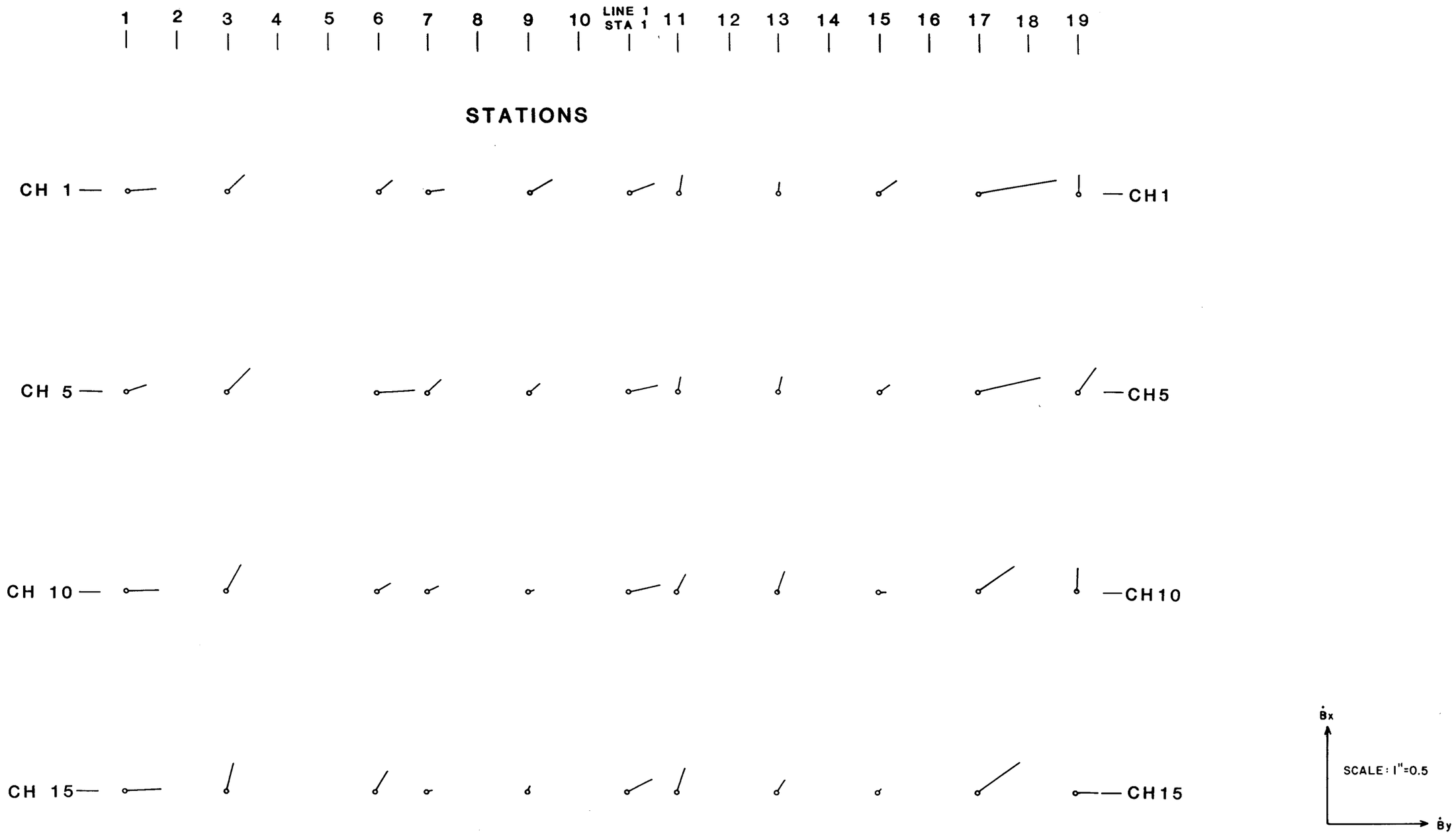
UNOCAL GEOTHERMAL

GEOELECTRIC SECTION
MEDICINE LAKE, CA
LINE 5

FIGURE 3-6



MAGNITUDE OF HORIZONTAL RESULTANT $\left(\frac{\dot{B}r}{\dot{B}z}\right)$

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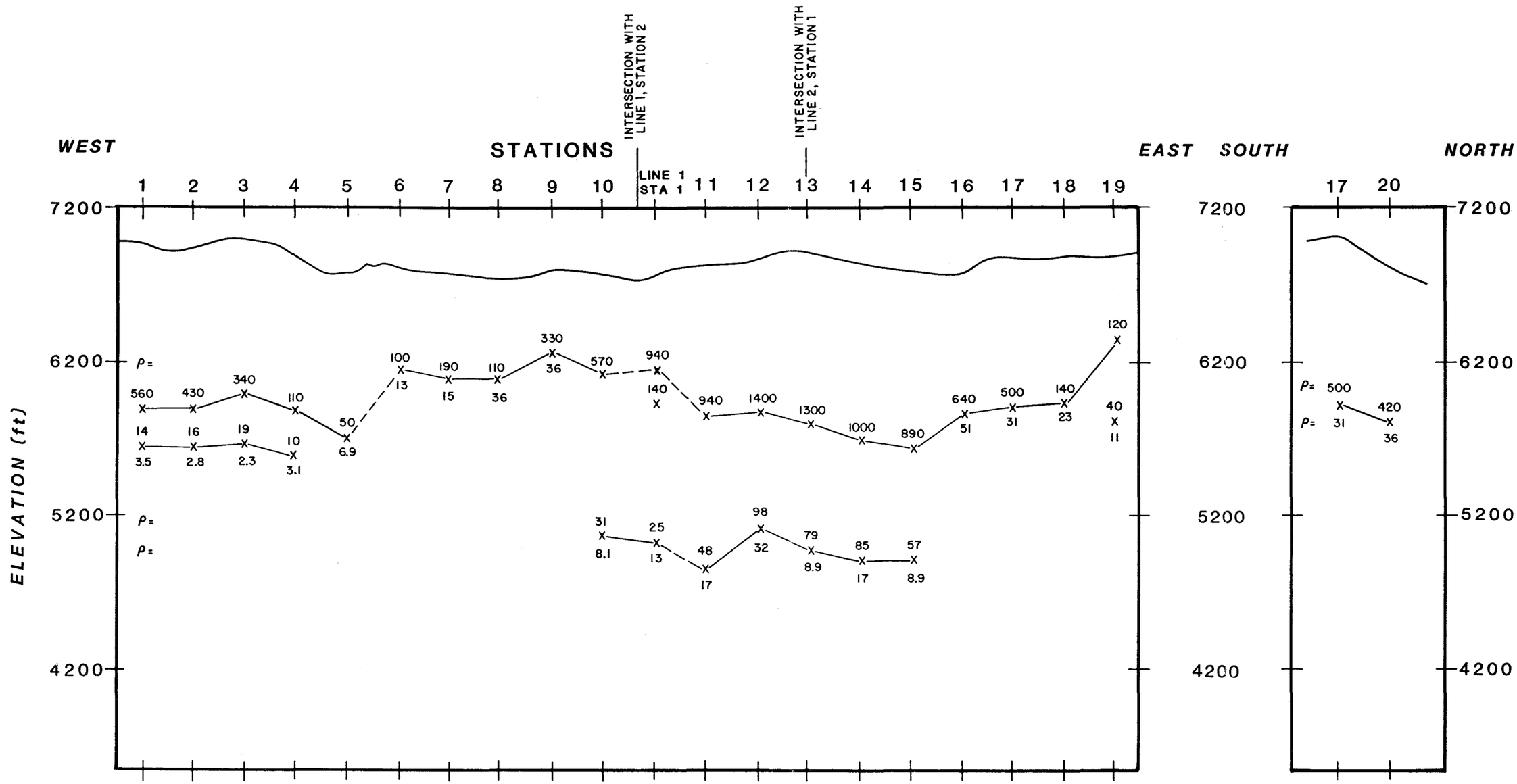
UNOCAL GEOTHERMAL

HORIZONTAL RESULTANT

LINE 6

FIGURE 3-7a



2000 0 2000 4000
HORIZONTAL 1"= 2000'

0 667 1334 2001
VERTICAL 1"=667'

ρ IS RESISTIVITY, OHM-M

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UNOCAL GEOTHERMAL

GEOELECTRIC SECTION

MEDICINE LAKE, CA

LINE 6

FIGURE 3-7

TABLE 4-3

L3S5-B

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		2054.4	6740.0		
237.51	136.0	1918.4	6293.9	.6	.6
17.11	74.2	1844.2	6050.6	4.3	4.9
7.00					

TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.42E+01	0.43E+01	-2.845	0.37E+03
0.11E-03	0.29E+01	0.28E+01	+2.007	0.33E+03
0.14E-03	0.19E+01	0.19E+01	+4.193	0.29E+03
0.18E-03	0.14E+01	0.13E+01	+5.176	0.25E+03
0.22E-03	0.98E+00	0.96E+00	+2.030	0.22E+03
0.28E-03	0.68E+00	0.67E+00	+1.775	0.19E+03
0.35E-03	0.47E+00	0.47E+00	-0.212	0.16E+03
0.44E-03	0.33E+00	0.34E+00	-1.694	0.14E+03
0.56E-03	0.23E+00	0.23E+00	-0.372	0.12E+03
0.71E-03	0.16E+00	0.17E+00	-0.949	0.10E+03
0.88E-03	0.12E+00	0.12E+00	+0.347	0.85E+02
0.11E-02	0.91E-01	0.89E-01	+1.659	0.72E+02
0.14E-02	0.60E-01	0.62E-01	-4.264	0.63E+02
0.18E-02	0.41E-01	0.44E-01	-7.352	0.54E+02
0.22E-02	0.29E-01	0.32E-01	-8.788	0.47E+02
0.29E-02	0.20E-01	0.22E-01	-10.788	0.41E+02
0.36E-02	0.15E-01	0.15E-01	-3.210	0.33E+02
0.45E-02	0.10E-01	0.11E-01	-2.834	0.29E+02
0.57E-02	0.73E-02	0.73E-02	+0.197	0.25E+02
0.72E-02	0.50E-02	0.49E-02	+3.366	0.22E+02
0.88E-02	0.37E-02	0.34E-02	+8.577	0.19E+02
0.11E-01	0.25E-02	0.23E-02	+11.108	0.17E+02
0.14E-01	0.16E-02	0.14E-02	+12.606	0.15E+02
0.18E-01	0.99E-03	0.89E-03	+12.136	0.14E+02

R: 168. X: 0. Y: 0. DL: 0. REQ: 168. CF: 1.0000
TDHZ ARRAY, 24 DATA POINTS, SYSTEM: NONE DATA: L3S5-B
JOB #G85143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 3 STA 5 OCT. 13, 1985
RMS LOG ERROR: 2.57E-02, ANTILOG YIELDS 6.1003 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	F 1	F 2	F 3	T 1	T 2	F 0
F 1	.00					
F 2	.00	.00				
F 3	.00	.00	.00			
T 1	.00	.00	.00	1.00		
T 2	.00	.00	.00	.00	1.00	
F 0	.00	.00	.00	.00	.00	.00

TABLE 4-4

L3S5-C

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		2054.4	6740.0		
237.51	133.7	1920.7	6301.5	.6	.6
17.11	105.7	1815.0	5954.6	6.2	6.7
4.00					

TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.42E+01	0.43E+01	-2.674	0.37E+03
0.11E-03	0.29E+01	0.29E+01	+1.054	0.33E+03
0.14E-03	0.19E+01	0.19E+01	+1.830	0.29E+03
0.18E-03	0.14E+01	0.13E+01	+1.159	0.25E+03
0.22E-03	0.98E+00	0.10E+01	-3.590	0.22E+03
0.28E-03	0.68E+00	0.72E+00	-5.965	0.19E+03
0.35E-03	0.47E+00	0.51E+00	-8.786	0.16E+03
0.44E-03	0.33E+00	0.37E+00	-9.004	0.14E+03
0.56E-03	0.23E+00	0.24E+00	-4.221	0.12E+03
0.71E-03	0.16E+00	0.16E+00	+0.153	0.10E+03
0.88E-03	0.12E+00	0.12E+00	+6.678	0.85E+02
0.11E-02	0.91E-01	0.79E-01	+14.152	0.72E+02
0.14E-02	0.60E-01	0.54E-01	+11.465	0.63E+02
0.18E-02	0.41E-01	0.38E-01	+8.645	0.54E+02
0.22E-02	0.29E-01	0.28E-01	+6.310	0.47E+02
0.29E-02	0.20E-01	0.20E-01	+1.425	0.41E+02
0.36E-02	0.15E-01	0.14E-01	+5.599	0.33E+02
0.45E-02	0.10E-01	0.10E-01	+1.950	0.29E+02
0.57E-02	0.73E-02	0.73E-02	-0.011	0.25E+02
0.72E-02	0.50E-02	0.51E-02	-2.261	0.22E+02
0.88E-02	0.37E-02	0.38E-02	-1.727	0.19E+02
0.11E-01	0.25E-02	0.26E-02	-4.428	0.17E+02
0.14E-01	0.16E-02	0.17E-02	-8.512	0.15E+02
0.18E-01	0.99E-03	0.12E-02	-13.466	0.14E+02

R: 168. X: 0. Y: 0. DL: 0. REQ: 168. CF: 1.0000
TDHZ ARRAY, 24 DATA POINTS, SYSTEM: NONE DATA: L3S5-C
JOB #G85143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 3 STA 5 OCT. 13, 1985
RMS LOG ERROR: 2.87E-02, ANTILOG YIELDS 6.8379 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	F 1	F 2	F 3	T 1	T 2	F 0
F 1	.00					
F 2	.00	.00				
F 3	.00	.00	.00			
T 1	.00	.00	.00	1.00		
T 2	.00	.00	.00	.00	1.00	
F 0	.00	.00	.00	.00	.00	.00

TABLE 4-6

L3S5-D

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		2054.4	6740.0		
237.51	129.3	1925.1	6315.9	.5	.5
21.00	87.1	1838.0	6030.1	4.1	4.7
5.53					

TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.42E+01	0.46E+01	-7.092	0.37E+03
0.11E-03	0.29E+01	0.31E+01	-5.333	0.33E+03
0.14E-03	0.19E+01	0.21E+01	-5.321	0.29E+03
0.18E-03	0.14E+01	0.14E+01	-4.555	0.25E+03
0.22E-03	0.98E+00	0.10E+01	-6.412	0.22E+03
0.28E-03	0.68E+00	0.71E+00	-4.577	0.19E+03
0.35E-03	0.47E+00	0.48E+00	-3.101	0.16E+03
0.44E-03	0.33E+00	0.34E+00	-1.268	0.14E+03
0.56E-03	0.23E+00	0.22E+00	+3.944	0.12E+03
0.71E-03	0.16E+00	0.15E+00	+6.743	0.10E+03
0.88E-03	0.12E+00	0.11E+00	+9.693	0.85E+02
0.11E-02	0.91E-01	0.81E-01	+11.878	0.72E+02
0.14E-02	0.60E-01	0.57E-01	+5.187	0.63E+02
0.18E-02	0.41E-01	0.41E-01	+0.500	0.54E+02
0.22E-02	0.29E-01	0.30E-01	-2.602	0.47E+02
0.29E-02	0.20E-01	0.21E-01	-6.521	0.41E+02
0.36E-02	0.15E-01	0.15E-01	-0.943	0.33E+02
0.45E-02	0.10E-01	0.11E-01	-2.603	0.29E+02
0.57E-02	0.73E-02	0.74E-02	-1.946	0.25E+02
0.72E-02	0.50E-02	0.51E-02	-1.270	0.22E+02
0.88E-02	0.37E-02	0.36E-02	+1.694	0.19E+02
0.11E-01	0.25E-02	0.25E-02	+1.858	0.17E+02
0.14E-01	0.16E-02	0.16E-02	+0.770	0.15E+02
0.18E-01	0.99E-03	0.10E-02	-1.735	0.14E+02

R: 168. X: 0. Y: 0. DL: 0. REQ: 168. CF: 1.0000
TDHZ ARRAY, 24 DATA POINTS, SYSTEM: NONE DATA: L3S5-D
JOB #685143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 3 STA 5 OCT. 13, 1985
RMS LOG ERROR: 2.14E-02, ANTILOG YIELDS 5.0555 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	F 1	F 2	F 3	T 1	T 2	F 0
F 1	.00					
F 2	.00	.00				
F 3	.00	.00	.00			
T 1	.00	.00	.00	1.00		
T 2	.00	.00	.00	.00	1.00	
F 0	.00	.00	.00	.00	.00	.00

TABLE 4-7

L355-E

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		2054.4	6740.0		
237.51	139.7	1914.7	6281.7	.6	.6
14.50	91.8	1822.8	5980.4	6.3	6.9
5.53					

TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.42E+01	0.42E+01	+0.131	0.37E+03
0.11E-03	0.29E+01	0.27E+01	+7.210	0.33E+03
0.14E-03	0.19E+01	0.18E+01	+10.665	0.29E+03
0.18E-03	0.14E+01	0.12E+01	+10.800	0.25E+03
0.22E-03	0.98E+00	0.93E+00	+5.509	0.22E+03
0.28E-03	0.68E+00	0.66E+00	+2.215	0.19E+03
0.35E-03	0.47E+00	0.48E+00	-2.679	0.16E+03
0.44E-03	0.33E+00	0.35E+00	-5.210	0.14E+03
0.56E-03	0.23E+00	0.24E+00	-3.668	0.12E+03
0.71E-03	0.16E+00	0.17E+00	-3.089	0.10E+03
0.88E-03	0.12E+00	0.12E+00	+0.083	0.85E+02
0.11E-02	0.91E-01	0.87E-01	+3.875	0.72E+02
0.14E-02	0.60E-01	0.60E-01	-0.519	0.63E+02
0.18E-02	0.41E-01	0.42E-01	-3.085	0.54E+02
0.22E-02	0.29E-01	0.31E-01	-4.473	0.47E+02
0.29E-02	0.20E-01	0.21E-01	-7.310	0.41E+02
0.36E-02	0.15E-01	0.15E-01	-0.911	0.33E+02
0.45E-02	0.10E-01	0.11E-01	-1.991	0.29E+02
0.57E-02	0.73E-02	0.74E-02	-0.933	0.25E+02
0.72E-02	0.50E-02	0.50E-02	-0.041	0.22E+02
0.88E-02	0.37E-02	0.36E-02	+3.148	0.19E+02
0.11E-01	0.25E-02	0.24E-02	+3.338	0.17E+02
0.14E-01	0.16E-02	0.16E-02	+2.273	0.15E+02
0.18E-01	0.99E-03	0.10E-02	-0.291	0.14E+02

R: 168. X: 0. Y: 0. DL: 0. REQ: 168. CF: 1.0000
TDHZ ARRAY, 24 DATA POINTS, SYSTEM: NONE DATA: L355-E
JOB #G85143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 3 STA 5 OCT. 13, 1985
RMS LOG ERROR: 1.95E-02, ANTILOG YIELDS 4.5938 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	F 1	F 2	F 3	T 1	T 2	F 0
F 1	.00					
F 2	.00	.00				
F 3	.00	.00	.00			
T 1	.00	.00	.00	1.00		
T 2	.00	.00	.00	.00	1.00	
F 0	.00	.00	.00	.00	.00	.00

TABLE 4-8 EFFECT IN VARYING RESISTIVITY OF MIDDLE LAYER LINE 3 STATION 5		
Resistivity (ohm-m)	Depth to Bottom Layer (m)	Overall Error (%)
215	224	5.2
238 (used in report)	224	3.2
251	225	3.8

Table 4-8 shows that a 10% change causes little change (<1%) in the total depth to the bottom layer. Although there is not a large change in overall error, it is important to examine the error at the times where the curve is most affected by the resistivity of the surface layer. This would be at early times. These errors are shown in Table 4-9.

TABLE 4-9 ERRORS IN SOLUTIONS AT SELECTED TIMES FOR FIGURES 4-1, 4-6 AND 4-7		
Resistivity (ohm-m)	Time (msec)	% Error
215	.089	15.3
	.14	4.9
238 (used in report)	.089	2.7
	.14	3.1
251	.089	4.1
	.14	6.7

From Table 4-9 it is apparent that the solution used in the report is the best of the three. The tables of inverted solutions for the curves shown in Figures 4-6 and 4-7 are given in Tables 4-10 and 4-11.

TABLE 4-10

L3S5-F

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		2054.4	6740.0		
214.51	137.3	1917.0	6289.5	.6	.6
17.11	86.2	1830.8	6006.7	5.0	5.7
5.53					

TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.42E+01	0.50E+01	-15.325	0.37E+03
0.11E-03	0.29E+01	0.32E+01	-8.747	0.33E+03
0.14E-03	0.19E+01	0.20E+01	-4.868	0.29E+03
0.18E-03	0.14E+01	0.14E+01	-0.493	0.25E+03
0.22E-03	0.98E+00	0.10E+01	-2.845	0.22E+03
0.28E-03	0.68E+00	0.70E+00	-3.203	0.19E+03
0.35E-03	0.47E+00	0.49E+00	-3.709	0.16E+03
0.44E-03	0.33E+00	0.35E+00	-3.545	0.14E+03
0.56E-03	0.23E+00	0.24E+00	-0.625	0.12E+03
0.71E-03	0.16E+00	0.16E+00	+2.491	0.10E+03
0.88E-03	0.12E+00	0.12E+00	+5.966	0.85E+02
0.11E-02	0.91E-01	0.84E-01	+8.099	0.72E+02
0.14E-02	0.60E-01	0.58E-01	+3.657	0.63E+02
0.18E-02	0.41E-01	0.41E-01	-0.670	0.54E+02
0.22E-02	0.29E-01	0.30E-01	-2.752	0.47E+02
0.29E-02	0.20E-01	0.21E-01	-6.387	0.41E+02
0.36E-02	0.15E-01	0.15E-01	-0.551	0.33E+02
0.45E-02	0.10E-01	0.11E-01	-1.596	0.29E+02
0.57E-02	0.73E-02	0.74E-02	-1.353	0.25E+02
0.72E-02	0.50E-02	0.50E-02	-0.167	0.22E+02
0.88E-02	0.37E-02	0.36E-02	+2.825	0.19E+02
0.11E-01	0.25E-02	0.25E-02	+2.528	0.17E+02
0.14E-01	0.16E-02	0.16E-02	+2.154	0.15E+02
0.18E-01	0.99E-03	0.10E-02	-1.192	0.14E+02

R: 168. X: 0. Y: 0. DL: 0. REQ: 168. CF: 1.0000
TDHZ ARRAY, 24 DATA POINTS, SYSTEM: NONE DATA: L3S5-F
JOB #G85143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 3 STA 5 OCT. 13, 1985
RMS LOG ERROR: 2.21E-02, ANTILOG YIELDS 5.2227 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	F 1	F 2	F 3	T 1	T 2	F 0
F 1	.00					
F 2	.00	.00				
F 3	.00	.00	.00			
T 1	.00	.00	.00	1.00		
T 2	.00	.00	.00	.00	1.00	
F 0	.00	.00	.00	.00	.00	.00

TABLE 4-11

L3S5-G

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		2054.4	6740.0		
251.00	133.8	1920.5	6300.9	.5	.5
17.11	90.7	1829.8	6003.3	5.3	5.8
5.53					

TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.42E+01	0.41E+01	+4.068	0.37E+03
0.11E-03	0.29E+01	0.27E+01	+7.033	0.33E+03
0.14E-03	0.19E+01	0.18E+01	+6.702	0.29E+03
0.18E-03	0.14E+01	0.13E+01	+4.040	0.25E+03
0.22E-03	0.98E+00	0.98E+00	+0.038	0.22E+03
0.28E-03	0.68E+00	0.69E+00	-1.814	0.19E+03
0.35E-03	0.47E+00	0.49E+00	-4.659	0.16E+03
0.44E-03	0.33E+00	0.35E+00	-5.046	0.14E+03
0.56E-03	0.23E+00	0.24E+00	-1.326	0.12E+03
0.71E-03	0.16E+00	0.16E+00	-0.058	0.10E+03
0.88E-03	0.12E+00	0.12E+00	+3.822	0.85E+02
0.11E-02	0.91E-01	0.84E-01	+7.608	0.72E+02
0.14E-02	0.60E-01	0.58E-01	+2.060	0.63E+02
0.18E-02	0.41E-01	0.41E-01	-1.063	0.54E+02
0.22E-02	0.29E-01	0.30E-01	-3.378	0.47E+02
0.29E-02	0.20E-01	0.21E-01	-6.489	0.41E+02
0.36E-02	0.15E-01	0.15E-01	-0.693	0.33E+02
0.45E-02	0.10E-01	0.11E-01	-2.004	0.29E+02
0.57E-02	0.73E-02	0.74E-02	-0.961	0.25E+02
0.72E-02	0.50E-02	0.50E-02	-0.539	0.22E+02
0.88E-02	0.37E-02	0.36E-02	+2.874	0.19E+02
0.11E-01	0.25E-02	0.25E-02	+2.934	0.17E+02
0.14E-01	0.16E-02	0.16E-02	+1.645	0.15E+02
0.18E-01	0.99E-03	0.10E-02	-0.498	0.14E+02

R: 168. X: 0. Y: 0. DL: 0. REQ: 168. CF: 1.0000
TDHZ ARRAY, 24 DATA POINTS, SYSTEM: NONE DATA: L3S5-G
JOB #G85143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 3 STA 5 OCT. 13, 1985
RMS LOG ERROR: 1.61E-02, ANTILOG YIELDS 3.7755 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	F 1	F 2	F 3	T 1	T 2	F 0
F 1	.00					
F 2	.00	.00				
F 3	.00	.00	.00			
T 1	.00	.00	.00	1.00		
T 2	.00	.00	.00	.00	1.00	
F 0	.00	.00	.00	.00	.00	.00

In Figures 4-8 and 4-9 the experimental data are superimposed on forward model curves in which the thickness of the first layer was changed. The thickness of the second layer was fixed during inverison. The purpose of this was to investigate the effect this would have on the resistivity at the bottom conductive layer. The results are shown in Table 4-12.

TABLE 4-12

EFFECTS OF VARYING THICKNESS OF SURFACE LAYER LINE 3 STATION 5

Thickness (m)	Resistivity of Bottom Layer (ohm-m)	Overall Error (%)
121	6.0	4.8
135 (used in report)	5.5	3.2
150	5.3	6.7

From Table 4-12 it is apparent that although the resistivity of the bottom layer does not change much due to the change in thickness, the overall error does change. The tables of inverted solutions corresponding to Figures 4-8 and 4-9 are given in Tables 4-13 and 4-14.

In Figures 4-10 and 4-11 the experimental data are superimposed on forward model curves in which the thickness of the second layer was changed. The thickness of the first layer was fixed. The purpose of this was to investigate what effect this change would have on the resistivity of the bottom layer. The results are shown in Table 4-15.

TABLE 4-13

L3S5-H

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		2054.4	6740.0		
211.34	150.0	1904.4	6247.9	.7	.7
12.38	88.9	1815.5	5956.2	7.2	7.9
5.31					

TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.42E+01	0.50E+01	-16.263	0.37E+03
0.11E-03	0.29E+01	0.30E+01	-4.447	0.33E+03
0.14E-03	0.19E+01	0.18E+01	+6.195	0.29E+03
0.18E-03	0.14E+01	0.12E+01	+15.557	0.25E+03
0.22E-03	0.98E+00	0.86E+00	+13.556	0.22E+03
0.28E-03	0.68E+00	0.61E+00	+10.974	0.19E+03
0.35E-03	0.47E+00	0.44E+00	+5.993	0.16E+03
0.44E-03	0.33E+00	0.33E+00	+1.698	0.14E+03
0.56E-03	0.23E+00	0.23E+00	+1.242	0.12E+03
0.71E-03	0.16E+00	0.16E+00	+1.224	0.10E+03
0.88E-03	0.12E+00	0.12E+00	+3.616	0.85E+02
0.11E-02	0.91E-01	0.86E-01	+5.693	0.72E+02
0.14E-02	0.60E-01	0.58E-01	+2.132	0.63E+02
0.18E-02	0.41E-01	0.41E-01	-1.567	0.54E+02
0.22E-02	0.29E-01	0.30E-01	-2.719	0.47E+02
0.29E-02	0.20E-01	0.21E-01	-5.853	0.41E+02
0.36E-02	0.15E-01	0.15E-01	+0.190	0.33E+02
0.45E-02	0.10E-01	0.11E-01	-0.642	0.29E+02
0.57E-02	0.73E-02	0.73E-02	-0.570	0.25E+02
0.72E-02	0.50E-02	0.50E-02	+0.404	0.22E+02
0.88E-02	0.37E-02	0.36E-02	+3.233	0.19E+02
0.11E-01	0.25E-02	0.25E-02	+2.507	0.17E+02
0.14E-01	0.16E-02	0.16E-02	+1.805	0.15E+02
0.18E-01	0.99E-03	0.10E-02	-1.981	0.14E+02

R: 168. X: 0. Y: 0. DL: 0. REQ: 168. CF: 1.0000
TDHZ ARRAY, 24 DATA POINTS, SYSTEM: NONE DATA: L3S5-H
JOB #G85143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 3 STA 5 OCT. 13, 1985
RMS LOG ERROR: 2.82E-02, ANTILOG YIELDS 6.6997 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	F 1	F 2	F 0
P 1	1.00					
P 2	.00	1.00				
P 3	.00	.00	1.00			
F 1	.00	.00	.00	.00		
F 2	.00	.00	.00	.00	.00	
F 0	.00	.00	.00	.00	.00	.00

TABLE 4-14

L3S5-I

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		2054.4	6740.0		
290.53	121.0	1933.4	6343.0	.4	.4
23.51	88.9	1844.5	6051.4	3.8	4.2
5.95					

TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.42E+01	0.40E+01	+6.494	0.37E+03
0.11E-03	0.29E+01	0.28E+01	+2.611	0.33E+03
0.14E-03	0.19E+01	0.20E+01	-3.091	0.29E+03
0.18E-03	0.14E+01	0.15E+01	-6.126	0.25E+03
0.22E-03	0.98E+00	0.10E+01	-6.468	0.22E+03
0.28E-03	0.68E+00	0.71E+00	-4.695	0.19E+03
0.35E-03	0.47E+00	0.49E+00	-4.096	0.16E+03
0.44E-03	0.33E+00	0.34E+00	-1.009	0.14E+03
0.56E-03	0.23E+00	0.22E+00	+3.987	0.12E+03
0.71E-03	0.16E+00	0.16E+00	+4.118	0.10E+03
0.88E-03	0.12E+00	0.11E+00	+8.213	0.85E+02
0.11E-02	0.91E-01	0.83E-01	+8.912	0.72E+02
0.14E-02	0.60E-01	0.58E-01	+2.097	0.63E+02
0.18E-02	0.41E-01	0.42E-01	-2.391	0.54E+02
0.22E-02	0.29E-01	0.31E-01	-5.344	0.47E+02
0.29E-02	0.20E-01	0.22E-01	-8.167	0.41E+02
0.36E-02	0.15E-01	0.15E-01	-3.007	0.33E+02
0.45E-02	0.10E-01	0.11E-01	-3.407	0.29E+02
0.57E-02	0.73E-02	0.74E-02	-2.041	0.25E+02
0.72E-02	0.50E-02	0.51E-02	-1.327	0.22E+02
0.88E-02	0.37E-02	0.36E-02	+3.424	0.19E+02
0.11E-01	0.25E-02	0.24E-02	+3.352	0.17E+02
0.14E-01	0.16E-02	0.15E-02	+3.436	0.15E+02
0.18E-01	0.99E-03	0.97E-03	+1.935	0.14E+02

R: 168. X: 0. Y: 0. DL: 0. REQ: 168. CF: 1.0000
TDHZ ARRAY, 24 DATA POINTS, SYSTEM: NONE DATA: L3S5-I
JOB #G85143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 3 STA 5 OCT. 13, 1985
RMS LOG ERROR: 2.03E-02, ANTILOG YIELDS 4.7963 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	F 1	F 2	F 0
P 1	1.00					
P 2	.00	1.00				
P 3	.00	.00	1.00			
F 1	.00	.00	.00	.00		
F 2	.00	.00	.00	.00	.00	
F 0	.00	.00	.00	.00	.00	.00

4.0 EQUIVALENCE OF SOLUTIONS

To study the equivalence of solutions the effect due to changing certain parameters of the model has been investigated for Station 5 on Line 3. This station was selected because of the conductive bottom layer. The solution used in the interpretation was:

ρ_1 = 240 ohm-m
ρ_2 = 17 ohm-m
ρ_3 = 5.5 ohm-m
h_1 = 135m
h_2 = 89m

The effect on the final solution was studied by individually changing each parameter and investigating the resulting change in other parameters.

In Figure 4-1 the experimental data has been superimposed on the forward model used in the report. Figures 4-2 and 4-3 show the same data superimposed on forward model curves where the resistivity of the bottom layer has been changed. The resistivities of all other layers were fixed while running the inversions. The purpose of this was to investigate how this change in resistivity would effect the depth to the bottom layer. The effect on the solution and the overall error in solution for each curve is shown in Table 4-1.

TABLE 4-1

EFFECTS OF VARYING RESISTIVITY OF BOTTOM LAYER LINE 3 STATION 5

Resistivity of Bottom Layer (ohm-m)	Depth to Bottom Layer (m)	Overall Error (%)
4.0	239	6.8
5.5 (used in report)	224	3.2
7.0	210	6.1

It is evident from Table 4-1 that the resistivity used in the report is the best of the three. The tables of inverted solutions shown in Figure 4-1 through 4-3 are given in Tables 4-2 through 4-4.

In Figures 4-4 and 4-5 the experimental data is superimposed on forward models in which the resistivity of the second layer was varied. All other resistivities were held constant. The purpose of this was to investigate the effect this would have on determining the depth to the bottom layer. The results are summarized in Table 4-5.

TABLE 4-5

EFFECT IN VARYING RESISTIVITY OF MIDDLE LAYER
LINE 3 STATION 5

Resistivity (ohm-m)	Depth to Bottom Layer (m)	Overall Error (%)
14	232	4.6
17 (used in report)	224	3.2
21	216	5.1

This table shows that varying the resistivity of the middle layer by approximately 20% only causes a 4% change in depth to the bottom layer. Of the three cases the one used in the report has the least overall error. The tables of solutions corresponding to Figures 4-4 and 4-5 are given in Tables 4-6 and 4-7.

In Figures 4-6 and 4-7 the experimental data are superimposed on forward model curves in which the resistivity of the first layer was changed. All other resistivities were fixed during inversion. The purpose of this was to examine what effect this would have in the depth to the bottom layer. The results are shown in Table 4-8.

TABLE 4-2

L3S5-A

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		2054.4	6740.0		
237.51	135.1	1919.2	6296.6	.6	.6
17.11	88.9	1830.3	6004.8	5.2	5.8
5.53					

TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.42E+01	0.43E+01	-2.741	0.37E+03
0.11E-03	0.29E+01	0.28E+01	+1.686	0.33E+03
0.14E-03	0.19E+01	0.19E+01	+3.116	0.29E+03
0.18E-03	0.14E+01	0.13E+01	+3.094	0.25E+03
0.22E-03	0.98E+00	0.99E+00	-0.853	0.22E+03
0.28E-03	0.68E+00	0.69E+00	-1.922	0.19E+03
0.35E-03	0.47E+00	0.49E+00	-3.948	0.16E+03
0.44E-03	0.33E+00	0.35E+00	-4.352	0.14E+03
0.56E-03	0.23E+00	0.24E+00	-0.761	0.12E+03
0.71E-03	0.16E+00	0.16E+00	+1.225	0.10E+03
0.88E-03	0.12E+00	0.12E+00	+4.606	0.85E+02
0.11E-02	0.91E-01	0.84E-01	+8.037	0.72E+02
0.14E-02	0.60E-01	0.58E-01	+2.743	0.63E+02
0.18E-02	0.41E-01	0.41E-01	-0.848	0.54E+02
0.22E-02	0.29E-01	0.30E-01	-3.088	0.47E+02
0.29E-02	0.20E-01	0.21E-01	-6.486	0.41E+02
0.36E-02	0.15E-01	0.15E-01	-0.534	0.33E+02
0.45E-02	0.10E-01	0.11E-01	-1.942	0.29E+02
0.57E-02	0.73E-02	0.74E-02	-1.120	0.25E+02
0.72E-02	0.50E-02	0.50E-02	-0.375	0.22E+02
0.88E-02	0.37E-02	0.36E-02	+2.679	0.19E+02
0.11E-01	0.25E-02	0.25E-02	+2.825	0.17E+02
0.14E-01	0.16E-02	0.16E-02	+1.713	0.15E+02
0.18E-01	0.99E-03	0.10E-02	-0.851	0.14E+02

R: 168. X: 0. Y: 0. DL: 0. REQ: 168. CF: 1.0000
TDHZ ARRAY, 24 DATA POINTS, SYSTEM: NONE DATA: L3S5-A
JOB #G85143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 3 STA 5 OCT. 13, 1985
RMS LOG ERROR: 1.37E-02, ANTILOG YIELDS 3.2033 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	1.00					
P 2	.00	1.00				
P 3	.00	.00	1.00			
T 1	.00	.00	.00	1.00		
T 2	.00	.00	.00	.00	1.00	
F 0	.00	.00	.00	.00	.00	.00

TABLE 4-15

EFFECTS OF VARYING THICKNESS OF SECOND LAYER
LINE 3 STATION 5

Thickness (m)	Resistivity of Bottom Layer (ohm-m)	Overall Error (%)
80	6.0	3.8
89	5.5	3.2
100	5.0	3.9

Table 4-15 shows that an 11% change in the thickness of the second layer does not cause the overall error to change much and causes a 10% change in the resistivity of the bottom layer. The tables of inverted solutions for Figures 4-10 and 4-11 are given in Tables 4-16 and 4-17.

In conclusion we have shown that a change in the resistivity of the bottom layer causes the largest change in depth to the bottom layer, but also doubles the overall error. Changing the resistivity of the surface layer does not cause the depth to the bottom layer to change. Changing the thicknesses of the layers does not have a great effect on the resistivity of the conductive layer.

TABLE 4-16

L3S5-J

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		2054.4	6740.0		
238.11	135.1	1919.3	6296.8	.6	.6
16.39	100.0	1819.3	5968.7	6.1	6.7
5.03					

TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.42E+01	0.43E+01	-1.526	0.37E+03
0.11E-03	0.29E+01	0.28E+01	+2.922	0.33E+03
0.14E-03	0.19E+01	0.19E+01	+4.203	0.29E+03
0.18E-03	0.14E+01	0.13E+01	+3.544	0.25E+03
0.22E-03	0.98E+00	0.99E+00	-1.359	0.22E+03
0.28E-03	0.68E+00	0.71E+00	-3.962	0.19E+03
0.35E-03	0.47E+00	0.51E+00	-7.399	0.16E+03
0.44E-03	0.33E+00	0.36E+00	-8.457	0.14E+03
0.56E-03	0.23E+00	0.25E+00	-5.068	0.12E+03
0.71E-03	0.16E+00	0.17E+00	-2.483	0.10E+03
0.88E-03	0.12E+00	0.12E+00	+2.332	0.85E+02
0.11E-02	0.91E-01	0.84E-01	+7.868	0.72E+02
0.14E-02	0.60E-01	0.57E-01	+4.394	0.63E+02
0.18E-02	0.41E-01	0.40E-01	+1.961	0.54E+02
0.22E-02	0.29E-01	0.29E-01	+0.391	0.47E+02
0.29E-02	0.20E-01	0.21E-01	-3.008	0.41E+02
0.36E-02	0.15E-01	0.14E-01	+2.803	0.33E+02
0.45E-02	0.10E-01	0.10E-01	+0.909	0.29E+02
0.57E-02	0.73E-02	0.72E-02	+1.013	0.25E+02
0.72E-02	0.50E-02	0.50E-02	+0.844	0.22E+02
0.88E-02	0.37E-02	0.36E-02	+3.197	0.19E+02
0.11E-01	0.25E-02	0.25E-02	+2.380	0.17E+02
0.14E-01	0.16E-02	0.16E-02	+0.199	0.15E+02
0.18E-01	0.99E-03	0.10E-02	-3.262	0.14E+02

R: 168. X: 0. Y: 0. DL: 0. REQ: 168. CF: 1.0000
TDHZ ARRAY, 24 DATA POINTS, SYSTEM: NONE DATA: L3S5-J
JOB #G85143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 3 STA 5 OCT. 13, 1985
RMS LOG ERROR: 1.68E-02, ANTILOG YIELDS 3.9464 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	F 1	F 2	F 0
P 1	1.00					
P 2	.00	1.00				
P 3	.00	.00	1.00			
F 1	.00	.00	.00	.00		
F 2	.00	.00	.00	.00	.00	
F 0	.00	.00	.00	.00	.00	.00

TABLE 4-17

L385-K

MODEL: 3 LAYERS

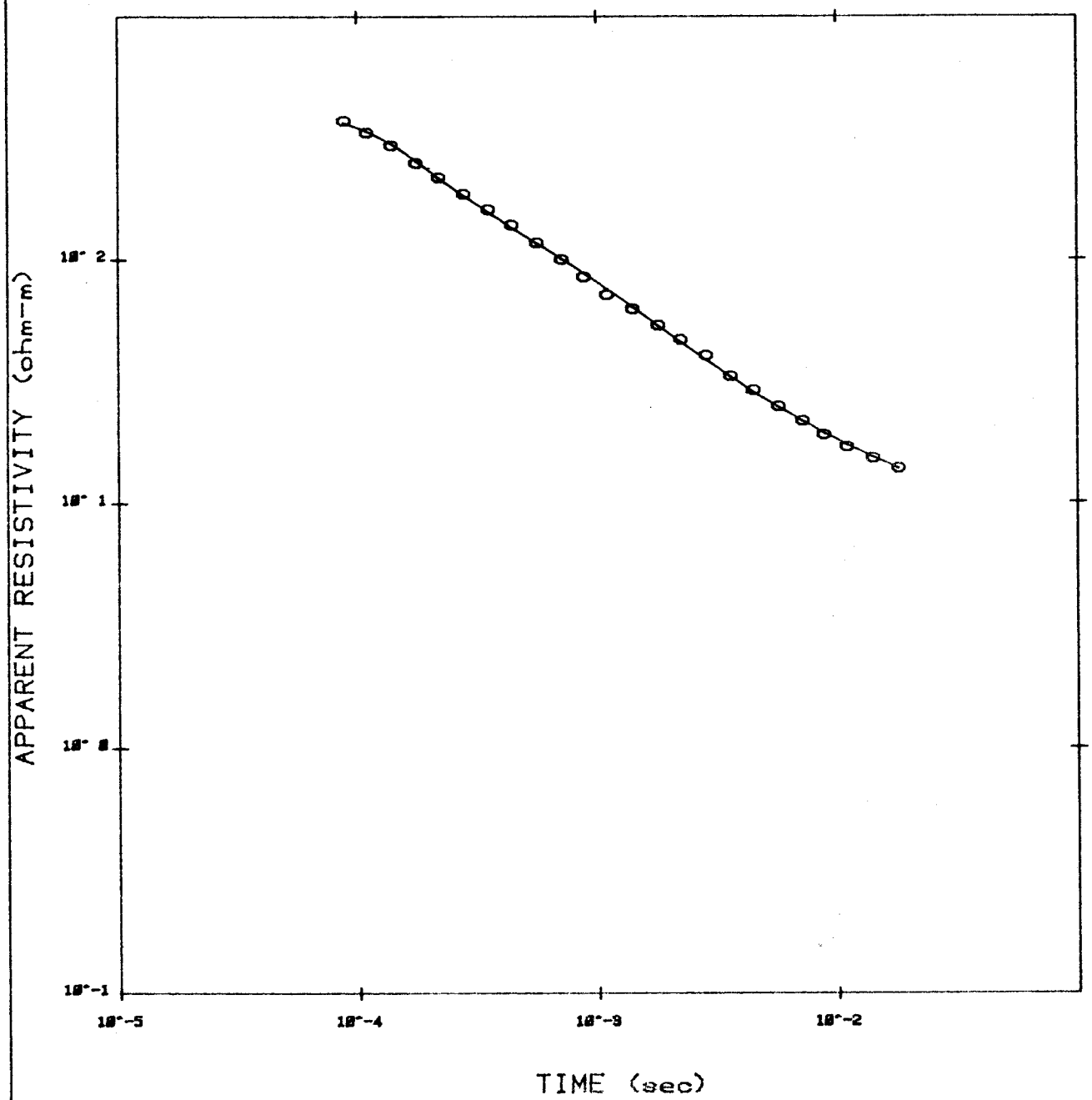
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		2054.4	6740.0		
236.62	135.1	1919.3	6296.8	.6	.6
17.71	80.0	1839.3	6034.3	4.5	5.1
5.96					

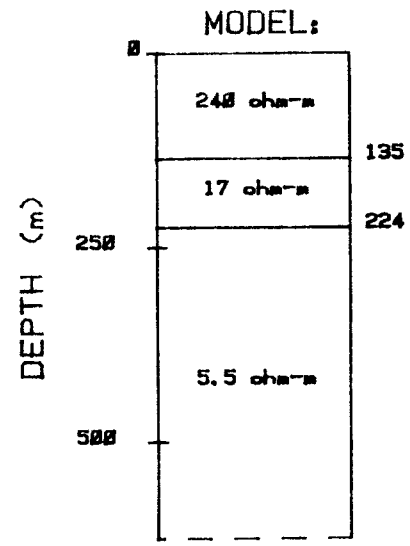
TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.42E+01	0.44E+01	-3.930	0.37E+03
0.11E-03	0.29E+01	0.29E+01	+0.492	0.33E+03
0.14E-03	0.19E+01	0.19E+01	+2.274	0.29E+03
0.18E-03	0.14E+01	0.13E+01	+3.187	0.25E+03
0.22E-03	0.98E+00	0.98E+00	+0.198	0.22E+03
0.28E-03	0.68E+00	0.68E+00	+0.446	0.19E+03
0.35E-03	0.47E+00	0.47E+00	-0.533	0.16E+03
0.44E-03	0.33E+00	0.34E+00	-0.841	0.14E+03
0.56E-03	0.23E+00	0.23E+00	+2.067	0.12E+03
0.71E-03	0.16E+00	0.16E+00	+2.907	0.10E+03
0.88E-03	0.12E+00	0.12E+00	+4.900	0.85E+02
0.11E-02	0.91E-01	0.85E-01	+6.616	0.72E+02
0.14E-02	0.60E-01	0.60E-01	+0.238	0.63E+02
0.18E-02	0.41E-01	0.42E-01	-3.790	0.54E+02
0.22E-02	0.29E-01	0.31E-01	-6.169	0.47E+02
0.29E-02	0.20E-01	0.22E-01	-9.354	0.41E+02
0.36E-02	0.15E-01	0.15E-01	-3.108	0.33E+02
0.45E-02	0.10E-01	0.11E-01	-4.024	0.29E+02
0.57E-02	0.73E-02	0.75E-02	-2.576	0.25E+02
0.72E-02	0.50E-02	0.51E-02	-1.045	0.22E+02
0.88E-02	0.37E-02	0.36E-02	+2.617	0.19E+02
0.11E-01	0.25E-02	0.24E-02	+3.560	0.17E+02
0.14E-01	0.16E-02	0.15E-02	+3.349	0.15E+02
0.18E-01	0.99E-03	0.98E-03	+1.502	0.14E+02

R: 168. X: 0. Y: 0. DL: 0. REQ: 168. CF: 1.0000
TDHZ ARRAY, 24 DATA POINTS, SYSTEM: NONE DATA: L385-K
JOB #685143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 3 STA 5 OCT. 13. 1985
RMS LOG ERROR: 1.60E-02. ANTILOG YIELDS 3.7630 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

P 1	1.00					
P 2	.00	1.00				
P 3	.00	.00	1.00			
F 1	.00	.00	.00	.00		
F 2	.00	.00	.00	.00	.00	
F 0	.00	.00	.00	.00	.00	.00
	P 1	P 2	P 3	F 1	F 2	F 0





ERROR= 3.2033 %
LOOP RADIUS= 100m

o FIELD DATA

— MODEL CURVE

THE EARTH TECHNOLOGY CORP.

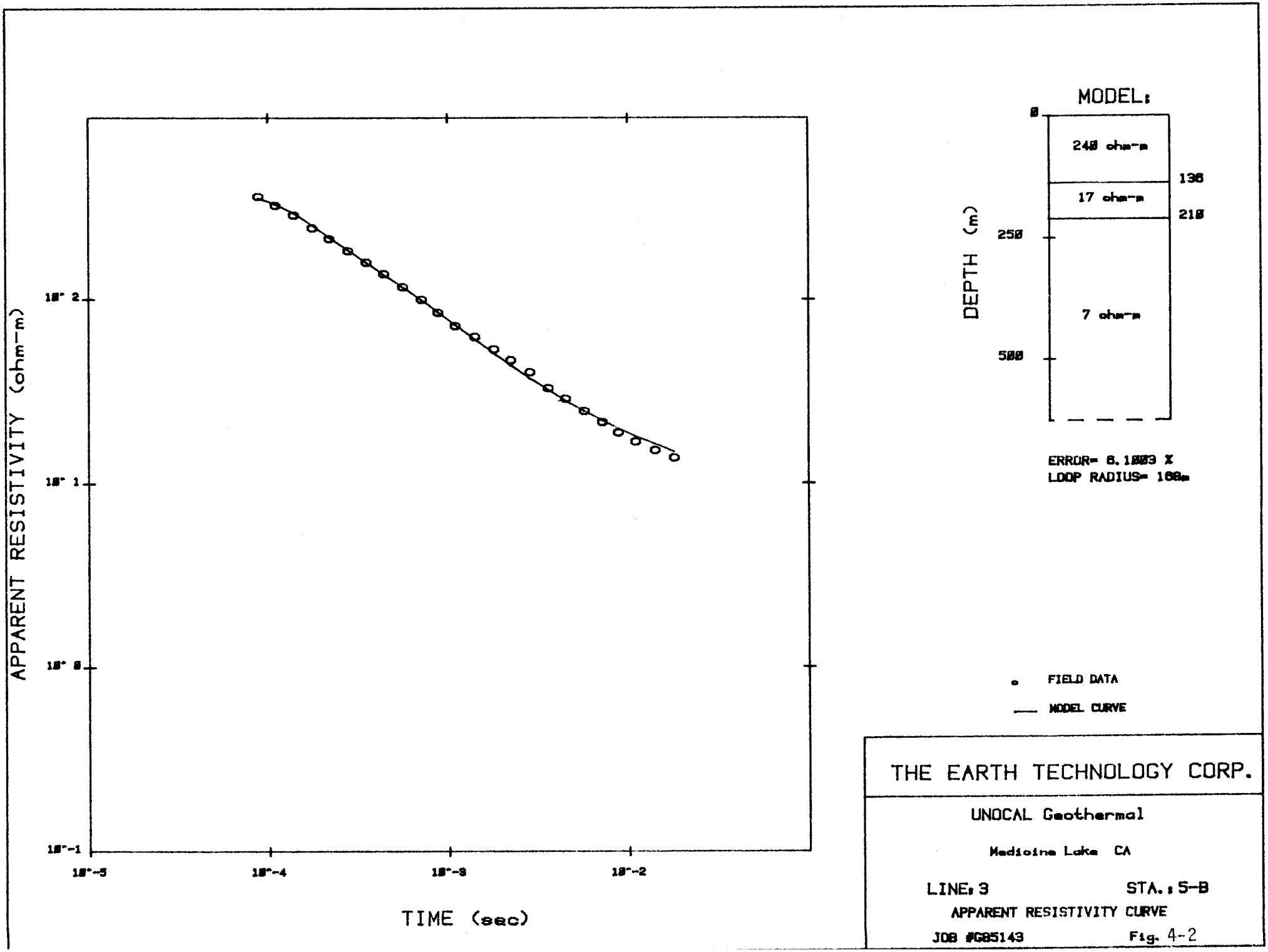
UNOCAL Geothermal

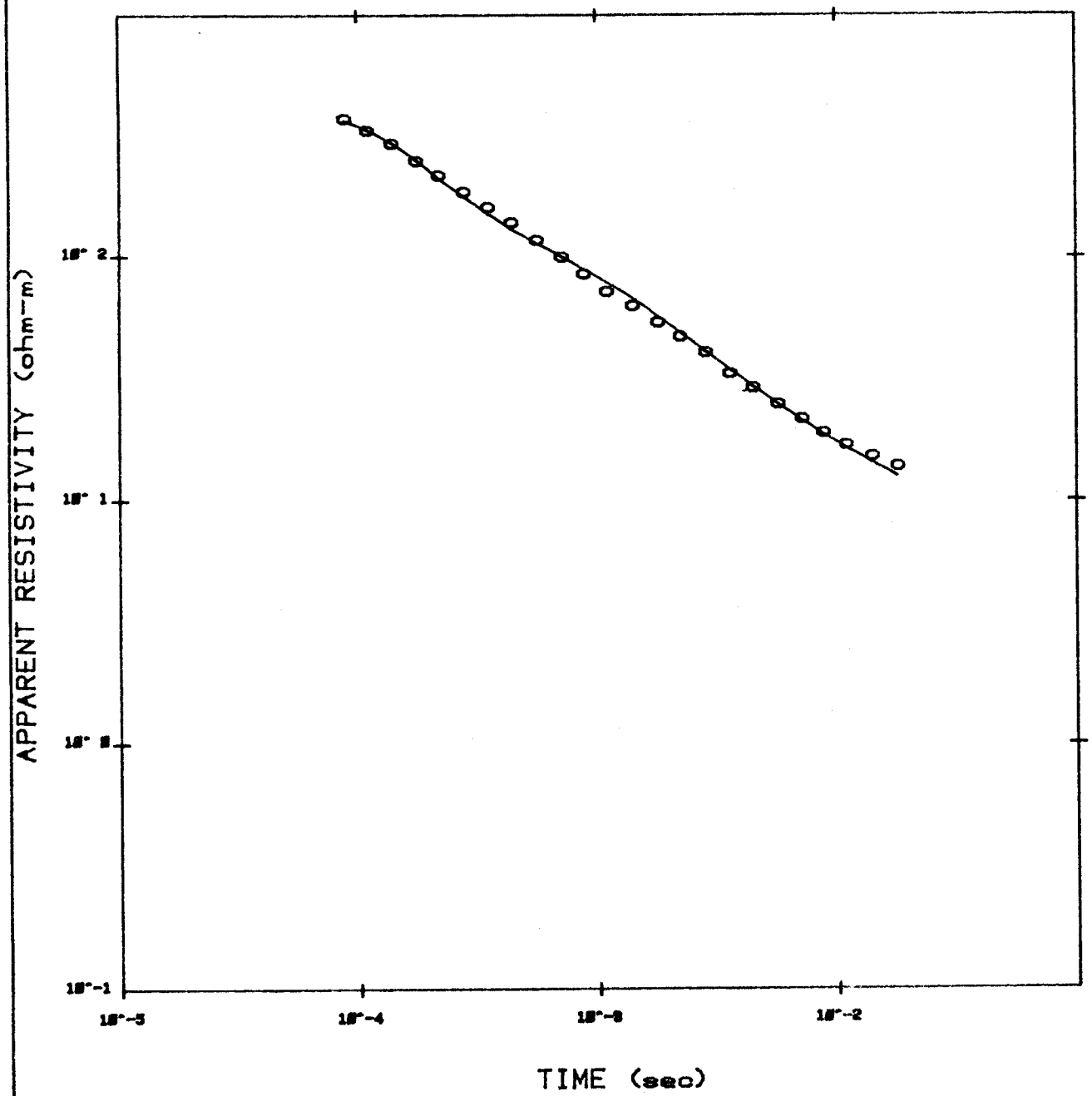
Medicine Lake CA

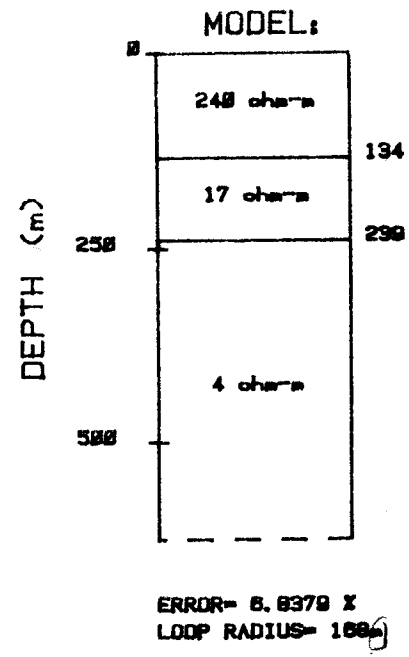
LINE: 3 STA.: 5-A

APPARENT RESISTIVITY CURVE

JOB #G85143 Fig. 4-1


APPARENT RESISTIVITY (ohm-m)
10^2
10^1
10^0
10^-1
10^-5
10^-4
10^-3
10^-2
TIME (sec)
MODEL:
0
240 ohm-m
136
17 ohm-m
210
250
7 ohm-m
500
DEPTH (m)
ERROR= 0.1003 %
LOOP RADIUS= 100m
FIELD DATA
MODEL CURVE
THE EARTH TECHNOLOGY CORP.
UNOCAL Geothermal
Medicine Lake CA
LINE: 3
STA.: 5-B
APPARENT RESISTIVITY CURVE
JOB #G85143
Fig. 4-2





• FIELD DATA

— MODEL CURVE

THE EARTH TECHNOLOGY CORP.

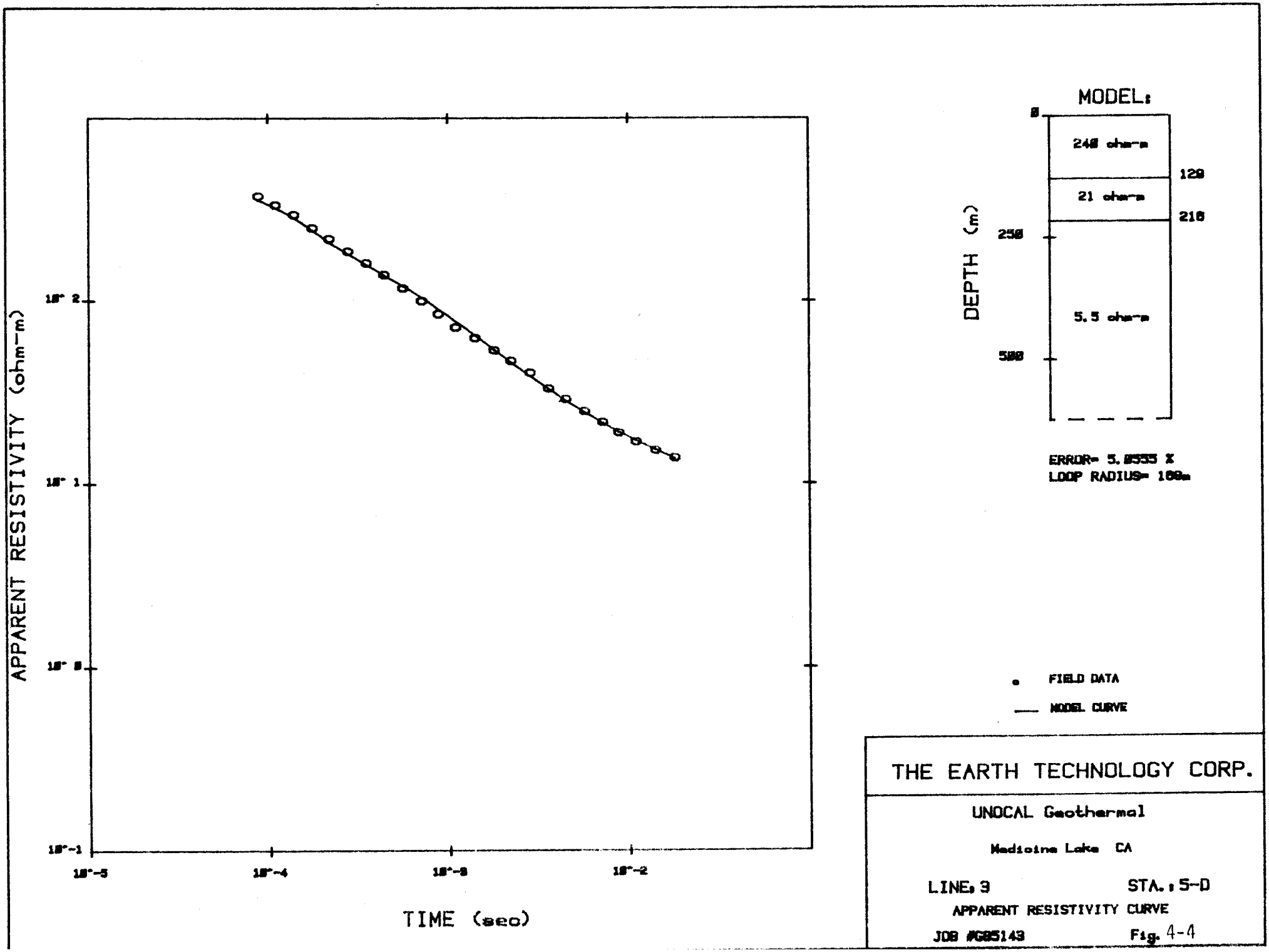
UNOCAL Geothermal

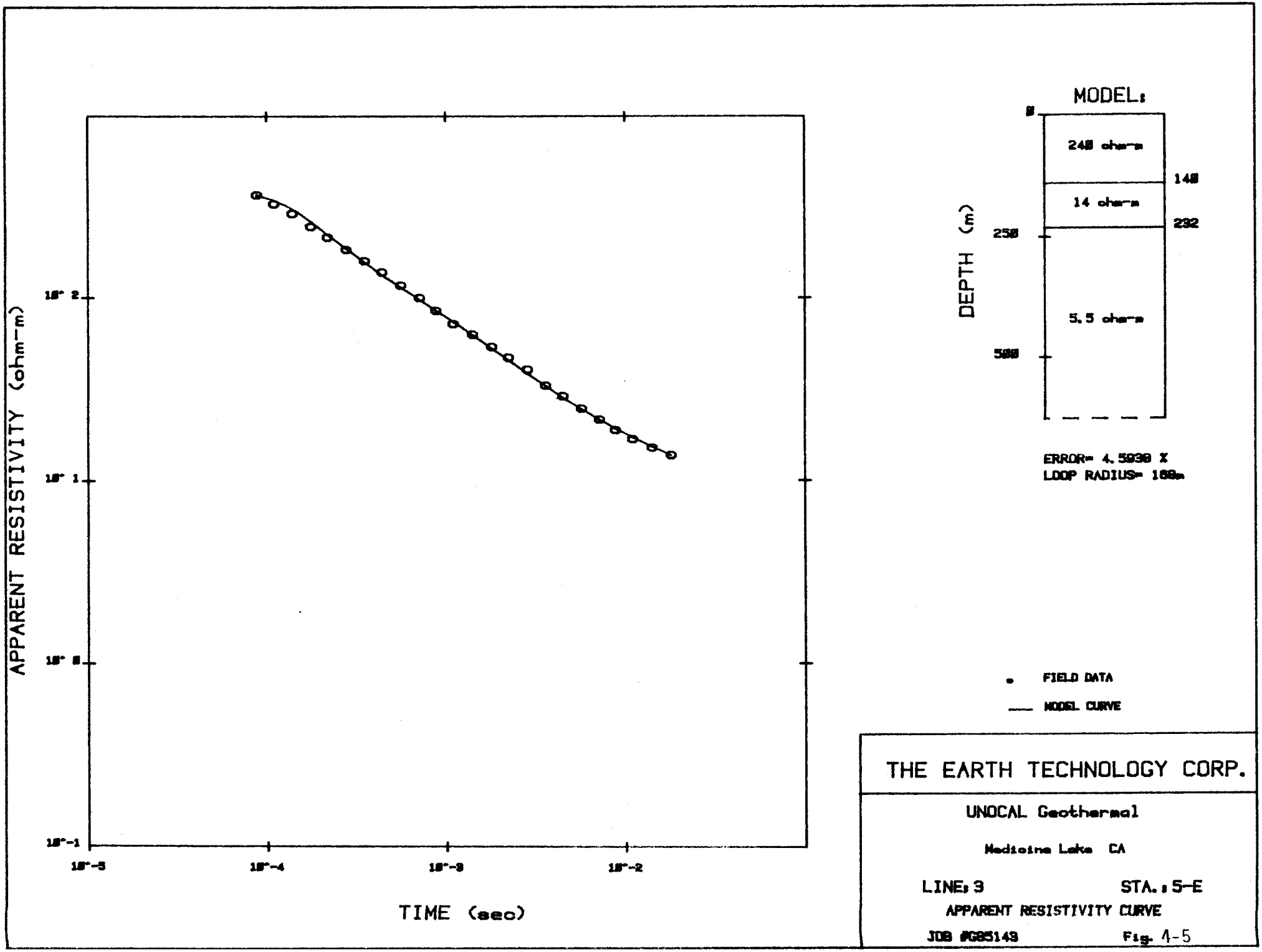
Medicine Lake CA

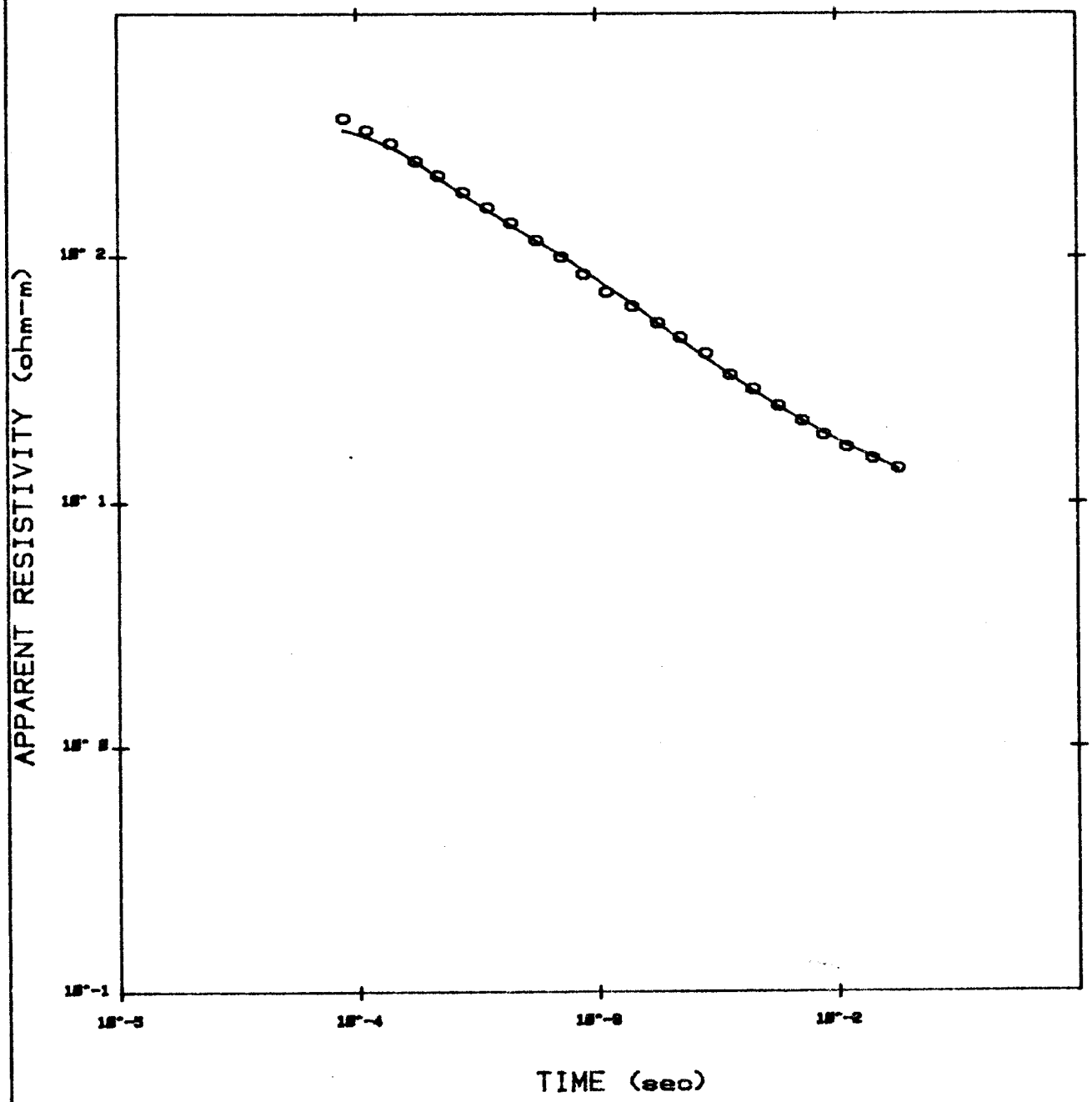
LINE: 3 STA.: 5-C

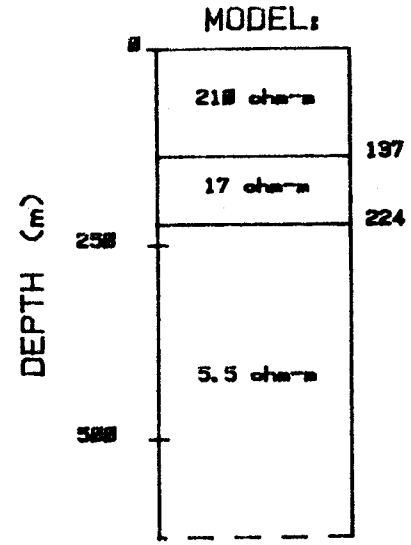
APPARENT RESISTIVITY CURVE

JOB #G85143 Fig. 4-3


APPARENT RESISTIVITY (ohm-m)
TIME (sec)
MODEL:
DEPTH (m)
0
250
500
240 ohm-m
21 ohm-m
5.5 ohm-m
120
210
ERROR= 5.0555 %
LOOP RADIUS= 100m
FIELD DATA
MODEL CURVE
THE EARTH TECHNOLOGY CORP.
UNOCAL Geothermal
Medicine Lake CA
LINE: 3
STA.: 5-D
APPARENT RESISTIVITY CURVE
JOB #G85143
Fig. 4-4


APPARENT RESISTIVITY (ohm-m)
TIME (sec)
MODEL:
DEPTH (m)
0
248 ohm-m
148
14 ohm-m
250
232
5.5 ohm-m
500
ERROR= 4.5930 %
LOOP RADIUS= 160m
FIELD DATA
MODEL CURVE
THE EARTH TECHNOLOGY CORP.
UNOCAL Geothermal
Medicine Lake CA
LINE: 3
STA.: 5-E
APPARENT RESISTIVITY CURVE
JOB #G85143
Fig. 4-5





• FIELD DATA

—— MODEL CURVE

THE EARTH TECHNOLOGY CORP.

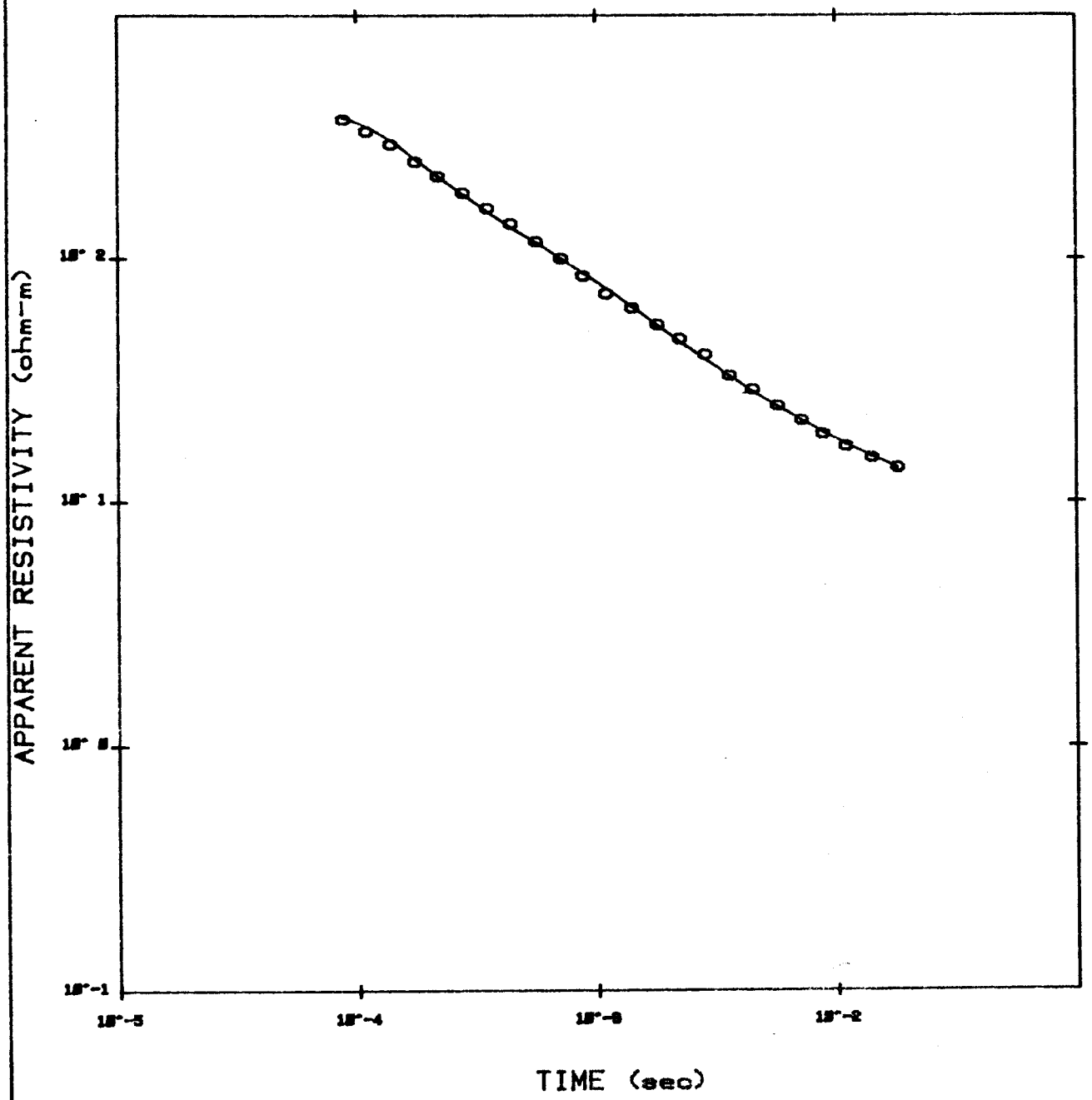
UNOCAL Geothermal

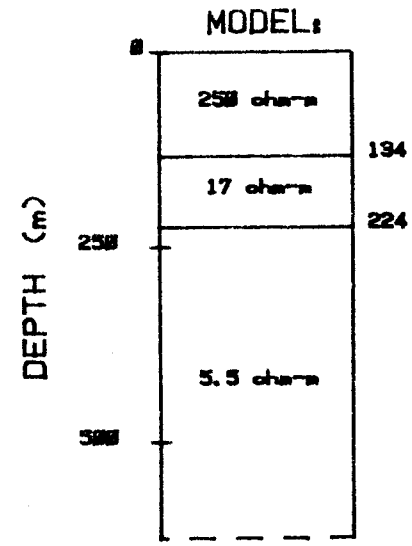
Medicine Lake CA

LINE: 3 STA.: 5-F

APPARENT RESISTIVITY CURVE

JOB #G85143 Fig. 4-6





ERROR= 3.7755 %
LOOP RADIUS= 100m

• FIELD DATA
— MODEL CURVE

THE EARTH TECHNOLOGY CORP.

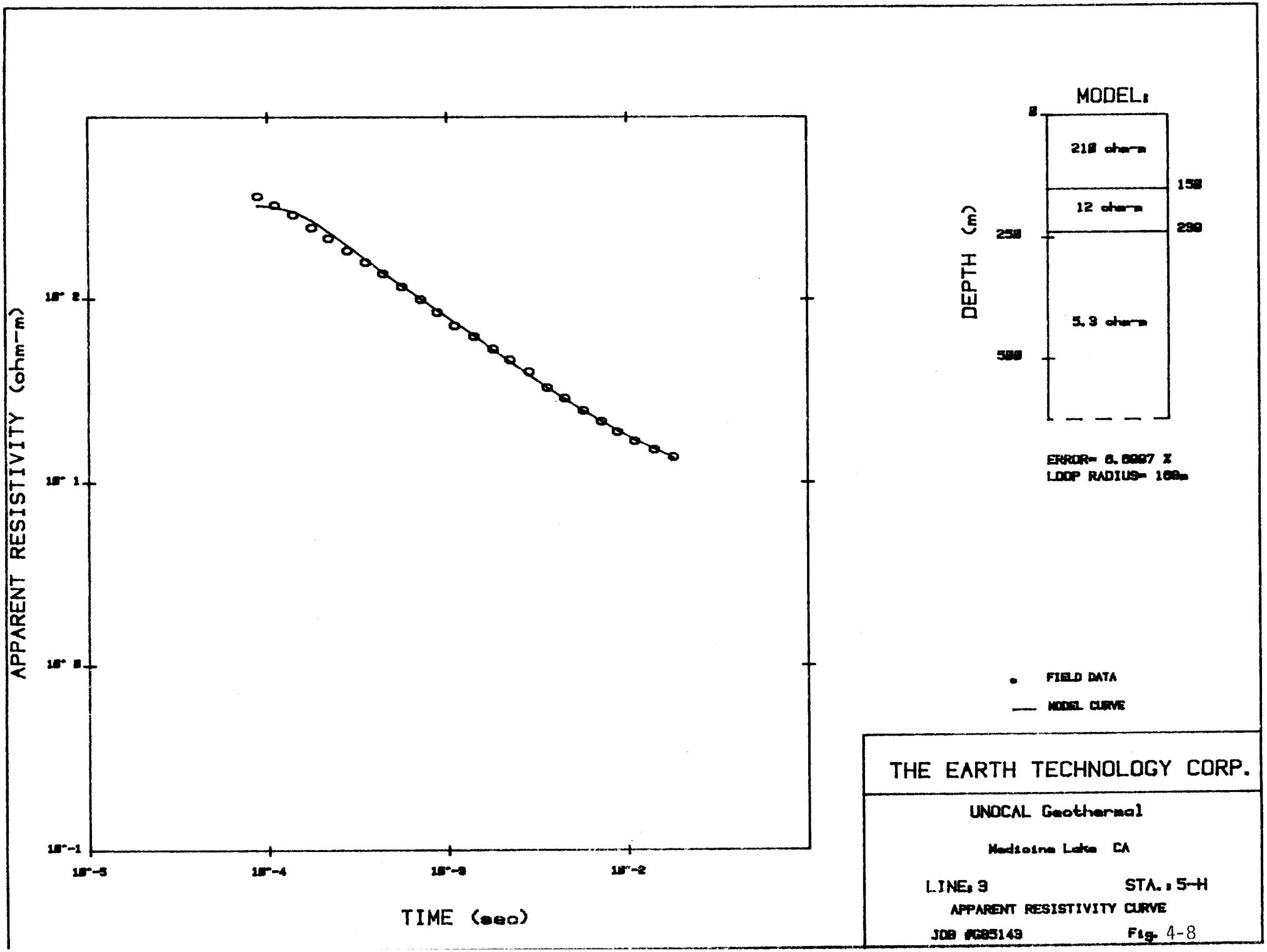
UNOCAL Geothermal

Medicine Lake CA

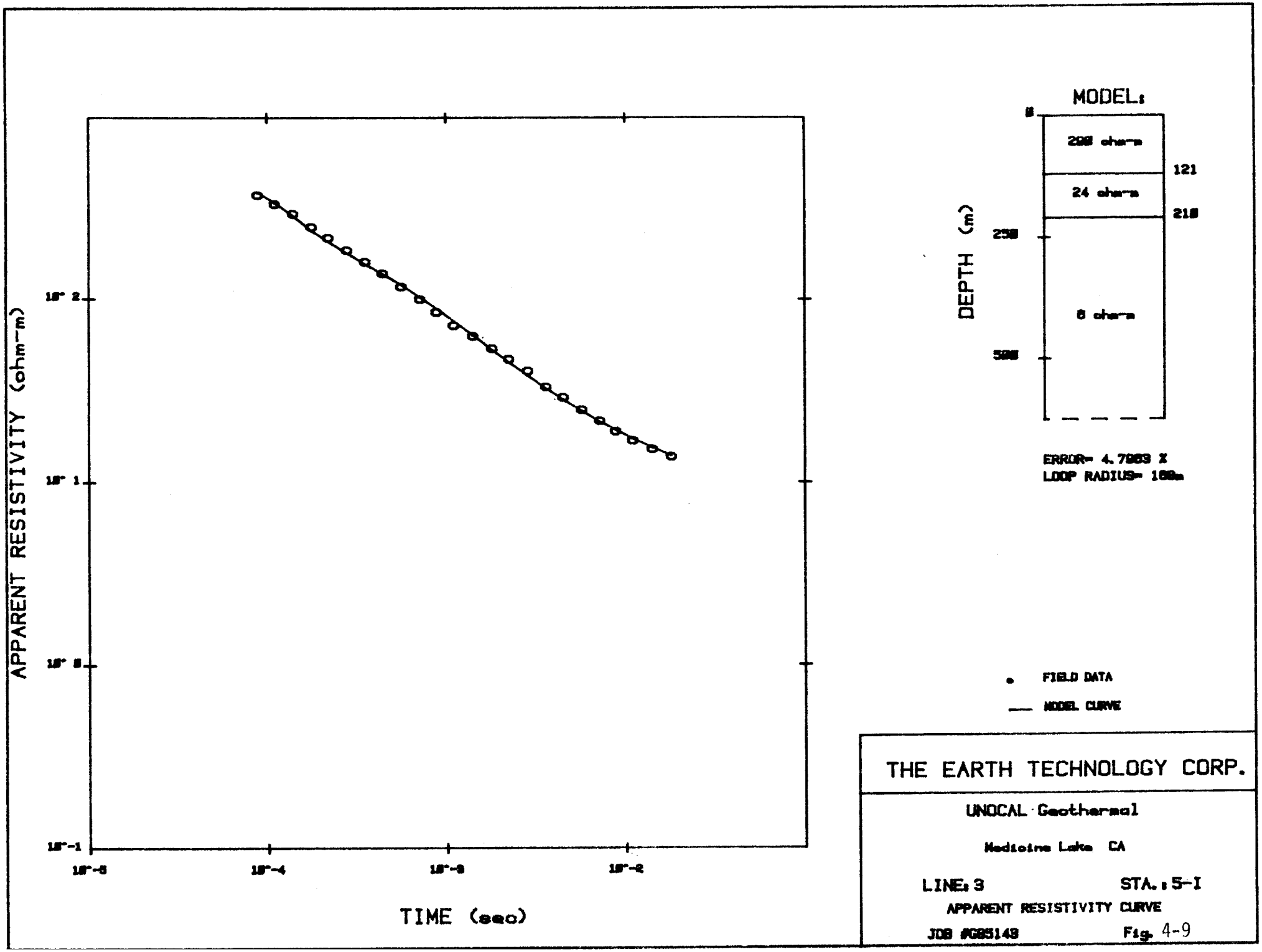
LINE: 3 STA.: 5-G

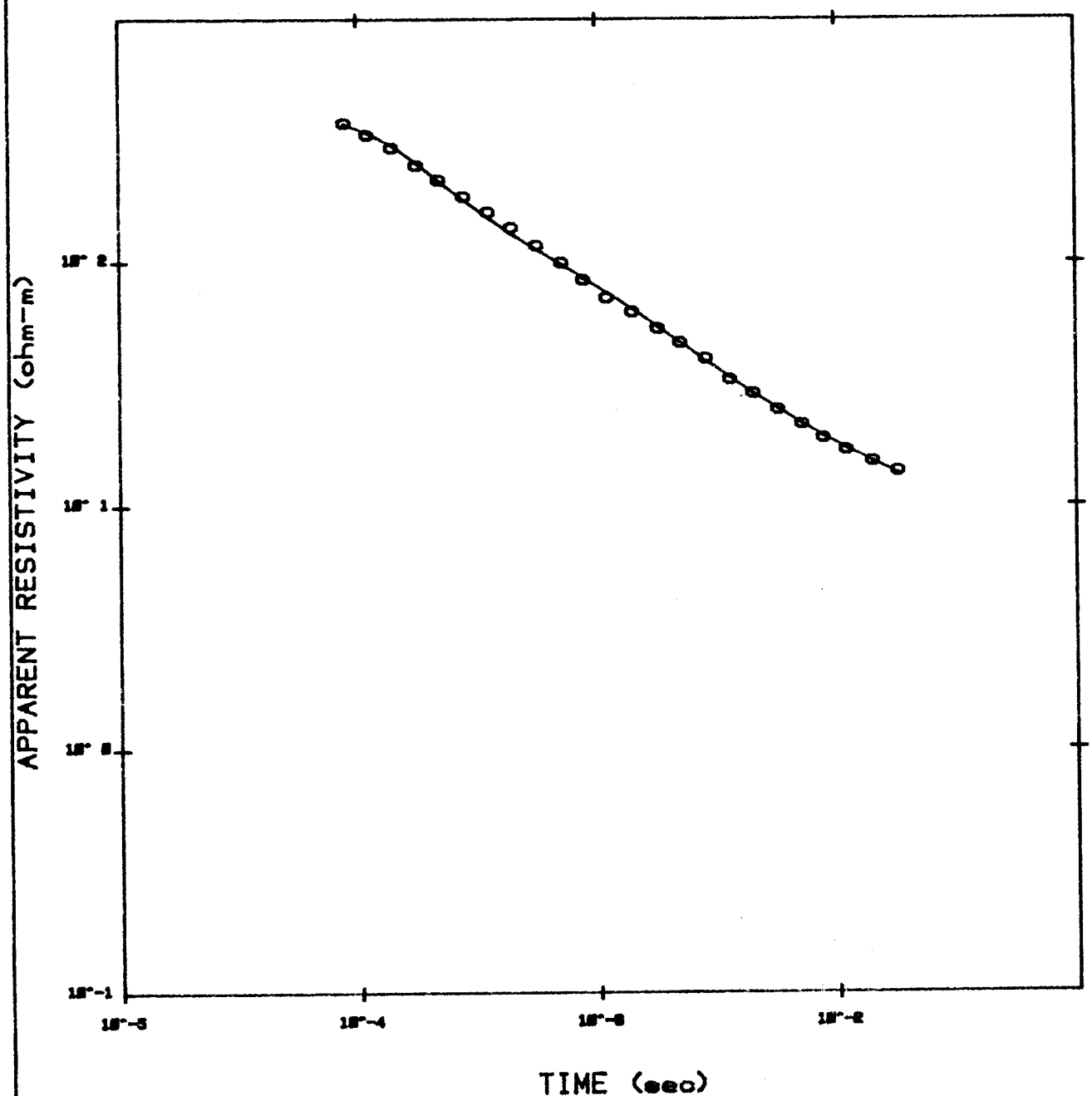
APPARENT RESISTIVITY CURVE

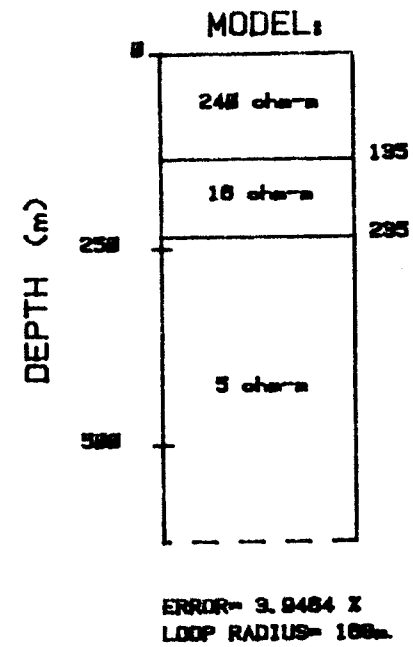
JOB #G85149 Fig. 4-7



APPARENT RESISTIVITY (ohm-m)
TIME (sec)
MODEL:
DEPTH (m)
210 ohm-m
12 ohm-m
5.3 ohm-m
ERROR= 6.6997 %
LOOP RADIUS= 100m
FIELD DATA
MODEL CURVE
THE EARTH TECHNOLOGY CORP.
UNOCAL Geothermal
Medicine Lake CA
LINE: 3
STA.: 5-H
APPARENT RESISTIVITY CURVE
JOB #G85143
Fig. 4-8


APPARENT RESISTIVITY (ohm-m)
TIME (sec)
MODEL:
DEPTH (m)
24 ohm-m
6 ohm-m
121
ERROR= 4.7983 %
FIELD DATA
MODEL CURVE
THE EARTH TECHNOLOGY CORP.
UNOCAL Geothermal
Medicine Lake CA
LINE: 3
STA.: 5-I
APPARENT RESISTIVITY CURVE
JOB #G85143
Fig. 4-9





• FIELD DATA

— MODEL CURVE

THE EARTH TECHNOLOGY CORP.

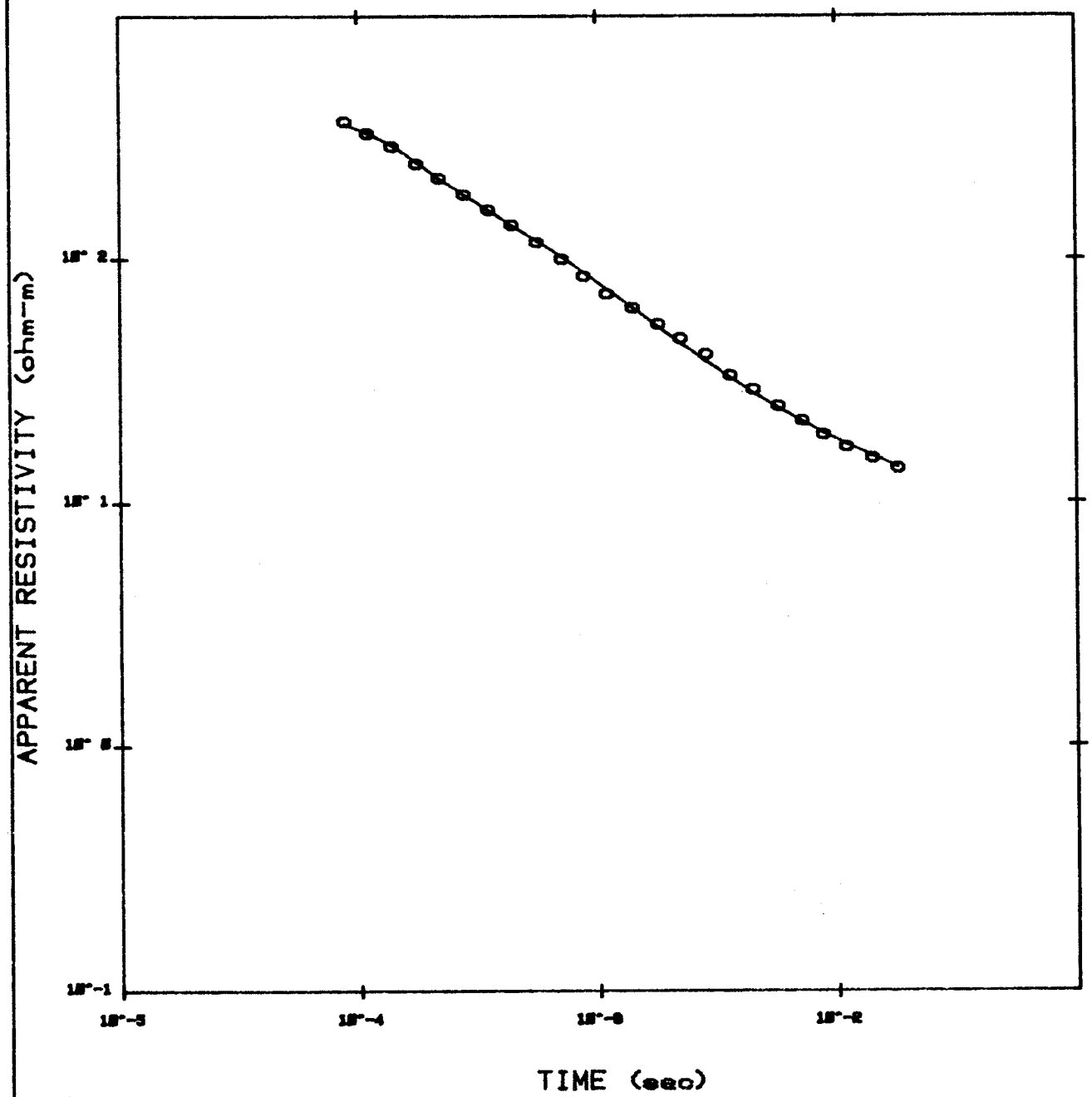
UNOCAL Geothermal

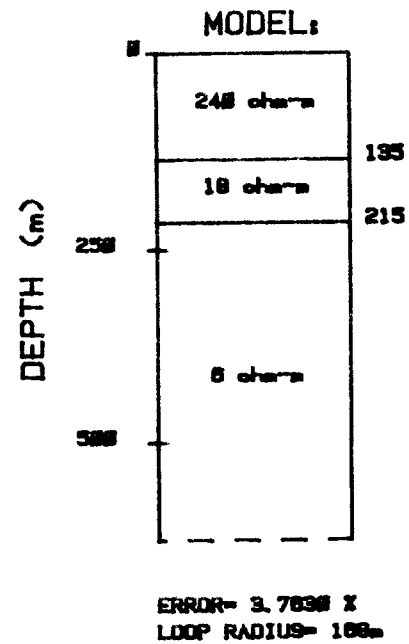
Medicine Lake CA

LINE: 3 STA.: 5-J

APPARENT RESISTIVITY CURVE

JOB #G85143 Fig. 4-10





• FIELD DATA

— MODEL CURVE

THE EARTH TECHNOLOGY CORP.

UNOCAL Geothermal

Medicine Lake CA

LINE: 3 STA.: 5-K

APPARENT RESISTIVITY CURVE

JOB #G85149 Fig. 4-11

5.0 HORIZONTAL READINGS AND NOISE MEASUREMENTS

5.1 HORIZONTAL READINGS

$\dot{B}x$: North
$\dot{B}y$: west
measurement directions

From the measurements taken of the two directions of the horizontal field, the angle and magnitude of the horizontal resultant was calculated. Tables of the values of $\dot{B}z$, $\dot{B}x$ and $\dot{B}y$ for the stations where horizontals were read are given in Appendix C. These values have been normalized to Volts/(Amp-m^2). Also shown in these tables is the normalized value of the horizontal resultant ($\dot{B}r$), the ratio of the resultant field to the vertical field ($\dot{B}r/\dot{B}z$), and the angle of the horizontal resultant (arctan ($\dot{B}x/\dot{B}y$)). The angle and magnitude of the horizontal resultants are plotted in plan view for channels 1, 5, 10 and 15 along the survey lines in Figures 3-2a through 3-7a. Although at the majority of the stations the resultant field is less than 15% that of the vertical field, there are several stations where the ratio is greater than 20%. Most of these stations occur where the geoelectric section is changing. It is important to note that all of the stations could be interpreted as one-dimensional structures.

5.2 NOISE MEASUREMENTS

The noise measurements taken show that the noise was less than 10% of the measured signal throughout the survey.

6.0 INFLUENCE OF TURN-ON TIME AND RAMP TIME OF PREVIOUS PULSE

The current waveform in the transmitter loop, as discussed in Section 3.0, consists of periods of time-on and time-off. The electromotive force in the receiver is measured only during time-off. The model curves are computed on the assumption that the secondary field is induced by the last ramp turn-off only. It is assumed that the secondary field, due to previous changes in current, has decayed to a negligible level.

It had been previously found that under certain conditions the turn-on time and ramp turn-off of a previous pulse can influence the measured secondary field. To investigate the influence of previous pulses the following were considered:

i) for the field measured at time t the influence of turn-on occurs at (t + 8.3) ms for high frequency (30 Hz), and at (t + 83) ms at low frequency (3 Hz). The polarity of turn-on pulse is opposite in respect to turn-off ramp time.

ii) the influence of the previous ramp turn-off occurs at (t + 2 X 8.3) ms for high frequency, and at (t + 2 X 83) ms at low frequency. The polarity of this pulse is also opposite to the main turn-off pulse.

iii) it is assumed that the amplitude of the induced electromotive force is the same for both turn-on and turn-off pulses.

In Figure 6-1 and 6-2 the influence of the turn-on pulse on the apparent resistivity is computed from forward model curves for the geoelectric sections interpreted at two example stations, Station 1 and Station 2. The computations are made for high (Figure 6-1) and low (Figure 6-2) frequency. The effect of pulse turn-on can be reduced by measurements at a lower frequency in the same time range, since the last ten time channels at a high frequency are equivalent to the first 10 time channels at the next lowest frequency.

To calculate the voltage due to previous turn-on and turn-off, the apparent resistivities calculated in the forward models are used. The

printouts from the forward models calculated at both stations are shown in Tables 6-1 and 6-2. The tables showing the calculations of the voltages due to previous turn-on and turn-off are given for both frequencies at both stations in Tables 6-3 through 6-7. For example, at channel 5 at 30 Hz, one calculates the voltage due to the previous turn-on by taking the time of channel 5 and adding 8.3 msec. The apparent resistivity at this time is then found by interpolating from the model curves, as indicated in Table 6-2. Using this value the voltage can then be calculated. The voltages due to the previous turn-on and turn-off are then added to the measured voltage, and a corrected apparent resistivity is calculated.

TABLE 6-1

FORWARD MODEL
STATION 1

RECTAN :
record : 1

.	Title	: PREVIOUS PULSE CALC. L5005040
.	Number of layers	: 3
3&4.	Thickness & Resistivity	:

Thickness	Resistivity
.177000E+03	.327000E+03
.117000E+03	.880000E+02
INFINITE	.680000E+02

.	Source - RECTANGULAR LOOP:	300.00 X 300.00
6.	Point of receiver (XO,YO):	.000E+00, [illegible]+00
7.	Current in transmitter :	10.000
.	Induction numbers :	BO= .10000E-01 NB= 10 BM= .10000E+03
7.	Time gates :	TO= .8850E-04 Gates 30 Freq= .3000E+02 Hz
0.	Field component :	BZ
.	On output file :	TIME DOMAIN
.	Output file name :	X.DAT record 1
3.	Runon correction :	NO
.	Low pass filter correct. :	NO

TIME DOMAIN RESPONSE

REAL TIME	TAU	BZ	APP.RES	TAU/H1	APP./RO1
.88500E-04	.13485E+04	.23466E-04	.40908E+03	.76184E+01	.12510E+01
.11150E-03	.15136E+04	.14142E-04	.39012E+03	.85513E+01	.11[illegible]01
.14048E-03	.16989E+04	.86834E-05	.36742E+03	.95985E+01	.11236E+01
.17700E-03	.19070E+04	.54757E-05	.33996E+03	.10774E+02	.10396E+01
.22301E-03	.21405E+04	.34683E-05	.31362E+03	.12093E+02	.95908E+00
.28097E-03	.24027E+04	.22411E-05	.28550E+03	.13574E+02	.87308E+00
.35400E-03	.26969E+04	.14429E-05	.26052E+03	.15237E+02	.79671E+00
.44601E-03	.30272E+04	.93550E-06	.23663E+03	.17103E+02	.72363E+00
.56194E-03	.33979E+04	.60506E-06	.21527E+03	.19197E+02	.65833E+00
.70800E-03	.38140E+04	.39012E-06	.19626E+03	.21548E+02	.60017E+00
.89202E-03	.42811E+04	.25102E-06	.17916E+03	.24187E+02	.54789E+00
.11239E-02	.48053E+04	.16002E-06	.16457E+03	.27149E+02	.50[illegible]7E+00
.14160E-02	.53938E+04	.10162E-06	.15156E+03	.30473E+02	.46349E+00
.17840E-02	.60543E+04	.63765E-07	.14069E+03	.34205E+02	.43026E+00
.22478E-02	.67958E+04	.39807E-07	.13105E+03	.38394E+02	.40078E+00
.28320E-02	.76280E+04	.24603E-07	.12289E+03	.43096E+02	.37582E+00
.35681E-02	.85621E+04	.15129E-07	.11563E+03	.48374E+02	.35361E+00
.44955E-02	.96107E+04	.92319E-08	.10936E+03	.54298E+02	.33443E+00
.56640E-02	.10788E+05	.55910E-08	.10395E+03	.60947E+02	.31788E+0[illegible]
.71362E-02	.12109E+05	.33688E-08	.99140E+02	.68411E+02	.30318E+0[illegible]
.89910E-02	.13592E+05	.20233E-08	.94759E+02	.76788E+02	.28978E+0[illegible]
.11328E-01	.15256E+05	.12143E-08	.90618E+02	.86192E+[illegible]	[illegible]7712E+0[illegible]
.14272E-01	.17124E+05	.73296E-09	.86323E+02	.96747E+02	.26399E+0[illegible]
.17982E-01	.19221E+05	.45130E-09	.81152E+02	.10860E+03	.24817E+0[illegible]
.22656E-01	.21575E+05	.27995E-09	.75912E+02	.12189E+0[illegible]	.23215E+0[illegible]
.28545E-01	.24217E+05	.17284E-09	.71237E+02	.13682E+03	.21785E+0[illegible]
.35964E-01	.27183E+05	.11974E-09	.61907E+02	.15358E+03	.18932E+0[illegible]
.45312E-01	.30512E+05	.90699E-10	.50615E+02	.17238E+03	.15477E+0[illegible]
.57090E-01	.34249E+05	.74[illegible]9E-10	.39486E+02	.19349E+03	.12975E+0[illegible]
.71929E-01	.38443E+05	.5[illegible]	.31644E+02	.21719E+03	.[illegible]

RECTAN>:
record : 2

TABLE 6-2

FORWARD MODEL
STATION 2

1. Title : PREVIOUS PULSE CALC. L5005290
2. Number of layers : 3

3&4. Thickness & Resistivity :

Thickness	Resistivity
.930000E+02	.650000E+02
.225000E+03	.110000E+02
INFINITE	.520000E+02

5. Source - RECTANGULAR LOOP: 300.00 X 300.00
6. Point of receiver (XO,YO): .000E+00, .000E+00
7. Current in transmitter : 10.000
8. Induction numbers : BO= .10000E-01 NB= 10 BM= .10000E+03
9. Time gates : TO= .8850E-04 Gates 30 Freq= .3000E+02 Hz
10. Field component : BZ
11. On output file : TIME DOMAIN
12. Output file name : X.DAT record 2
13. Runon correction : NO
14. Low pass filter correct. : NO

TIME DOMAIN RESPONSE

REAL TIME	TAU	BZ	APP.RES	TAU/H1	APP./RD1
.88500E-04	.60120E+03	.10627E-03	.14945E+03	.64645E+01	.22993E+01
.11150E-03	.67482E+03	.69261E-04	.13527E+03	.72562E+01	.20811E+01
.14048E-03	.75746E+03	.44396E-04	.12380E+03	.81448E+01	.19047E+01
.17700E-03	.85022E+03	.29056E-04	.11174E+03	.91422E+01	.17191E+01
.22301E-03	.95434E+03	.19353E-04	.99688E+02	.10262E+02	.15337E+01
.28097E-03	.10712E+04	.13354E-04	.86862E+02	.11518E+02	.13363E+01
.35400E-03	.12024E+04	.93961E-05	.74709E+02	.12929E+02	.11494E+01
.44601E-03	.13496E+04	.66335E-05	.64112E+02	.14512E+02	.98633E+00
.56194E-03	.15149E+04	.47058E-05	.54843E+02	.16290E+02	.84374E+00
.70800E-03	.17004E+04	.32[illegible]E-05	.47336E+02	.18284E+02	.72824E+00
.89202E-03	.19087E+04	.22[illegible]E-05	.41077E+02	.20524E+02	.63196E+00
.11239E-02	.21424E+04	.15[illegible]E-05	.35979E+02	.23037E+02	.55332E+00
.14160E-02	.24048E+04	.10[illegible]E-05	.31739E+02	.25858E+02	.48829E+00
.17840E-02	.26993E+04	.71[illegible]E-06	.28170E+02	.29025E+02	.43339E+00
.22479E-02	.30299E+04	.47[illegible]E-06	.25195E+02	.32579E+02	.38761E+00
.28320E-02	.34009E+04	.30[illegible]E-06	.22707E+02	.36569E+02	.34934E+00
.35681E-02	.38174E+04	.19[illegible]E-06	.20753E+02	.41047E+02	.31928E+00
[illegible]755E-02	[illegible]E+04	.12[illegible]E-06	.19274E+02	.46074E+02	.29652E+00
.56640E-02	[illegible]E+04	.76[illegible]E-07	.18237E+02	.51716E+02	.28056E+00
.71362E-02	[illegible]E+04	.45[illegible]E-07	.17601E+02	.58049E+02	.27079E+00
.89910E-02	[illegible]E+04	.25[illegible]E-07	.17316E+02	.65158E+02	.26639E+00
.11328E-01	.68018E+04	.14[illegible]E-07	.17319E+02	.73138E+02	.26645E+00
.14272E-01	.76348E+04	.79440E-08	.17626E+02	.82094E+02	.27117E+00
.17982E-01	.85697E+04	.42542E-08	.18186E+02	.92148E+02	.27978E+00
.22656E-01	.96192E+04	.22471E-08	.18936E+02	.10343E+03	.29132E+00
.28545E-01	.10797E+05	.11666E-08	.19946E+02	.11610E+03	.30686E+00
[illegible]64E-01	.12119E+05	.60757E-09	.20965E+02	.13032E+03	.32254E+00
.45312E-01	.13604E+05	.31096E-09	.22294E+02	.14628E+03	.34298E+00
.57090E-01	.15270E+05	.16273E-09	.23358E+02	.16419E+03	.35936E+00
.71928E-01	.17139E+05	.85936E-10	.24325E+02	.18430E+03	.37423E+00

TABLE 5-3

CALCULATION OF THE INFLUENCE OF SUPERPOSITION OF PULSES
STATION 1 - 30 Hz

CH	Time, t msec	t + 2 X 8.3 msec	t + 8.3 msec	Voltage Due To Previous Turn-Off	Voltage Due To Previous Turn-On	Measured Reading	Corrected Reading	New ρ_a	Old ρ_a	% $\left(\frac{\text{old}\,\rho_a}{\text{new}\,\rho_a}\right)$
1	.0885	16.689	8.389	0.35	1.56	15860	15862	404.6	404.6	0
2	.1115	16.7115	8.412	0.35	1.56	10018	10020	373.9	374.0	0.03
3	.145	16.741	8.441	0.35	1.54	6043	6045	338.0	338.1	0.03
4	.177	16.777	8.477	0.35	1.53	3776	3778	331.7	331.8	0.03
5	.223	16.823	8.523	0.34	1.51	2455	2457	300.7	300.8	0.03
6	.281	16.881	8.581	0.34	1.49	1547	1549	278.2	278.4	0.07
7	.354	16.954	8.654	0.34	1.46	979	981	256.7	257.0	0.12
8	.446	17.046	8.746	0.33	1.43	645	647	230.5	231.0	0.22
9	.562	17.162	8.862	0.33	1.39	410	412	211.8	212.5	0.33
10	.708	17.308	9.008	0.32	1.34	269	271	190.6	191.6	0.52
11	.892	17.492	9.192	0.32	1.28	182	184	167.9	169.1	0.71
12	1.124	17.724	9.424	0.31	1.21	115	116.5	154.9	156.2	0.83
13	1.416	18.016	9.716	0.30	1.13	68	69.4	148.9	150.9	1.33
14	1.784	18.384	10.084	0.29	1.04	41	42.3	140.9	143.9	2.08
15	2.248	18.848	10.548	0.27	.94	26	27.2	128.7	132.6	2.94
16	2.832	19.432	11.132	0.25	.84	15.3	16.4	122.7	128.5	4.51
17	3.568	20.168	11.868	0.24	.73	8.8	9.8	117.7	126.4	6.90
18	4.496	21.096	12.796	0.22	.62	5.5	6.3	107.5	117.6	8.62
19	5.664	22.264	13.964	0.19	.51	3.2	3.9	100.7	114.87	12.34
20	7.136	23.736	15.436	0.17	.41	1.8	2.4	94.7	114.7	17.4

TABLE 6-4

CALCULATION OF THE INFLUENCE OF SUPERPOSITION OF PULSES
STATION 1 - 3 Hz

CH	Time, t msec	t + 2 X 8.3 msec	t + 8.3 msec	Voltage Due To Previous Turn-Off	Voltage Due To Previous Turn-On	Measured Reading	Corrected Reading	New ρ_a	Old ρ_a	$\left(\frac{\text{old}\rho_a}{\text{new}\rho_a}\right)$ %
1	0.892	167.49	84.19	0.12	0.13	733.2	733.5	168.3	168.4	0.06
2	1.112	167.71	84.41	0.12	0.13	473.2	473.45	156.0	156.1	0.06
3	1.416	168.02	84.72	0.12	0.13	279.0	279.3	148.3	148.4	0.07
4	1.784	168.38	85.08	0.12	0.13	171.9	172.15	139.3	139.4	0.07
5	2.247	168.85	85.55	0.12	0.13	108.1	108.4	129.1	129.3	0.15
6	2.832	169.43	86.13	0.12	0.13	65.9	66.2	121.9	122.3	0.33
7	3.568	170.17	86.87	0.12	0.13	38.7	39.0	118.1	118.7	0.51
8	4.496	171.1	87.8	0.12	0.13	25.2	25.5	106.6	107.5	0.8[illegible]
9	5.664	172.26	88.96	0.12	0.13	14.9	15.2	102.4	103.8	1.35
10	7.136	173.74	90.44	0.12	0.13	9.3	9.6	94.7	96.7	2.07
11	8.991	175.59	92.29	0.12	0.12	6.3	6.6	82.7	85.3	3.1
12	11.328	177.93	94.63	0.12	0.12	3.9	4.1	77.3	79.9	3.3

TABLE 6-5

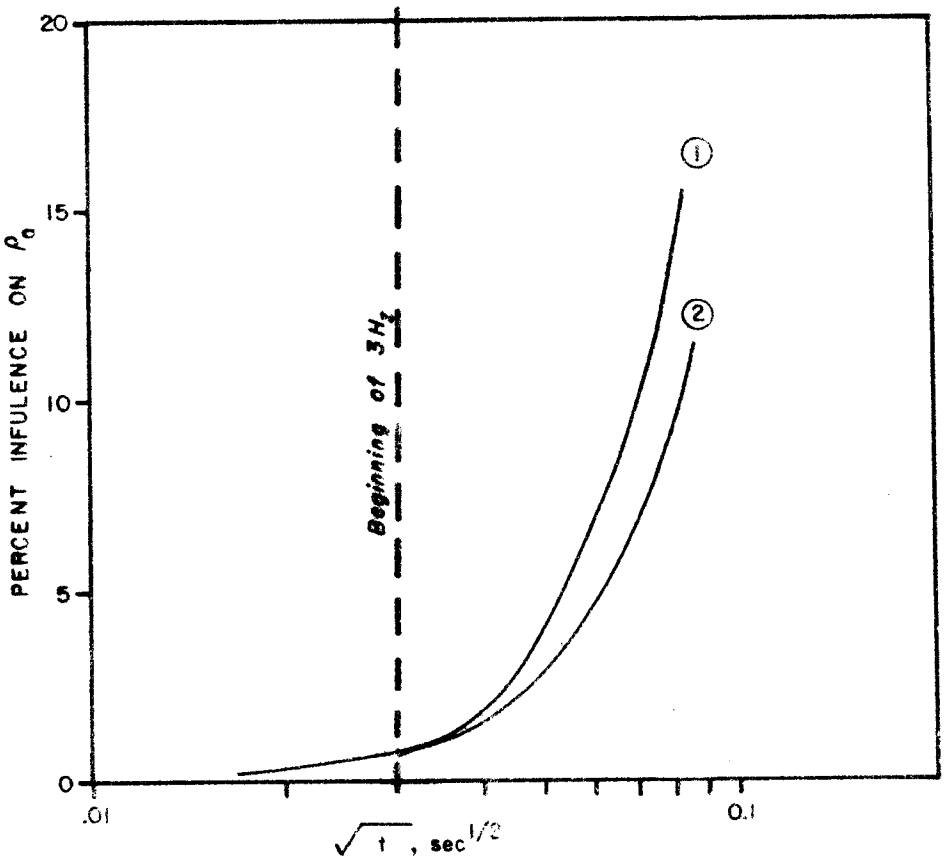
CALCULATION OF THE INFLUENCE OF SUPERPOSITION OF PULSES
STATION 2 - 30 Hz

CH	Time, t msec	t + 2 X 8.3 msec	t + 8.3 msec	Voltage Due To Previous Turn-Off	Voltage Due To Previous Turn-On	Measured Reading	Corrected Reading	New ρ_a	Old ρ_a	% $\left(\frac{\text{old}\,\rho_a}{\text{new}\,\rho_a}\right)$
1	0.0885	16.689	8.389	.87	5.08	19615	19621	139.3	139.4	0.07
2	.1115	16.7115	8.412	.86	5.05	12935	12941	125.1	125.2	0.08
3	.1405	16.741	8.441	.86	5.01	8149	8155	115.8	115.9	0.09
4	.177	16.777	8.477	.85	4.95	5352	5357	104.3	104.4	0.10
5	.223	16.823	8.523	.85	4.89	3674	3680	91.1	91.2	0.11
6	.281	16.881	8.581	.84	4.82	2460	2466	81.0	81.1	0.12
7	.354	16.954	8.654	.83	4.72	1670	1676	71.3	71.4	0.14
8	.446	17.046	8.746	.82	4.6	1184	1189	61.0	61.1	0.16
9	.562	17.162	8.862	.80	4.46	817	822	53.1	53.3	0.38
10	.708	17.308	9.008	.78	4.29	577	582	45.3	45.7	0.66
11	.892	17.492	9.192	.76	4.08	429	434	37.6	37.9	0.79
12	1.124	17.724	9.424	.74	3.83	304	309	32.1	32.4	0.93
13	1.416	18.016	9.716	.70	3.55	205	209	28.3	28.7	1.39
14	1.784	18.384	10.084	.66	3.24	138	142	24.9	25.4	2.0
15	2.248	18.848	10.548	.62	2.89	94	97.5	21.8	22.3	2.2
16	2.832	19.432	11.132	.57	2.53	59	62.1	20.0	20.7	3.4
17	3.568	20.168	11.868	.52	2.14	36	38.7	18.7	19.6	4.6
18	4.496	21.096	12.796	.46	1.76	22	24.2	17.4	18.5	5.9
19	5.664	22.264	13.964	.39	1.4	12	13.8	17.2	18.9	9.0
20	7.136	23.736	15.436	.33	1.07	7	8.4	16.3	18.4	11.4

TABLE 6-6

CALCULATION OF THE INFLUENCE OF SUPERPOSITION OF PULSES
STATION 2 - 3 Hz

CH	Time, t msec	t + 2 X 8.3 msec	t + 8.3 msec	Voltage Due To Previous Turn-Off	Voltage Due To Previous Turn-On	Measured Reading	Corrected Reading	New ρ_a	Old ρ_a	% $\left(\frac{\text{old}\,\rho_a}{\text{new}\,\rho_a}\right)$
1	.892	167.49	84.19	0.04	0.15	6954.2	6954.4	37.6	37.6	0
2	1.112	167.712	84.41	0.04	0.15	5014.9	5015.1	32.4	32.4	0
3	1.416	168.02	84.72	0.04	0.15	3387.1	3387.3	28.1	28.1	0
4	1.784	168.38	85.08	0.04	0.15	2310.2	2310.4	24.7	24.7	0
5	2.247	168.85	85.55	0.04	0.15	1583.1	1583.3	21.6	21.6	0
6	2.832	169.43	86.13	0.04	0.14	1004.1	1004.3	19.9	19.9	0
7	3.568	170.17	86.87	0.04	0.14	620.5	620.7	18.7	18.7	0
8	4.496	171.10	87.80	0.04	0.14	384.7	384.9	17.5	17.5	0
9	5.664	172.26	88.96	0.04	0.13	225.5	225.7	17.0	17.0	0
10	7.136	173.74	90.44	0.04	0.13	129.7	129.9	16.7	16.7	0
11	8.991	175.59	92.29	0.04	0.12	80.6	80.8	15.6	15.6	0
12	11.328	177.93	94.63	0.04	0.12	44.2	44.4	15.8	15.8	0
13	14.272	180.87	97.57	0.04	0.11	19.9	20.1	18.2	18.3	0.6
14	17.982	184.58	101.28	0.04	0.10	7.0	7.1	24.8	25.1	1.2
15	22.66	189.26	105.96	0.03	0.09	1.8	1.9	40.6	42.1	3.6



STATION ①

ρ_1	h_1	ρ_2	h_2	ρ_3
327	177	88	117	68

STATION ②

ρ_1	h_1	ρ_2	h_2	ρ_3
65	93	11	225	52

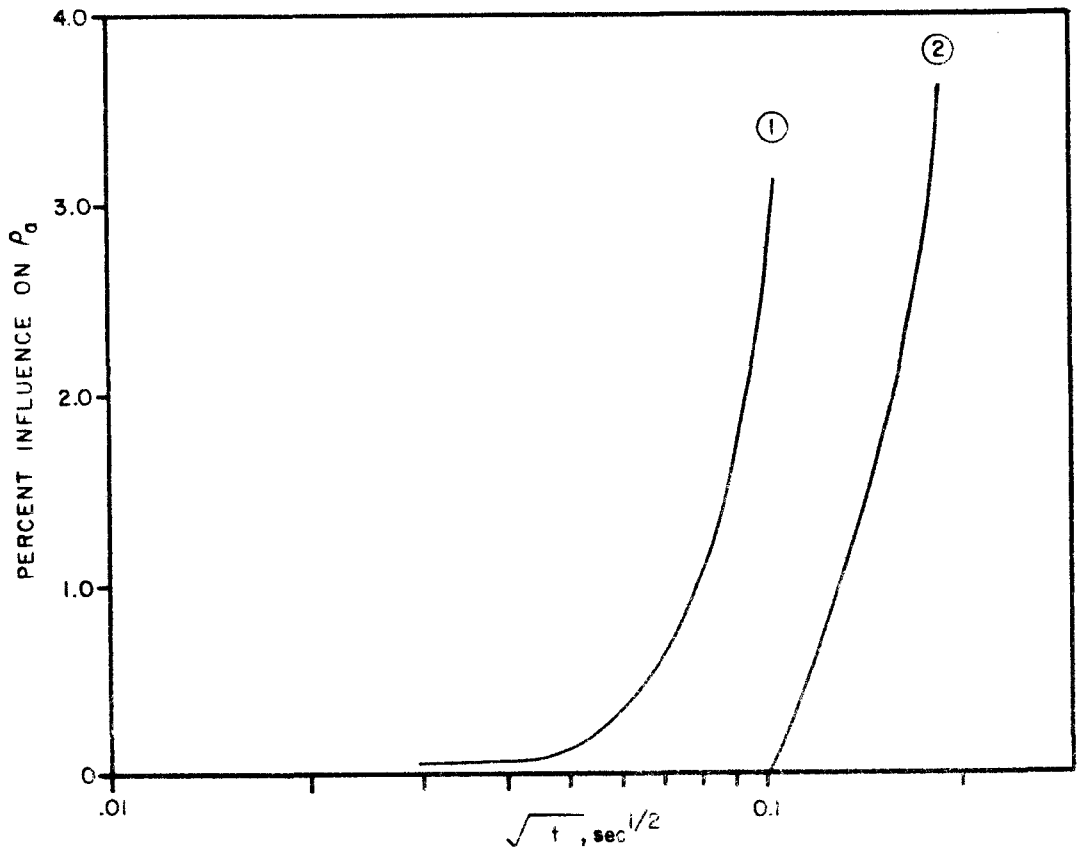
The Earth Technology Corporation

PROJECT NO.: 85143

UNOCAL GEOTHERMAL

INFLUENCE OF SUPERPOSITION OF PULSES 30 Hz

FIGURE



STATION ①

ρ_1	h_1	ρ_2	h_2	ρ_3
327	177	88	117	68

STATION ②

ρ_1	h_1	ρ_2	h_2	ρ_3
65	93	11	225	52

The Earth Technology Corporation

PROJECT NO.: 85143

UNOCAL GEOTHERMAL

INFLUENCE OF SUPERPOSITION OF PULSES

3 Hz

GEONICS LIMITED

EM37 Ground Transient Electromagnetic System
Technical Specifications

Transmitter

Current Waveform	See Figure 1
Repetition Rate	3Hz or 30Hz in countries using 60 Hz power line frequency; 2.5Hz or 25Hz in countries using 50Hz power line frequency; all four base frequencies are switch selectable.
Turn-off Time (Δt)	fast linear turn-ff of maximum 300 usec. at 20 amps into 300x600m loop. Decreases proportionally with current and loop area$^{\frac{1}{2}}$ to minimum of 20 usec. Actual value of t read on front panel meter.
Transmitter Loop	any dimensions from 40mx40m to 300mx600m maximum at 20 amps. Larger dimensions at reduced current. Transmitter output voltage switch adjustabe for smaller loops. Value of loop resistance read from front panel meter; resistance must be greater than 1 ohm on lowest voltage setting to prevent overload.
Transmitter Protection	circuit breaker protection against input over-voltage; instantaneous solid state protection against output short circuit; automatically resets on removal of short circuit. Input voltage, output voltage and current indicated on front panel meter.
Transmitter Output Voltage	160 volts (zero to peak) maximum; 20 volts (zero to peak) minimum
Transmitter Output Power	2.8 kw maximum
Transmitter Wire Supplied	1800m. #10 copper wire PVC insulated with nylon jacket; transmitter wire contained on 6 reels (supplied); 2 reel winders supplied.
Transmitter Motor Generator	5 HP Honda gasoline engine coupled to 120 volt, 3 phase, 400Hz alternator. Approximately 8 hours continuous operation from full (built-in) fuel tank.

GEONICS LIMITED

Receiver

Measured Quantity	time rate of decay of magnetic flux along 3 axes.
Sensor	air-cored coil of bandwidth 40 kHz; 1m dia. by 7cmx5cm cross-section. Coil holder supplied to facilitate measurement along 3 axes.
Time Channels	20 time channels with locations and widths as shown in Figure 2. Successive operation at 30Hz, then 3Hz, effectively gives 30 channels covering range from 80 usec. to 80msec.
Output Display	4 digit plus sign LED display; display also shows channel number and gain.
Integration Time	2^n cycles at 30 Hz; n=4,6,8,10,12,14 (switch selectable); similar integration times at other base frequencies.
Receiver Output Noise	typically 1.5×10^{-10} volt/m^2 at last gate at 30 Hz with integration time of 34 seconds. Noise will be higher during intense local spherics activity.
Output Connector	all 20 channels in analog format and house-keeping functions in digital format available from output connector.
Synchronization to TX	any of the following (switch selectable) (1) reference cable (2) primary pulse (3) 27 MHz radio link (40 channels) (4) high stability (oven controlled) quartz crystals.
Noise Rejection Circuitry	Selective clipping of atmospheric noise pluses at all times. Audio output of RX coil (transmitter pulse blanked out) is available on built-in loud speaker for ready ingentification of interference.
Receiver Batteries	12 volt rechargeable Gel-cell; 9 hours continuous operating time at 17°C. Two batteries and a battery charger supplied to permit charging of second battery from transmitter motor generator during survey.

1. PHYSICAL

Dimensions	- 16 X 23 X 21 cm
Weight	- 3.1 kg

2. ENVIRONMENTAL

Operating Temperature	- -30°C to +60°C

3. ELECTRICAL

Power Requirements

Normal Mode	- 500mA at 12 volts = 6.00 watts
Power Save Mode	- 275mA at 12 volts = 3.30 watts
Display Heater	- 600mA at 12 volts = 7.2 watts (Only when it turns on)
Analog Inputs	- ±7 volts maximum - Single ended (Signal Ground is return)
Analog Input Impedance	- Approximately 220KΩ minimum each line
Digital Inputs	- All lines except Integration Time + 12 V = HIGH = Logic 1 0V = LOW = Logic 0 - Integration Time + 8 V = HIGH = Logic 1 0V = LOW = Logic 0 - Single ended (Power Ground is return)
Digital Input Impedance	- All lines except Integration Time Approximately 23KΩ minimum each line - Integration Time Approximately 15KΩ minimum each line
Analog to Digital Converter	- 12 bits plus sign (13 bits) resolution CMOS Dual Slope Integrating type
Signal Resolution	- 7.000 V/4096 = 1.709 mV

4. INPUT AND OUTPUT CONNECTIONS

Input Data Via	- keyboards and 50 pin "D" connector AMP P/N 205869-2

Pin assignments for the connector are as follows:

PIN	DESCRIPTION	PIN	DESCRIPTION
1	Ch 1	5	Ch 5
2	Ch 2	6	Ch 6
3	Ch 3	7	Ch 7
4	Ch 4	8	Ch 8

4. INPUT AND OUTPUT CONNECTIONS (continued)

PIN	DESCRIPTION
9	Ch 9
10	Ch 10
11	Ch 11
12	Ch 12
13	Ch 13
14	Ch 14
15	+12V Power
16	+12V Power
17	NC
18	Ch 18
19	Ch 19
20	Ch 20
21	Ch 0 (Primary Field)
22	T/O Time
23	Freq (MSB)
24	Radio
25	P. Pulse
26	Crystal
27	Ref.
28	Integration Time τ0 (LSB)
29	Integration Time τ1

PIN	DESCRIPTION
30	Integration Time τ2 (MSB)
31	NC
32	+12V Power
33	+12V Power
34	Power Ground
35	Mode Ø (LSB)
36	Freq (LSB)
37	Mode 1 (MSB)
38	Ch 15
39	Ch 16
40	Ch 17
41	Gain 0 (LSB)
42	Gain 1
43	Gain 2
44	Gain 3 (MSB)
45	Power Ground
46	Signal Ground
47	Signal Ground
48	Power Ground
49	Power Ground
50	Polarity

τ2	τ1	τ0	INT. TIME
0	0	0	4
0	0	1	6
0	1	0	8
0	1	1	10
1	0	0	12
1	0	1	14

MSB	LSB	FREQ.
0	0	LOW
0	1	MED
1	0	HIGH

PIN 50	POLARITY
1	Positive
0	Negative

MODE 1 MSB	MODE Ø LSB	MODE
0	0	CAL
0	1	NULL
1	0	OPR

4. INPUT AND OUTPUT CONNECTIONS (continued)

PIN				SYNC. MODE
27	26	25	24	
0	0	0	1	Radio
0	0	1	0	P. Pulse
0	1	0	0	Crystal
1	0	0	0	Ref.

GAIN				GAIN
3	2	1	0	
0	0	0	1	1
0	0	1	0	2
0	0	1	1	3
0	1	0	0	4
0	1	0	1	5
0	1	1	0	6
0	1	1	1	7
1	0	0	0	8
1	0	0	1	9

Output Data via - Standard RS-232C port a 25 pin "D" connector

ITT CANNON P/N DB-25S

5. FEATURES:

Storage Medium	- CMOS STATIC RAM with Battery back-up.
Maximum Storage	- with 32K bytes of memory, 511 records; - with 64K bytes of memory, 959 records.
Recording Time	- One record of 22 analog channels, 6 digital channels, and the header, takes about 17 seconds.
Analog Channels	- 22 which consist of: 1 Primary field channel; 1 Turn-off (T/O) channel; 20 Output channels.
Digital Channels	- 6 which consist of the Mode; Sync. Mode; Freq.; Gain; Integration time; and Polarity.
Header	- 5 user inputs which consist of the Day; Month; Line; Station; and Component.
Keyboard	- Two (sealed); one for header information; one for numerals.
Display	- 16 Character alphanumeric LCD with heater for low temperature capability. Heater switches on and off automatically as necessary when the temperature drops to about 3°C.
Data Recall	- Data can easily be recalled to the display.
Power Save	- Allows shutdown of some of the circuitry to save approximately 225mA at 12V = 2.7 watts.

APPENDIX B

CALCULATION OF APPARENT RESISTIVITY

I. LATE STAGE

Late stage apparent resistivity can be calculated by using the following equation:

$$\rho_t = \left(\frac{E\phi^{h.s.}}{E\phi}\right)^{2/3} \rho_1 = \frac{\mu_0}{4\pi t} \left(\frac{r\mu_0 M_t}{5t\ E\phi}\right)^{2/3} \qquad [1]$$

where:

$E\phi^{h.s.}$ is the late stage time derivative of the electrical field over uniform half-space of resistivity ρ_1.

$E\phi$ is the late stage time derivative of the electrical field over layered ground.

r is the separation between transmitter and receiver dipoles.

M_t is the moment of the transmitter.

t is the time.

μ_0 is the magnetic susceptibility = $4\pi \times 10^{-7}\ \frac{\text{henry}}{\text{m}}$

Solving for $E\phi$ we get:

$$E\phi = \frac{\mu_0^{3/2}}{(4\pi t)^{3/2}} \quad \frac{r\mu_0 M_t}{5t} \quad \frac{1}{\rho^{3/2}}$$

$$E\phi = \frac{\mu_0^{5/2}\ r\ M_t\ \sigma^{3/2}}{8\ t^{3/2}\ \pi^{3/2}\ 5\ t}$$

$$E\phi = \frac{\mu^{5/2}\ r\ M_t \sigma^{3/2}}{40\ \pi\sqrt{\pi}\ t^{5/2}} \qquad [2]$$

(Kaufman and Keller, Frequency and Transient Soundings, 1983, p. 334)

Assuming from the theory of reciprocity that the receiver loop can be considered the transmitter and vice versa, we sum $E\phi$ around the loop:

$$EMF = E\phi(2\pi r) = \frac{\mu_0^{5/2}\ \sigma^{3/2}\ r\ M_t\ (2\pi r)}{40\ \pi\sqrt{\pi}\ \ t^{5/2}}$$

$$= \frac{\mu_0^{5/2}\ \sigma^{3/2}\ M_t\ (2\pi r^2)}{40\ \pi\sqrt{\pi}\ \ t^{5/2}}$$

$\pi r^2 = Mr$, moment of the receiver

$$EMF = \frac{\mu_0^{5/2}\ \sigma^{3/2}\ M_t\ Mr}{20\ \pi\sqrt{\pi}\ \ t^{5/2}} \qquad [3]$$

Using equation 3, we can arrive at the voltage reading:

$$V = EMF = \frac{\mu_0^{5/2}\ \sigma^{3/2}\ M_t\ Mr}{20\ \pi\sqrt{\pi}\ \ t^{5/2}}$$

And from this we can calculate apparent resistivity from voltage:

$$\rho^{3/2} = \frac{\mu_0^{5/2}\ M_t\ Mr}{20\ \pi^{3/2}\ t^{5/2}\ V}$$

$$\rho_a = \left(\frac{\mu^{5/3}\ Mr^{2/3}}{20^{2/3}\ \pi}\right)\frac{M_t^{2/3}}{t^{5/3}\ V^{2/3}} \qquad [4]$$

The terms in the paranthesis in equation [4] are constants which only depend on the receiver coil used and on the preamplification factor of 52.1 built into the Geonic's EM 37. Since the EM 37 reads millivolts and milliseconds and the equations are in terms of volts and seconds, these conversions can also be built into this constant.

$$K_{loop} = \frac{\mu^{5/3}\ Mr^{2/3}}{20^{2/3}\ \pi}\left(\frac{1000msec}{sec}\right)^{5/3}\left(\frac{1000mV}{V}\right)^{2/3}$$

$$K_{loop} = \frac{4\ \pi x10^{-7}\ ^{5/3}\ Mr^{2/3}}{20^{2/3}\ \pi}\left(\frac{1000msec}{sec}\right)^{5/3}\left(\frac{1000mV}{V}\right)^{2/3}$$

$$K_{loop} = 6.322\ X\ 10^{-5}\ Mr^{2/3}$$

For a receiver coil with an effective area of $100m^2$,

$$Mr = 100m^2 \times 52.1 = 5210 \text{ and}$$
$$K_{loop} = 6.322 \times 10^{-5} (5210)^{2/3} = 1.9 \times 10^{-2}$$

For a receiver coil with an effective area of $1000m^2$,

$$Mr = 1000m^2 \times 52.1 = 52100 \text{ and}$$
$$K_{loop} = 6.322 \times 10^{-5} (52100)^{2/3} = 8.82 \times 10^{-2}$$

Using the constants calculated above in equation [4], we now have an equation for late stage apparent resistivity:

$$\rho_a = K_{loop} \frac{M_t^{2/3}}{t^{5/3} V^{2/3}} \qquad [5]$$

Using the sounding data from Table 1, we can calculate ρ_a:

Frequency = 30 Hz
Gain = 3
Current = 17.5 amps
Receiver Coil = $100m^2$
Loop = 500m X 500m

At channel #5, t = 0.22 msec and the voltage corrected for turnoff = 3747 millivolts.

To calculate ρ_a:

1. Convert from a square loop to a circular loop:

$$r = 1.12 \frac{L}{2} = 1.12 (250m) = 280m$$

2. $M_t = A_t \times I = \pi (280)^2 (17.5 \text{ amps}) = 4.310 \times 10^6$

3. Correct the voltage for the gain:

$$V = V\, 2^{-G} = 3747(2)^{-3} = 468.4$$

4. Substitute into equation [5]:

$$\rho_a = 1.9 \times 10^{-2} \quad \frac{(4.310 \times 10^6)^{2/3}}{(.22)^{5/3}\ (468.4)^{2/3}}$$

$$\rho_a = 104.3 \text{ ohm-m}$$

II. EARLY STAGE

During early stage, the asympototic expression for $E\phi$ due to a vertical dipole source is:

$$E\phi = \frac{3M\rho}{2\pi r^4} \qquad [1]$$

(Kaufman and Keller, Frequency and Transient Soundings, 1983, p. 331)

where:

M is the moment of source and integrating around the loop yields.

$$V = 2\pi r E\phi = \frac{6\pi M\rho r}{2\pi r^4}$$

$$V = \frac{6\pi r^2 M\rho}{2\pi r^5}$$

$$V = \frac{6\ Mr\ M_t\ \rho}{2\pi r^5}$$

$$M_t = \pi r^2 I$$

$$Mr = A \text{ receiver} \times 52.1 \times 2^G$$

$$V = \frac{6\pi r^2 \times I \times A_{rec} \times 52.1\ 2^G \times \rho}{2\pi r^5}$$

$$V = \text{Reading} \times 10^{-3}$$

$$\rho = \frac{V \times 10^{-3} \times 2\pi r^5}{6\pi r^2 A_{rec} \times 2^G \times I \times 52.1}$$

$$\rho = \frac{V \times 10^{-3}\ r^3}{3 \times 52.1 \times A_{rec} \times 2^G \times I}$$

$$\rho = 6.4 \times 10^{-6} \quad \frac{V \times r^3}{A_{rec} \times 2^G \times I}$$

For Ch. 5 on Table 1

V = 3447 mvolts

r = 280 m

A_{rec} = 100 m^2

Gain = 3

I = 17.5 amps

$$\rho = \frac{6.4 \times 10^{-6}\ 1(3447)(280)^3}{100 \times 2^3 \times 17.5}$$

ρ = 37.6 ohm-m

TABLE 1

LINE: 000N
STA.: 002W

FREQUENCY = 30 hz
LOOP SIZE = 500 x 500 m
COIL AREA = 100 sq. m
CURRENT = 17.5 amps
TURNOFF = 290 usec
GAIN = 3
SPACING = 280 m

CORRECTION FACTOR= t^-5/2

CH.	SQRT(T)	$V_{meas.}$	K_{fact}	V_{corr}	ROA-LATE	ROA-EARLY
1	.0094	2457.0	5.515	13550.3	200.00	1.360E+02
2	.0105	2258.0	4.621	10433.6	167.27	1.047E+02
3	.0118	1935.5	3.816	7385.6	140.91	7.412E+01
4	.0133	1645.5	3.205	5274.6	119.32	5.293E+01
5	.0148	1358.5	2.759	3747.8	104.30	3.761E+01
6	.0167	1048.9	2.369	2485.0	91.78	2.494E+01
7	.0188	776.3	2.071	1607.5	82.63	1.613E+01
8	.0210	566.1	1.852	1048.5	75.97	1.052E+01
9	.0237	385.5	1.665	641.7	70.48	6.440E+00
10	.0267	258.1	1.523	393.0	66.13	3.944E+00
11	.0297	181.7	1.421	258.1	61.52	2.591E+00
12	.0331	119.2	1.337	159.3	58.99	1.599E+00
13	.0376	72.8	1.261	91.8	55.93	9.211E-01
14	.0424	44.9	1.204	54.1	53.29	5.427E-01
15	.0472	28.6	1.165	33.2	51.58	3.337E-01
16	.0534	17.2	1.128	19.3	48.95	1.942E-01
17	.0600	7.5	1.101	8.3	58.51	8.289E-02
18	.0670	5.9	1.081	6.4	47.90	6.442E-02
19	.0755	3.3	1.064	3.5	48.01	3.536E-02
20	.0848	1.8	1.051	1.9	48.93	1.924E-02

THE EARTH TECHNOLOGY CORP.

Job #: 685133
Client: AMOCO
Location :ELK CREEK MT.
File:ELKCRK.DAT Snd#: 3 , 3

LINE 1

LINE: 1001
STA.: 010S

NORMALIZED HORIZONTAL COMPONENTS

CH.	BZ	BX	BY	BR	BR/BZ	arctan BX/BY
1	9.92E-08	-4.75E-09	-1.34E-08	1.42E-08	0.14	19.54
2	8.15E-08	-3.56E-09	-1.04E-08	1.10E-08	0.14	18.83
3	6.71E-08	-2.16E-09	-9.03E-09	9.29E-09	0.14	13.48
4	5.78E-08	-1.24E-09	-7.99E-09	8.09E-09	0.14	8.85
5	5.04E-08	-1.23E-09	-7.02E-09	7.13E-09	0.14	9.91
6	4.27E-08	-1.13E-09	-6.26E-09	6.36E-09	0.15	10.22
7	3.59E-08	-1.17E-09	-5.36E-09	5.49E-09	0.15	12.32
8	3.03E-08	-1.01E-09	-4.60E-09	4.71E-09	0.16	12.43
9	2.43E-08	-7.46E-10	-3.86E-09	3.93E-09	0.16	10.93
10	1.92E-08	-6.18E-10	-3.01E-09	3.07E-09	0.16	11.61
11	1.52E-08	-5.83E-10	-2.51E-09	2.58E-09	0.17	13.07
12	1.13E-08	-4.91E-10	-1.74E-09	1.81E-09	0.16	15.71
13	7.58E-09	-3.00E-10	-1.13E-09	1.17E-09	0.15	14.87
14	4.88E-09	-2.42E-10	-6.48E-10	6.91E-10	0.14	20.49
15	3.16E-09	-1.41E-10	-3.49E-10	3.77E-10	0.12	22.04
16	1.90E-09	-7.71E-11	-1.65E-10	1.82E-10	0.10	25.01
17	1.13E-09	-4.00E-11	-5.54E-11	6.83E-11	0.06	35.87
18	6.88E-10	-2.09E-11	-1.75E-11	2.72E-11	0.04	50.08
19	4.09E-10	2.13E-12	-9.52E-12	8.78E-12	0.02	-14.04
20	2.66E-10	-2.56E-12	8.52E-12	8.90E-12	0.03	-16.70

THE EARTH TECHNOLOGY CORP.

Job #:685143
Client:UNOCAL Geothermal
Location:Mt. Shasta CA
File:A:SHASTA1.DAT

LINE: 1001
STA.: 030S

NORMALIZED HORIZONTAL COMPONENTS

CH.	BZ	BX	BY	BR	BR/BZ	arctan BX/BY
1	1.31E-07	-6.12E-11	9.13E-09	9.14E-09	0.07	-0.38
2	1.14E-07	-6.89E-10	7.30E-09	7.33E-09	0.06	-5.39
3	9.88E-08	-1.99E-10	6.33E-09	6.34E-09	0.06	-1.80
4	8.59E-08	-3.21E-10	4.93E-09	4.94E-09	0.06	-3.73
5	7.41E-08	-4.74E-10	3.69E-09	3.72E-09	0.05	-7.33
6	5.96E-08	-1.30E-10	2.13E-09	2.13E-09	0.04	-3.49
7	4.51E-08	4.28E-10	3.60E-10	5.59E-10	0.01	49.99
8	3.53E-08	5.62E-10	-3.52E-10	6.63E-10	0.02	-57.96
9	3.02E-08	-8.53E-10	-9.18E-11	8.58E-10	0.03	83.86
10	2.29E-08	-9.07E-10	-1.84E-10	9.25E-10	0.04	78.55
11	1.47E-08	5.51E-11	-9.10E-10	9.12E-10	0.06	-3.46
12	1.32E-08	-8.89E-10	-2.42E-10	9.21E-10	0.07	74.79
13	7.68E-09	-2.83E-10	-3.90E-10	4.82E-10	0.06	35.96
14	4.81E-09	-1.65E-10	-2.63E-10	3.11E-10	0.06	32.12
15	3.60E-09	-2.39E-10	-6.73E-11	2.48E-10	0.07	74.25
16	2.13E-09	-9.03E-11	-4.82E-11	1.02E-10	0.05	61.90
17	1.48E-09	-9.79E-11	3.06E-11	1.03E-10	0.07	-72.65
18	8.42E-10	-2.68E-11	1.57E-11	3.10E-11	0.04	-59.64
19	5.57E-10	-2.60E-11	2.68E-11	3.73E-11	0.07	-44.17
20	3.67E-10	-2.41E-11	2.30E-11	3.33E-11	0.09	-46.40

THE EARTH TECHNOLOGY CORP.

Job #:685143
Client:UNOCAL Geothermal
Location:Mt. Shasta CA
File:A:SHASTA1.DAT

LINE: 1001
STA.: 0505

NORMALIZED HORIZONTAL COMPONENTS

CH.	BZ	BX	BY	BR	BR/BZ	arctan BX/BY
1	2.24E-07	6.51E-09	-3.90E-08	3.95E-08	0.18	-9.48
2	1.71E-07	4.83E-09	-2.73E-08	2.78E-08	0.16	-10.01
3	1.25E-07	4.75E-09	-1.83E-08	1.89E-08	0.15	-14.52
4	9.20E-08	4.28E-09	-1.17E-08	1.24E-08	0.14	-20.14
5	6.85E-08	3.98E-09	-7.33E-09	6.34E-09	0.12	-28.53
6	4.91E-08	3.58E-09	-4.59E-09	5.82E-09	0.12	-37.94
7	3.45E-08	3.72E-09	-3.10E-09	4.84E-09	0.14	-50.24
8	2.50E-08	3.08E-09	-2.05E-09	3.70E-09	0.15	-56.39
9	1.79E-08	1.32E-09	-1.19E-09	1.78E-09	0.10	-47.84
10	1.28E-08	5.97E-10	-7.15E-10	9.31E-10	0.07	-39.90
11	9.43E-09	1.14E-09	-9.56E-10	1.49E-09	0.16	-50.14
12	7.05E-09	1.14E-10	-4.62E-10	4.76E-10	0.07	-13.89
13	4.79E-09	2.64E-10	-4.56E-10	5.27E-10	0.11	-30.06
14	3.30E-09	1.95E-10	-3.92E-10	4.38E-10	0.13	-26.47
15	2.44E-09	9.06E-11	-2.66E-10	2.81E-10	0.12	-18.84
16	1.69E-09	9.41E-11	-2.32E-10	2.50E-10	0.15	-22.12
17	1.18E-09	3.79E-11	-1.59E-10	1.63E-10	0.14	-13.44
18	8.28E-10	7.26E-11	-1.35E-10	1.53E-10	0.18	-28.33
19	5.72E-10	-3.79E-11	-1.01E-10	1.08E-10	0.19	20.60
20	3.84E-10	-8.20E-11	-4.41E-11	9.31E-11	0.24	61.72

THE EARTH TECHNOLOGY CORP.

Job #:685143
Client:UNOCAL Geothermal
Location:Mt. Shasta CA
File:A:SHASTA1.DAT

LINE: 1001
STA.: 0709

NORMALIZED HORIZONTAL COMPONENTS

CH.	BZ	BX	BY	BR	BR/BZ	arctan BX/BY
1	4.34E-07	6.60E-08	1.19E-07	1.36E-07	0.31	28.95
2	3.17E-07	4.77E-08	8.37E-08	9.64E-08	0.30	29.66
3	2.24E-07	3.46E-08	5.62E-08	6.60E-08	0.30	31.65
4	1.64E-07	2.68E-08	3.97E-08	4.79E-08	0.29	33.96
5	1.24E-07	2.11E-08	2.99E-08	3.67E-08	0.30	35.22
6	9.20E-08	1.61E-08	2.17E-08	2.70E-08	0.29	36.47
7	6.72E-08	1.17E-08	1.56E-08	1.95E-08	0.29	36.94
8	5.03E-08	8.60E-09	1.18E-08	1.46E-08	0.29	36.11
9	3.57E-08	6.86E-09	9.40E-09	1.16E-08	0.33	36.10
10	2.51E-08	4.85E-09	7.07E-09	8.57E-09	0.34	34.47
11	1.87E-08	3.08E-09	4.62E-09	5.55E-09	0.30	33.64
12	1.31E-08	2.62E-09	4.03E-09	4.81E-09	0.37	33.02
13	8.90E-09	1.49E-09	2.51E-09	2.92E-09	0.33	30.77
14	6.02E-09	9.21E-10	1.71E-09	1.94E-09	0.32	28.26
15	4.32E-09	7.21E-10	1.32E-09	1.51E-09	0.35	28.61
16	2.99E-09	4.33E-10	8.67E-10	9.69E-10	0.32	26.57
17	2.04E-09	2.80E-10	6.36E-10	6.95E-10	0.34	23.79
18	1.43E-09	1.44E-10	4.09E-10	4.33E-10	0.30	19.34
19	9.48E-10	9.41E-11	2.74E-10	2.89E-10	0.31	18.97
20	6.24E-10	6.34E-11	1.64E-10	1.76E-10	0.28	21.10

THE EARTH TECHNOLOGY CORP.

Job #:GCS147
Client:UNOCAL Geothermal
Location:Mt. Shasta CA
File:A:SHASTA2.DAT

LINE: 1001
STA.: 0905

NORMALIZED HORIZONTAL COMPONENTS

CH.	BZ	BX	BY	BR	BR/BZ	arctan BX/BY
1	1.56E-06	-2.51E-07	2.00E-07	3.21E-07	0.20	-51.48
2	1.17E-06	-1.91E-07	1.53E-07	2.45E-07	0.21	-51.24
3	8.28E-07	-1.27E-07	1.03E-07	1.63E-07	0.20	-50.97
4	5.88E-07	-7.83E-08	6.45E-08	1.02E-07	0.17	-50.52
5	4.25E-07	-4.64E-08	3.85E-08	6.03E-08	0.14	-50.33
6	2.99E-07	-2.45E-08	2.04E-08	3.19E-08	0.11	-50.32
7	2.10E-07	-1.21E-08	9.38E-09	1.53E-08	0.07	-52.17
8	1.53E-07	-6.60E-09	3.98E-09	7.71E-09	0.05	-58.93
9	1.09E-07	-3.91E-09	8.34E-10	4.00E-09	0.04	-77.96
10	7.79E-08	-2.87E-09	-5.36E-10	2.92E-09	0.04	79.43
11	5.90E-08	-2.28E-09	-1.43E-09	2.69E-09	0.05	57.94
12	4.19E-08	-1.94E-09	-1.55E-09	2.48E-09	0.06	51.41
13	2.88E-08	-1.51E-09	-1.53E-09	2.14E-09	0.07	44.60
14	1.96E-08	-1.21E-09	-1.20E-09	1.71E-09	0.09	45.22
15	1.39E-08	-9.58E-10	-8.78E-10	1.30E-09	0.09	47.48
16	9.45E-09	-6.82E-10	-5.58E-10	8.81E-10	0.09	50.74
17	6.41E-09	-4.58E-10	-3.21E-10	5.59E-10	0.09	54.92
18	4.48E-09	-3.10E-10	-1.54E-10	3.46E-10	0.08	63.60
19	2.94E-09	-1.94E-10	-6.04E-11	2.03E-10	0.07	72.66
20	1.91E-09	-1.16E-10	0.00E+00	1.16E-10	0.06	-45.00

THE EARTH TECHNOLOGY CORP.

Job #:685143
Client:UNOCAL Geothermal
Location:Mt. Shasta CA
File:A:SHASTA2.DAT

LINE: 1001
STA.: 1005

NORMALIZED HORIZONTAL COMPONENTS

CH.	BZ	BX	BY	BR	BR/BZ	arctan BX/BY
1	1.58E-06	-3.40E-07	6.29E-07	7.15E-07	0.45	-28.39
2	1.30E-06	-2.37E-07	5.03E-07	5.57E-07	0.43	-25.25
3	1.03E-06	-1.60E-07	3.87E-07	4.19E-07	0.41	-22.49
4	8.13E-07	-1.15E-07	3.02E-07	3.23E-07	0.40	-20.86
5	6.38E-07	-8.74E-08	2.33E-07	2.49E-07	0.39	-20.53
6	4.72E-07	-6.58E-08	1.70E-07	1.82E-07	0.39	-21.16
7	3.35E-07	-4.93E-08	1.17E-07	1.27E-07	0.38	-22.82
8	2.37E-07	-3.63E-08	7.87E-08	8.67E-08	0.37	-24.72
9	1.58E-07	-2.36E-08	4.63E-08	5.19E-08	0.33	-27.01
10	1.03E-07	-1.40E-08	2.49E-08	2.85E-08	0.28	-29.33
11	7.03E-08	-8.87E-09	1.43E-08	1.68E-08	0.24	-31.85
12	4.65E-08	-4.16E-09	6.29E-09	7.54E-09	0.16	-33.48
13	2.87E-08	-1.78E-09	2.48E-09	3.06E-09	0.11	-35.68
14	1.88E-08	-7.01E-10	1.05E-09	1.26E-09	0.07	-33.65
15	1.32E-08	-2.14E-10	5.63E-10	6.02E-10	0.05	-20.83
16	9.08E-09	-1.45E-10	3.92E-10	4.18E-10	0.05	-20.26
17	6.27E-09	-1.11E-10	2.78E-10	3.00E-10	0.05	-21.72
18	4.37E-09	-1.31E-10	2.14E-10	2.51E-10	0.06	-31.41
19	2.90E-09	-1.38E-10	1.47E-10	2.02E-10	0.07	-43.31
20	1.87E-09	-1.35E-10	1.04E-10	1.70E-10	0.09	-52.31

THE EARTH TECHNOLOGY CORP.

Job #:G85143
Client:UNOCAL Geothermal
Location:Mt. Shasta CA
File:A:SHASTA2.DAT

LINE: 1001
STA.: 110S

NORMALIZED HORIZONTAL COMPONENTS

CH.	BZ	BX	BY	BR	BR/BZ	arctan BX/BY
1	2.12E-06	-2.33E-07	6.19E-07	6.61E-07	0.31	-20.65
2	1.77E-06	-2.01E-07	5.10E-07	5.48E-07	0.31	-21.54
3	1.39E-06	-1.65E-07	4.00E-07	4.32E-07	0.31	-22.38
4	1.07E-06	-1.33E-07	3.12E-07	3.39E-07	0.32	-23.02
5	8.08E-07	-1.05E-07	2.40E-07	2.62E-07	0.32	-23.65
6	5.62E-07	-7.77E-08	1.70E-07	1.87E-07	0.33	-24.58
7	3.69E-07	-5.44E-08	1.13E-07	1.25E-07	0.34	-25.69
8	2.43E-07	-3.76E-08	7.34E-08	8.25E-08	0.34	-27.13
9	1.51E-07	-2.43E-08	4.29E-08	4.93E-08	0.33	-29.52
10	9.50E-08	-1.50E-08	2.40E-08	2.83E-08	0.30	-31.96
11	6.39E-08	-9.11E-09	1.41E-08	1.68E-08	0.26	-32.85
12	4.35E-08	-5.72E-09	8.07E-09	9.90E-09	0.23	-35.33
13	2.80E-08	-3.05E-09	4.29E-09	5.27E-09	0.19	-35.44
14	1.89E-08	-1.82E-09	2.56E-09	3.14E-09	0.17	-35.33
15	1.36E-08	-1.34E-09	1.74E-09	2.20E-09	0.16	-37.54
16	9.27E-09	-8.94E-10	1.15E-09	1.46E-09	0.16	-37.83
17	6.32E-09	-6.59E-10	8.02E-10	1.04E-09	0.16	-39.44
18	4.31E-09	-4.65E-10	5.57E-10	7.26E-10	0.17	-39.87
19	2.83E-09	-3.43E-10	3.92E-10	5.20E-10	0.18	-41.19
20	1.82E-09	-2.33E-10	2.74E-10	3.59E-10	0.20	-40.34

THE EARTH TECHNOLOGY CORP.

Job #:685143
Client:UNOCAL Geothermal
Location:Mt. Shasta CA
File:A:SHASTA2.DAT

LINE: 1001
STA.: 1305

NORMALIZED HORIZONTAL COMPONENTS

CH.	BZ	BX	BY	BR	BR/BZ	arctan BX/BY
1	3.45E-07	-1.96E-08	-6.82E-08	7.09E-08	0.21	16.05
2	2.84E-07	-1.42E-08	-5.09E-08	5.29E-08	0.19	15.60
3	2.26E-07	-9.51E-09	-3.87E-08	3.99E-08	0.18	13.80
4	1.81E-07	-5.83E-09	-2.94E-08	3.00E-08	0.17	11.21
5	1.46E-07	-3.75E-09	-2.21E-08	2.24E-08	0.15	9.63
6	1.13E-07	-1.87E-09	-1.65E-08	1.66E-08	0.15	6.48
7	8.70E-08	-5.25E-10	-1.20E-08	1.20E-08	0.14	2.51
8	6.79E-08	7.87E-11	-8.50E-09	8.50E-09	0.13	-0.53
9	5.10E-08	5.59E-10	-6.41E-09	6.44E-09	0.13	-4.98
10	3.86E-08	6.97E-10	-4.41E-09	4.46E-09	0.12	-8.99
11	3.03E-08	6.30E-10	-3.25E-09	3.31E-09	0.11	-10.96
12	2.25E-08	5.10E-10	-2.11E-09	2.17E-09	0.10	-13.59
13	1.59E-08	3.09E-10	-1.26E-09	1.30E-09	0.08	-13.73
14	1.11E-08	1.41E-10	-7.05E-10	7.19E-10	0.06	-11.31
15	7.87E-09	4.35E-11	-3.79E-10	3.82E-10	0.05	-6.54
16	5.27E-09	-4.54E-11	-1.72E-10	1.78E-10	0.03	14.80
17	3.42E-09	-8.66E-11	-4.57E-11	9.79E-11	0.03	62.16
18	2.24E-09	-1.03E-10	7.12E-12	1.03E-10	0.05	-86.05
19	1.37E-09	-9.48E-11	2.85E-11	9.90E-11	0.07	-73.28
20	8.34E-10	-8.02E-11	2.96E-11	8.55E-11	0.10	-69.74

THE EARTH TECHNOLOGY CORP.

Job #:G85143
Client:UNOCAL Geothermal
Location:Mt. Shasta CA
File:A:SHASTA3.DAT

LINE: 1001
STA.: 150S

NORMALIZED HORIZONTAL COMPONENTS

CH.	BZ	BX	BY	BR	BR/BZ	arctan BX/BY
1	1.06E-07	2.13E-09	2.70E-09	3.44E-09	0.03	38.21
2	9.09E-08	2.33E-09	9.37E-10	2.51E-09	0.03	68.09
3	7.64E-08	1.41E-09	1.00E-09	1.73E-09	0.02	54.46
4	6.48E-08	8.43E-10	8.30E-10	1.18E-09	0.02	45.46
5	5.42E-08	4.42E-10	6.83E-10	8.13E-10	0.02	32.91
6	4.29E-08	-1.34E-10	6.86E-10	6.99E-10	0.02	-11.04
7	3.26E-08	-6.19E-10	5.62E-10	8.36E-10	0.03	-47.76
8	2.68E-08	-6.49E-10	4.42E-10	7.85E-10	0.03	-55.77
9	2.38E-08	-3.31E-10	8.47E-10	9.09E-10	0.04	-21.37
10	1.76E-08	-5.99E-10	6.59E-10	8.91E-10	0.05	-42.26
11	1.29E-08	-7.91E-10	6.23E-10	1.01E-09	0.08	-51.80
12	1.18E-08	-4.10E-10	6.72E-10	7.87E-10	0.07	-31.36
13	7.97E-09	-5.22E-10	5.46E-10	7.56E-10	0.09	-43.71
14	5.47E-09	-4.74E-10	4.53E-10	6.55E-10	0.12	-46.32
15	4.16E-09	-3.84E-10	3.91E-10	5.48E-10	0.13	-44.51
16	2.62E-09	-3.37E-10	2.94E-10	4.47E-10	0.17	-48.92
17	1.80E-09	-2.40E-10	2.10E-10	3.18E-10	0.18	-48.84
18	1.10E-09	-1.80E-10	1.43E-10	2.30E-10	0.21	-51.44
19	6.59E-10	-1.13E-10	7.56E-11	1.36E-10	0.21	-56.23
20	3.51E-10	-6.90E-11	3.78E-11	7.86E-11	0.22	-61.25

THE EARTH TECHNOLOGY CORP.

Job #:685143
Client:UNOCAL Geothermal
Location:Mt. Shasta CA
File:A:SHASTA3.DAT

LINE: 1001
STA.: 160S

NORMALIZED HORIZONTAL COMPONENTS

CH.	BZ	BX	BY	BR	BR/BZ	arctan BX/BY
1	6.17E-08	-1.78E-08	-1.22E-08	2.16E-08	0.35	55.52
2	5.55E-08	-1.62E-08	-1.13E-08	1.97E-08	0.36	55.08
3	4.73E-08	-1.38E-08	-9.61E-09	1.68E-08	0.36	55.17
4	4.02E-08	-1.18E-08	-8.21E-09	1.44E-08	0.36	55.26
5	3.28E-08	-9.87E-09	-6.76E-09	1.20E-08	0.36	55.58
6	2.50E-08	-7.62E-09	-4.91E-09	9.07E-09	0.36	57.24
7	1.96E-08	-5.96E-09	-3.85E-09	7.09E-09	0.36	57.17
8	1.84E-08	-5.55E-09	-3.80E-09	6.73E-09	0.37	55.62
9	1.63E-08	-4.86E-09	-3.44E-09	5.95E-09	0.37	54.66
10	9.61E-09	-2.98E-09	-1.76E-09	3.46E-09	0.36	59.44
11	8.56E-09	-2.65E-09	-1.62E-09	3.11E-09	0.36	58.55
12	7.07E-09	-2.22E-09	-1.41E-09	2.63E-09	0.37	57.61
13	5.08E-09	-1.63E-09	-1.01E-09	1.92E-09	0.38	58.10
14	3.31E-09	-1.12E-09	-6.65E-10	1.30E-09	0.39	59.24
15	2.35E-09	-8.18E-10	-4.85E-10	9.51E-10	0.41	59.35
16	1.39E-09	-5.12E-10	-2.84E-10	5.86E-10	0.42	61.05
17	9.45E-10	-3.45E-10	-2.14E-10	4.06E-10	0.43	58.23
18	6.08E-10	-2.26E-10	-1.37E-10	2.64E-10	0.43	58.79
19	3.70E-10	-1.26E-10	-8.54E-11	1.52E-10	0.41	55.86
20	1.98E-10	-6.06E-11	-4.18E-11	7.36E-11	0.37	55.37

THE EARTH TECHNOLOGY CORP.

Job #:G85143
Client:UNOCAL Geothermal
Location:Mt. Shasta CA
File:A:SHASTA3.DAT

LINE 2

LINE: 2000
STA.: 0105

NORMALIZED HORIZONTAL COMPONENTS

CH.	BZ	BX	BY	BR	BR/BZ	arctan BX/BY
1	4.44E-08	-3.41E-09	8.98E-09	9.61E-09	0.22	-20.81
2	3.53E-08	-2.17E-09	7.79E-09	8.09E-09	0.23	-15.55
3	2.79E-08	-1.07E-09	5.74E-09	5.84E-09	0.21	-10.56
4	2.26E-08	-2.54E-10	4.36E-09	4.37E-09	0.19	-3.34
5	1.82E-08	-2.28E-10	3.66E-09	3.66E-09	0.20	-3.56
6	1.39E-08	-8.57E-10	2.51E-09	2.65E-09	0.19	-18.85
7	1.00E-08	-1.73E-09	1.66E-09	2.39E-09	0.24	-46.19
8	7.43E-09	-1.93E-09	1.17E-09	2.26E-09	0.30	-58.83
9	5.97E-09	-4.69E-11	8.30E-10	8.31E-10	0.14	-3.23
10	4.39E-09	2.18E-10	6.59E-10	6.94E-10	0.16	18.26
11	2.81E-09	-1.05E-09	2.25E-10	1.07E-09	0.38	-77.89
12	2.51E-09	3.16E-10	4.02E-10	5.11E-10	0.20	38.19
13	1.53E-09	-2.52E-10	1.86E-10	3.13E-10	0.21	-53.52
14	1.04E-09	-2.24E-10	1.33E-10	2.60E-10	0.25	-59.34
15	8.19E-10	-5.36E-12	1.22E-10	1.22E-10	0.15	-2.52
16	5.77E-10	-5.19E-11	8.30E-11	9.79E-11	0.17	-32.01
17	4.16E-10	-2.01E-12	6.93E-11	6.93E-11	0.17	-1.66
18	2.88E-10	-3.75E-11	4.08E-11	5.54E-11	0.19	-42.55
19	2.04E-10	-2.41E-11	3.55E-11	4.29E-11	0.21	-34.19
20	1.49E-10	-7.03E-12	3.65E-11	3.72E-11	0.25	-10.91

THE EARTH TECHNOLOGY CORP.

Job #:G85143
Client:UNOCAL Geothermal
Location:Mt. Shasta CA
File:A:SHASTA3.DAT

LINE: 2000
STA.: 030S

NORMALIZED HORIZONTAL COMPONENTS

CH.	BZ	BX	BY	BR	BR/BZ	arctan BX/BY
1	6.73E-08	8.05E-10	-4.93E-09	4.99E-09	0.07	-9.28
2	5.53E-08	1.25E-09	-4.48E-09	4.66E-09	0.08	-15.57
3	4.38E-08	1.21E-09	-3.12E-09	3.35E-09	0.08	-21.14
4	3.48E-08	6.39E-10	-2.50E-09	2.58E-09	0.07	-14.34
5	2.76E-08	9.72E-10	-2.01E-09	2.24E-09	0.08	-25.77
6	2.10E-08	5.59E-10	-1.45E-09	1.55E-09	0.07	-21.11
7	1.56E-08	6.84E-10	-9.55E-10	1.17E-09	0.08	-35.62
8	1.17E-08	4.34E-10	-6.14E-10	7.52E-10	0.06	-35.23
9	8.37E-09	3.16E-10	-4.06E-10	5.14E-10	0.06	-37.87
10	5.98E-09	2.29E-10	-2.43E-10	3.34E-10	0.06	-43.32
11	4.52E-09	1.64E-10	-1.80E-10	2.44E-10	0.05	-42.23
12	3.24E-09	1.00E-10	-1.07E-10	1.46E-10	0.05	-43.08
13	2.28E-09	7.36E-11	-8.89E-11	1.15E-10	0.05	-39.63
14	1.62E-09	5.00E-11	-5.97E-11	7.79E-11	0.05	-39.94
15	1.22E-09	3.75E-11	-5.69E-11	6.82E-11	0.06	-33.37
16	8.97E-10	2.08E-11	-4.34E-11	4.81E-11	0.05	-25.64
17	6.49E-10	-3.47E-12	-2.64E-11	2.66E-11	0.04	7.50
18	4.86E-10	1.35E-11	-2.15E-11	2.54E-11	0.05	-32.17
19	3.50E-10	1.18E-11	-1.42E-11	1.85E-11	0.05	-39.67
20	2.48E-10	2.67E-11	-5.90E-12	2.74E-11	0.11	-77.55

THE EARTH TECHNOLOGY CORP.

Job #:G85143
Client:UNOCAL Geothermal
Location:Mt. Shasta CA
File:A:SHASTA4.DAT

LINE: 2000
STA.: 0505

NORMALIZED HORIZONTAL COMPONENTS

CH.	BZ	BX	BY	BR	BR/BZ	arctan BX/BY
1	4.51E-07	3.28E-08	-1.35E-08	3.55E-08	0.08	-67.65
2	3.83E-07	2.21E-08	-1.48E-08	2.66E-08	0.07	-56.24
3	3.20E-07	1.61E-08	-1.62E-08	2.28E-08	0.07	-44.80
4	2.72E-07	1.30E-08	-1.61E-08	2.07E-08	0.08	-39.00
5	2.31E-07	1.23E-08	-1.57E-08	1.99E-08	0.09	-38.09
6	1.90E-07	1.25E-08	-1.38E-08	1.86E-08	0.10	-42.16
7	1.54E-07	1.32E-08	-1.15E-08	1.75E-08	0.11	-48.88
8	1.26E-07	1.31E-08	-1.00E-08	1.65E-08	0.13	-52.61
9	1.01E-07	1.12E-08	-9.26E-09	1.45E-08	0.14	-50.36
10	7.86E-08	1.01E-08	-7.66E-09	1.27E-08	0.16	-52.79
11	6.20E-08	9.70E-09	-5.61E-09	1.12E-08	0.18	-59.97
12	4.82E-08	7.36E-09	-5.04E-09	8.93E-09	0.19	-55.60
13	3.43E-08	6.20E-09	-3.34E-09	7.04E-09	0.21	-61.66
14	2.43E-08	4.80E-09	-2.24E-09	5.30E-09	0.22	-65.02
15	1.80E-08	3.63E-09	-1.69E-09	4.01E-09	0.22	-65.07
16	1.25E-08	2.71E-09	-1.09E-09	2.92E-09	0.23	-68.13
17	8.66E-09	1.92E-09	-7.39E-10	2.06E-09	0.24	-68.97
18	6.00E-09	1.41E-09	-4.62E-10	1.49E-09	0.25	-71.89
19	3.94E-09	9.54E-10	-2.99E-10	9.99E-10	0.25	-72.62
20	2.54E-09	6.14E-10	-1.82E-10	6.40E-10	0.25	-73.49

THE EARTH TECHNOLOGY CORP.

Job #:G85143
Client:UNOCAL Geothermal
Location:Mt. Shasta CA
File:A:SHASTA4.DAT

LINE: 2000
STA.: 0709

NORMALIZED HORIZONTAL COMPONENTS

CH.	BZ	BX	BY	BR	BR/BZ	arctan BX/BY
1	3.88E-07	-7.58E-09	-4.90E-08	4.96E-08	0.13	8.79
2	3.11E-07	-8.83E-09	-4.10E-08	4.20E-08	0.14	12.15
3	2.51E-07	-1.01E-08	-3.33E-08	3.48E-08	0.14	16.90
4	2.15E-07	-1.14E-08	-2.77E-08	3.00E-08	0.14	22.33
5	1.92E-07	-1.19E-08	-2.37E-08	2.65E-08	0.14	26.73
6	1.65E-07	-1.14E-08	-1.89E-08	2.21E-08	0.13	30.99
7	1.36E-07	-1.10E-08	-1.44E-08	1.81E-08	0.13	37.49
8	1.19E-07	-8.23E-09	-1.08E-08	1.36E-08	0.11	37.39
9	9.51E-08	-6.25E-09	-9.67E-09	1.15E-08	0.12	32.87
10	7.95E-08	-4.57E-09	-8.36E-09	9.53E-09	0.12	28.66
11	6.62E-08	-3.82E-09	-5.64E-09	6.81E-09	0.10	34.07
12	5.46E-08	-2.63E-09	-5.82E-09	6.39E-09	0.12	24.33
13	4.17E-08	-1.99E-09	-4.05E-09	4.51E-09	0.11	26.22
14	3.14E-08	-1.54E-09	-3.17E-09	3.52E-09	0.11	25.86
15	2.39E-08	-1.19E-09	-2.60E-09	2.86E-09	0.12	24.60
16	1.70E-08	-9.54E-10	-1.92E-09	2.14E-09	0.13	26.45
17	1.16E-08	-7.41E-10	-1.33E-09	1.52E-09	0.13	29.12
18	7.88E-09	-6.87E-10	-9.86E-10	1.20E-09	0.15	34.86
19	5.03E-09	-5.15E-10	-6.35E-10	8.17E-10	0.16	39.07
20	3.15E-09	-3.70E-10	-4.08E-10	5.50E-10	0.17	42.24

THE EARTH TECHNOLOGY CORP.

Job #:G85143
Client:UNOCAL Geothermal
Location:Mt. Shasta CA
File:A:SHASTA4.DAT

LINE: 2000
STA.: 0905

NORMALIZED HORIZONTAL COMPONENTS

CH.	BZ	BX	BY	BR	BR/BZ	arctan BX/BY
1	6.85E-07	-4.51E-07	2.73E-07	5.27E-07	0.77	-58.76
2	5.49E-07	-3.37E-07	1.96E-07	3.90E-07	0.71	-59.82
3	4.14E-07	-2.34E-07	1.31E-07	2.68E-07	0.65	-60.86
4	3.13E-07	-1.64E-07	9.03E-08	1.87E-07	0.60	-61.17
5	2.38E-07	-1.18E-07	6.68E-08	1.35E-07	0.57	-60.47
6	1.76E-07	-8.41E-08	4.73E-08	9.65E-08	0.55	-60.63
7	1.33E-07	-6.06E-08	3.54E-08	7.02E-08	0.53	-59.70
8	1.06E-07	-4.85E-08	3.36E-08	5.90E-08	0.56	-55.26
9	7.93E-08	-3.69E-08	2.79E-08	4.62E-08	0.58	-52.94
10	6.18E-08	-2.84E-08	2.18E-08	3.58E-08	0.58	-52.47
11	4.85E-08	-2.26E-08	1.80E-08	2.89E-08	0.60	-51.50
12	3.96E-08	-1.74E-08	1.37E-08	2.31E-08	0.58	-51.81
13	2.92E-08	-1.27E-08	1.00E-08	1.61E-08	0.55	-51.71
14	2.22E-08	-9.19E-09	7.15E-09	1.16E-08	0.53	-52.09
15	1.73E-08	-6.81E-09	5.14E-09	8.53E-09	0.49	-52.94
16	1.28E-08	-4.78E-09	3.54E-09	5.95E-09	0.46	-53.46
17	9.25E-09	-3.26E-09	2.38E-09	4.04E-09	0.44	-53.87
18	6.70E-09	-2.22E-09	1.61E-09	2.75E-09	0.41	-54.04
19	4.55E-09	-1.41E-09	1.03E-09	1.75E-09	0.38	-53.79
20	2.98E-09	-8.55E-10	6.33E-10	1.06E-09	0.36	-53.49

THE EARTH TECHNOLOGY CORP.

Job #:685143
Client:UNOCAL Geothermal
Location:Mt. Shasta CA
File:A:SHASTA4.DAT

LINE: 2000
STA.: 100S

NORMALIZED HORIZONTAL COMPONENTS

CH.	BZ	BX	BY	BR	BR/BZ	arctan BX/BY
1	4.67E-07	-7.28E-09	-6.39E-08	6.43E-08	0.14	6.50
2	3.71E-07	-3.42E-09	-5.19E-08	5.20E-08	0.14	3.76
3	2.87E-07	-1.94E-09	-3.75E-08	3.75E-08	0.13	2.97
4	2.29E-07	-1.14E-09	-2.68E-08	2.68E-08	0.12	2.44
5	1.87E-07	-1.08E-09	-1.92E-08	1.93E-08	0.10	3.22
6	1.49E-07	-8.54E-10	-1.33E-08	1.33E-08	0.09	3.68
7	1.18E-07	-6.32E-10	-9.53E-09	9.55E-09	0.08	3.79
8	9.64E-08	-1.87E-10	-7.25E-09	7.26E-09	0.08	1.48
9	7.98E-08	-1.39E-09	-4.85E-09	5.05E-09	0.06	15.97
10	6.40E-08	-1.94E-09	-3.51E-09	4.01E-09	0.06	28.96
11	4.87E-08	-8.97E-10	-2.92E-09	3.05E-09	0.06	17.08
12	3.98E-08	-1.78E-09	-1.94E-09	2.63E-09	0.07	42.60
13	2.78E-08	-1.15E-09	-1.51E-09	1.90E-09	0.07	37.34
14	2.01E-08	-1.11E-09	-1.10E-09	1.56E-09	0.08	45.14
15	1.51E-08	-1.07E-09	-8.39E-10	1.36E-09	0.09	51.96
16	1.08E-08	-9.89E-10	-6.43E-10	1.18E-09	0.11	56.98
17	7.45E-09	-8.52E-10	-5.40E-10	1.01E-09	0.14	57.62
18	5.17E-09	-7.32E-10	-4.60E-10	8.64E-10	0.17	57.87
19	3.34E-09	-5.85E-10	-3.72E-10	6.94E-10	0.21	57.55
20	2.09E-09	-4.39E-10	-2.84E-10	5.23E-10	0.25	57.09

THE EARTH TECHNOLOGY CORP.

Job #:G85143
Client:UNOCAL Geothermal
Location:Mt. Shasta CA
File:A:SHASTA4.DAT

LINE: 2000
STA.: 1105

NORMALIZED HORIZONTAL COMPONENTS

CH.	BZ	BX	BY	BR	BR/BZ	arctan BX/BY
1	5.26E-07	4.46E-08	-1.35E-07	1.42E-07	0.27	-18.32
2	3.91E-07	2.75E-08	-9.77E-08	1.01E-07	0.26	-15.74
3	2.87E-07	1.58E-08	-6.80E-08	6.98E-08	0.24	-13.10
4	2.20E-07	9.41E-09	-4.92E-08	5.01E-08	0.23	-10.81
5	1.73E-07	5.59E-09	-3.72E-08	3.76E-08	0.22	-8.55
6	1.32E-07	2.92E-09	-2.74E-08	2.75E-08	0.21	-6.10
7	1.00E-07	1.22E-09	-2.03E-08	2.03E-08	0.20	-3.45
8	7.82E-08	5.25E-10	-1.55E-08	1.55E-08	0.20	-1.94
9	6.12E-08	2.32E-10	-1.21E-08	1.21E-08	0.20	-1.10
10	4.71E-08	1.43E-10	-9.46E-09	9.46E-09	0.20	-0.87
11	3.61E-08	-2.04E-10	-7.75E-09	7.75E-09	0.21	1.51
12	2.83E-08	-6.27E-11	-6.29E-09	6.29E-09	0.22	0.57
13	1.96E-08	-1.44E-10	-4.80E-09	4.80E-09	0.24	1.73
14	1.36E-08	-1.17E-10	-3.65E-09	3.66E-09	0.27	1.84
15	9.73E-09	-6.00E-11	-2.78E-09	2.78E-09	0.29	1.24
16	6.34E-09	-6.54E-11	-1.96E-09	1.96E-09	0.31	1.91
17	4.06E-09	-4.23E-11	-1.31E-09	1.31E-09	0.32	1.85
18	2.54E-09	-3.48E-11	-8.45E-10	8.45E-10	0.33	2.36
19	1.51E-09	-2.04E-11	-4.89E-10	4.90E-10	0.32	2.39
20	8.78E-10	-1.64E-11	-2.64E-10	2.65E-10	0.30	3.54

THE EARTH TECHNOLOGY CORP.

Job #:685143
Client:UNOCAL Geothermal
Location:Mt. Shasta CA
File:A:SHASTA5.DAT

LINE: 2000
STA.: 130S

NORMALIZED HORIZONTAL COMPONENTS

CH.	BZ	BX	BY	BR	BR/BZ	arctan BX/BY
1	1.31E-07	-2.85E-09	-2.01E-08	2.03E-08	0.15	8.07
2	1.05E-07	-1.98E-09	-1.58E-08	1.60E-08	0.15	7.11
3	8.16E-08	-1.87E-09	-1.24E-08	1.25E-08	0.15	8.59
4	6.35E-08	-1.50E-09	-1.01E-08	1.02E-08	0.16	8.46
5	4.93E-08	-1.15E-09	-8.12E-09	8.20E-09	0.17	8.02
6	3.59E-08	-7.63E-10	-6.13E-09	6.18E-09	0.17	7.10
7	2.49E-08	-2.35E-10	-4.48E-09	4.49E-09	0.18	3.00
8	1.77E-08	-4.43E-11	-3.28E-09	3.28E-09	0.19	0.77
9	1.34E-08	-2.28E-10	-2.49E-09	2.51E-09	0.19	5.23
10	9.43E-09	-1.47E-10	-1.78E-09	1.79E-09	0.19	4.70
11	5.82E-09	1.64E-10	-1.19E-09	1.20E-09	0.21	-7.84
12	4.93E-09	-7.22E-11	-9.95E-10	9.98E-10	0.20	4.15
13	2.79E-09	1.91E-11	-6.16E-10	6.16E-10	0.22	-1.77
14	1.79E-09	7.22E-11	-4.21E-10	4.27E-10	0.24	-9.73
15	1.35E-09	2.86E-11	-3.03E-10	3.04E-10	0.22	-5.40
16	8.67E-10	2.83E-11	-1.93E-10	1.95E-10	0.23	-8.33
17	6.05E-10	1.09E-11	-1.34E-10	1.34E-10	0.22	-4.67
18	3.76E-10	2.32E-11	-9.13E-11	9.42E-11	0.25	-14.24
19	2.40E-10	1.30E-11	-6.48E-11	6.60E-11	0.28	-11.31
20	1.64E-10	1.40E-11	-5.59E-11	5.76E-11	0.35	-14.04

THE EARTH TECHNOLOGY CORP.

Job #:G85143
Client:UNOCAL Geothermal
Location:Mt. Shasta CA
File:A:SHASTA5.DAT

LINE: 2000
STA.: 150S

NORMALIZED HORIZONTAL COMPONENTS

CH.	BZ	BX	BY	BR	BR/BZ	arctan BX/BY
1	2.38E-07	2.94E-08	-9.78E-10	2.94E-08	0.12	-88.10
2	1.00E-07	1.11E-08	2.95E-09	1.15E-08	0.11	75.07
3	5.80E-08	6.13E-09	2.92E-09	6.79E-09	0.12	64.54
4	3.79E-08	4.19E-09	2.25E-09	4.75E-09	0.13	61.77
5	2.58E-08	2.90E-09	2.35E-09	3.73E-09	0.14	51.03
6	1.75E-08	1.83E-09	1.58E-09	2.42E-09	0.14	49.17
7	1.19E-08	1.23E-09	1.30E-09	1.79E-09	0.15	43.34
8	8.41E-09	9.21E-10	1.06E-09	1.41E-09	0.17	40.89
9	5.74E-09	6.15E-10	8.19E-10	1.02E-09	0.18	36.92
10	3.91E-09	4.60E-10	6.03E-10	7.59E-10	0.19	37.36
11	2.83E-09	3.34E-10	5.43E-10	6.37E-10	0.23	31.62
12	1.92E-09	2.31E-10	3.34E-10	4.06E-10	0.21	34.71
13	1.23E-09	1.71E-10	2.09E-10	2.70E-10	0.22	39.36
14	7.82E-10	1.17E-10	1.50E-10	1.90E-10	0.24	38.05
15	5.22E-10	8.15E-11	9.45E-11	1.25E-10	0.24	40.76
16	3.59E-10	5.50E-11	8.07E-11	9.76E-11	0.27	34.29
17	2.28E-10	3.83E-11	6.36E-11	7.42E-11	0.33	31.07
18	1.56E-10	2.32E-11	3.71E-11	4.38E-11	0.28	32.06
19	9.45E-11	1.26E-11	1.87E-11	2.26E-11	0.24	33.98
20	6.19E-11	2.12E-11	1.43E-11	2.55E-11	0.41	56.06

THE EARTH TECHNOLOGY CORP.

Job #:G85143
Client:UNOCAL Geothermal
Location:Mt. Shasta CA
File:A:SHASTA6.DAT

LINE 3

LINE: 3000
STA.: 010E

NORMALIZED HORIZONTAL COMPONENTS

CH.	BZ	BX	BY	BR	BR/BZ	arctan BX/BY
1	9.43E-07	1.58E-07	-2.41E-08	1.60E-07	0.17	-81.36
2	5.30E-07	4.84E-08	-2.70E-09	4.85E-08	0.09	-86.80
3	3.11E-07	1.57E-08	2.91E-09	1.60E-08	0.05	79.51
4	1.96E-07	7.59E-09	1.61E-09	7.76E-09	0.04	78.03
5	1.31E-07	4.90E-09	2.19E-10	4.91E-09	0.04	87.45
6	8.65E-08	3.93E-09	-6.13E-10	3.98E-09	0.05	-81.13
7	5.74E-08	3.72E-09	-1.72E-09	4.10E-09	0.07	-65.14
8	4.04E-08	3.40E-09	-2.56E-09	4.26E-09	0.11	-53.06
9	2.82E-08	2.42E-09	-1.20E-09	2.70E-09	0.10	-63.66
10	2.04E-08	1.48E-09	8.55E-10	1.71E-09	0.08	59.91
11	1.50E-08	1.39E-09	-5.00E-10	1.48E-09	0.10	-70.22
12	1.10E-08	8.14E-10	3.61E-10	8.90E-10	0.08	66.09
13	7.52E-09	6.39E-10	1.72E-11	6.39E-10	0.08	88.46
14	5.27E-09	3.72E-10	1.62E-10	4.06E-10	0.08	66.40
15	3.80E-09	2.33E-10	2.03E-10	3.09E-10	0.08	48.90
16	2.69E-09	1.77E-10	2.32E-10	2.91E-10	0.11	37.27
17	1.85E-09	1.41E-10	1.14E-10	1.81E-10	0.10	50.86
18	1.31E-09	8.67E-11	9.61E-11	1.29E-10	0.10	42.06
19	9.06E-10	7.30E-11	4.61E-11	8.63E-11	0.10	57.75
20	6.31E-10	4.57E-11	2.69E-11	5.30E-11	0.08	59.47

THE EARTH TECHNOLOGY CORP.

Job #:G85143
Client:UNOCAL Geothermal
Location:Mt. Shasta CA
File:A:SHASTA6.DAT

LINE: 3000
STA.: 030E

NORMALIZED HORIZONTAL COMPONENTS

CH.	BZ	BX	BY	BR	BR/BZ	arctan BX/BY
1	6.18E-07	5.60E-08	4.96E-08	7.48E-08	0.12	48.48
2	3.84E-07	3.94E-08	2.96E-08	4.93E-08	0.13	53.08
3	2.88E-07	2.94E-08	2.27E-08	3.71E-08	0.13	52.35
4	2.31E-07	2.15E-08	1.89E-08	2.87E-08	0.12	48.63
5	1.89E-07	1.55E-08	1.64E-08	2.26E-08	0.12	43.50
6	1.49E-07	1.03E-08	1.37E-08	1.71E-08	0.11	36.84
7	1.14E-07	5.72E-09	1.15E-08	1.29E-08	0.11	26.39
8	8.82E-08	2.53E-09	9.70E-09	1.00E-08	0.11	14.60
9	6.80E-08	8.87E-10	8.07E-09	8.12E-09	0.12	6.27
10	5.28E-08	4.33E-11	6.68E-09	6.68E-09	0.13	0.37
11	3.88E-08	-8.13E-10	5.55E-09	5.61E-09	0.14	-8.33
12	3.03E-08	-6.63E-10	4.35E-09	4.40E-09	0.15	-8.67
13	2.06E-08	-7.31E-10	3.29E-09	3.37E-09	0.16	-12.52
14	1.45E-08	-5.48E-10	2.46E-09	2.52E-09	0.17	-12.54
15	1.08E-08	-3.46E-10	1.89E-09	1.92E-09	0.18	-10.38
16	7.42E-09	-1.88E-10	1.38E-09	1.39E-09	0.19	-7.75
17	5.04E-09	-7.21E-11	9.78E-10	9.81E-10	0.19	-4.21
18	3.41E-09	-1.44E-11	6.87E-10	6.87E-10	0.20	-1.20
19	2.26E-09	1.01E-11	4.53E-10	4.53E-10	0.20	1.28
20	1.49E-09	2.16E-11	2.91E-10	2.92E-10	0.20	4.25

THE EARTH TECHNOLOGY CORP.

Job #:G85143
Client:UNOCAL Geothermal
Location:Mt. Shasta CA
File:A:SHASTA6.DAT

LINE: 3000
STA.: 050E

NORMALIZED HORIZONTAL COMPONENTS

CH.	BZ	BX	BY	BR	BR/BZ	arctan BX/BY
1	4.81E-07	-8.16E-08	2.18E-08	8.45E-08	0.18	-75.04
2	3.97E-07	-7.34E-08	1.22E-08	7.44E-08	0.19	-80.55
3	3.24E-07	-6.23E-08	4.24E-09	6.24E-08	0.19	-86.11
4	2.70E-07	-5.17E-08	-7.93E-10	5.17E-08	0.19	89.12
5	2.26E-07	-4.15E-08	-4.11E-09	4.17E-08	0.18	84.35
6	1.82E-07	-3.07E-08	-5.73E-09	3.13E-08	0.17	79.43
7	1.43E-07	-2.13E-08	-6.38E-09	2.22E-08	0.16	73.33
8	1.14E-07	-1.46E-08	-6.32E-09	1.59E-08	0.14	66.63
9	8.91E-08	-9.69E-09	-5.87E-09	1.13E-08	0.13	58.79
10	6.80E-08	-5.98E-09	-5.09E-09	7.85E-09	0.12	49.60
11	5.19E-08	-3.32E-09	-4.14E-09	5.30E-09	0.10	38.78
12	3.99E-08	-2.12E-09	-3.38E-09	3.99E-09	0.10	32.18
13	2.76E-08	-7.89E-10	-2.39E-09	2.51E-09	0.09	18.28
14	1.91E-08	-2.23E-10	-1.66E-09	1.68E-09	0.09	7.66
15	1.40E-08	-3.46E-11	-1.17E-09	1.17E-09	0.08	1.70
16	9.52E-09	9.05E-11	-7.49E-10	7.54E-10	0.08	-6.89
17	6.55E-09	9.37E-11	-4.87E-10	4.96E-10	0.08	-10.89
18	4.47E-09	1.05E-10	-2.99E-10	3.17E-10	0.07	-19.26
19	2.98E-09	5.77E-11	-1.84E-10	1.93E-10	0.06	-17.39
20	1.93E-09	4.58E-11	-1.08E-10	1.17E-10	0.06	-22.94

THE EARTH TECHNOLOGY CORP.

Job #:G85143
Client:UNOCAL Geothermal
Location:Mt. Shasta CA
File:A:SHASTA7.DAT

LINE: 3000
STA.: 070E

NORMALIZED HORIZONTAL COMPONENTS

CH.	BZ	BX	BY	BR	BR/BZ	arctan BX/BY
1	1.89E-07	1.93E-08	2.90E-08	3.48E-08	0.18	33.68
2	1.40E-07	1.20E-08	1.93E-08	2.27E-08	0.16	31.79
3	1.01E-07	7.27E-09	1.24E-08	1.44E-08	0.14	30.29
4	7.52E-08	5.25E-09	9.21E-09	1.06E-08	0.14	29.67
5	5.74E-08	3.69E-09	6.91E-09	7.83E-09	0.14	28.12
6	4.27E-08	2.94E-09	5.24E-09	6.01E-09	0.14	29.29
7	3.00E-08	2.64E-09	3.98E-09	4.78E-09	0.16	33.52
8	2.20E-08	2.29E-09	3.33E-09	4.04E-09	0.18	34.57
9	1.82E-08	1.54E-09	2.31E-09	2.78E-09	0.15	33.67
10	1.46E-08	9.77E-10	1.84E-09	2.08E-09	0.14	27.94
11	9.25E-09	1.19E-09	1.41E-09	1.84E-09	0.20	40.24
12	8.81E-09	6.63E-10	1.22E-09	1.39E-09	0.16	28.59
13	5.68E-09	6.40E-10	8.85E-10	1.09E-09	0.19	35.87
14	4.13E-09	4.69E-10	7.08E-10	8.49E-10	0.21	33.50
15	3.44E-09	3.46E-10	5.38E-10	6.40E-10	0.19	32.76
16	2.51E-09	2.33E-10	3.98E-10	4.61E-10	0.18	30.33
17	1.85E-09	1.69E-10	2.88E-10	3.34E-10	0.18	30.33
18	1.31E-09	1.10E-10	1.98E-10	2.27E-10	0.17	29.13
19	9.29E-10	6.92E-11	1.33E-10	1.50E-10	0.16	27.43
20	6.52E-10	5.23E-11	8.40E-11	9.89E-11	0.15	31.89

THE EARTH TECHNOLOGY CORP.

Job #:085143
Client:UNOCAL Geothermal
Location:Mt. Shasta CA
File:A:SHASTA7.DAT

LINE: 3000
STA.: 090E

NORMALIZED HORIZONTAL COMPONENTS

CH.	BZ	BX	BY	BR	BR/BZ	arctan BX/BY
1	1.01E-07	-3.46E-10	1.21E-08	1.21E-08	0.12	-1.64
2	7.89E-08	-8.22E-10	1.03E-08	1.03E-08	0.13	-4.57
3	5.88E-08	-3.75E-10	7.61E-09	7.62E-09	0.13	-2.82
4	4.43E-08	1.30E-10	5.59E-09	5.60E-09	0.13	1.33
5	3.35E-08	4.33E-11	3.99E-09	3.99E-09	0.12	0.62
6	2.45E-08	3.17E-10	2.80E-09	2.82E-09	0.12	6.47
7	1.76E-08	2.09E-10	1.67E-09	1.68E-09	0.10	7.14
8	1.30E-08	3.57E-10	1.12E-09	1.18E-09	0.09	17.60
9	9.46E-09	2.67E-10	7.21E-10	7.69E-10	0.08	20.30
10	6.86E-09	5.05E-11	4.00E-10	4.03E-10	0.06	7.19
11	5.28E-09	7.93E-11	3.24E-10	3.34E-10	0.06	13.74
12	3.97E-09	3.60E-11	2.38E-10	2.41E-10	0.06	8.62
13	2.86E-09	6.92E-11	1.85E-10	1.97E-10	0.07	20.56
14	2.10E-09	8.65E-12	1.40E-10	1.40E-10	0.07	3.54
15	1.57E-09	5.91E-11	1.14E-10	1.28E-10	0.08	27.43
16	1.15E-09	3.60E-11	9.41E-11	1.01E-10	0.09	20.96
17	8.36E-10	2.63E-11	7.89E-11	8.32E-11	0.10	18.43
18	6.17E-10	1.77E-11	5.44E-11	5.72E-11	0.09	17.98
19	4.44E-10	3.28E-11	3.46E-11	4.77E-11	0.11	43.47
20	3.17E-10	2.96E-11	3.14E-11	4.31E-11	0.14	43.31

THE EARTH TECHNOLOGY CORP.

Job #:G85143
Client:UNOCAL Geothermal
Location:Mt. Shasta CA
File:A:SHASTA7.DAT

LINE: 3000
STA.: 110E

NORMALIZED HORIZONTAL COMPONENTS

CH.	BZ	BX	BY	BR	BR/BZ	arctan BX/BY
1	1.83E-07	-4.45E-08	5.25E-08	6.88E-08	0.38	-40.27
2	1.43E-07	-3.42E-08	4.10E-08	5.34E-08	0.37	-39.77
3	1.06E-07	-2.43E-08	3.04E-08	3.89E-08	0.37	-38.58
4	7.89E-08	-1.73E-08	2.28E-08	2.86E-08	0.36	-37.29
5	5.95E-08	-1.21E-08	1.72E-08	2.10E-08	0.35	-35.14
6	4.41E-08	-8.56E-09	1.26E-08	1.53E-08	0.35	-34.13
7	3.25E-08	-5.89E-09	9.41E-09	1.11E-08	0.34	-32.03
8	2.49E-08	-4.53E-09	7.04E-09	8.37E-09	0.34	-32.79
9	1.86E-08	-3.22E-09	5.35E-09	6.25E-09	0.34	-31.05
10	1.40E-08	-2.44E-09	3.96E-09	4.65E-09	0.33	-31.67
11	1.12E-08	-1.93E-09	3.24E-09	3.77E-09	0.34	-30.84
12	8.42E-09	-1.41E-09	2.43E-09	2.81E-09	0.33	-30.18
13	6.11E-09	-1.02E-09	1.75E-09	2.03E-09	0.33	-30.27
14	4.50E-09	-6.95E-10	1.25E-09	1.43E-09	0.32	-28.99
15	3.37E-09	-5.00E-10	8.82E-10	1.01E-09	0.30	-29.55
16	2.43E-09	-3.33E-10	6.03E-10	6.89E-10	0.28	-28.89
17	1.74E-09	-2.36E-10	3.91E-10	4.57E-10	0.26	-31.08
18	1.27E-09	-1.72E-10	2.52E-10	3.05E-10	0.24	-34.31
19	9.00E-10	-1.17E-10	1.59E-10	1.97E-10	0.22	-36.30
20	6.11E-10	-7.03E-11	8.58E-11	1.11E-10	0.18	-39.33

THE EARTH TECHNOLOGY CORP.

Job #:G85143
Client:UNOCAL Geothermal
Location:Mt. Shasta CA
File:A:SHASTA7.DAT

LINE: 3000
STA.: 120E

NORMALIZED HORIZONTAL COMPONENTS

CH.	BZ	BX	BY	BR	BR/BZ	arctan BX/BY
1	1.34E-07	2.91E-08	-9.20E-09	3.05E-08	0.23	-72.46
2	1.11E-07	2.32E-08	-8.31E-09	2.46E-08	0.22	-70.29
3	9.01E-08	1.86E-08	-6.20E-09	1.96E-08	0.22	-71.57
4	7.34E-08	1.45E-08	-4.77E-09	1.53E-08	0.21	-71.82
5	6.02E-08	1.17E-08	-3.85E-09	1.23E-08	0.20	-71.71
6	4.73E-08	9.15E-09	-2.66E-09	9.53E-09	0.20	-73.79
7	3.67E-08	6.95E-09	-2.04E-09	7.24E-09	0.20	-73.61
8	2.89E-08	5.42E-09	-1.64E-09	5.66E-09	0.20	-73.17
9	2.18E-08	4.07E-09	-1.05E-09	4.20E-09	0.19	-75.50
10	1.65E-08	3.12E-09	-8.11E-10	3.22E-09	0.19	-75.42
11	1.31E-08	2.49E-09	-6.13E-10	2.57E-09	0.20	-76.18
12	9.86E-09	1.86E-09	-4.56E-10	1.91E-09	0.19	-76.20
13	7.16E-09	1.36E-09	-3.19E-10	1.39E-09	0.19	-76.78
14	5.21E-09	9.30E-10	-1.60E-10	9.44E-10	0.18	-80.24
15	3.93E-09	7.05E-10	-1.15E-10	7.14E-10	0.18	-80.71
16	2.86E-09	5.01E-10	-4.07E-11	5.03E-10	0.18	-85.36
17	2.06E-09	3.41E-10	-1.91E-11	3.41E-10	0.17	-86.79
18	1.51E-09	2.30E-10	-3.97E-12	2.30E-10	0.15	-89.01
19	1.07E-09	1.50E-10	9.73E-12	1.51E-10	0.14	86.30
20	7.47E-10	9.44E-11	1.05E-11	9.50E-11	0.13	83.68

THE EARTH TECHNOLOGY CORP.

Job #:G85143
Client:UNOCAL Geothermal
Location:Mt. Shasta CA
File:A:SHASTA8.DAT

LINE: 3000
STA.: 130E

NORMALIZED HORIZONTAL COMPONENTS

CH.	BZ	BX	BY	BR	BR/BZ	arctan BX/BY
1	9.90E-08	3.06E-09	-4.31E-09	5.28E-09	0.05	-35.34
2	8.35E-08	2.64E-09	-3.00E-09	3.99E-09	0.05	-41.34
3	6.81E-08	1.74E-09	-2.71E-09	3.22E-09	0.05	-32.77
4	5.58E-08	1.21E-09	-2.45E-09	2.73E-09	0.05	-26.29
5	4.61E-08	1.18E-09	-2.54E-09	2.80E-09	0.06	-24.98
6	3.63E-08	7.93E-10	-2.09E-09	2.24E-09	0.06	-20.74
7	2.79E-08	5.30E-10	-2.02E-09	2.09E-09	0.08	-14.68
8	2.18E-08	2.16E-10	-1.82E-09	1.84E-09	0.08	-6.76
9	1.69E-08	2.78E-10	-1.34E-09	1.37E-09	0.08	-11.66
10	1.27E-08	1.55E-10	-1.15E-09	1.16E-09	0.09	-7.68
11	9.78E-09	1.66E-10	-9.53E-10	9.67E-10	0.10	-9.87
12	7.73E-09	1.89E-10	-6.81E-10	7.06E-10	0.09	-15.51
13	5.61E-09	1.53E-10	-5.06E-10	5.30E-10	0.09	-16.76
14	4.13E-09	1.28E-10	-3.65E-10	3.87E-10	0.09	-19.38
15	3.23E-09	1.36E-10	-2.57E-10	2.90E-10	0.09	-27.84
16	2.40E-09	1.03E-10	-1.86E-10	2.13E-10	0.09	-29.08
17	1.81E-09	7.57E-11	-1.28E-10	1.48E-10	0.08	-30.65
18	1.35E-09	5.37E-11	-9.66E-11	1.11E-10	0.08	-29.07
19	9.86E-10	4.15E-11	-6.34E-11	7.58E-11	0.08	-33.16
20	7.09E-10	2.34E-11	-4.18E-11	4.79E-11	0.07	-29.26

THE EARTH TECHNOLOGY CORP.

Job #:G85143
Client:UNOCAL Geothermal
Location:Mt. Shasta CA
File:A:SHASTA8.DAT

LINE 4

LINE: 4000
STA.: 010S

NORMALIZED HORIZONTAL COMPONENTS

CH.	BZ	BX	BY	BR	BR/BZ	arctan BX/BY
1	8.79E-07	1.16E-07	-1.96E-07	2.27E-07	0.26	-30.64
2	6.66E-07	9.03E-08	-1.95E-07	2.15E-07	0.32	-24.84
3	4.75E-07	6.52E-08	-1.81E-07	1.93E-07	0.41	-19.79
4	3.39E-07	4.92E-08	-1.33E-07	1.42E-07	0.42	-20.33
5	2.44E-07	3.78E-08	-9.46E-08	1.02E-07	0.42	-21.76
6	1.69E-07	2.79E-08	-4.99E-08	5.72E-08	0.34	-29.23
7	1.16E-07	2.01E-08	-3.94E-08	4.42E-08	0.38	-27.04
8	8.27E-08	1.51E-08	-2.47E-08	2.90E-08	0.35	-31.34
9	5.69E-08	1.05E-08	-1.45E-08	1.79E-08	0.31	-35.86
10	3.92E-08	7.23E-09	-8.30E-09	1.10E-08	0.28	-41.08
11	2.85E-08	5.12E-09	-5.02E-09	7.17E-09	0.25	-45.53
12	1.93E-08	3.35E-09	-2.65E-09	4.27E-09	0.22	-51.71
13	1.23E-08	2.01E-09	-1.13E-09	2.31E-09	0.19	-60.62
14	7.99E-09	1.31E-09	-3.48E-10	1.35E-09	0.17	-75.08
15	5.49E-09	8.59E-10	-6.15E-11	8.61E-10	0.16	-85.91
16	3.74E-09	5.76E-10	6.04E-11	5.79E-10	0.15	84.02
17	2.63E-09	4.24E-10	8.40E-11	4.32E-10	0.16	78.80
18	1.89E-09	2.86E-10	8.77E-11	2.99E-10	0.16	72.93
19	1.33E-09	1.93E-10	8.13E-11	2.10E-10	0.16	67.15
20	8.94E-10	1.51E-10	6.86E-11	1.66E-10	0.19	65.52

THE EARTH TECHNOLOGY CORP.

Job #:G85143
Client:UNOCAL Geothermal
Location:Mt. Shasta CA
File:A:SHASTA8.DAT

LINE: 4000
STA.: 0305

NORMALIZED HORIZONTAL COMPONENTS

CH.	BZ	BX	BY	BR	BR/BZ	arctan BX/BY
1	4.19E-07	5.87E-08	8.12E-08	1.00E-07	0.24	35.86
2	3.24E-07	4.68E-08	6.54E-08	8.04E-08	0.25	35.62
3	2.40E-07	3.45E-08	4.92E-08	6.00E-08	0.25	35.04
4	1.81E-07	2.54E-08	3.77E-08	4.55E-08	0.25	34.04
5	1.38E-07	1.92E-08	2.91E-08	3.48E-08	0.25	33.37
6	1.03E-07	1.38E-08	2.18E-08	2.58E-08	0.25	32.42
7	7.79E-08	1.04E-08	1.66E-08	1.96E-08	0.25	32.12
8	5.61E-08	7.90E-09	1.29E-08	1.52E-08	0.27	31.42
9	4.07E-08	5.64E-09	9.28E-09	1.09E-08	0.27	31.30
10	2.99E-08	3.72E-09	6.60E-09	7.58E-09	0.25	29.42
11	2.29E-08	2.97E-09	4.88E-09	5.71E-09	0.25	31.32
12	1.67E-08	1.79E-09	3.15E-09	3.62E-09	0.22	29.59
13	1.14E-08	1.07E-09	1.81E-09	2.10E-09	0.18	30.57
14	7.80E-09	5.70E-10	9.39E-10	1.10E-09	0.14	31.25
15	5.51E-09	2.71E-10	4.37E-10	5.14E-10	0.09	31.82
16	3.73E-09	1.11E-10	1.74E-10	2.07E-10	0.06	32.61
17	2.53E-09	5.66E-11	5.23E-11	7.70E-11	0.03	47.28
18	1.79E-09	2.02E-11	2.70E-11	3.37E-11	0.02	36.75
19	1.25E-09	8.29E-12	3.68E-11	3.77E-11	0.03	12.71
20	8.65E-10	4.15E-11	2.60E-11	4.89E-11	0.06	57.95

THE EARTH TECHNOLOGY CORP.

Job #:G85143
Client:UNOCAL Geothermal
Location:Mt. Shasta CA
File:A:SHASTA8.DAT

LINE: 4000
STA.: 0505

NORMALIZED HORIZONTAL COMPONENTS

CH.	BZ	BX	BY	BR	BR/BZ	arctan BX/BY
1	2.64E-07	-2.32E-08	-3.89E-08	4.54E-08	0.17	30.83
2	2.00E-07	-1.70E-08	-2.88E-08	3.34E-08	0.17	30.53
3	1.47E-07	-1.24E-08	-1.86E-08	2.24E-08	0.15	33.56
4	1.12E-07	-8.05E-09	-1.23E-08	1.47E-08	0.13	33.16
5	8.61E-08	-5.28E-09	-7.95E-09	9.54E-09	0.11	33.59
6	6.42E-08	-3.40E-09	-4.59E-09	5.72E-09	0.09	36.55
7	4.73E-08	-2.27E-09	-2.47E-09	3.35E-09	0.07	42.60
8	3.57E-08	-1.34E-09	-1.27E-09	1.85E-09	0.05	46.48
9	2.58E-08	-9.93E-10	-4.35E-10	1.08E-09	0.04	66.36
10	1.88E-08	-5.06E-10	-1.42E-10	5.26E-10	0.03	74.38
11	1.45E-08	-4.35E-10	-1.11E-10	4.49E-10	0.03	75.69
12	1.07E-08	-2.91E-10	-3.60E-11	2.93E-10	0.03	82.95
13	7.53E-09	-1.47E-10	2.70E-11	1.49E-10	0.02	-79.59
14	5.33E-09	-6.60E-11	2.70E-11	7.13E-11	0.01	-67.75
15	3.93E-09	1.80E-11	1.80E-11	2.54E-11	0.01	45.00
16	2.77E-09	6.82E-11	-2.36E-11	7.22E-11	0.03	-70.91
17	1.94E-09	8.62E-11	-2.25E-11	8.91E-11	0.05	-75.38
18	1.42E-09	8.47E-11	-6.15E-11	1.05E-10	0.07	-54.03
19	1.00E-09	1.01E-10	-4.42E-11	1.10E-10	0.11	-66.39
20	7.26E-10	8.13E-11	-4.42E-11	9.26E-11	0.13	-61.46

THE EARTH TECHNOLOGY CORP.

Job #:G8514Z
Client:UNOCAL Geothermal
Location:Mt. Shasta CA
File:A:SHASTA8.DAT

LINE: 4000
STA.: 070S

NORMALIZED HORIZONTAL COMPONENTS

CH.	BZ	BX	BY	BR	BR/BZ	arctan BX/BY
1	1.11E-07	5.71E-09	-8.65E-11	5.71E-09	0.05	-89.13
2	8.79E-08	8.95E-09	-6.63E-10	8.98E-09	0.10	-85.76
3	6.71E-08	6.91E-09	-3.75E-10	6.92E-09	0.10	-86.89
4	5.14E-08	5.25E-09	-5.19E-10	5.27E-09	0.10	-84.35
5	3.94E-08	3.76E-09	-3.17E-10	3.78E-09	0.10	-85.18
6	2.95E-08	2.84E-09	-4.94E-10	2.89E-09	0.10	-80.15
7	2.15E-08	1.86E-09	-4.33E-10	1.91E-09	0.09	-76.93
8	1.61E-08	1.43E-09	-3.39E-10	1.47E-09	0.09	-76.65
9	1.21E-08	1.16E-09	-3.14E-10	1.21E-09	0.10	-74.93
10	9.05E-09	9.84E-10	-1.66E-10	9.98E-10	0.11	-80.44
11	7.29E-09	7.45E-10	-1.87E-10	7.69E-10	0.11	-75.89
12	5.68E-09	6.76E-10	-1.15E-10	6.86E-10	0.12	-80.32
13	4.34E-09	4.74E-10	-8.36E-11	4.82E-10	0.11	-80.00
14	3.35E-09	3.65E-10	-4.76E-11	3.68E-10	0.11	-82.57
15	2.70E-09	2.98E-10	-1.01E-11	2.99E-10	0.11	-88.06
16	2.09E-09	2.14E-10	6.13E-12	2.14E-10	0.10	88.36
17	1.61E-09	1.74E-10	1.73E-11	1.75E-10	0.11	84.31
18	1.25E-09	1.41E-10	1.55E-11	1.42E-10	0.11	83.72
19	9.46E-10	8.87E-11	1.19E-11	8.95E-11	0.09	82.36
20	6.98E-10	5.91E-11	9.01E-12	5.98E-11	0.09	81.33

THE EARTH TECHNOLOGY CORP.

Job #:G85143
Client:UNOCAL Geothermal
Location:Mt. Shasta CA
File:A:SHASTA9.DAT

LINE: 4000
STA.: 090S

NORMALIZED HORIZONTAL COMPONENTS

CH.	BZ	BX	BY	BR	BR/BZ	arctan BX/BY
1	6.37E-08	-1.66E-08	1.08E-08	1.98E-08	0.31	-56.96
2	5.24E-08	-1.28E-08	9.07E-09	1.57E-08	0.30	-54.66
3	4.11E-08	-9.57E-09	6.55E-09	1.16E-08	0.28	-55.64
4	3.25E-08	-7.21E-09	5.10E-09	8.83E-09	0.27	-54.70
5	2.57E-08	-5.46E-09	3.75E-09	6.63E-09	0.26	-55.55
6	1.97E-08	-3.77E-09	2.81E-09	4.70E-09	0.24	-53.32
7	1.49E-08	-2.64E-09	2.16E-09	3.41E-09	0.23	-50.70
8	1.17E-08	-1.87E-09	1.63E-09	2.48E-09	0.21	-48.89
9	9.07E-09	-1.46E-09	1.09E-09	1.82E-09	0.20	-53.29
10	7.15E-09	-1.10E-09	9.01E-10	1.42E-09	0.20	-50.75
11	5.78E-09	-8.49E-10	7.35E-10	1.12E-09	0.19	-49.11
12	4.68E-09	-7.47E-10	5.81E-10	9.46E-10	0.20	-52.15
13	3.62E-09	-5.38E-10	4.66E-10	7.11E-10	0.20	-49.11
14	2.82E-09	-4.41E-10	3.65E-10	5.72E-10	0.20	-50.42
15	2.27E-09	-3.86E-10	3.06E-10	4.93E-10	0.22	-51.65
16	1.74E-09	-3.12E-10	2.60E-10	4.06E-10	0.23	-50.23
17	1.32E-09	-2.52E-10	1.98E-10	3.21E-10	0.24	-51.60
18	9.98E-10	-2.04E-10	1.55E-10	2.56E-10	0.26	-52.79
19	7.13E-10	-1.64E-10	1.17E-10	2.02E-10	0.28	-54.46
20	4.95E-10	-1.13E-10	9.30E-11	1.46E-10	0.30	-50.50

THE EARTH TECHNOLOGY CORP.

Job #:885143
Client:UNOCAL Geothermal
Location:Mt. Shasta CA
File:A:SHASTA9.DAT

LINE: 4000
STA.: 110S

NORMALIZED HORIZONTAL COMPONENTS

CH.	BZ	BX	BY	BR	BR/BZ	arctan BX/BY
1	2.96E-08	-1.99E-09	7.21E-11	1.99E-09	0.07	-87.92
2	2.56E-08	-1.34E-09	6.06E-10	1.47E-09	0.06	-65.70
3	2.17E-08	-1.43E-09	2.16E-10	1.44E-09	0.07	-81.38
4	1.83E-08	-1.23E-09	-1.01E-10	1.23E-09	0.07	85.29
5	1.53E-08	-8.94E-10	1.30E-10	9.03E-10	0.06	-81.74
6	1.26E-08	-1.11E-09	-5.41E-11	1.11E-09	0.09	87.21
7	1.00E-08	-8.76E-10	7.21E-12	8.76E-10	0.09	-89.53
8	7.99E-09	-8.76E-10	1.73E-10	8.93E-10	0.11	-78.83
9	6.26E-09	-5.23E-10	-8.65E-11	5.30E-10	0.08	80.60
10	4.87E-09	-4.76E-10	0.00E+00	4.76E-10	0.10	-45.00
11	3.89E-09	-5.32E-10	6.34E-11	5.36E-10	0.14	-83.20
12	3.05E-09	-2.88E-10	-4.18E-11	2.91E-10	0.10	81.75
13	2.25E-09	-2.91E-10	6.92E-11	2.99E-10	0.13	-76.63
14	1.67E-09	-2.47E-10	3.75E-11	2.49E-10	0.15	-81.35
15	1.29E-09	-1.69E-10	2.60E-11	1.71E-10	0.13	-81.25
16	9.37E-10	-1.53E-10	5.41E-12	1.53E-10	0.16	-87.98
17	6.57E-10	-1.30E-10	1.01E-11	1.31E-10	0.20	-85.56
18	4.59E-10	-9.98E-11	-4.33E-12	9.99E-11	0.22	87.52
19	3.03E-10	-6.42E-11	-5.05E-12	6.44E-11	0.21	85.50
20	1.93E-10	-3.50E-11	-1.19E-11	3.69E-11	0.19	71.21

THE EARTH TECHNOLOGY CORP.

Job #:G85143
Client:UNOCAL Geothermal
Location:Mt. Shasta CA
File:A:SHASTA9.DAT

LINE: 4000
STA.: 1305

NORMALIZED HORIZONTAL COMPONENTS

CH.	BZ	BX	BY	BR	BR/BZ	arctan BX/BY
1	3.09E-08	8.36E-10	-3.47E-09	3.57E-09	0.12	-13.53
2	2.58E-08	1.30E-10	-2.67E-09	2.67E-09	0.10	-2.79
3	2.05E-08	-2.88E-11	-2.19E-09	2.19E-09	0.11	0.75
4	1.67E-08	1.73E-10	-1.82E-09	1.82E-09	0.11	-5.44
5	1.41E-08	2.88E-11	-1.31E-09	1.31E-09	0.09	-1.26
6	1.17E-08	-5.41E-11	-1.02E-09	1.03E-09	0.09	3.02
7	8.68E-09	-1.23E-10	-7.21E-10	7.31E-10	0.08	9.65
8	5.91E-09	-8.65E-11	-5.66E-10	5.72E-10	0.10	8.69
9	4.24E-09	-1.62E-10	-3.82E-10	4.15E-10	0.10	23.00
10	3.20E-09	-1.23E-10	-2.78E-10	3.03E-10	0.09	23.82
11	2.53E-09	-1.49E-10	-2.00E-10	2.49E-10	0.10	36.54
12	1.85E-09	-8.36E-11	-1.79E-10	1.97E-10	0.11	25.07
13	1.31E-09	-9.08E-11	-9.08E-11	1.28E-10	0.10	45.00
14	9.23E-10	-6.92E-11	-7.93E-11	1.05E-10	0.11	41.11
15	6.46E-10	-2.88E-11	-5.19E-11	5.94E-11	0.09	29.05
16	4.47E-10	-3.46E-11	-3.50E-11	4.92E-11	0.11	44.70
17	3.00E-10	-9.73E-12	-2.67E-11	2.84E-11	0.09	20.05
18	2.08E-10	-1.12E-11	-1.98E-11	2.28E-11	0.11	29.41
19	1.33E-10	0.00E+00	-1.30E-11	1.30E-11	0.10	0.00
20	7.79E-11	1.30E-11	-9.37E-12	1.60E-11	0.21	-54.16

THE EARTH TECHNOLOGY CORP.

Job #:G85143
Client:UNOCAL Geothermal
Location:Mt. Shasta CA
File:A:SHASTA9.DAT

LINE: 4000
STA.: 1505

NORMALIZED HORIZONTAL COMPONENTS

CH.	BZ	BX	BY	BR	BR/BZ	arctan BX/BY
1	3.13E-08	-5.93E-09	2.54E-09	6.45E-09	0.21	-66.82
2	2.28E-08	-3.79E-09	2.36E-09	4.47E-09	0.20	-58.05
3	1.60E-08	-3.10E-09	1.33E-09	3.37E-09	0.21	-66.83
4	1.14E-08	-2.32E-09	1.02E-09	2.54E-09	0.22	-66.20
5	8.65E-09	-1.87E-09	7.64E-10	2.02E-09	0.23	-67.82
6	6.57E-09	-1.36E-09	5.62E-10	1.47E-09	0.22	-67.52
7	4.87E-09	-1.24E-09	3.42E-10	1.29E-09	0.26	-74.60
8	3.75E-09	-8.07E-10	2.85E-10	8.56E-10	0.23	-70.57
9	2.80E-09	-7.64E-10	2.09E-10	7.92E-10	0.28	-74.70
10	2.11E-09	-4.65E-10	1.19E-10	4.80E-10	0.23	-75.65
11	1.65E-09	-4.14E-10	1.02E-10	4.26E-10	0.26	-76.10
12	1.20E-09	-3.03E-10	8.80E-11	3.15E-10	0.26	-73.80
13	8.42E-10	-2.19E-10	3.46E-11	2.22E-10	0.26	-81.03
14	6.11E-10	-1.66E-10	4.90E-11	1.73E-10	0.28	-73.53
15	4.50E-10	-1.28E-10	4.04E-11	1.35E-10	0.30	-72.54
16	3.11E-10	-8.33E-11	3.71E-11	9.12E-11	0.29	-65.97
17	2.05E-10	-7.21E-11	7.57E-12	7.25E-11	0.35	-84.01
18	1.47E-10	-5.91E-11	-2.20E-11	6.31E-11	0.43	69.60
19	9.52E-11	-5.08E-11	-1.98E-11	5.46E-11	0.57	68.69
20	6.63E-11	-2.85E-11	-3.60E-12	2.87E-11	0.43	82.79

THE EARTH TECHNOLOGY CORP.

Job #:G85143
Client:UNOCAL Geothermal
Location:Mt. Shasta CA
File:A:SHASTA10.DAT

LINE: 4000
STA.: 170S

NORMALIZED HORIZONTAL COMPONENTS

CH.	BZ	BX	BY	BR	BR/BZ	arctan BX/BY
1	3.73E-08	-3.65E-09	-2.39E-09	4.36E-09	0.12	56.73
2	2.64E-08	-3.20E-09	-1.11E-09	3.39E-09	0.13	70.87
3	1.79E-08	-2.84E-09	-6.78E-10	2.92E-09	0.16	76.58
4	1.26E-08	-1.50E-09	-4.04E-10	1.55E-09	0.12	74.93
5	9.69E-09	-1.60E-09	-4.90E-10	1.67E-09	0.17	72.97
6	6.95E-09	-8.94E-10	-3.64E-10	9.65E-10	0.14	67.84
7	4.99E-09	-7.89E-10	-3.35E-10	8.58E-10	0.17	66.99
8	3.75E-09	-6.52E-10	-2.60E-10	7.02E-10	0.19	68.31
9	2.71E-09	-4.69E-10	-3.10E-10	5.62E-10	0.21	56.51
10	1.93E-09	-3.60E-10	-2.60E-10	4.44E-10	0.23	54.25
11	1.50E-09	-3.01E-10	-2.15E-10	3.70E-10	0.25	54.51
12	1.08E-09	-1.70E-10	-1.47E-10	2.25E-10	0.21	49.16
13	7.27E-10	-1.23E-10	-1.21E-10	1.72E-10	0.24	45.34
14	5.19E-10	-7.21E-11	-6.92E-11	9.99E-11	0.19	46.17
15	3.81E-10	-5.91E-11	-4.76E-11	7.59E-11	0.20	51.17
16	2.48E-10	-2.99E-11	-5.66E-11	6.40E-11	0.26	27.86
17	1.59E-10	-2.88E-11	-5.37E-11	6.10E-11	0.38	28.23
18	1.10E-10	1.01E-11	-3.89E-11	4.02E-11	0.37	-14.53
19	6.92E-11	2.52E-12	-9.73E-12	1.01E-11	0.15	-14.53
20	4.33E-11	7.93E-12	1.15E-11	1.40E-11	0.32	34.51

THE EARTH TECHNOLOGY CORP.

Job #:G85143
Client:UNOCAL Geothermal
Location:Mt. Shasta CA
File:A:SHASTA10.DAT

LINE 5

STA.: 020E

NORMALIZED HORIZONTAL COMPONENTS (V/(A-m^2))

CH.	BZ	BX	BY	BR	BR/BZ	arctan BX/BY
1	4.36E-08	-2.11E-09	-2.78E-10	2.13E-09	0.05	82.50
2	2.95E-08	-2.07E-09	-3.75E-10	2.10E-09	0.07	79.73
3	2.00E-08	-6.53E-10	-2.78E-11	6.53E-10	0.03	87.56
4	1.41E-08	-9.02E-10	0.00E+00	9.02E-10	0.06	-90.00
5	1.02E-08	-5.97E-10	-6.94E-11	6.01E-10	0.06	83.37
6	7.00E-09	-4.34E-10	2.43E-11	4.35E-10	0.06	-86.79
7	4.79E-09	-4.10E-10	-7.64E-11	4.17E-10	0.09	79.44
8	3.44E-09	-3.40E-10	-6.25E-11	3.46E-10	0.10	79.59
9	2.47E-09	-2.57E-10	-1.74E-11	2.57E-10	0.10	86.13
10	1.82E-09	-1.74E-10	4.86E-11	1.80E-10	0.10	-74.36
11	1.40E-09	-1.44E-10	2.78E-11	1.47E-10	0.11	-79.11
12	1.07E-09	-1.24E-10	5.69E-11	1.36E-10	0.13	-65.27
13	7.72E-10	-7.78E-11	3.61E-11	8.57E-11	0.11	-65.10
14	5.61E-10	-4.58E-11	4.03E-11	6.10E-11	0.11	-48.69
15	4.05E-10	-4.44E-11	1.80E-11	4.80E-11	0.12	-67.89
16	2.97E-10	-3.33E-11	2.64E-11	4.25E-11	0.14	-51.63
17	2.04E-10	-2.43E-11	1.18E-11	2.70E-11	0.13	-64.09
18	1.40E-10	-2.53E-11	1.11E-11	2.77E-11	0.20	-66.33
19	9.72E-11	-2.71E-11	4.86E-12	2.75E-11	0.28	-79.82
20	6.66E-11	-2.43E-11	9.37E-12	2.60E-11	0.39	-68.91

THE EARTH TECHNOLOGY CORP.

Job #:G85143
Client:UNOCAL Geothermal
Location:Medicine Lake CA
File:A:SHASTA13.DAT

LINE: 5000
STA.: 040E

NORMALIZED HORIZONTAL COMPONENTS (V/(A-m^2))

CH.	BZ	BX	BY	BR	BR/BZ	arctan BX/BY
1	8.35E-08	-2.36E-10	2.37E-08	2.37E-08	0.28	-0.57
2	5.92E-08	5.00E-10	1.58E-08	1.58E-08	0.27	1.81
3	4.14E-08	5.41E-10	1.12E-08	1.12E-08	0.27	2.76
4	3.02E-08	2.08E-10	8.25E-09	8.25E-09	0.27	1.45
5	2.25E-08	1.25E-10	6.32E-09	6.32E-09	0.28	1.13
6	1.65E-08	1.18E-10	4.94E-09	4.94E-09	0.30	1.37
7	1.18E-08	-7.64E-11	3.60E-09	3.60E-09	0.31	-1.22
8	8.61E-09	-1.74E-11	2.69E-09	2.69E-09	0.31	-0.37
9	6.14E-09	-6.60E-11	2.04E-09	2.04E-09	0.33	-1.85
10	4.42E-09	-1.39E-10	1.46E-09	1.46E-09	0.33	-5.44
11	3.32E-09	-1.80E-10	1.06E-09	1.07E-09	0.32	-9.69
12	2.41E-09	-4.58E-11	8.16E-10	8.18E-10	0.34	-3.21
13	1.69E-09	-8.61E-11	5.25E-10	5.32E-10	0.32	-9.31
14	1.21E-09	-9.02E-11	3.60E-10	3.71E-10	0.31	-14.09
15	8.89E-10	-5.28E-11	2.61E-10	2.66E-10	0.30	-11.43
16	6.39E-10	-5.41E-11	1.90E-10	1.97E-10	0.31	-15.92
17	4.50E-10	-4.51E-11	1.24E-10	1.32E-10	0.29	-20.06
18	3.19E-10	-3.02E-11	9.27E-11	9.75E-11	0.31	-18.05
19	2.14E-10	-1.32E-11	5.76E-11	5.91E-11	0.28	-12.89
20	1.39E-10	-2.08E-11	4.86E-11	5.29E-11	0.38	-23.20

THE EARTH TECHNOLOGY CORP.

Job #:G85143
Client:UNOCAL GEOTHERMAL
Location:MT. SHASTA CA
File:A:SHASTA12.DAT

LINE: 5000
STA.: 060E

NORMALIZED HORIZONTAL COMPONENTS

CH.	BZ	BX	BY	BR	BR/BZ	arctan BX/BY
1	8.18E-07	6.29E-09	1.91E-07	1.91E-07	0.23	1.88
2	6.25E-07	1.37E-08	1.53E-07	1.54E-07	0.25	5.12
3	4.54E-07	1.95E-08	1.14E-07	1.16E-07	0.26	9.65
4	3.32E-07	2.20E-08	8.38E-08	8.67E-08	0.26	14.72
5	2.46E-07	2.11E-08	6.06E-08	6.42E-08	0.26	19.16
6	1.74E-07	1.80E-08	4.10E-08	4.48E-08	0.26	23.68
7	1.22E-07	1.41E-08	2.68E-08	3.03E-08	0.25	27.64
8	8.75E-08	1.06E-08	1.80E-08	2.09E-08	0.24	30.53
9	6.08E-08	7.42E-09	1.17E-08	1.39E-08	0.23	32.35
10	4.25E-08	4.99E-09	7.82E-09	9.28E-09	0.22	32.55
11	3.21E-08	3.51E-09	5.66E-09	6.66E-09	0.21	31.83
12	2.31E-08	2.40E-09	4.01E-09	4.67E-09	0.20	30.86
13	1.61E-08	1.60E-09	2.74E-09	3.17E-09	0.20	30.34
14	1.13E-08	1.15E-09	1.94E-09	2.25E-09	0.20	30.65
15	8.18E-09	8.58E-10	1.43E-09	1.67E-09	0.20	31.01
16	5.75E-09	6.42E-10	1.03E-09	1.21E-09	0.21	31.94
17	3.93E-09	4.65E-10	7.30E-10	8.66E-10	0.22	32.51
18	2.69E-09	3.44E-10	5.37E-10	6.38E-10	0.24	32.63
19	1.72E-09	2.34E-10	3.62E-10	4.31E-10	0.25	32.86
20	1.07E-09	1.80E-10	2.41E-10	3.01E-10	0.28	36.74

THE EARTH TECHNOLOGY CORP.

Job #:G85143
Client:UNOCAL Geothermal
Location:Mt. Shasta CA
File:A:SHASTA12.DAT

LINE: 5000
STA.: 080E

NORMALIZED HORIZONTAL COMPONENTS

CH.	BZ	BX	BY	BR	BR/BZ	arctan BX/BY
1	3.38E-06	3.42E-07	-3.69E-07	5.03E-07	0.15	-42.79
2	2.82E-06	1.82E-07	-3.03E-07	3.54E-07	0.13	-30.99
3	2.21E-06	4.04E-08	-2.26E-07	2.30E-07	0.10	-10.13
4	1.70E-06	-4.72E-08	-1.60E-07	1.66E-07	0.10	16.48
5	1.28E-06	-8.71E-08	-1.06E-07	1.38E-07	0.11	39.30
6	9.07E-07	-9.43E-08	-6.40E-08	1.14E-07	0.13	55.84
7	6.15E-07	-8.26E-08	-3.36E-08	8.91E-08	0.14	67.85
8	4.21E-07	-6.50E-08	-1.65E-08	6.70E-08	0.16	75.73
9	2.72E-07	-4.60E-08	-5.89E-09	4.64E-08	0.17	82.70
10	1.76E-07	-3.15E-08	-5.28E-10	3.15E-08	0.18	89.04
11	1.23E-07	-2.28E-08	1.82E-09	2.28E-08	0.19	-85.43
12	8.23E-08	-1.56E-08	2.83E-09	1.59E-08	0.19	-79.71
13	5.28E-08	-1.03E-08	2.92E-09	1.07E-08	0.20	-74.21
14	3.49E-08	-7.04E-09	2.44E-09	7.45E-09	0.21	-70.86
15	2.42E-08	-5.09E-09	1.88E-09	5.42E-09	0.22	-69.75
16	1.60E-08	-3.51E-09	1.30E-09	3.75E-09	0.23	-69.70
17	1.04E-08	-2.38E-09	8.33E-10	2.52E-09	0.24	-70.69
18	7.02E-09	-1.60E-09	5.25E-10	1.68E-09	0.24	-71.83
19	4.49E-09	-1.01E-09	3.17E-10	1.06E-09	0.24	-72.61
20	2.82E-09	-6.19E-10	1.89E-10	6.47E-10	0.23	-73.04

THE EARTH TECHNOLOGY CORP.

Job #:G85143
Client:UNOCAL Geothermal
Location:Mt. Shasta CA
File:A:SHASTA12.DAT

LINE: 5000
STA.: 100E

NORMALIZED HORIZONTAL COMPONENTS

CH.	BZ	BX	BY	BR	BR/BZ	arctan BX/BY
1	9.56E-07	-3.76E-07	-1.60E-07	4.08E-07	0.43	66.95
2	7.28E-07	-2.45E-07	-9.93E-08	2.65E-07	0.36	67.96
3	5.34E-07	-1.58E-07	-5.89E-08	1.69E-07	0.32	69.61
4	4.01E-07	-1.10E-07	-3.73E-08	1.16E-07	0.29	71.18
5	3.06E-07	-7.92E-08	-2.54E-08	8.32E-08	0.27	72.19
6	2.26E-07	-5.65E-08	-1.75E-08	5.92E-08	0.26	72.83
7	1.66E-07	-3.99E-08	-1.21E-08	4.17E-08	0.25	73.16
8	1.25E-07	-2.90E-08	-8.69E-09	3.02E-08	0.24	73.30
9	9.21E-08	-2.03E-08	-6.22E-09	2.12E-08	0.23	72.96
10	6.93E-08	-1.46E-08	-4.47E-09	1.52E-08	0.22	72.95
11	5.52E-08	-1.12E-08	-3.45E-09	1.17E-08	0.21	72.89
12	4.25E-08	-8.31E-09	-2.54E-09	8.69E-09	0.20	72.98
13	3.19E-08	-6.19E-09	-1.88E-09	6.47E-09	0.20	73.12
14	2.40E-08	-4.65E-09	-1.46E-09	4.88E-09	0.20	72.64
15	1.84E-08	-3.55E-09	-1.14E-09	3.73E-09	0.20	72.16
16	1.34E-08	-2.61E-09	-8.89E-10	2.76E-09	0.21	71.20
17	9.47E-09	-1.87E-09	-6.36E-10	1.98E-09	0.21	71.26
18	6.70E-09	-1.31E-09	-4.94E-10	1.40E-09	0.21	69.26
19	4.45E-09	-8.33E-10	-3.22E-10	8.93E-10	0.20	68.86
20	2.85E-09	-5.11E-10	-2.05E-10	5.51E-10	0.19	68.09

THE EARTH TECHNOLOGY CORP.

Job #:G85143
Client:UNOCAL Geothermal
Location:Mt. Shasta CA
File:A:SHASTA12.DAT

LINE: 5000
STA.: 120E

NORMALIZED HORIZONTAL COMPONENTS

CH.	BZ	BX	BY	BR	BR/BZ	arctan BX/BY
1	8.04E-07	-9.01E-08	1.29E-08	9.10E-08	0.11	-81.87
2	5.90E-07	-6.03E-08	-1.80E-10	6.03E-08	0.10	89.83
3	4.18E-07	-3.88E-08	-1.87E-09	3.88E-08	0.09	87.23
4	3.09E-07	-2.71E-08	7.08E-10	2.71E-08	0.09	-88.50
5	2.39E-07	-2.04E-08	3.35E-09	2.06E-08	0.09	-80.66
6	1.85E-07	-1.61E-08	5.76E-09	1.71E-08	0.09	-70.32
7	1.46E-07	-1.33E-08	6.37E-09	1.48E-08	0.10	-64.43
8	1.18E-07	-1.16E-08	6.08E-09	1.31E-08	0.11	-62.33
9	9.27E-08	-9.85E-09	5.72E-09	1.14E-08	0.12	-59.88
10	7.26E-08	-8.25E-09	4.78E-09	9.53E-09	0.13	-59.93
11	5.83E-08	-7.02E-09	4.10E-09	8.13E-09	0.14	-59.72
12	4.43E-08	-5.54E-09	3.23E-09	6.41E-09	0.14	-59.77
13	3.21E-08	-4.24E-09	2.39E-09	4.87E-09	0.15	-60.63
14	2.31E-08	-3.21E-09	1.69E-09	3.63E-09	0.16	-62.20
15	1.70E-08	-2.52E-09	1.21E-09	2.80E-09	0.16	-64.36
16	1.21E-08	-1.97E-09	7.62E-10	2.11E-09	0.18	-68.84
17	8.30E-09	-1.58E-09	4.25E-10	1.64E-09	0.20	-74.97
18	5.76E-09	-1.22E-09	2.09E-10	1.24E-09	0.21	-80.27
19	3.73E-09	-9.11E-10	4.62E-11	9.12E-10	0.24	-87.10
20	2.34E-09	-6.38E-10	-2.36E-11	6.38E-10	0.27	87.88

THE EARTH TECHNOLOGY CORP.

Job #:G85143
Client:UNOCAL Geothermal
Location:Mt. Shasta CA
File:A:SHASTA12.DAT

LINE: 5000
STA.: 140E

NORMALIZED HORIZONTAL COMPONENTS

CH.	BZ	BX	BY	BR	BR/BZ	arctan BX/BY
1	2.04E-07	-6.58E-09	2.19E-08	2.29E-08	0.11	-16.73
2	1.69E-07	-5.58E-09	1.74E-08	1.83E-08	0.11	-17.79
3	1.40E-07	-5.76E-09	1.36E-08	1.48E-08	0.11	-22.95
4	1.20E-07	-5.40E-09	1.19E-08	1.30E-08	0.11	-24.49
5	1.03E-07	-4.86E-09	1.01E-08	1.12E-08	0.11	-25.68
6	8.58E-08	-4.93E-09	8.40E-09	9.74E-09	0.11	-30.41
7	7.10E-08	-4.71E-09	6.92E-09	8.37E-09	0.12	-34.22
8	5.88E-08	-4.70E-09	5.68E-09	7.37E-09	0.13	-39.65
9	4.73E-08	-4.53E-09	4.26E-09	6.22E-09	0.13	-46.74
10	3.76E-08	-4.34E-09	3.36E-09	5.49E-09	0.15	-52.19
11	3.02E-08	-3.98E-09	2.61E-09	4.76E-09	0.16	-56.74
12	2.33E-08	-3.59E-09	1.88E-09	4.06E-09	0.17	-62.32
13	1.67E-08	-3.05E-09	1.32E-09	3.32E-09	0.20	-66.54
14	1.18E-08	-2.55E-09	9.21E-10	2.71E-09	0.23	-70.16
15	8.49E-09	-2.05E-09	6.57E-10	2.15E-09	0.25	-72.25
16	5.70E-09	-1.58E-09	4.23E-10	1.63E-09	0.29	-74.96
17	3.67E-09	-1.14E-09	2.61E-10	1.17E-09	0.32	-77.08
18	2.38E-09	-7.96E-10	1.65E-10	8.13E-10	0.34	-78.32
19	1.43E-09	-4.89E-10	1.15E-10	5.03E-10	0.35	-76.83
20	8.33E-10	-2.77E-10	7.95E-11	2.88E-10	0.35	-73.99

THE EARTH TECHNOLOGY CORP.

Job #:G85143
Client:UNOCAL Geothermal
Location:Mt. Shasta CA
File:A:SHASTA11.DAT

LINE: 5000
STA.: 150E

NORMALIZED HORIZONTAL COMPONENTS

CH.	BZ	BX	BY	BR	BR/BZ	arctan BX/BY
1	1.99E-07	-7.09E-09	-1.00E-08	1.23E-08	0.06	35.33
2	1.70E-07	-6.82E-09	-8.55E-09	1.09E-08	0.06	38.56
3	1.41E-07	-4.53E-09	-7.69E-09	8.92E-09	0.06	30.47
4	1.18E-07	-2.94E-09	-7.26E-09	7.84E-09	0.07	22.07
5	9.95E-08	-1.97E-09	-7.33E-09	7.59E-09	0.08	15.05
6	8.03E-08	-5.62E-10	-6.94E-09	6.96E-09	0.09	4.63
7	6.38E-08	4.69E-10	-6.62E-09	6.63E-09	0.10	-4.05
8	5.08E-08	9.96E-10	-6.07E-09	6.15E-09	0.12	-9.32
9	3.85E-08	1.44E-09	-5.39E-09	5.58E-09	0.14	-14.95
10	2.88E-08	1.61E-09	-4.70E-09	4.97E-09	0.17	-18.88
11	2.21E-08	1.64E-09	-4.00E-09	4.32E-09	0.20	-22.30
12	1.59E-08	1.38E-09	-3.22E-09	3.50E-09	0.22	-23.17
13	1.06E-08	1.18E-09	-2.41E-09	2.69E-09	0.25	-26.04
14	7.02E-09	9.30E-10	-1.77E-09	2.00E-09	0.28	-27.74
15	4.80E-09	7.59E-10	-1.28E-09	1.49E-09	0.31	-30.65
16	3.08E-09	5.29E-10	-8.54E-10	1.00E-09	0.33	-31.77
17	1.92E-09	3.89E-10	-5.44E-10	6.69E-10	0.35	-35.60
18	1.22E-09	3.04E-10	-3.45E-10	4.60E-10	0.38	-41.42
19	7.44E-10	1.82E-10	-2.05E-10	2.74E-10	0.37	-41.62
20	4.39E-10	8.23E-11	-1.23E-10	1.48E-10	0.34	-33.80

THE EARTH TECHNOLOGY CORP.

Job #:G85143
Client:UNOCAL Geothermal
Location:Mt. Shasta CA
File:A:SHASTA11.DAT

LINE: 5000
STA.: 160E

NORMALIZED HORIZONTAL COMPONENTS (V/(A-m^2))

CH.	BZ	BX	BY	BR	BR/BZ	arctan BX/BY
1	2.12E-07	-7.14E-08	-8.58E-08	1.12E-07	0.53	39.76
2	1.88E-07	-6.62E-08	-8.63E-08	1.09E-07	0.58	37.52
3	1.65E-07	-6.12E-08	-8.97E-08	1.09E-07	0.66	34.30
4	1.48E-07	-5.83E-08	-9.37E-08	1.10E-07	0.75	31.89
5	1.35E-07	-6.12E-08	-9.91E-08	1.16E-07	0.86	31.70
6	1.16E-07	-3.30E-08	-4.79E-08	5.82E-08	0.50	34.54
7	7.68E-08	-3.11E-08	-4.78E-08	5.71E-08	0.74	33.05
8	3.68E-08	-1.80E-08	-2.26E-08	2.89E-08	0.78	38.48
9	2.34E-08	-8.70E-09	-1.11E-08	1.41E-08	0.60	38.08
10	1.64E-08	-6.32E-09	-7.82E-09	1.01E-08	0.61	38.93
11	1.21E-08	-4.80E-09	-5.76E-09	7.50E-09	0.62	39.78
12	8.35E-09	-3.36E-09	-3.93E-09	5.17E-09	0.62	40.49
13	5.42E-09	-2.24E-09	-2.52E-09	3.37E-09	0.62	41.62
14	3.50E-09	-1.49E-09	-1.57E-09	2.16E-09	0.62	43.43
15	2.35E-09	-9.66E-10	-1.04E-09	1.42E-09	0.60	43.02
16	1.51E-09	-5.95E-10	-6.76E-10	9.01E-10	0.60	41.35
17	9.52E-10	-3.97E-10	-4.26E-10	5.83E-10	0.61	42.99
18	6.14E-10	-2.52E-10	-2.55E-10	3.59E-10	0.58	44.63
19	3.84E-10	-1.69E-10	-1.61E-10	2.34E-10	0.61	46.37
20	2.42E-10	-1.22E-10	-1.12E-10	1.66E-10	0.69	47.37

THE EARTH TECHNOLOGY CORP.

Job #:G85143
Client:UNOCAL Geothermal
Location:Medicine Lake CA
File:a:shasta11.dat

LINE: 5000
STA.: 180E

NORMALIZED HORIZONTAL COMPONENTS

CH.	BZ	BX	BY	BR	BR/BZ	arctan BX/BY
1	7.58E-08	3.56E-09	1.86E-09	4.02E-09	0.05	62.42
2	6.01E-08	2.85E-09	1.85E-09	3.40E-09	0.06	57.12
3	4.58E-08	1.69E-09	8.65E-10	1.90E-09	0.04	62.85
4	3.52E-08	9.66E-10	6.20E-10	1.15E-09	0.03	57.31
5	2.72E-08	5.77E-10	2.31E-10	6.21E-10	0.02	68.20
6	2.02E-08	2.70E-10	-6.49E-11	2.78E-10	0.01	-76.50
7	1.47E-08	-1.48E-10	-2.02E-10	2.50E-10	0.02	36.21
8	1.09E-08	-8.65E-11	-2.52E-10	2.67E-10	0.02	18.92
9	7.76E-09	-1.73E-10	-2.52E-10	3.06E-10	0.04	34.44
10	5.42E-09	-1.48E-10	-1.91E-10	2.42E-10	0.04	37.72
11	4.04E-09	-1.98E-10	-2.45E-10	3.15E-10	0.08	38.86
12	2.84E-09	-1.23E-10	-1.61E-10	2.03E-10	0.07	37.20
13	1.85E-09	-1.31E-10	-1.14E-10	1.74E-10	0.09	49.04
14	1.22E-09	-1.04E-10	-9.08E-11	1.38E-10	0.11	48.81
15	8.65E-10	-4.61E-11	-5.19E-11	6.94E-11	0.08	41.63
16	5.74E-10	-4.29E-11	-3.42E-11	5.49E-11	0.10	51.40
17	3.81E-10	-2.49E-11	-2.27E-11	3.37E-11	0.09	47.60
18	2.62E-10	-1.98E-11	-1.23E-11	2.33E-11	0.09	58.28
19	1.79E-10	-1.77E-11	-5.41E-12	1.85E-11	0.10	72.98
20	1.18E-10	-7.57E-12	-1.80E-12	7.78E-12	0.07	76.61

THE EARTH TECHNOLOGY CORP.

Job #:G85143
Client:UNOCAL Geothermal
Location:Mt. Shasta CA
File:A:SHASTA11.DAT

LINE: 5000
STA.: 200E

NORMALIZED HORIZONTAL COMPONENTS

CH.	BZ	BX	BY	BR	BR/BZ	arctan BX/BY
1	5.70E-08	-3.71E-09	1.77E-09	4.11E-09	0.07	-64.42
2	4.64E-08	-2.78E-09	6.63E-10	2.86E-09	0.06	-76.59
3	3.53E-08	-2.54E-09	4.04E-10	2.57E-09	0.07	-80.96
4	2.66E-08	-2.77E-09	4.61E-10	2.81E-09	0.11	-80.54
5	2.02E-08	-1.92E-09	2.02E-10	1.93E-09	0.10	-83.99
6	1.44E-08	-1.52E-09	7.21E-11	1.52E-09	0.11	-87.29
7	1.00E-08	-1.17E-09	-4.33E-11	1.17E-09	0.12	87.89
8	7.09E-09	-8.33E-10	-9.37E-11	8.38E-10	0.12	83.58
9	4.87E-09	-6.27E-10	0.00E+00	6.27E-10	0.13	-45.00
10	3.32E-09	-4.87E-10	-1.08E-11	4.87E-10	0.15	88.72
11	2.42E-09	-3.00E-10	-3.89E-11	3.02E-10	0.12	82.60
12	1.67E-09	-2.41E-10	-1.73E-11	2.41E-10	0.14	85.89
13	1.08E-09	-1.33E-10	-7.21E-12	1.33E-10	0.12	86.89
14	7.27E-10	-6.63E-11	0.00E+00	6.63E-11	0.09	-45.00
15	5.08E-10	-6.92E-11	-2.88E-12	6.93E-11	0.14	87.61
16	3.58E-10	-3.57E-11	-3.24E-12	3.58E-11	0.10	84.81
17	2.36E-10	-3.82E-11	-4.69E-12	3.85E-11	0.16	83.01
18	1.67E-10	-1.05E-11	-5.41E-12	1.18E-11	0.07	62.65
19	1.10E-10	-1.98E-11	-1.44E-12	1.99E-11	0.18	85.84
20	8.36E-11	-3.60E-12	3.24E-12	4.85E-12	0.06	-48.01

THE EARTH TECHNOLOGY CORP.

Job #:G85143
Client:UNOCAL Geothermal
Location:Mt. Shasta CA
File:A:SHASTA11.DAT

LINE: 5000
STA.: 220E

NORMALIZED HORIZONTAL COMPONENTS

CH.	BZ	BX	BY	BR	BR/BZ	arctan BX/BY
1	4.15E-08	3.89E-09	2.02E-09	4.39E-09	0.11	62.59
2	3.17E-08	2.71E-09	1.82E-09	3.26E-09	0.10	56.17
3	2.30E-08	1.86E-09	9.37E-10	2.08E-09	0.09	63.26
4	1.70E-08	1.01E-09	7.07E-10	1.23E-09	0.07	55.01
5	1.30E-08	8.80E-10	4.18E-10	9.74E-10	0.07	64.57
6	9.57E-09	7.46E-10	4.58E-10	8.75E-10	0.09	58.47
7	7.09E-09	4.94E-10	2.96E-10	5.76E-10	0.08	59.10
8	5.31E-09	2.85E-10	3.39E-10	4.43E-10	0.08	40.04
9	3.89E-09	2.70E-10	2.70E-10	3.82E-10	0.10	45.00
10	2.85E-09	1.48E-10	2.49E-10	2.89E-10	0.10	30.72
11	2.17E-09	1.04E-10	2.19E-10	2.43E-10	0.11	25.35
12	1.56E-09	8.36E-11	1.47E-10	1.69E-10	0.11	29.62
13	1.05E-09	4.61E-11	1.10E-10	1.19E-10	0.11	22.83
14	7.27E-10	1.87E-11	8.94E-11	9.13E-11	0.13	11.84
15	5.19E-10	1.87E-11	5.62E-11	5.93E-11	0.11	18.43
16	3.49E-10	7.93E-12	3.89E-11	3.97E-11	0.11	11.51
17	2.42E-10	-1.08E-12	2.67E-11	2.67E-11	0.11	-2.32
18	1.67E-10	1.80E-12	1.66E-11	1.67E-11	0.10	6.20
19	1.18E-10	-4.33E-12	1.12E-11	1.20E-11	0.10	-21.16
20	7.21E-11	-2.52E-12	6.13E-12	6.63E-12	0.09	-22.38

THE EARTH TECHNOLOGY CORP.

Job #:G85143
Client:UNOCAL Geothermal
Location:Mt. Shasta CA
File:A:SHASTA11.DAT

LINE: 5000
STA.: 240E

NORMALIZED HORIZONTAL COMPONENTS

CH.	BZ	BX	BY	BR	BR/BZ	arctan BX/BY
1	2.04E-08	-3.26E-09	-3.62E-09	4.87E-09	0.24	42.00
2	1.65E-08	-1.87E-09	-2.47E-09	3.10E-09	0.19	37.24
3	1.26E-08	-1.80E-09	-2.44E-09	3.03E-09	0.24	36.49
4	9.86E-09	-1.63E-09	-1.72E-09	2.37E-09	0.24	43.52
5	7.79E-09	-1.12E-09	-1.51E-09	1.89E-09	0.24	36.61
6	5.98E-09	-9.12E-10	-1.24E-09	1.54E-09	0.26	36.25
7	4.60E-09	-7.75E-10	-9.26E-10	1.21E-09	0.26	39.92
8	3.58E-09	-4.97E-10	-7.75E-10	9.21E-10	0.26	32.69
9	2.71E-09	-3.21E-10	-6.70E-10	7.43E-10	0.27	25.57
10	2.03E-09	-3.71E-10	-4.94E-10	6.18E-10	0.30	36.94
11	1.60E-09	-9.66E-11	-3.98E-10	4.10E-10	0.26	13.64
12	1.18E-09	-1.66E-10	-3.01E-10	3.44E-10	0.29	28.82
13	8.48E-10	-1.10E-10	-2.05E-10	2.32E-10	0.27	28.16
14	5.94E-10	-8.36E-11	-1.33E-10	1.57E-10	0.26	32.23
15	4.33E-10	-4.47E-11	-1.11E-10	1.20E-10	0.28	21.93
16	2.98E-10	-5.41E-11	-9.12E-11	1.06E-10	0.36	30.66
17	2.02E-10	7.21E-12	-3.86E-11	3.92E-11	0.19	-10.59
18	1.38E-10	1.69E-11	-3.10E-11	3.53E-11	0.26	-28.66
19	8.80E-11	3.24E-12	-2.78E-11	2.79E-11	0.32	-6.67
20	5.62E-11	-1.08E-12	-2.70E-11	2.71E-11	0.48	2.29

THE EARTH TECHNOLOGY CORP.

Job #:G85143
Client:UNOCAL Geothermal
Location:Mt. Shasta CA
File:A:SHASTA10.DAT

LINE 6

LINE: 6000
STA.: 010E

NORMALIZED HORIZONTAL COMPONENTS (V/(A-m^2))

CH.	BZ	BX	BY	BR	BR/BZ	arctan BX/BY
1	1.88E-07	-1.64E-09	-2.67E-08	2.67E-08	0.14	3.52
2	1.20E-07	-2.36E-10	-1.35E-08	1.35E-08	0.11	1.01
3	7.33E-08	1.18E-09	-6.90E-09	7.00E-09	0.10	-9.71
4	4.82E-08	1.32E-09	-4.07E-09	4.28E-09	0.09	-17.96
5	3.39E-08	1.00E-09	-3.28E-09	3.43E-09	0.10	-16.97
6	2.40E-08	9.30E-10	-2.54E-09	2.71E-09	0.11	-20.08
7	1.76E-08	5.48E-10	-2.16E-09	2.22E-09	0.13	-14.27
8	1.35E-08	4.44E-10	-1.93E-09	1.98E-09	0.15	-12.94
9	1.02E-08	1.15E-10	-1.66E-09	1.66E-09	0.16	-3.96
10	7.89E-09	5.90E-11	-1.26E-09	1.26E-09	0.16	-2.69
11	6.39E-09	1.14E-10	-1.16E-09	1.17E-09	0.18	-5.60
12	4.93E-09	-8.61E-11	-8.65E-10	8.69E-10	0.18	5.68
13	3.72E-09	6.94E-12	-7.07E-10	7.07E-10	0.19	-0.56
14	2.83E-09	1.39E-11	-5.29E-10	5.29E-10	0.19	-1.50
15	2.21E-09	-9.72E-12	-3.85E-10	3.85E-10	0.17	1.45
16	1.67E-09	3.47E-12	-3.05E-10	3.05E-10	0.18	-0.65
17	1.26E-09	1.15E-11	-2.21E-10	2.21E-10	0.18	-2.97
18	9.39E-10	8.33E-12	-1.59E-10	1.60E-10	0.17	-2.99
19	6.69E-10	6.94E-12	-1.08E-10	1.08E-10	0.16	-3.68
20	4.72E-10	2.43E-12	-7.01E-11	7.02E-11	0.15	-1.98

THE EARTH TECHNOLOGY CORP.

Job #:G85143
Client:UNOCAL Geothermal
Location:Medicine Lake CA
File:A:SHASTA13.DAT

LINE: 6000
STA.: 030E

NORMALIZED HORIZONTAL COMPONENTS (V/(A-m^2))

CH.	BZ	BX	BY	BR	BR/BZ	arctan BX/BY
1	4.17E-07	-3.54E-08	3.59E-08	5.05E-08	0.12	-44.60
2	2.91E-07	-2.89E-08	2.86E-08	4.07E-08	0.14	-45.35
3	1.89E-07	-2.11E-08	2.10E-08	2.98E-08	0.16	-45.26
4	1.24E-07	-1.45E-08	1.50E-08	2.09E-08	0.17	-43.98
5	8.32E-08	-1.01E-08	1.01E-08	1.43E-08	0.17	-44.80
6	5.45E-08	-6.79E-09	6.57E-09	9.45E-09	0.17	-45.91
7	3.56E-08	-4.85E-09	3.91E-09	6.23E-09	0.17	-51.13
8	2.46E-08	-3.46E-09	2.52E-09	4.28E-09	0.17	-53.91
9	1.66E-08	-2.30E-09	1.55E-09	2.77E-09	0.17	-56.03
10	1.13E-08	-1.62E-09	8.96E-10	1.85E-09	0.16	-61.03
11	8.31E-09	-1.44E-09	6.62E-10	1.58E-09	0.19	-65.24
12	5.81E-09	-8.86E-10	3.87E-10	9.67E-10	0.17	-66.38
13	3.97E-09	-6.37E-10	2.49E-10	6.84E-10	0.17	-68.70
14	2.74E-09	-4.58E-10	1.24E-10	4.75E-10	0.17	-74.91
15	2.03E-09	-3.00E-10	7.36E-11	3.09E-10	0.15	-76.21
16	1.45E-09	-1.65E-10	1.53E-11	1.66E-10	0.11	-84.72
17	1.04E-09	-1.16E-10	1.49E-11	1.17E-10	0.11	-82.69
18	7.66E-10	-9.96E-11	0.00E+00	9.96E-11	0.13	-90.00
19	5.61E-10	-5.94E-11	-4.86E-12	5.96E-11	0.11	85.32
20	4.03E-10	-3.99E-11	3.47E-12	4.01E-11	0.10	-85.03

THE EARTH TECHNOLOGY CORP.

Job #:G85143
Client:UNOCAL Geothermal
Location:Medicine Lake CA
File:A:SHASTA13.DAT

LINE: 6000
STA.: 060E

NORMALIZED HORIZONTAL COMPONENTS (V/(A-m^2))

CH.	BZ	BX	BY	BR	BR/BZ	arctan BX/BY
1	-2.58E-06	-1.28E-07	1.63E-07	2.07E-07	-0.08	-38.30
2	-1.90E-06	-7.82E-08	1.88E-07	2.04E-07	-0.11	-22.59
3	-1.27E-06	-3.78E-08	1.73E-07	1.77E-07	-0.14	-12.28
4	-8.24E-07	-1.56E-08	1.37E-07	1.38E-07	-0.17	-6.49
5	-5.35E-07	-4.15E-09	9.80E-08	9.81E-08	-0.18	-2.43
6	-3.33E-07	8.16E-10	6.14E-08	6.14E-08	-0.18	0.76
7	-2.07E-07	2.79E-09	3.46E-08	3.47E-08	-0.17	4.61
8	-1.39E-07	3.42E-09	1.96E-08	1.99E-08	-0.14	9.88
9	-9.26E-08	3.24E-09	9.84E-09	1.04E-08	-0.11	18.23
10	-6.41E-08	2.89E-09	4.79E-09	5.60E-09	-0.09	31.12
11	-4.78E-08	2.73E-09	2.35E-09	3.60E-09	-0.08	49.19
12	-3.39E-08	2.44E-09	7.11E-10	2.54E-09	-0.07	73.74
13	-2.31E-08	2.01E-09	-2.17E-10	2.02E-09	-0.09	-83.86
14	-1.59E-08	1.54E-09	-6.16E-10	1.66E-09	-0.10	-68.18
15	-1.12E-08	1.22E-09	-7.16E-10	1.41E-09	-0.13	-59.56
16	-7.58E-09	8.37E-10	-6.47E-10	1.06E-09	-0.14	-52.28
17	-4.95E-09	4.85E-10	-5.01E-10	6.98E-10	-0.14	-44.07
18	-3.32E-09	2.76E-10	-3.55E-10	4.50E-10	-0.14	-37.82
19	-2.09E-09	1.19E-10	-2.22E-10	2.52E-10	-0.12	-28.26
20	-1.29E-09	1.04E-12	-1.33E-10	1.33E-10	-0.10	-0.45

THE EARTH TECHNOLOGY CORP.

Job #:G85143
Client:UNOCAL Geothermal
Location:Medicine Lake CA
File:A:SHASTA14.DAT

LINE: 6000
STA.: 070E

NORMALIZED HORIZONTAL COMPONENTS (V/(A-m^2))

CH.	BZ	BX	BY	BR	BR/BZ	arctan BX/BY
1	-9.58E-07	9.07E-09	-8.05E-08	8.10E-08	-0.08	-6.43
2	-6.28E-07	2.19E-08	-4.59E-08	5.09E-08	-0.08	-25.49
3	-3.95E-07	2.13E-08	-2.65E-08	3.40E-08	-0.09	-38.78
4	-2.62E-07	1.58E-08	-1.61E-08	2.25E-08	-0.09	-44.48
5	-1.84E-07	9.94E-09	-1.07E-08	1.46E-08	-0.08	-42.84
6	-1.30E-07	5.84E-09	-6.76E-09	8.94E-09	-0.07	-40.83
7	-9.40E-08	3.82E-09	-4.60E-09	5.98E-09	-0.06	-39.70
8	-7.15E-08	2.40E-09	-3.28E-09	4.06E-09	-0.06	-36.11
9	-5.38E-08	1.44E-09	-2.58E-09	2.95E-09	-0.05	-29.22
10	-4.13E-08	9.61E-10	-1.98E-09	2.20E-09	-0.05	-25.92
11	-3.28E-08	1.13E-09	-1.23E-09	1.67E-09	-0.05	-42.50
12	-2.52E-08	4.96E-10	-8.89E-10	1.02E-09	-0.04	-29.15
13	-1.83E-08	4.01E-10	-3.22E-10	5.15E-10	-0.03	-51.24
14	-1.31E-08	1.60E-10	-4.72E-11	1.67E-10	-0.01	-73.53
15	-9.49E-09	-5.97E-11	1.19E-10	1.34E-10	-0.01	-26.57
16	-6.45E-09	-1.43E-10	1.77E-10	2.28E-10	-0.04	-38.93
17	-4.23E-09	-1.92E-10	1.64E-10	2.52E-10	-0.06	-49.52
18	-2.77E-09	-2.15E-10	1.39E-10	2.56E-10	-0.09	-57.17
19	-1.71E-09	-1.91E-10	8.68E-11	2.10E-10	-0.12	-65.56
20	-1.03E-09	-1.54E-10	4.51E-11	1.61E-10	-0.16	-73.72

THE EARTH TECHNOLOGY CORP.

Job #:G85143
Client:UNOCAL Geothermal
Location:Medicine Lake CA
File:A:SHASTA14.DAT

LINE: 6000
STA.: 090E

NORMALIZED HORIZONTAL COMPONENTS (V/(A-m^2))

CH.	BZ	BX	BY	BR	BR/BZ	arctan BX/BY
1	3.94E-07	-2.32E-08	-4.28E-08	4.87E-08	0.12	28.52
2	2.93E-07	-1.63E-08	-2.92E-08	3.35E-08	0.11	29.16
3	2.25E-07	-9.80E-09	-1.82E-08	2.07E-08	0.09	28.29
4	1.82E-07	-6.35E-09	-1.08E-08	1.26E-08	0.07	30.33
5	1.50E-07	-4.82E-09	-6.19E-09	7.85E-09	0.05	37.88
6	1.21E-07	-3.33E-09	-3.77E-09	5.03E-09	0.04	41.50
7	9.58E-08	-2.20E-09	-2.31E-09	3.19E-09	0.03	43.63
8	7.66E-08	-1.42E-09	-1.58E-09	2.12E-09	0.03	41.88
9	5.86E-08	-9.55E-10	-1.31E-09	1.62E-09	0.03	36.04
10	4.40E-08	-3.85E-10	-9.55E-10	1.03E-09	0.02	21.98
11	3.39E-08	-8.75E-11	-9.61E-10	9.65E-10	0.03	5.20
12	2.44E-08	-6.66E-11	-5.05E-10	5.10E-10	0.02	7.51
13	1.61E-08	-3.05E-11	-3.11E-10	3.13E-10	0.02	5.61
14	1.03E-08	-6.94E-11	-9.02E-11	1.14E-10	0.01	37.57
15	6.78E-09	-1.19E-10	4.30E-11	1.27E-10	0.02	-70.18
16	4.08E-09	-1.09E-10	7.01E-11	1.30E-10	0.03	-57.25
17	2.38E-09	-8.19E-11	6.01E-11	1.02E-10	0.04	-53.76
18	1.43E-09	-2.43E-11	2.74E-11	3.66E-11	0.03	-41.54
19	8.16E-10	-1.46E-11	7.64E-12	1.65E-11	0.02	-62.35
20	4.61E-10	-9.37E-12	5.90E-12	1.11E-11	0.02	-57.80

THE EARTH TECHNOLOGY CORP.

Job #:G85143
Client:UNOCAL Geothermal
Location:Medicine Lake CA
File:A:SHASTA14.DAT

LINE: 6000
STA.: 110E

NORMALIZED HORIZONTAL COMPONENTS (V/(A-m^2))

CH.	BZ	BX	BY	BR	BR/BZ	arctan BX/BY
1	8.12E-08	7.00E-09	-1.40E-09	7.14E-09	0.09	-78.67
2	5.86E-08	5.29E-09	-8.89E-10	5.36E-09	0.09	-80.46
3	4.54E-08	3.97E-09	3.89E-10	3.99E-09	0.09	84.41
4	3.74E-08	3.18E-09	3.33E-10	3.20E-09	0.09	84.02
5	3.14E-08	2.54E-09	3.61E-10	2.57E-09	0.08	81.91
6	2.59E-08	2.19E-09	-1.08E-10	2.20E-09	0.08	-87.19
7	2.09E-08	2.15E-09	-1.56E-10	2.15E-09	0.10	-85.84
8	1.71E-08	1.96E-09	-3.85E-10	2.00E-09	0.12	-78.90
9	1.35E-08	1.19E-09	-5.03E-10	1.30E-09	0.10	-67.14
10	1.04E-08	9.37E-10	-4.96E-10	1.06E-09	0.10	-62.09
11	8.05E-09	1.08E-09	-4.11E-10	1.16E-09	0.14	-69.19
12	6.00E-09	4.98E-10	-3.82E-10	6.28E-10	0.10	-52.55
13	4.03E-09	4.98E-10	-2.43E-10	5.55E-10	0.14	-64.01
14	2.70E-09	3.68E-10	-1.32E-10	3.91E-10	0.14	-70.28
15	1.85E-09	2.18E-10	-7.64E-11	2.31E-10	0.12	-70.69
16	1.20E-09	1.68E-10	-9.37E-12	1.68E-10	0.14	-86.80
17	7.75E-10	8.19E-11	9.02E-12	8.24E-11	0.11	83.71
18	5.14E-10	6.60E-11	3.02E-11	7.25E-11	0.14	65.40
19	3.28E-10	3.75E-11	1.08E-11	3.90E-11	0.12	73.98
20	2.08E-10	2.71E-11	2.26E-11	3.52E-11	0.17	50.19

THE EARTH TECHNOLOGY CORP.

Job #:G85143
Client:UNOCAL Geothermal
Location:Medicine Lake CA
File:A:SHASTA15.DAT

LINE: 6000
STA.: 130E

NORMALIZED HORIZONTAL COMPONENTS (V/(A-m^2))

CH.	BZ	BX	BY	BR	BR/BZ	arctan BX/BY
1	5.30E-08	-2.61E-09	-2.08E-10	2.62E-09	0.05	85.44
2	3.98E-08	-1.82E-09	-6.25E-10	1.92E-09	0.05	71.04
3	3.01E-08	-1.93E-09	-6.11E-10	2.02E-09	0.07	72.43
4	2.37E-08	-1.87E-09	-7.64E-10	2.02E-09	0.09	67.83
5	1.90E-08	-1.32E-09	-3.33E-10	1.36E-09	0.07	75.82
6	1.48E-08	-1.25E-09	-4.65E-10	1.33E-09	0.09	69.53
7	1.12E-08	-9.61E-10	-1.91E-10	9.80E-10	0.09	78.77
8	8.64E-09	-6.07E-10	-3.47E-11	6.08E-10	0.07	86.73
9	6.37E-09	-6.04E-10	-2.50E-10	6.54E-10	0.10	67.52
10	4.62E-09	-4.76E-10	-1.77E-10	5.07E-10	0.11	69.58
11	3.45E-09	-2.30E-10	2.50E-11	2.32E-10	0.07	-83.81
12	2.48E-09	-2.78E-10	-1.79E-10	3.30E-10	0.13	57.18
13	1.66E-09	-9.72E-11	-6.25E-11	1.16E-10	0.07	57.26
14	1.13E-09	-5.83E-11	-2.36E-11	6.29E-11	0.06	67.96
15	8.05E-10	-5.28E-11	-3.33E-11	6.24E-11	0.08	57.72
16	5.47E-10	3.12E-12	1.74E-12	3.57E-12	0.01	60.95
17	3.79E-10	-2.19E-11	-2.36E-11	3.22E-11	0.08	42.81
18	2.65E-10	-7.98E-12	-1.18E-11	1.42E-11	0.05	34.08
19	1.78E-10	-2.50E-11	-1.08E-11	2.72E-11	0.15	66.71
20	1.15E-10	-3.47E-12	-1.74E-12	3.88E-12	0.03	63.43

THE EARTH TECHNOLOGY CORP.

Job #:G85143
Client:UNOCAL Geothermal
Location:Medicine Lake CA
File:A:SHASTA15.DAT

LINE: 6000
STA.: 150E

NORMALIZED HORIZONTAL COMPONENTS (V/(A-m^2))

CH.	BZ	BX	BY	BR	BR/BZ	arctan BX/BY
1	1.01E-07	5.35E-09	8.07E-09	9.68E-09	0.10	33.53
2	6.46E-08	3.92E-09	5.62E-09	6.85E-09	0.11	34.85
3	4.45E-08	2.67E-09	3.44E-09	4.35E-09	0.10	37.75
4	3.33E-08	1.47E-09	2.42E-09	2.83E-09	0.08	31.35
5	2.61E-08	1.10E-09	1.62E-09	1.96E-09	0.08	34.03
6	1.99E-08	8.61E-10	1.21E-09	1.48E-09	0.07	35.48
7	1.50E-08	1.91E-10	7.05E-10	7.30E-10	0.05	15.16
8	1.15E-08	1.42E-10	3.40E-10	3.69E-10	0.03	22.70
9	8.40E-09	2.43E-11	3.12E-10	3.13E-10	0.04	4.45
10	6.07E-09	1.39E-11	1.15E-10	1.15E-10	0.02	6.91
11	4.57E-09	-1.14E-10	4.30E-11	1.22E-10	0.03	-69.29
12	3.28E-09	-6.66E-11	7.08E-11	9.72E-11	0.03	-43.26
13	2.22E-09	-2.92E-11	2.08E-11	3.58E-11	0.02	-54.46
14	1.53E-09	-3.89E-11	6.94E-12	3.95E-11	0.03	-79.88
15	1.09E-09	-5.55E-12	-4.17E-12	6.94E-12	0.01	53.13
16	7.51E-10	-3.12E-12	-1.18E-11	1.22E-11	0.02	14.83
17	5.10E-10	1.74E-12	-3.47E-12	3.88E-12	0.01	-26.57
18	3.58E-10	6.94E-12	-3.47E-12	7.76E-12	0.02	-63.43
19	2.42E-10	7.29E-12	1.39E-12	7.42E-12	0.03	79.22
20	1.61E-10	8.33E-12	6.94E-13	8.36E-12	0.05	85.24

THE EARTH TECHNOLOGY CORP.

Job #:G85143
Client:UNOCAL Geothermal
Location:Medicine Lake CA
File:A:SHASTA15.DAT

LINE: 6000
STA.: 170E

NORMALIZED HORIZONTAL COMPONENTS (V/(A-m^2))

CH.	BZ	BX	BY	BR	BR/BZ	arctan BX/BY
1	2.84E-07	-1.50E-08	1.09E-07	1.10E-07	0.39	-7.85
2	1.71E-07	-9.04E-09	6.64E-08	6.70E-08	0.39	-7.75
3	1.03E-07	-4.75E-09	3.85E-08	3.88E-08	0.38	-7.04
4	6.69E-08	-3.15E-09	2.32E-08	2.34E-08	0.35	-7.75
5	4.74E-08	-3.18E-09	1.48E-08	1.51E-08	0.32	-12.16
6	3.40E-08	-2.55E-09	9.18E-09	9.53E-09	0.28	-15.56
7	2.49E-08	-2.11E-09	6.11E-09	6.46E-09	0.26	-19.06
8	1.92E-08	-1.64E-09	4.39E-09	4.69E-09	0.24	-20.45
9	1.47E-08	-1.81E-09	2.94E-09	3.45E-09	0.24	-31.57
10	1.13E-08	-1.40E-09	2.13E-09	2.55E-09	0.23	-33.21
11	8.90E-09	-9.11E-10	1.85E-09	2.06E-09	0.23	-26.20
12	6.86E-09	-1.02E-09	1.31E-09	1.66E-09	0.24	-37.95
13	4.93E-09	-6.25E-10	1.01E-09	1.19E-09	0.24	-31.62
14	3.52E-09	-4.68E-10	7.44E-10	8.79E-10	0.25	-32.16
15	2.55E-09	-3.55E-10	5.29E-10	6.37E-10	0.25	-33.90
16	1.72E-09	-2.18E-10	3.76E-10	4.35E-10	0.25	-30.05
17	1.11E-09	-1.48E-10	2.37E-10	2.79E-10	0.25	-32.05
18	7.05E-10	-7.46E-11	1.61E-10	1.78E-10	0.25	-24.81
19	4.11E-10	-4.03E-11	8.05E-11	9.00E-11	0.22	-26.57
20	2.33E-10	-1.94E-11	4.79E-11	5.17E-11	0.22	-22.09

THE EARTH TECHNOLOGY CORP.

Job #:G85143
Client:UNOCAL Geothermal
Location:Medicine Lake CA
File:A:SHASTA15.DAT

LINE: 6000
STA.: 190E

NORMALIZED HORIZONTAL COMPONENTS (V/(A-m^2))

CH.	BZ	BX	BY	BR	BR/BZ	arctan BX/BY
1	1.48E-06	1.17E-07	4.78E-09	1.17E-07	0.08	87.65
2	1.10E-06	1.03E-07	3.90E-08	1.10E-07	0.10	69.32
3	7.88E-07	8.49E-08	5.26E-08	9.99E-08	0.13	58.23
4	5.70E-07	6.88E-08	4.94E-08	8.47E-08	0.15	54.34
5	4.15E-07	5.48E-08	3.91E-08	6.73E-08	0.16	54.47
6	2.89E-07	4.06E-08	2.66E-08	4.85E-08	0.17	56.73
7	1.96E-07	2.86E-08	1.51E-08	3.24E-08	0.17	62.28
8	1.36E-07	1.99E-08	7.57E-09	2.13E-08	0.16	69.22
9	9.05E-08	1.30E-08	2.40E-09	1.32E-08	0.15	79.54
10	6.01E-08	7.96E-09	-1.80E-10	7.96E-09	0.13	-88.70
11	4.24E-08	4.93E-09	-1.34E-09	5.10E-09	0.12	-74.80
12	2.80E-08	2.73E-09	-1.56E-09	3.15E-09	0.11	-60.27
13	1.73E-08	1.13E-09	-1.48E-09	1.86E-09	0.11	-37.25
14	1.08E-08	3.39E-10	-1.13E-09	1.18E-09	0.11	-16.73
15	7.20E-09	1.67E-11	-9.11E-10	9.11E-10	0.13	-1.05
16	4.72E-09	-1.18E-10	-5.46E-10	5.58E-10	0.12	12.20
17	3.15E-09	-9.44E-11	-4.36E-10	4.46E-10	0.14	12.22
18	2.19E-09	-8.19E-11	-2.75E-10	2.87E-10	0.13	16.59
19	1.47E-09	-5.55E-11	-3.08E-10	3.13E-10	0.21	10.21
20	9.11E-10	-2.78E-11	-1.83E-10	1.85E-10	0.20	8.62

THE EARTH TECHNOLOGY CORP.

Job #:G85143
Client:UNOCAL Geothermal
Location:Medicine Lake CA
File:A:SHASTA16.DAT

MEDICINE LAKE, CALIFORNIA
ATTACHMENT A

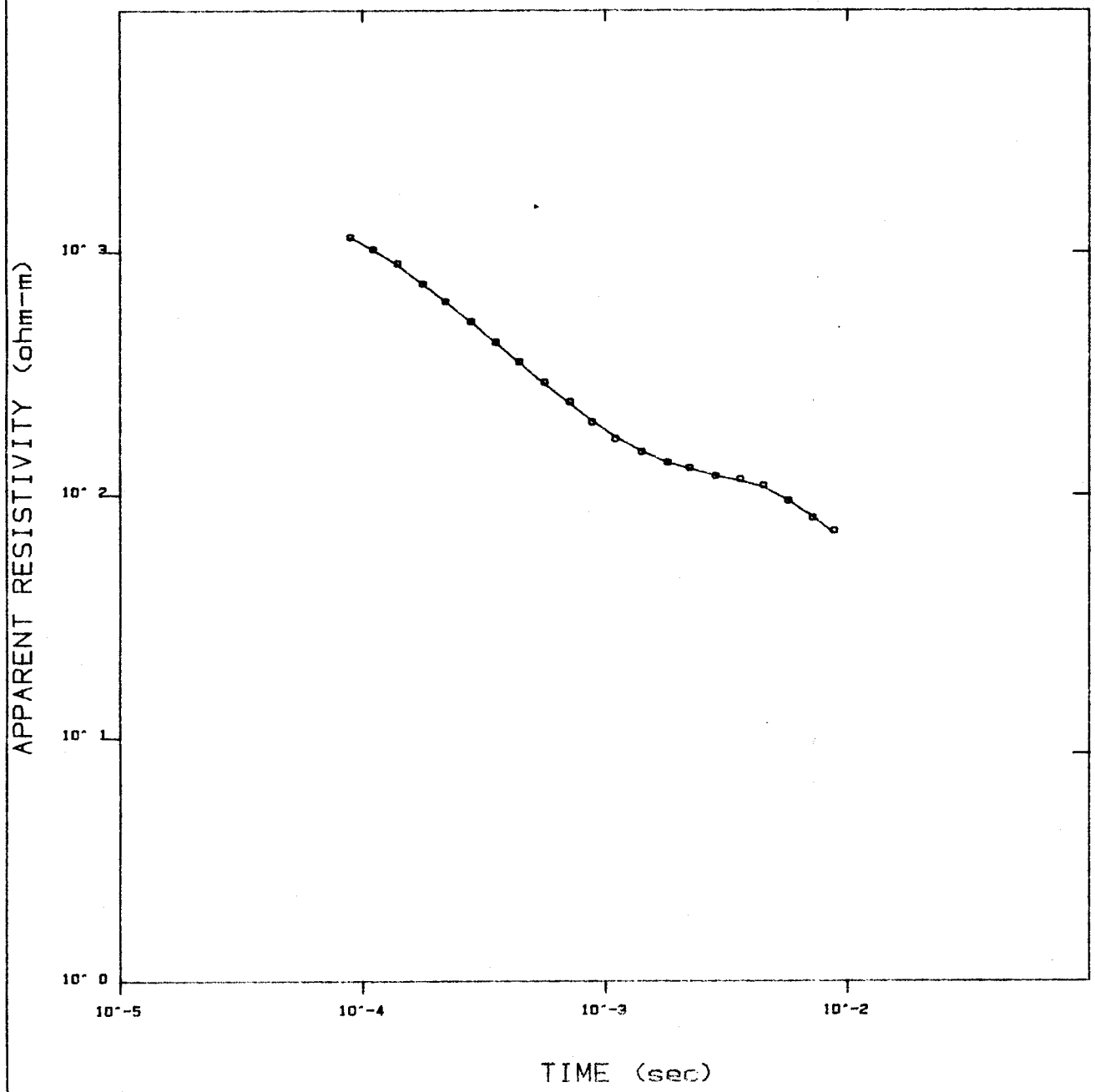
INVERTED SOLUTIONS AND CURVES

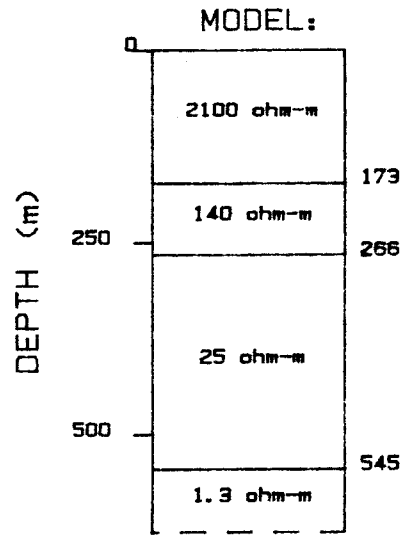
GM 3806

Prepared For:
UNOCAL Geothermal
Santa Rosa, California

Prepared By:
The Earth Technology Corporation
Geophysics Department
2801 Youngfield, #390
Golden, Colorado 80401

Job #G85143





ERROR= 1.6262 %
LOOP RADIUS= 168m

o FIELD DATA

—— MODEL CURVE

THE EARTH TECHNOLOGY CORP

UNOCAL Geothermal

Medicine Lake CA

LINE: 1 STA.: 1

APPARENT RESISTIVITY CURVE

JOB #G85143 Fig.

L100S010

MODEL: 4 LAYERS

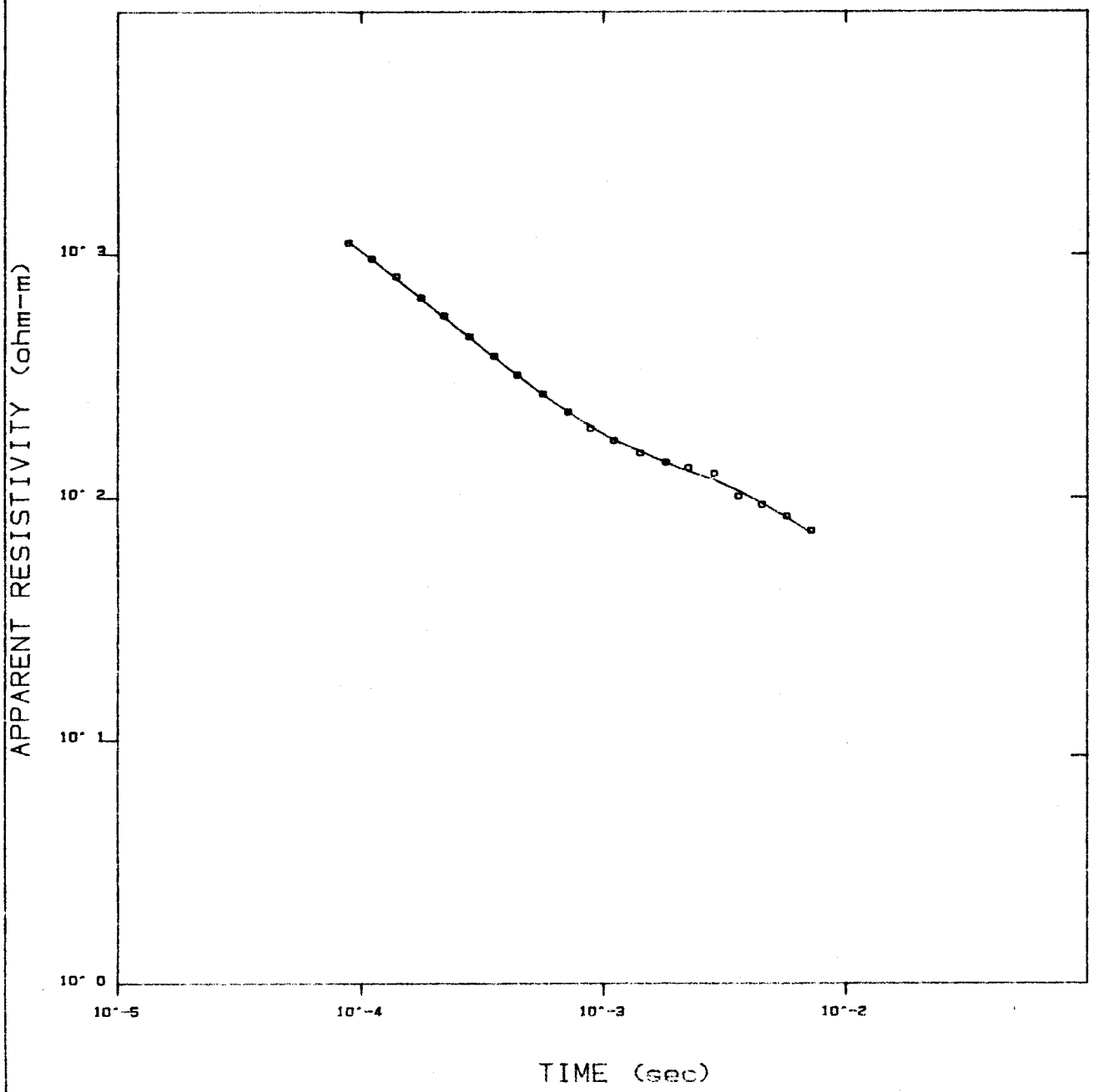
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		2060.4	6760.0		
2103.53	172.9	1887.6	6192.8	.1	.1
136.98	93.0	1794.5	5887.6	.7	.8
25.48	278.9	1515.7	4972.6	10.9	11.7
1.28					

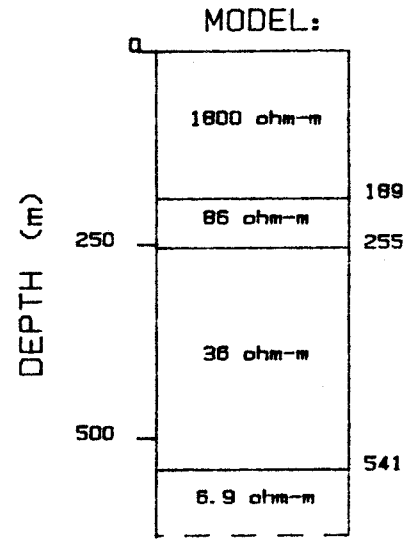
TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.78E+00	0.77E+00	+0.918	0.12E+04
0.11E-03	0.54E+00	0.54E+00	-0.065	0.10E+04
0.14E-03	0.37E+00	0.37E+00	-0.964	0.89E+03
0.18E-03	0.27E+00	0.27E+00	+0.099	0.74E+03
0.22E-03	0.20E+00	0.20E+00	+0.879	0.62E+03
0.28E-03	0.15E+00	0.15E+00	+0.340	0.51E+03
0.35E-03	0.11E+00	0.11E+00	-0.432	0.42E+03
0.44E-03	0.84E-01	0.84E-01	-0.342	0.35E+03
0.56E-03	0.61E-01	0.62E-01	-1.614	0.29E+03
0.71E-03	0.44E-01	0.45E-01	-1.759	0.24E+03
0.88E-03	0.35E-01	0.34E-01	+2.300	0.20E+03
0.11E-02	0.25E-01	0.24E-01	+2.909	0.17E+03
0.14E-02	0.16E-01	0.16E-01	+1.788	0.15E+03
0.18E-02	0.10E-01	0.10E-01	+0.136	0.14E+03
0.22E-02	0.65E-02	0.66E-02	-0.742	0.13E+03
0.29E-02	0.40E-02	0.39E-02	+1.084	0.12E+03
0.36E-02	0.23E-02	0.24E-02	-1.889	0.12E+03
0.45E-02	0.15E-02	0.15E-02	-2.531	0.11E+03
0.57E-02	0.10E-02	0.99E-03	+0.972	0.94E+02
0.72E-02	0.71E-03	0.70E-03	+2.102	0.80E+02
0.88E-02	0.52E-03	0.54E-03	-3.423	0.70E+02

R: 168. X: 0. Y: 0. DL: 0. REQ: 168. CF: 1.0000
TDHZ ARRAY, 21 DATA POINTS, SYSTEM: NONE DATA: L100S010
JOB #G85143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 1 STA 1 OCT. 7, 1985
RMS LOG ERROR: 7.01E-03, ANTILOG YIELDS 1.6262 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	P 4	T 1	T 2	T 3	F 0
P 1	.98							
P 2	.00	.78						
P 3	.00	-.01	1.00					
P 4	.00	-.02	-.01	.98				
T 1	.00	.06	.00	.00	.99			
T 2	.00	-.07	.00	.00	.02	.98		
T 3	.00	-.02	.00	-.01	.00	.00	1.00	
F 0	.00	.00	.00	.00	.00	.00	.00	.00





ERROR= 3.2796 %
LOOP RADIUS= 168m

o FIELD DATA

—— MODEL CURVE

THE EARTH TECHNOLOGY CORP

UNOCAL Geothermal

Medicine Lake CA

LINE: 1 STA.: 2

APPARENT RESISTIVITY CURVE

JOB #G85143 Fig.

L100S020

MODEL: 4 LAYERS

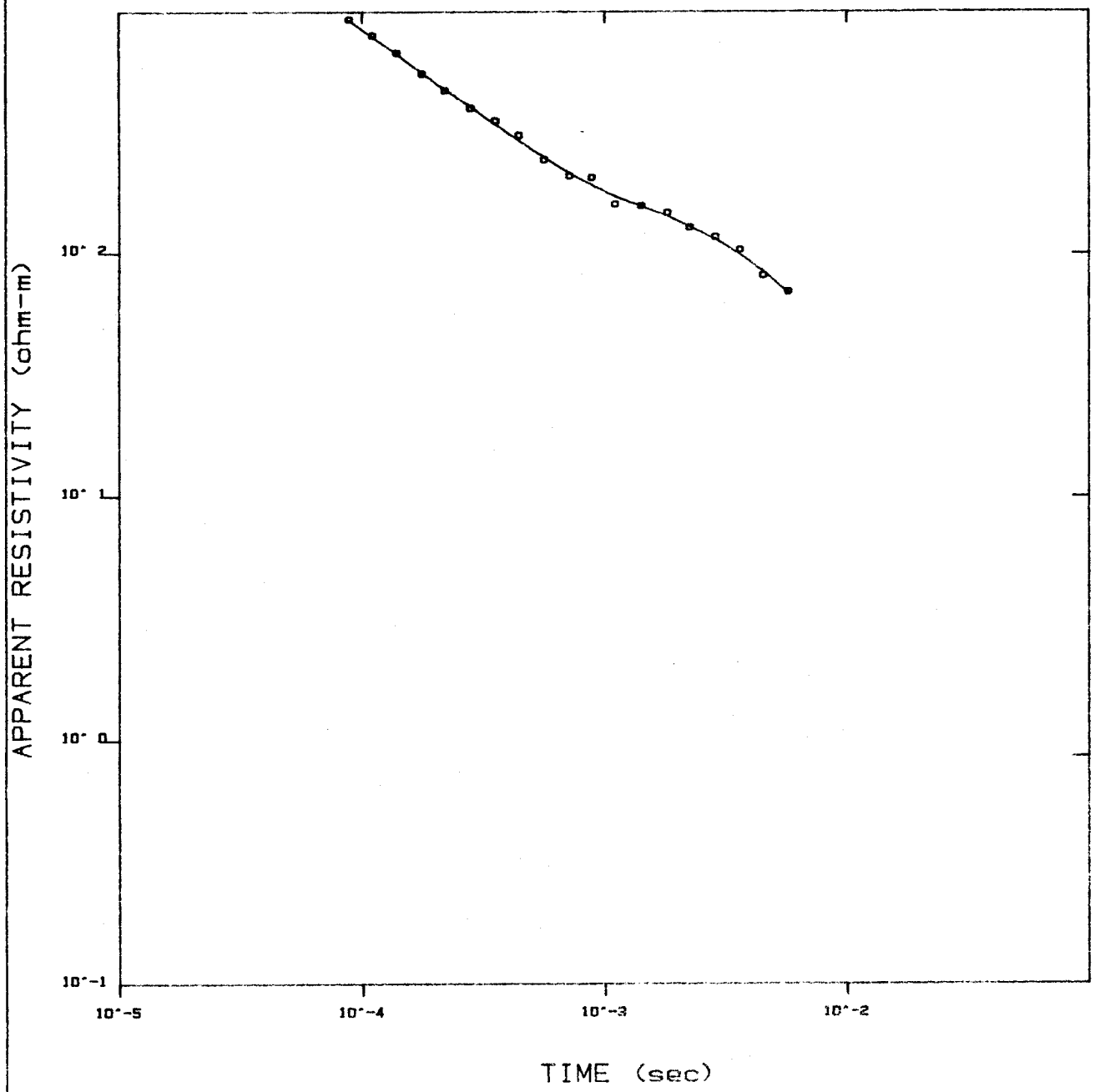
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		2066.5	6780.0		
1766.40	188.8	1877.7	6160.5	.1	.1
85.84	65.7	1812.0	5944.8	.8	.9
36.28	286.2	1525.7	5005.7	7.9	8.8
6.88					

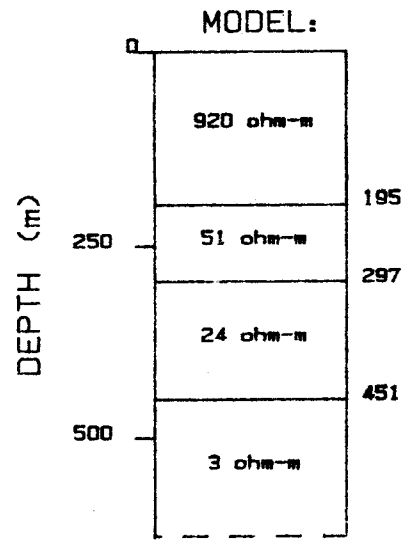
TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.82E+00	0.80E+00	+2.497	0.11E+04
0.11E-03	0.60E+00	0.60E+00	+0.367	0.95E+03
0.14E-03	0.43E+00	0.43E+00	-1.694	0.81E+03
0.18E-03	0.32E+00	0.32E+00	-0.744	0.66E+03
0.22E-03	0.24E+00	0.24E+00	-1.280	0.56E+03
0.28E-03	0.18E+00	0.18E+00	-0.678	0.46E+03
0.35E-03	0.13E+00	0.13E+00	-1.099	0.38E+03
0.44E-03	0.97E-01	0.97E-01	+0.202	0.32E+03
0.56E-03	0.69E-01	0.69E-01	+0.066	0.26E+03
0.71E-03	0.49E-01	0.49E-01	+0.779	0.22E+03
0.88E-03	0.37E-01	0.35E-01	+4.020	0.19E+03
0.11E-02	0.25E-01	0.25E-01	+1.777	0.17E+03
0.14E-02	0.16E-01	0.16E-01	+3.179	0.15E+03
0.18E-02	0.99E-02	0.99E-02	+0.041	0.14E+03
0.22E-02	0.63E-02	0.66E-02	-4.410	0.13E+03
0.29E-02	0.37E-02	0.40E-02	-7.926	0.12E+03
0.36E-02	0.29E-02	0.26E-02	+8.096	0.10E+03
0.45E-02	0.18E-02	0.18E-02	+2.918	0.93E+02
0.57E-02	0.12E-02	0.12E-02	-0.562	0.83E+02
0.72E-02	0.82E-03	0.85E-03	-2.860	0.73E+02

R: 168. X: 0. Y: 0. DL: 0. REQ: 168. CF: 1.0000
TDHZ ARRAY, 20 DATA POINTS, SYSTEM: NONE DATA: L100S020
JOB #G85143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 1 STA 2 OCT. 7, 1985
RMS LOG ERROR: 1.40E-02, ANTILOG YIELDS 3.2796 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	P 4	T 1	T 2	T 3	F 0
P 1	.41							
P 2	-.02	.11						
P 3	.00	-.04	.96					
P 4	-.02	-.03	-.13	.33				
T 1	.05	.15	.00	.00	.97			
T 2	-.18	.04	.05	.08	.01	.82		
T 3	.00	-.10	-.02	-.05	.01	.03	.96	
F 0	.00	.00	.00	.00	.00	.00	.00	.00





ERROR= 5.1042 %
LOOP RADIUS= 168m

o FIELD DATA

— MODEL CURVE

THE EARTH TECHNOLOGY CORP

UNOCAL Geothermal

Medicine Lake CA

LINE: 1 STA.: 3

APPARENT RESISTIVITY CURVE

JOB #G85143 Fig.

L100S030

MODEL: 4 LAYERS

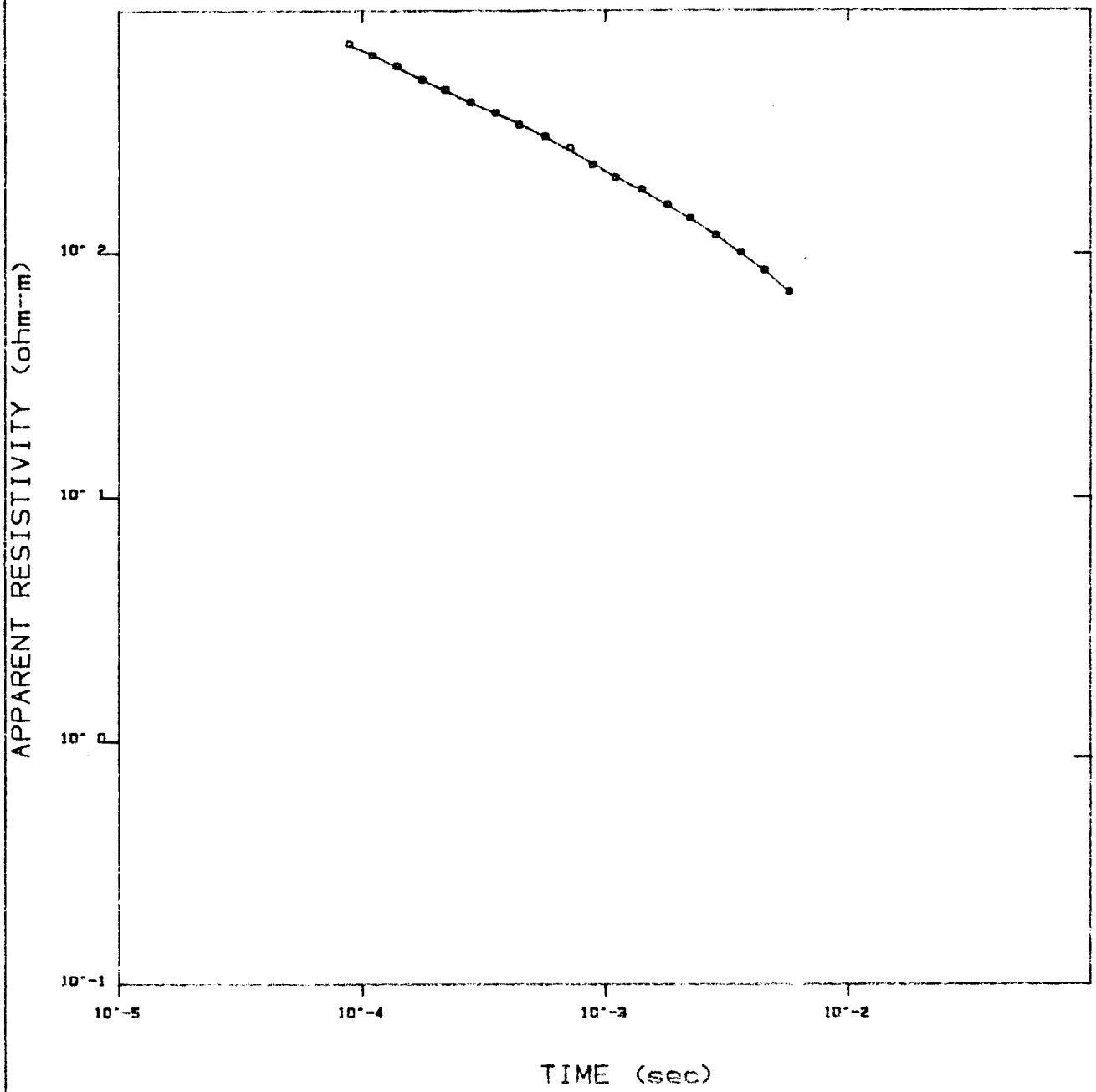
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		2066.5	6780.0		
917.75	195.1	1871.4	6139.9	.2	.2
50.63	101.6	1769.9	5806.6	2.0	2.2
24.21	154.4	1615.4	5300.0	6.4	8.6
2.97					

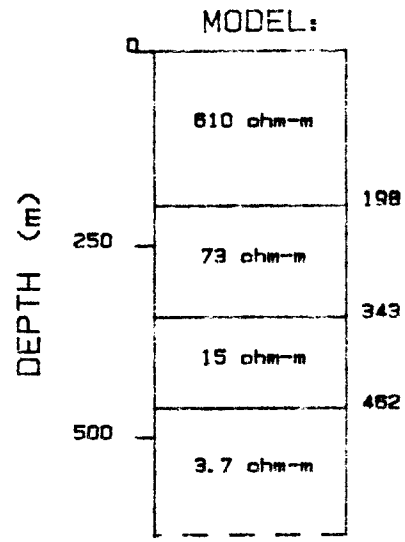
TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.11E+01	0.11E+01	-0.412	0.92E+03
0.11E-03	0.79E+00	0.80E+00	-0.981	0.79E+03
0.14E-03	0.56E+00	0.57E+00	-0.474	0.67E+03
0.18E-03	0.41E+00	0.41E+00	+1.623	0.55E+03
0.22E-03	0.31E+00	0.30E+00	+2.862	0.47E+03
0.28E-03	0.21E+00	0.21E+00	+2.821	0.40E+03
0.35E-03	0.14E+00	0.15E+00	-3.960	0.36E+03
0.44E-03	0.10E+00	0.11E+00	-6.901	0.31E+03
0.56E-03	0.77E-01	0.74E-01	+4.203	0.25E+03
0.71E-03	0.54E-01	0.51E-01	+4.778	0.21E+03
0.88E-03	0.32E-01	0.36E-01	-9.670	0.21E+03
0.11E-02	0.27E-01	0.24E-01	+12.498	0.16E+03
0.14E-02	0.15E-01	0.15E-01	+0.141	0.16E+03
0.18E-02	0.91E-02	0.94E-02	-4.089	0.15E+03
0.22E-02	0.66E-02	0.64E-02	+1.978	0.13E+03
0.29E-02	0.41E-02	0.42E-02	-2.226	0.12E+03
0.36E-02	0.27E-02	0.29E-02	-5.882	0.10E+03
0.45E-02	0.23E-02	0.22E-02	+6.508	0.80E+02
0.57E-02	0.16E-02	0.16E-02	+0.164	0.69E+02

R: 168. X: 0. Y: 0. DL: 0. REQ: 168. CF: 1.0000
TDHZ ARRAY, 19 DATA POINTS, SYSTEM: NONE DATA: L100S030
JOB #G85143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 1 STA 3 OCT. 7, 1985
RMS LOG ERROR: 2.16E-02, ANTILOG YIELDS 5.1042 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	P 4	T 1	T 2	T 3	F 0
P 1	.65							
P 2	-.22	.77						
P 3	-.04	-.09	.76					
P 4	.05	-.02	-.25	.31				
T 1	.08	.07	.01	-.02	.98			
T 2	.01	.08	.16	-.02	-.01	.76		
T 3	-.10	-.13	-.14	-.07	.03	.14	.86	
F 0	.00	.00	.00	.00	.00	.00	.00	.00





ERROR= 1.4088 %
LOOP RADIUS= 188m

FIELD DATA

MODEL CURVE

THE EARTH TECHNOLOGY CORP

UNOCAL Geothermal

Medicine Lake CA

LINE: 1 STA.: 4

APPARENT RESISTIVITY CURVE

JOB #G85143 Fig.

L100S040

MODEL: 4 LAYERS

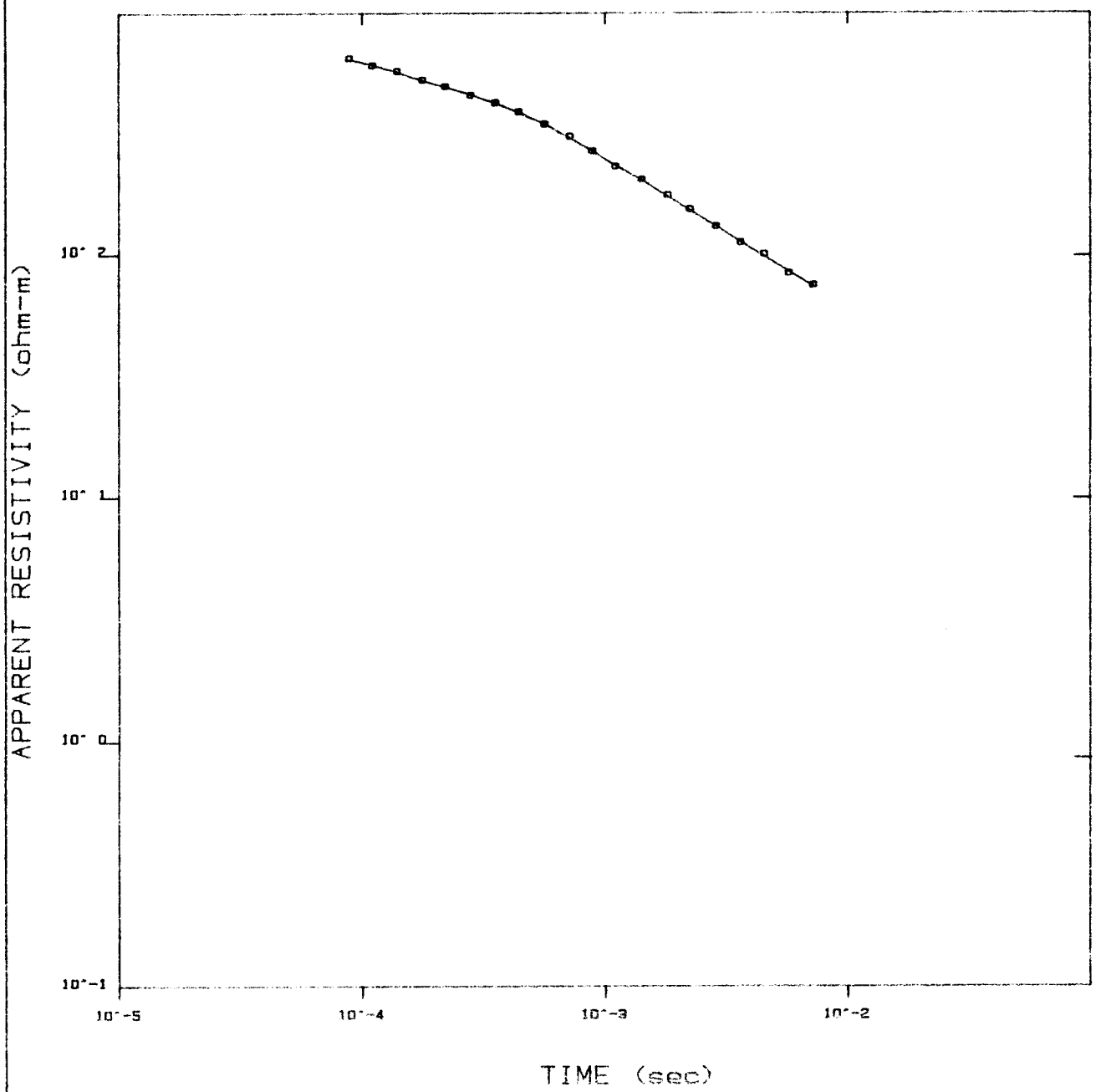
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		2072.6	6800.0		
613.58	197.8	1874.8	6151.0	.3	.3
73.40	145.0	1729.8	5675.3	2.0	2.3
14.93	119.3	1610.6	5284.1	8.0	10.3
3.67					

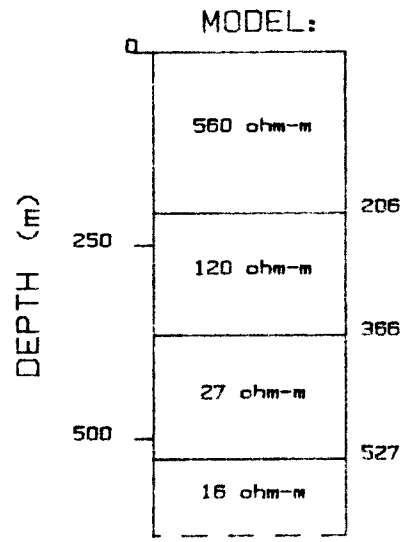
TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.16E+01	0.16E+01	-0.752	0.72E+03
0.11E-03	0.11E+01	0.11E+01	+1.994	0.65E+03
0.14E-03	0.70E+00	0.70E+00	-1.097	0.58E+03
0.18E-03	0.46E+00	0.46E+00	-0.174	0.51E+03
0.22E-03	0.31E+00	0.31E+00	-0.447	0.47E+03
0.28E-03	0.20E+00	0.20E+00	-0.185	0.41E+03
0.35E-03	0.13E+00	0.13E+00	+0.194	0.38E+03
0.44E-03	0.88E-01	0.86E-01	+2.287	0.34E+03
0.56E-03	0.57E-01	0.57E-01	-0.586	0.30E+03
0.71E-03	0.37E-01	0.38E-01	-3.805	0.27E+03
0.88E-03	0.27E-01	0.27E-01	+2.471	0.23E+03
0.11E-02	0.19E-01	0.19E-01	+1.293	0.21E+03
0.14E-02	0.12E-01	0.12E-01	-0.254	0.18E+03
0.18E-02	0.81E-02	0.82E-02	-0.943	0.16E+03
0.22E-02	0.58E-02	0.58E-02	+0.075	0.14E+03
0.29E-02	0.40E-02	0.39E-02	+0.972	0.12E+03
0.36E-02	0.28E-02	0.29E-02	-0.741	0.10E+03
0.45E-02	0.21E-02	0.21E-02	-0.508	0.85E+02
0.57E-02	0.16E-02	0.16E-02	+0.605	0.69E+02

R: 168. X: 0. Y: 0. DL: 0. REQ: 168. CF: 1.0000
TDHZ ARRAY, 19 DATA POINTS, SYSTEM: NONE DATA: L100S040
JOB #G85143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 1 STA 4 OCT. 7, 1985
RMS LOG ERROR: 6.08E-03, ANTILOG YIELDS 1.4098 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	P 4	T 1	T 2	T 3	F 0
P 1	1.00							
P 2	.00	.99						
P 3	.00	-.02	.96					
P 4	-.01	-.02	-.06	.88				
T 1	.00	.00	.00	.00	1.00			
T 2	.00	.00	.00	-.01	.00	1.00		
T 3	.00	-.01	-.01	-.01	.00	.00	1.00	
F 0	.00	.00	.00	.00	.00	.00	.00	.00





ERROR= 1.2398 %
LOOP RADIUS= 168m

o FIELD DATA

— MODEL CURVE

THE EARTH TECHNOLOGY CORP

UNOCAL Geothermal

Medicine Lake CA

LINE: 1 STA.: 5

APPARENT RESISTIVITY CURVE

JOB #085143 Fig.

L1005050

MODEL: 4 LAYERS

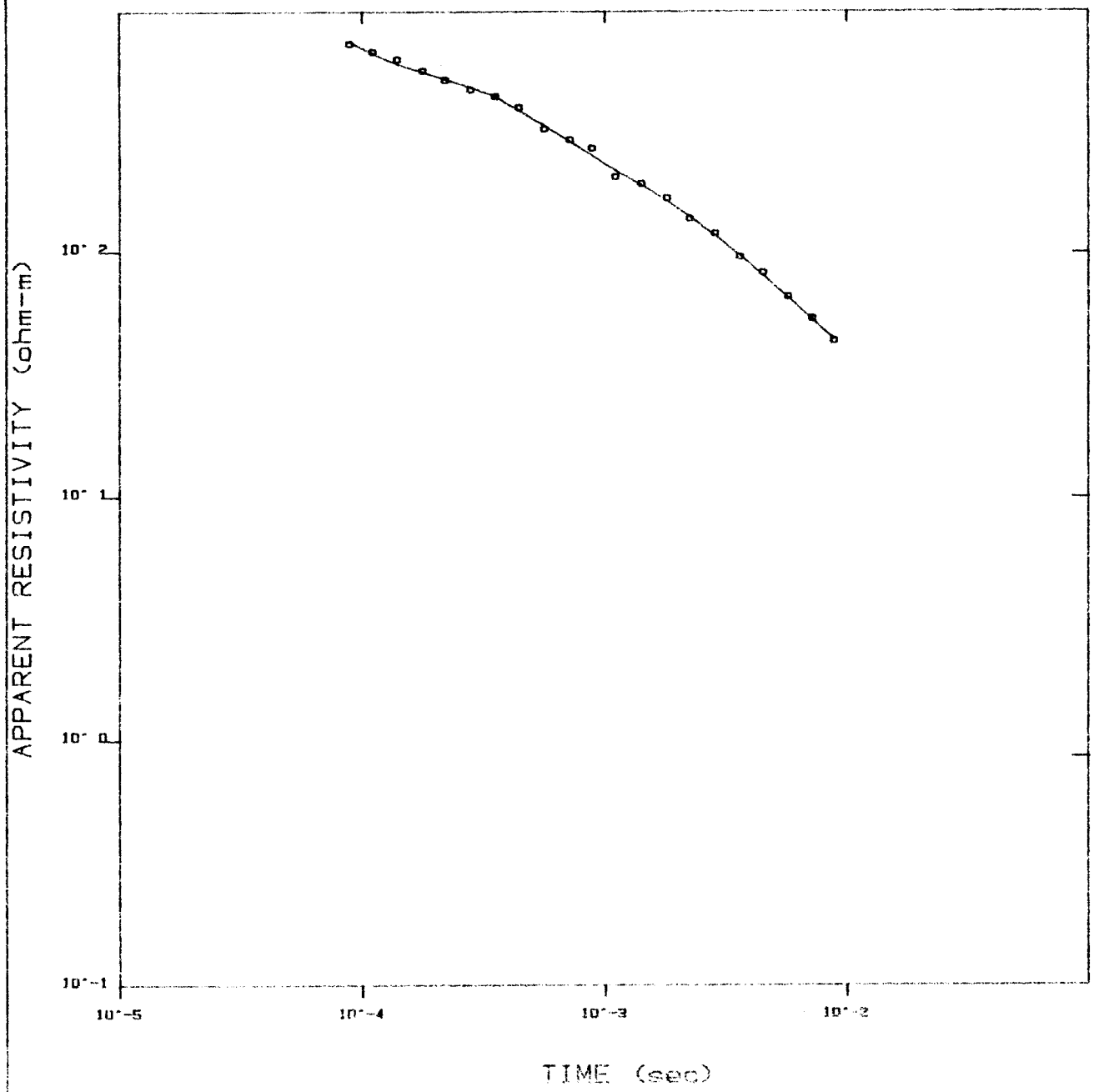
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		2072.6	6800.0		
557.35	206.0	1866.7	6124.2	.4	.4
122.84	160.3	1706.4	5598.3	1.3	1.7
26.90	160.3	1546.0	5072.3	6.0	7.6
16.27					

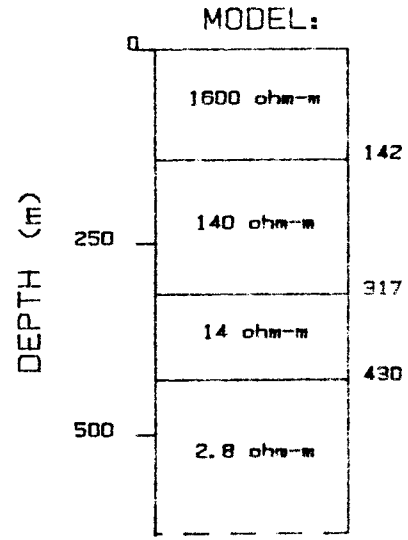
TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.18E+01	0.19E+01	-0.522	0.65E+03
0.11E-03	0.12E+01	0.12E+01	+1.401	0.61E+03
0.14E-03	0.71E+00	0.72E+00	-0.861	0.57E+03
0.18E-03	0.44E+00	0.45E+00	-0.673	0.53E+03
0.22E-03	0.29E+00	0.29E+00	+0.019	0.50E+03
0.28E-03	0.18E+00	0.17E+00	+1.396	0.46E+03
0.35E-03	0.11E+00	0.11E+00	-0.302	0.42E+03
0.44E-03	0.71E-01	0.71E-01	-0.309	0.39E+03
0.56E-03	0.46E-01	0.46E-01	+0.397	0.35E+03
0.71E-03	0.30E-01	0.31E-01	-2.132	0.31E+03
0.88E-03	0.22E-01	0.22E-01	+1.068	0.27E+03
0.11E-02	0.16E-01	0.15E-01	+2.113	0.23E+03
0.14E-02	0.10E-01	0.10E-01	-0.216	0.20E+03
0.18E-02	0.70E-02	0.70E-02	-1.068	0.18E+03
0.22E-02	0.50E-02	0.50E-02	-1.215	0.15E+03
0.29E-02	0.34E-02	0.34E-02	+1.154	0.13E+03
0.36E-02	0.24E-02	0.24E-02	+1.026	0.11E+03
0.45E-02	0.16E-02	0.17E-02	-1.882	0.10E+03
0.57E-02	0.12E-02	0.11E-02	+2.197	0.84E+02
0.72E-02	0.78E-03	0.78E-03	-1.070	0.75E+02

R: 168. X: 0. Y: 0. DL: 0. REC: 168. CF: 1.0000
TDHZ ARRAY, 20 DATA POINTS, SYSTEM: NONE DATA: L1005050
JOB #685143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 1 STA 5 OCT. 7, 1985
RMS LOG ERROR: 5.35E-03, ANTILOG YIELDS 1.2398 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	P 4	T 1	T 2	T 3	F 0
P 1	1.00							
P 2	.00	.98						
P 3	.00	-.01	.99					
P 4	.00	-.01	-.02	.97				
T 1	.00	.01	.00	.00	1.00			
T 2	.00	.00	.00	.00	.00	1.00		
T 3	.00	.01	.01	.03	.00	.00	.98	
F 0	.00	.00	.00	.00	.00	.00	.00	.00





ERROR= 4.3591 %
LOOP RADIUS= 168m

FIELD DATA

MODEL CURVE

THE EARTH TECHNOLOGY CORP

UNOCAL Geothermal

Medicine Lake CA

LINE: 1 STA.: 6

APPARENT RESISTIVITY CURVE

JOB #G85143 Fig.

L1005060

MODEL: 4 LAYERS

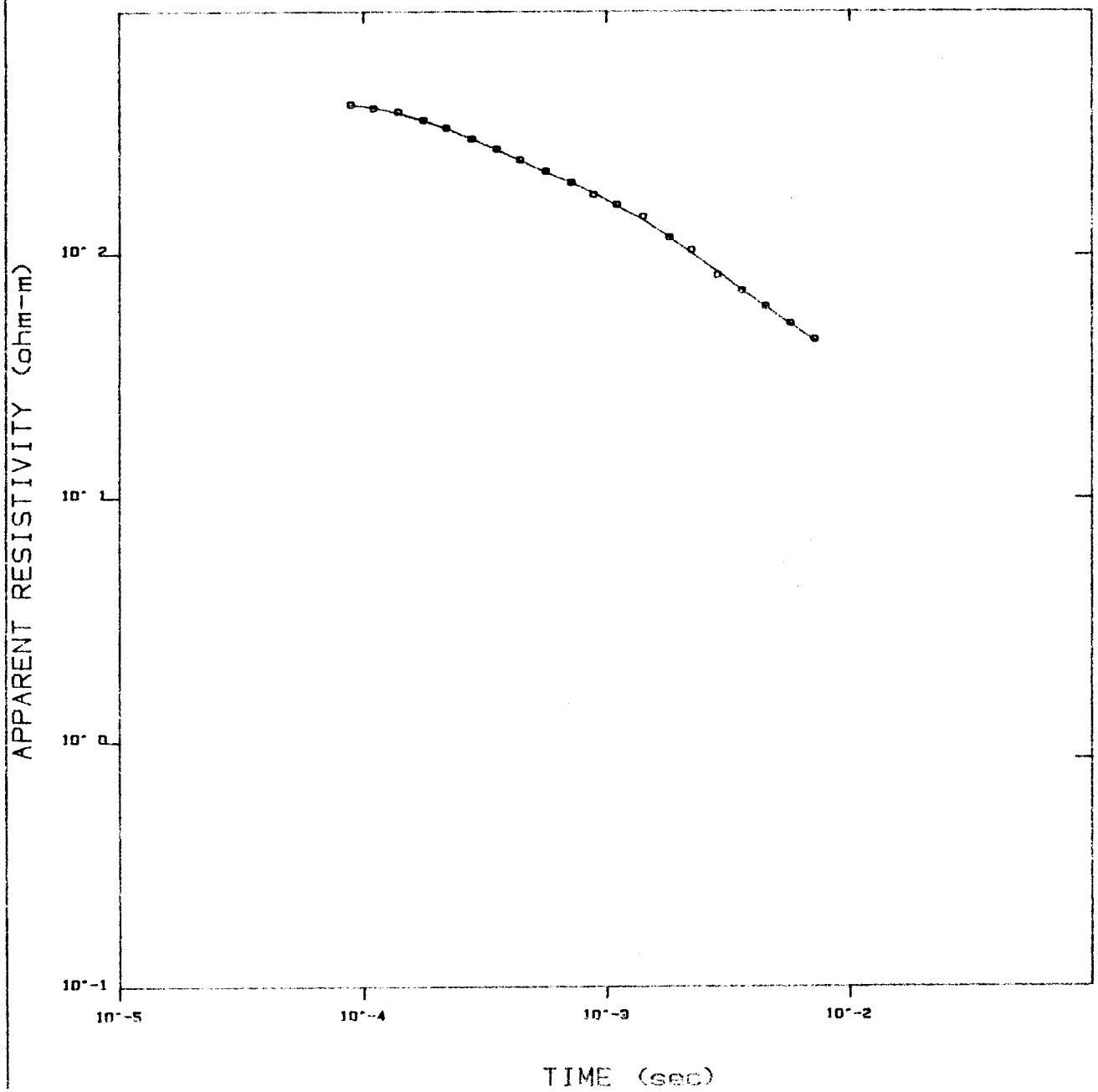
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		2066.5	6780.0		
1552.43	142.4	1924.1	6312.8	.1	.1
137.37	174.9	1749.2	5738.9	1.3	1.4
13.76	112.4	1636.8	5370.1	8.2	9.5
2.81					

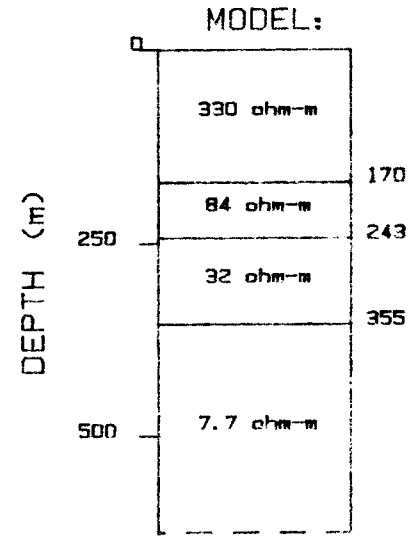
TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.15E+01	0.15E+01	+4.016	0.73E+03
0.11E-03	0.99E+00	0.10E+01	-1.543	0.68E+03
0.14E-03	0.62E+00	0.66E+00	-5.833	0.63E+03
0.18E-03	0.40E+00	0.40E+00	-0.726	0.57E+03
0.22E-03	0.27E+00	0.26E+00	+1.261	0.52E+03
0.28E-03	0.17E+00	0.16E+00	+4.629	0.47E+03
0.35E-03	0.10E+00	0.10E+00	+0.874	0.44E+03
0.44E-03	0.68E-01	0.70E-01	-3.407	0.40E+03
0.56E-03	0.50E-01	0.48E-01	+5.119	0.33E+03
0.71E-03	0.32E-01	0.33E-01	-1.743	0.30E+03
0.88E-03	0.22E-01	0.24E-01	-9.109	0.27E+03
0.11E-02	0.19E-01	0.17E-01	+10.990	0.21E+03
0.14E-02	0.11E-01	0.11E-01	-0.947	0.19E+03
0.18E-02	0.74E-02	0.77E-02	-3.392	0.17E+03
0.22E-02	0.59E-02	0.56E-02	+3.797	0.14E+03
0.29E-02	0.39E-02	0.40E-02	-2.474	0.12E+03
0.36E-02	0.31E-02	0.30E-02	+3.484	0.95E+02
0.45E-02	0.22E-02	0.23E-02	-3.094	0.82E+02
0.57E-02	0.17E-02	0.17E-02	-0.413	0.65E+02
0.72E-02	0.13E-02	0.13E-02	-1.012	0.53E+02
0.88E-02	0.11E-02	0.11E-02	+3.075	0.43E+02

R: 168. X: 0. Y: 0. DL: 0. REQ: 168. CF: 1.0000
TDHI ARRAY, 21 DATA POINTS, SYSTEM: NONE DATA: L1005060
JOB #685143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 1 STA 6 OCT. 8, 1985
RMS LOG ERROR: 1.85E-02, ANTILOG YIELDS 4.3591 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	P 4	T 1	T 2	T 3	F 0
P 1	.99							
P 2	.00	1.00						
P 3	.00	.00	.99					
P 4	.00	.00	-.01	.98				
T 1	.00	.00	.00	.00	1.00			
T 2	.00	.00	.00	.00	.00	1.00		
T 3	.00	.00	.00	.00	.00	.00	1.00	
F 0	.00	.00	.00	.00	.00	.00	.00	.00





ERROR= 2.0422 %
LOOP RADIUS= 168m

o FIELD DATA

— MODEL CURVE

THE EARTH TECHNOLOGY CORP

UNOCAL Geothermal

Medicine Lake CA

LINE: 1 STA.: 7

APPARENT RESISTIVITY CURVE

JOB #G85143 Fig.

L1005070

MODEL: 4 LAYERS

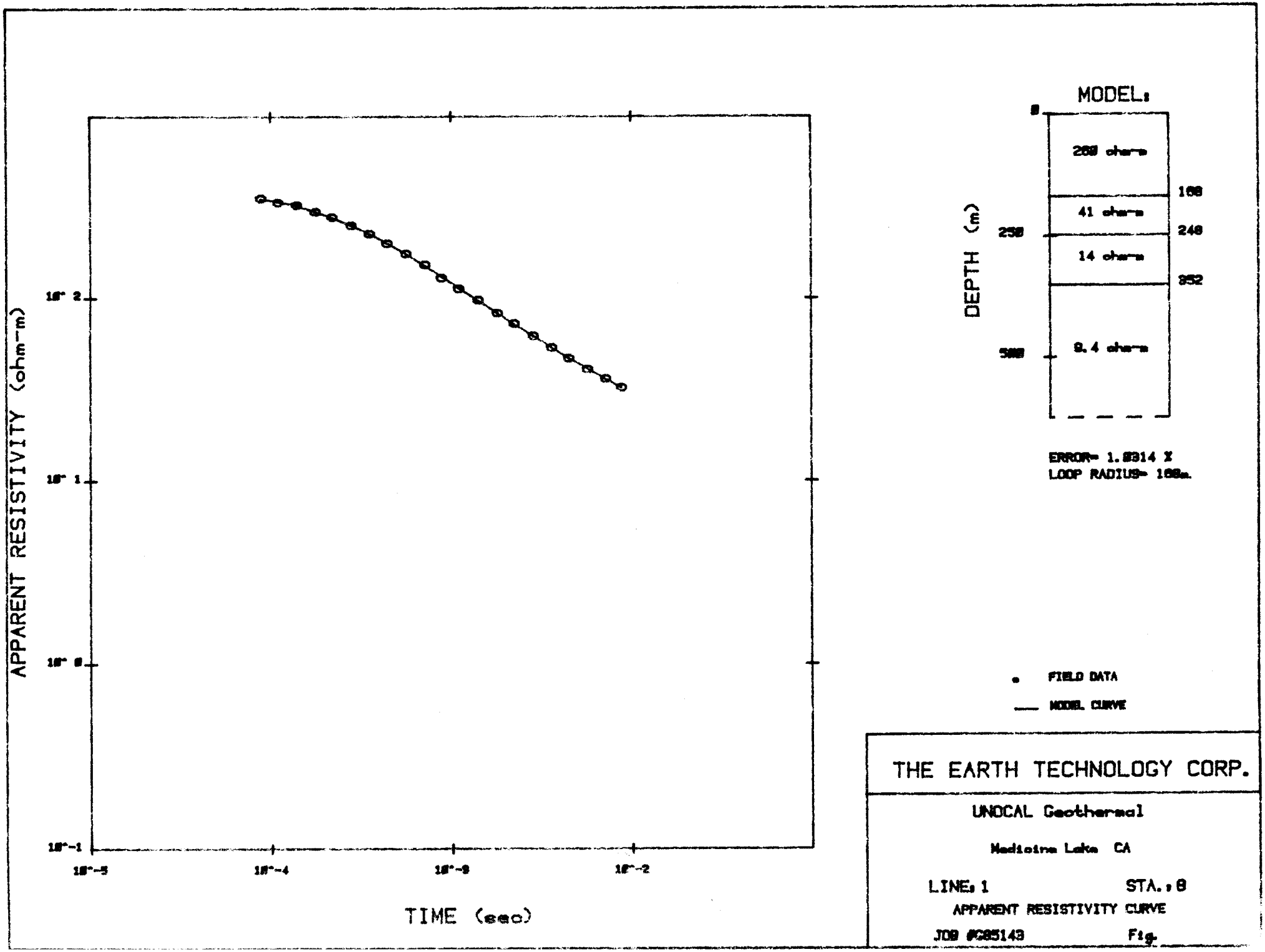
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		2072.6	6800.0		
327.86	170.3	1902.3	6241.3	.5	.5
84.26	72.8	1829.6	6002.5	.9	1.4
31.92	111.8	1717.7	5635.7	3.5	4.9
7.70					

TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.36E+01	0.36E+01	+0.384	0.41E+03
0.11E-03	0.22E+01	0.22E+01	+1.094	0.40E+03
0.14E-03	0.13E+01	0.13E+01	-1.537	0.39E+03
0.18E-03	0.80E+00	0.80E+00	-0.028	0.36E+03
0.22E-03	0.52E+00	0.52E+00	+0.008	0.33E+03
0.28E-03	0.33E+00	0.33E+00	+0.153	0.30E+03
0.35E-03	0.21E+00	0.21E+00	-0.255	0.27E+03
0.44E-03	0.14E+00	0.14E+00	-0.093	0.25E+03
0.56E-03	0.91E-01	0.92E-01	-0.603	0.22E+03
0.71E-03	0.59E-01	0.59E-01	+0.613	0.20E+03
0.88E-03	0.41E-01	0.40E-01	+3.369	0.18E+03
0.11E-02	0.27E-01	0.28E-01	-1.106	0.16E+03
0.14E-02	0.18E-01	0.18E-01	-3.693	0.14E+03
0.18E-02	0.13E-01	0.13E-01	+1.209	0.12E+03
0.22E-02	0.90E-02	0.93E-02	-3.834	0.10E+03
0.29E-02	0.70E-02	0.66E-02	+5.687	0.82E+02
0.36E-02	0.48E-02	0.48E-02	+1.310	0.71E+02
0.45E-02	0.35E-02	0.35E-02	+0.220	0.61E+02
0.57E-02	0.25E-02	0.25E-02	-0.894	0.52E+02
0.72E-02	0.17E-02	0.18E-02	-0.952	0.44E+02

R: 168. X: 0. Y: 0. DL: 0. REQ: 168. CF: 1.0000
TDHZ ARRAY, 20 DATA POINTS, SYSTEM: NONE DATA: L1005070
JOB #685143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 1 STA 7 OCT. 8, 1985
RMS LOG ERROR: 8.78E-03, ANTILOG YIELDS 2.0422 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	P 4	T 1	T 2	T 3	F 0
P 1	.99							
P 2	-.04	.20						
P 3	.00	-.15	.72					
P 4	.00	.00	-.09	.84				
T 1	.02	.23	.02	-.01	.93			
T 2	-.04	-.12	.24	.04	.09	.57		
T 3	.00	-.24	-.11	.03	.05	.10	.86	
F 0	.00	.00	.00	.00	.00	.00	.00	.00


APPARENT RESISTIVITY (ohm-m)
TIME (sec)
MODEL:
DEPTH (m)
0
200 ohm-m
100
41 ohm-m
250
240
14 ohm-m
352
500
9.4 ohm-m
ERROR= 1.0314 %
LOOP RADIUS= 100m.
FIELD DATA
MODEL CURVE
THE EARTH TECHNOLOGY CORP.
UNOCAL Geothermal
Medicine Lake CA
LINE: 1
STA.: 0
APPARENT RESISTIVITY CURVE
JOB #C85143
Fig.

L100S080

MODEL: 4 LAYERS

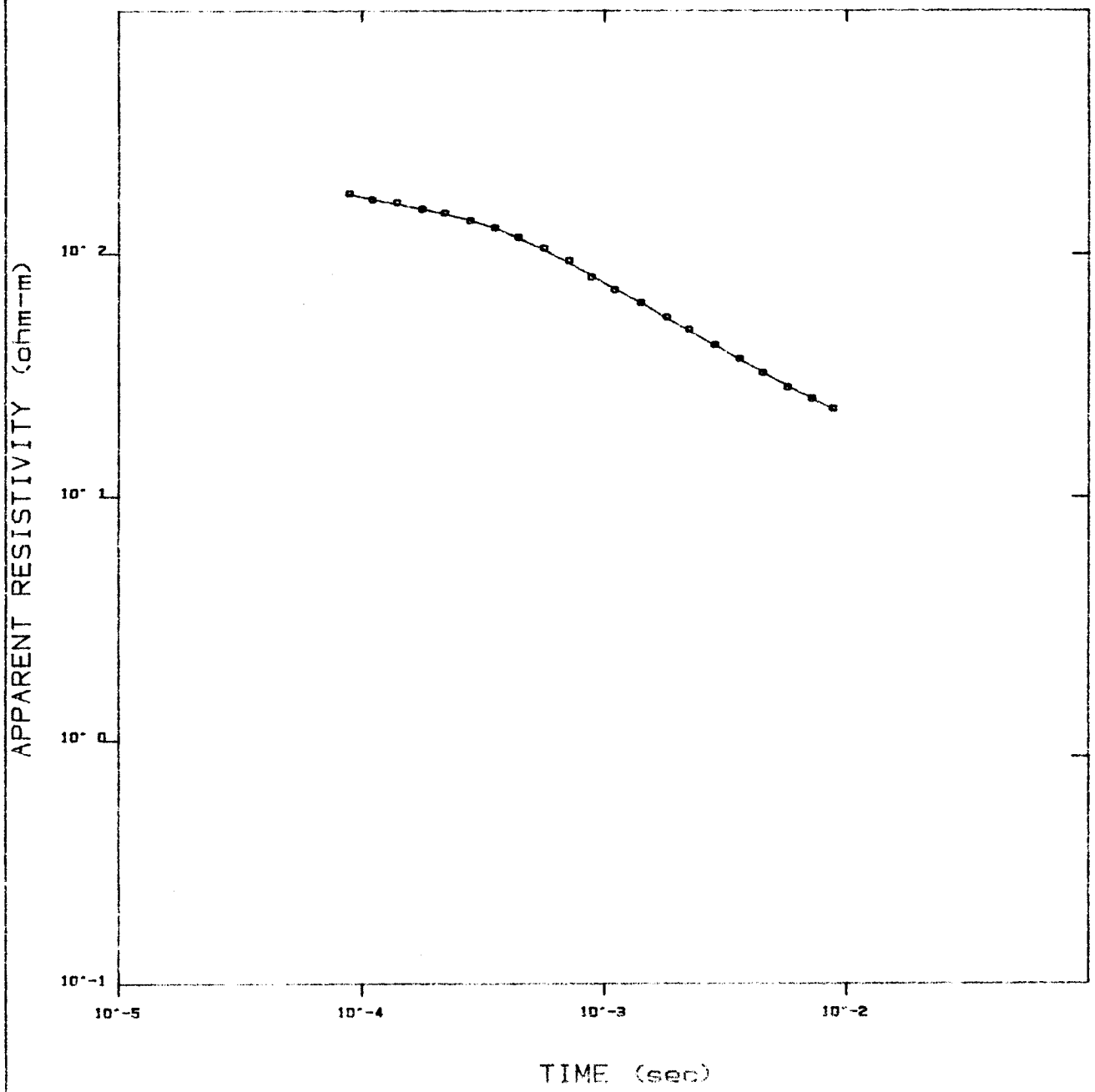
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		2072.6	6800.0		
263.12	167.6	1905.1	6250.2	.6	.6
41.02	80.7	1824.3	5985.4	2.0	2.6
13.62	104.2	1720.2	5643.7	7.6	10.2
9.35					

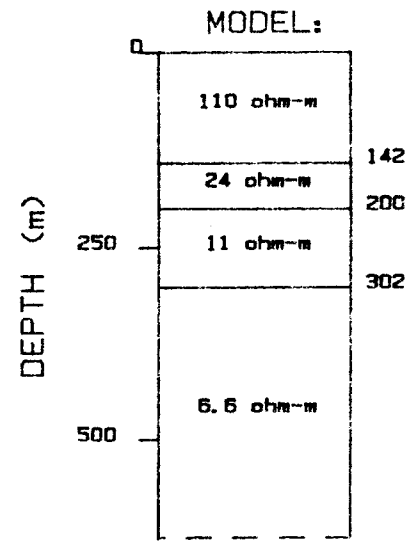
TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.45E+01	0.45E+01	-0.979	0.36E+03
0.11E-03	0.28E+01	0.28E+01	+1.403	0.34E+03
0.14E-03	0.16E+01	0.16E+01	-0.415	0.33E+03
0.18E-03	0.10E+01	0.10E+01	-0.482	0.30E+03
0.22E-03	0.67E+00	0.67E+00	-1.049	0.28E+03
0.28E-03	0.43E+00	0.42E+00	+0.926	0.25E+03
0.35E-03	0.28E+00	0.28E+00	-0.030	0.23E+03
0.44E-03	0.19E+00	0.19E+00	+0.385	0.20E+03
0.56E-03	0.13E+00	0.13E+00	-0.465	0.18E+03
0.71E-03	0.86E-01	0.89E-01	-2.188	0.15E+03
0.88E-03	0.65E-01	0.64E-01	+2.525	0.13E+03
0.11E-02	0.46E-01	0.46E-01	+1.005	0.11E+03
0.14E-02	0.31E-01	0.31E-01	-0.960	0.98E+02
0.18E-02	0.21E-01	0.21E-01	-0.219	0.83E+02
0.22E-02	0.15E-01	0.15E-01	-1.236	0.73E+02
0.29E-02	0.10E-01	0.10E-01	+0.311	0.62E+02
0.36E-02	0.73E-02	0.73E-02	+0.467	0.54E+02
0.45E-02	0.51E-02	0.51E-02	+0.098	0.47E+02
0.57E-02	0.35E-02	0.34E-02	+1.164	0.41E+02
0.72E-02	0.23E-02	0.23E-02	-0.297	0.36E+02
0.88E-02	0.17E-02	0.16E-02	+0.281	0.32E+02

R: 168. X: 0. Y: 0. DL: 0. REQ: 168. CF: 1.0000
TDHZ ARRAY, 21 DATA POINTS, SYSTEM: NONE DATA: L100S080
JOB #G85143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 1 STA 8 OCT. 6, 1985
RMS LOG ERROR: 4.46E-03, ANTILOG YIELDS 1.0314 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	P 4	T 1	T 2	T 3	F 0
P 1	1.00							
P 2	.00	.97						
P 3	.00	-.01	.99					
P 4	.00	-.01	-.01	.97				
T 1	.00	.01	.00	.00	1.00			
T 2	.00	.00	.01	.00	.00	1.00		
T 3	.00	.01	.02	.03	.00	-.01	.96	
F 0	.00	.00	.00	.00	.00	.00	.00	.00





ERROR= 1.4073 %
LOOP RADIUS= 168m

o FIELD DATA

— MODEL CURVE

THE EARTH TECHNOLOGY CORP

UNOCAL Geothermal

Medicine Lake CA

LINE: 1 STA.: 9

APPARENT RESISTIVITY CURVE

JOB #G85143 Fig.

L1005090

MODEL: 4 LAYERS

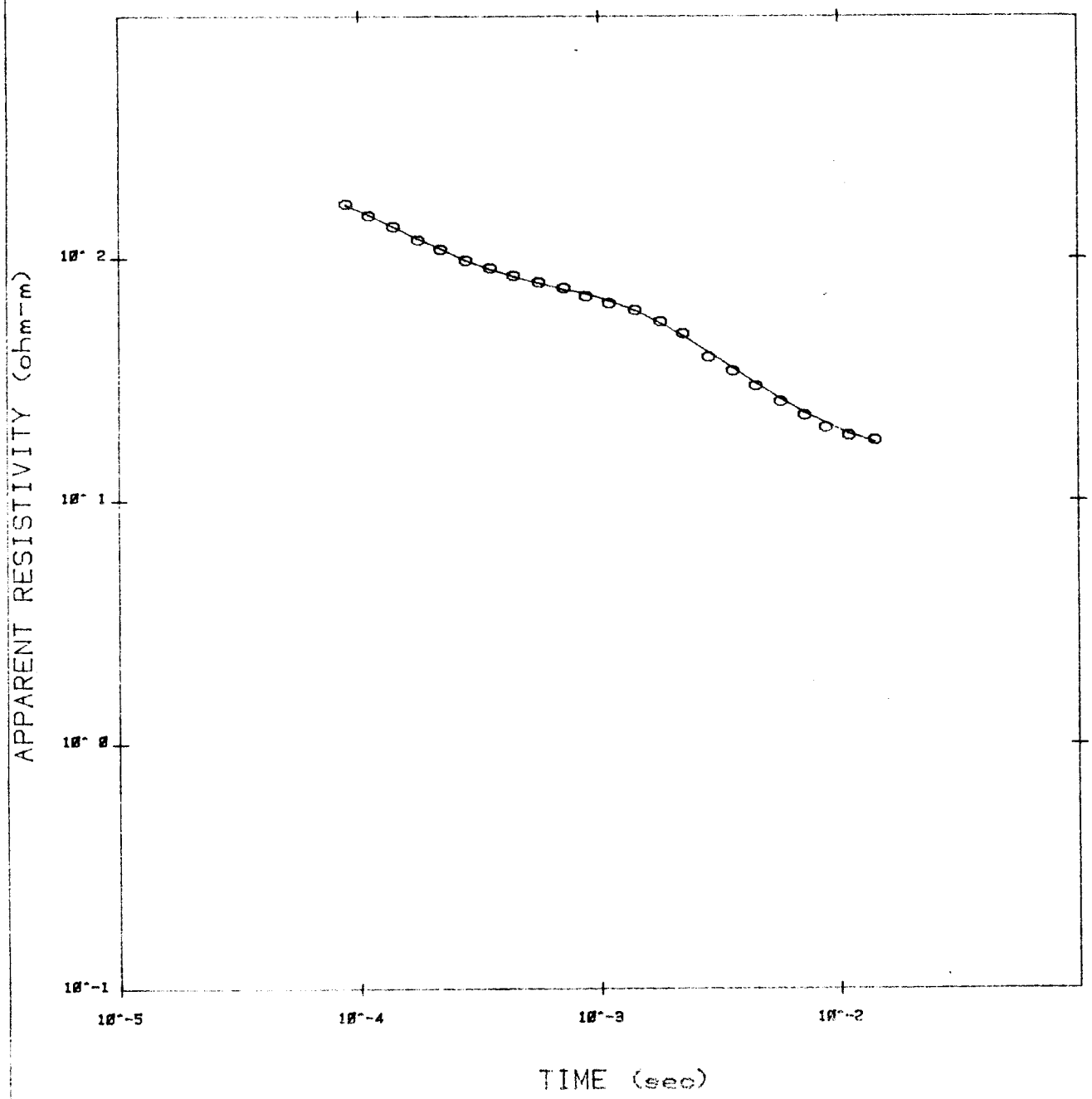
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		2060.4	6760.0		
111.23	141.6	1918.8	6295.4	1.3	1.3
24.43	58.1	1860.8	6104.9	2.4	3.6
10.64	102.3	1758.5	5769.4	9.6	13.3
6.57					

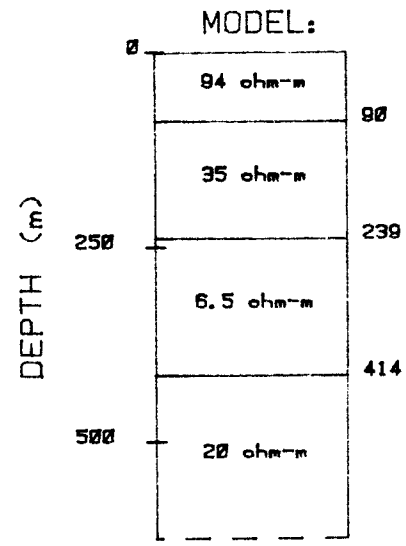
TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.13E+02	0.13E+02	+0.305	0.18E+03
0.11E-03	0.81E+01	0.80E+01	+0.762	0.17E+03
0.14E-03	0.47E+01	0.48E+01	-1.571	0.16E+03
0.18E-03	0.28E+01	0.28E+01	+0.448	0.15E+03
0.22E-03	0.18E+01	0.18E+01	-0.485	0.15E+03
0.28E-03	0.11E+01	0.11E+01	+1.115	0.14E+03
0.35E-03	0.66E+00	0.66E+00	+0.701	0.13E+03
0.44E-03	0.43E+00	0.44E+00	-0.580	0.12E+03
0.56E-03	0.28E+00	0.28E+00	-1.804	0.10E+03
0.71E-03	0.18E+00	0.19E+00	-2.729	0.93E+02
0.88E-03	0.14E+00	0.13E+00	+3.500	0.79E+02
0.11E-02	0.94E-01	0.93E-01	+1.723	0.70E+02
0.14E-02	0.61E-01	0.61E-01	+0.238	0.62E+02
0.18E-02	0.41E-01	0.41E-01	-1.049	0.54E+02
0.22E-02	0.28E-01	0.29E-01	-1.357	0.48E+02
0.29E-02	0.19E-01	0.19E-01	-0.243	0.42E+02
0.36E-02	0.13E-01	0.13E-01	-0.567	0.36E+02
0.45E-02	0.91E-02	0.90E-02	+1.375	0.32E+02
0.57E-02	0.61E-02	0.60E-02	+1.593	0.28E+02
0.72E-02	0.40E-02	0.40E-02	+0.358	0.25E+02
0.88E-02	0.28E-02	0.28E-02	-1.302	0.23E+02

R: 168. X: 0. Y: 0. DL: 0. REQ: 168. CF: 1.0000
TDHZ ARRAY, 21 DATA POINTS, SYSTEM: NONE DATA: L1005090
JOB #GS5143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 1 STA 9 OCT. 8, 1985
RMS LOG ERROR: 6.07E-03, ANTILOG YIELDS 1.4073 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	P 4	T 1	T 2	T 3	F 0
P 1	1.00							
P 2	-.02	.32						
P 3	.00	-.16	.83					
P 4	.00	-.06	-.10	.63				
T 1	.00	.15	.03	.00	.96			
T 2	.00	.11	.18	.04	-.01	.73		
T 3	.00	-.07	.13	.27	.02	-.08	.55	
F 0	.00	.00	.00	.00	.00	.00	.00	.00





ERROR= 3.1844 %
LOOP RADIUS= 168m

FIELD DATA

MODEL CURVE

THE EARTH TECHNOLOGY CORP.

UNOCAL Geothermal

Medicine Lake CA

LINE: 1 STA.: 10

APPARENT RESISTIVITY CURVE

JOB #G85143 Fig.

L100S100

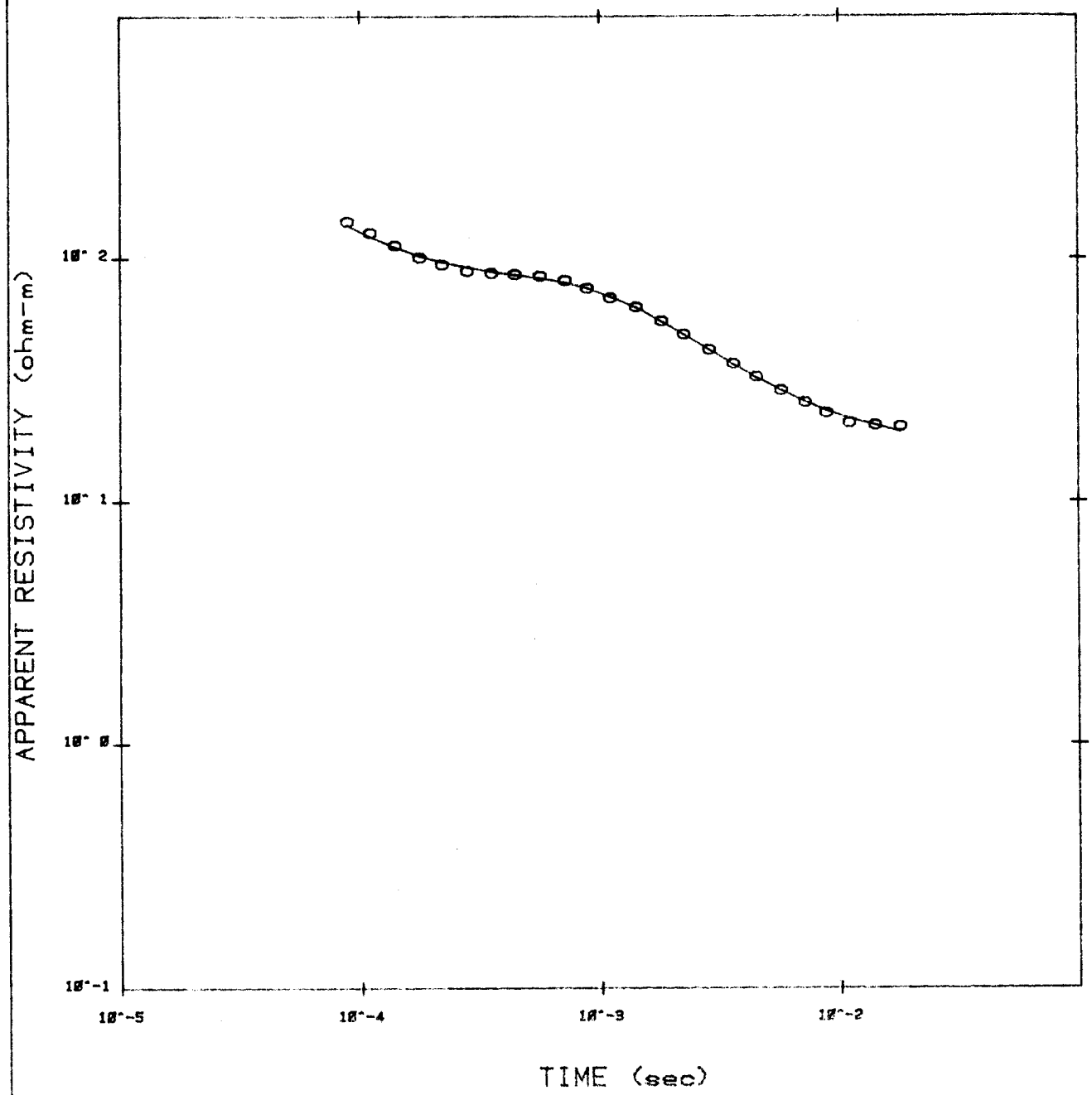
MODEL: 4 LAYERS

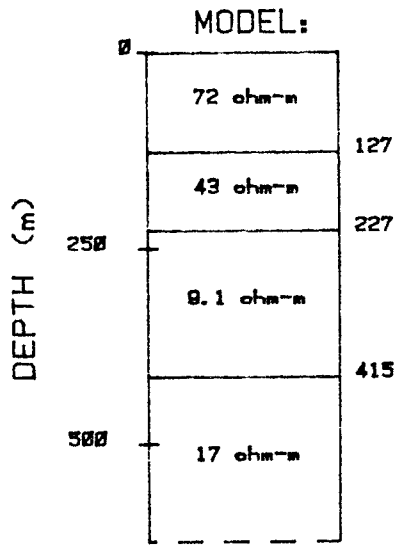
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		2033.0	6670.0		
93.76	89.5	1943.5	6376.3	1.0	1.0
34.86	149.4	1794.1	5886.1	4.3	5.2
6.50	175.6	1618.5	5309.9	27.0	32.2
20.00					

TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.14E+02	0.14E+02	-1.365	0.17E+03
0.11E-03	0.95E+01	0.94E+01	+1.175	0.15E+03
0.14E-03	0.62E+01	0.62E+01	-0.306	0.14E+03
0.18E-03	0.41E+01	0.40E+01	+1.541	0.12E+03
0.22E-03	0.28E+01	0.27E+01	+1.311	0.11E+03
0.28E-03	0.18E+01	0.18E+01	+0.025	0.98E+02
0.35E-03	0.11E+01	0.11E+01	-1.827	0.91E+02
0.44E-03	0.69E+00	0.70E+00	-1.345	0.85E+02
0.56E-03	0.42E+00	0.42E+00	-1.379	0.80E+02
0.71E-03	0.25E+00	0.26E+00	-2.044	0.76E+02
0.88E-03	0.17E+00	0.16E+00	+3.733	0.70E+02
0.11E-02	0.10E+00	0.10E+00	+3.704	0.65E+02
0.14E-02	0.62E-01	0.63E-01	-0.559	0.61E+02
0.18E-02	0.40E-01	0.41E-01	-2.195	0.55E+02
0.22E-02	0.28E-01	0.29E-01	-2.918	0.49E+02
0.29E-02	0.21E-01	0.20E-01	+7.736	0.39E+02
0.36E-02	0.14E-01	0.14E-01	+4.381	0.34E+02
0.45E-02	0.10E-01	0.98E-02	+4.071	0.30E+02
0.57E-02	0.70E-02	0.68E-02	+3.882	0.26E+02
0.72E-02	0.48E-02	0.46E-02	+3.681	0.22E+02
0.88E-02	0.34E-02	0.32E-02	+6.275	0.20E+02
0.11E-01	0.22E-02	0.21E-02	+2.510	0.19E+02
0.14E-01	0.13E-02	0.13E-02	-2.407	0.18E+02

R: 168. X: 0. Y: 0. DL: 0. REO: 168. CF: 1.0000
TDHI ARRAY, 23 DATA POINTS, SYSTEM: NONE DATA: L100S100
JOB #GS5143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 1 STA 10 OCT. 8, 1985
RMS LOG ERROR: 1.36E-02, ANTILOG YIELDS 3.1844 %

CURRENT RESOLUTION MATRICES NOT AVAILABLE





ERROR= 3.4029 %
LOOP RADIUS= 168m

o FIELD DATA

—— MODEL CURVE

THE EARTH TECHNOLOGY CORP.

UNOCAL Geothermal

Medicine Lake CA

LINE: 1 STA.: 11

APPARENT RESISTIVITY CURVE

JOB #G85143 Fig.

L100S110

MODEL: 4 LAYERS

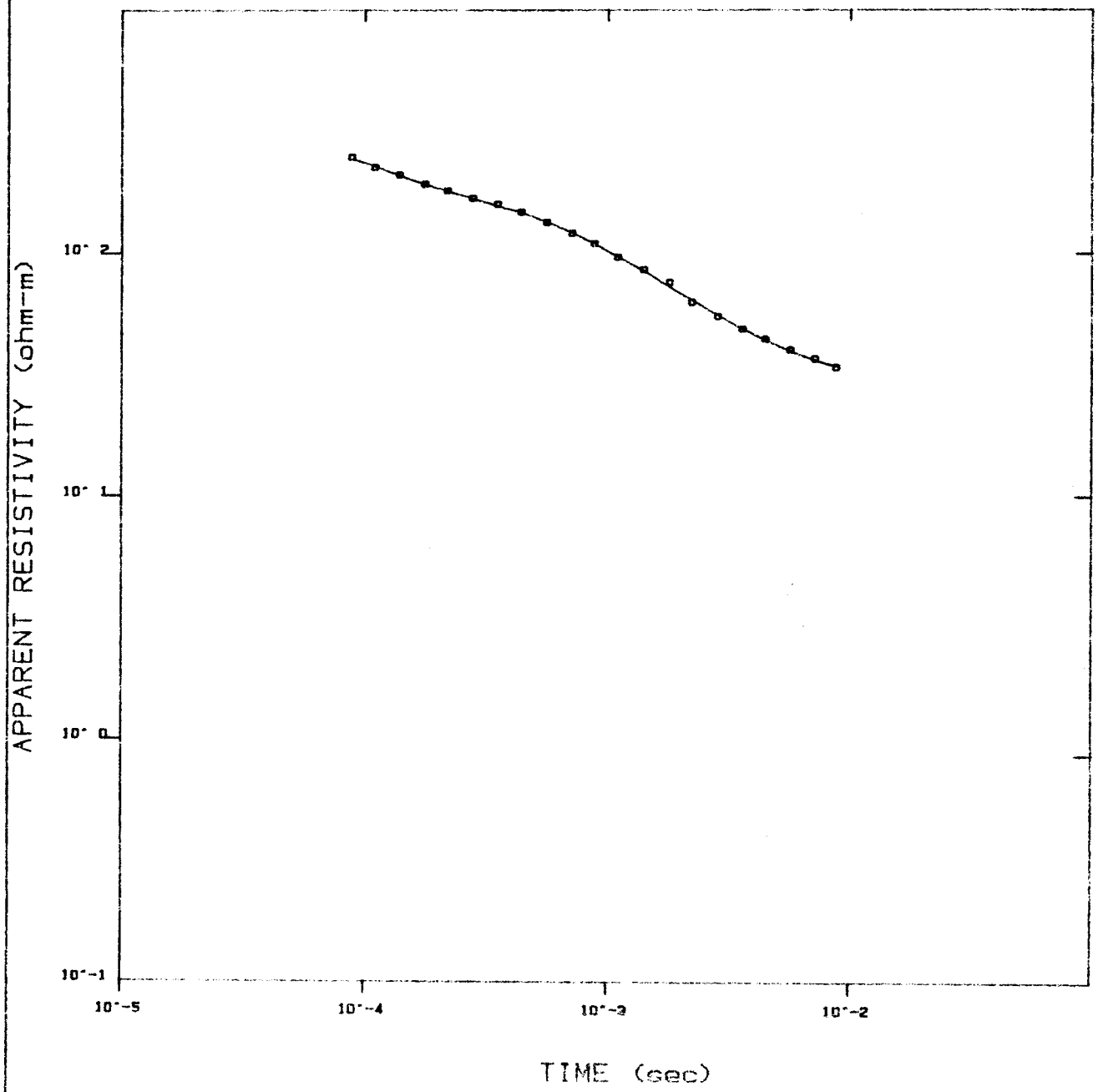
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		2023.9	6640.0		
72.03	126.6	1897.2	6224.5	1.8	1.8
42.51	100.0	1797.2	5896.2	2.4	4.1
9.08	188.5	1608.6	5277.7	20.8	24.9
17.16					

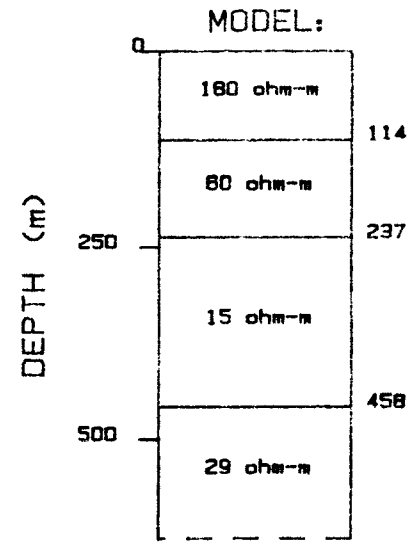
TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.18E+02	0.19E+02	-5.518	0.14E+03
0.11E-03	0.12E+02	0.13E+02	-5.435	0.13E+03
0.14E-03	0.81E+01	0.83E+01	-2.407	0.11E+03
0.18E-03	0.53E+01	0.52E+01	+2.452	0.10E+03
0.22E-03	0.34E+01	0.33E+01	+3.960	0.94E+02
0.28E-03	0.21E+01	0.19E+01	+5.723	0.89E+02
0.35E-03	0.12E+01	0.11E+01	+2.580	0.87E+02
0.44E-03	0.68E+00	0.69E+00	-0.643	0.86E+02
0.56E-03	0.38E+00	0.39E+00	-2.861	0.85E+02
0.71E-03	0.22E+00	0.23E+00	-2.452	0.81E+02
0.88E-03	0.15E+00	0.15E+00	+0.541	0.76E+02
0.11E-02	0.97E-01	0.95E-01	+1.659	0.69E+02
0.14E-02	0.59E-01	0.60E-01	-0.602	0.63E+02
0.18E-02	0.39E-01	0.39E-01	-0.257	0.55E+02
0.22E-02	0.28E-01	0.28E-01	-0.351	0.49E+02
0.29E-02	0.19E-01	0.19E-01	-0.162	0.42E+02
0.36E-02	0.13E-01	0.13E-01	-0.731	0.37E+02
0.45E-02	0.88E-02	0.89E-02	-1.297	0.33E+02
0.57E-02	0.59E-02	0.59E-02	-0.303	0.29E+02
0.72E-02	0.39E-02	0.39E-02	+1.284	0.26E+02
0.88E-02	0.27E-02	0.26E-02	+3.174	0.23E+02
0.11E-01	0.18E-02	0.17E-02	+6.479	0.21E+02
0.14E-01	0.10E-02	0.10E-02	+0.065	0.21E+02
0.18E-01	0.55E-03	0.60E-03	-7.983	0.21E+02

R: 168. X: 0. Y: 0. DL: 0. REQ: 168. CF: 1.0000
TDHZ ARRAY, 24 DATA POINTS, SYSTEM: NONE DATA: L100S110
JOB #G85143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 1 STA 11 OCT 8, 1985
RMS LOG ERROR: 1.45E-02, ANTILOG YIELDS 3.4029 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	F 1	F 2	F 3	F 4	T 1	T 2	T 3	F 0
F 1	.95							
F 2	.04	.24						
F 3	-.01	-.07	.73					
F 4	.00	.01	.02	.03				
T 1	.03	.24	.06	-.02	.65			
T 2	-.04	-.05	.12	-.03	.32	.37		
T 3	.00	-.03	-.14	-.05	.03	.05	.11	
F 0	.00	.00	.00	.00	.00	.00	.00	.00





ERROR= 2.0226 %
LOOP RADIUS= 168m

o FIELD DATA

—— MODEL CURVE

THE EARTH TECHNOLOGY CORP

UNOCAL Geothermal

Medicine Lake CA

LINE: 1 STA.: 12

APPARENT RESISTIVITY CURVE

JOB #G85143 Fig.

L100S120

MODEL: 4 LAYERS

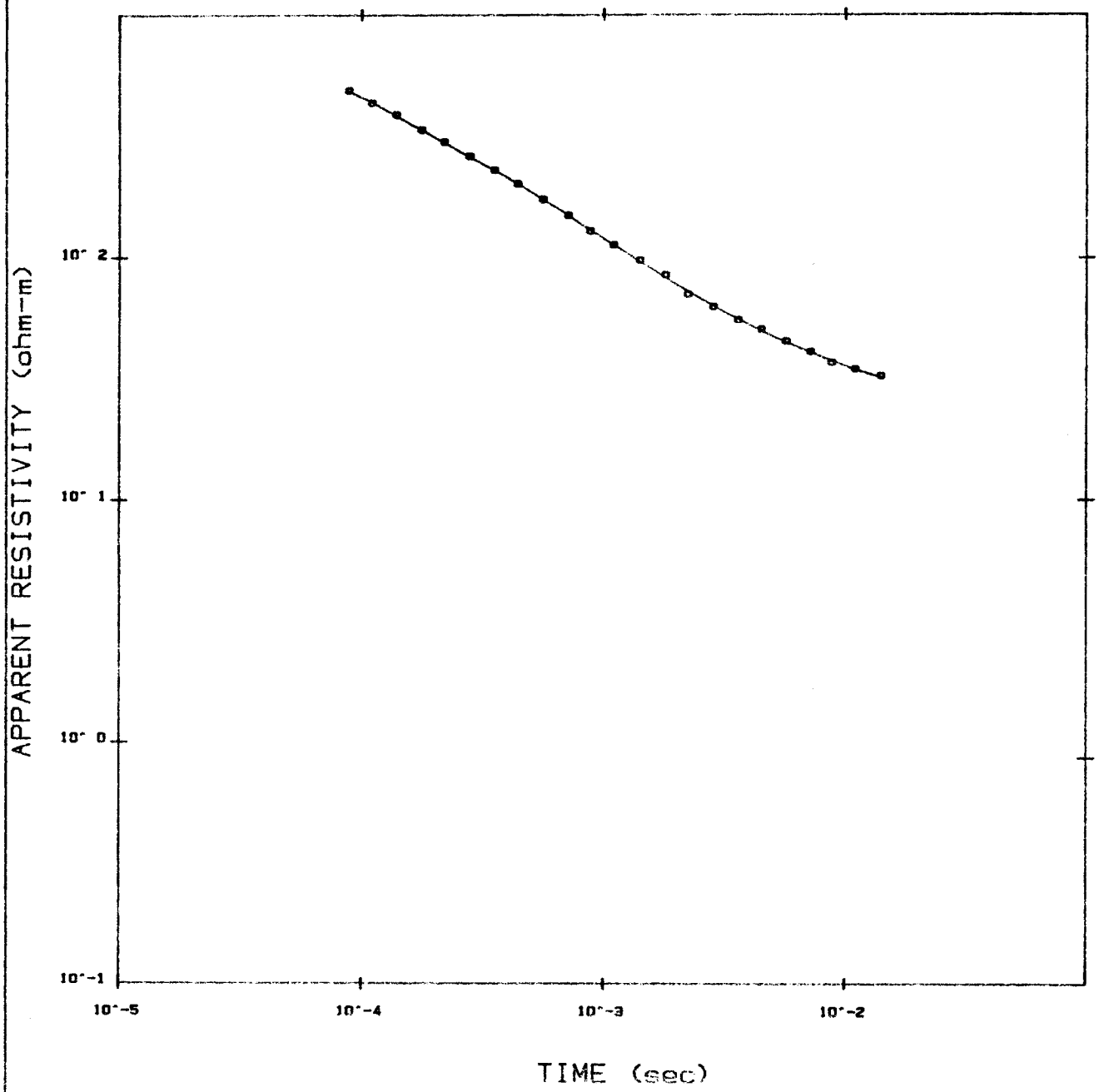
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		1999.5	6560.0		
178.36	113.9	1885.5	6186.2	.6	.6
60.49	123.3	1762.2	5781.6	2.0	2.7
14.80	221.0	1541.2	5056.6	14.9	17.6
28.63					

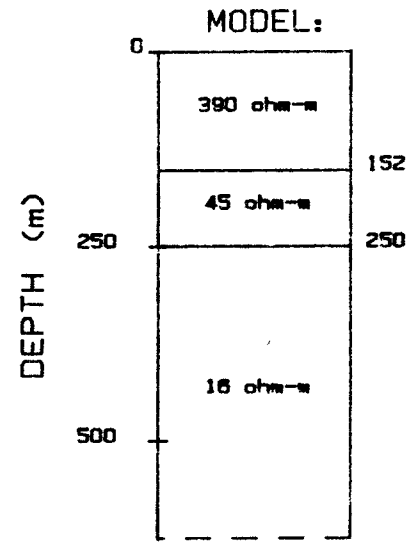
TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.77E+01	0.78E+01	-1.164	0.25E+03
0.11E-03	0.52E+01	0.50E+01	+2.346	0.23E+03
0.14E-03	0.32E+01	0.32E+01	-0.434	0.21E+03
0.18E-03	0.20E+01	0.20E+01	+0.119	0.19E+03
0.22E-03	0.13E+01	0.13E+01	-0.099	0.18E+03
0.28E-03	0.79E+00	0.79E+00	-0.131	0.17E+03
0.35E-03	0.48E+00	0.49E+00	-1.929	0.16E+03
0.44E-03	0.31E+00	0.31E+00	-0.206	0.15E+03
0.56E-03	0.19E+00	0.19E+00	+1.974	0.13E+03
0.71E-03	0.12E+00	0.12E+00	+1.116	0.12E+03
0.88E-03	0.85E-01	0.85E-01	+0.313	0.11E+03
0.11E-02	0.60E-01	0.59E-01	+1.474	0.95E+02
0.14E-02	0.38E-01	0.39E-01	-1.698	0.85E+02
0.18E-02	0.25E-01	0.27E-01	-5.809	0.75E+02
0.22E-02	0.20E-01	0.19E-01	+3.670	0.62E+02
0.29E-02	0.13E-01	0.13E-01	+2.545	0.54E+02
0.36E-02	0.86E-02	0.85E-02	+0.848	0.48E+02
0.45E-02	0.57E-02	0.58E-02	-0.435	0.44E+02
0.57E-02	0.37E-02	0.37E-02	-1.351	0.39E+02
0.72E-02	0.23E-02	0.24E-02	-1.700	0.36E+02
0.88E-02	0.16E-02	0.16E-02	+1.543	0.33E+02

R: 168. X: 0. Y: 0. DL: 0. REQ: 169. CF: 1.0000
TDHZ ARRAY, 21 DATA POINTS, SYSTEM: NONE DATA: L100S120
JOB #G85143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 1 STA 12 OCT 8, 1985
RMS LOG ERROR: 8.70E-03, ANTILOG YIELDS 2.0226 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	P 4	T 1	T 2	T 3	F 0
P 1	1.00							
P 2	.00	.99						
P 3	.00	.00	1.00					
P 4	.00	-.01	-.02	.83				
T 1	.00	.00	.00	.01	1.00			
T 2	.00	.00	.00	.00	.00	1.00		
T 3	.00	-.01	-.01	-.11	.01	.00	.91	
F 0	.00	.00	.00	.00	.00	.00	.00	.00





ERROR= 1.7580 %
LOOP RADIUS= 168m

o FIELD DATA

— MODEL CURVE

THE EARTH TECHNOLOGY CORP

UNOCAL Geothermal

Medicine Lake CA

LINE: 1 STA.: 13

APPARENT RESISTIVITY CURVE

JOB #G85143 Fig.

L100S130

MODEL: 3 LAYERS

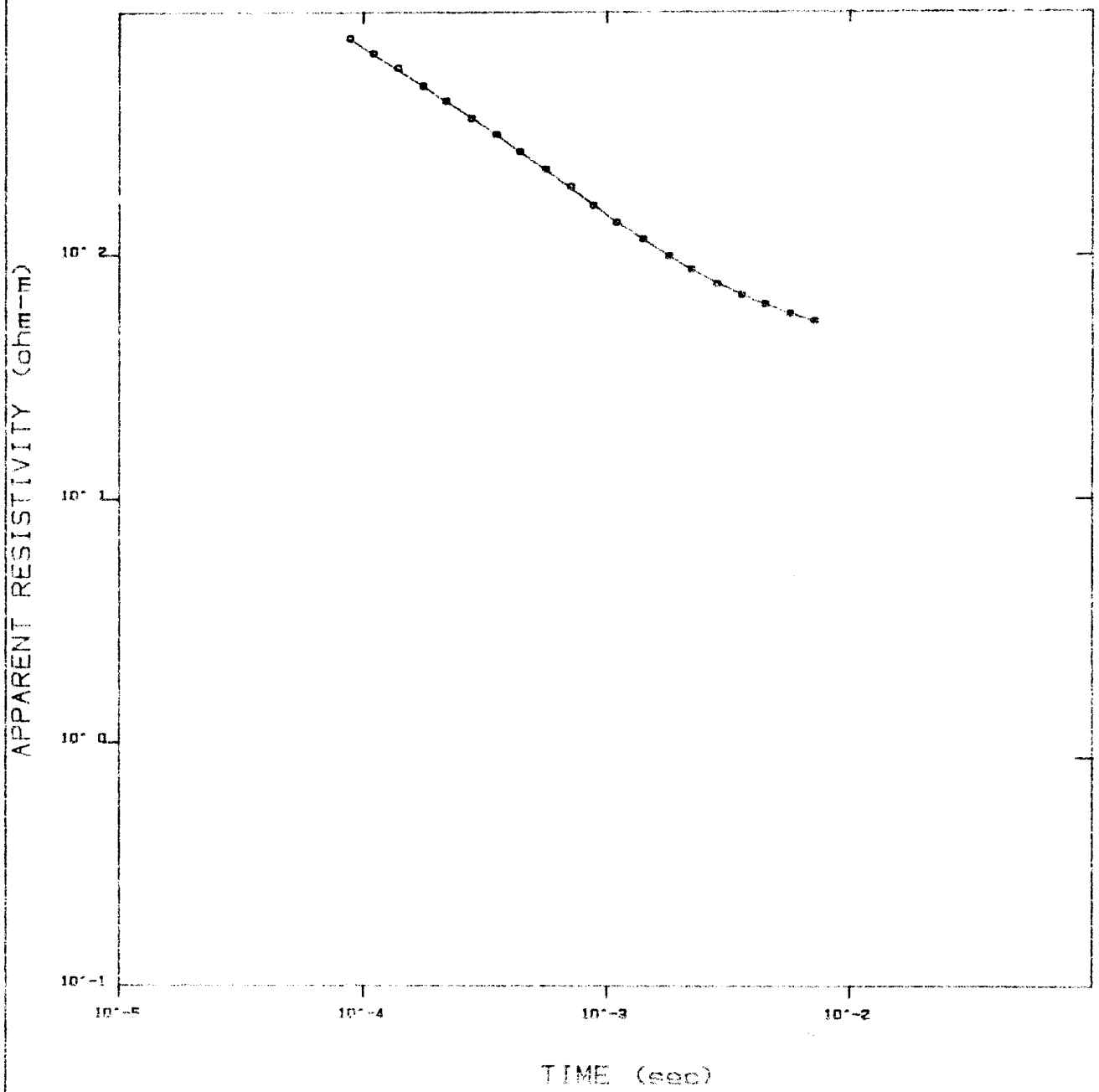
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		1987.3	6520.0		
389.40	152.0	1835.3	6021.3	.4	.4
44.59	97.7	1737.6	5700.7	2.2	2.6
16.37					

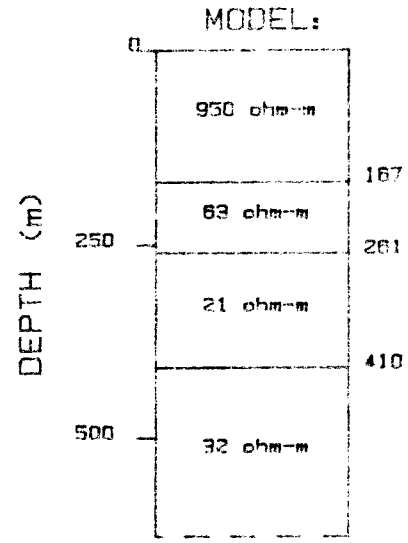
TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.28E+01	0.28E+01	+0.008	0.48E+03
0.11E-03	0.20E+01	0.19E+01	+1.403	0.43E+03
0.14E-03	0.13E+01	0.13E+01	-1.254	0.39E+03
0.18E-03	0.87E+00	0.87E+00	+0.276	0.33E+03
0.22E-03	0.61E+00	0.61E+00	-0.452	0.30E+03
0.28E-03	0.41E+00	0.41E+00	-0.584	0.26E+03
0.35E-03	0.28E+00	0.27E+00	+0.289	0.23E+03
0.44E-03	0.19E+00	0.19E+00	+0.815	0.20E+03
0.56E-03	0.13E+00	0.13E+00	-0.395	0.17E+03
0.71E-03	0.91E-01	0.90E-01	+0.774	0.15E+03
0.88E-03	0.67E-01	0.66E-01	+1.674	0.13E+03
0.11E-02	0.47E-01	0.47E-01	-0.702	0.11E+03
0.14E-02	0.31E-01	0.32E-01	-1.804	0.97E+02
0.18E-02	0.21E-01	0.22E-01	-4.688	0.84E+02
0.22E-02	0.16E-01	0.15E-01	+4.289	0.70E+02
0.29E-02	0.10E-01	0.10E-01	+0.904	0.63E+02
0.36E-02	0.70E-02	0.69E-02	+1.513	0.55E+02
0.45E-02	0.46E-02	0.47E-02	-1.446	0.50E+02
0.57E-02	0.30E-02	0.31E-02	-0.797	0.45E+02
0.72E-02	0.20E-02	0.20E-02	-0.235	0.41E+02
0.88E-02	0.14E-02	0.13E-02	+2.902	0.37E+02
0.11E-01	0.87E-03	0.87E-03	-0.080	0.34E+02
0.14E-01	0.51E-03	0.52E-03	-1.682	0.32E+02

R: 168. X: 0. Y: 0. DL: 0. REQ: 168. CF: 1.0000
TDHZ ARRAY, 23 DATA POINTS, SYSTEM: NONE DATA: L100S130
JOB #G85143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 1 STA 13 OCT. 9, 1985
RMS LOG ERROR: 7.57E-03, ANTILOG YIELDS 1.7580 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	1.00					
P 2	.00	.99				
P 3	.00	.00	1.00			
T 1	.00	.00	.00	1.00		
T 2	.00	.00	.00	.00	1.00	
F 0	.00	.00	.00	.00	.00	.00





ERROR= .9669 %
LOOP RADIUS= 168m

FIELD DATA

MODEL CURVE

THE EARTH TECHNOLOGY CORP

UNOCAL Geothermal

Medicine Lake CA

LINE: 1 STA.: 14

APPARENT RESISTIVITY CURVE

JOB #685143 Fig.

L100S140

MODEL: 4 LAYERS

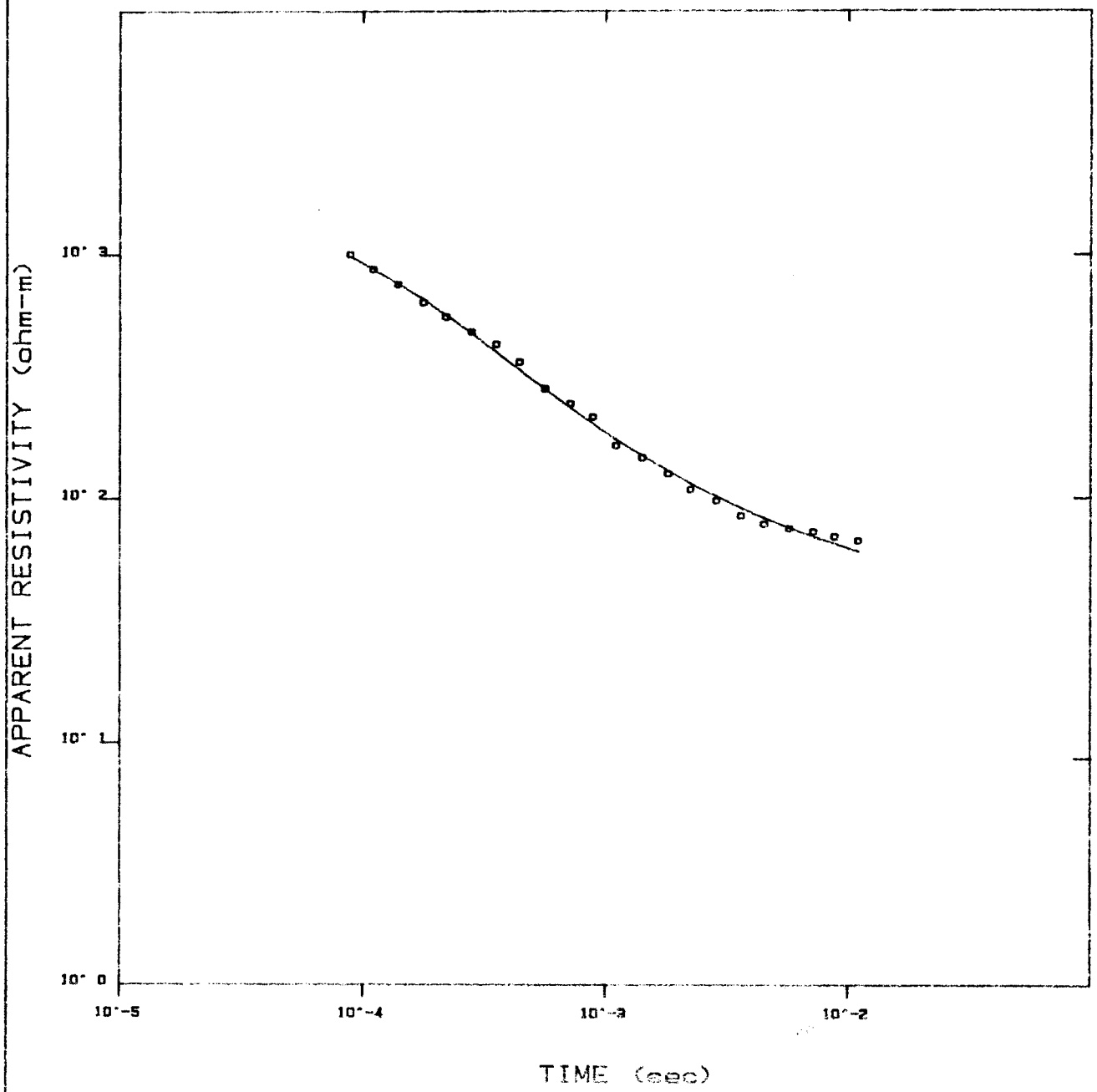
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		1975.1	6480.0		
945.12	167.0	1808.1	5932.1	.2	.2
63.03	93.5	1714.6	5625.3	1.5	1.7
21.38	149.5	1565.1	5134.9	7.0	8.7
31.94					

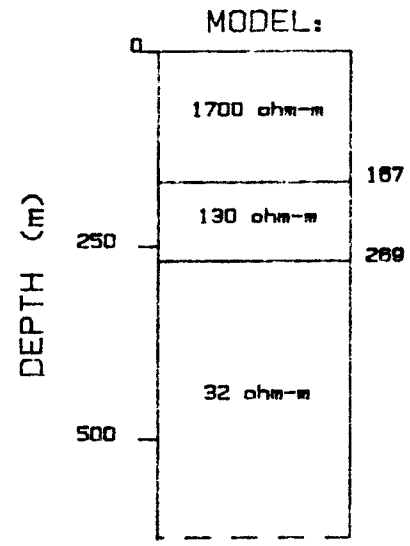
TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.14E+01	0.14E+01	+0.421	0.78E+03
0.11E-03	0.10E+01	0.10E+01	-0.716	0.68E+03
0.14E-03	0.69E+00	0.70E+00	-1.562	0.59E+03
0.18E-03	0.48E+00	0.48E+00	+0.309	0.50E+03
0.22E-03	0.35E+00	0.35E+00	+0.050	0.43E+03
0.28E-03	0.24E+00	0.24E+00	+1.603	0.37E+03
0.35E-03	0.17E+00	0.17E+00	+0.240	0.32E+03
0.44E-03	0.12E+00	0.12E+00	-0.113	0.27E+03
0.56E-03	0.87E-01	0.88E-01	-0.660	0.23E+03
0.71E-03	0.62E-01	0.64E-01	-1.866	0.19E+03
0.88E-03	0.48E-01	0.47E-01	+1.596	0.16E+03
0.11E-02	0.35E-01	0.35E-01	+1.021	0.14E+03
0.14E-02	0.24E-01	0.24E-01	+0.481	0.12E+03
0.18E-02	0.17E-01	0.17E-01	+0.523	0.98E+02
0.22E-02	0.12E-01	0.12E-01	+0.360	0.86E+02
0.29E-02	0.78E-02	0.77E-02	+1.808	0.75E+02
0.36E-02	0.51E-02	0.51E-02	+0.191	0.68E+02
0.45E-02	0.34E-02	0.34E-02	+0.176	0.62E+02
0.57E-02	0.21E-02	0.21E-02	+0.959	0.57E+02
0.72E-02	0.13E-02	0.13E-02	-0.550	0.53E+02

R: 168. X: 0. Y: 0. DL: 0. REQ: 168. CF: 1.0000
TDHZ ARRAY, 20 DATA POINTS, SYSTEM: NONE DATA: L100S140
JOB #685143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 1 STA 14 OCT. 9, 1985
RMS LOG ERROR: 4.18E-03, ANTILOG YIELDS .9669 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	P 4	T 1	T 2	T 3	F 0
P 1	.97							
P 2	-.02	.98						
P 3	.00	.00	1.00					
P 4	.00	-.01	-.01	.90				
T 1	.01	.01	.00	.00	1.00			
T 2	-.01	.00	.00	.00	.00	.99		
T 3	.00	-.01	-.01	-.08	.00	.01	.92	
F 0	.00	.00	.00	.00	.00	.00	.00	.00





ERROR= 7.6419 %
LOOP RADIUS= 168m

o FIELD DATA

— MODEL CURVE

THE EARTH TECHNOLOGY CORP

UNOCAL Geothermal

Medicine Lake CA

LINE: 1 STA.: 15

APPARENT RESISTIVITY CURVE

JOB #C85143 Fig.

L100S150

MODEL: 3 LAYERS

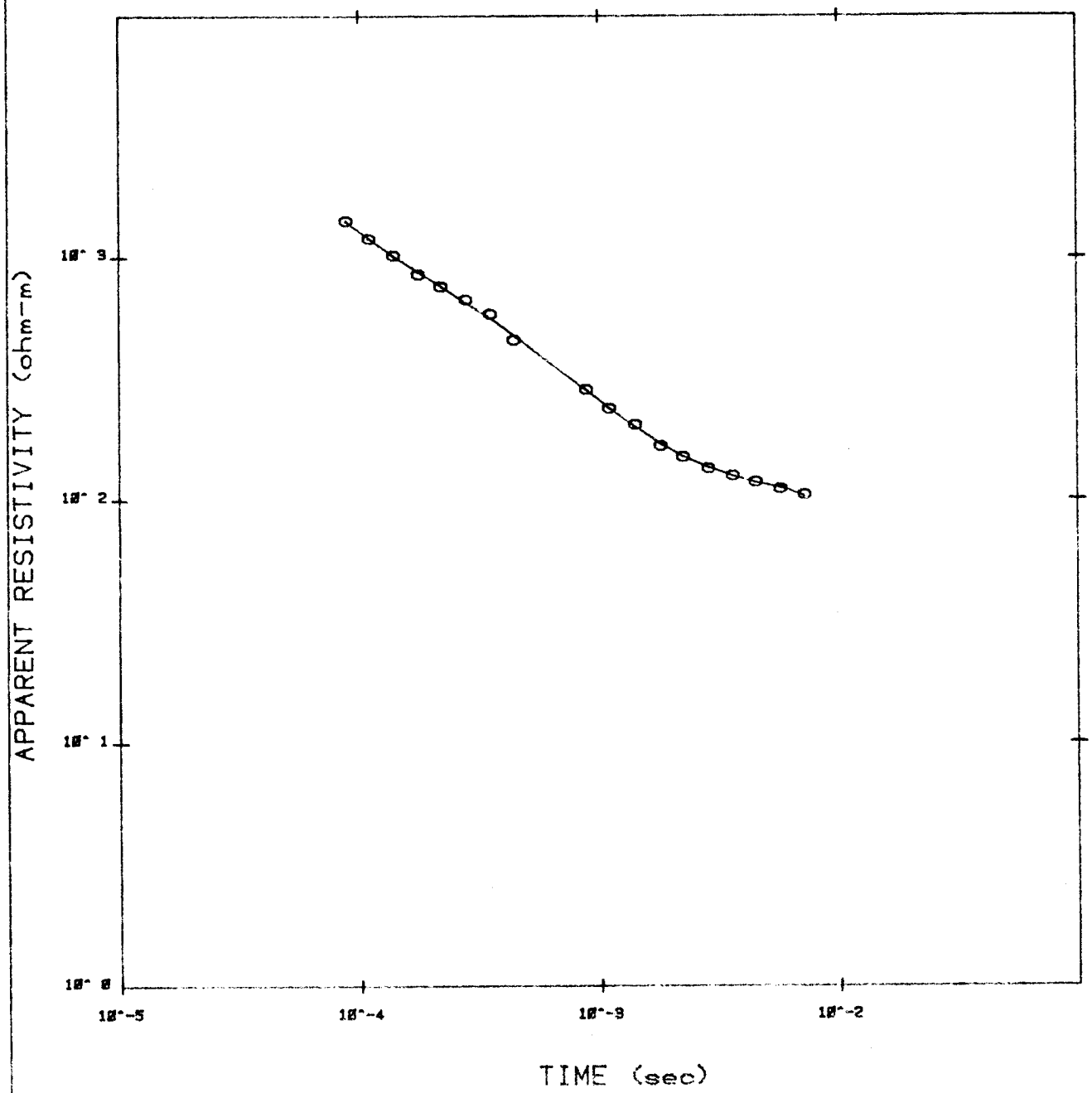
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		1962.9	6440.0		
1680.29	167.2	1795.7	5891.5	.1	.1
126.46	102.0	1693.8	5556.9	.8	.9
32.36					

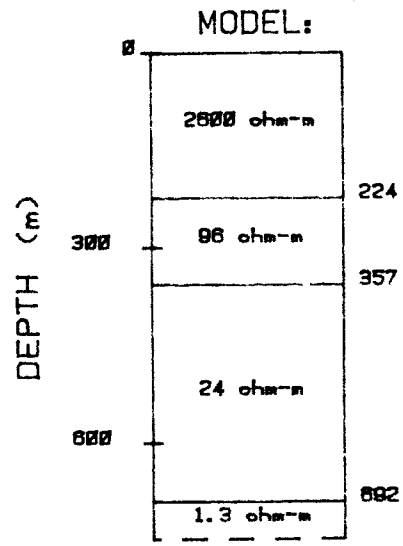
TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.96E+00	0.98E+00	-1.902	0.10E+04
0.11E-03	0.69E+00	0.69E+00	+0.484	0.87E+03
0.14E-03	0.48E+00	0.47E+00	+1.760	0.75E+03
0.18E-03	0.34E+00	0.32E+00	+5.884	0.63E+03
0.22E-03	0.24E+00	0.24E+00	+3.501	0.55E+03
0.28E-03	0.17E+00	0.17E+00	-1.054	0.48E+03
0.35E-03	0.11E+00	0.12E+00	-9.395	0.42E+03
0.44E-03	0.80E-01	0.89E-01	-10.172	0.36E+03
0.56E-03	0.64E-01	0.64E-01	-0.083	0.28E+03
0.71E-03	0.43E-01	0.46E-01	-5.018	0.24E+03
0.88E-03	0.31E-01	0.33E-01	-7.988	0.21E+03
0.11E-02	0.27E-01	0.24E-01	+9.427	0.16E+03
0.14E-02	0.17E-01	0.16E-01	+4.089	0.15E+03
0.18E-02	0.12E-01	0.11E-01	+4.358	0.13E+03
0.22E-02	0.85E-02	0.77E-02	+9.457	0.11E+03
0.29E-02	0.54E-02	0.50E-02	+7.753	0.97E+02
0.36E-02	0.37E-02	0.33E-02	+12.378	0.84E+02
0.45E-02	0.24E-02	0.22E-02	+10.006	0.77E+02
0.57E-02	0.14E-02	0.14E-02	+1.941	0.74E+02
0.72E-02	0.83E-03	0.89E-03	-6.420	0.72E+02
0.88E-02	0.54E-03	0.59E-03	-8.841	0.69E+02
0.11E-01	0.33E-03	0.38E-03	-13.751	0.66E+02

R: 168. X: 0. Y: 0. DL: 0. REQ: 168. CF: 1.0000
TDHZ ARRAY, 22 DATA POINTS, SYSTEM: NONE DATA: L100S150
JOB #G85143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 1 STA 15 OCT. 9, 1985
RMS LOG ERROR: 3.20E-02, ANTILOG YIELDS 7.6419 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	.97					
P 2	-.01	.96				
P 3	.00	.00	1.00			
T 1	.00	.01	.00	1.00		
T 2	-.01	-.01	.00	.00	1.00	
F 0	.00	.00	.00	.00	.00	.00





ERROR= 2.7954 %
LOOP RADIUS= 168m

o FIELD DATA

— MODEL CURVE

THE EARTH TECHNOLOGY CORP.

UNOCAL Geothermal

Medicine Lake CA

LINE: 1 STA.: 16

APPARENT RESISTIVITY CURVE

JOB #G85143 Fig.

L100S160

MODEL: 4 LAYERS

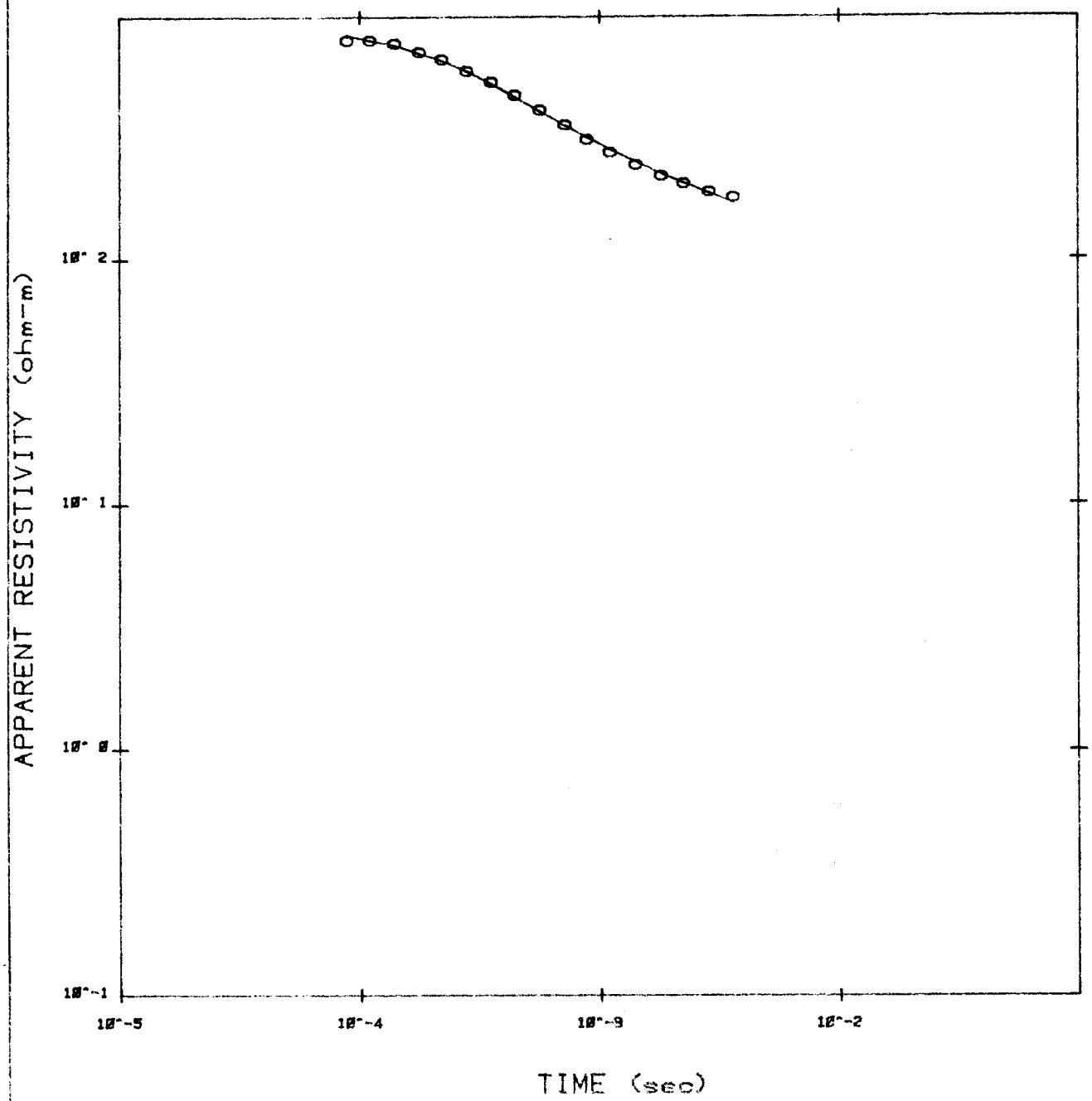
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		1938.5	6360.0		
2616.32	223.7	1714.8	5626.1	.1	.1
96.27	133.7	1581.1	5187.5	1.4	1.5
24.39	334.2	1247.0	4091.1	13.7	15.2
1.33					

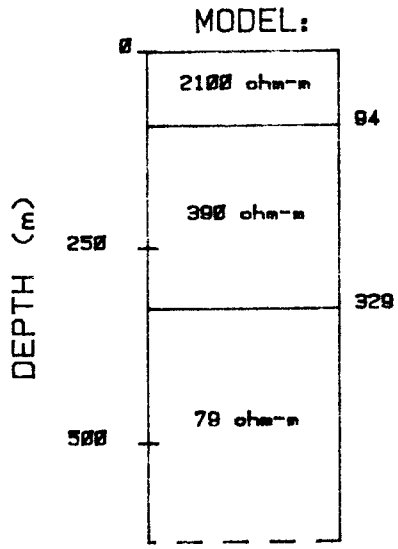
TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.57E+00	0.57E+00	-0.600	0.14E+04
0.11E-03	0.43E+00	0.42E+00	+0.187	0.12E+04
0.14E-03	0.30E+00	0.30E+00	-0.570	0.10E+04
0.18E-03	0.21E+00	0.21E+00	+3.757	0.85E+03
0.22E-03	0.15E+00	0.15E+00	+0.723	0.76E+03
0.28E-03	0.98E-01	0.10E+00	-3.702	0.67E+03
0.35E-03	0.67E-01	0.71E-01	-5.257	0.59E+03
0.44E-03	0.55E-01	0.52E-01	+7.238	0.46E+03
0.88E-03	0.20E-01	0.20E-01	-0.732	0.29E+03
0.11E-02	0.15E-01	0.15E-01	+1.008	0.24E+03
0.14E-02	0.10E-01	0.10E-01	-2.594	0.20E+03
0.18E-02	0.75E-02	0.73E-02	+3.176	0.17E+03
0.22E-02	0.51E-02	0.51E-02	+0.440	0.15E+03
0.29E-02	0.33E-02	0.32E-02	+1.476	0.13E+03
0.36E-02	0.20E-02	0.20E-02	-0.143	0.13E+03
0.45E-02	0.13E-02	0.13E-02	-1.116	0.12E+03
0.57E-02	0.78E-03	0.76E-03	+1.925	0.11E+03
0.72E-02	0.47E-03	0.48E-03	-2.042	0.10E+03

R: 168. X: 0. Y: 0. DL: 0. REQ: 168. CF: 1.0000
TDHZ ARRAY, 18 DATA POINTS, SYSTEM: NONE DATA: L100S160
JOB #G85143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 1 STA 16 OCT 9, 1985
RMS LOG ERROR: 1.20E-02, ANTILOG YIELDS 2.7954 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	P 4	T 1	T 2	T 3	F 0
P 1	.98							
P 2	-.01	.99						
P 3	.00	-.01	.99					
P 4	.01	.00	-.01	.95				
T 1	.00	.00	.00	.00	1.00			
T 2	.00	.00	.00	.00	.00	1.00		
T 3	.00	-.01	-.01	-.01	.00	.00	.98	
F 0	.00	.00	.00	.00	.00	.00	.00	.00





ERROR= 3.4901 %
LOOP RADIUS= 188m

o FIELD DATA

— MODEL CURVE

THE EARTH TECHNOLOGY CORP.

UNOCAL Geothermal

Medicine Lake CA

LINE: 1 STA.: 17

APPARENT RESISTIVITY CURVE

JOB #G85143 Fig.

L100S170

MODEL: 3 LAYERS

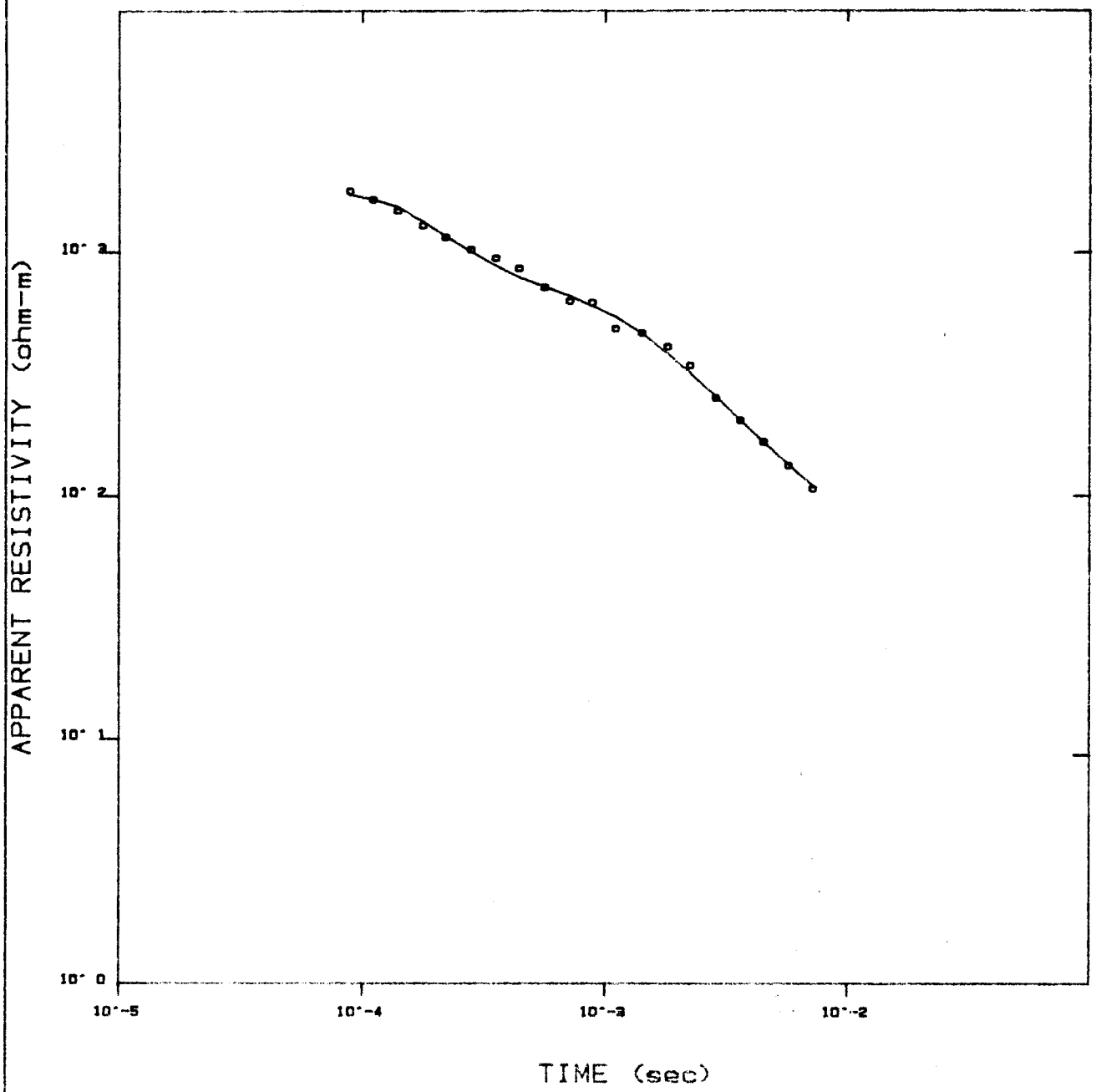
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		1877.6	6160.0		
2071.17	94.5	1783.1	5850.1	.0	.0
385.80	234.5	1548.6	5080.7	.6	.7
79.10					

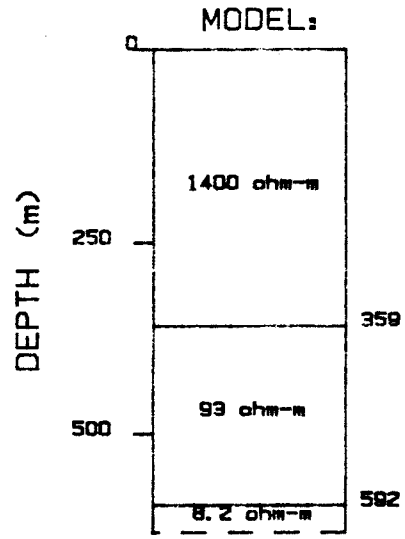
TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.13E+01	0.12E+01	+7.945	0.80E+03
0.11E-03	0.77E+00	0.77E+00	-0.118	0.80E+03
0.14E-03	0.45E+00	0.46E+00	-2.497	0.78E+03
0.18E-03	0.28E+00	0.28E+00	-1.316	0.72E+03
0.22E-03	0.18E+00	0.18E+00	-1.174	0.67E+03
0.28E-03	0.12E+00	0.12E+00	-0.427	0.60E+03
0.35E-03	0.75E-01	0.77E-01	-2.275	0.54E+03
0.44E-03	0.52E-01	0.53E-01	-2.653	0.48E+03
0.56E-03	0.35E-01	0.35E-01	-1.772	0.42E+03
0.71E-03	0.24E-01	0.24E-01	-0.183	0.36E+03
0.88E-03	0.17E-01	0.17E-01	+3.568	0.32E+03
0.11E-02	0.12E-01	0.11E-01	+3.606	0.28E+03
0.14E-02	0.77E-02	0.73E-02	+5.075	0.25E+03
0.18E-02	0.49E-02	0.47E-02	+2.944	0.22E+03
0.22E-02	0.32E-02	0.32E-02	+1.069	0.21E+03
0.29E-02	0.20E-02	0.20E-02	-1.494	0.19E+03
0.36E-02	0.12E-02	0.13E-02	-7.146	0.18E+03

R: 168. X: 0. Y: 0. DL: 0. REQ: 168. CF: 1.0000
TDHZ ARRAY, 17 DATA POINTS, SYSTEM: NONE DATA: L100S170
JOB #G85143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 1 STA 17 OCT. 22, 1985
RMS LOG ERROR: 1.49E-02, ANTILOG YIELDS 3.4901 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	.06					
P 2	.09	.59				
P 3	.01	-.07	.65			
T 1	.07	.42	.04	.41		
T 2	-.05	-.07	.13	.16	.84	
F 0	.00	.00	.00	.00	.00	.00





ERROR= 7.2086 %
LOOP RADIUS= 168m

o FIELD DATA

—— MODEL CURVE

THE EARTH TECHNOLOGY CORP

UNOCAL Geothermal

Medicine Lake CA

LINE: 2 STA.: 1

APPARENT RESISTIVITY CURVE

JOB #G85143 Fig.

L200S010

MODEL: 3 LAYERS

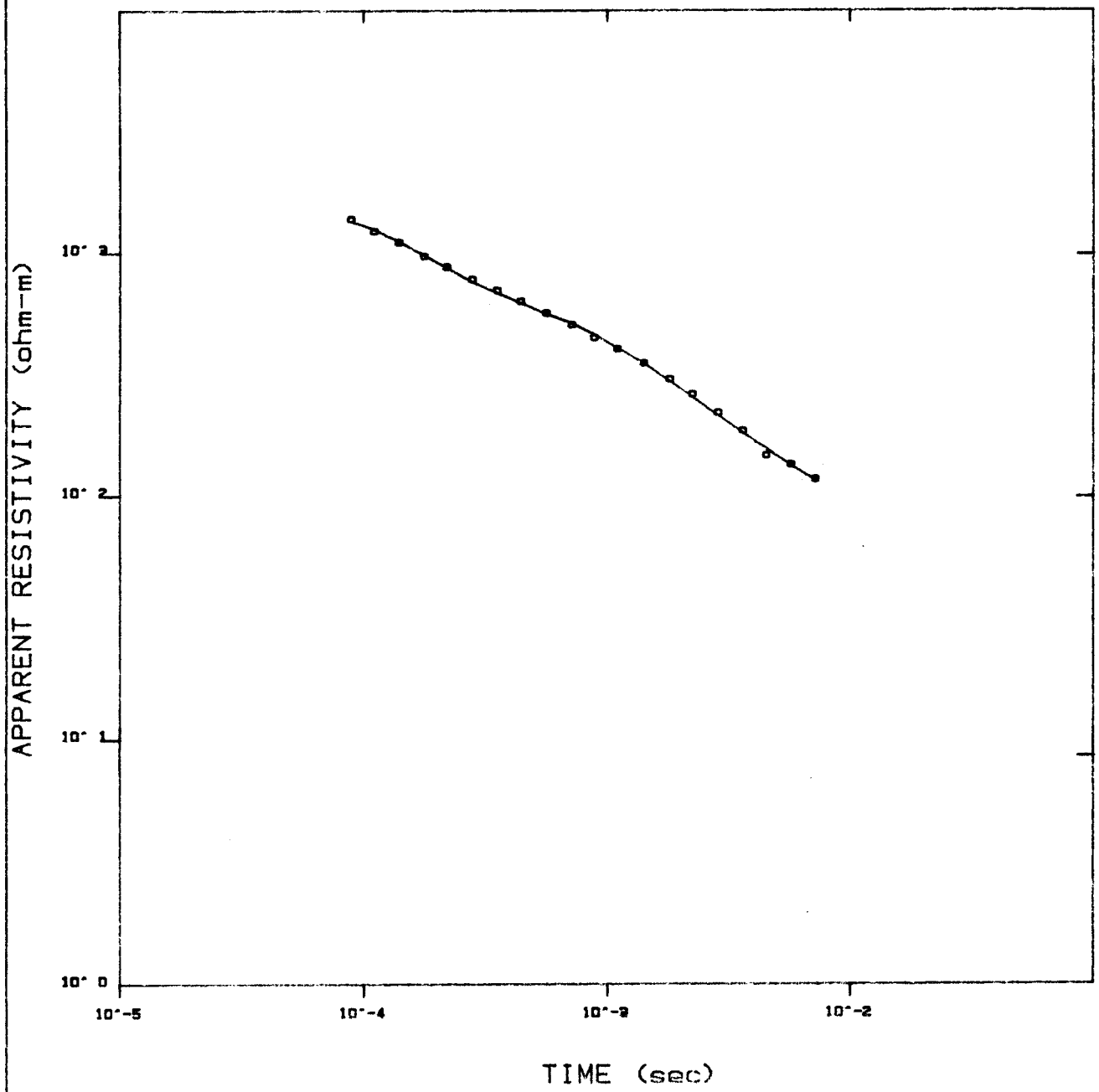
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		2100.1	6890.0		
1413.35	358.5	1741.6	5713.9	.3	.3
92.79	233.0	1508.6	4949.4	2.5	2.8
8.24					

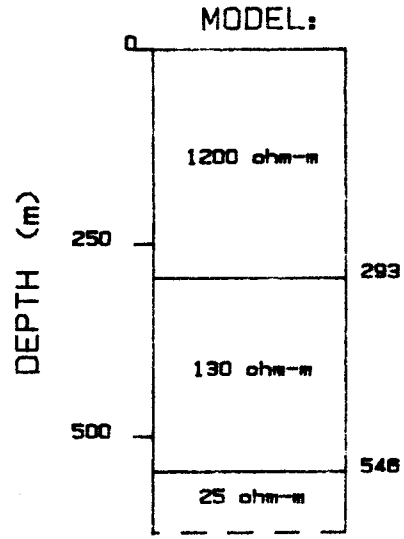
TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.40E+00	0.42E+00	-3.737	0.18E+04
0.11E-03	0.26E+00	0.26E+00	+1.779	0.16E+04
0.14E-03	0.17E+00	0.16E+00	+6.012	0.15E+04
0.18E-03	0.12E+00	0.11E+00	+5.776	0.13E+04
0.22E-03	0.81E-01	0.79E-01	+2.092	0.11E+04
0.28E-03	0.53E-01	0.54E-01	-2.114	0.10E+04
0.35E-03	0.33E-01	0.37E-01	-9.785	0.94E+03
0.44E-03	0.22E-01	0.25E-01	-11.395	0.85E+03
0.56E-03	0.16E-01	0.16E-01	+1.877	0.71E+03
0.71E-03	0.11E-01	0.98E-02	+8.476	0.62E+03
0.88E-03	0.64E-02	0.66E-02	-3.950	0.61E+03
0.11E-02	0.53E-02	0.45E-02	+19.416	0.48E+03
0.14E-02	0.30E-02	0.30E-02	+0.340	0.46E+03
0.18E-02	0.20E-02	0.22E-02	-8.929	0.40E+03
0.22E-02	0.15E-02	0.17E-02	-9.469	0.34E+03
0.29E-02	0.13E-02	0.13E-02	+2.048	0.25E+03
0.36E-02	0.99E-03	0.98E-03	+0.819	0.20E+03
0.45E-02	0.77E-03	0.77E-03	+1.173	0.17E+03
0.57E-02	0.59E-03	0.58E-03	+2.240	0.13E+03
1036 0.72E-02	0.47E-03	0.44E-03	+5.247	0.11E+03

R: 168. X: 0. Y: 0. DL: 0. REQ: 168. CF: 1.0000
TDHZ ARRAY, 20 DATA POINTS, SYSTEM: NONE DATA: L200S010
JOB #G85143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 2 STA 1 OCT. 9, 1985
RMS LOG ERROR: 3.02E-02, ANTILOG YIELDS 7.2086 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	1.00					
P 2	.00	1.00				
P 3	.00	.00	.99			
T 1	.00	.00	.00	1.00		
T 2	.00	.00	.00	.00	1.00	
F 0	.00	.00	.00	.00	.00	.00





ERROR= 3.3704 %
LOOP RADIUS= 168m

o FIELD DATA

— MODEL CURVE

THE EARTH TECHNOLOGY CORP

UNOCAL Geothermal

Medicine Lake CA

LINE: 2 STA.: 3

APPARENT RESISTIVITY CURVE

JOB #G85143 Fig.

L2005030

MODEL: 3 LAYERS

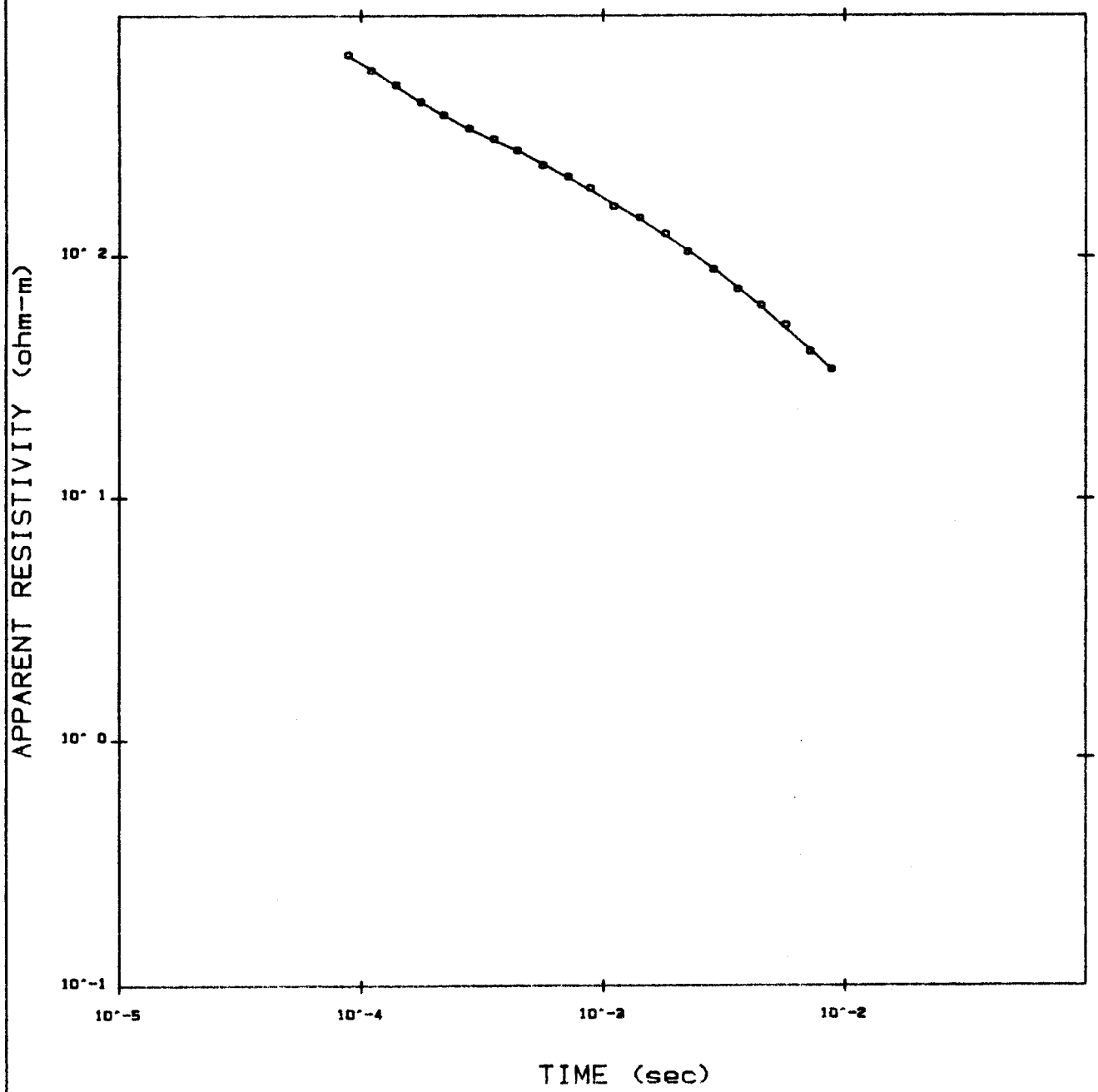
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		2133.6	7000.0		
1186.26	293.2	1840.4	6038.0	.2	.2
129.19	252.9	1587.5	5208.4	2.0	2.2
25.13					

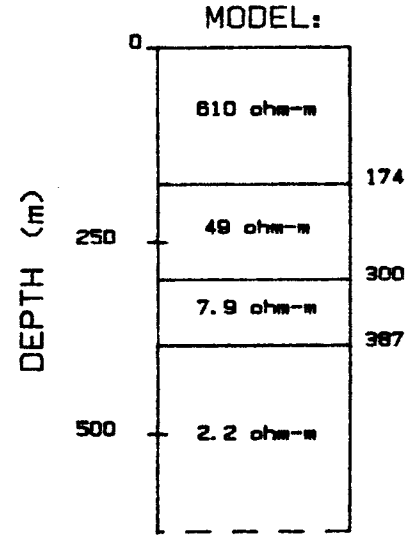
TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.59E+00	0.60E+00	-1.885	0.14E+04
0.11E-03	0.41E+00	0.39E+00	+3.184	0.12E+04
0.14E-03	0.26E+00	0.26E+00	+1.641	0.11E+04
0.18E-03	0.18E+00	0.17E+00	+2.077	0.97E+03
0.22E-03	0.12E+00	0.12E+00	-1.177	0.88E+03
0.28E-03	0.79E-01	0.81E-01	-3.039	0.78E+03
0.35E-03	0.51E-01	0.53E-01	-3.076	0.70E+03
0.44E-03	0.34E-01	0.35E-01	-1.488	0.63E+03
0.56E-03	0.22E-01	0.22E-01	-0.665	0.57E+03
0.71E-03	0.14E-01	0.14E-01	+2.792	0.51E+03
0.88E-03	0.10E-01	0.97E-02	+5.386	0.45E+03
0.11E-02	0.69E-02	0.68E-02	+1.796	0.40E+03
0.14E-02	0.45E-02	0.45E-02	+0.112	0.35E+03
0.18E-02	0.31E-02	0.32E-02	-2.464	0.30E+03
0.22E-02	0.23E-02	0.23E-02	-3.933	0.26E+03
0.29E-02	0.16E-02	0.16E-02	-3.257	0.22E+03
0.36E-02	0.11E-02	0.12E-02	-2.446	0.18E+03
0.45E-02	0.93E-03	0.84E-03	+10.364	0.15E+03
0.57E-02	0.58E-03	0.59E-03	-0.451	0.13E+03
0.72E-02	0.40E-03	0.41E-03	-0.955	0.12E+03

R: 168. X: 0. Y: 0. DL: 0. REQ: 168. CF: 1.0000
TDHZ ARRAY, 20 DATA POINTS, SYSTEM: NONE DATA: L2005030
JOB #G85143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 2 STA 3 OCT. 10, 1985
RMS LOG ERROR: 1.44E-02, ANTILOG YIELDS 3.3704 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	1.00					
P 2	.00	1.00				
P 3	.00	.00	1.00			
T 1	.00	.00	.00	1.00		
T 2	.00	.00	.00	.00	1.00	
F 0	.00	.00	.00	.00	.00	.00





ERROR= 2.1552 %
LOOP RADIUS= 168m

o FIELD DATA

— MODEL CURVE

THE EARTH TECHNOLOGY CORP

UNOCAL Geothermal

Medicine Lake CA

LINE: 2 STA.: 4

APPARENT RESISTIVITY CURVE

JOB #G85143 Fig.

L2005040

MODEL: 4 LAYERS

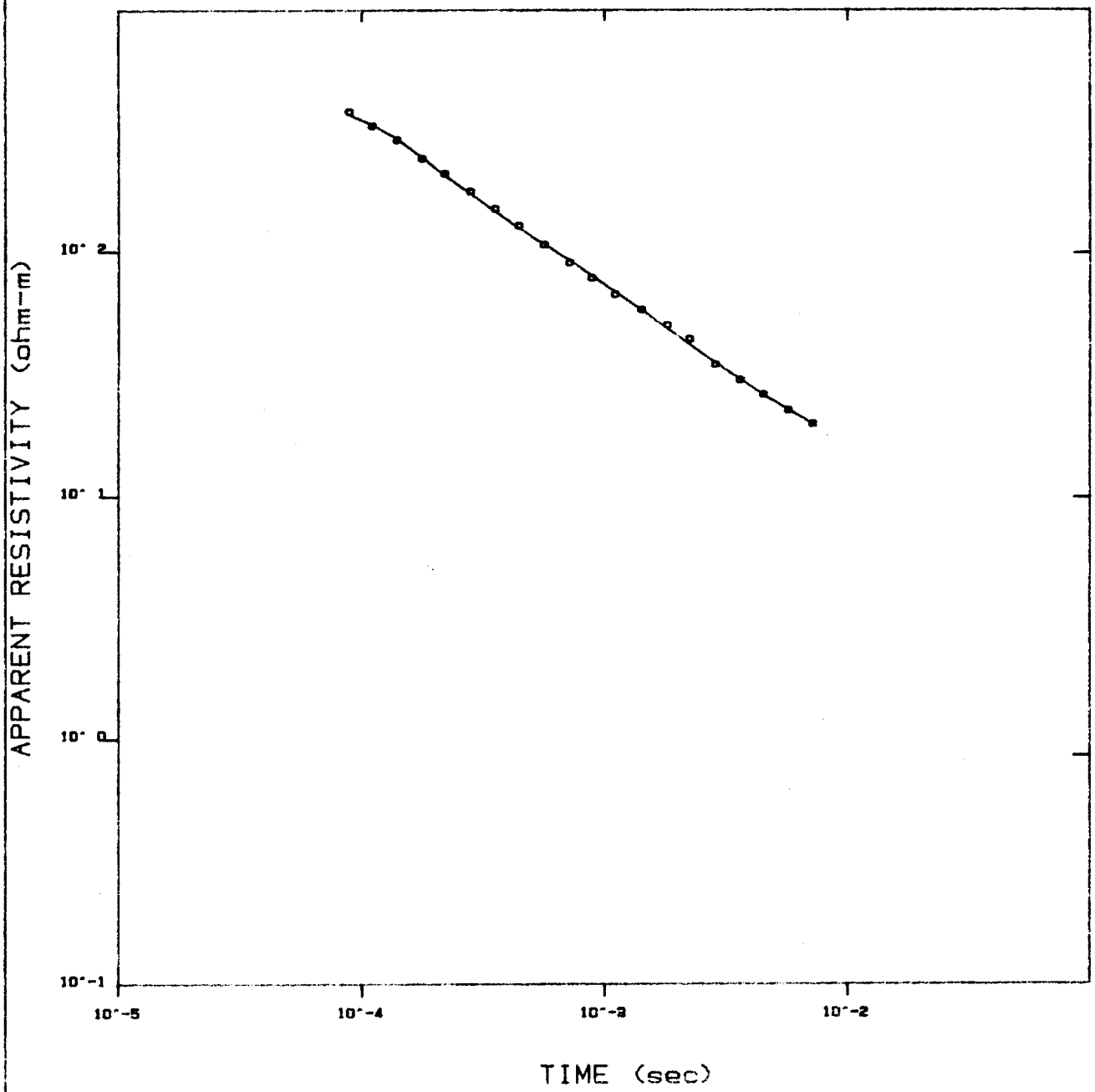
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		2078.7	6820.0		
607.36	173.7	1905.1	6250.2	.3	.3
48.71	126.6	1778.5	5834.9	2.6	2.9
7.87	86.4	1692.0	5551.3	11.0	13.9
2.17					

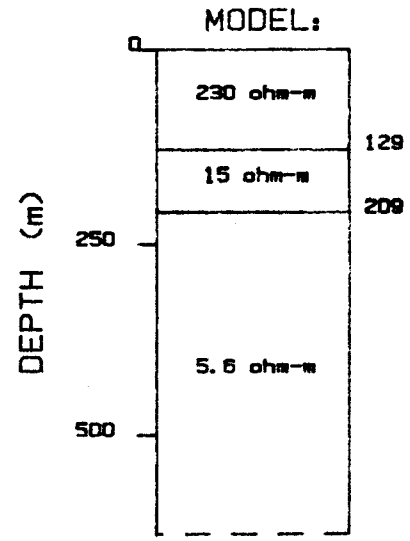
TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.17E+01	0.17E+01	-0.305	0.68E+03
0.11E-03	0.12E+01	0.12E+01	+2.003	0.59E+03
0.14E-03	0.84E+00	0.85E+00	-1.098	0.51E+03
0.18E-03	0.59E+00	0.59E+00	-0.506	0.44E+03
0.22E-03	0.41E+00	0.41E+00	+0.070	0.39E+03
0.28E-03	0.27E+00	0.27E+00	-0.108	0.34E+03
0.35E-03	0.18E+00	0.18E+00	-1.417	0.31E+03
0.44E-03	0.12E+00	0.12E+00	+0.946	0.28E+03
0.56E-03	0.80E-01	0.78E-01	+2.606	0.24E+03
0.71E-03	0.52E-01	0.53E-01	-0.864	0.21E+03
0.88E-03	0.36E-01	0.37E-01	-2.145	0.19E+03
0.11E-02	0.27E-01	0.26E-01	+3.463	0.16E+03
0.14E-02	0.17E-01	0.18E-01	-1.940	0.14E+03
0.18E-02	0.12E-01	0.12E-01	-2.268	0.12E+03
0.22E-02	0.90E-02	0.88E-02	+2.385	0.10E+03
0.29E-02	0.63E-02	0.62E-02	+1.759	0.87E+02
0.36E-02	0.47E-02	0.46E-02	+2.077	0.72E+02
0.45E-02	0.34E-02	0.34E-02	-1.884	0.62E+02
0.57E-02	0.24E-02	0.26E-02	-5.153	0.52E+02
0.72E-02	0.20E-02	0.19E-02	+2.942	0.40E+02
0.88E-02	0.15E-02	0.15E-02	+1.202	0.34E+02

R: 168. X: 0. Y: 0. DL: 0. REQ: 168. CF: 1.0000
TDHZ ARRAY, 21 DATA POINTS, SYSTEM: NONE DATA: L2005040
JOB #G85143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 2 STA 4 OCT. 10, 1985
RMS LOG ERROR: 9.26E-03, ANTILOG YIELDS 2.1552 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	P 4	T 1	T 2	T 3	F 0
P 1	1.00							
P 2	.00	.99						
P 3	.00	-.01	.97					
P 4	.00	-.01	-.03	.95				
T 1	.00	.00	.00	.00	1.00			
T 2	.00	.00	.00	.00	.00	1.00		
T 3	.00	.00	.00	.00	.00	.00	1.00	
F 0	.00	.00	.00	.00	.00	.00	.00	.00





ERROR= 2.9250 %
LOOP RADIUS= 168m

o FIELD DATA

— MODEL CURVE

THE EARTH TECHNOLOGY CORP.

UNOCAL Geothermal

Medicine Lake CA

LINE: 2 STA.: 5

APPARENT RESISTIVITY CURVE

JOB #G85143 Fig.

L200S050

MODEL: 3 LAYERS

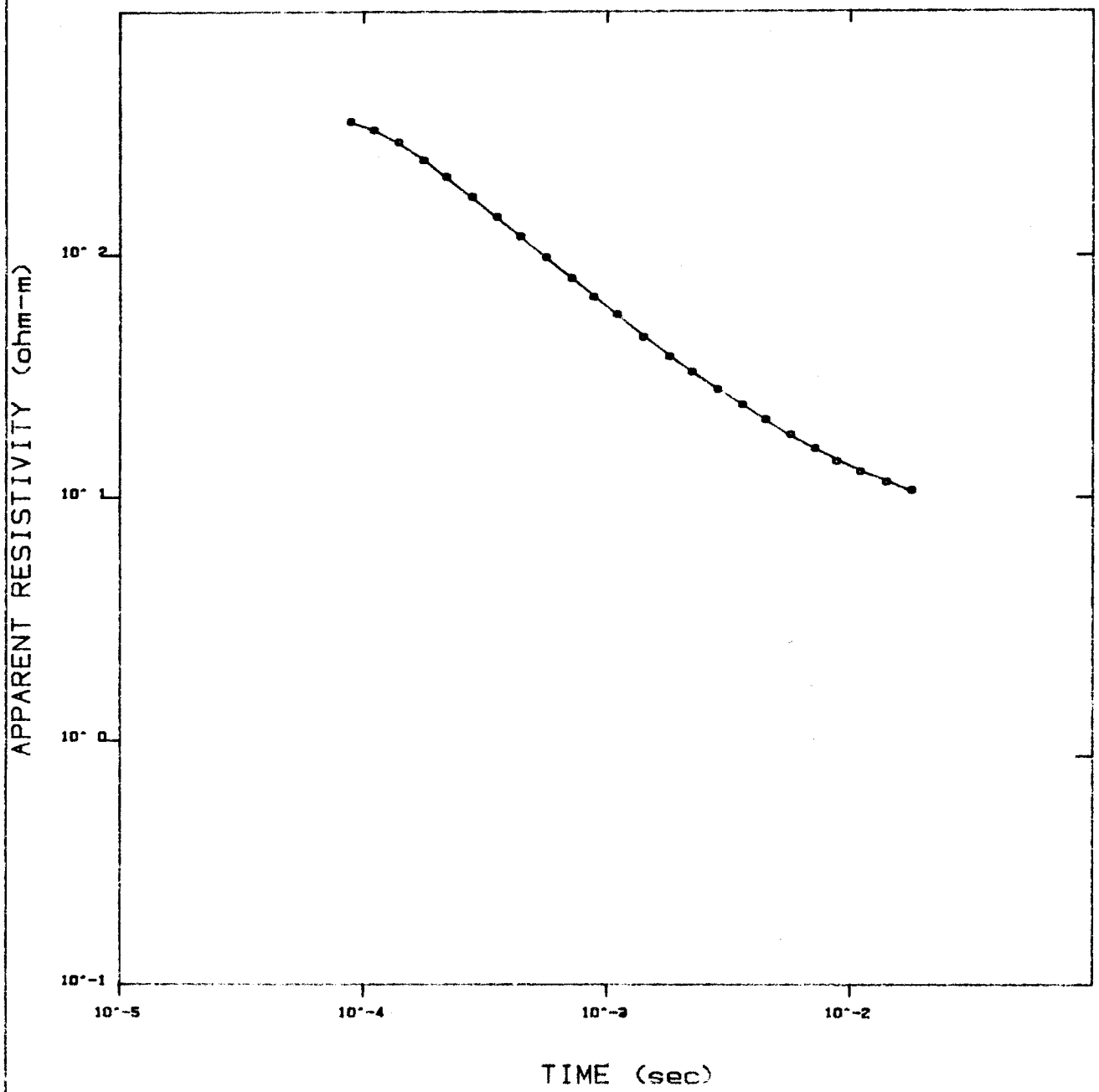
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		2048.3	6720.0		
234.27	129.3	1919.0	6295.8	.6	.6
14.78	79.5	1839.5	6035.0	5.4	5.9
5.55					

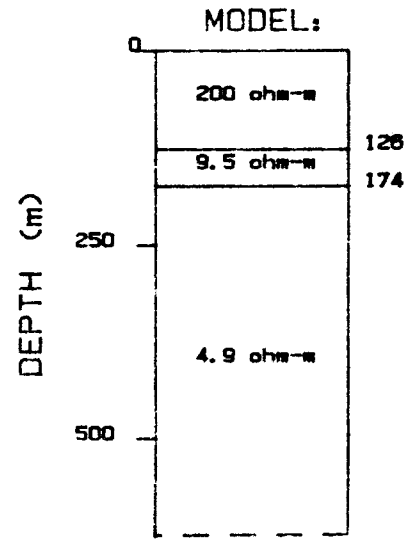
TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.41E+01	0.43E+01	-2.755	0.38E+03
0.11E-03	0.29E+01	0.29E+01	+1.800	0.33E+03
0.14E-03	0.20E+01	0.19E+01	+2.856	0.29E+03
0.18E-03	0.14E+01	0.14E+01	+2.387	0.24E+03
0.22E-03	0.10E+01	0.11E+01	-1.316	0.21E+03
0.28E-03	0.73E+00	0.74E+00	-2.489	0.18E+03
0.35E-03	0.51E+00	0.53E+00	-3.262	0.15E+03
0.44E-03	0.38E+00	0.39E+00	-2.605	0.13E+03
0.56E-03	0.27E+00	0.27E+00	+0.859	0.11E+03
0.71E-03	0.19E+00	0.19E+00	+3.431	0.90E+02
0.88E-03	0.14E+00	0.14E+00	+3.115	0.78E+02
0.11E-02	0.10E+00	0.99E-01	+4.001	0.66E+02
0.14E-02	0.69E-01	0.69E-01	+0.100	0.57E+02
0.18E-02	0.47E-01	0.49E-01	-4.191	0.49E+02
0.22E-02	0.33E-01	0.36E-01	-6.842	0.43E+02
0.29E-02	0.26E-01	0.25E-01	+2.597	0.34E+02
0.36E-02	0.18E-01	0.18E-01	+1.546	0.30E+02
0.45E-02	0.13E-01	0.13E-01	+0.356	0.26E+02
0.57E-02	0.86E-02	0.85E-02	+0.890	0.22E+02
0.72E-02	0.58E-02	0.58E-02	+0.603	0.20E+02

R: 168. X: 0. Y: 0. DL: 0. REQ: 168. CF: 1.0000
TDHZ ARRAY, 20 DATA POINTS, SYSTEM: NONE DATA: L200S050
JOB #685143 UNOCAL GEOTHERMAL -- MT. SHASTA CALIF
LINE 2 STA 5 OCT. 10, 1985
RMS LOG ERROR: 1.25E-02, ANTILOG YIELDS 2.9250 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	1.00					
P 2	.00	1.00				
P 3	.00	.00	1.00			
T 1	.00	.00	.00	1.00		
T 2	.00	.00	.00	.00	1.00	
F 0	.00	.00	.00	.00	.00	.00





ERROR= 1.5430 %
LOOP RADIUS= 168m

o FIELD DATA

— MODEL CURVE

THE EARTH TECHNOLOGY CORP.

UNOCAL Geothermal

Medicine Lake CA

LINE: 2 STA.: 6

APPARENT RESISTIVITY CURVE

JOB #G85143 Fig.

L200S060

MODEL: 3 LAYERS

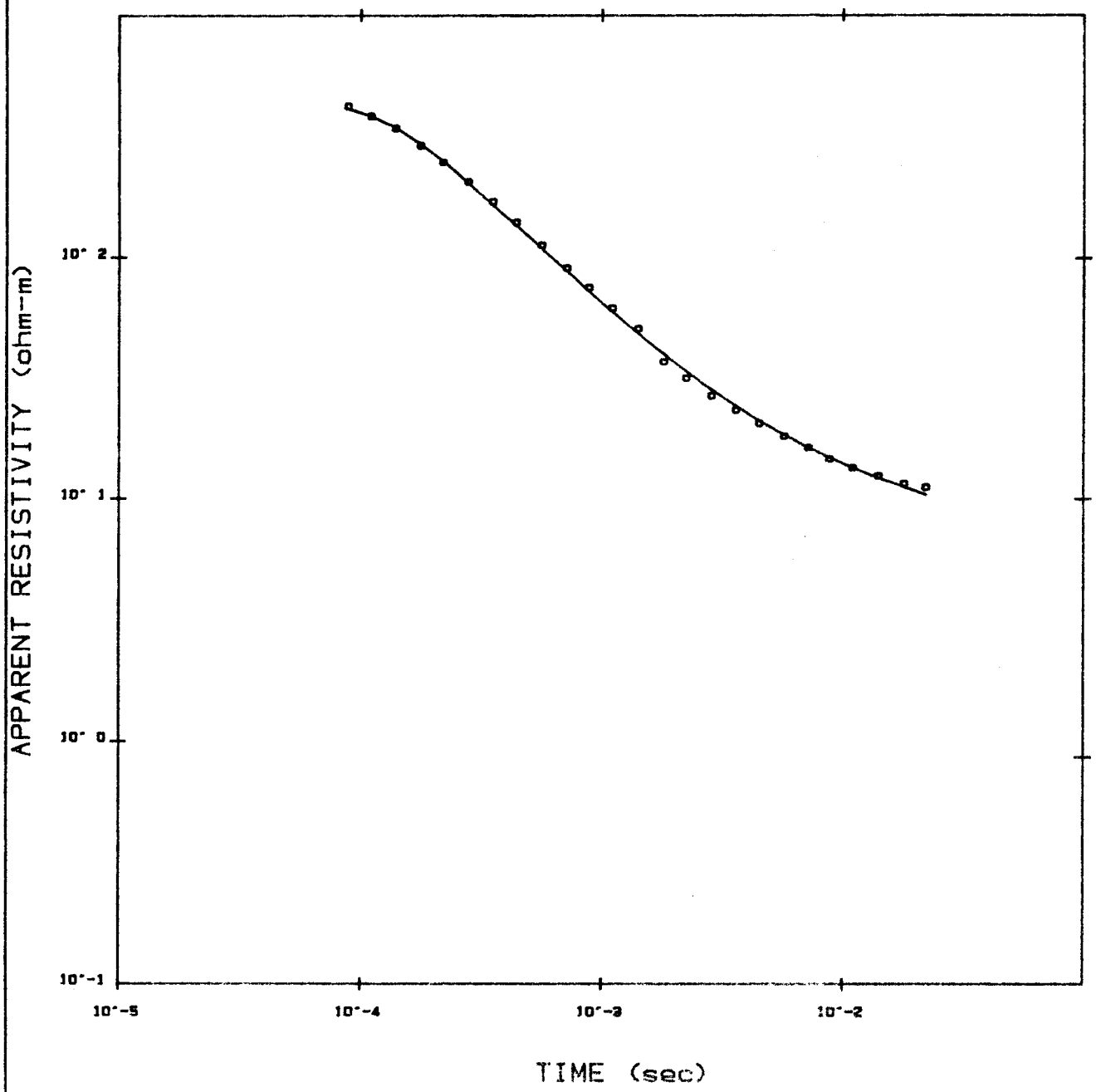
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		2045.2	6710.0		
203.71	125.6	1919.6	6298.0	.6	.6
9.52	48.4	1871.3	6139.3	5.1	5.7
4.87					

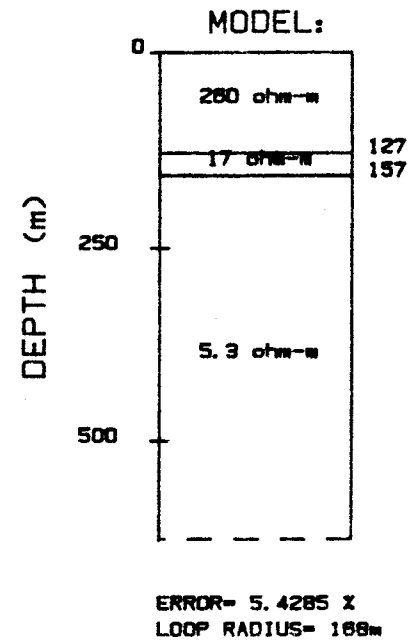
TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.46E+01	0.46E+01	+0.108	0.35E+03
0.11E-03	0.30E+01	0.30E+01	+0.853	0.32E+03
0.14E-03	0.20E+01	0.20E+01	-1.508	0.29E+03
0.18E-03	0.14E+01	0.14E+01	+1.910	0.24E+03
0.22E-03	0.10E+01	0.11E+01	-0.070	0.21E+03
0.28E-03	0.76E+00	0.77E+00	-1.387	0.17E+03
0.35E-03	0.56E+00	0.56E+00	-0.425	0.14E+03
0.44E-03	0.42E+00	0.42E+00	+0.139	0.12E+03
0.56E-03	0.31E+00	0.31E+00	-0.162	0.97E+02
0.71E-03	0.23E+00	0.23E+00	+0.965	0.80E+02
0.88E-03	0.18E+00	0.17E+00	+0.895	0.67E+02
0.11E-02	0.13E+00	0.13E+00	-1.597	0.57E+02
0.14E-02	0.97E-01	0.95E-01	+2.800	0.46E+02
0.18E-02	0.70E-01	0.69E-01	+1.379	0.38E+02
0.22E-02	0.51E-01	0.51E-01	+0.367	0.33E+02
0.29E-02	0.35E-01	0.36E-01	-0.972	0.28E+02
0.36E-02	0.25E-01	0.25E-01	-2.651	0.24E+02
0.45E-02	0.17E-01	0.18E-01	-2.062	0.21E+02
0.57E-02	0.12E-01	0.12E-01	-2.004	0.18E+02
0.72E-02	0.81E-02	0.81E-02	-0.276	0.16E+02
0.88E-02	0.59E-02	0.57E-02	+3.042	0.14E+02
0.11E-01	0.39E-02	0.39E-02	+1.678	0.13E+02
0.14E-01	0.24E-02	0.24E-02	+1.537	0.12E+02
0.18E-01	0.15E-02	0.15E-02	-1.646	0.11E+02

R: 168. X: 0. Y: 0. DL: 0. REQ: 168. CF: 1.0000
TDH7 ARRAY, 24 DATA POINTS, SYSTEM: NONE DATA: L200S060
JOB #685143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 2 STA 6 OCT. 10, 1985
RMS LOG ERROR: 6.65E-03, ANTILOG YIELDS 1.5430 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	1.00					
P 2	.00	1.00				
P 3	.00	.00	1.00			
T 1	.00	.00	.00	1.00		
T 2	.00	.00	.00	.00	1.00	
F 0	.00	.00	.00	.00	.00	.00





o FIELD DATA

— MODEL CURVE

THE EARTH TECHNOLOGY CORP

UNOCAL Geothermal

Medicine Lake CA

LINE: 2 STA.: 7

APPARENT RESISTIVITY CURVE

JOB #G85143 Fig.

L200S070

MODEL: 3 LAYERS

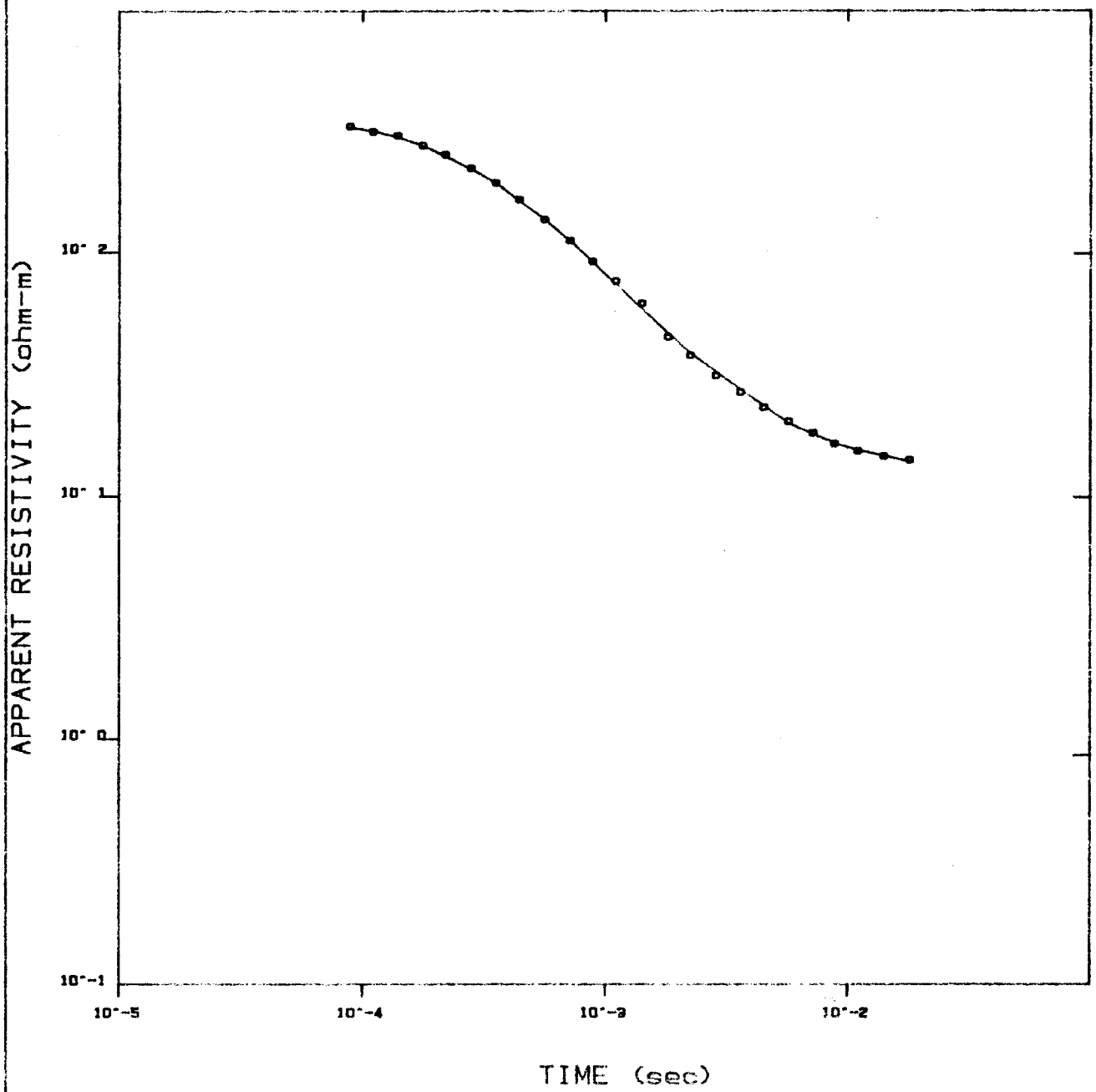
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		2048.3	6720.0		
260.59	127.1	1921.1	6303.0	.5	.5
16.54	29.6	1891.6	6205.9	1.8	2.3
5.32					

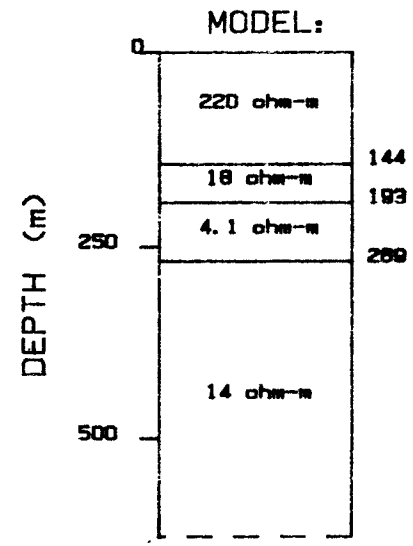
TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.35E+01	0.36E+01	-2.086	0.42E+03
0.11E-03	0.23E+01	0.23E+01	+0.211	0.38E+03
0.14E-03	0.15E+01	0.15E+01	+2.118	0.34E+03
0.18E-03	0.11E+01	0.11E+01	+2.728	0.29E+03
0.22E-03	0.80E+00	0.79E+00	+2.194	0.25E+03
0.28E-03	0.58E+00	0.58E+00	+0.668	0.20E+03
0.35E-03	0.43E+00	0.44E+00	-2.697	0.17E+03
0.44E-03	0.33E+00	0.35E+00	-4.466	0.14E+03
0.56E-03	0.25E+00	0.26E+00	-4.594	0.11E+03
0.71E-03	0.19E+00	0.20E+00	-4.854	0.90E+02
0.88E-03	0.15E+00	0.16E+00	-5.529	0.75E+02
0.11E-02	0.12E+00	0.12E+00	-4.718	0.61E+02
0.14E-02	0.84E-01	0.89E-01	-6.418	0.50E+02
0.18E-02	0.73E-01	0.65E-01	+11.803	0.37E+02
0.22E-02	0.54E-01	0.49E-01	+10.143	0.32E+02
0.29E-02	0.37E-01	0.34E-01	+9.590	0.27E+02
0.36E-02	0.26E-01	0.24E-01	+6.493	0.23E+02
0.45E-02	0.18E-01	0.17E-01	+3.801	0.21E+02
0.57E-02	0.12E-01	0.11E-01	+2.726	0.18E+02
0.72E-02	0.77E-02	0.77E-02	+0.485	0.16E+02
0.88E-02	0.55E-02	0.54E-02	+2.238	0.15E+02
0.11E-01	0.36E-02	0.36E-02	+0.616	0.13E+02
0.14E-01	0.22E-02	0.22E-02	-2.514	0.12E+02
0.18E-01	0.13E-02	0.14E-02	-4.973	0.11E+02
0.22E-01	0.83E-03	0.91E-03	-9.607	0.11E+02

R: 168. X: 0. Y: 0. DL: 0. REQ: 168. CF: 1.0000
TDHZ ARRAY, 25 DATA POINTS, SYSTEM: NONE DATA: L200S070
JOB #G85143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 2 STA 7 OCT. 10, 1985
RMS LOG ERROR: 2.30E-02, ANTILOG YIELDS 5.4285 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	.97					
P 2	-.07	.10				
P 3	.00	-.01	.99			
T 1	.01	.10	.00	.99		
T 2	-.06	-.20	.02	.04	.80	
F 0	.00	.00	.00	.00	.00	.00





ERROR= 2.3525 %
LOOP RADIUS= 168m

o FIELD DATA

— MODEL CURVE

THE EARTH TECHNOLOGY CORP.

UNOCAL Geothermal

Medicine Lake CA

LINE: 2 STA.: 8

APPARENT RESISTIVITY CURVE

JOB #C85143 Fig.

L2005080

MODEL: 4 LAYERS

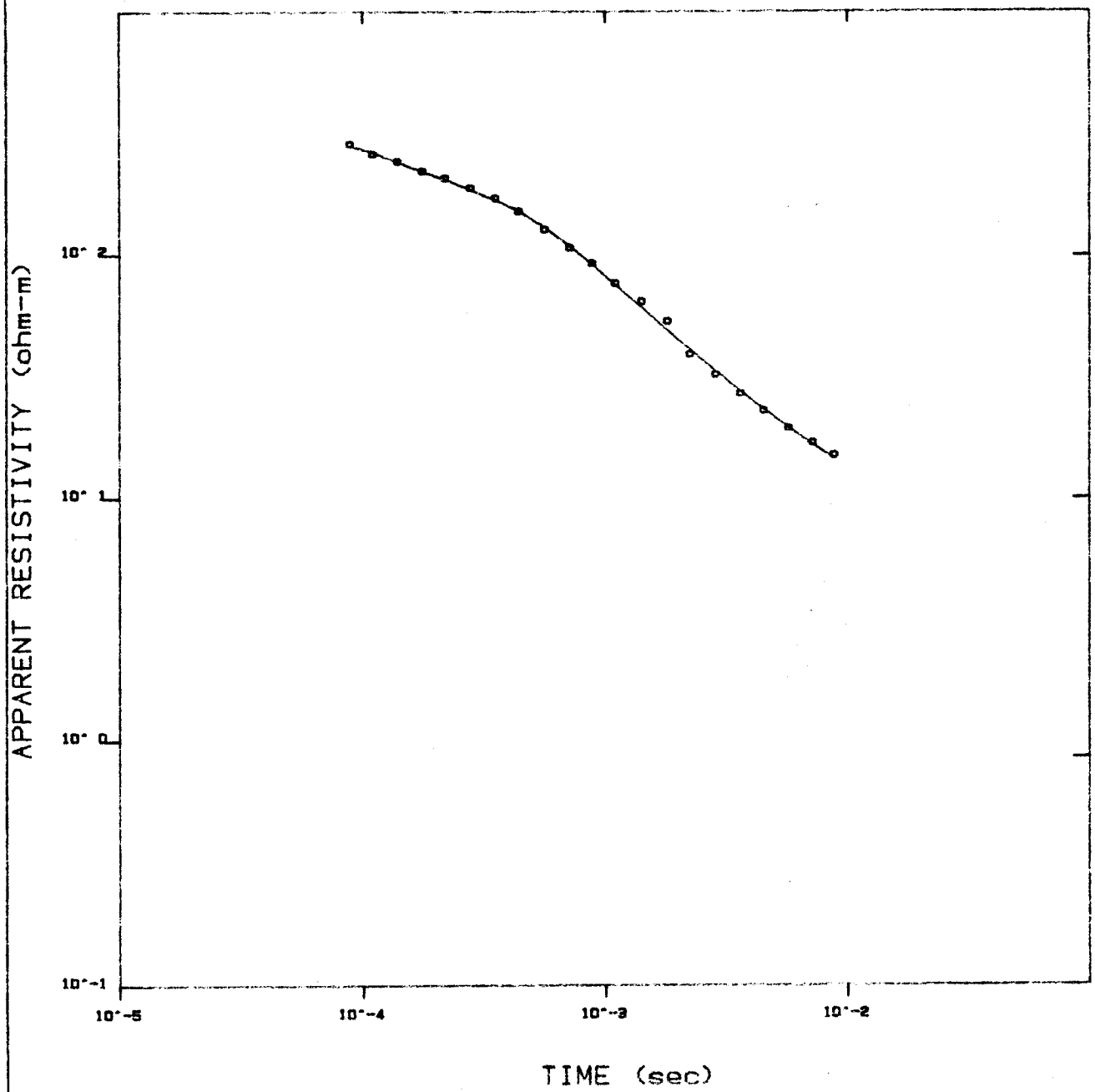
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		2023.9	6640.0		
216.73	143.8	1880.1	6168.4	.7	.7
18.01	49.1	1831.0	6007.3	2.7	3.4
4.11	76.0	1755.1	5758.1	18.5	21.9
13.64					

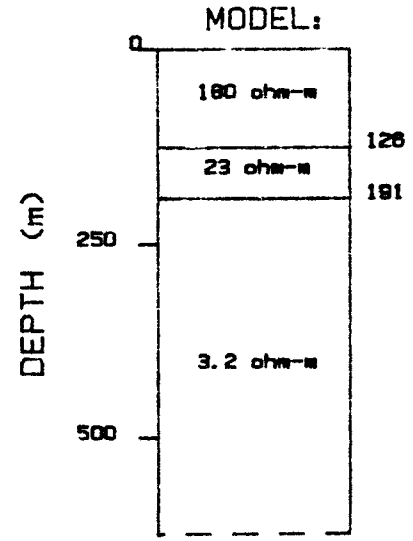
TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.50E+01	0.50E+01	-0.503	0.33E+03
0.11E-03	0.31E+01	0.31E+01	+1.313	0.32E+03
0.14E-03	0.19E+01	0.19E+01	-0.891	0.30E+03
0.18E-03	0.12E+01	0.12E+01	+1.217	0.28E+03
0.22E-03	0.77E+00	0.79E+00	-1.449	0.25E+03
0.28E-03	0.51E+00	0.51E+00	-0.345	0.22E+03
0.35E-03	0.35E+00	0.35E+00	+0.369	0.19E+03
0.44E-03	0.26E+00	0.25E+00	+0.879	0.17E+03
0.56E-03	0.19E+00	0.18E+00	+0.574	0.14E+03
0.71E-03	0.14E+00	0.14E+00	+0.841	0.11E+03
0.88E-03	0.11E+00	0.11E+00	+0.335	0.92E+02
0.11E-02	0.84E-01	0.87E-01	-2.845	0.76E+02
0.14E-02	0.63E-01	0.67E-01	-6.134	0.61E+02
0.18E-02	0.55E-01	0.52E-01	+6.528	0.44E+02
0.22E-02	0.42E-01	0.40E-01	+3.401	0.37E+02
0.29E-02	0.30E-01	0.30E-01	+1.076	0.31E+02
0.36E-02	0.21E-01	0.21E-01	-1.015	0.27E+02
0.45E-02	0.15E-01	0.15E-01	-2.128	0.23E+02
0.57E-02	0.10E-01	0.10E-01	-2.245	0.20E+02
0.72E-02	0.66E-02	0.66E-02	-0.987	0.18E+02
0.88E-02	0.46E-02	0.45E-02	+1.640	0.16E+02
0.11E-01	0.29E-02	0.29E-02	+1.378	0.15E+02
0.14E-01	0.17E-02	0.17E-02	+1.404	0.15E+02
0.18E-01	0.97E-03	0.98E-03	-1.495	0.14E+02

R: 168. X: 0. Y: 0. DL: 0. REQ: 168. CF: 1.0000
TDHZ ARRAY, 24 DATA POINTS, SYSTEM: NONE DATA: L2005080
JOB #685143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 2 STA 8 OCT. 10, 1985
RMS LOG ERROR: 1.01E-02, ANTILOG YIELDS 2.3525 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	P 4	T 1	T 2	T 3	F 0
P 1	1.00							
P 2	.00	.95						
P 3	.00	-.01	1.00					
P 4	.00	-.01	.00	.98				
T 1	.00	.01	.00	.00	1.00			
T 2	.00	-.01	.00	.00	.00	1.00		
T 3	.00	-.02	-.01	-.02	.00	.00	.98	
F 0	.00	.00	.00	.00	.00	.00	.00	.00





ERROR= 4.4638 %
LOOP RADIUS= 168m

o FIELD DATA

— MODEL CURVE

THE EARTH TECHNOLOGY CORP.

UNOCAL Geothermal

Medicine Lake CA

LINE: 2 STA.: 9

APPARENT RESISTIVITY CURVE

JOB #G85143 Fig.

L2005090

MODEL: 3 LAYERS

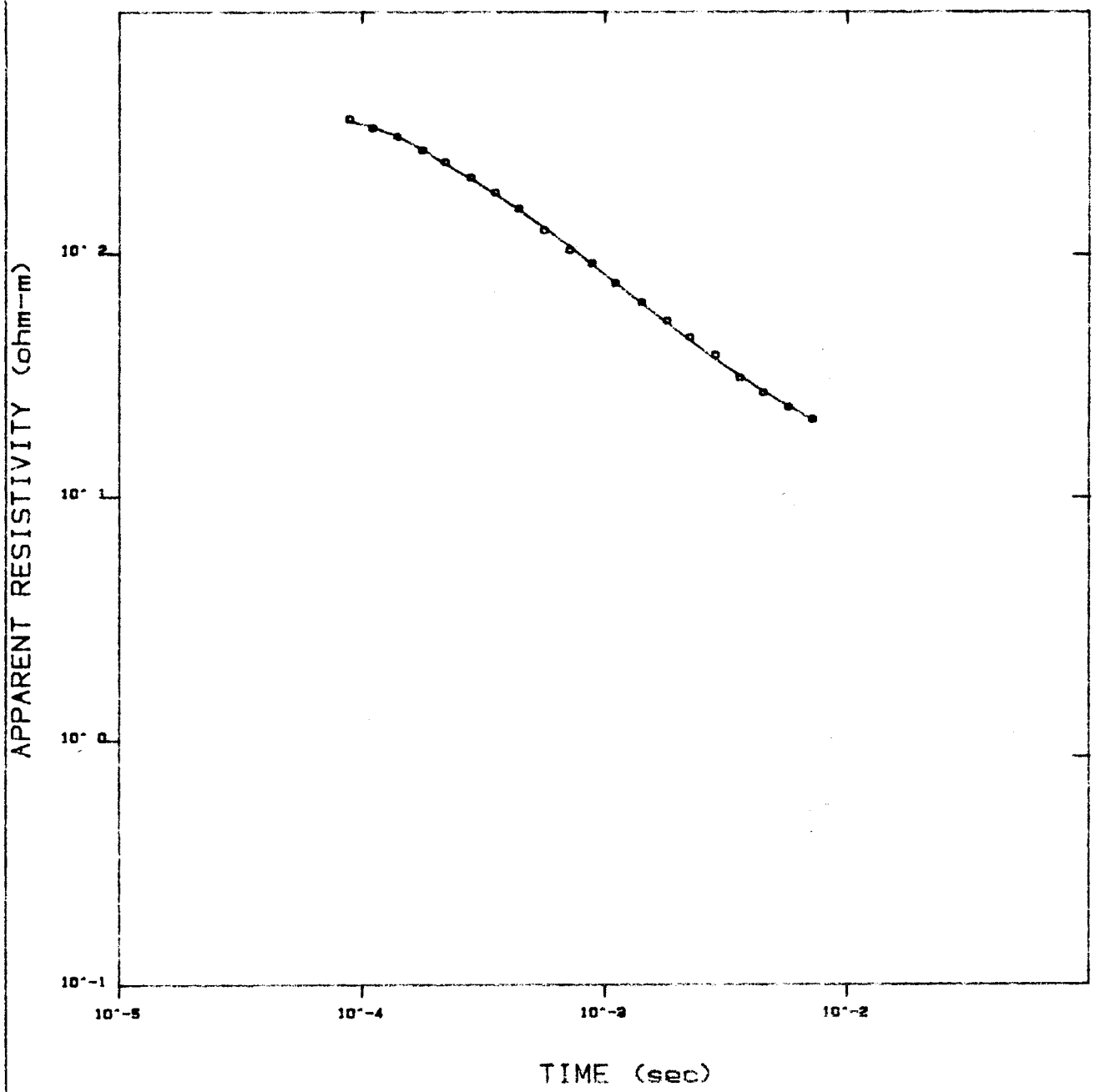
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		1999.5	6560.0		
183.11	125.5	1874.0	6148.2	.7	.7
23.38	65.8	1808.2	5932.3	2.8	3.5
3.18					

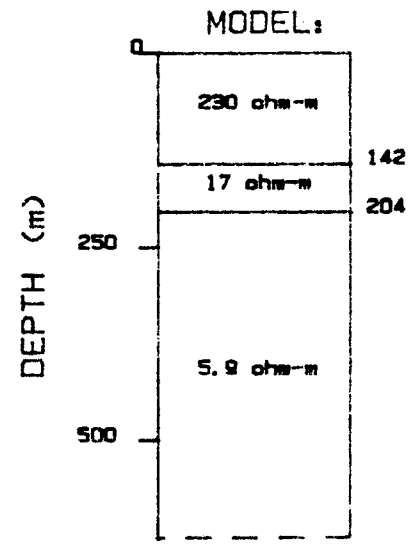
TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.63E+01	0.64E+01	-1.951	0.29E+03
0.11E-03	0.42E+01	0.41E+01	+3.133	0.26E+03
0.14E-03	0.26E+01	0.26E+01	-0.046	0.24E+03
0.18E-03	0.16E+01	0.16E+01	+0.284	0.22E+03
0.22E-03	0.11E+01	0.11E+01	-0.560	0.21E+03
0.28E-03	0.67E+00	0.68E+00	-1.730	0.19E+03
0.35E-03	0.43E+00	0.44E+00	-1.982	0.17E+03
0.44E-03	0.29E+00	0.29E+00	+0.851	0.15E+03
0.56E-03	0.21E+00	0.20E+00	+3.979	0.13E+03
0.71E-03	0.15E+00	0.14E+00	+3.915	0.11E+03
0.88E-03	0.11E+00	0.11E+00	-0.466	0.92E+02
0.11E-02	0.83E-01	0.85E-01	-1.270	0.76E+02
0.14E-02	0.58E-01	0.63E-01	-7.273	0.64E+02
0.18E-02	0.42E-01	0.47E-01	-11.539	0.53E+02
0.22E-02	0.39E-01	0.37E-01	+7.825	0.39E+02
0.29E-02	0.29E-01	0.27E-01	+6.470	0.32E+02
0.36E-02	0.21E-01	0.20E-01	+3.923	0.27E+02
0.45E-02	0.15E-01	0.15E-01	+3.255	0.23E+02
0.57E-02	0.11E-01	0.11E-01	+1.051	0.19E+02
0.72E-02	0.74E-02	0.76E-02	-1.901	0.17E+02
0.88E-02	0.53E-02	0.55E-02	-3.654	0.15E+02

R: 168. X: 0. Y: 0. DL: 0. REQ: 168. CF: 1.0000
TDHZ ARRAY. 21 DATA POINTS, SYSTEM: NONE DATA: L2005090
JOB #G85143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 2 STA 9 OCT. 10, 1985
RMS LOG ERROR: 1.90E-02, ANTILOG YIELDS 4.4638 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	1.00					
P 2	.00	.98				
P 3	.00	.00	1.00			
T 1	.00	.00	.00	1.00		
T 2	.00	-.01	.00	.00	1.00	
F 0	.00	.00	.00	.00	.00	.00





ERROR= 2.7381 %
LOOP RADIUS= 168m

o FIELD DATA

—— MODEL CURVE

THE EARTH TECHNOLOGY CORP.

UNOCAL Geothermal

Medicine Lake CA

LINE: 2 STA.: 10

APPARENT RESISTIVITY CURVE

JOB #G85143 Fig.

L2005100

MODEL: 3 LAYERS

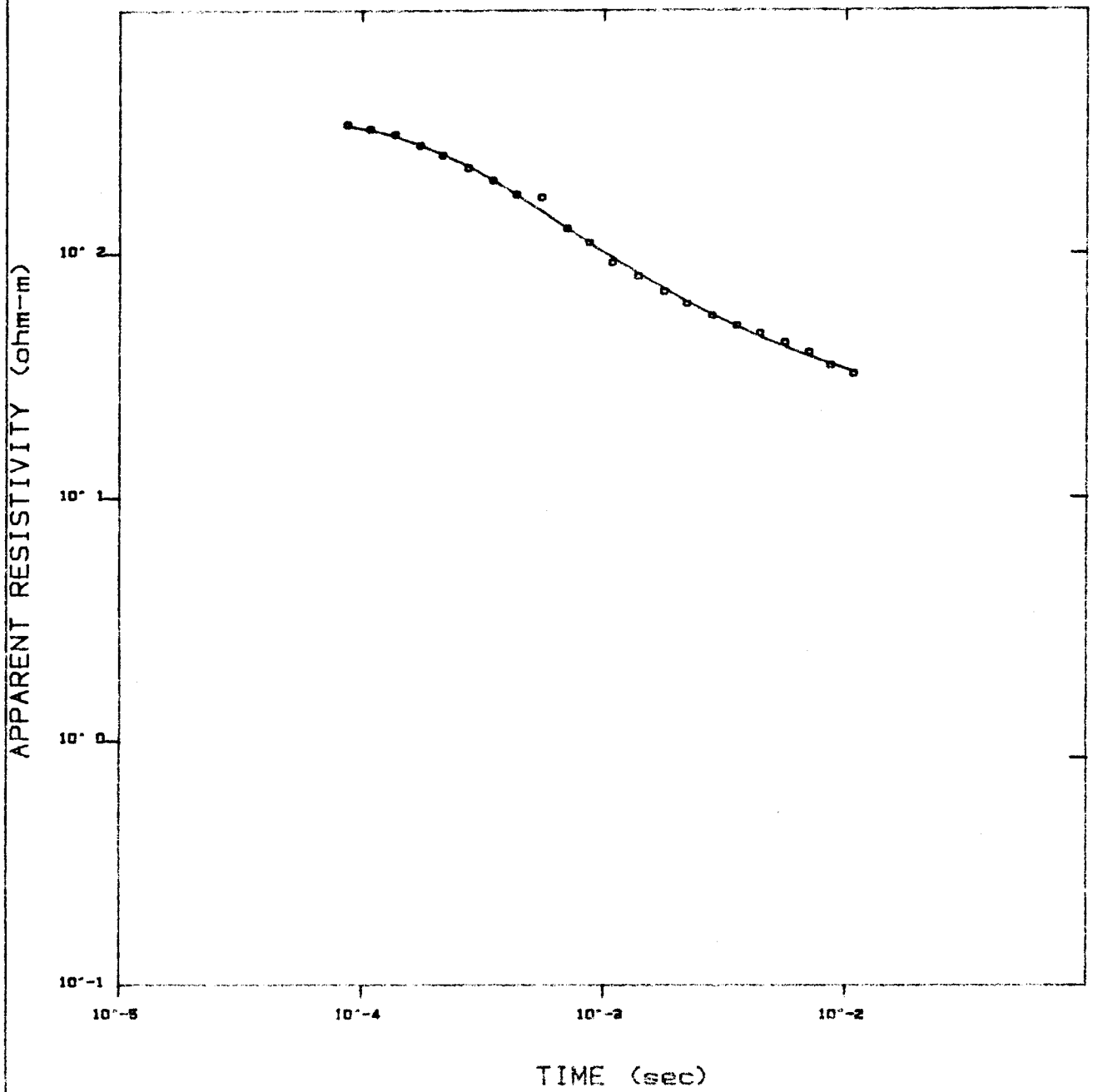
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		1987.3	6520.0		
234.37	142.0	1845.3	6054.0	.6	.6
17.40	61.5	1783.8	5852.4	3.5	4.1
5.90					

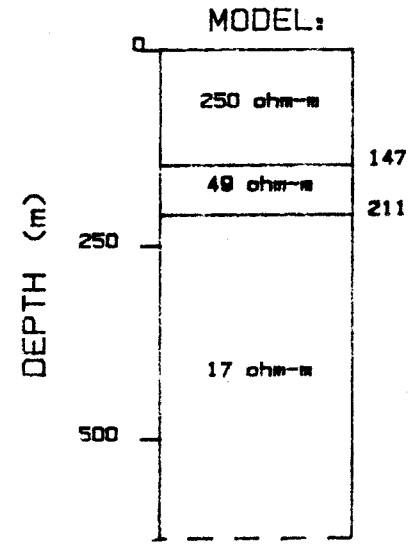
TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.44E+01	0.45E+01	-1.799	0.36E+03
0.11E-03	0.29E+01	0.28E+01	+1.824	0.33E+03
0.14E-03	0.18E+01	0.18E+01	+1.613	0.31E+03
0.18E-03	0.12E+01	0.12E+01	+0.886	0.27E+03
0.22E-03	0.84E+00	0.86E+00	-2.101	0.24E+03
0.28E-03	0.57E+00	0.58E+00	-1.404	0.21E+03
0.35E-03	0.40E+00	0.40E+00	-1.808	0.18E+03
0.44E-03	0.29E+00	0.29E+00	-1.440	0.15E+03
0.56E-03	0.21E+00	0.21E+00	+3.567	0.12E+03
0.71E-03	0.16E+00	0.15E+00	+5.894	0.10E+03
0.88E-03	0.11E+00	0.11E+00	-0.621	0.91E+02
0.11E-02	0.85E-01	0.84E-01	+1.603	0.75E+02
0.14E-02	0.59E-01	0.60E-01	-0.912	0.63E+02
0.18E-02	0.42E-01	0.43E-01	-3.037	0.53E+02
0.22E-02	0.31E-01	0.32E-01	-3.874	0.45E+02
0.29E-02	0.22E-01	0.23E-01	-5.177	0.38E+02
0.36E-02	0.17E-01	0.16E-01	+3.610	0.31E+02
0.45E-02	0.12E-01	0.12E-01	+2.490	0.27E+02
0.57E-02	0.80E-02	0.78E-02	+1.799	0.24E+02
0.72E-02	0.53E-02	0.53E-02	-0.267	0.21E+02

R: 168. X: 0. Y: 0. DL: 0. REQ: 168. CF: 1.0000
TDHZ ARRAY, 20 DATA POINTS, SYSTEM: NONE DATA: L2005100
JOB #685143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 2 STA 10 OCT. 10, 1985
RMS LOG ERROR: 1.17E-02, ANTILOG YIELDS 2.7381 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	1.00					
P 2	.00	.99				
P 3	.00	.00	1.00			
T 1	.00	.00	.00	1.00		
T 2	.00	.00	.00	.00	1.00	
F 0	.00	.00	.00	.00	.00	.00





ERROR= 5.3953 %
LOOP RADIUS= 168m

o FIELD DATA

—— MODEL CURVE

THE EARTH TECHNOLOGY CORP.

UNOCAL Geothermal

Medicine Lake CA

LINE: 2 STA.: 11

APPARENT RESISTIVITY CURVE

JOB #G85143 Fig.

L200S110

MODEL: 3 LAYERS

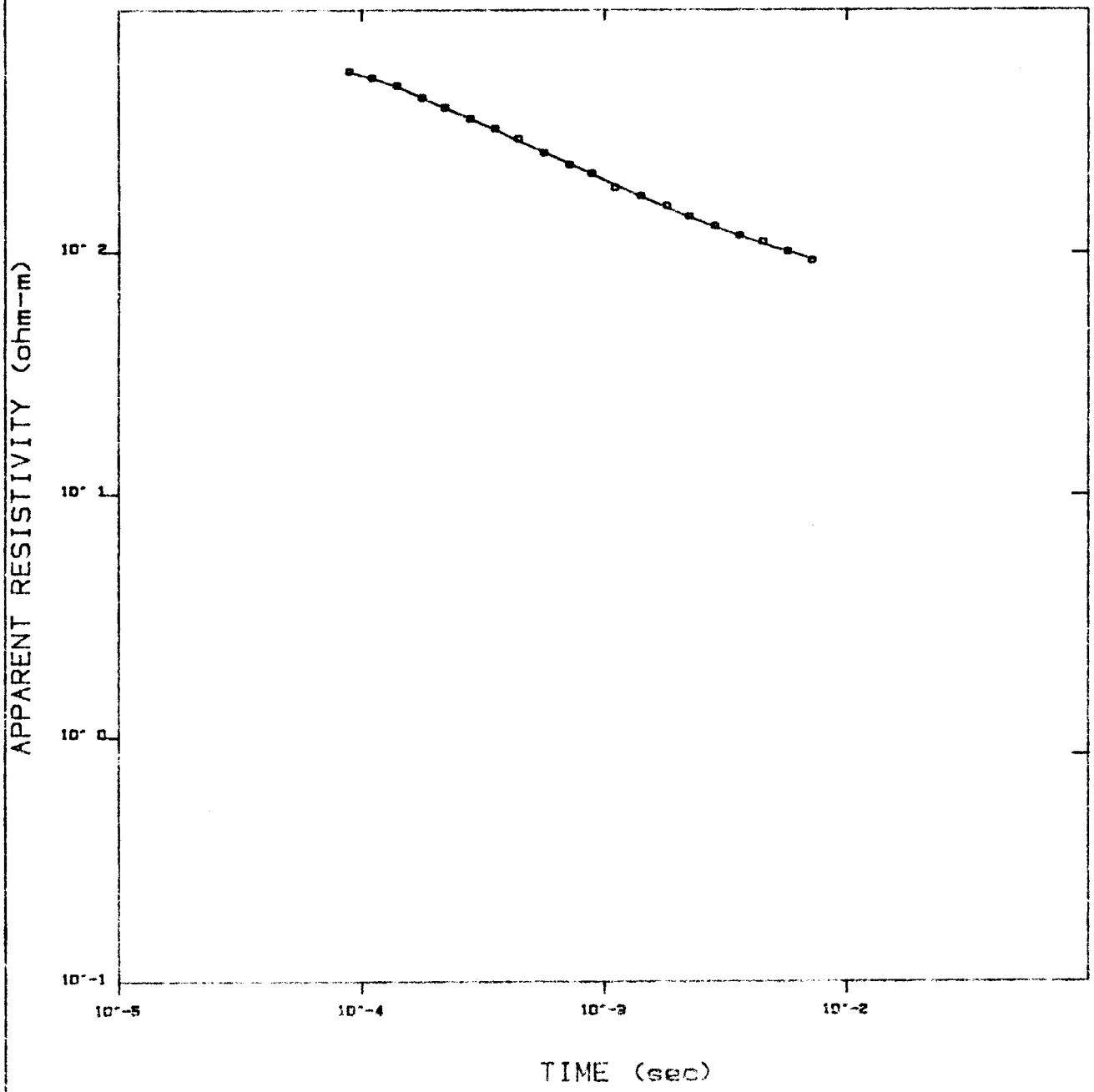
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		1956.8	6420.0		
252.27	147.3	1809.6	5936.9	.6	.6
49.24	63.5	1746.0	5728.4	1.3	1.9
17.29					

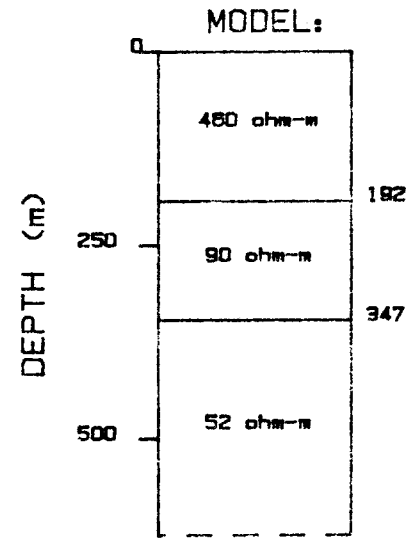
TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.48E+01	0.48E+01	-0.573	0.34E+03
0.11E-03	0.30E+01	0.30E+01	-1.036	0.33E+03
0.14E-03	0.18E+01	0.18E+01	-1.580	0.31E+03
0.18E-03	0.11E+01	0.11E+01	+1.612	0.28E+03
0.22E-03	0.77E+00	0.75E+00	+2.144	0.26E+03
0.28E-03	0.50E+00	0.48E+00	+3.618	0.23E+03
0.35E-03	0.33E+00	0.33E+00	+1.167	0.20E+03
0.44E-03	0.23E+00	0.23E+00	+0.222	0.18E+03
0.56E-03	0.13E+00	0.16E+00	-17.317	0.17E+03
0.71E-03	0.11E+00	0.11E+00	+1.410	0.13E+03
0.88E-03	0.82E-01	0.82E-01	+0.137	0.11E+03
0.11E-02	0.64E-01	0.59E-01	+8.216	0.91E+02
0.14E-02	0.41E-01	0.40E-01	+4.556	0.80E+02
0.18E-02	0.28E-01	0.27E-01	+4.914	0.69E+02
0.22E-02	0.20E-01	0.19E-01	+3.914	0.62E+02
0.29E-02	0.13E-01	0.12E-01	+2.400	0.55E+02
0.36E-02	0.81E-02	0.81E-02	-0.298	0.50E+02
0.45E-02	0.52E-02	0.54E-02	-4.769	0.47E+02
0.57E-02	0.33E-02	0.34E-02	-5.249	0.43E+02
0.72E-02	0.21E-02	0.22E-02	-4.686	0.39E+02
0.88E-02	0.15E-02	0.15E-02	+2.365	0.34E+02
0.11E-01	0.97E-03	0.94E-03	+3.489	0.32E+02

R: 168. X: 0. Y: 0. DL: 0. REQ: 168. CF: 1.0000
TDH7 ARRAY. 22 DATA POINTS. SYSTEM: NONE DATA: L200S110
JOB #G85143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 2 STA 11 OCT. 11, 1985
RMS LOG ERROR: 2.28E-02, ANTILOG YIELDS 5.3953 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	.99					
P 2	-.05	.23				
P 3	.00	-.02	.99			
T 1	.02	.19	.00	.95		
T 2	-.03	-.18	.01	.06	.86	
F 0	.00	.00	.00	.00	.00	.00





ERROR= 1.7070 %
LOOP RADIUS= 168m

o FIELD DATA

—— MODEL CURVE

THE EARTH TECHNOLOGY CORP.

UNOCAL Geothermal

Medicine Lake CA

LINE: 2 STA.: 12

APPARENT RESISTIVITY CURVE

JOB #G85143 Fig.

L2005120

MODEL: 3 LAYERS

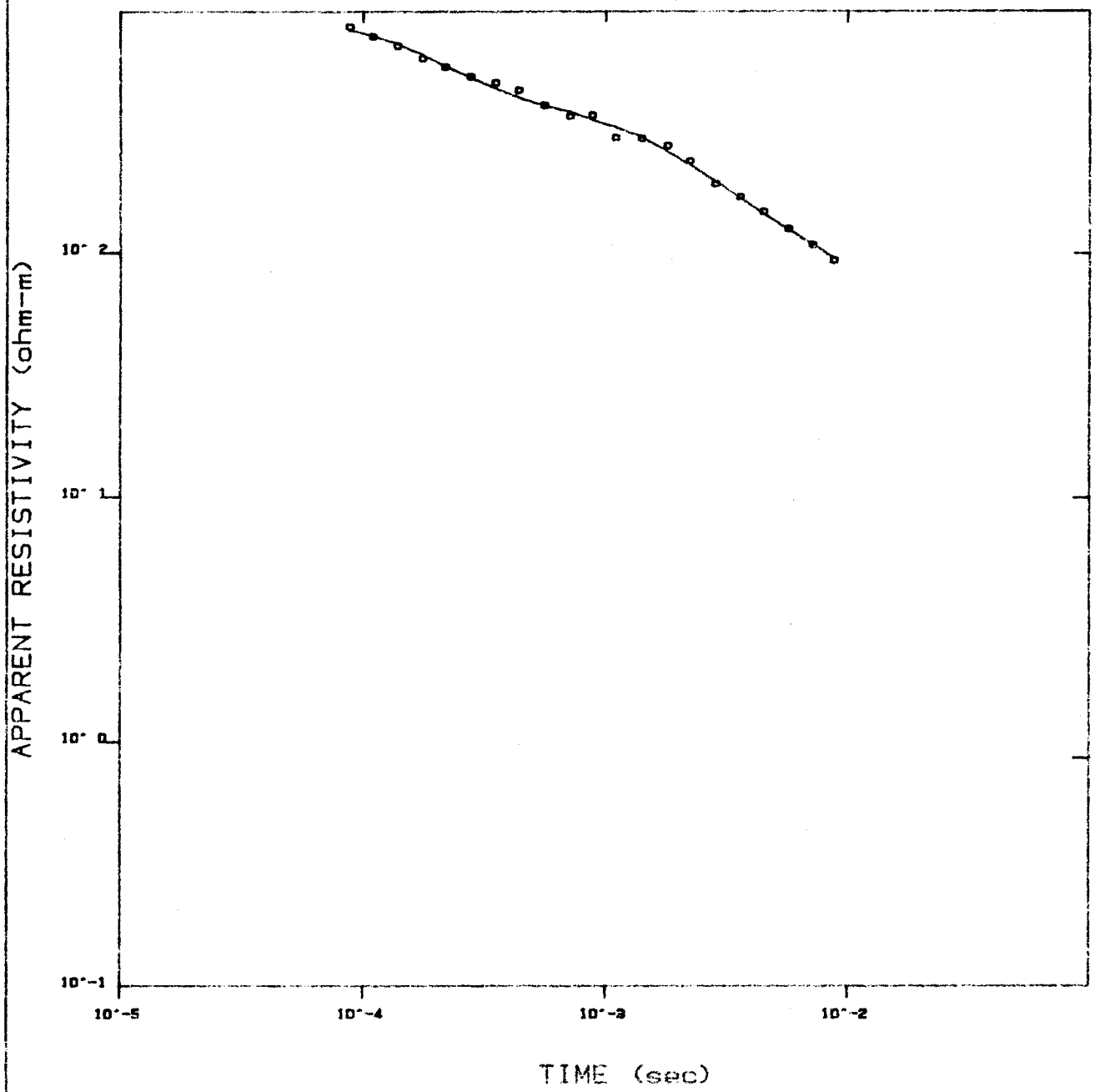
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		1947.7	6390.0		
458.95	191.7	1756.0	5761.1	.4	.4
89.90	155.4	1600.6	5251.2	1.7	2.1
51.58					

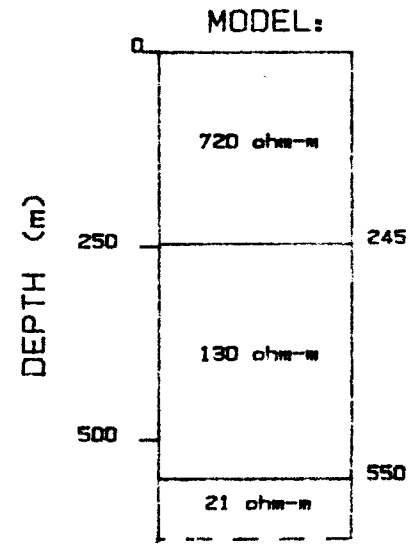
TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.23E+01	0.23E+01	+0.253	0.55E+03
0.11E-03	0.15E+01	0.15E+01	+0.305	0.52E+03
0.14E-03	0.93E+00	0.93E+00	-0.584	0.48E+03
0.18E-03	0.60E+00	0.60E+00	+0.665	0.43E+03
0.22E-03	0.40E+00	0.40E+00	-0.104	0.39E+03
0.28E-03	0.26E+00	0.26E+00	+0.826	0.35E+03
0.35E-03	0.17E+00	0.17E+00	-1.279	0.32E+03
0.44E-03	0.11E+00	0.11E+00	-2.288	0.29E+03
0.56E-03	0.72E-01	0.72E-01	+1.282	0.26E+03
0.71E-03	0.47E-01	0.47E-01	+1.874	0.23E+03
0.88E-03	0.31E-01	0.32E-01	-1.086	0.21E+03
0.11E-02	0.22E-01	0.21E-01	+4.343	0.18E+03
0.14E-02	0.13E-01	0.14E-01	-0.662	0.17E+03
0.18E-02	0.84E-02	0.86E-02	-2.260	0.16E+03
0.22E-02	0.57E-02	0.58E-02	-0.576	0.14E+03
0.29E-02	0.36E-02	0.36E-02	-0.949	0.13E+03
0.36E-02	0.23E-02	0.23E-02	+0.421	0.12E+03
0.45E-02	0.14E-02	0.15E-02	-2.913	0.11E+03
0.57E-02	0.90E-03	0.90E-03	+0.246	0.10E+03
0.72E-02	0.58E-03	0.56E-03	+2.944	0.92E+02

R: 168. X: 0. Y: 0. DL: 0. REQ: 168. CF: 1.0000
TDHZ ARRAY, 20 DATA POINTS, SYSTEM: NONE DATA: L2005120
JOB #685143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 2 STA 12 OCT. 11, 1985
RMS LOG ERROR: 7.35E-03, ANTILOG YIELDS 1.7070 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	1.00					
P 2	.00	1.00				
P 3	.00	.00	1.00			
T 1	.00	.00	.00	1.00		
T 2	.00	.00	.00	.00	1.00	
F 0	.00	.00	.00	.00	.00	.00





ERROR= 5.8550 %
LOOP RADIUS= 168m

o FIELD DATA

— MODEL CURVE

THE EARTH TECHNOLOGY CORP.

UNOCAL Geothermal

Medicine Lake CA

LINE: 2 STA.: 13

APPARENT RESISTIVITY CURVE

JOB #G85143 Fig.

L2005130

MODEL: 3 LAYERS

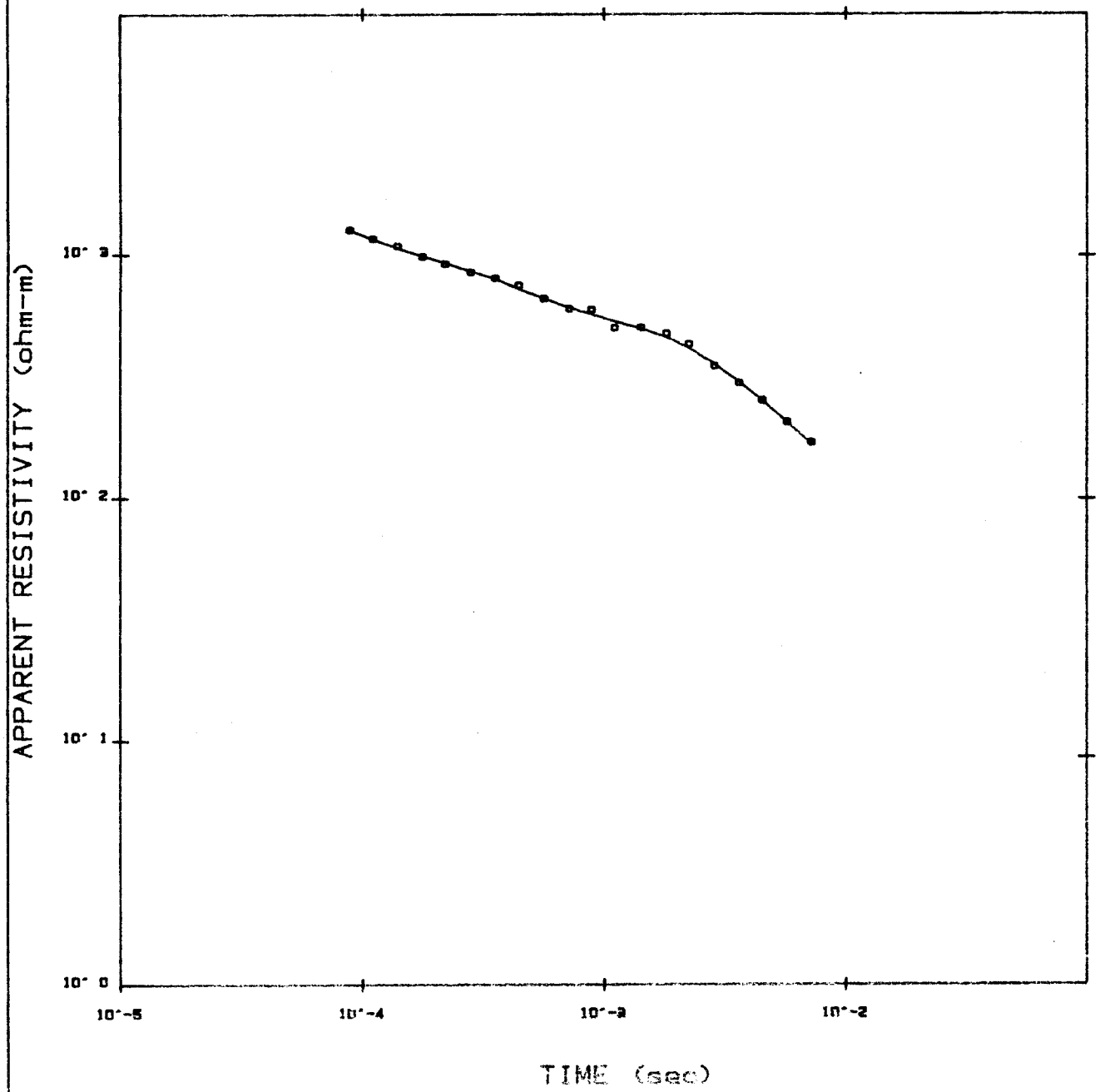
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		1950.7	6400.0		
719.61	245.2	1705.5	5595.6	.3	.3
126.90	304.6	1401.0	4596.3	2.4	2.7
20.99					

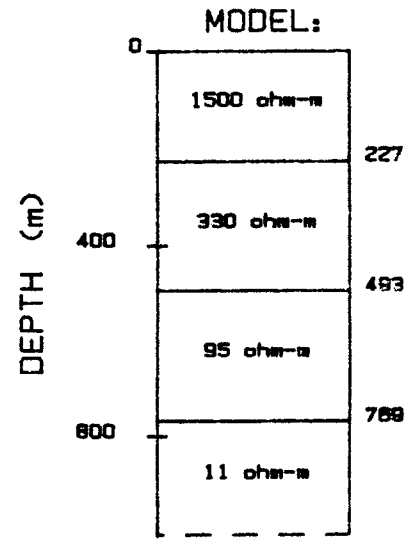
TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.12E+01	0.13E+01	-4.130	0.86E+03
0.11E-03	0.81E+00	0.79E+00	+1.770	0.78E+03
0.14E-03	0.51E+00	0.50E+00	+3.681	0.71E+03
0.18E-03	0.33E+00	0.32E+00	+5.818	0.64E+03
0.22E-03	0.22E+00	0.22E+00	+2.412	0.58E+03
0.28E-03	0.14E+00	0.14E+00	-0.975	0.53E+03
0.35E-03	0.84E-01	0.90E-01	-6.972	0.50E+03
0.44E-03	0.53E-01	0.59E-01	-9.690	0.47E+03
0.56E-03	0.36E-01	0.36E-01	-0.198	0.41E+03
0.71E-03	0.23E-01	0.22E-01	+6.852	0.37E+03
0.88E-03	0.13E-01	0.14E-01	-5.345	0.37E+03
0.11E-02	0.11E-01	0.91E-02	+16.981	0.30E+03
0.14E-02	0.58E-02	0.56E-02	+2.047	0.30E+03
0.18E-02	0.35E-02	0.38E-02	-7.670	0.28E+03
0.22E-02	0.25E-02	0.27E-02	-4.999	0.24E+03
0.29E-02	0.19E-02	0.18E-02	+4.288	0.19E+03
0.36E-02	0.13E-02	0.13E-02	-0.701	0.17E+03
0.45E-02	0.92E-03	0.94E-03	-2.054	0.15E+03
0.57E-02	0.65E-03	0.65E-03	-0.744	0.13E+03
0.72E-02	0.46E-03	0.45E-03	+1.134	0.11E+03
0.88E-02	0.34E-03	0.33E-03	+3.637	0.93E+02

R: 168. X: 0. Y: 0. DL: 0. REC: 168. CF: 1.0000
TDHZ ARRAY, 21 DATA POINTS, SYSTEM: NONE DATA: L2005130
JOB #685143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 2 STA 13 OCT. 11, 1985
RMS LOG ERROR: 2.47E-02, ANTILOG YIELDS 5.8550 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	1.00					
P 2	.00	1.00				
P 3	.00	.00	1.00			
T 1	.00	.00	.00	1.00		
T 2	.00	.00	.00	.00	1.00	
F 0	.00	.00	.00	.00	.00	.00





ERROR= 3.5287 %
LOOP RADIUS= 168m

o FIELD DATA

—— MODEL CURVE

THE EARTH TECHNOLOGY CORP.

UNOCAL Geothermal

Medicine Lake CA

LINE: 2 STA.: 14

APPARENT RESISTIVITY CURVE

JOB #G85143 Fig.

L200S140

MODEL: 4 LAYERS

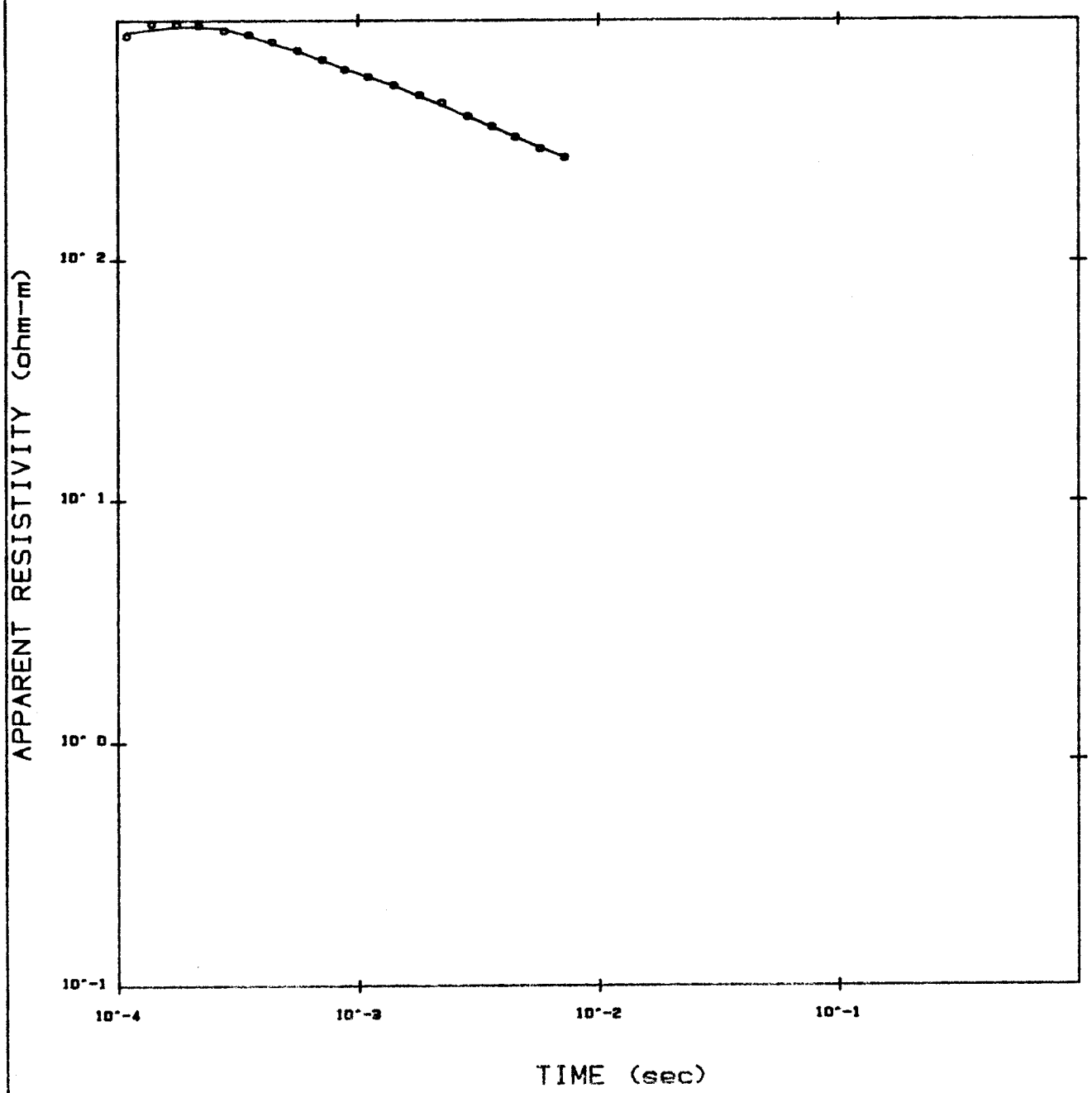
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		1944.6	6380.0		
1473.77	226.5	1718.2	5637.0	.2	.2
326.43	266.9	1451.3	4761.3	.8	1.0
95.48	275.4	1175.9	3857.9	2.9	3.9
10.73					

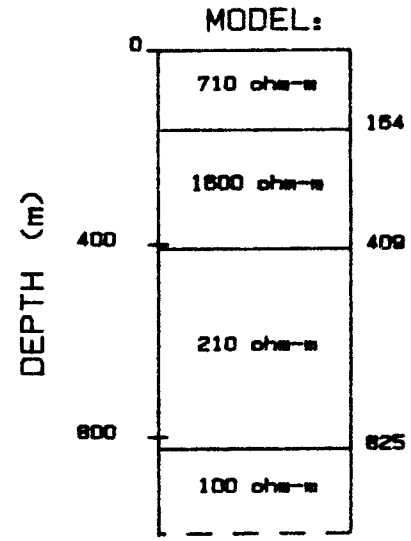
TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.67E+00	0.66E+00	+0.681	0.13E+04
0.11E-03	0.44E+00	0.44E+00	-0.341	0.12E+04
0.14E-03	0.27E+00	0.28E+00	-2.241	0.11E+04
0.18E-03	0.17E+00	0.17E+00	+0.935	0.98E+03
0.22E-03	0.11E+00	0.11E+00	+1.067	0.91E+03
0.28E-03	0.70E-01	0.69E-01	+1.806	0.84E+03
0.35E-03	0.42E-01	0.43E-01	-0.618	0.80E+03
0.44E-03	0.27E-01	0.28E-01	-4.359	0.74E+03
0.56E-03	0.18E-01	0.18E-01	+0.788	0.65E+03
0.71E-03	0.11E-01	0.11E-01	+3.067	0.59E+03
0.88E-03	0.68E-02	0.72E-02	-6.062	0.59E+03
0.11E-02	0.51E-02	0.46E-02	+10.156	0.49E+03
0.14E-02	0.27E-02	0.27E-02	-0.715	0.50E+03
0.18E-02	0.16E-02	0.17E-02	-4.787	0.47E+03
0.22E-02	0.11E-02	0.11E-02	-4.675	0.42E+03
0.29E-02	0.81E-03	0.78E-03	+3.785	0.34E+03
0.36E-02	0.57E-03	0.56E-03	+2.031	0.29E+03
0.45E-02	0.42E-03	0.42E-03	+0.373	0.25E+03
0.57E-02	0.31E-03	0.31E-03	-0.011	0.20E+03
0.72E-02	0.23E-03	0.23E-03	-1.091	0.17E+03

R: 168. X: 0. Y: 0. DL: 0. REQ: 168. CF: 1.0000
TDHZ ARRAY, 20 DATA POINTS, SYSTEM: NONE DATA: L200S140
JOB G85143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 2 STA 14 OCT. 11, 1985
RMS LOG ERROR: 1.51E-02, ANTILOG YIELDS 3.5267 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	P 4	T 1	T 2	T 3	F 0
P 1	.99							
P 2	-.01	.99						
P 3	.00	.00	.99					
P 4	.00	.00	-.01	.98				
T 1	.01	.01	.00	.00	.99			
T 2	.00	.00	.00	.00	.00	1.00		
T 3	.00	.00	.00	.00	.00	.00	1.00	
F 0	.00	.00	.00	.00	.00	.00	.00	.00





ERROR= 2.5945 %
LOOP RADIUS= 168m

o FIELD DATA

— MODEL CURVE

THE EARTH TECHNOLOGY CORP.

UNOCAL Geothermal

Medicine Lake CA

LINE: 2 STA.: 15

APPARENT RESISTIVITY CURVE

JOB #G85143 Fig.

L200S150

MODEL: 4 LAYERS

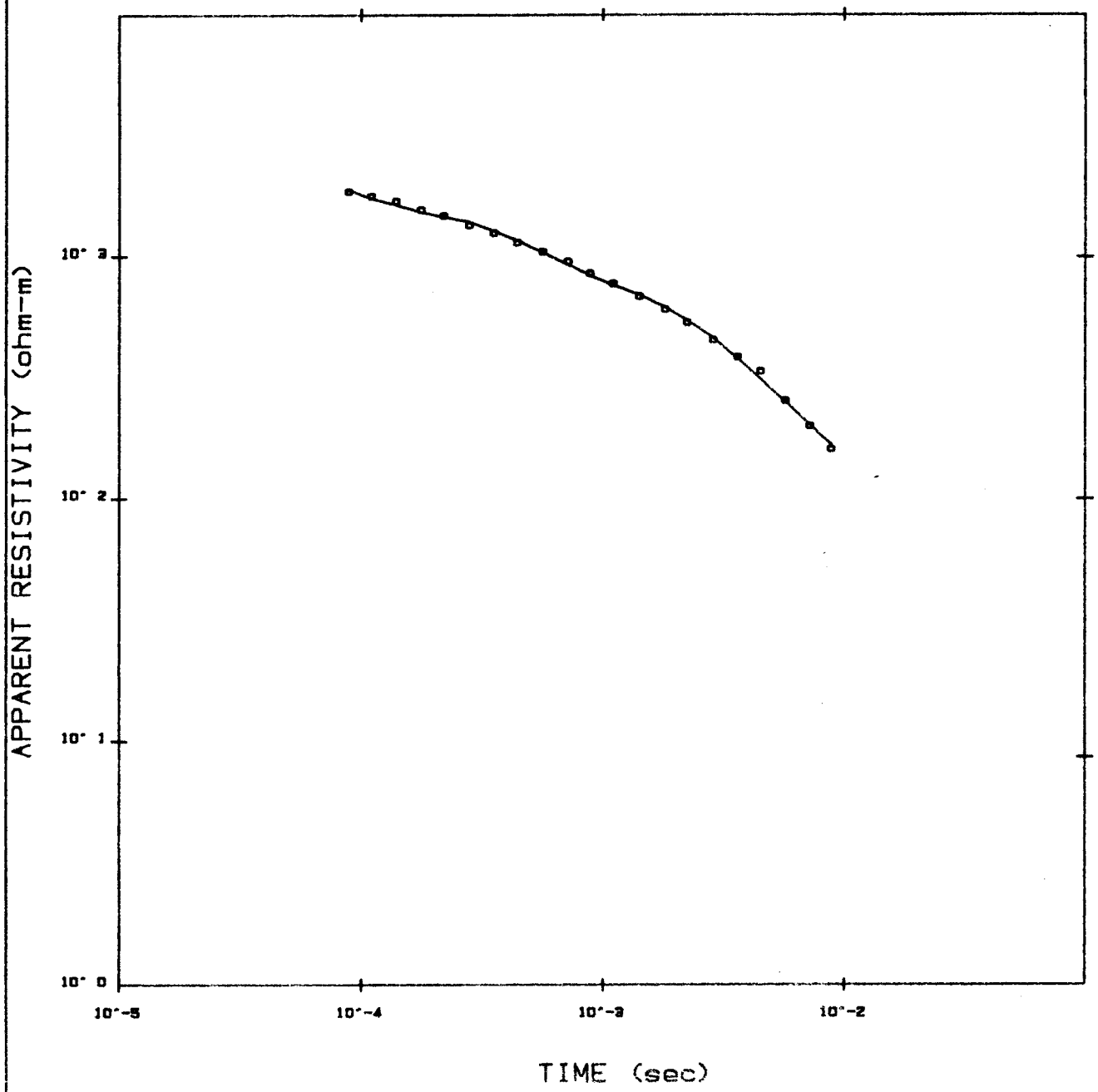
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		1941.6	6370.0		
709.19	164.3	1777.3	5830.9	.2	.2
1594.06	245.1	1532.2	5026.9	.2	.4
211.27	415.5	1116.7	3663.8	2.0	2.4
103.42					

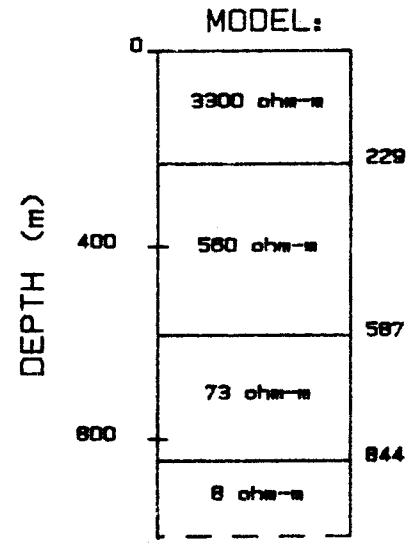
TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.11E-03	0.70E+00	0.65E+00	+7.591	0.85E+03
0.14E-03	0.33E+00	0.35E+00	-6.229	0.97E+03
0.18E-03	0.18E+00	0.18E+00	-1.415	0.96E+03
0.22E-03	0.11E+00	0.11E+00	-1.573	0.95E+03
0.28E-03	0.63E-01	0.62E-01	+2.570	0.90E+03
0.35E-03	0.37E-01	0.38E-01	-0.276	0.87E+03
0.44E-03	0.24E-01	0.24E-01	-1.332	0.81E+03
0.56E-03	0.15E-01	0.15E-01	-0.508	0.74E+03
0.71E-03	0.93E-02	0.93E-02	-0.471	0.68E+03
0.88E-03	0.63E-02	0.62E-02	+1.698	0.62E+03
0.11E-02	0.40E-02	0.40E-02	+0.580	0.58E+03
0.14E-02	0.24E-02	0.24E-02	+0.224	0.53E+03
0.18E-02	0.15E-02	0.16E-02	-1.603	0.48E+03
0.22E-02	0.10E-02	0.10E-02	-2.167	0.45E+03
0.29E-02	0.66E-03	0.66E-03	-0.280	0.39E+03
0.36E-02	0.42E-03	0.42E-03	-0.671	0.36E+03
0.45E-02	0.28E-03	0.28E-03	+0.327	0.32E+03
0.57E-02	0.18E-03	0.18E-03	+1.880	0.29E+03
0.72E-02	0.12E-03	0.12E-03	+1.301	0.27E+03

R: 168. X: 0. Y: 0. DL: 0. REQ: 168. CF: 1.0000
TDHZ ARRAY, 19 DATA POINTS, SYSTEM: NONE DATA: L200S150
JOB #685143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 2 STA 15 OCT. 12, 1985
RMS LOG ERROR: 1.11E-02, ANTILOG YIELDS 2.5945 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	P 4	T 1	T 2	T 3	F 0
P 1	1.00							
P 2	-.01	.92						
P 3	.00	-.01	1.00					
P 4	.00	-.01	.00	.99				
T 1	-.02	-.16	-.01	-.02	.62			
T 2	.02	.13	.01	.02	.31	.74		
T 3	.00	.00	.00	.00	.00	.00	1.00	
F 0	.00	.00	.00	.00	.00	.00	.00	.00





ERROR= 4.1808 %
LOOP RADIUS= 188m

o FIELD DATA

— MODEL CURVE

THE EARTH TECHNOLOGY CORP.

UNOCAL Geothermal

Medicine Lake CA

LINE: 2 STA.: 16

APPARENT RESISTIVITY CURVE

JOB #G85143 Fig.

L200S160

MODEL: 4 LAYERS

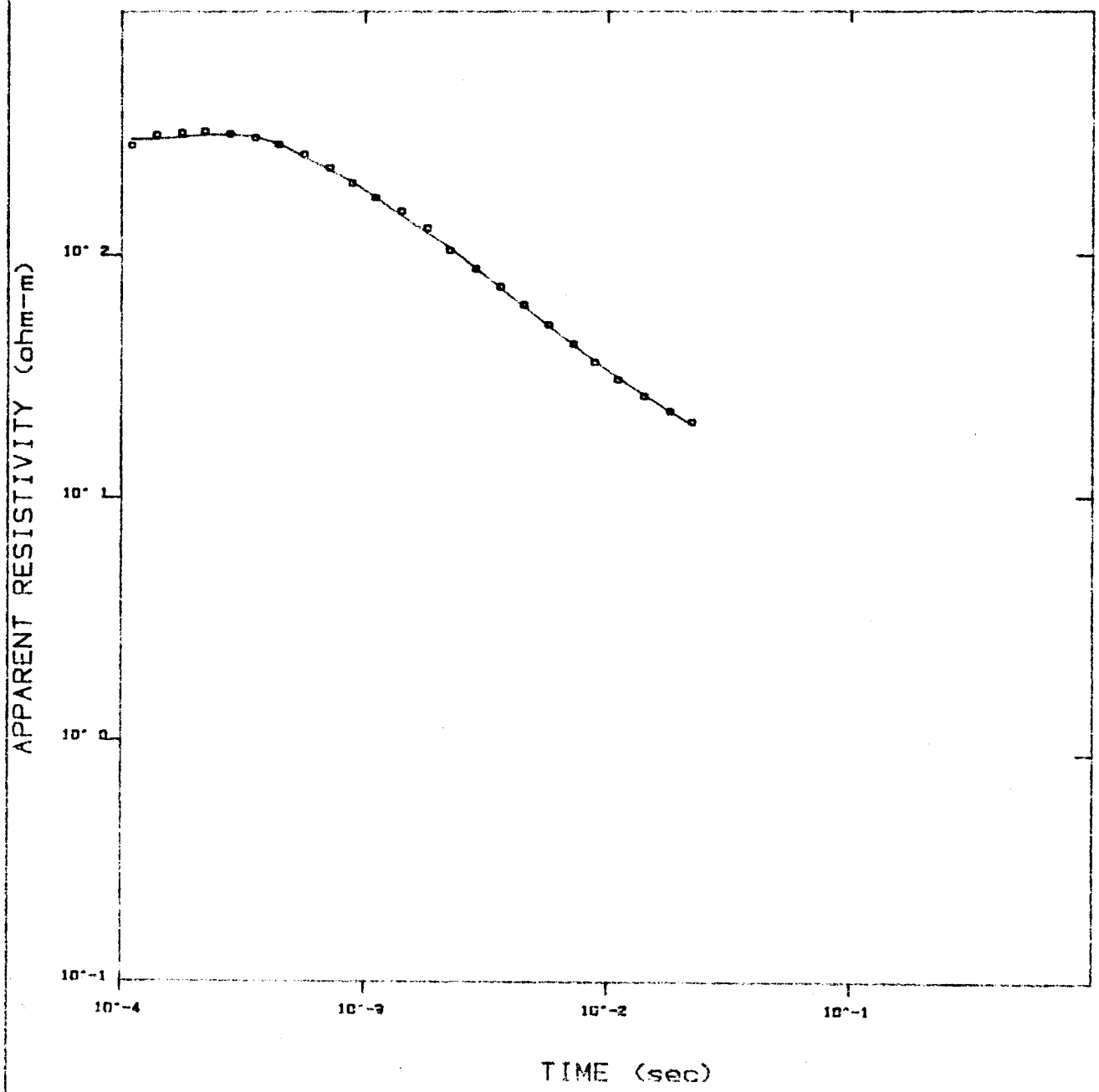
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		1926.3	6320.0		
3314.18	229.2	1697.2	5568.1	.1	.1
556.80	357.9	1339.2	4393.8	.6	.7
73.30	257.1	1082.1	3550.2	3.5	4.2
8.00					

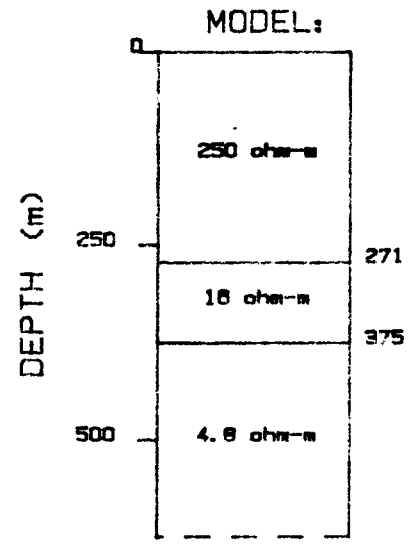
TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.38E+00	0.37E+00	+3.505	0.19E+04
0.11E-03	0.23E+00	0.24E+00	-2.500	0.18E+04
0.14E-03	0.14E+00	0.15E+00	-5.011	0.17E+04
0.18E-03	0.87E-01	0.89E-01	-2.733	0.16E+04
0.22E-03	0.56E-01	0.56E-01	-0.811	0.15E+04
0.28E-03	0.35E-01	0.33E-01	+5.563	0.13E+04
0.35E-03	0.22E-01	0.21E-01	+4.082	0.12E+04
0.44E-03	0.14E-01	0.14E-01	+3.379	0.11E+04
0.56E-03	0.88E-02	0.89E-02	-0.453	0.10E+04
0.71E-03	0.56E-02	0.58E-02	-3.580	0.95E+03
0.88E-03	0.39E-02	0.40E-02	-2.345	0.85E+03
0.11E-02	0.26E-02	0.26E-02	-1.548	0.77E+03
0.14E-02	0.17E-02	0.16E-02	+3.111	0.68E+03
0.18E-02	0.11E-02	0.11E-02	+3.295	0.60E+03
0.22E-02	0.77E-03	0.74E-03	+4.085	0.53E+03
0.29E-02	0.53E-03	0.51E-03	+3.707	0.45E+03
0.36E-02	0.38E-03	0.38E-03	-1.052	0.39E+03
0.45E-02	0.27E-03	0.30E-03	-10.010	0.34E+03
0.57E-02	0.22E-03	0.23E-03	-1.443	0.26E+03
0.72E-02	0.18E-03	0.17E-03	+2.990	0.20E+03
0.88E-02	0.15E-03	0.14E-03	+7.250	0.16E+03

R: 168. X: 0. Y: 0. DL: 0. REQ: 168. CF: 1.0000
TDHZ ARRAY, 21 DATA POINTS, SYSTEM: NONE DATA: L200S160
JOB #G85143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 2 STA 16 OCT. 11, 1985
RMS LOG ERROR: 1.78E-02, ANTILOG YIELDS 4.1808 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	P 4	T 1	T 2	T 3	F 0
P 1	.99							
P 2	.00	1.00						
P 3	.00	.00	.99					
P 4	.00	.00	-.01	.99				
T 1	.01	.00	.00	.00	1.00			
T 2	.00	.00	.00	.00	.00	1.00		
T 3	.00	.00	.00	.00	.00	.00	1.00	
F 0	.00	.00	.00	.00	.00	.00	.00	.00





ERROR= 3.2823 %
LOOP RADIUS= 168m

o FIELD DATA

— MODEL CURVE

THE EARTH TECHNOLOGY CORP

UNOCAL Geothermal

Medicine Lake CA

LINE: 3 STA.: 1

APPARENT RESISTIVITY CURVE

JOB #G85143 Fig.

L3005010

MODEL: 3 LAYERS

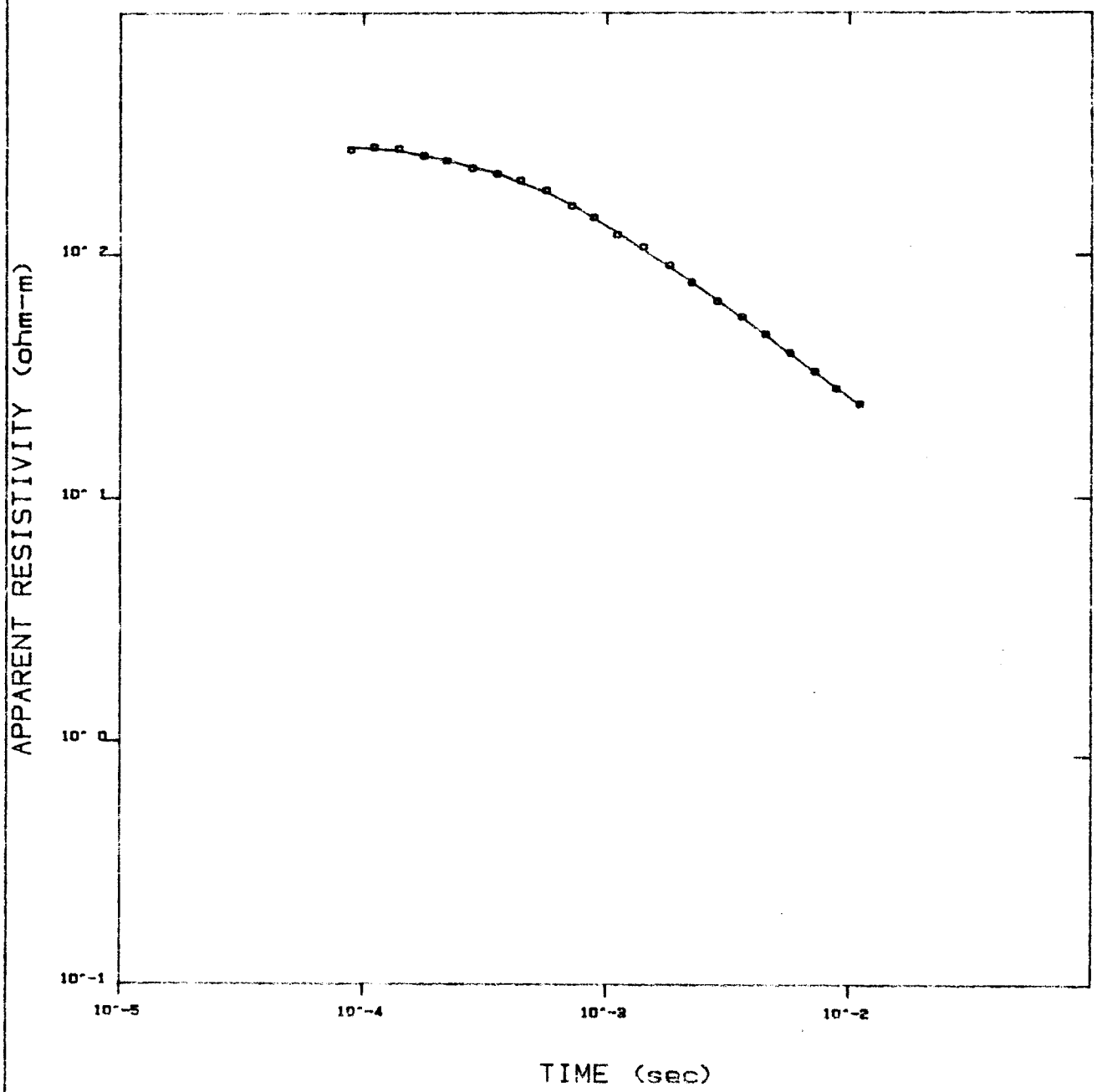
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		2060.4	6760.0		
245.36	271.1	1789.4	5870.7	1.1	1.1
15.89	104.3	1685.1	5528.6	6.6	7.7
4.81					

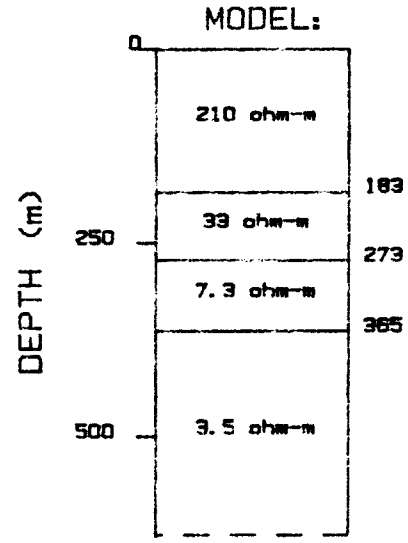
TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.11E-03	0.38E+01	0.34E+01	+11.311	0.28E+03
0.14E-03	0.18E+01	0.19E+01	-3.799	0.31E+03
0.18E-03	0.95E+00	0.99E+00	-3.933	0.32E+03
0.22E-03	0.55E+00	0.56E+00	-2.803	0.32E+03
0.28E-03	0.31E+00	0.31E+00	+0.709	0.31E+03
0.35E-03	0.18E+00	0.18E+00	+1.044	0.30E+03
0.44E-03	0.12E+00	0.11E+00	+1.387	0.28E+03
0.56E-03	0.72E-01	0.74E-01	-1.576	0.26E+03
0.71E-03	0.48E-01	0.49E-01	-2.349	0.23E+03
0.88E-03	0.35E-01	0.34E-01	+2.524	0.20E+03
0.11E-02	0.25E-01	0.24E-01	+2.421	0.17E+03
0.14E-02	0.16E-01	0.17E-01	-2.295	0.15E+03
0.18E-02	0.11E-01	0.12E-01	-3.650	0.13E+03
0.22E-02	0.89E-02	0.86E-02	+4.056	0.10E+03
0.29E-02	0.63E-02	0.62E-02	+1.544	0.87E+02
0.36E-02	0.45E-02	0.46E-02	-0.816	0.74E+02
0.45E-02	0.34E-02	0.34E-02	-2.379	0.62E+02
0.57E-02	0.25E-02	0.25E-02	-1.905	0.51E+02
0.72E-02	0.18E-02	0.18E-02	-1.154	0.43E+02
0.88E-02	0.14E-02	0.14E-02	+1.909	0.36E+02
0.11E-01	0.10E-02	0.10E-02	+2.421	0.31E+02
0.14E-01	0.71E-03	0.70E-03	+1.752	0.26E+02
0.18E-01	0.48E-03	0.48E-03	+0.396	0.22E+02
0.22E-01	0.33E-03	0.34E-03	-2.853	0.20E+02

R: 168. X: 0. Y: 0. DL: 0. REQ: 168. CF: 1.0000
TDHZ ARRAY, 24 DATA POINTS, SYSTEM: NONE DATA: L3005010
JOB #685143 UNOCAL GEOTHERMAL - MT. SHASTA
LINE 3 STA 1 OCT. 12, 1985
RMS LOG ERROR: 1.39E-02, ANTILOG YIELDS 3.2623 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	1.00					
P 2	.00	.99				
P 3	.00	.00	1.00			
T 1	.00	.00	.00	1.00		
T 2	.00	.00	.00	.00	1.00	
F 0	.00	.00	.00	.00	.00	.00





ERROR= 2.0046 %
LOOP RADIUS= 188m

o FIELD DATA

— MODEL CURVE

THE EARTH TECHNOLOGY CORP

UNOCAL Geothermal

Medicine Lake CA

LINE: 3 STA.: 2

APPARENT RESISTIVITY CURVE

JOB #C85143 Fig.

L3008020

MODEL: 4 LAYERS

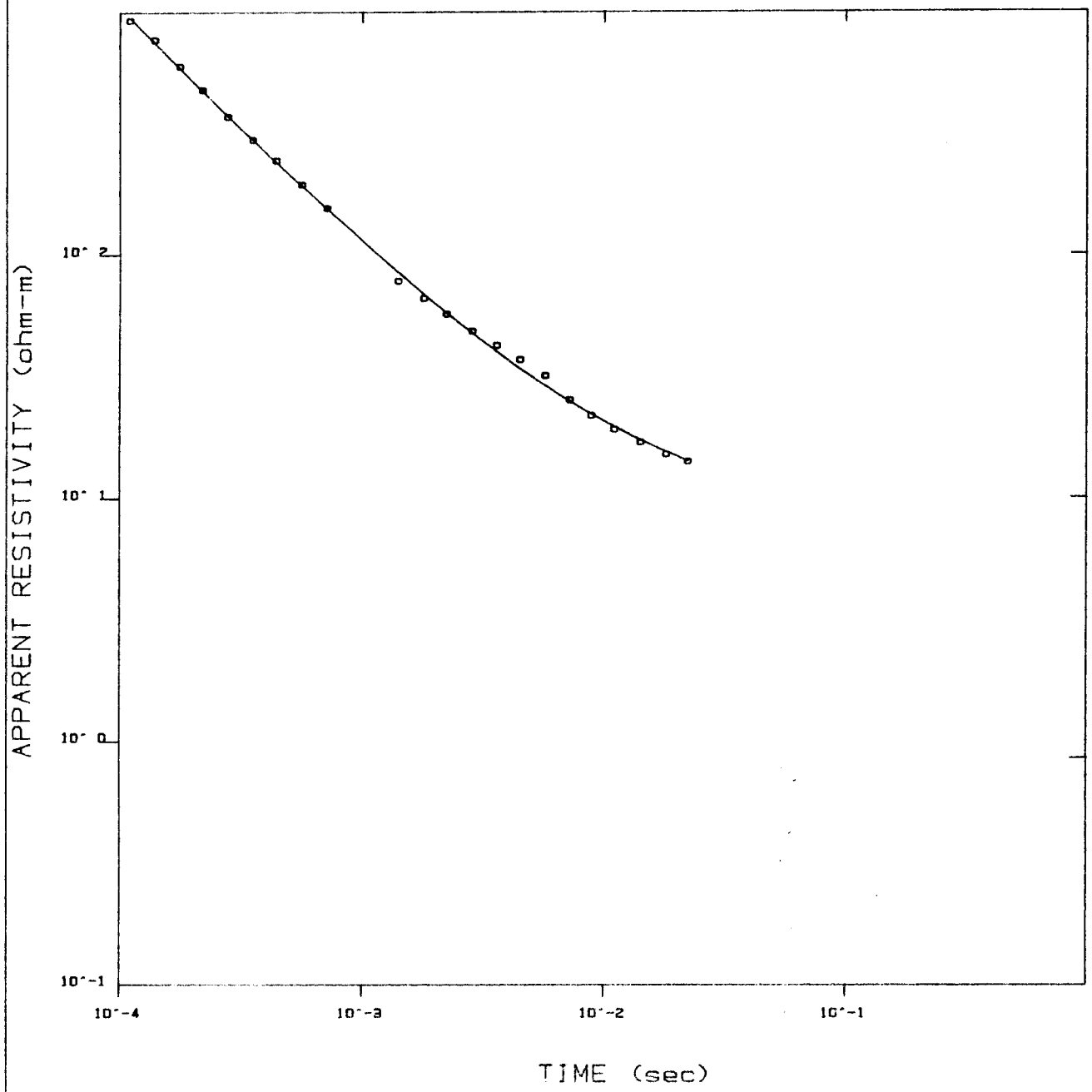
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		2054.4	6740.0		
207.39	183.1	1871.2	6139.1	.9	.9
33.20	89.9	1781.3	5844.1	2.7	3.6
7.28	92.1	1689.1	5541.8	12.7	16.3
3.53					

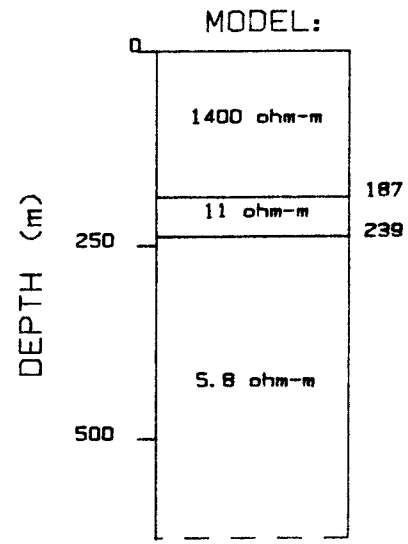
TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.67E+01	0.65E+01	+4.201	0.27E+03
0.11E-03	0.37E+01	0.38E+01	-2.684	0.28E+03
0.14E-03	0.21E+01	0.22E+01	-2.778	0.28E+03
0.18E-03	0.13E+01	0.13E+01	+0.960	0.26E+03
0.22E-03	0.82E+00	0.81E+00	+0.946	0.25E+03
0.28E-03	0.50E+00	0.49E+00	+2.301	0.23E+03
0.35E-03	0.30E+00	0.29E+00	+1.224	0.22E+03
0.44E-03	0.19E+00	0.19E+00	-2.526	0.20E+03
0.56E-03	0.12E+00	0.12E+00	-1.874	0.18E+03
0.71E-03	0.82E-01	0.80E-01	+2.176	0.16E+03
0.88E-03	0.57E-01	0.57E-01	+0.192	0.14E+03
0.11E-02	0.42E-01	0.41E-01	+3.681	0.12E+03
0.14E-02	0.27E-01	0.28E-01	-2.259	0.11E+03
0.18E-02	0.19E-01	0.19E-01	-2.150	0.90E+02
0.22E-02	0.14E-01	0.14E-01	+0.825	0.77E+02
0.29E-02	0.10E-01	0.98E-02	+1.574	0.64E+02
0.36E-02	0.70E-02	0.70E-02	-0.852	0.55E+02
0.45E-02	0.51E-02	0.51E-02	-0.652	0.47E+02
0.57E-02	0.37E-02	0.37E-02	-1.196	0.40E+02
0.72E-02	0.27E-02	0.27E-02	-0.272	0.33E+02
0.88E-02	0.20E-02	0.20E-02	+1.424	0.28E+02
0.11E-01	0.15E-02	0.15E-02	-0.580	0.24E+02

R: 168. X: 0. Y: 0. DL: 0. REQ: 168. CF: 1.0000
TDHZ ARRAY, 22 DATA POINTS, SYSTEM: NONE DATA: L3008020
JOB #G85143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 3 STA 2 OCT. 12, 1985
RMS LOG ERROR: 8.62E-03, ANTILOG YIELDS 2.0046 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	P 4	T 1	T 2	T 3	F 0
P 1	1.00							
P 2	.00	.96						
P 3	.00	-.02	.97					
P 4	.00	-.01	-.02	.98				
T 1	.00	.01	.00	.00	1.00			
T 2	.00	.00	.01	.00	.00	1.00		
T 3	.00	.00	.01	.01	.00	.00	.99	
F 0	.00	.00	.00	.00	.00	.00	.00	.00





ERROR= 6.0316 %
LOOP RADIUS= 168m

o FIELD DATA

—— MODEL CURVE

THE EARTH TECHNOLOGY CORP

UNOCAL Geothermal

Medicine Lake CA

LINE: 3 STA.: 3

APPARENT RESISTIVITY CURVE

JOB #G85143 Fig.

L3005030

MODEL: 3 LAYERS

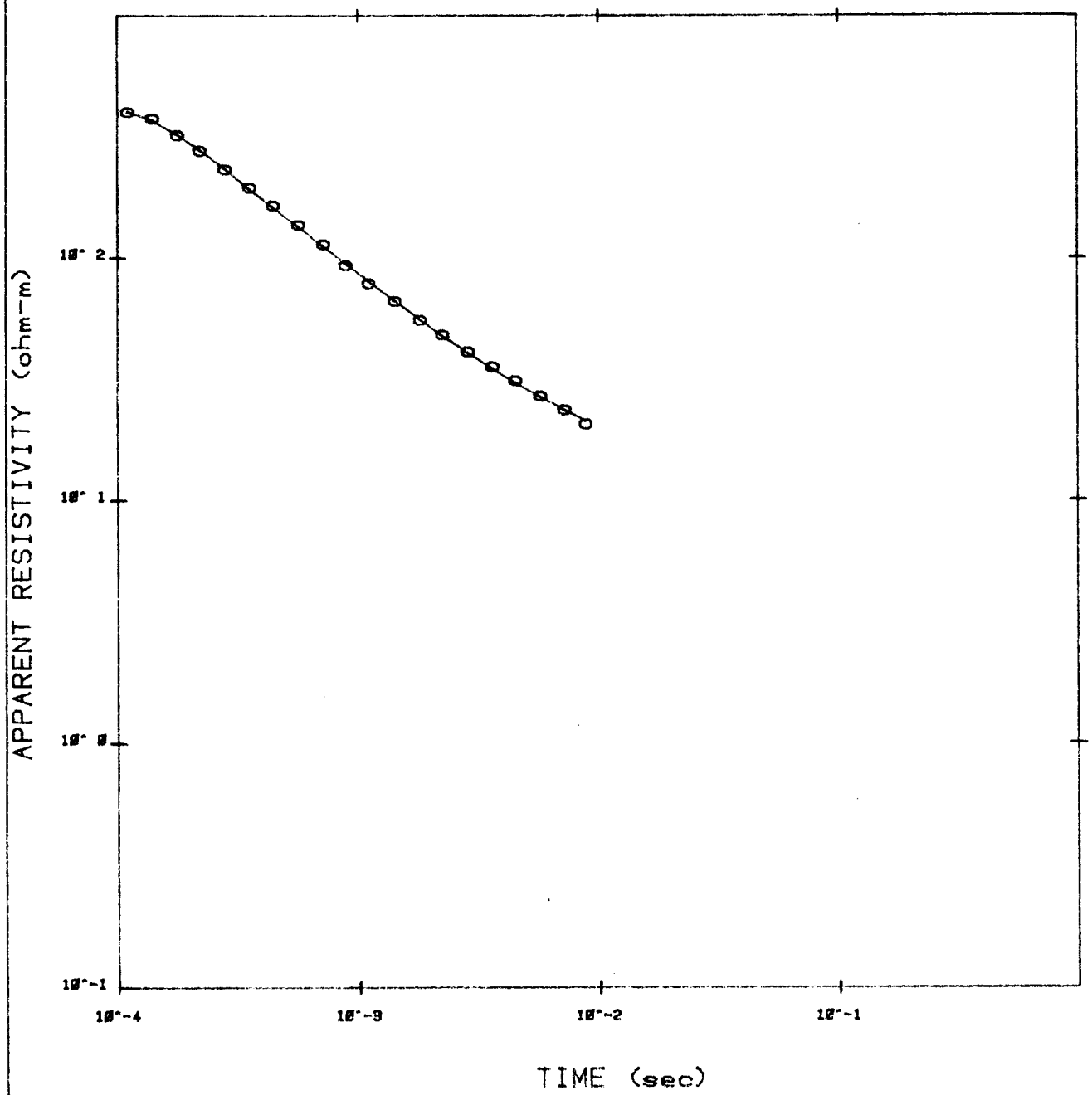
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		2066.5	6780.0		
1426.76	186.6	1880.0	6167.9	.1	.1
11.44	52.3	1827.7	5996.3	4.6	4.7
5.83					

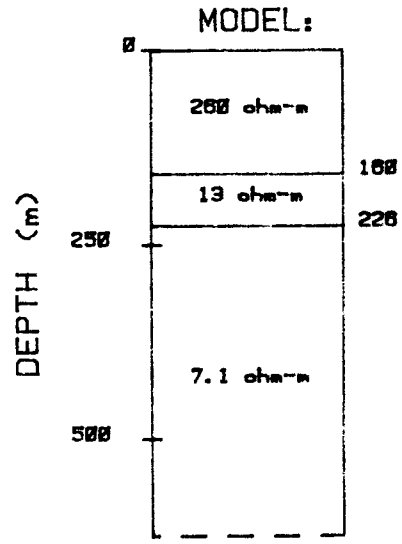
TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.11E-03	0.63E+00	0.60E+00	+5.460	0.92E+03
0.14E-03	0.46E+00	0.48E+00	-3.495	0.76E+03
0.18E-03	0.37E+00	0.38E+00	-1.818	0.59E+03
0.22E-03	0.30E+00	0.31E+00	-0.538	0.48E+03
0.28E-03	0.24E+00	0.24E+00	+1.436	0.37E+03
0.35E-03	0.18E+00	0.18E+00	+0.899	0.30E+03
0.44E-03	0.14E+00	0.14E+00	-1.743	0.25E+03
0.56E-03	0.11E+00	0.11E+00	-0.795	0.20E+03
0.71E-03	0.84E-01	0.84E-01	+0.062	0.16E+03
0.14E-02	0.44E-01	0.39E-01	+14.309	0.77E+02
0.18E-02	0.31E-01	0.29E-01	+6.790	0.65E+02
0.22E-02	0.23E-01	0.22E-01	+2.281	0.56E+02
0.29E-02	0.16E-01	0.16E-01	-2.818	0.48E+02
0.36E-02	0.11E-01	0.12E-01	-7.879	0.42E+02
0.45E-02	0.75E-02	0.84E-02	-11.810	0.37E+02
0.57E-02	0.51E-02	0.59E-02	-12.535	0.31E+02
0.72E-02	0.41E-02	0.41E-02	-1.258	0.25E+02
0.88E-02	0.30E-02	0.30E-02	+2.834	0.22E+02
0.11E-01	0.21E-02	0.20E-02	+4.052	0.19E+02
0.14E-01	0.14E-02	0.13E-02	+4.312	0.17E+02
0.18E-01	0.88E-03	0.84E-03	+4.382	0.15E+02
0.22E-01	0.58E-03	0.57E-03	+1.473	0.14E+02

R: 168. X: 0. Y: 0. DL: 0. REQ: 169. CF: 1.0000
TDHZ ARRAY, 22 DATA POINTS, SYSTEM: NONE DATA: L3005030
JOB #G85143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 3 STA 3 OCT. 12, 1985
RMS LOG ERROR: 2.54E-02, ANTILOG YIELDS 6.0316 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	.92					
P 2	-.02	.99				
P 3	.00	.00	1.00			
T 1	.00	.00	.00	1.00		
T 2	.00	.00	.00	.00	1.00	
F 0	.00	.00	.00	.00	.00	.00





ERROR= 2.0444 %
LOOP RADIUS= 100m

• FIELD DATA

—— MODEL CURVE

THE EARTH TECHNOLOGY CORP.

UNOCAL Geothermal

Medicine Lake CA

LINE: 3 STA.: 4

APPARENT RESISTIVITY CURVE

JOB #G85143 Fig.

L3005040

MODEL: 3 LAYERS

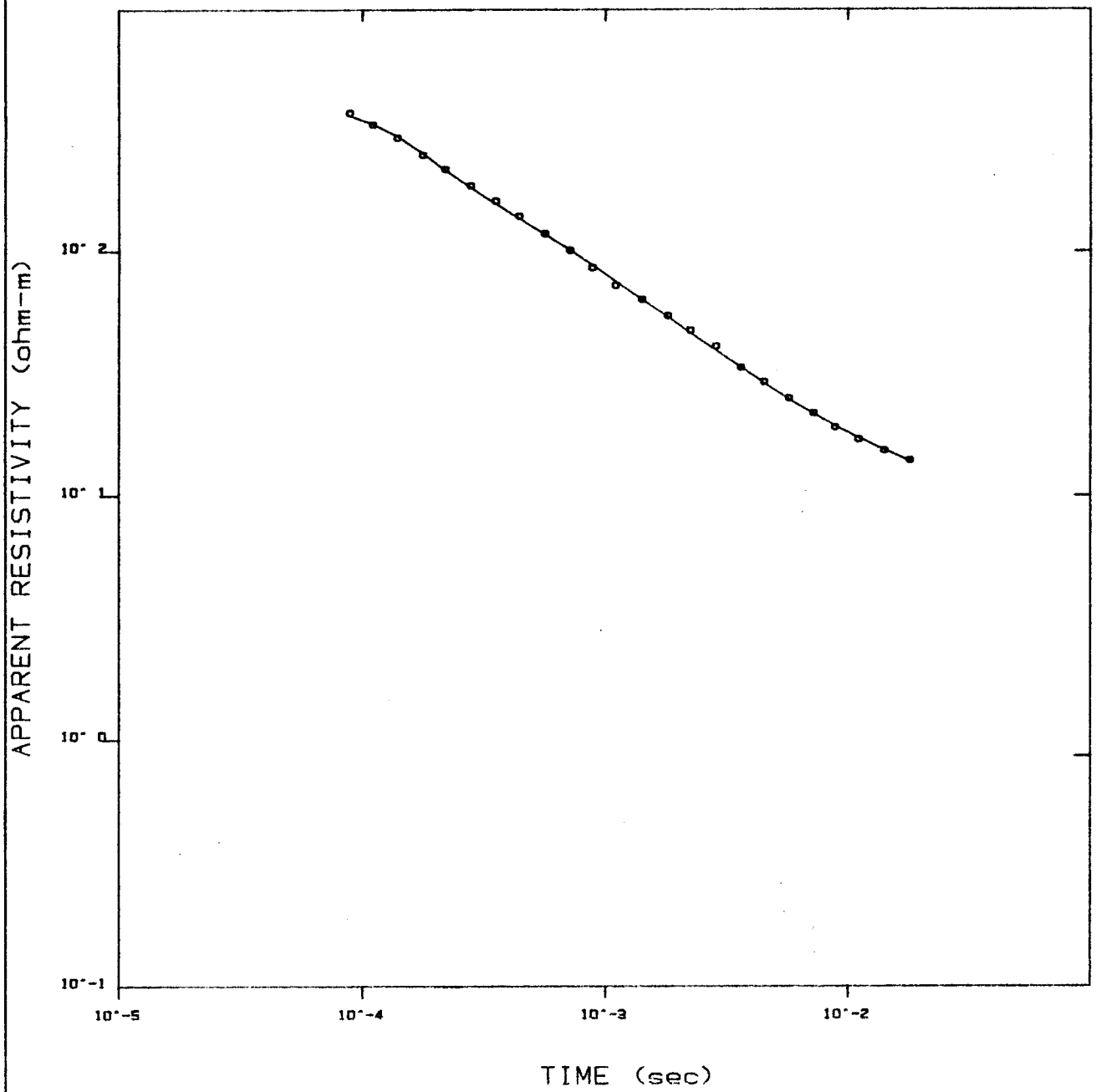
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		2066.5	6780.0		
261.01	160.2	1906.4	6254.4	.6	.6
12.61	65.7	1840.6	6038.8	5.2	5.8
7.08					

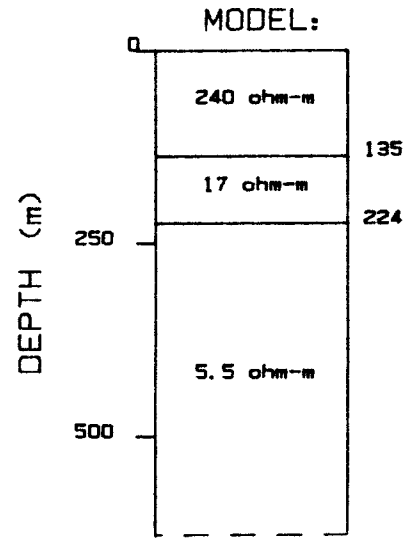
TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.11E-03	0.22E+01	0.22E+01	+0.507	0.40E+03
0.14E-03	0.14E+01	0.14E+01	-2.147	0.37E+03
0.18E-03	0.94E+00	0.93E+00	+0.936	0.32E+03
0.22E-03	0.69E+00	0.68E+00	+1.226	0.28E+03
0.28E-03	0.49E+00	0.48E+00	+1.591	0.23E+03
0.35E-03	0.35E+00	0.36E+00	-1.568	0.19E+03
0.44E-03	0.26E+00	0.26E+00	-1.737	0.16E+03
0.56E-03	0.19E+00	0.19E+00	-1.712	0.14E+03
0.71E-03	0.14E+00	0.14E+00	-2.042	0.11E+03
0.88E-03	0.11E+00	0.10E+00	+3.441	0.93E+02
0.11E-02	0.80E-01	0.77E-01	+3.615	0.78E+02
0.14E-02	0.55E-01	0.55E-01	+0.957	0.66E+02
0.18E-02	0.39E-01	0.39E-01	+0.903	0.55E+02
0.22E-02	0.29E-01	0.29E-01	-0.877	0.48E+02
0.29E-02	0.20E-01	0.20E-01	-1.114	0.41E+02
0.36E-02	0.14E-01	0.14E-01	-2.389	0.35E+02
0.45E-02	0.97E-02	0.99E-02	-2.785	0.31E+02
0.57E-02	0.66E-02	0.67E-02	-1.037	0.27E+02
0.72E-02	0.45E-02	0.45E-02	+0.141	0.23E+02
0.88E-02	0.33E-02	0.32E-02	+4.154	0.20E+02

R: 168. X: 0. Y: 0. DL: 0. REQ: 168. CF: 1.0000
TDHZ ARRAY, 20 DATA POINTS, SYSTEM: NONE DATA: L3005040
JOB #685143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 3 STA 4 OCT. 12, 1985
RMS LOG ERROR: 8.79E-03, ANTILOG YIELDS 2.0444 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	1.00					
P 2	.00	1.00				
P 3	.00	.00	1.00			
T 1	.00	.00	.00	1.00		
T 2	.00	.00	.00	.00	.99	
F 0	.00	.00	.00	.00	.00	.00





ERROR= 3.2033 %
LOOP RADIUS= 168m

o FIELD DATA

—— MODEL CURVE

THE EARTH TECHNOLOGY CORP

UNOCAL Geothermal

Medicine Lake CA

LINE: 3 STA.: 5

APPARENT RESISTIVITY CURVE

JOB #G85143 Fig.

L300S050

MODEL: 3 LAYERS

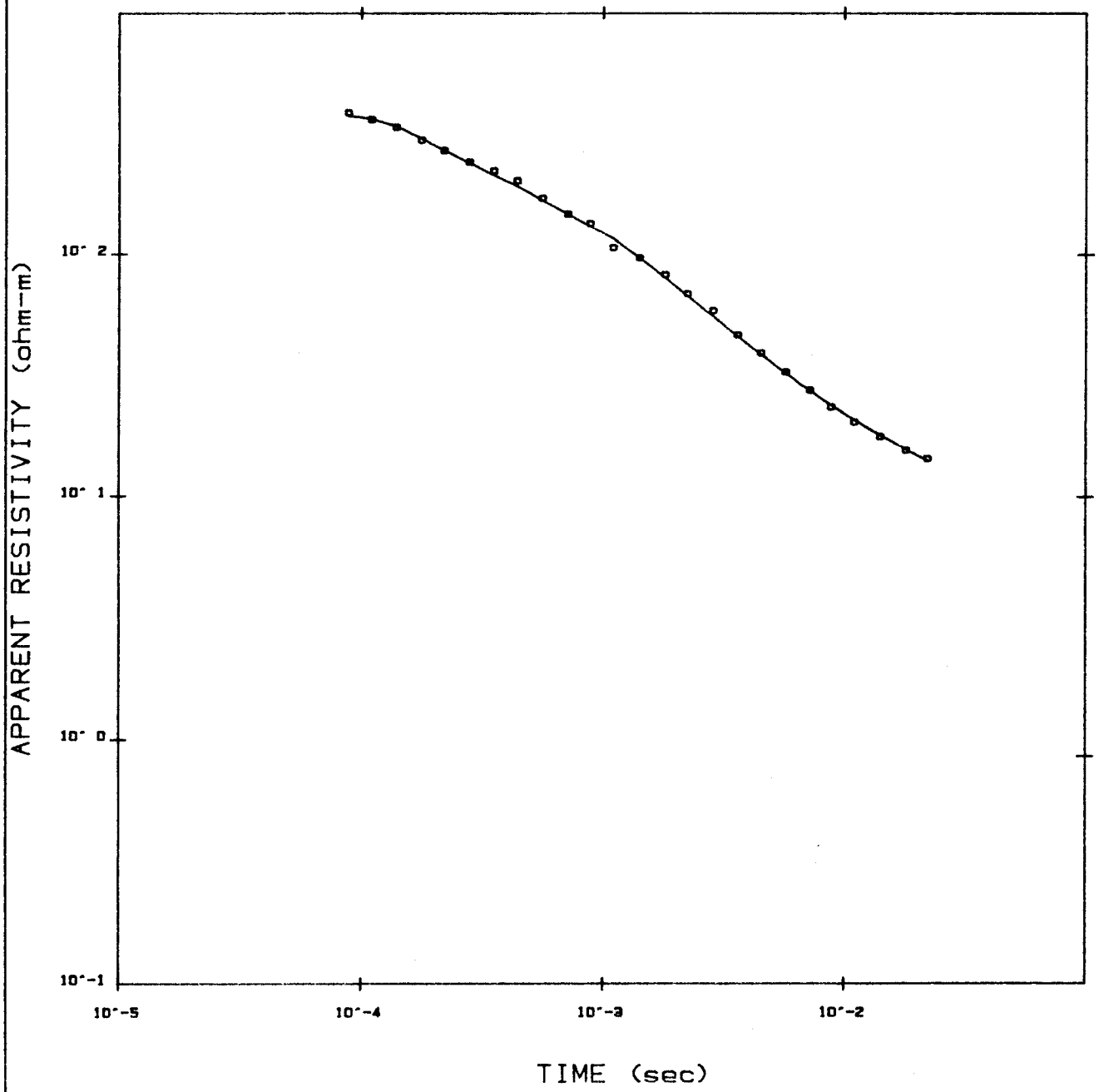
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		2054.4	6740.0		
237.51	135.1	1919.2	6296.6	.6	.6
17.11	88.9	1830.3	6004.8	5.2	5.8
5.53					

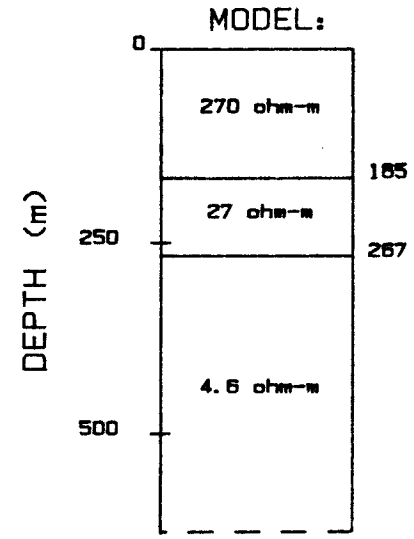
TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.42E+01	0.43E+01	-2.741	0.37E+03
0.11E-03	0.29E+01	0.28E+01	+1.686	0.33E+03
0.14E-03	0.19E+01	0.19E+01	+3.116	0.29E+03
0.18E-03	0.14E+01	0.13E+01	+3.094	0.25E+03
0.22E-03	0.98E+00	0.99E+00	-0.853	0.22E+03
0.28E-03	0.68E+00	0.69E+00	-1.922	0.19E+03
0.35E-03	0.47E+00	0.49E+00	-3.948	0.16E+03
0.44E-03	0.33E+00	0.35E+00	-4.352	0.14E+03
0.56E-03	0.23E+00	0.24E+00	-0.761	0.12E+03
0.71E-03	0.16E+00	0.16E+00	+1.225	0.10E+03
0.88E-03	0.12E+00	0.12E+00	+4.606	0.85E+02
0.11E-02	0.91E-01	0.84E-01	+8.037	0.72E+02
0.14E-02	0.60E-01	0.58E-01	+2.743	0.63E+02
0.18E-02	0.41E-01	0.41E-01	-0.848	0.54E+02
0.22E-02	0.29E-01	0.30E-01	-3.088	0.47E+02
0.29E-02	0.20E-01	0.21E-01	-6.486	0.41E+02
0.36E-02	0.15E-01	0.15E-01	-0.534	0.33E+02
0.45E-02	0.11E-01	0.11E-01	-1.942	0.29E+02
0.57E-02	0.73E-02	0.74E-02	-1.120	0.25E+02
0.72E-02	0.50E-02	0.50E-02	-0.375	0.22E+02
0.88E-02	0.37E-02	0.36E-02	+2.679	0.19E+02
0.11E-01	0.25E-02	0.25E-02	+2.825	0.17E+02
0.14E-01	0.16E-02	0.16E-02	+1.713	0.15E+02
0.18E-01	0.99E-03	0.10E-02	-0.851	0.14E+02

R: 168. X: 0. Y: 0. DL: 0. REQ: 168. CF: 1.0000
TDHZ ARRAY, 24 DATA POINTS, SYSTEM: NONE DATA: L300S050
JOB #G85143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 3 STA 5 OCT. 13, 1985
RMS LOG ERROR: 1.37E-02, ANTILOG YIELDS 3.2033 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	1.00					
P 2	.00	1.00				
P 3	.00	.00	1.00			
T 1	.00	.00	.00	1.00		
T 2	.00	.00	.00	.00	1.00	
F 0	.00	.00	.00	.00	.00	.00





ERROR= 4.4729 %
LOOP RADIUS= 168m

o FIELD DATA

— MODEL CURVE

THE EARTH TECHNOLOGY CORP

UNOCAL Geothermal

Medicine Lake CA

LINE: 3 STA.: 6

APPARENT RESISTIVITY CURVE

JOB #G85143 Fig.

L3005060

MODEL: 3 LAYERS

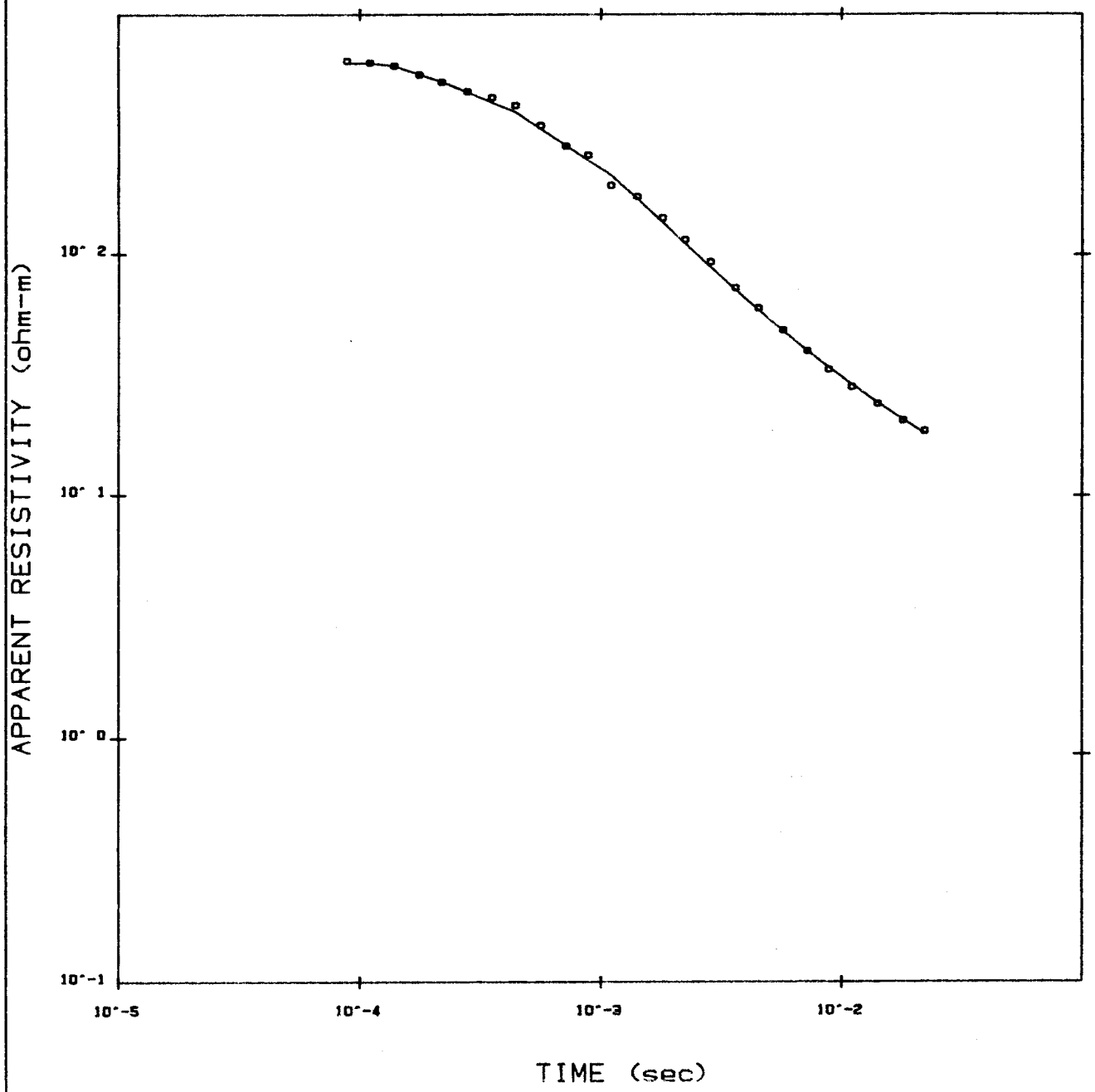
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		2063.5	6770.0		
267.79	165.4	1898.1	6227.3	.6	.6
26.61	102.0	1796.1	5892.8	3.8	4.5
4.56					

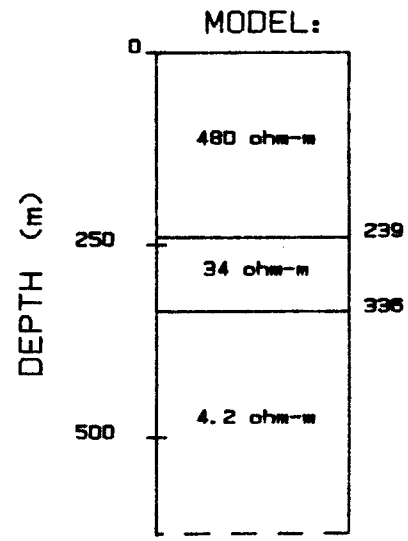
TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.40E+01	0.41E+01	-2.898	0.38E+03
0.11E-03	0.26E+01	0.25E+01	+1.915	0.36E+03
0.14E-03	0.16E+01	0.16E+01	+2.782	0.34E+03
0.18E-03	0.10E+01	0.10E+01	+2.772	0.30E+03
0.22E-03	0.71E+00	0.70E+00	+1.236	0.27E+03
0.28E-03	0.46E+00	0.46E+00	-0.243	0.24E+03
0.35E-03	0.29E+00	0.31E+00	-6.429	0.22E+03
0.44E-03	0.19E+00	0.20E+00	-7.544	0.20E+03
0.56E-03	0.13E+00	0.13E+00	+1.523	0.17E+03
0.71E-03	0.92E-01	0.87E-01	+5.479	0.15E+03
0.88E-03	0.62E-01	0.62E-01	+0.579	0.13E+03
0.11E-02	0.51E-01	0.44E-01	+14.786	0.11E+03
0.14E-02	0.32E-01	0.31E-01	+0.771	0.96E+02
0.18E-02	0.22E-01	0.23E-01	-3.985	0.82E+02
0.22E-02	0.17E-01	0.17E-01	-2.668	0.68E+02
0.29E-02	0.12E-01	0.13E-01	-7.388	0.58E+02
0.36E-02	0.92E-02	0.93E-02	-1.145	0.46E+02
0.45E-02	0.68E-02	0.70E-02	-1.724	0.39E+02
0.57E-02	0.49E-02	0.50E-02	-0.846	0.32E+02
0.72E-02	0.36E-02	0.36E-02	-0.520	0.27E+02
0.88E-02	0.27E-02	0.26E-02	+3.087	0.23E+02
0.11E-01	0.19E-02	0.19E-02	+3.257	0.20E+02
0.14E-01	0.13E-02	0.13E-02	+2.328	0.18E+02
0.18E-01	0.84E-03	0.83E-03	+2.012	0.15E+02
0.22E-01	0.56E-03	0.58E-03	-2.302	0.14E+02

R: 168. X: 0. Y: 0. DL: 0. REQ: 168. CF: 1.0000
TDHZ ARRAY, 25 DATA POINTS, SYSTEM: NONE DATA: L3005060
JOB #G85143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 3 STA 6 OCT. 13, 1985
RMS LOG ERROR: 1.90E-02, ANTILOG YIELDS 4.4729 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	1.00					
P 2	.00	1.00				
P 3	.00	.00	1.00			
T 1	.00	.00	.00	1.00		
T 2	.00	.00	.00	.00	1.00	
F 0	.00	.00	.00	.00	.00	.00





ERROR= 5.1038 %
LOOP RADIUS= 168m

o FIELD DATA

— MODEL CURVE

THE EARTH TECHNOLOGY CORP

UNOCAL Geothermal

Medicine Lake CA

LINE: 3 STA.: 7

APPARENT RESISTIVITY CURVE

JOB #G85143 Fig.

L3005070

MODEL: 3 LAYERS

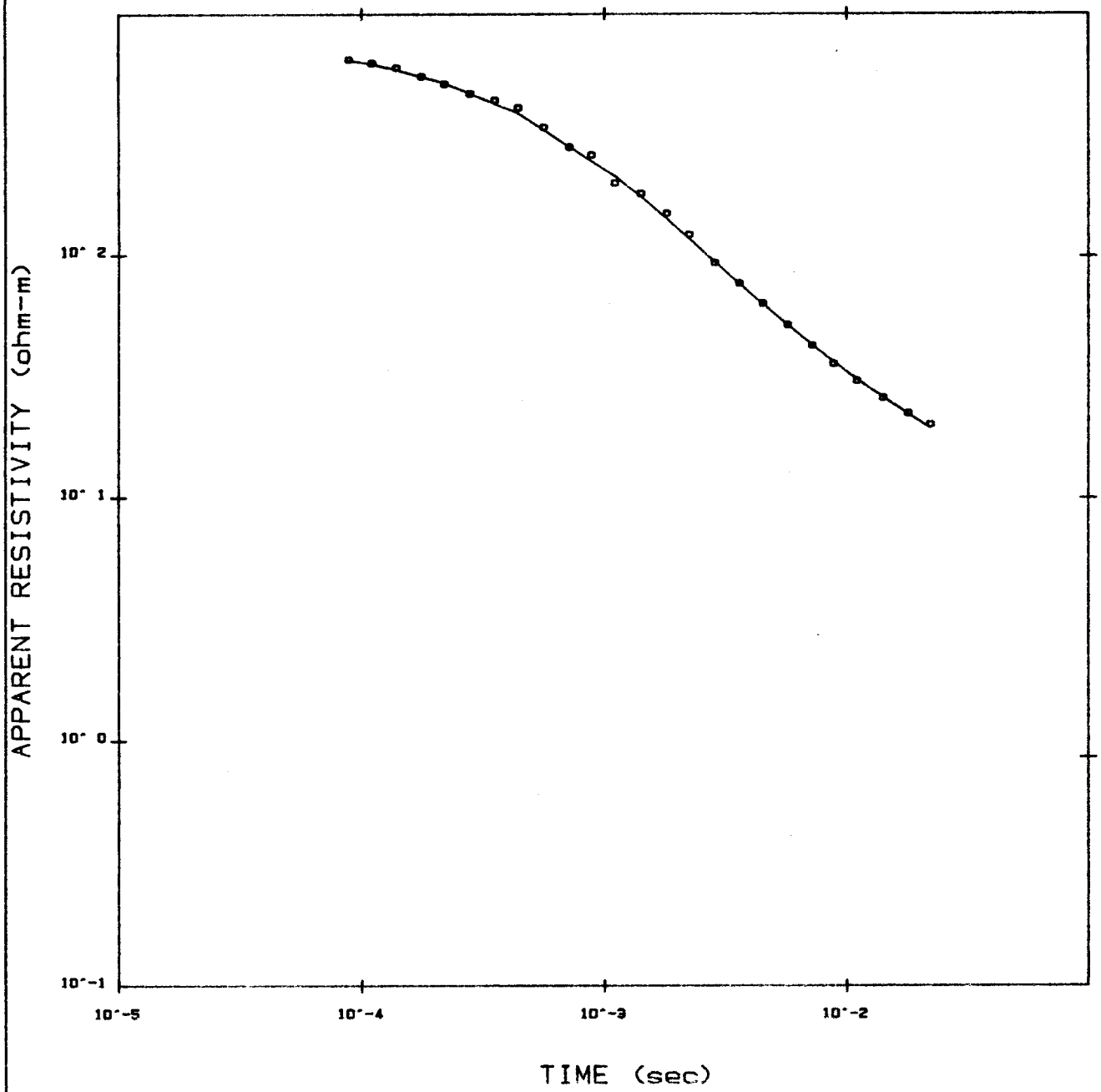
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		2100.1	6890.0		
482.13	239.2	1860.8	6105.1	.5	.5
34.32	97.0	1763.8	5786.9	2.8	3.3
4.24					

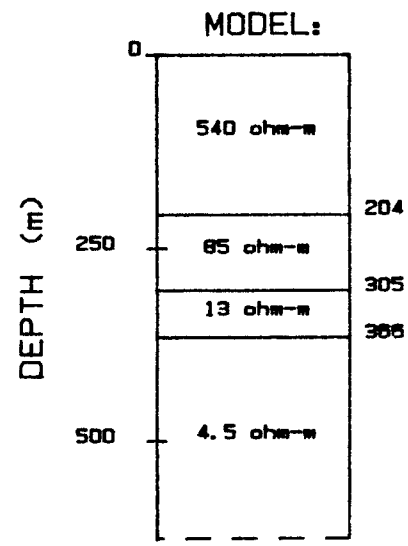
TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.19E+01	0.19E+01	-1.335	0.63E+03
0.11E-03	0.11E+01	0.11E+01	+1.058	0.62E+03
0.14E-03	0.66E+00	0.65E+00	+0.735	0.60E+03
0.18E-03	0.41E+00	0.40E+00	+1.499	0.55E+03
0.22E-03	0.27E+00	0.26E+00	+1.591	0.52E+03
0.28E-03	0.17E+00	0.17E+00	+1.149	0.47E+03
0.35E-03	0.10E+00	0.11E+00	-5.944	0.44E+03
0.44E-03	0.65E-01	0.71E-01	-8.516	0.41E+03
0.56E-03	0.48E-01	0.46E-01	+2.954	0.34E+03
0.71E-03	0.35E-01	0.32E-01	+10.092	0.28E+03
0.88E-03	0.24E-01	0.24E-01	-0.582	0.26E+03
0.11E-02	0.21E-01	0.18E-01	+16.400	0.19E+03
0.14E-02	0.13E-01	0.13E-01	-2.129	0.17E+03
0.18E-02	0.97E-02	0.10E-01	-5.604	0.14E+03
0.22E-02	0.78E-02	0.82E-02	-4.583	0.11E+03
0.29E-02	0.58E-02	0.62E-02	-6.710	0.93E+02
0.36E-02	0.47E-02	0.48E-02	-1.925	0.72E+02
0.45E-02	0.36E-02	0.37E-02	-1.917	0.59E+02
0.57E-02	0.27E-02	0.27E-02	-0.387	0.48E+02
0.72E-02	0.21E-02	0.21E-02	+0.390	0.39E+02
0.88E-02	0.16E-02	0.16E-02	+4.097	0.33E+02
0.11E-01	0.12E-02	0.12E-02	+3.647	0.26E+02
0.14E-01	0.82E-03	0.80E-03	+2.301	0.24E+02
0.18E-01	0.56E-03	0.55E-03	+1.882	0.20E+02
0.22E-01	0.39E-03	0.40E-03	-2.750	0.18E+02

R: 168. X: 0. Y: 0. DL: 0. REQ: 168. CF: 1.0000
TDHZ ARRAY, 25 DATA POINTS, SYSTEM: NONE DATA: L3005070
JOB #G85143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 3 STA 7 OCT. 13, 1985
RMS LOG ERROR: 2.16E-02, ANTILOG YIELDS 5.1038 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	1.00					
P 2	.00	.99				
P 3	.00	.00	1.00			
T 1	.00	.00	.00	1.00		
T 2	.00	.00	.00	.00	1.00	
F 0	.00	.00	.00	.00	.00	.00





ERROR= 4.0715 %
LOOP RADIUS= 168m

o FIELD DATA

— MODEL CURVE

THE EARTH TECHNOLOGY CORP

UNOCAL Geothermal

Medicine Lake CA

LINE: 3 STA.: 8

APPARENT RESISTIVITY CURVE

JOB #G85143 Fig.

L300S080

MODEL: 4 LAYERS

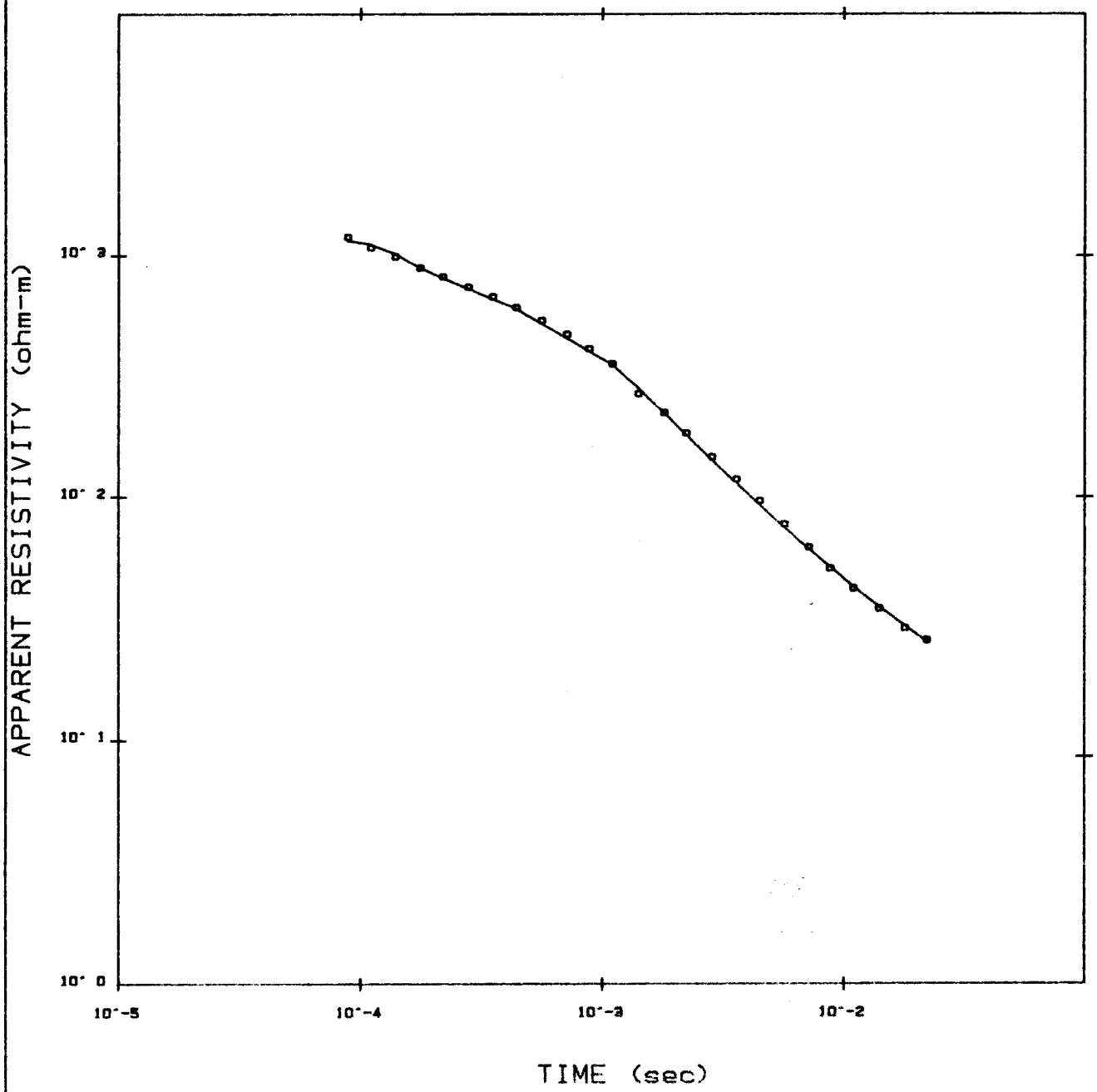
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		2130.6	6990.0		
536.14	204.4	1926.2	6319.5	.4	.4
85.18	100.6	1825.6	5989.5	1.2	1.6
13.38	61.2	1764.4	5788.6	4.6	6.1
4.54					

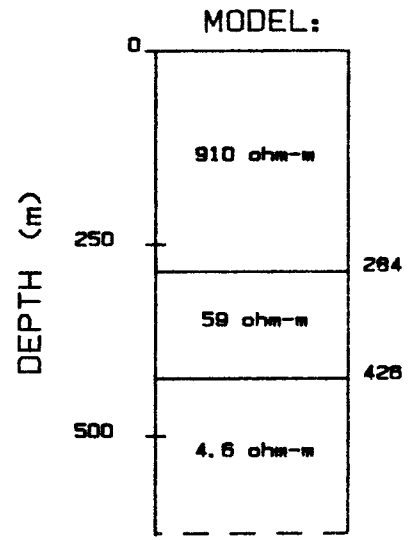
TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.18E+01	0.18E+01	+0.039	0.65E+03
0.11E-03	0.11E+01	0.11E+01	-0.456	0.63E+03
0.14E-03	0.67E+00	0.68E+00	-2.089	0.60E+03
0.18E-03	0.42E+00	0.41E+00	+0.495	0.55E+03
0.22E-03	0.27E+00	0.26E+00	+2.706	0.51E+03
0.28E-03	0.17E+00	0.16E+00	+3.850	0.47E+03
0.35E-03	0.10E+00	0.11E+00	-1.862	0.44E+03
0.44E-03	0.66E-01	0.71E-01	-7.188	0.41E+03
0.56E-03	0.47E-01	0.47E-01	+0.317	0.34E+03
0.71E-03	0.35E-01	0.33E-01	+6.749	0.28E+03
0.88E-03	0.23E-01	0.24E-01	-3.439	0.26E+03
0.11E-02	0.20E-01	0.18E-01	+11.506	0.20E+03
0.14E-02	0.12E-01	0.13E-01	-3.392	0.18E+03
0.18E-02	0.90E-02	0.96E-02	-6.564	0.15E+03
0.22E-02	0.71E-02	0.75E-02	-4.970	0.12E+03
0.29E-02	0.57E-02	0.56E-02	+2.147	0.93E+02
0.36E-02	0.43E-02	0.43E-02	+0.004	0.77E+02
0.45E-02	0.33E-02	0.33E-02	+0.097	0.63E+02
0.57E-02	0.25E-02	0.24E-02	+0.652	0.51E+02
0.72E-02	0.18E-02	0.18E-02	+1.235	0.42E+02
0.88E-02	0.14E-02	0.14E-02	+4.092	0.36E+02
0.11E-01	0.11E-02	0.10E-02	+2.520	0.30E+02
0.14E-01	0.72E-03	0.71E-03	+1.344	0.26E+02
0.18E-01	0.49E-03	0.49E-03	-0.736	0.22E+02
0.22E-01	0.34E-03	0.35E-03	-4.782	0.20E+02

R: 168. X: 0. Y: 0. DL: 0. REQ: 168. CF: 1.0000
TDHZ ARRAY, 25 DATA POINTS, SYSTEM: NONE DATA: L300S080
JOB #G85143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 3 STA 8 OCT. 13, 1985
RMS LOG ERROR: 1.73E-02, ANTILOG YIELDS 4.0715 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	P 4	T 1	T 2	T 3	F 0
P 1	.98							
P 2	-.08	.30						
P 3	.01	-.18	.34					
P 4	.00	.00	-.05	.95				
T 1	.03	.18	.02	.00	.95			
T 2	-.05	-.24	.18	.01	.08	.79		
T 3	-.01	-.19	-.13	.04	.04	.00	.84	
F 0	.00	.00	.00	.00	.00	.00	.00	.00





ERROR= 3.9124 %
LOOP RADIUS= 168m

o FIELD DATA

—— MODEL CURVE

THE EARTH TECHNOLOGY CORP

UNOCAL Geothermal

Medicine Lake CA

LINE: 3 STA.: 9

APPARENT RESISTIVITY CURVE

JOB #G85143 Fig.

L3005090

MODEL: 3 LAYERS

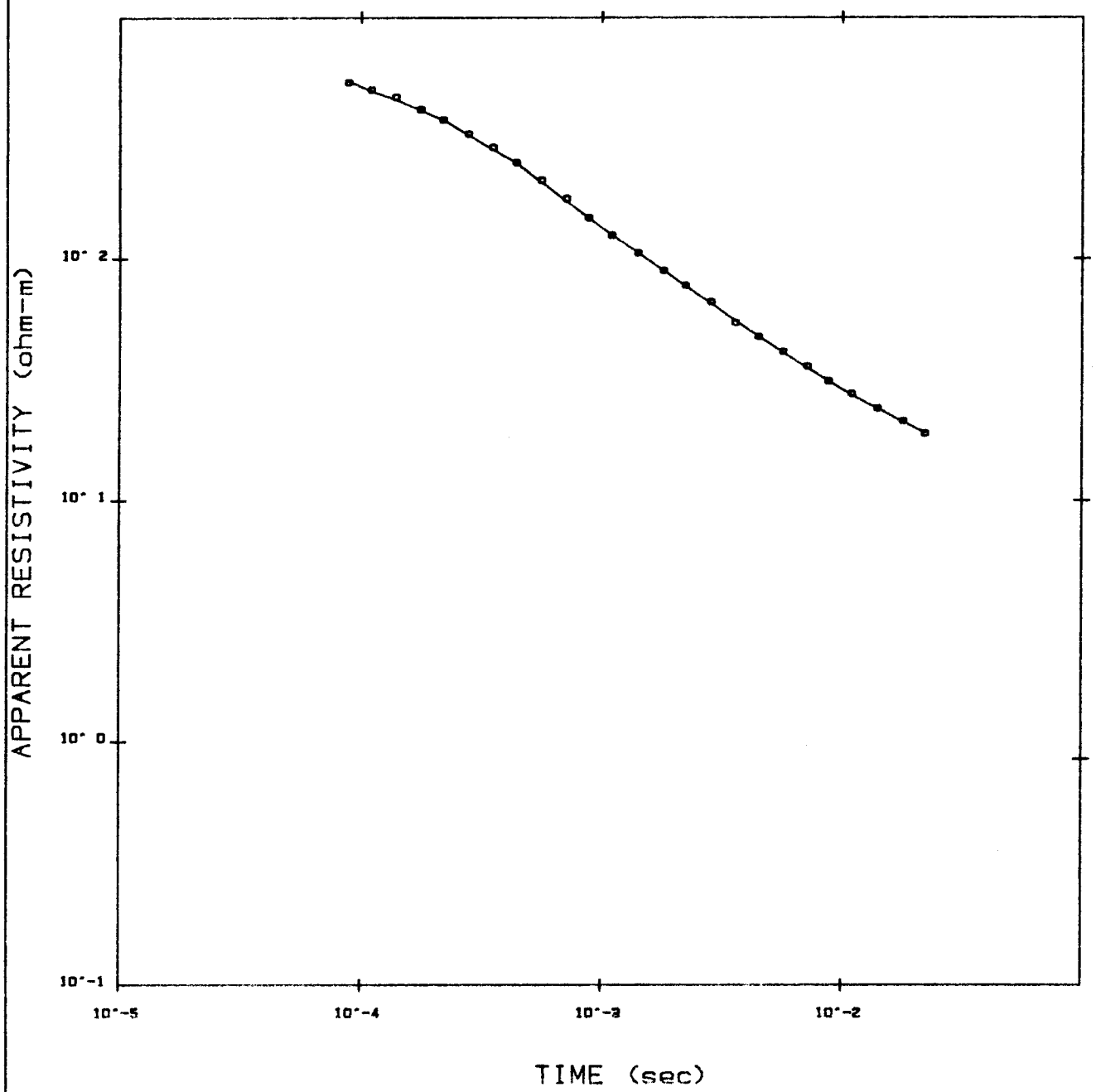
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		2121.4	6960.0		
914.42	284.3	1837.1	6027.2	.3	.3
59.37	141.6	1695.5	5562.7	2.4	2.7
4.57					

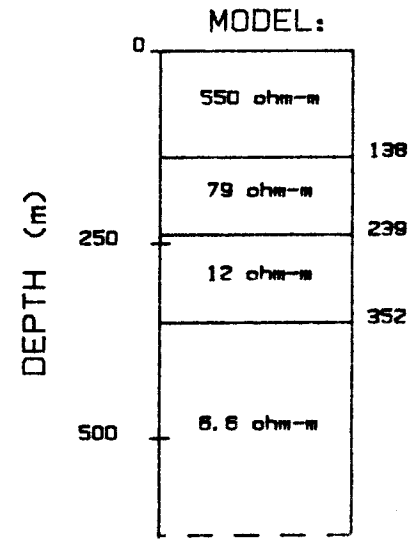
TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.74E+00	0.77E+00	-4.193	0.12E+04
0.11E-03	0.50E+00	0.47E+00	+5.174	0.11E+04
0.14E-03	0.32E+00	0.30E+00	+4.154	0.99E+03
0.18E-03	0.20E+00	0.20E+00	+0.779	0.88E+03
0.22E-03	0.14E+00	0.14E+00	-1.914	0.81E+03
0.28E-03	0.86E-01	0.90E-01	-4.085	0.73E+03
0.35E-03	0.55E-01	0.58E-01	-5.564	0.67E+03
0.44E-03	0.37E-01	0.38E-01	-1.579	0.60E+03
0.56E-03	0.24E-01	0.23E-01	+3.543	0.53E+03
0.71E-03	0.16E-01	0.16E-01	+3.427	0.47E+03
0.88E-03	0.12E-01	0.11E-01	+4.338	0.41E+03
0.11E-02	0.84E-02	0.85E-02	-0.884	0.35E+03
0.14E-02	0.69E-02	0.63E-02	+9.134	0.27E+03
0.18E-02	0.49E-02	0.49E-02	+0.434	0.22E+03
0.22E-02	0.39E-02	0.39E-02	-1.735	0.18E+03
0.29E-02	0.29E-02	0.30E-02	-3.515	0.15E+03
0.36E-02	0.23E-02	0.24E-02	-5.370	0.12E+03
0.45E-02	0.18E-02	0.19E-02	-5.031	0.95E+02
0.57E-02	0.14E-02	0.14E-02	-3.718	0.76E+02
0.72E-02	0.11E-02	0.11E-02	-1.697	0.61E+02
0.88E-02	0.87E-03	0.85E-03	+2.900	0.50E+02
0.11E-01	0.67E-03	0.64E-03	+3.249	0.41E+02
0.14E-01	0.47E-03	0.46E-03	+3.057	0.34E+02
0.18E-01	0.34E-03	0.33E-03	+3.703	0.28E+02
0.22E-01	0.24E-03	0.24E-03	-0.981	0.25E+02

R: 168. X: 0. Y: 0. DL: 0. REO: 168. CF: 1.0000
TDHZ ARRAY, 25 DATA POINTS, SYSTEM: NONE DATA: L3005090
JOB #685143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 3 STA 9 OCT. 13, 1985
RMS LOG ERROR: 1.67E-02, ANTILOG YIELDS 3.9124 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	1.00					
P 2	.00	.99				
P 3	.00	.00	1.00			
T 1	.00	.00	.00	1.00		
T 2	.00	.00	.00	.00	1.00	
F 0	.00	.00	.00	.00	.00	.00





ERROR= 1.8027 %
LOOP RADIUS= 168m

o FIELD DATA

— MODEL CURVE

THE EARTH TECHNOLOGY CORP

UNOCAL Geothermal

Medicine Lake CA

LINE: 3 STA.: 10

APPARENT RESISTIVITY CURVE

JOB #G85143 Fig.

L3005100

MODEL: 4 LAYERS

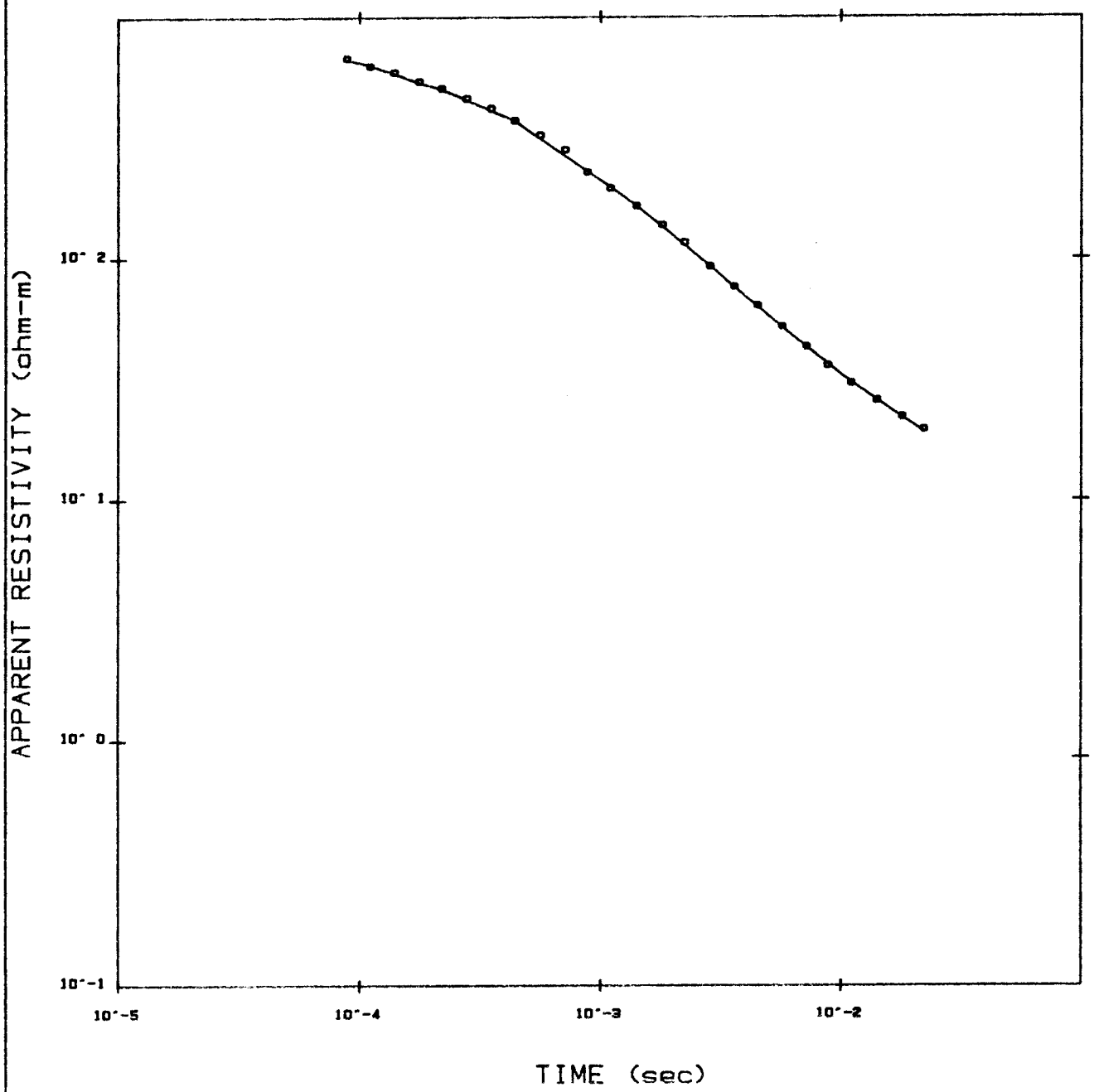
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		2115.3	6940.0		
551.57	138.3	1977.0	6486.3	.3	.3
79.23	101.0	1876.0	6155.0	1.3	1.6
12.11	112.3	1763.7	5786.5	9.3	10.8
6.55					

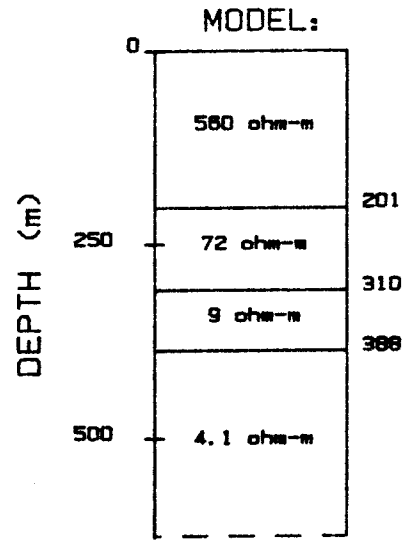
TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.25E+01	0.24E+01	+2.539	0.53E+03
0.11E-03	0.16E+01	0.16E+01	-0.983	0.50E+03
0.14E-03	0.99E+00	0.10E+01	-3.163	0.46E+03
0.18E-03	0.64E+00	0.65E+00	-0.755	0.41E+03
0.22E-03	0.44E+00	0.44E+00	+0.283	0.37E+03
0.28E-03	0.29E+00	0.28E+00	+3.740	0.33E+03
0.35E-03	0.20E+00	0.19E+00	+1.471	0.29E+03
0.44E-03	0.14E+00	0.14E+00	-0.486	0.25E+03
0.56E-03	0.98E-01	0.10E+00	-2.024	0.21E+03
0.71E-03	0.70E-01	0.72E-01	-3.047	0.18E+03
0.88E-03	0.54E-01	0.54E-01	+0.604	0.15E+03
0.11E-02	0.40E-01	0.40E-01	+0.719	0.12E+03
0.14E-02	0.28E-01	0.27E-01	+0.880	0.11E+03
0.18E-02	0.20E-01	0.19E-01	+0.726	0.88E+02
0.22E-02	0.14E-01	0.14E-01	-1.020	0.77E+02
0.29E-02	0.97E-02	0.98E-02	-1.908	0.66E+02
0.36E-02	0.73E-02	0.70E-02	+3.577	0.54E+02
0.45E-02	0.51E-02	0.50E-02	+1.303	0.47E+02
0.57E-02	0.35E-02	0.35E-02	-0.893	0.41E+02
0.72E-02	0.24E-02	0.25E-02	-2.171	0.36E+02
0.88E-02	0.18E-02	0.18E-02	+0.503	0.31E+02
0.11E-01	0.12E-02	0.13E-02	-1.172	0.27E+02
0.14E-01	0.81E-03	0.81E-03	+0.056	0.24E+02
0.18E-01	0.53E-03	0.54E-03	-0.702	0.21E+02
0.22E-01	0.37E-03	0.37E-03	+1.812	0.19E+02

R: 168. X: 0. Y: 0. DL: 0. REO: 168. CF: 1.0000
TDHZ ARRAY, 25 DATA POINTS, SYSTEM: NONE DATA: L3005100
JOB #G85143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 3 STA 10 OCT. 13, 1985
RMS LOG ERROR: 7.76E-03, ANTILOG YIELDS 1.8027 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	P 4	T 1	T 2	T 3	F 0
P 1	.98							
P 2	-.02	.97						
P 3	.00	.00	1.00					
P 4	.00	.00	.00	1.00				
T 1	.01	.02	.00	.00	.99			
T 2	-.02	-.02	.00	.00	.01	.99		
T 3	.00	.00	.00	.00	.00	.00	1.00	
F 0	.00	.00	.00	.00	.00	.00	.00	.00





ERROR= 2.0177 %
LOOP RADIUS= 168m

o FIELD DATA

— MODEL CURVE

THE EARTH TECHNOLOGY CORP

UNOCAL Geothermal

Medicine Lake CA

LINE: 3 STA.: 11

APPARENT RESISTIVITY CURVE

JOB #G85143 Fig.

L3005110

MODEL: 4 LAYERS

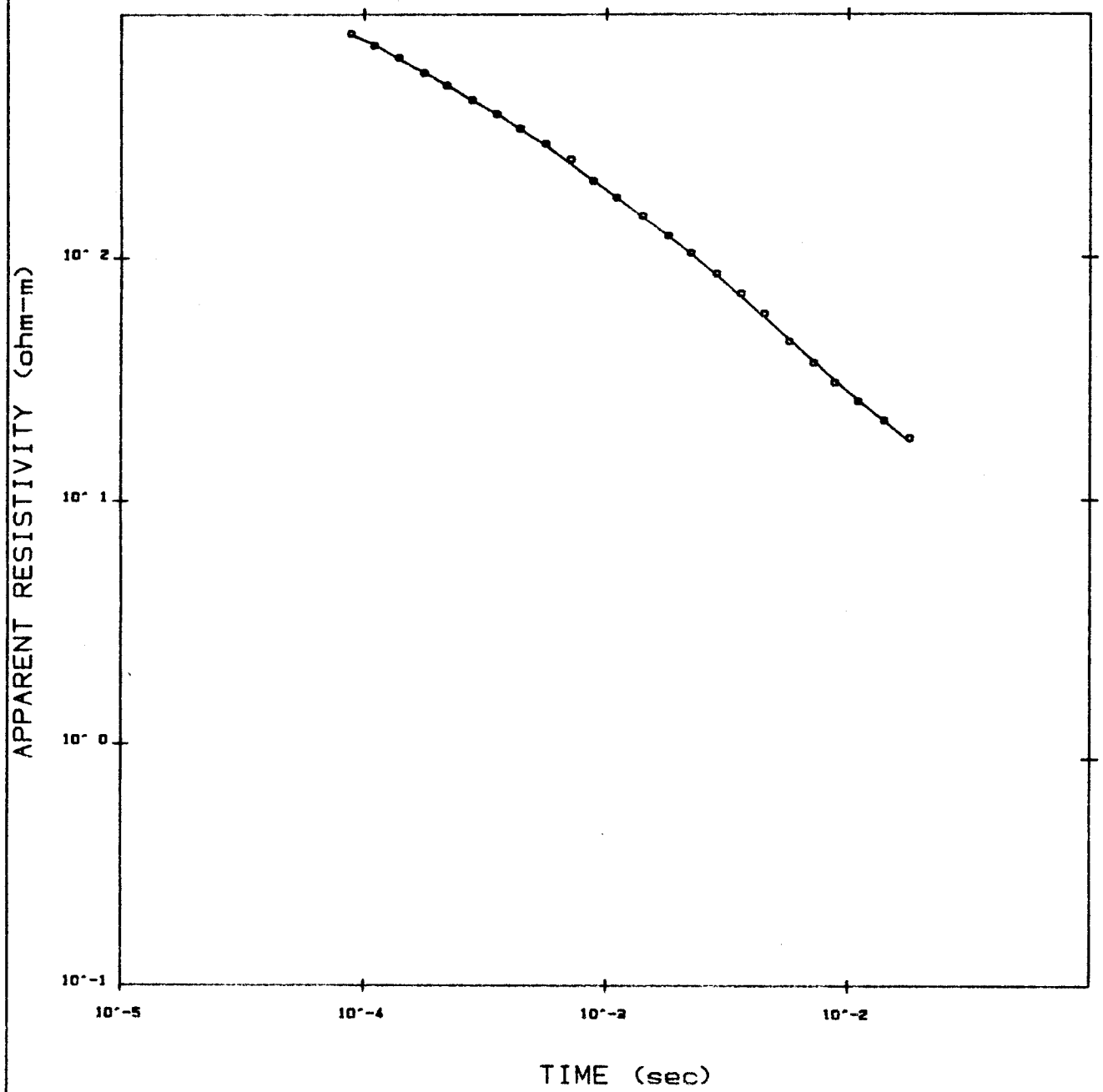
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		2133.6	7000.0		
556.16	200.9	1932.7	6341.0	.4	.4
71.66	109.0	1823.8	5983.4	1.5	1.9
9.04	77.9	1745.8	5727.8	8.6	10.5
4.10					

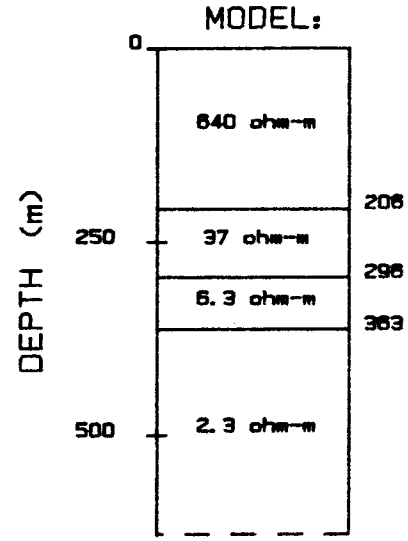
TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.17E+01	0.17E+01	-0.282	0.67E+03
0.11E-03	0.11E+01	0.11E+01	+2.423	0.63E+03
0.14E-03	0.68E+00	0.69E+00	-1.256	0.59E+03
0.18E-03	0.43E+00	0.43E+00	-1.172	0.54E+03
0.22E-03	0.28E+00	0.28E+00	-0.236	0.51E+03
0.28E-03	0.17E+00	0.17E+00	+1.839	0.46E+03
0.35E-03	0.11E+00	0.11E+00	+0.457	0.42E+03
0.44E-03	0.75E-01	0.75E-01	+0.267	0.37E+03
0.56E-03	0.51E-01	0.51E-01	-1.155	0.33E+03
0.71E-03	0.35E-01	0.36E-01	-5.123	0.28E+03
0.88E-03	0.28E-01	0.27E-01	+4.552	0.23E+03
0.11E-02	0.21E-01	0.20E-01	+2.301	0.19E+03
0.14E-02	0.14E-01	0.14E-01	+1.094	0.16E+03
0.18E-02	0.10E-01	0.10E-01	-1.492	0.14E+03
0.22E-02	0.77E-02	0.79E-02	-3.313	0.12E+03
0.29E-02	0.59E-02	0.58E-02	+0.599	0.92E+02
0.36E-02	0.44E-02	0.44E-02	-0.253	0.75E+02
0.45E-02	0.33E-02	0.33E-02	-1.086	0.63E+02
0.57E-02	0.25E-02	0.25E-02	-0.318	0.51E+02
0.72E-02	0.18E-02	0.18E-02	+0.166	0.43E+02
0.88E-02	0.14E-02	0.14E-02	+2.598	0.36E+02
0.11E-01	0.11E-02	0.10E-02	+1.815	0.30E+02
0.14E-01	0.73E-03	0.72E-03	+1.000	0.26E+02
0.18E-01	0.50E-03	0.50E-03	-0.677	0.22E+02
0.22E-01	0.36E-03	0.37E-03	-2.319	0.19E+02

R: 168. X: 0. Y: 0. DL: 0. REQ: 168. CF: 1.0000
TDHZ ARRAY, 25 DATA POINTS, SYSTEM: NONE DATA: L3005110
JOB #G85143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 3 STA 11 OCT. 13, 1985
RMS LOG ERROR: 8.68E-03, ANTILOG YIELDS 2.0177 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	P 4	T 1	T 2	T 3	F 0
P 1	1.00							
P 2	-.01	.94						
P 3	.00	-.02	.99					
P 4	.00	.00	.00	1.00				
T 1	.00	.02	.01	.00	.99			
T 2	-.01	-.02	.00	.00	.01	.99		
T 3	.00	-.01	.00	.00	.00	.00	1.00	
F 0	.00	.00	.00	.00	.00	.00	.00	.00





ERROR= 2.5481 %
LOOP RADIUS= 168m

o FIELD DATA

— MODEL CURVE

THE EARTH TECHNOLOGY CORP

UNOCAL Geothermal

Medicine Lake CA

LINE: 3 STA.: 12

APPARENT RESISTIVITY CURVE

JOB #G85143 Fig.

L3006120

MODEL: 4 LAYERS

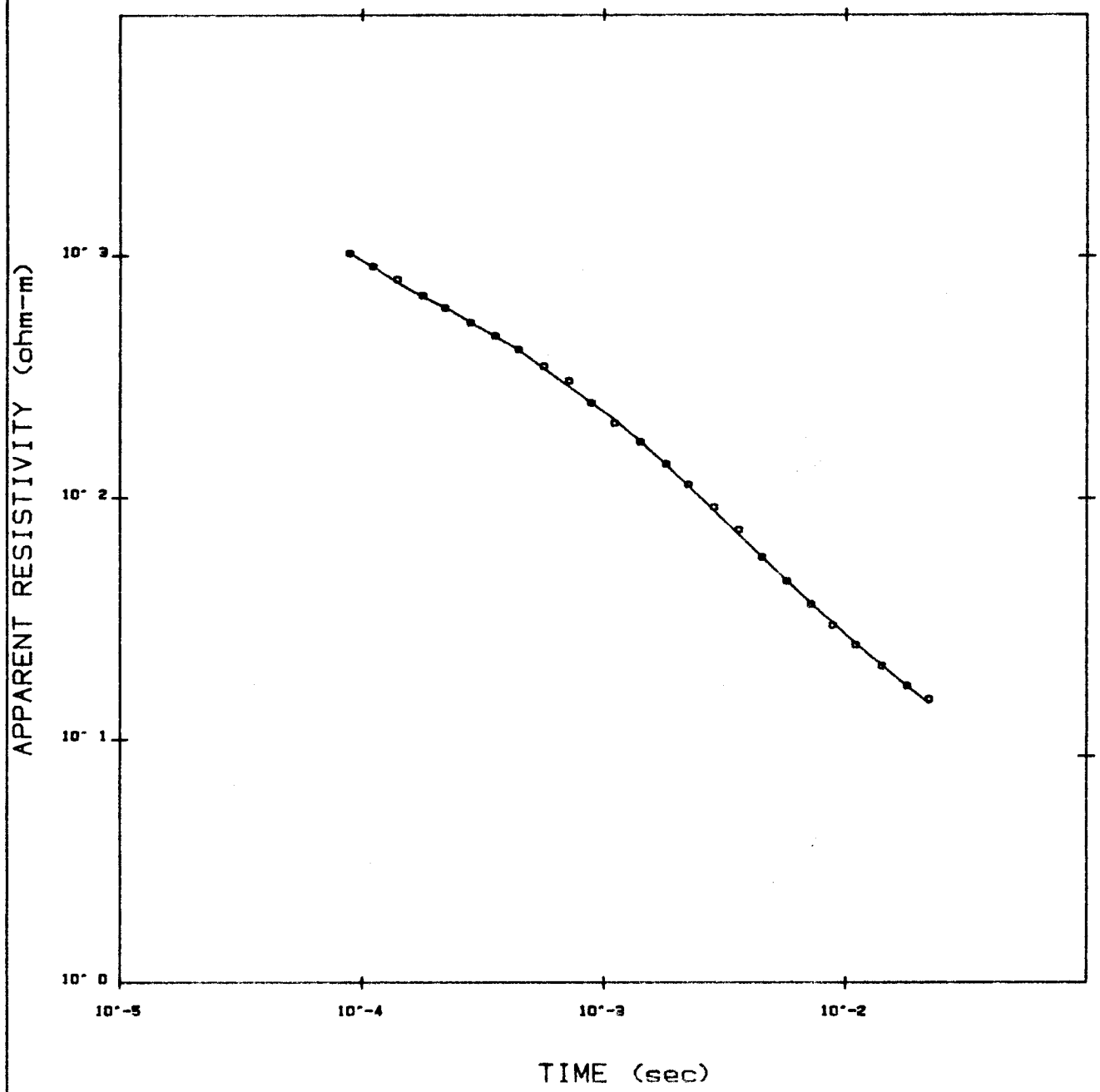
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		2158.0	7080.0		
637.93	205.8	1952.2	6404.7	.3	.3
36.75	90.0	1862.2	6109.6	2.4	2.8
6.25	67.3	1794.9	5888.9	10.8	13.5
2.28					

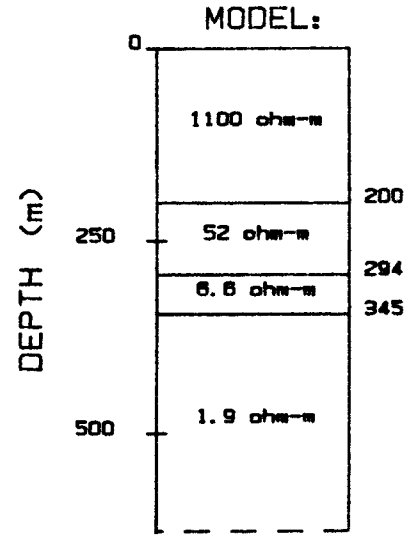
TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.13E+01	0.13E+01	-0.154	0.82E+03
0.11E-03	0.89E+00	0.86E+00	+2.531	0.73E+03
0.14E-03	0.58E+00	0.59E+00	-1.327	0.66E+03
0.18E-03	0.40E+00	0.39E+00	+0.869	0.57E+03
0.22E-03	0.28E+00	0.27E+00	+0.497	0.51E+03
0.28E-03	0.19E+00	0.19E+00	+0.339	0.44E+03
0.35E-03	0.13E+00	0.12E+00	+1.027	0.39E+03
0.44E-03	0.88E-01	0.86E-01	+1.665	0.34E+03
0.56E-03	0.59E-01	0.61E-01	-2.204	0.29E+03
0.71E-03	0.41E-01	0.43E-01	-4.504	0.25E+03
0.88E-03	0.33E-01	0.32E-01	+3.193	0.21E+03
0.11E-02	0.24E-01	0.23E-01	+2.080	0.18E+03
0.14E-02	0.17E-01	0.16E-01	+1.381	0.15E+03
0.18E-02	0.12E-01	0.12E-01	+0.068	0.12E+03
0.22E-02	0.90E-02	0.91E-02	-0.453	0.10E+03
0.29E-02	0.66E-02	0.67E-02	-1.368	0.85E+02
0.36E-02	0.49E-02	0.51E-02	-4.077	0.70E+02
0.45E-02	0.37E-02	0.39E-02	-4.787	0.58E+02
0.57E-02	0.31E-02	0.30E-02	+2.829	0.45E+02
0.72E-02	0.23E-02	0.22E-02	+2.503	0.37E+02
0.88E-02	0.18E-02	0.18E-02	+3.924	0.30E+02
0.11E-01	0.14E-02	0.13E-02	+2.133	0.25E+02
0.14E-01	0.97E-03	0.97E-03	-0.016	0.21E+02
0.18E-01	0.67E-03	0.70E-03	-4.390	0.18E+02

R: 168. X: 0. Y: 0. DL: 0. REQ: 168. CF: 1.0000
TDHZ ARRAY, 24 DATA POINTS, SYSTEM: NONE DATA: L3006120
JOB #685143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 3 STA 12 OCT. 14, 1985
RMS LOG ERROR: 1.09E-02, ANTILOG YIELDS 2.5481 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	P 4	T 1	T 2	T 3	F 0
P 1	.99							
P 2	-.01	.97						
P 3	-.01	-.02	.98					
P 4	.00	.00	-.01	.99				
T 1	.00	.01	.00	.00	1.00			
T 2	.00	-.01	.00	.00	.00	1.00		
T 3	.00	-.01	.00	.00	.00	.00	1.00	
F 0	.00	.00	.00	.00	.00	.00	.00	.00





ERROR= 2.9178 %
LOOP RADIUS= 168m

FIELD DATA

MODEL CURVE

THE EARTH TECHNOLOGY CORP

UNOCAL Geothermal

Medicine Lake CA

LINE: 3 STA.: 13

APPARENT RESISTIVITY CURVE

JOB #G85143 Fig.

L300S130

MODEL: 4 LAYERS

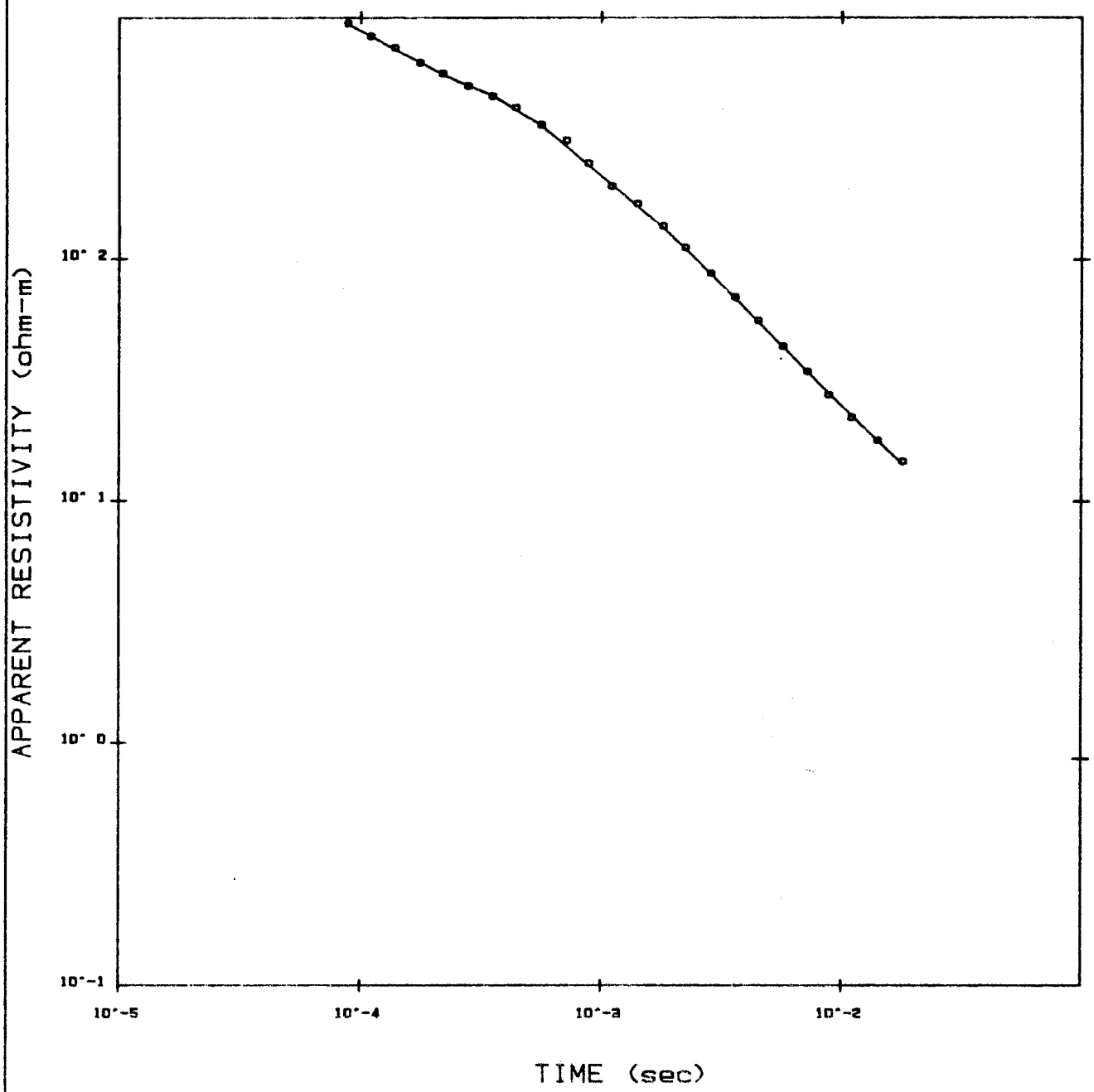
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		2133.6	7000.0		
1107.50	199.6	1934.0	6345.2	.2	.2
52.29	94.0	1840.0	6036.7	1.8	2.0
6.56	51.2	1788.8	5868.8	7.8	9.8
1.93					

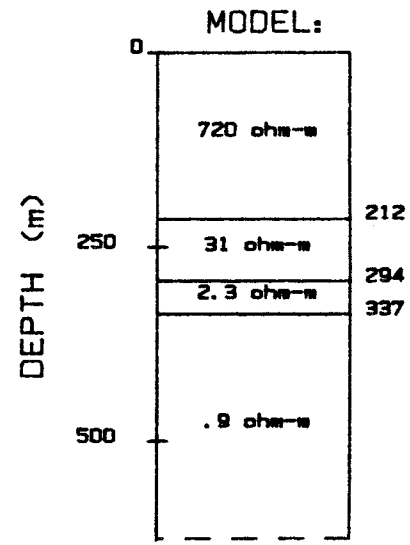
TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.93E+00	0.92E+00	+0.985	0.10E+04
0.11E-03	0.65E+00	0.65E+00	+0.082	0.90E+03
0.14E-03	0.44E+00	0.45E+00	-3.201	0.79E+03
0.18E-03	0.30E+00	0.31E+00	-1.042	0.68E+03
0.22E-03	0.21E+00	0.21E+00	+1.533	0.60E+03
0.28E-03	0.14E+00	0.14E+00	+3.241	0.52E+03
0.35E-03	0.96E-01	0.95E-01	+0.246	0.46E+03
0.44E-03	0.67E-01	0.67E-01	-0.159	0.41E+03
0.56E-03	0.46E-01	0.47E-01	-1.094	0.35E+03
0.71E-03	0.31E-01	0.33E-01	-4.362	0.30E+03
0.88E-03	0.25E-01	0.25E-01	+3.134	0.24E+03
0.11E-02	0.19E-01	0.18E-01	+5.394	0.20E+03
0.14E-02	0.14E-01	0.13E-01	+2.011	0.17E+03
0.18E-02	0.10E-01	0.10E-01	-0.705	0.14E+03
0.22E-02	0.79E-02	0.80E-02	-1.406	0.11E+03
0.29E-02	0.59E-02	0.61E-02	-3.866	0.91E+02
0.36E-02	0.45E-02	0.48E-02	-6.129	0.74E+02
0.45E-02	0.39E-02	0.38E-02	+0.939	0.57E+02
0.57E-02	0.30E-02	0.30E-02	+1.284	0.45E+02
0.72E-02	0.24E-02	0.23E-02	+2.389	0.36E+02
0.88E-02	0.19E-02	0.18E-02	+4.191	0.29E+02
0.11E-01	0.15E-02	0.14E-02	+2.880	0.24E+02
0.14E-01	0.11E-02	0.10E-02	+1.946	0.20E+02
0.18E-01	0.76E-03	0.76E-03	-0.353	0.17E+02
0.22E-01	0.55E-03	0.57E-03	-4.829	0.15E+02

R: 168. X: 0. Y: 0. DL: 0. REQ: 168. CF: 1.0000
TDHZ ARRAY, 25 DATA POINTS, SYSTEM: NONE DATA: L300S130
JOB #685143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 3 STA 13 OCT. 14, 1985
RMS LOG ERROR: 1.25E-02, ANTILOG YIELDS 2.9178 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	P 4	T 1	T 2	T 3	F 0
P 1	.97							
P 2	-.03	.96						
P 3	-.01	-.03	.95					
P 4	.00	.00	-.01	1.00				
T 1	.01	.01	.01	.00	1.00			
T 2	-.01	-.01	.00	.00	.00	.99		
T 3	-.01	-.01	-.01	.00	.00	.00	.99	
F 0	.00	.00	.00	.00	.00	.00	.00	.00





ERROR= 2.1736 %
LOOP RADIUS= 168m

o FIELD DATA

— MODEL CURVE

THE EARTH TECHNOLOGY CORP

UNOCAL Geothermal

Medicine Lake CA

LINE: 3 STA.: 14

APPARENT RESISTIVITY CURVE

JOB #G85143 Fig.

L300S140

MODEL: 4 LAYERS

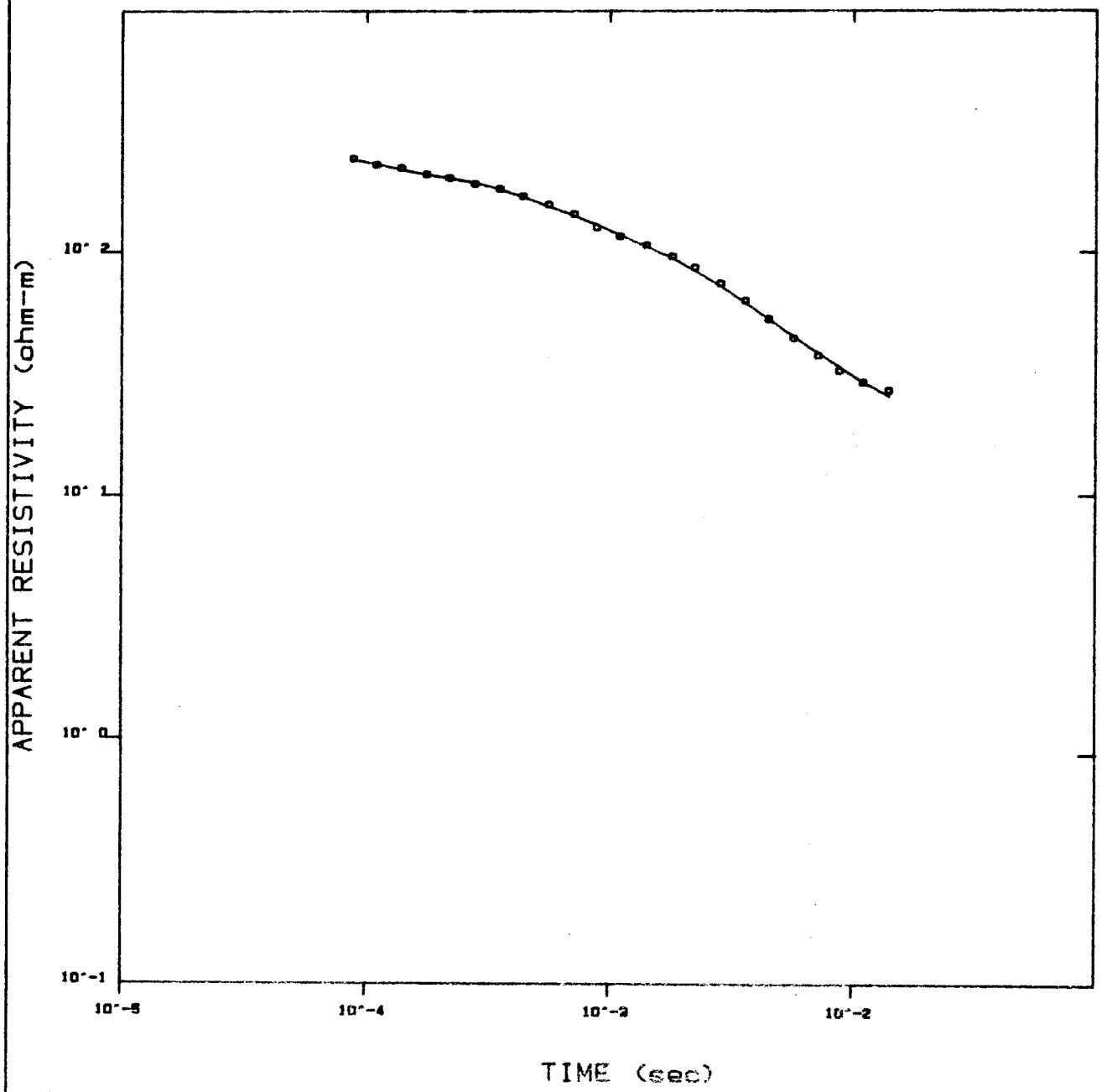
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		2133.6	7000.0		
719.50	212.4	1921.4	6303.8	.3	.3
31.17	81.9	1839.5	6035.0	2.6	2.9
2.29	42.8	1796.7	5894.6	18.7	21.6
.93					

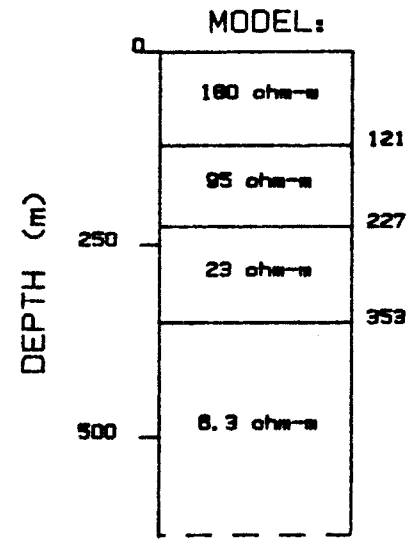
TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.11E+01	0.11E+01	+0.294	0.94E+03
0.11E-03	0.73E+00	0.73E+00	+0.706	0.83E+03
0.14E-03	0.48E+00	0.49E+00	-1.753	0.75E+03
0.18E-03	0.32E+00	0.32E+00	+0.867	0.65E+03
0.22E-03	0.22E+00	0.22E+00	-0.798	0.58E+03
0.28E-03	0.15E+00	0.14E+00	+0.609	0.52E+03
0.35E-03	0.93E-01	0.92E-01	+1.111	0.47E+03
0.44E-03	0.63E-01	0.63E-01	-0.311	0.42E+03
0.56E-03	0.44E-01	0.44E-01	-0.779	0.36E+03
0.71E-03	0.30E-01	0.31E-01	-3.708	0.31E+03
0.88E-03	0.25E-01	0.24E-01	+2.256	0.25E+03
0.11E-02	0.20E-01	0.18E-01	+6.826	0.20E+03
0.14E-02	0.14E-01	0.14E-01	-0.859	0.17E+03
0.18E-02	0.10E-01	0.10E-01	-2.233	0.14E+03
0.22E-02	0.81E-02	0.82E-02	-1.430	0.11E+03
0.29E-02	0.63E-02	0.64E-02	-0.342	0.87E+02
0.36E-02	0.50E-02	0.50E-02	-0.892	0.69E+02
0.45E-02	0.40E-02	0.40E-02	-1.018	0.55E+02
0.57E-02	0.32E-02	0.32E-02	-0.256	0.43E+02
0.72E-02	0.26E-02	0.25E-02	+0.714	0.34E+02
0.88E-02	0.21E-02	0.21E-02	+3.046	0.27E+02
0.11E-01	0.17E-02	0.16E-02	+2.771	0.22E+02
0.14E-01	0.13E-02	0.13E-02	+0.319	0.18E+02
0.18E-01	0.93E-03	0.96E-03	-3.631	0.15E+02

R: 168. X: 0. Y: 0. DL: 0. REQ: 168. CF: 1.0000
TDHZ ARRAY, 24 DATA POINTS, SYSTEM: NONE DATA: L300S140
JOB #G85143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 3 STA 14 OCT. 14, 1985
RMS LOG ERROR: 9.34E-03, ANTILOG YIELDS 2.1736 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	P 4	T 1	T 2	T 3	F 0
P 1	.99							
P 2	-.01	.97						
P 3	-.01	-.02	.98					
P 4	.00	-.01	-.02	.98				
T 1	.00	.01	.00	.00	1.00			
T 2	.00	-.01	.00	.00	.00	1.00		
T 3	.00	.00	.00	.00	.00	.00	1.00	
F 0	.00	.00	.00	.00	.00	.00	.00	.00





ERROR= 2.9883 %
LOOP RADIUS= 160m

o FIELD DATA

— MODEL CURVE

THE EARTH TECHNOLOGY CORP.

UNOCAL Geothermal

Medicine Lake CA

LINE: 4 STA.: 1

APPARENT RESISTIVITY CURVE

JOB #G85143 Fig.

L4005010

MODEL: 4 LAYERS

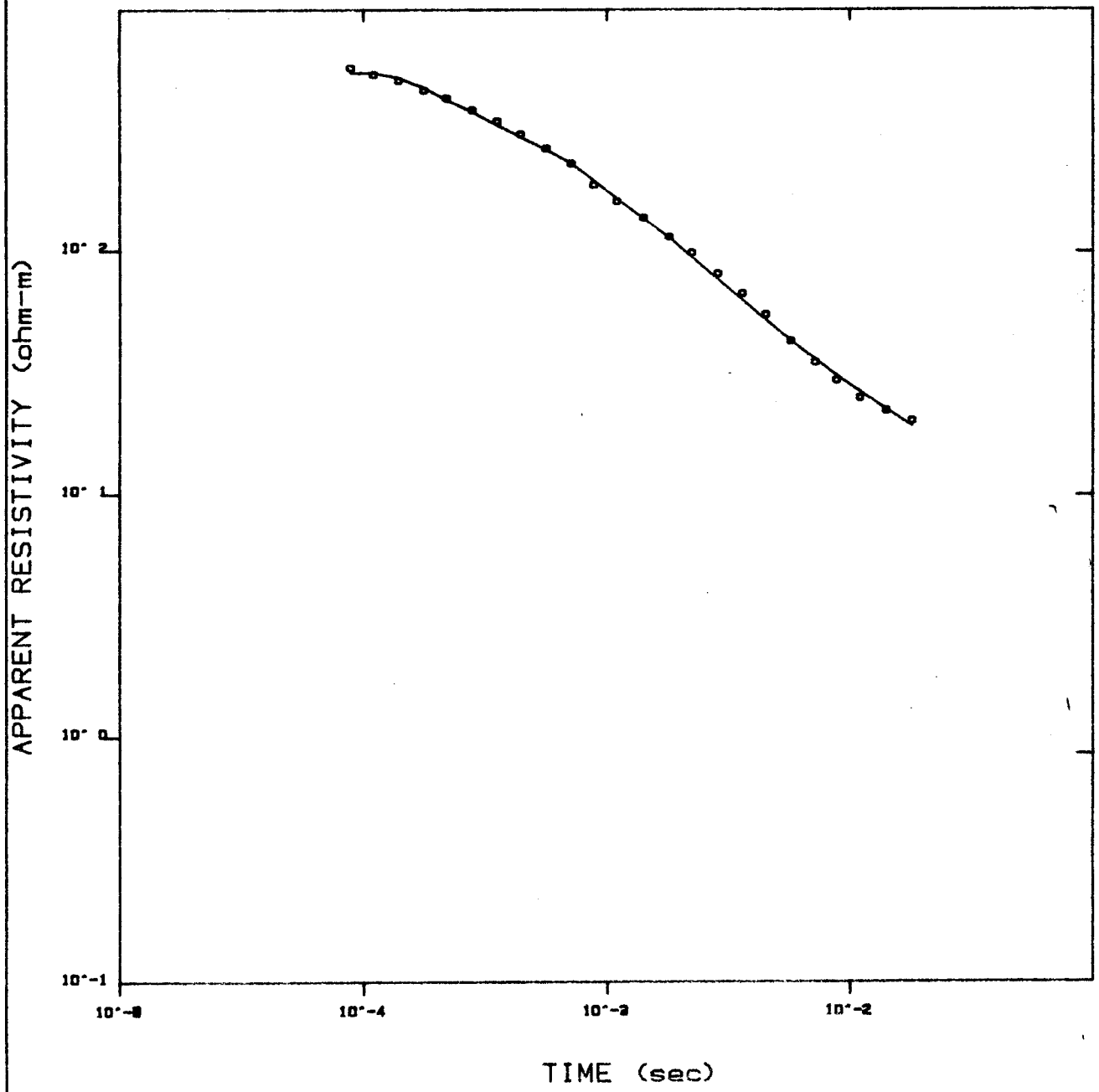
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		2072.6	6800.0		
182.24	120.8	1951.8	6403.6	.7	.7
94.57	105.8	1846.0	6056.3	1.1	1.8
22.79	126.3	1719.7	5642.0	5.5	7.3
6.32					

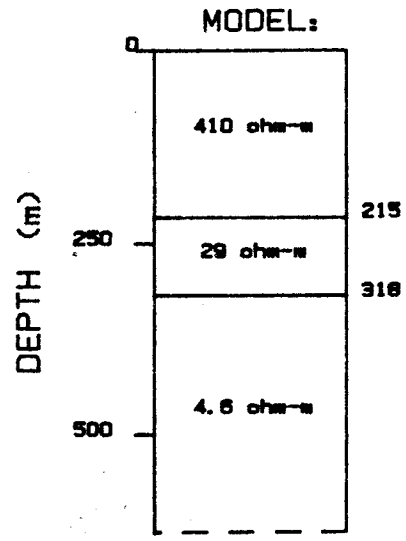
TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.79E+01	0.79E+01	-0.334	0.25E+03
0.11E-03	0.50E+01	0.49E+01	+1.341	0.23E+03
0.14E-03	0.29E+01	0.30E+01	-1.578	0.22E+03
0.18E-03	0.18E+01	0.18E+01	+0.097	0.21E+03
0.22E-03	0.11E+01	0.11E+01	+0.387	0.20E+03
0.28E-03	0.64E+00	0.63E+00	+1.556	0.19E+03
0.35E-03	0.39E+00	0.39E+00	-0.337	0.18E+03
0.44E-03	0.25E+00	0.25E+00	-1.063	0.17E+03
0.56E-03	0.15E+00	0.15E+00	-1.876	0.16E+03
0.71E-03	0.95E-01	0.97E-01	-2.162	0.14E+03
0.88E-03	0.68E-01	0.65E-01	+4.479	0.13E+03
0.11E-02	0.45E-01	0.43E-01	+2.835	0.12E+03
0.14E-02	0.27E-01	0.27E-01	+1.461	0.11E+03
0.18E-02	0.17E-01	0.18E-01	-1.752	0.95E+02
0.22E-02	0.12E-01	0.13E-01	-3.670	0.86E+02
0.29E-02	0.82E-02	0.84E-02	-2.884	0.74E+02
0.36E-02	0.58E-02	0.59E-02	-2.373	0.63E+02
0.45E-02	0.43E-02	0.43E-02	+0.764	0.53E+02
0.57E-02	0.31E-02	0.30E-02	+3.073	0.44E+02
0.72E-02	0.22E-02	0.21E-02	+4.232	0.38E+02
0.86E-02	0.16E-02	0.15E-02	+5.709	0.33E+02
0.11E-01	0.11E-02	0.11E-02	+0.861	0.29E+02
0.14E-01	0.67E-03	0.72E-03	-7.523	0.27E+02

R: 168. X: 0. Y: 0. DL: 0. REQ: 168. CF: 1.0000
TDHZ ARRAY, 23 DATA POINTS, SYSTEM: NONE DATA: L4005010
JOB #G85143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 4 STA 1 OCT. 14, 1985
RMS LOG ERROR: 1.27E-02, ANTILOG YIELDS 2.9683 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	P 4	T 1	T 2	T 3	F 0
P 1	1.00							
P 2	-.01	.86						
P 3	.00	-.04	.99					
P 4	.00	.00	.00	1.00				
T 1	.01	.12	.03	.00	.90			
T 2	-.01	-.09	-.02	.00	.08	.94		
T 3	.00	-.03	-.01	.00	.03	-.02	.99	
F 0	.00	.00	.00	.00	.00	.00	.00	.00





ERROR= 5.5809 %
LOOP RADIUS= 168m

o FIELD DATA

— MODEL CURVE

THE EARTH TECHNOLOGY CORP

UNOCAL Geothermal

Medicine Lake CA

LINE: 4 STA.: 2

APPARENT RESISTIVITY CURVE

JOB #G85143 Fig.

L100S020

MODEL: 3 LAYERS

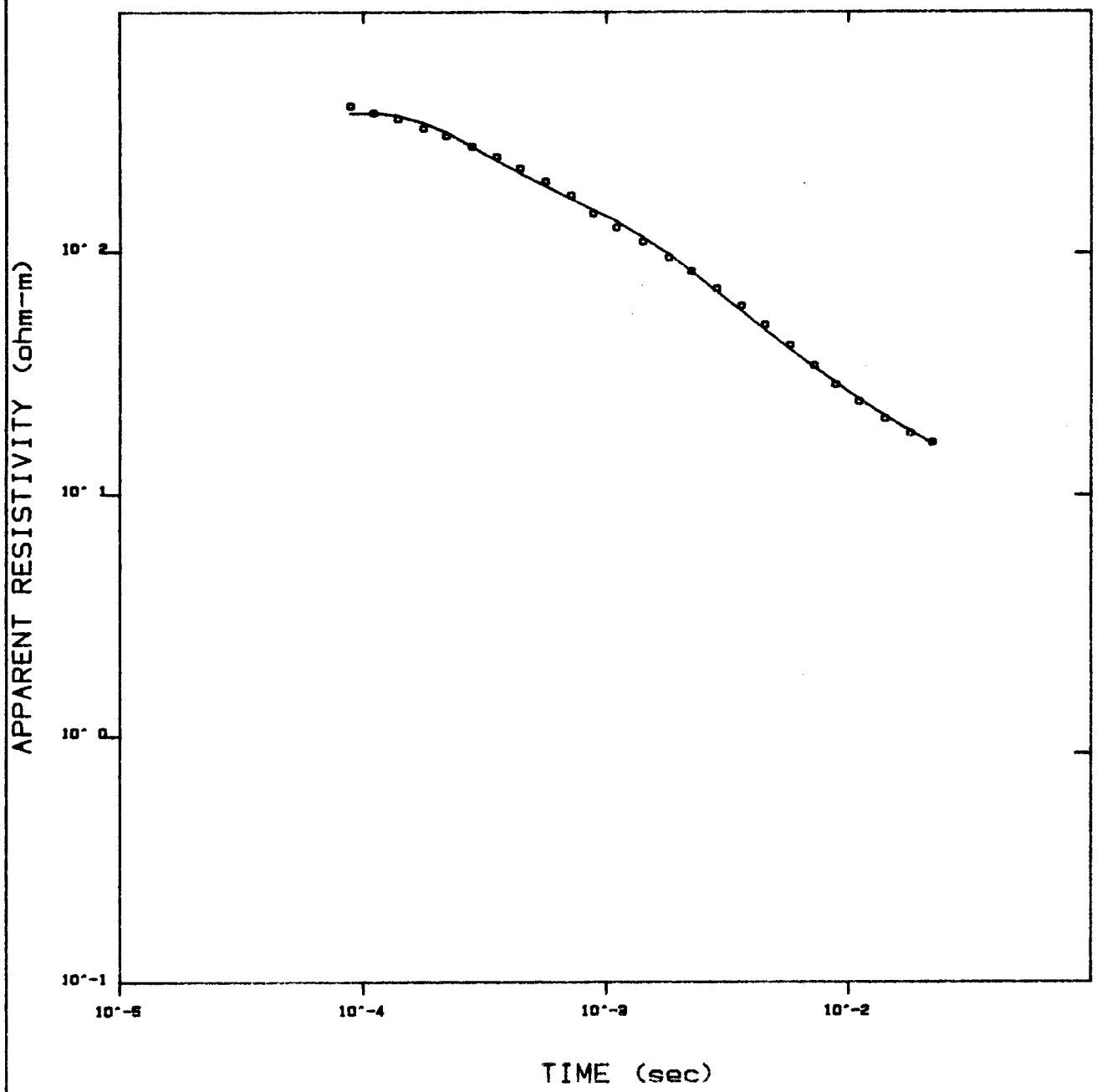
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		2097.0	6880.0		
406.22	214.8	1882.2	6175.3	.5	.5
28.92	102.9	1779.3	5837.6	3.6	4.1
4.58					

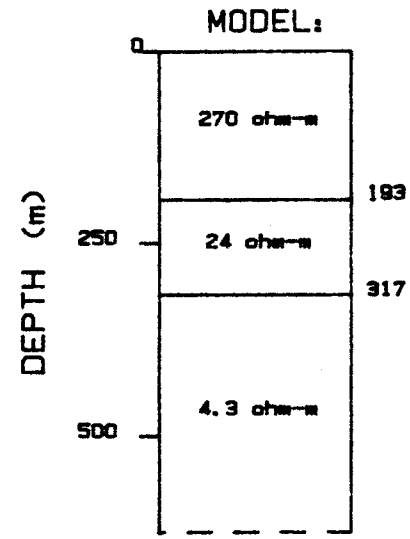
TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.23E+01	0.24E+01	-5.281	0.56E+03
0.11E-03	0.14E+01	0.14E+01	+2.845	0.53E+03
0.14E-03	0.87E+00	0.84E+00	+4.279	0.50E+03
0.18E-03	0.55E+00	0.52E+00	+4.709	0.46E+03
0.22E-03	0.36E+00	0.37E+00	-1.218	0.42E+03
0.28E-03	0.23E+00	0.24E+00	-2.308	0.38E+03
0.35E-03	0.15E+00	0.16E+00	-4.454	0.34E+03
0.44E-03	0.10E+00	0.11E+00	-4.615	0.30E+03
0.56E-03	0.69E-01	0.70E-01	-1.857	0.27E+03
0.71E-03	0.47E-01	0.47E-01	+0.875	0.23E+03
0.88E-03	0.37E-01	0.34E-01	+10.254	0.19E+03
0.11E-02	0.27E-01	0.25E-01	+8.789	0.16E+03
0.14E-02	0.19E-01	0.18E-01	+3.780	0.14E+03
0.18E-02	0.13E-01	0.13E-01	-0.673	0.11E+03
0.22E-02	0.98E-02	0.10E-01	-5.367	0.98E+02
0.29E-02	0.72E-02	0.77E-02	-6.996	0.80E+02
0.36E-02	0.53E-02	0.58E-02	-8.220	0.66E+02
0.45E-02	0.41E-02	0.44E-02	-6.799	0.54E+02
0.57E-02	0.33E-02	0.33E-02	+1.338	0.42E+02
0.72E-02	0.25E-02	0.24E-02	+4.601	0.35E+02
0.88E-02	0.19E-02	0.18E-02	+7.364	0.29E+02
0.11E-01	0.14E-02	0.13E-02	+8.567	0.25E+02
0.14E-01	0.91E-03	0.89E-03	+2.003	0.22E+02
0.18E-01	0.57E-03	0.61E-03	-6.595	0.20E+02

R: 168. X: 0. Y: 0. DL: 0. REQ: 168. CF: 1.0000
TDHZ ARRAY, 24 DATA POINTS, SYSTEM: NONE DATA: L100S020
JOB #685143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 4 STA 2 OCT. 14, 1985
RMS LOG ERROR: 2.36E-02, ANTILOG YIELDS 5.5809 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	1.00					
P 2	.00	1.00				
P 3	.00	.00	1.00			
T 1	.00	.00	.00	1.00		
T 2	.00	.00	.00	.00	1.00	
F 0	.00	.00	.00	.00	.00	.00





ERROR= 5.8074 %
LOOP RADIUS= 168m

FIELD DATA

MODEL CURVE

THE EARTH TECHNOLOGY CORP

UNOCAL Geothermal

Medicine Lake CA

LINE: 4 STA.: 3

APPARENT RESISTIVITY CURVE

JOB #G85143 Fig.

L4005030

MODEL: 3 LAYERS

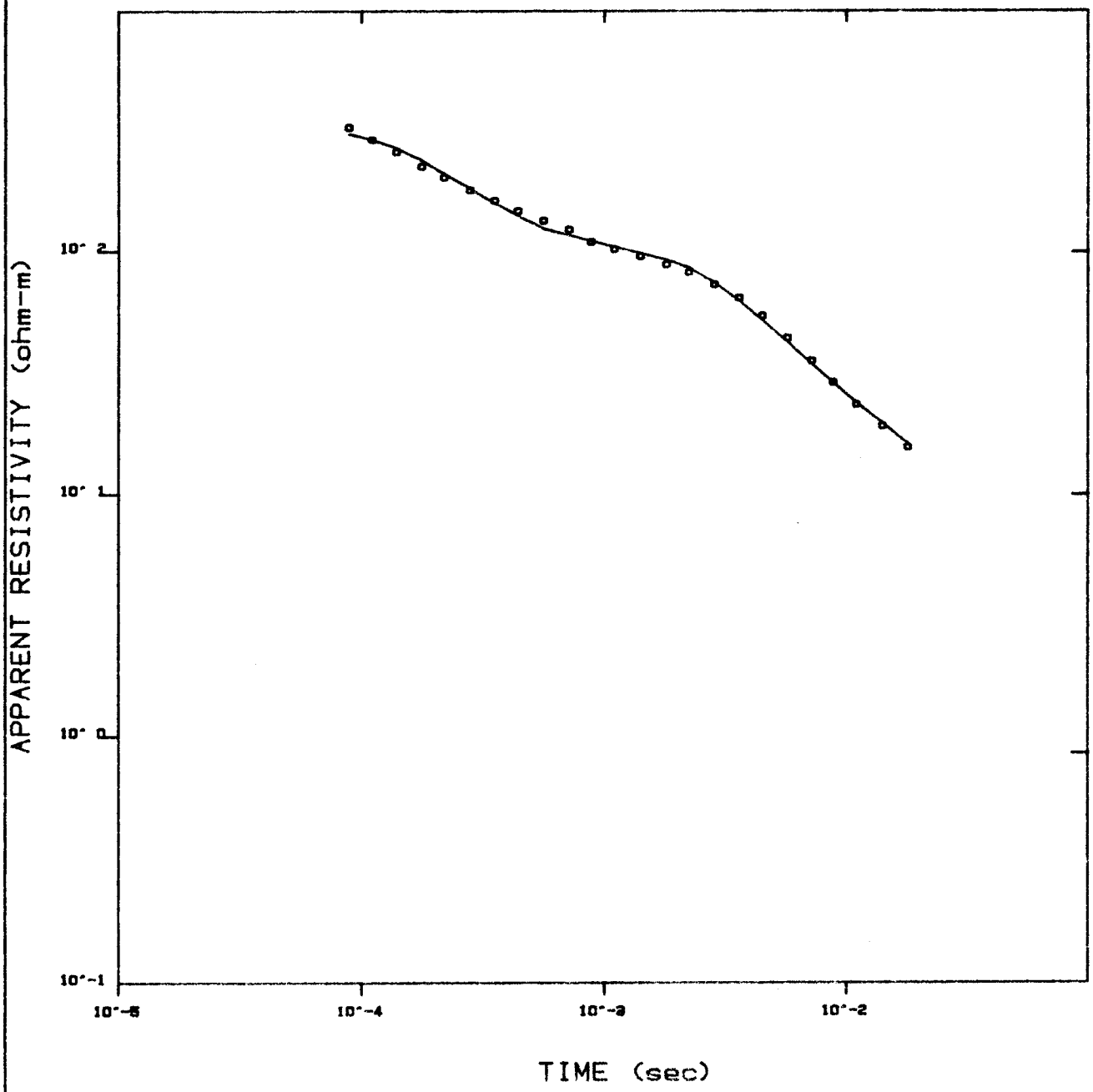
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		2100.1	6890.0		
274.96	192.7	1907.4	6257.8	.7	.7
24.21	124.2	1783.1	5850.1	5.1	5.8
4.32					

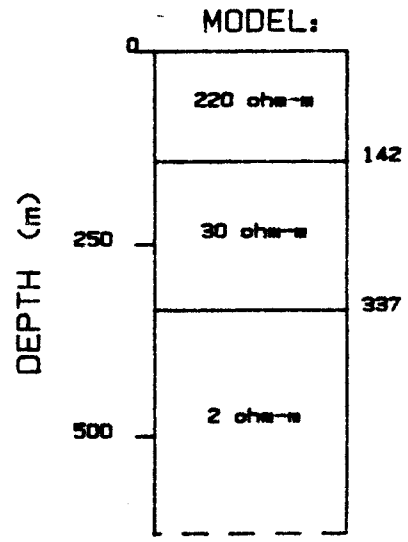
TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.89E-04	0.38E+01	0.42E+01	-9.090	0.40E+03
0.11E-03	0.25E+01	0.24E+01	+1.038	0.37E+03
0.14E-03	0.15E+01	0.14E+01	+5.149	0.35E+03
0.18E-03	0.93E+00	0.85E+00	+8.655	0.32E+03
0.22E-03	0.61E+00	0.57E+00	+6.144	0.30E+03
0.28E-03	0.38E+00	0.38E+00	+0.992	0.27E+03
0.35E-03	0.25E+00	0.26E+00	-5.683	0.25E+03
0.44E-03	0.17E+00	0.18E+00	-6.810	0.22E+03
0.56E-03	0.11E+00	0.12E+00	-7.374	0.20E+03
0.71E-03	0.73E-01	0.77E-01	-5.425	0.17E+03
0.88E-03	0.56E-01	0.52E-01	+6.446	0.14E+03
0.11E-02	0.39E-01	0.36E-01	+9.543	0.13E+03
0.14E-02	0.26E-01	0.24E-01	+7.723	0.11E+03
0.18E-02	0.18E-01	0.17E-01	+5.269	0.95E+02
0.22E-02	0.13E-01	0.12E-01	+0.557	0.83E+02
0.29E-02	0.87E-02	0.90E-02	-3.559	0.71E+02
0.36E-02	0.62E-02	0.66E-02	-6.956	0.60E+02
0.45E-02	0.47E-02	0.50E-02	-6.237	0.50E+02
0.57E-02	0.34E-02	0.36E-02	-4.747	0.41E+02
0.72E-02	0.26E-02	0.26E-02	-2.175	0.34E+02
0.88E-02	0.20E-02	0.20E-02	+3.122	0.28E+02
0.11E-01	0.15E-02	0.14E-02	+4.449	0.24E+02
0.14E-01	0.10E-02	0.98E-03	+4.337	0.20E+02
0.18E-01	0.68E-03	0.66E-03	+3.479	0.18E+02
0.22E-01	0.46E-03	0.47E-03	-1.735	0.16E+02

R: 168. X: 0. Y: 0. DL: 0. REQ: 168. CF: 1.0000
TDHZ ARRAY, 25 DATA POINTS, SYSTEM: NONE DATA: L4005030
JOB #G85143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 4 STA 3 OCT. 14, 1985
RMS LOG ERROR: 2.45E-02, ANTILOG YIELDS 5.8074 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	1.00					
P 2	.00	1.00				
P 3	.00	.00	1.00			
T 1	.00	.00	.00	1.00		
T 2	.00	.00	.00	.00	1.00	
F 0	.00	.00	.00	.00	.00	.00





ERROR= 6.1232 %
LOOP RADIUS= 168m

o FIELD DATA

— MODEL CURVE

THE EARTH TECHNOLOGY CORP

UNOCAL Geothermal

Medicine Lake CA

LINE: 4 STA.: 4

APPARENT RESISTIVITY CURVE

JOB #G85143 Fig.

L400S040

MODEL: 3 LAYERS

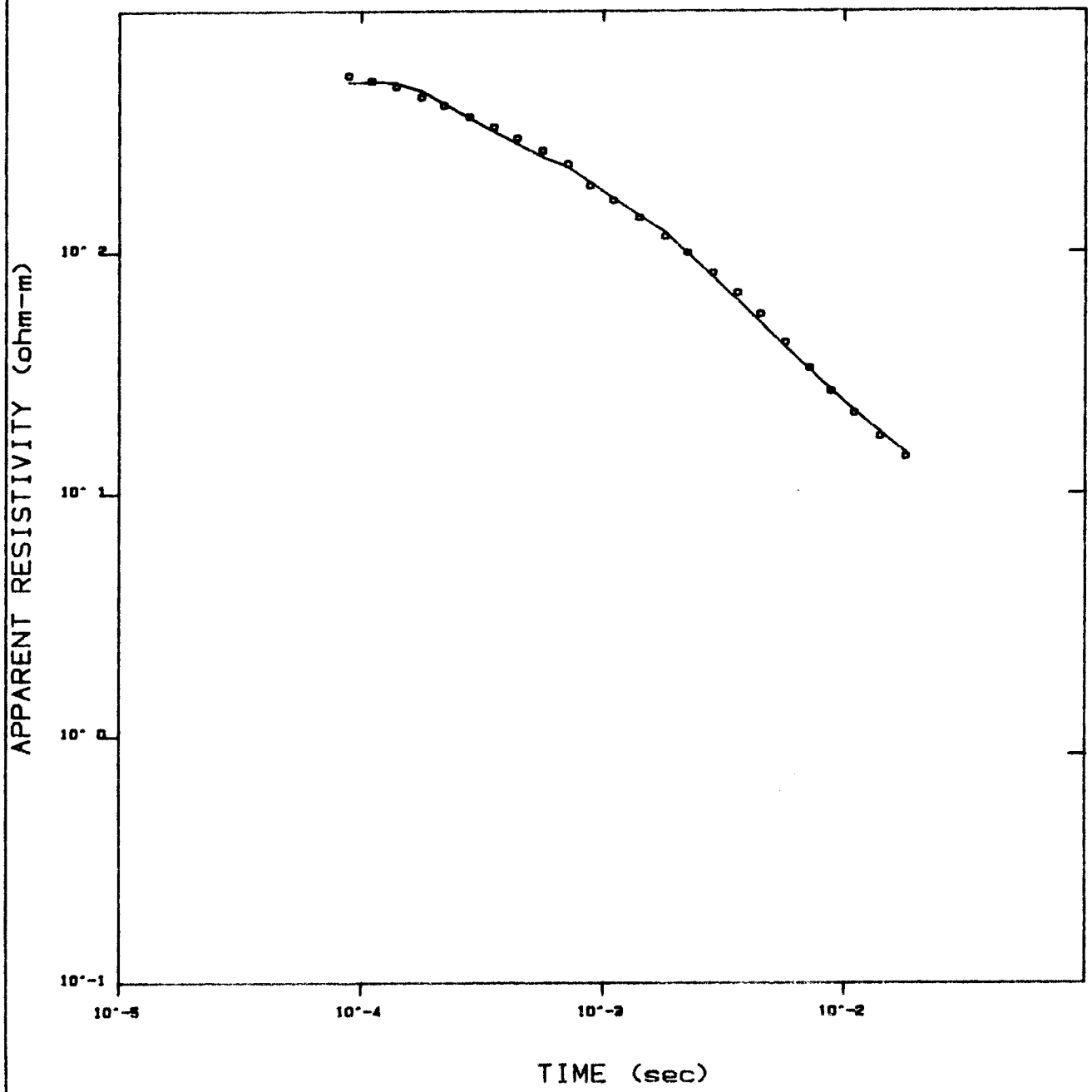
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		2112.3	6930.0		
216.12	142.1	1970.1	6463.7	.7	.7
30.42	194.9	1775.2	5824.1	6.4	7.1
2.01					

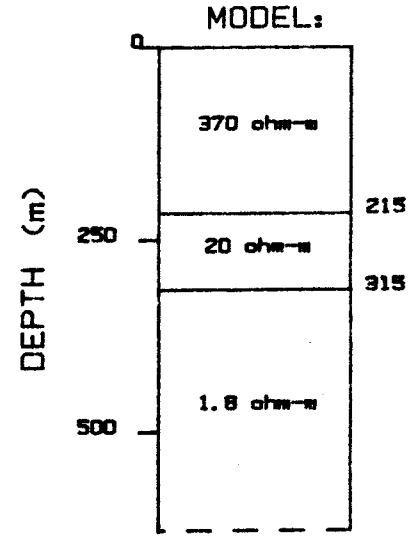
TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.51E+01	0.55E+01	-7.883	0.33E+03
0.11E-03	0.35E+01	0.35E+01	+0.876	0.29E+03
0.14E-03	0.23E+01	0.22E+01	+5.523	0.26E+03
0.18E-03	0.16E+01	0.14E+01	+10.061	0.23E+03
0.22E-03	0.11E+01	0.10E+01	+6.450	0.20E+03
0.28E-03	0.71E+00	0.69E+00	+2.510	0.18E+03
0.35E-03	0.46E+00	0.47E+00	-2.809	0.16E+03
0.44E-03	0.31E+00	0.33E+00	-7.250	0.15E+03
0.56E-03	0.19E+00	0.21E+00	-10.355	0.13E+03
0.71E-03	0.12E+00	0.13E+00	-10.086	0.12E+03
0.88E-03	0.84E-01	0.87E-01	-2.724	0.11E+03
0.11E-02	0.54E-01	0.53E-01	+1.225	0.10E+03
0.14E-02	0.32E-01	0.30E-01	+7.307	0.95E+02
0.18E-02	0.20E-01	0.18E-01	+7.499	0.88E+02
0.22E-02	0.13E-01	0.12E-01	+6.949	0.81E+02
0.29E-02	0.83E-02	0.80E-02	+3.310	0.73E+02
0.36E-02	0.56E-02	0.58E-02	-3.627	0.64E+02
0.45E-02	0.41E-02	0.44E-02	-5.646	0.54E+02
0.57E-02	0.31E-02	0.33E-02	-5.009	0.44E+02
0.72E-02	0.24E-02	0.25E-02	-3.516	0.36E+02
0.88E-02	0.20E-02	0.20E-02	+0.448	0.29E+02
0.11E-01	0.15E-02	0.15E-02	+3.699	0.24E+02
0.14E-01	0.11E-02	0.11E-02	+4.490	0.19E+02
0.18E-01	0.83E-03	0.79E-03	+5.625	0.16E+02

R: 168. X: 0. Y: 0. DL: 0. REQ: 168. CF: 1.0000
TDHZ ARRAY, 24 DATA POINTS, SYSTEM: NONE DATA: L400S040
JOB #G85143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 4 STA 4 OCT. 14, 1985
RMS LOG ERROR: 2.58E-02, ANTILOG YIELDS 6.1232 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	1.00					
P 2	.00	1.00				
P 3	.00	.00	1.00			
T 1	.00	.00	.00	1.00		
T 2	.00	.00	.00	.00	1.00	
F 0	.00	.00	.00	.00	.00	.00





ERROR= 7.2770 %
LOOP RADIUS= 168m

o FIELD DATA

— MODEL CURVE

THE EARTH TECHNOLOGY CORP

UNOCAL Geothermal

Medicine Lake CA

LINE: 4 STA.: 5

APPARENT RESISTIVITY CURVE

JOB #G85143 Fig.

L400S050

MODEL: 3 LAYERS

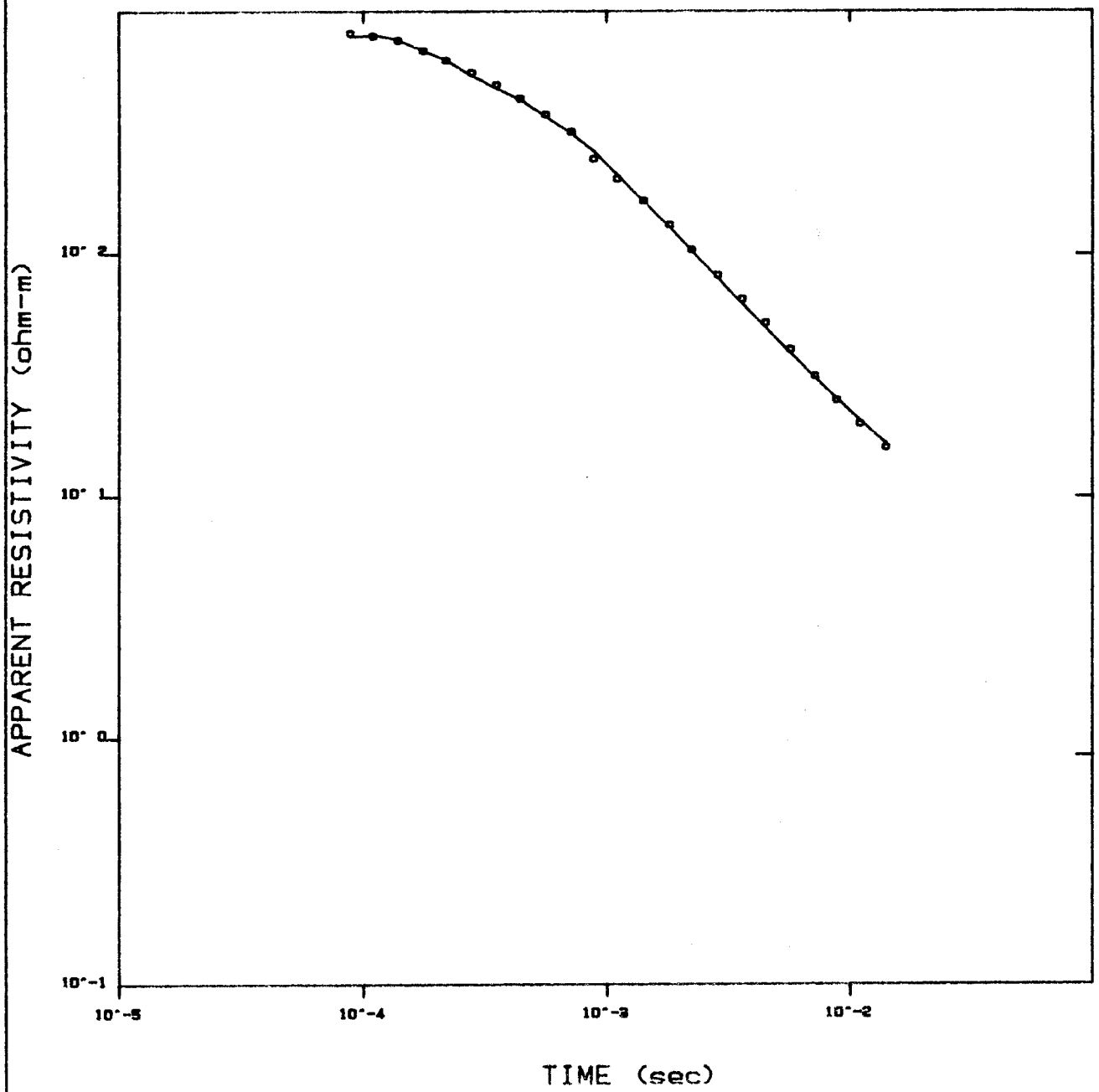
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		2130.6	6990.0		
371.04	214.9	1915.6	6284.8	.6	.6
19.71	100.0	1815.6	5956.6	5.1	5.7
1.83					

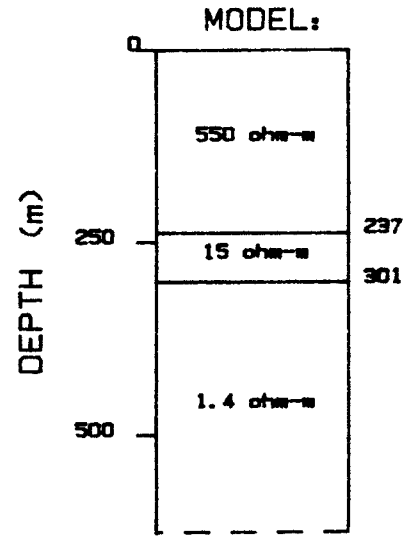
TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.25E+01	0.27E+01	-7.614	0.54E+03
0.11E-03	0.15E+01	0.15E+01	+0.835	0.51E+03
0.14E-03	0.92E+00	0.87E+00	+6.010	0.48E+03
0.18E-03	0.59E+00	0.53E+00	+9.432	0.44E+03
0.22E-03	0.39E+00	0.37E+00	+3.692	0.40E+03
0.28E-03	0.25E+00	0.25E+00	-1.271	0.36E+03
0.35E-03	0.16E+00	0.17E+00	-5.879	0.33E+03
0.44E-03	0.11E+00	0.12E+00	-9.015	0.30E+03
0.56E-03	0.70E-01	0.76E-01	-8.218	0.26E+03
0.71E-03	0.47E-01	0.48E-01	-3.748	0.23E+03
0.88E-03	0.37E-01	0.34E-01	+10.351	0.19E+03
0.11E-02	0.26E-01	0.24E-01	+10.850	0.16E+03
0.14E-02	0.18E-01	0.16E-01	+11.597	0.14E+03
0.18E-02	0.13E-01	0.12E-01	+6.262	0.12E+03
0.22E-02	0.97E-02	0.96E-02	+0.700	0.99E+02
0.29E-02	0.71E-02	0.74E-02	-4.705	0.81E+02
0.36E-02	0.52E-02	0.58E-02	-9.571	0.67E+02
0.45E-02	0.41E-02	0.46E-02	-11.369	0.55E+02
0.57E-02	0.34E-02	0.36E-02	-5.507	0.42E+02
0.72E-02	0.27E-02	0.28E-02	-2.112	0.33E+02
0.88E-02	0.22E-02	0.22E-02	+2.505	0.26E+02
0.11E-01	0.18E-02	0.17E-02	+4.553	0.22E+02
0.14E-01	0.13E-02	0.12E-02	+7.140	0.17E+02
0.18E-01	0.96E-03	0.90E-03	+6.136	0.14E+02

R: 168. X: 0. Y: 0. DL: 0. REQ: 168. CF: 1.0000
TDHZ ARRAY, 24 DATA POINTS, SYSTEM: NONE DATA: L400S050
JOB #685143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 4 STA 5 OCT. 14, 1985
RMS LOG ERROR: 3.05E-02, ANTILOG YIELDS 7.2770 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	1.00					
P 2	.00	1.00				
P 3	.00	.00	1.00			
T 1	.00	.00	.00	1.00		
T 2	.00	.00	.00	.00	1.00	
F 0	.00	.00	.00	.00	.00	.00





ERROR= 4.5839 %
LOOP RADIUS= 166m

FIELD DATA

MODEL CURVE

THE EARTH TECHNOLOGY CORP

UNOCAL Geothermal

Medicine Lake CA

LINE: 4 STA.: 6

APPARENT RESISTIVITY CURVE

JOB #G85143 Fig.

L400S060

MODEL: 3 LAYERS

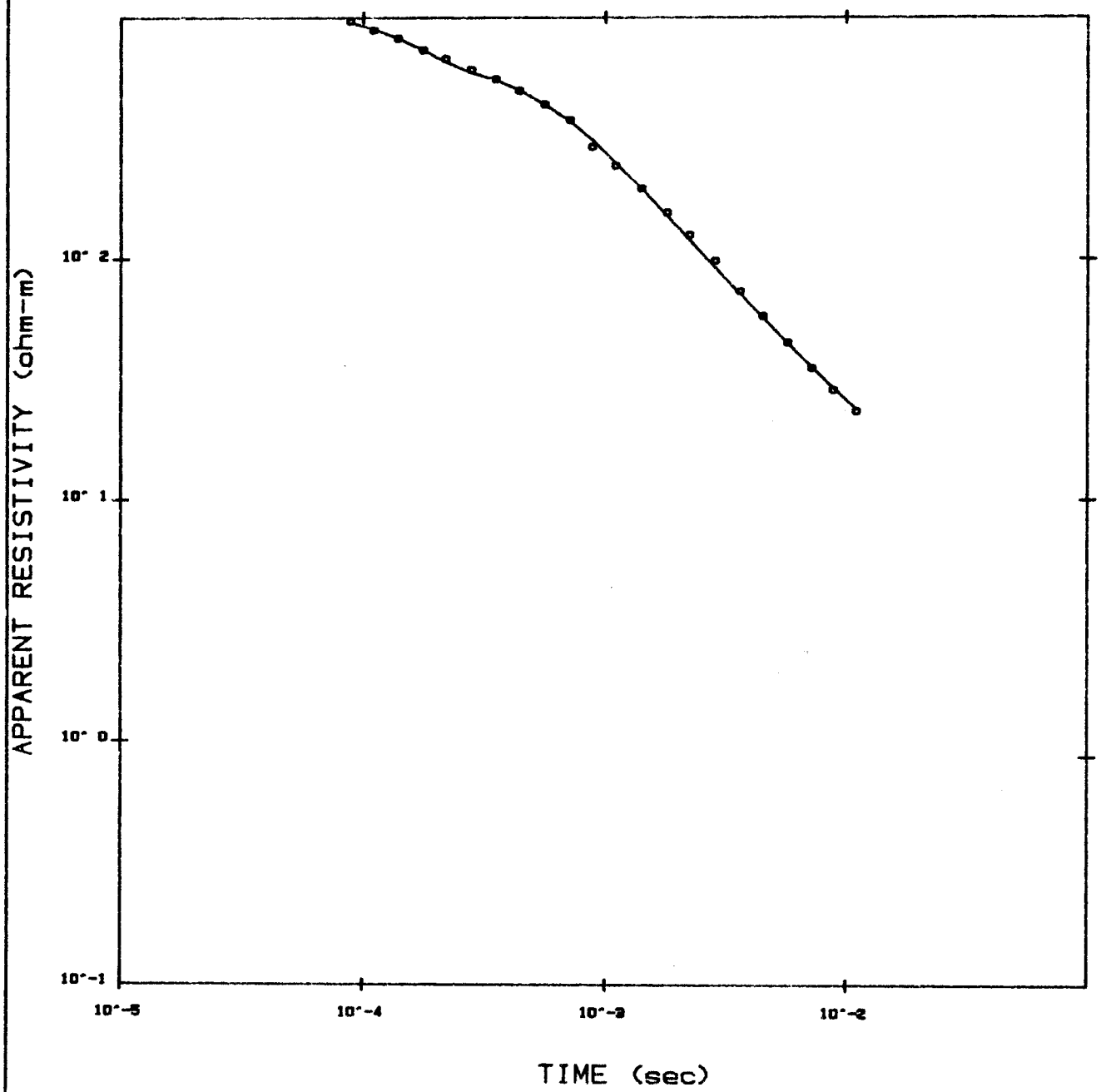
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		2130.6	6990.0		
545.99	237.0	1893.5	6212.3	.4	.4
14.84	64.2	1829.3	6001.5	4.3	4.8
1.36					

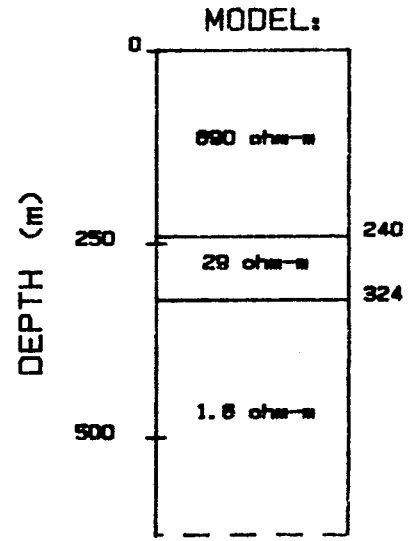
TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.13E+01	0.14E+01	-2.864	0.80E+03
0.11E-03	0.80E+00	0.78E+00	+2.968	0.78E+03
0.14E-03	0.48E+00	0.47E+00	+1.788	0.75E+03
0.18E-03	0.30E+00	0.30E+00	+1.336	0.68E+03
0.22E-03	0.20E+00	0.20E+00	+0.812	0.62E+03
0.28E-03	0.13E+00	0.14E+00	-3.446	0.55E+03
0.35E-03	0.88E-01	0.92E-01	-4.192	0.49E+03
0.44E-03	0.61E-01	0.62E-01	-1.139	0.43E+03
0.56E-03	0.42E-01	0.42E-01	+0.006	0.37E+03
0.71E-03	0.30E-01	0.30E-01	-1.806	0.31E+03
0.88E-03	0.25E-01	0.23E-01	+12.014	0.24E+03
0.11E-02	0.19E-01	0.18E-01	+8.527	0.20E+03
0.14E-02	0.14E-01	0.14E-01	+1.936	0.16E+03
0.18E-02	0.11E-01	0.11E-01	-2.541	0.13E+03
0.22E-02	0.90E-02	0.91E-02	-0.957	0.10E+03
0.29E-02	0.70E-02	0.73E-02	-3.786	0.81E+02
0.36E-02	0.55E-02	0.59E-02	-6.309	0.65E+02
0.45E-02	0.45E-02	0.48E-02	-6.186	0.51E+02
0.57E-02	0.36E-02	0.38E-02	-4.823	0.40E+02
0.72E-02	0.29E-02	0.30E-02	-1.909	0.31E+02
0.88E-02	0.25E-02	0.24E-02	+3.032	0.25E+02
0.11E-01	0.20E-02	0.19E-02	+5.048	0.20E+02
0.14E-01	0.15E-02	0.14E-02	+6.513	0.16E+02

R: 168. X: 0. Y: 0. DL: 0. REQ: 168. CF: 1.0000
TDHZ ARRAY, 23 DATA POINTS, SYSTEM: NONE DATA: L400S060
JOB #685143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 4 STA 6 OCT. 15, 1985
RMS LOG ERROR: 1.95E-02, ANTILOG YIELDS 4.5939 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	1.00					
P 2	.00	.99				
P 3	.00	.00	.99			
T 1	.00	.00	.00	1.00		
T 2	.00	.00	.00	.00	1.00	
F 0	.00	.00	.00	.00	.00	.00





ERROR= 4.1351 %
LOOP RADIUS= 168m

o FIELD DATA
— MODEL CURVE

THE EARTH TECHNOLOGY CORP.

UNOCAL Geothermal

Medicine Lake CA

LINE: 4 STA.: 7

APPARENT RESISTIVITY CURVE

JOB #G85143 Fig.

L4005070

MODEL: 3 LAYERS

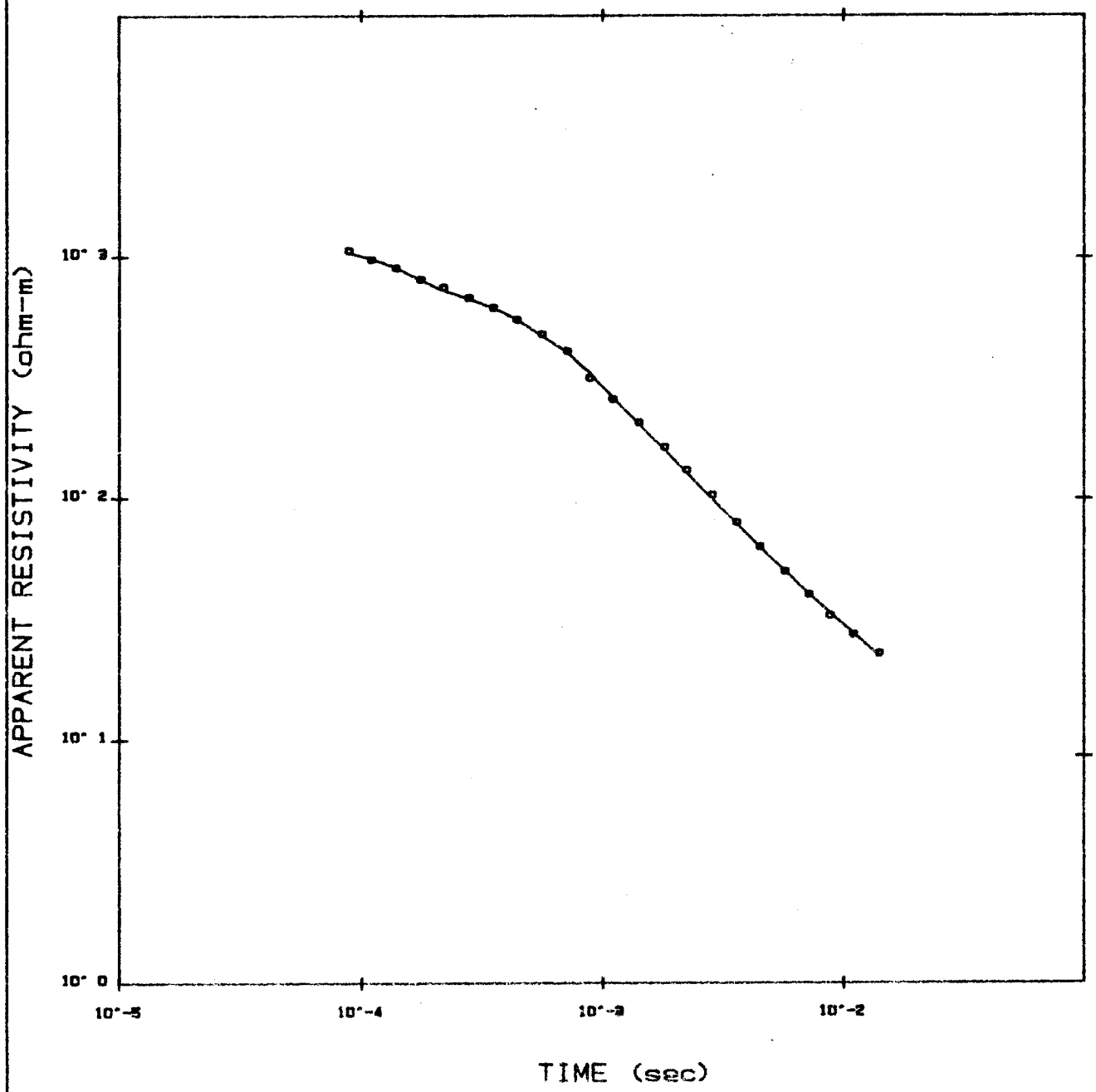
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		2130.6	6990.0		
693.87	239.8	1890.8	6203.4	.3	.3
28.76	83.9	1806.9	5928.0	2.9	3.3
1.59					

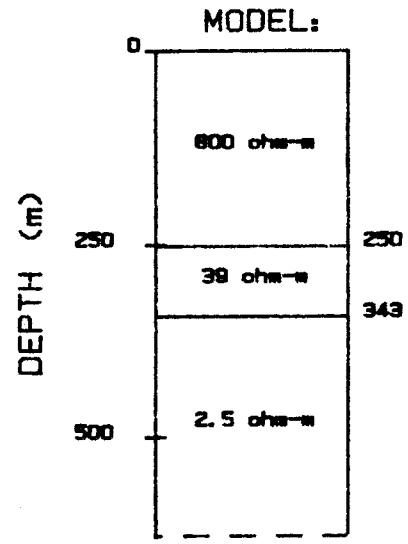
TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.10E+01	0.10E+01	-1.210	0.96E+03
0.11E-03	0.67E+00	0.65E+00	+3.102	0.88E+03
0.14E-03	0.42E+00	0.42E+00	+1.058	0.82E+03
0.18E-03	0.27E+00	0.27E+00	+1.215	0.73E+03
0.22E-03	0.18E+00	0.19E+00	-3.687	0.68E+03
0.28E-03	0.11E+00	0.12E+00	-3.618	0.61E+03
0.35E-03	0.72E-01	0.73E-01	-0.922	0.56E+03
0.44E-03	0.49E-01	0.48E-01	+1.139	0.50E+03
0.56E-03	0.32E-01	0.32E-01	+0.295	0.44E+03
0.71E-03	0.22E-01	0.23E-01	-0.594	0.38E+03
0.88E-03	0.19E-01	0.17E-01	+11.260	0.29E+03
0.11E-02	0.15E-01	0.14E-01	+5.797	0.24E+03
0.14E-02	0.11E-01	0.11E-01	+0.840	0.19E+03
0.18E-02	0.84E-02	0.88E-02	-4.096	0.15E+03
0.22E-02	0.68E-02	0.73E-02	-6.200	0.12E+03
0.29E-02	0.53E-02	0.58E-02	-8.308	0.97E+02
0.36E-02	0.46E-02	0.47E-02	-1.747	0.73E+02
0.45E-02	0.38E-02	0.38E-02	-1.016	0.58E+02
0.57E-02	0.30E-02	0.30E-02	+0.229	0.45E+02
0.72E-02	0.24E-02	0.24E-02	+2.073	0.35E+02
0.88E-02	0.20E-02	0.19E-02	+4.300	0.28E+02
0.11E-01	0.16E-02	0.15E-02	+3.436	0.23E+02

R: 168. X: 0. Y: 0. DL: 0. REC: 16E. CF: 1.0000
TDHZ ARRAY, 22 DATA POINTS, SYSTEM: NONE DATA: L4005070
JOB #685143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 4 STA 7 OCT. 15, 1985
RMS LOG ERROR: 1.76E-02, ANTILOG YIELDS 4.1351 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	1.00					
P 2	.00	.99				
P 3	.00	.00	.99			
T 1	.00	.00	.00	1.00		
T 2	.00	-.01	.00	.00	1.00	
F 0	.00	.00	.00	.00	.00	.00





ERROR= 2.9436 %
LOOP RADIUS= 168m

o FIELD DATA
— MODEL CURVE

THE EARTH TECHNOLOGY CORP

UNOCAL Geothermal

Medicine Lake CA

LINE: 4 STA.: 8

APPARENT RESISTIVITY CURVE

JOB #G85143 Fig.

L4005080

MODEL: 3 LAYERS

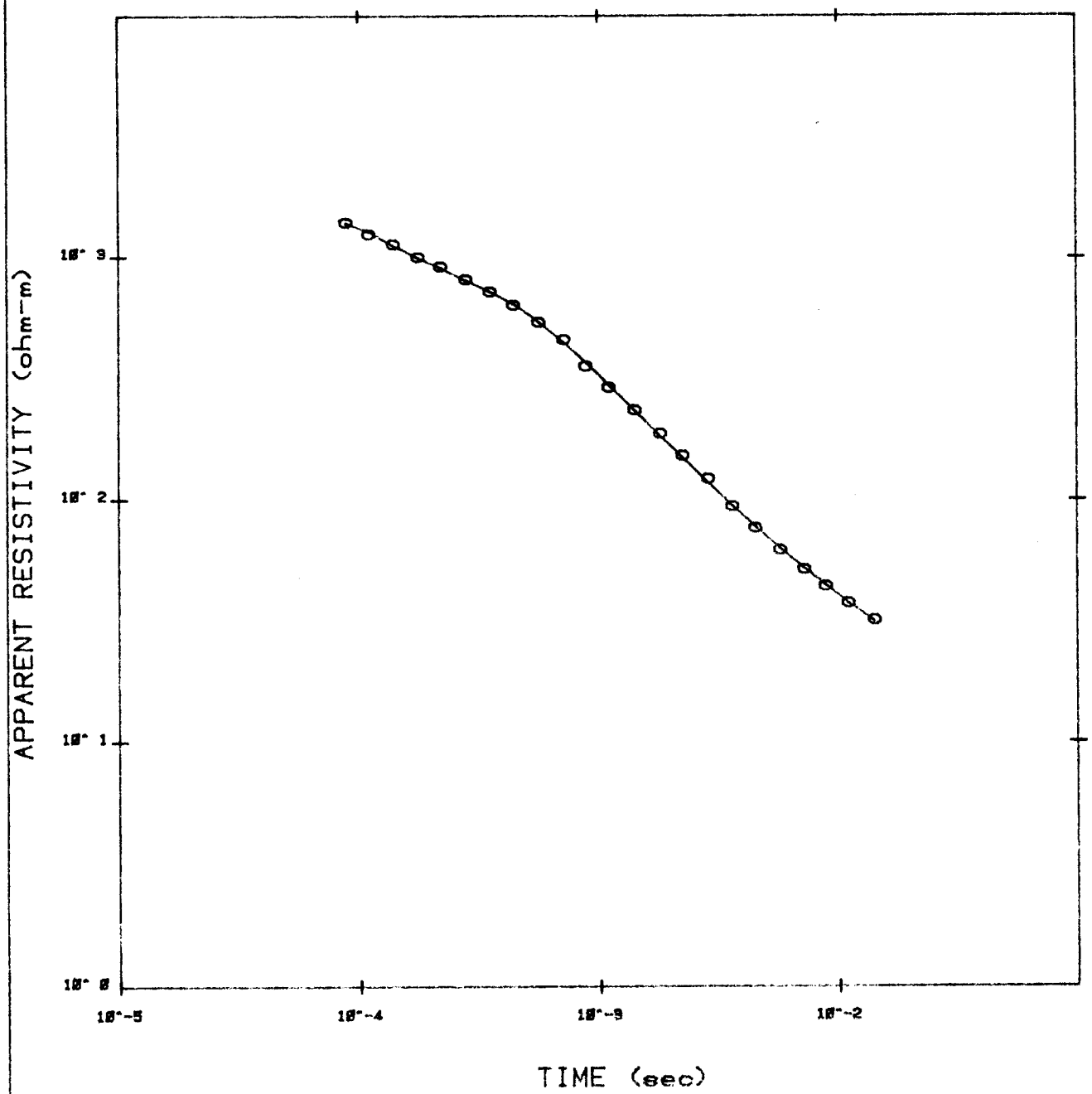
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		2130.6	6990.0		
799.09	250.2	1880.4	6169.2	.3	.3
38.88	92.8	1787.6	5864.7	2.4	2.7
2.45					

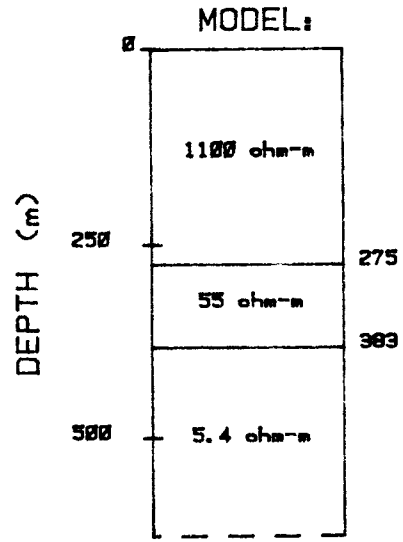
TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.88E+00	0.90E+00	-2.079	0.11E+04
0.11E-03	0.58E+00	0.57E+00	+2.242	0.97E+03
0.14E-03	0.37E+00	0.36E+00	+2.117	0.90E+03
0.18E-03	0.23E+00	0.24E+00	-0.589	0.81E+03
0.22E-03	0.15E+00	0.16E+00	-3.805	0.75E+03
0.28E-03	0.98E-01	0.99E-01	-0.961	0.67E+03
0.35E-03	0.63E-01	0.62E-01	+0.466	0.61E+03
0.44E-03	0.43E-01	0.42E-01	+0.664	0.55E+03
0.56E-03	0.29E-01	0.28E-01	+0.883	0.48E+03
0.71E-03	0.20E-01	0.20E-01	-2.219	0.41E+03
0.88E-03	0.17E-01	0.16E-01	+7.511	0.32E+03
0.11E-02	0.13E-01	0.13E-01	+3.667	0.26E+03
0.14E-02	0.10E-01	0.10E-01	-0.388	0.21E+03
0.18E-02	0.78E-02	0.80E-02	-3.083	0.16E+03
0.22E-02	0.63E-02	0.66E-02	-3.733	0.13E+03
0.29E-02	0.49E-02	0.52E-02	-5.320	0.10E+03
0.36E-02	0.41E-02	0.41E-02	-1.408	0.79E+02
0.45E-02	0.33E-02	0.33E-02	+0.253	0.62E+02
0.57E-02	0.26E-02	0.26E-02	+1.754	0.49E+02
0.72E-02	0.21E-02	0.20E-02	+1.894	0.39E+02
0.88E-02	0.17E-02	0.16E-02	+4.123	0.32E+02
0.11E-01	0.13E-02	0.12E-02	+2.199	0.27E+02
0.14E-01	0.87E-03	0.90E-03	-2.726	0.23E+02

R: 168. X: 0. Y: 0. DL: 0. REQ: 168. CF: 1.0000
TDH7 ARRAY, 23 DATA POINTS, SYSTEM: NONE DATA: L4005080
JOB #685143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 4 STA 8 OCT. 15, 1985
RMS LOG ERROR: 1.26E-02, ANTILOG YIELDS 2.9436 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	1.00					
P 2	.00	.98				
P 3	.00	.00	1.00			
T 1	.00	.00	.00	1.00		
T 2	.00	-.01	.00	.00	1.00	
F 0	.00	.00	.00	.00	.00	.00





ERROR= 2.6496 %
LOOP RADIUS= 168m

FIELD DATA

MODEL CURVE

THE EARTH TECHNOLOGY CORP.

UNOCAL Geothermal

Medicine Lake CA

LINE: 4 STA.: 9

APPARENT RESISTIVITY CURVE

JOB #G85143 Fig.

L400S090

MODEL: 3 LAYERS

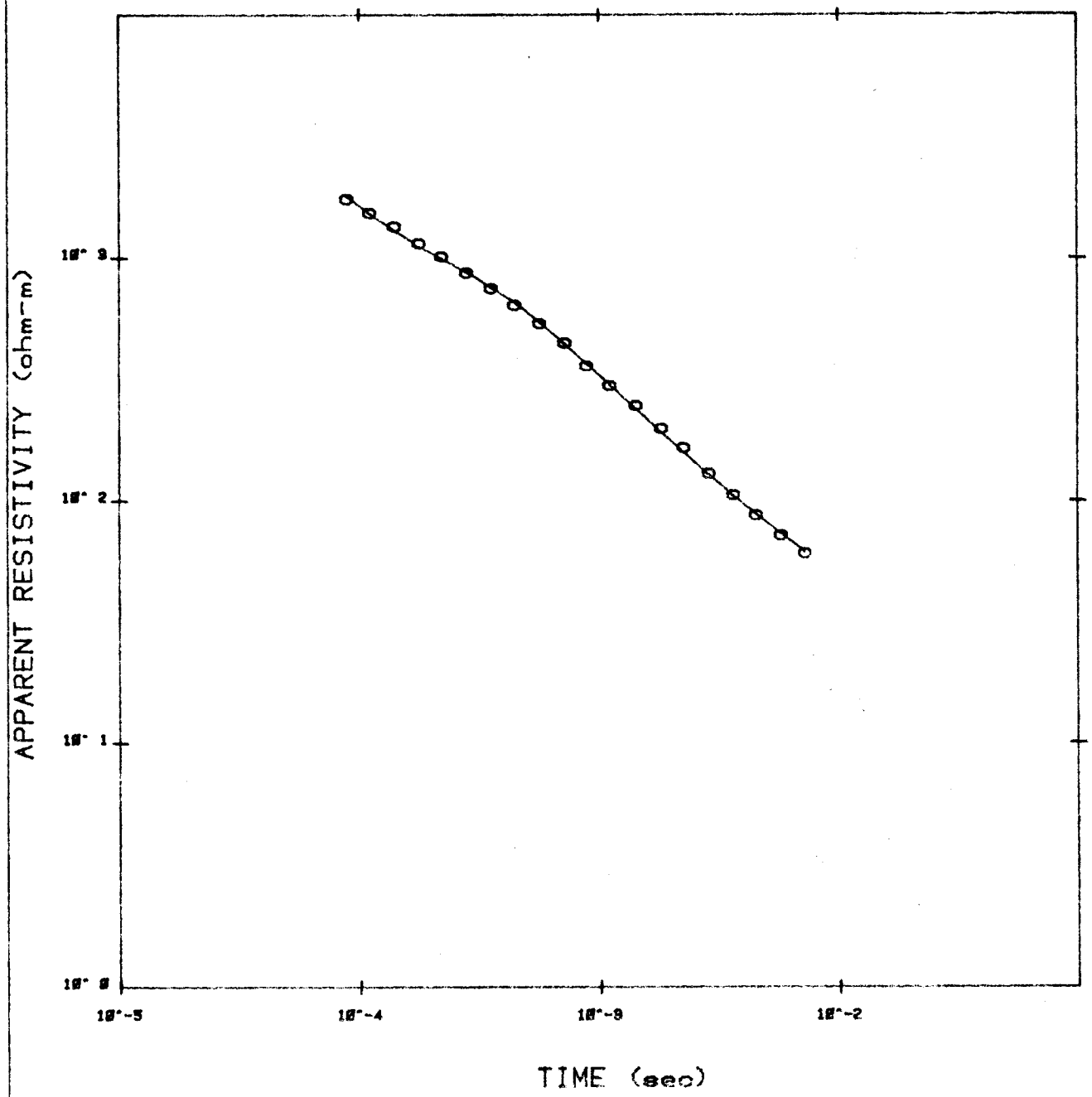
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		2127.5	6980.0		
1116.79	275.1	1852.4	6077.3	.2	.2
55.45	108.0	1744.3	5722.9	1.9	2.2
5.36					

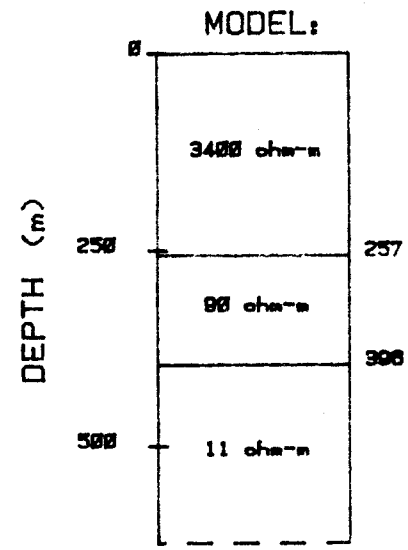
TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.58E+00	0.59E+00	-0.524	0.14E+04
0.11E-03	0.40E+00	0.38E+00	+3.951	0.12E+04
0.14E-03	0.26E+00	0.26E+00	-1.497	0.11E+04
0.18E-03	0.17E+00	0.17E+00	-0.923	0.10E+04
0.22E-03	0.11E+00	0.12E+00	-1.738	0.92E+03
0.28E-03	0.74E-01	0.75E-01	-1.161	0.81E+03
0.35E-03	0.49E-01	0.49E-01	+0.351	0.72E+03
0.44E-03	0.34E-01	0.34E-01	+2.550	0.63E+03
0.56E-03	0.24E-01	0.24E-01	+0.898	0.54E+03
0.71E-03	0.17E-01	0.18E-01	-3.230	0.46E+03
0.88E-03	0.14E-01	0.14E-01	+5.928	0.36E+03
0.11E-02	0.11E-01	0.11E-01	+3.148	0.29E+03
0.14E-02	0.83E-02	0.83E-02	-0.932	0.24E+03
0.18E-02	0.63E-02	0.65E-02	-3.507	0.19E+03
0.22E-02	0.50E-02	0.52E-02	-3.154	0.15E+03
0.29E-02	0.38E-02	0.40E-02	-5.531	0.12E+03
0.36E-02	0.31E-02	0.31E-02	+0.994	0.94E+02
0.45E-02	0.25E-02	0.24E-02	+1.900	0.77E+02
0.57E-02	0.19E-02	0.18E-02	+1.998	0.62E+02
0.72E-02	0.14E-02	0.14E-02	+1.708	0.51E+02
0.88E-02	0.11E-02	0.10E-02	+2.034	0.44E+02
0.11E-01	0.78E-03	0.78E-03	-0.035	0.37E+02
0.14E-01	0.53E-03	0.54E-03	-1.401	0.32E+02

R: 168. X: 0. Y: 0. DL: 0. REQ: 168. CF: 1.0000
TDHZ ARRAY, 23 DATA POINTS, SYSTEM: NONE DATA: L400S090
JOB #665143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 4 STA 9 OCT. 15, 1985
RMS LOG ERROR: 1.14E-02, ANTILOG YIELDS 2.6496 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	1.00					
P 2	-.01	.98				
P 3	.00	.00	1.00			
T 1	.00	.00	.00	1.00		
T 2	.00	-.01	.00	.00	1.00	
F 0	.00	.00	.00	.00	.00	.00





ERROR= 3.3900 %
LOOP RADIUS= 100m

FIELD DATA

MODEL CURVE

THE EARTH TECHNOLOGY CORP.

UNOCAL Geothermal

Medicine Lake CA

LINE: 4 STA.: 10

APPARENT RESISTIVITY CURVE

JOB #G85143 Fig.

L400S100

MODEL: 3 LAYERS

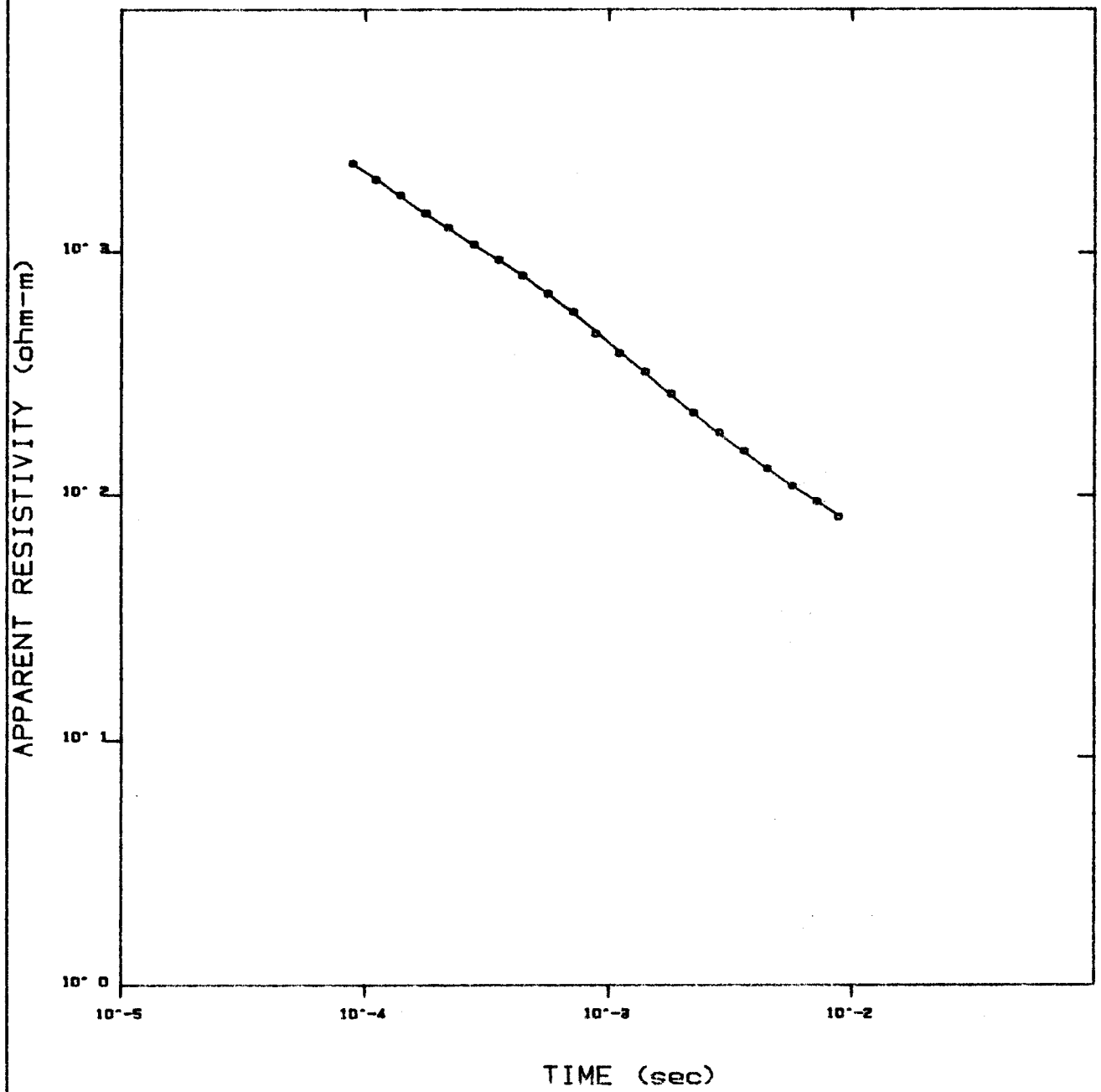
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		2118.4	6950.0		
3406.27	256.6	1861.8	6108.2	.1	.1
89.61	139.2	1722.6	5651.5	1.6	1.6
10.51					

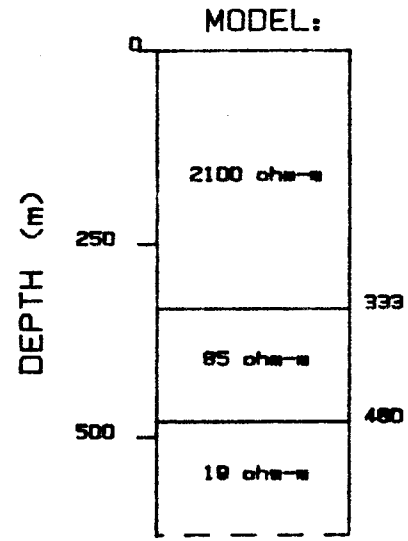
TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.42E+00	0.40E+00	+5.279	0.17E+04
0.11E-03	0.29E+00	0.29E+00	-0.025	0.15E+04
0.14E-03	0.20E+00	0.21E+00	-5.030	0.13E+04
0.18E-03	0.14E+00	0.14E+00	-4.540	0.12E+04
0.22E-03	0.97E-01	0.99E-01	-2.037	0.10E+04
0.28E-03	0.67E-01	0.66E-01	+1.737	0.87E+03
0.35E-03	0.46E-01	0.45E-01	+2.380	0.75E+03
0.44E-03	0.34E-01	0.32E-01	+4.575	0.64E+03
0.56E-03	0.24E-01	0.23E-01	+2.836	0.54E+03
0.71E-03	0.17E-01	0.17E-01	-0.388	0.45E+03
0.88E-03	0.14E-01	0.14E-01	+3.504	0.36E+03
0.11E-02	0.11E-01	0.11E-01	+1.270	0.30E+03
0.14E-02	0.77E-02	0.80E-02	-3.738	0.25E+03
0.18E-02	0.58E-02	0.61E-02	-4.622	0.20E+03
0.22E-02	0.45E-02	0.48E-02	-5.512	0.16E+03
0.29E-02	0.35E-02	0.35E-02	-1.112	0.13E+03
0.36E-02	0.26E-02	0.27E-02	-0.144	0.11E+03
0.45E-02	0.20E-02	0.20E-02	+1.701	0.88E+02
0.57E-02	0.15E-02	0.14E-02	+2.585	0.73E+02
0.72E-02	0.11E-02	0.10E-02	+3.757	0.61E+02

R: 168. X: 0. Y: 0. DL: 0. REG: 168. CF: 1.0000
TDHZ ARRAY, 20 DATA POINTS, SYSTEM: NONE DATA: L400S100
JOB #G85143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 4 STA 10 OCT. 15, 1985
RMS LOG ERROR: 1.45E-02, ANTILOG YIELDS 3.3890 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	.95					
P 2	-.01	1.00				
P 3	.00	.00	1.00			
T 1	.00	.00	.00	1.00		
T 2	-.01	.00	.00	.00	1.00	
F 0	.00	.00	.00	.00	.00	.00





ERROR= 1.6409 %
LOOP RADIUS= 168m

FIELD DATA

MODEL CURVE

THE EARTH TECHNOLOGY CORP

UNOCAL Geothermal

Medicine Lake CA

LINE: 4 STA.: 11

APPARENT RESISTIVITY CURVE

JOB #G85143 Fig.

L400S110

MODEL: 3 LAYERS

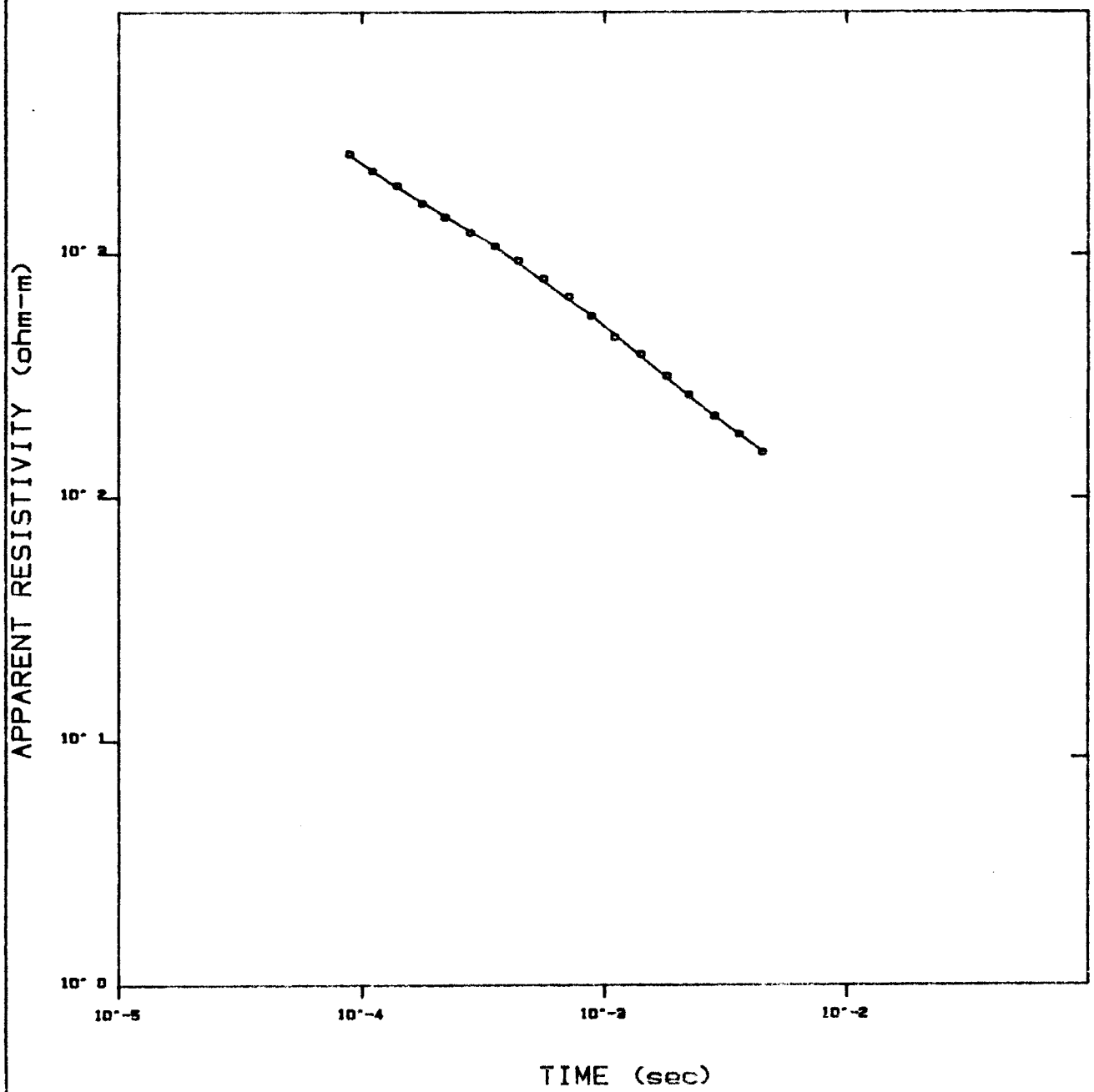
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		2121.4	6960.0		
2084.27	332.7	1788.7	5868.6	.2	.2
85.01	147.5	1641.3	5384.8	1.7	1.9
19.09					

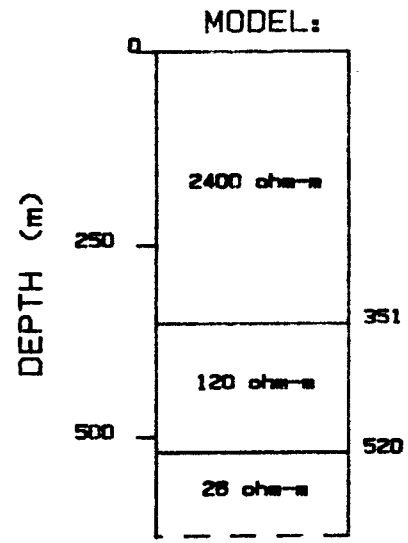
TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.27E+00	0.27E+00	+0.195	0.23E+04
0.11E-03	0.20E+00	0.19E+00	+2.605	0.20E+04
0.14E-03	0.14E+00	0.14E+00	-1.679	0.17E+04
0.18E-03	0.97E-01	0.98E-01	-0.671	0.14E+04
0.22E-03	0.70E-01	0.71E-01	-0.849	0.13E+04
0.28E-03	0.49E-01	0.49E-01	-0.601	0.11E+04
0.35E-03	0.34E-01	0.34E-01	-0.059	0.93E+03
0.44E-03	0.24E-01	0.24E-01	+1.211	0.80E+03
0.56E-03	0.17E-01	0.17E-01	-0.317	0.67E+03
0.71E-03	0.12E-01	0.12E-01	-1.285	0.57E+03
0.88E-03	0.97E-02	0.93E-02	+3.927	0.46E+03
0.11E-02	0.73E-02	0.71E-02	+3.078	0.39E+03
0.14E-02	0.51E-02	0.52E-02	-1.327	0.32E+03
0.18E-02	0.38E-02	0.38E-02	-1.984	0.26E+03
0.22E-02	0.29E-02	0.29E-02	-1.070	0.22E+03
0.29E-02	0.21E-02	0.21E-02	-1.752	0.18E+03
0.36E-02	0.15E-02	0.15E-02	-1.088	0.15E+03
0.45E-02	0.11E-02	0.11E-02	-0.206	0.13E+03
0.57E-02	0.80E-03	0.80E-03	+0.197	0.11E+03
0.72E-02	0.56E-03	0.56E-03	+0.145	0.94E+02
0.88E-02	0.42E-03	0.41E-03	+2.465	0.81E+02

R: 168. X: 0. Y: 0. DL: 0. REQ: 168. CF: 1.0000
TDHZ ARRAY, 21 DATA POINTS, SYSTEM: NONE DATA: L400S110
JOB #GS5143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 4 STA 11 OCT. 15, 1985
RMS LOG ERROR: 7.07E-03, ANTILOG YIELDS 1.6409 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	.99					
P 2	-.01	.99				
P 3	.00	.00	1.00			
T 1	.00	.00	.00	1.00		
T 2	.00	.00	.00	.00	1.00	
F 0	.00	.00	.00	.00	.00	.00





ERROR= 1.5307 %
LOOP RADIUS= 168m

o FIELD DATA

—— MODEL CURVE

THE EARTH TECHNOLOGY CORP

UNOCAL Geothermal

Medicine Lake CA

LINE: 4 STA.: 12

APPARENT RESISTIVITY CURVE

JOB #G85143 Fig.

L400S120

MODEL: 3 LAYERS

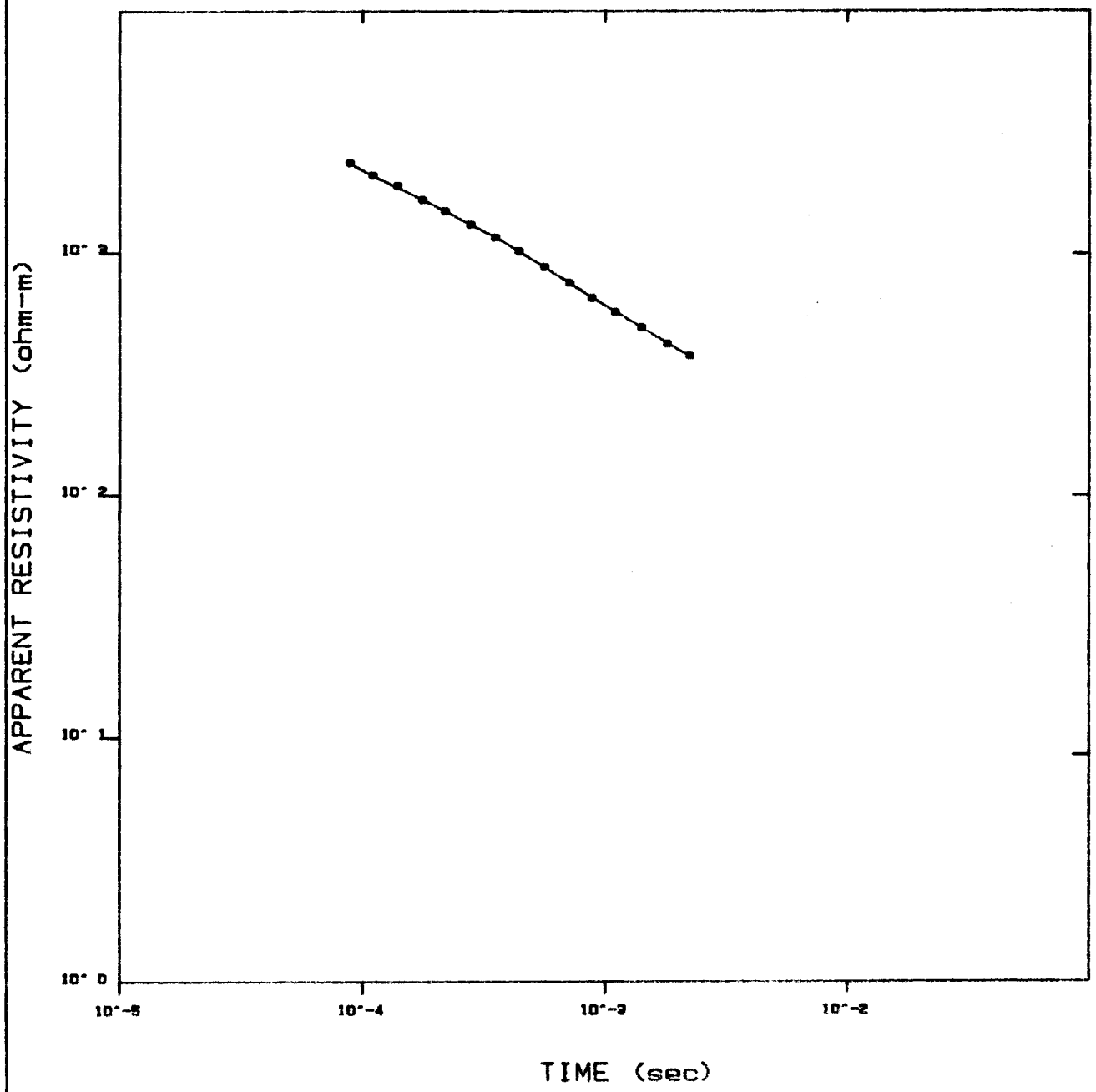
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		2115.3	6940.0		
2440.65	350.7	1764.6	5789.4	.1	.1
118.11	169.1	1595.5	5234.5	1.4	1.6
25.83					

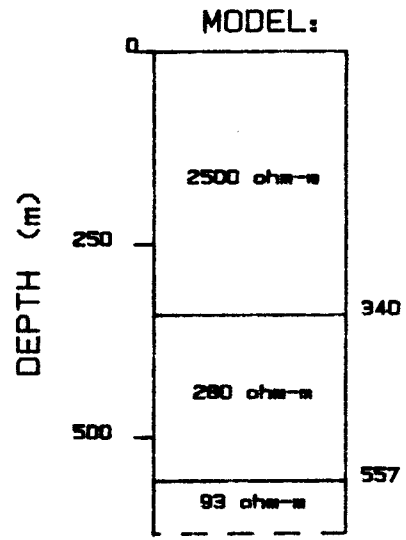
TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.23E+00	0.23E+00	-0.230	0.26E+04
0.11E-03	0.17E+00	0.17E+00	+0.798	0.22E+04
0.14E-03	0.12E+00	0.12E+00	-1.038	0.19E+04
0.18E-03	0.83E-01	0.82E-01	+0.565	0.16E+04
0.22E-03	0.59E-01	0.59E-01	-0.091	0.14E+04
0.28E-03	0.40E-01	0.40E-01	+0.481	0.12E+04
0.35E-03	0.27E-01	0.27E-01	+0.302	0.11E+04
0.44E-03	0.19E-01	0.19E-01	-1.506	0.93E+03
0.56E-03	0.14E-01	0.14E-01	-0.003	0.79E+03
0.71E-03	0.96E-02	0.97E-02	-0.751	0.66E+03
0.88E-03	0.75E-02	0.74E-02	+1.171	0.55E+03
0.11E-02	0.58E-02	0.56E-02	+4.584	0.45E+03
0.14E-02	0.40E-02	0.41E-02	-2.059	0.38E+03
0.18E-02	0.29E-02	0.30E-02	-2.325	0.31E+03
0.22E-02	0.22E-02	0.23E-02	-1.521	0.26E+03
0.29E-02	0.16E-02	0.16E-02	+0.028	0.22E+03
0.36E-02	0.12E-02	0.12E-02	+0.296	0.18E+03
0.45E-02	0.87E-03	0.85E-03	+1.594	0.15E+03

R: 168. X: 0. Y: 0. DL: 0. REG: 168. CF: 1.0000
TDHZ ARRAY, 18 DATA POINTS, SYSTEM: NONE DATA: L400S120
JOB #885143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 4 STA 12 OCT. 15, 1985
RMS LOG ERROR: 6.60E-03, ANTILOG YIELDS 1.5307 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	.99					
P 2	-.01	.99				
P 3	.00	.00	1.00			
T 1	.00	.00	.00	1.00		
T 2	.00	.00	.00	.00	1.00	
F 0	.00	.00	.00	.00	.00	.00





ERROR= .7651 %
LOOP RADIUS= 168m

FIELD DATA

MODEL CURVE

THE EARTH TECHNOLOGY CORP

UNOCAL Geothermal

Medicine Lake CA

LINE: 4 STA.: 13

APPARENT RESISTIVITY CURVE

JOB #G85143 Fig.

L4005130

MODEL: 3 LAYERS

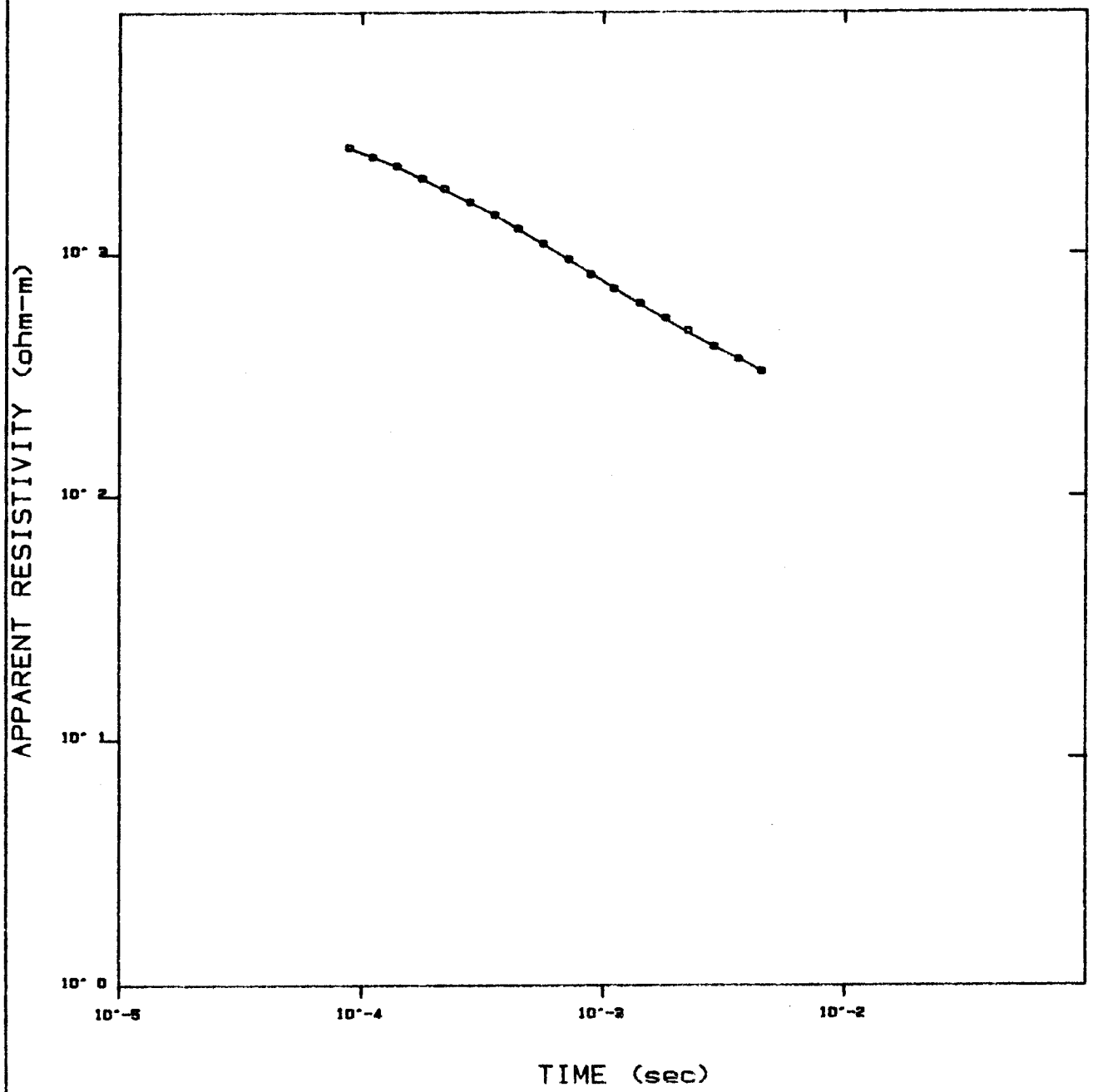
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		2066.5	6780.0		
2465.21	339.9	1726.6	5664.7	.1	.1
275.75	216.7	1510.0	4953.9	.8	.9
93.03					

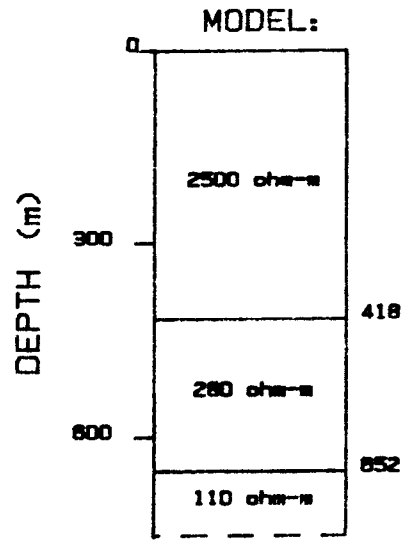
TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.27E+00	0.27E+00	+0.236	0.24E+04
0.11E-03	0.18E+00	0.18E+00	+0.406	0.21E+04
0.14E-03	0.12E+00	0.12E+00	-1.468	0.19E+04
0.18E-03	0.80E-01	0.79E-01	+0.525	0.17E+04
0.22E-03	0.55E-01	0.55E-01	+0.269	0.15E+04
0.28E-03	0.36E-01	0.36E-01	+0.587	0.13E+04
0.35E-03	0.24E-01	0.24E-01	+1.380	0.12E+04
0.44E-03	0.17E-01	0.17E-01	+0.626	0.10E+04
0.56E-03	0.12E-01	0.12E-01	+0.220	0.87E+03
0.71E-03	0.80E-02	0.79E-02	+0.658	0.75E+03
0.88E-03	0.58E-02	0.58E-02	+1.494	0.65E+03
0.11E-02	0.41E-02	0.41E-02	+0.098	0.57E+03
0.14E-02	0.28E-02	0.28E-02	-0.381	0.49E+03
0.18E-02	0.19E-02	0.19E-02	+0.704	0.42E+03
0.22E-02	0.13E-02	0.13E-02	-0.153	0.37E+03

R: 168. X: 0. Y: 0. DL: 0. REQ: 168. CF: 1.0000
TDHZ ARRAY, 15 DATA POINTS, SYSTEM: NONE DATA: L4005130
JOB #G85143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 4 STA 13 OCT. 15, 1985
RMS LOG ERROR: 3.31E-03, ANTILOG YIELDS .7651 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	.98					
P 2	-.02	.97				
P 3	.00	-.01	1.00			
T 1	.01	.01	.00	1.00		
T 2	-.01	-.01	.00	.00	1.00	
F 0	.00	.00	.00	.00	.00	.00





ERROR= 1.0964 %
LOOP RADIUS= 166m

o FIELD DATA

— MODEL CURVE

THE EARTH TECHNOLOGY CORP

UNOCAL Geothermal

Medicine Lake CA

LINE: 4 STA.: 14

APPARENT RESISTIVITY CURVE

JOB #G85143 Fig.

L400S140

MODEL: 3 LAYERS

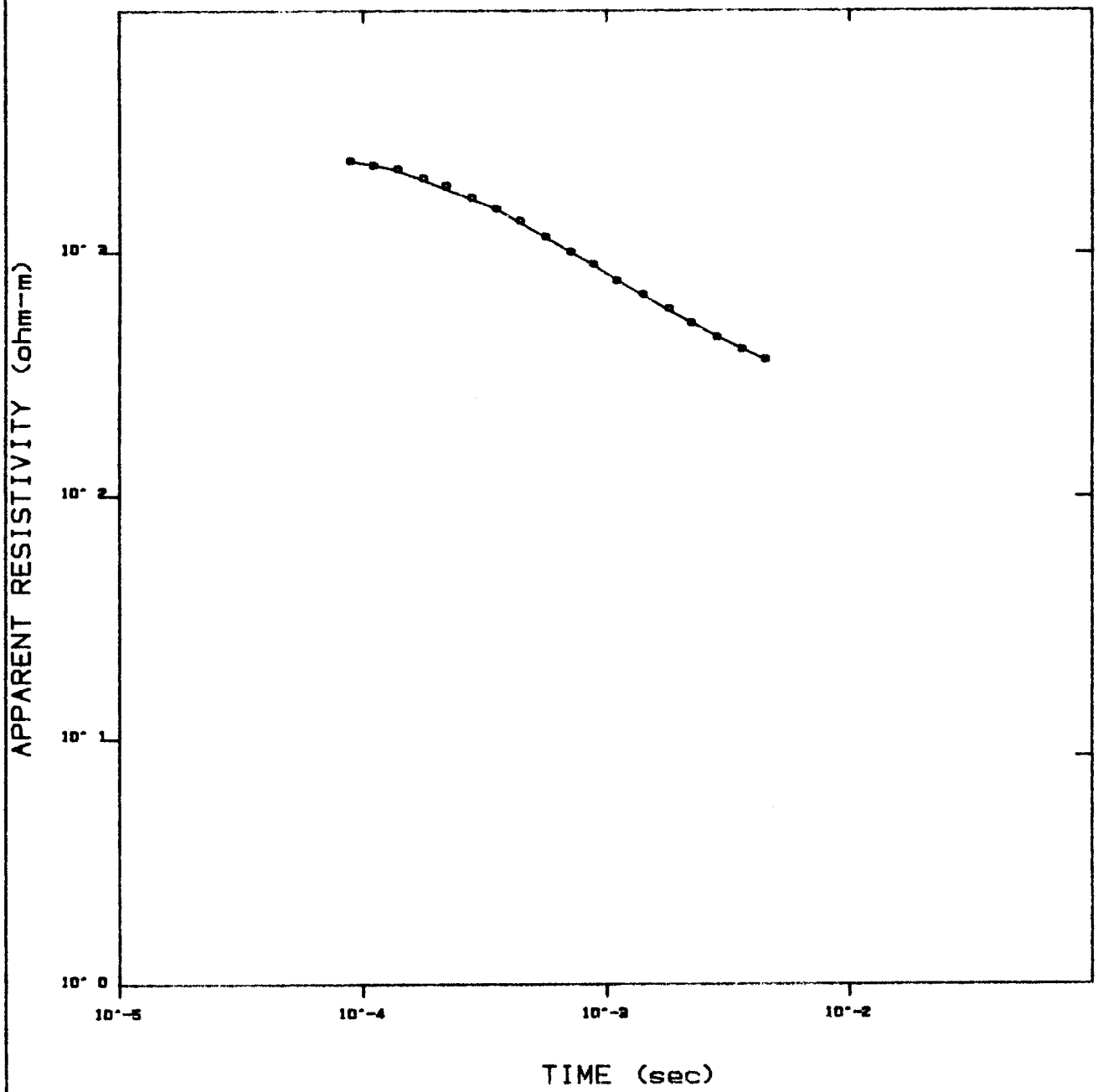
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		2060.4	6760.0		
2520.37	418.2	1642.3	5388.0	.2	.2
281.92	234.1	1408.2	4620.1	.8	1.0
112.66					

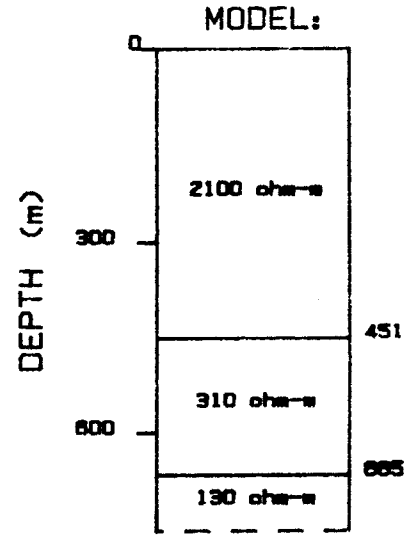
TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.21E+00	0.21E+00	-0.802	0.28E+04
0.11E-03	0.14E+00	0.14E+00	+1.200	0.25E+04
0.14E-03	0.88E-01	0.88E-01	+0.176	0.23E+04
0.18E-03	0.58E-01	0.57E-01	+0.223	0.21E+04
0.22E-03	0.39E-01	0.40E-01	-1.452	0.19E+04
0.28E-03	0.26E-01	0.26E-01	-0.266	0.16E+04
0.35E-03	0.17E-01	0.17E-01	+0.216	0.14E+04
0.44E-03	0.12E-01	0.12E-01	-0.004	0.13E+04
0.56E-03	0.82E-02	0.82E-02	+0.660	0.11E+04
0.71E-03	0.57E-02	0.56E-02	+0.526	0.94E+03
0.88E-03	0.41E-02	0.41E-02	+1.658	0.82E+03
0.11E-02	0.29E-02	0.29E-02	+0.537	0.72E+03
0.14E-02	0.19E-02	0.19E-02	-1.007	0.62E+03
0.18E-02	0.13E-02	0.13E-02	-1.809	0.54E+03
0.22E-02	0.90E-03	0.93E-03	-2.432	0.48E+03
0.29E-02	0.61E-03	0.61E-03	+0.343	0.41E+03
0.36E-02	0.41E-03	0.40E-03	+0.909	0.37E+03
0.45E-02	0.28E-03	0.28E-03	+1.401	0.35E+03

R: 168. X: 0. Y: 0. DL: 0. RED: 168. CF: 1.0000
TDHZ ARRAY, 18 DATA POINTS, SYSTEM: NONE DATA: L400S140
JOB #G85143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 4 STA 14 OCT. 15, 1985
RMS LOG ERROR: 4.74E-03, ANTILOG YIELDS 1.0964 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	1.00					
P 2	.00	.99				
P 3	.00	.00	1.00			
T 1	.00	.00	.00	1.00		
T 2	.00	.00	.00	.00	1.00	
F 0	.00	.00	.00	.00	.00	.00





ERROR= .9982 %
LOOP RADIUS= 100m

o FIELD DATA

— MODEL CURVE

THE EARTH TECHNOLOGY CORP

UNOCAL Geothermal

Medicine Lake CA

LINE: 4 STA.: 15

APPARENT RESISTIVITY CURVE

JOB #G85143 Fig.

L4005150

MODEL: 3 LAYERS

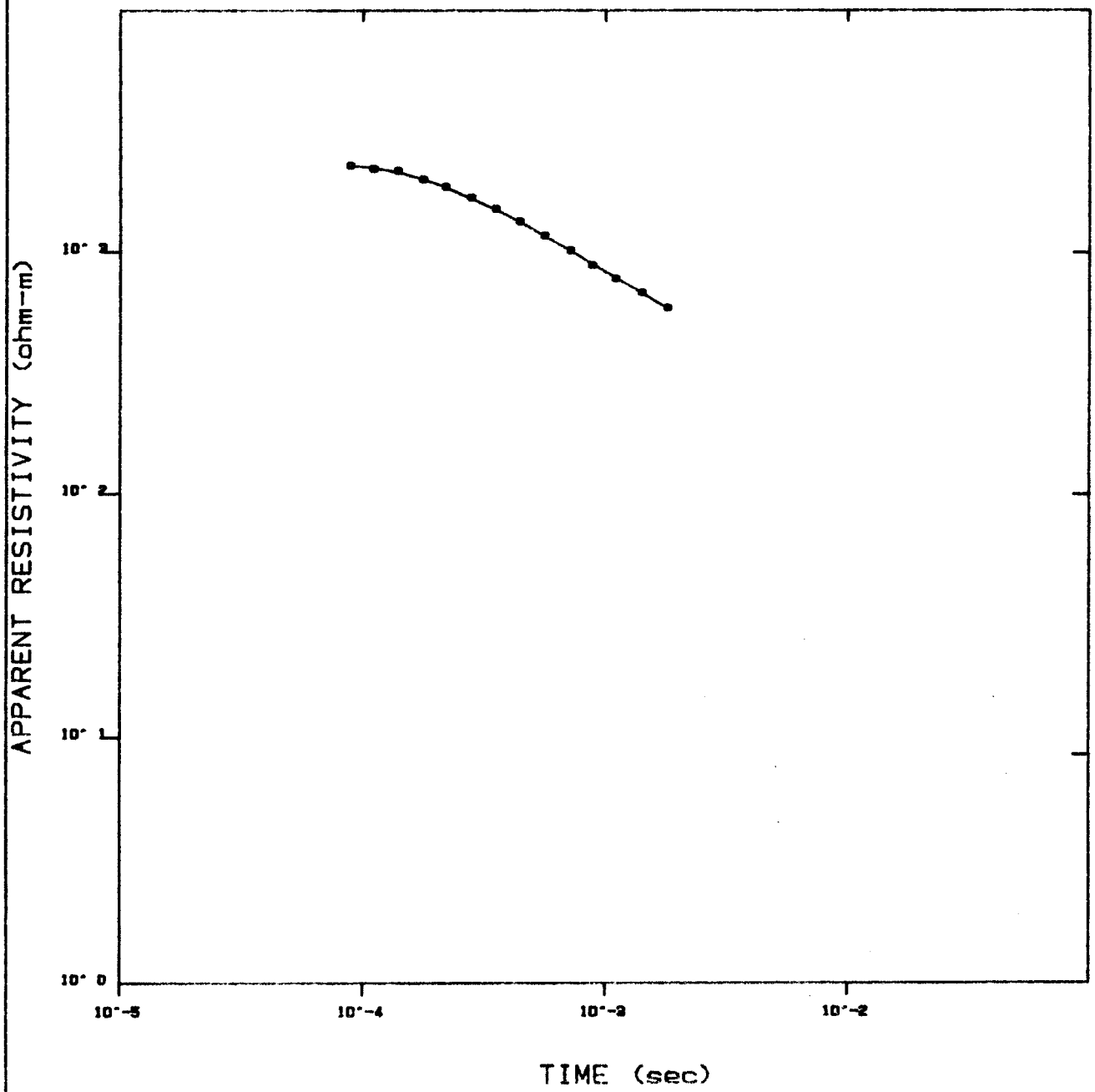
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		2023.9	6640.0		
2117.08	450.6	1573.3	5161.6	.2	.2
313.79	214.5	1358.8	4457.9	.7	.9
125.24					

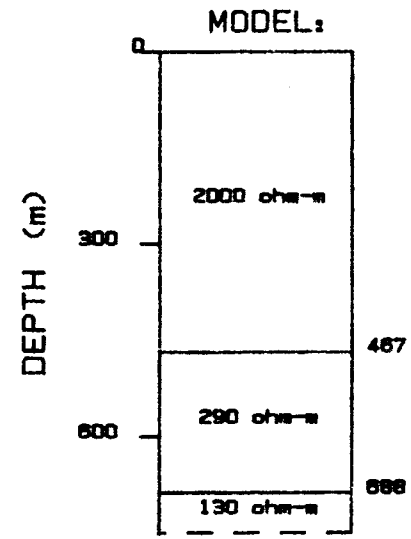
TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.86E-04	0.26E+00	0.26E+00	-0.471	0.24E+04
0.11E-03	0.16E+00	0.16E+00	+1.099	0.23E+04
0.14E-03	0.93E-01	0.95E-01	-1.639	0.22E+04
0.18E-03	0.58E-01	0.57E-01	+1.037	0.20E+04
0.22E-03	0.38E-01	0.38E-01	-0.660	0.19E+04
0.28E-03	0.25E-01	0.25E-01	+0.433	0.17E+04
0.35E-03	0.16E-01	0.16E-01	-0.261	0.15E+04
0.44E-03	0.11E-01	0.11E-01	-1.256	0.14E+04
0.56E-03	0.75E-02	0.75E-02	+0.657	0.12E+04
0.71E-03	0.52E-02	0.51E-02	+1.548	0.10E+04
0.88E-03	0.37E-02	0.37E-02	-0.787	0.89E+03
0.11E-02	0.26E-02	0.26E-02	+0.942	0.76E+03
0.14E-02	0.17E-02	0.17E-02	-0.178	0.67E+03
0.18E-02	0.12E-02	0.12E-02	-2.092	0.58E+03
0.22E-02	0.83E-03	0.83E-03	+0.269	0.51E+03
0.29E-02	0.55E-03	0.55E-03	+0.835	0.44E+03
0.36E-02	0.36E-03	0.36E-03	+0.779	0.40E+03
0.45E-02	0.24E-03	0.24E-03	-0.312	0.36E+03

R: 168. X: 0. Y: 0. DL: 0. REQ: 168. CF: 1.0000
TDHZ ARRAY, 18 DATA POINTS, SYSTEM: NONE DATA: L4005150
JOB #G85143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 4 STA 15 OCT. 16, 1985
RMS LOG ERROR: 4.31E-03, ANTILOG YIELDS .9982 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	1.00					
P 2	.00	.98				
P 3	.00	.00	1.00			
T 1	.00	.01	.00	1.00		
T 2	.00	.00	.00	.00	1.00	
F 0	.00	.00	.00	.00	.00	.00





ERROR= .8281 %
LOOP RADIUS= 168

FIELD DATA

MODEL CURVE

THE EARTH TECHNOLOGY CORP

UNOCAL Geothermal

Medicine Lake CA

LINE: 4 STA.: 16

APPARENT RESISTIVITY CURVE

JOB #G85143 Fig.

L4005160

MODEL: 3 LAYERS

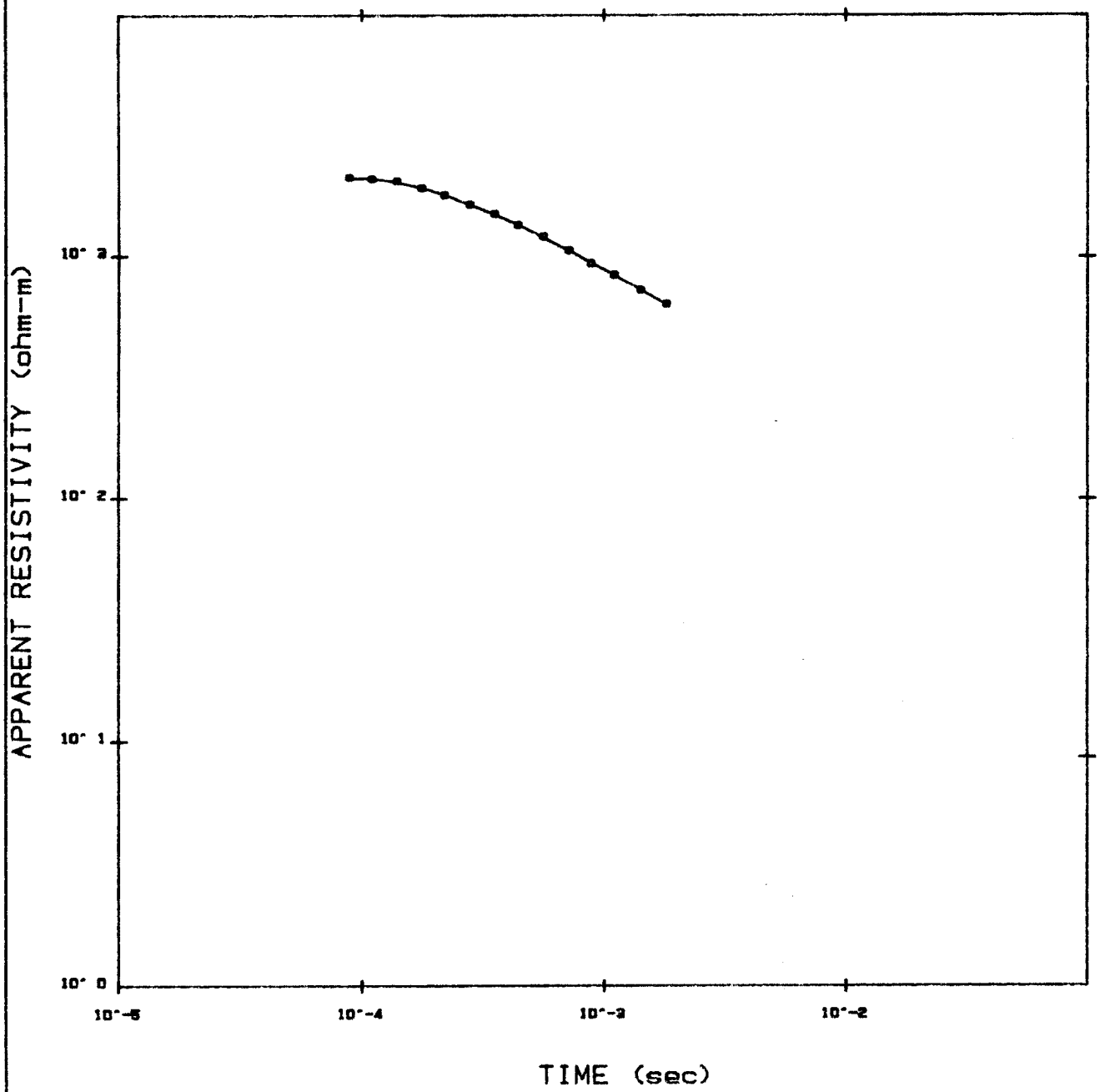
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		1962.9	6440.0		
1987.96	466.5	1496.4	4909.4	.2	.2
290.95	221.9	1274.5	4181.4	.8	1.0
134.44					

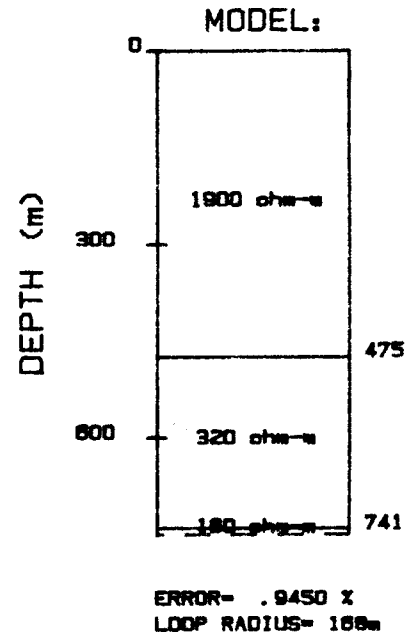
TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.28E+00	0.28E+00	-0.131	0.23E+04
0.11E-03	0.17E+00	0.17E+00	+1.290	0.22E+04
0.14E-03	0.98E-01	0.99E-01	-1.668	0.22E+04
0.18E-03	0.60E-01	0.60E-01	+0.455	0.20E+04
0.22E-03	0.39E-01	0.39E-01	-0.159	0.19E+04
0.28E-03	0.25E-01	0.25E-01	-0.753	0.17E+04
0.35E-03	0.16E-01	0.16E-01	-0.565	0.15E+04
0.44E-03	0.11E-01	0.11E-01	-0.051	0.13E+04
0.56E-03	0.75E-02	0.75E-02	-0.339	0.12E+04
0.71E-03	0.51E-02	0.51E-02	+0.179	0.10E+04
0.88E-03	0.37E-02	0.36E-02	+1.790	0.88E+03
0.11E-02	0.26E-02	0.26E-02	+0.436	0.78E+03
0.14E-02	0.17E-02	0.17E-02	+0.037	0.68E+03
0.18E-02	0.11E-02	0.12E-02	-0.607	0.59E+03

R: 168. X: 0. Y: 0. DL: 0. REQ: 168. CF: 1.0000
TDHZ ARRAY, 14 DATA POINTS. SYSTEM: NONE DATA: L4005160
JOB #685143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 4 STA 16 OCT. 16, 1985
RMS LOG ERROR: 3.57E-03, ANTILOG YIELDS .8261 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	.99					
P 2	-.05	.65				
P 3	-.02	-.18	.66			
T 1	.01	.09	.03	.97		
T 2	.00	.03	.09	.00	.94	
F 0	.00	.00	.00	.00	.00	.00





FIELD DATA

MODEL CURVE

THE EARTH TECHNOLOGY CORP

UNOCAL Geothermal

Medicine Lake CA

LINE: 4 STA.: 17

APPARENT RESISTIVITY CURVE

JOB #G85143 Fig.

L400S170

MODEL: 3 LAYERS

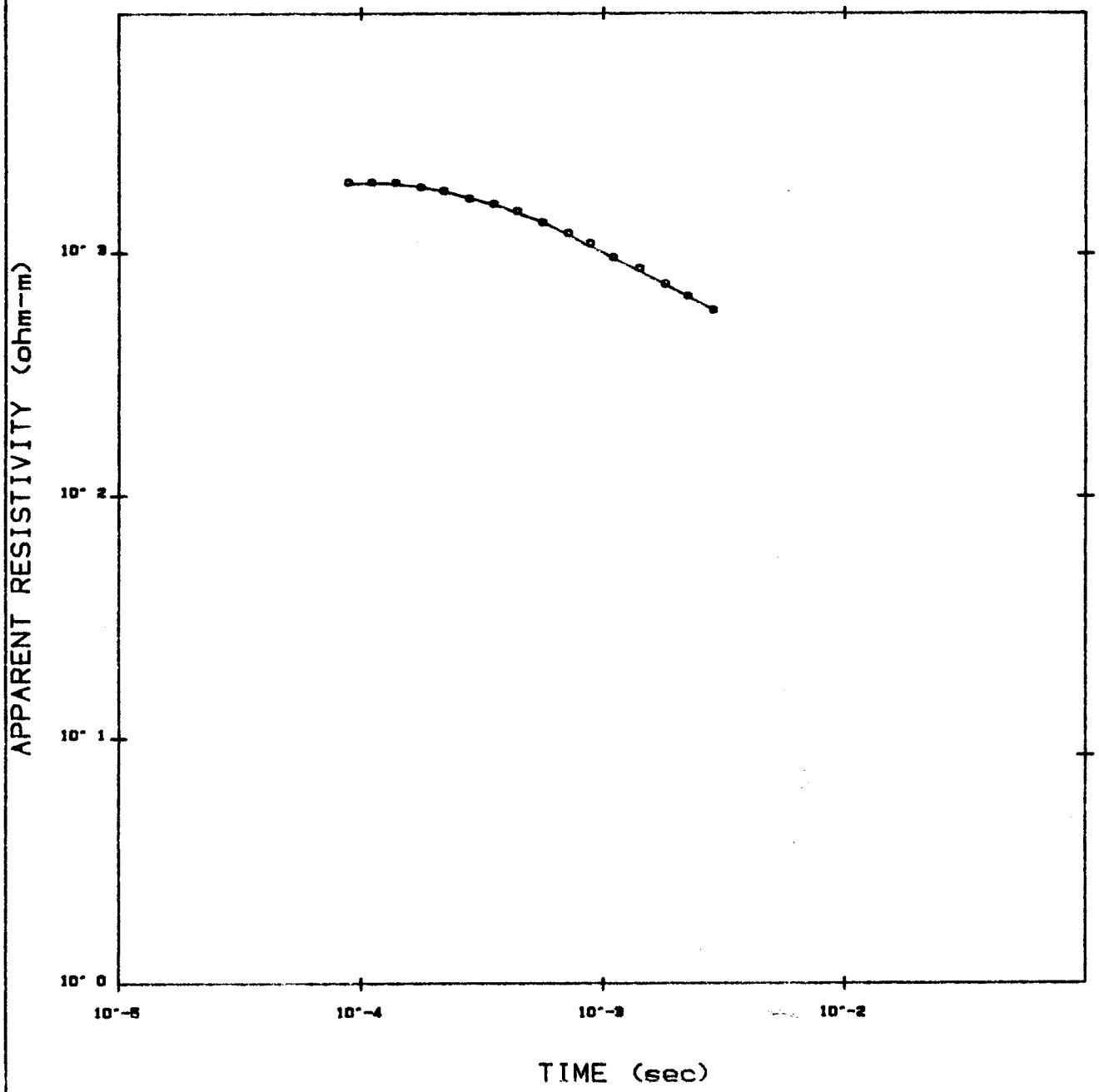
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		1898.9	6230.0		
1899.63	475.3	1423.6	4670.5	.3	.3
323.57	265.2	1158.4	3800.5	.8	1.1
161.32					

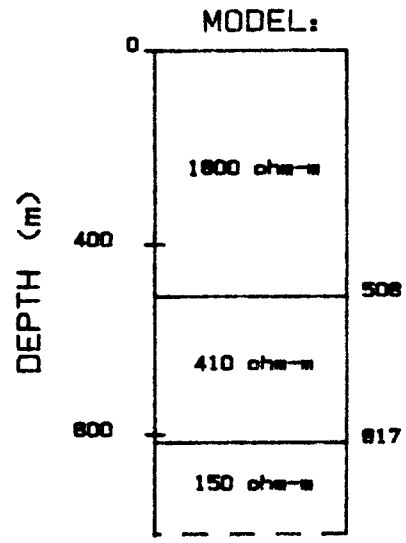
TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.31E+00	0.31E+00	+0.590	0.21E+04
0.11E-03	0.18E+00	0.18E+00	+0.899	0.21E+04
0.14E-03	0.11E+00	0.11E+00	-1.139	0.21E+04
0.18E-03	0.64E-01	0.63E-01	+0.555	0.19E+04
0.22E-03	0.41E-01	0.41E-01	+1.067	0.18E+04
0.28E-03	0.26E-01	0.26E-01	-0.117	0.16E+04
0.35E-03	0.17E-01	0.17E-01	-0.148	0.15E+04
0.44E-03	0.11E-01	0.11E-01	+0.413	0.13E+04
0.56E-03	0.71E-02	0.72E-02	-1.361	0.12E+04
0.71E-03	0.48E-02	0.48E-02	+0.105	0.11E+04
0.88E-03	0.34E-02	0.33E-02	+1.961	0.93E+03
0.11E-02	0.23E-02	0.23E-02	-1.143	0.84E+03
0.14E-02	0.15E-02	0.15E-02	+1.136	0.73E+03
0.18E-02	0.10E-02	0.10E-02	-0.171	0.64E+03

R: 168. X: 0. Y: 0. DL: 0. REQ: 168. CF: 1.0000
TDHZ ARRAY, 14 DATA POINTS, SYSTEM: NONE DATA: L400S170
JOB #685143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 4 STA 17 OCT. 16, 1985
RMS LOG ERROR: 4.08E-03, ANTILOG YIELDS .9450 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	1.00					
P 2	.00	.99				
P 3	.00	-.01	.98			
T 1	.00	.00	.00	1.00		
T 2	.00	.00	.00	.00	1.00	
F 0	.00	.00	.00	.00	.00	.00





ERROR= .0850 %
LOOP RADIUS= 168m

o FIELD DATA

— MODEL CURVE

THE EARTH TECHNOLOGY CORP

UNOCAL Geothermal

Medicine Lake CA

LINE: 4 STA.: 18

APPARENT RESISTIVITY CURVE

JOB #G85143 Fig.

L4005180

MODEL: 3 LAYERS

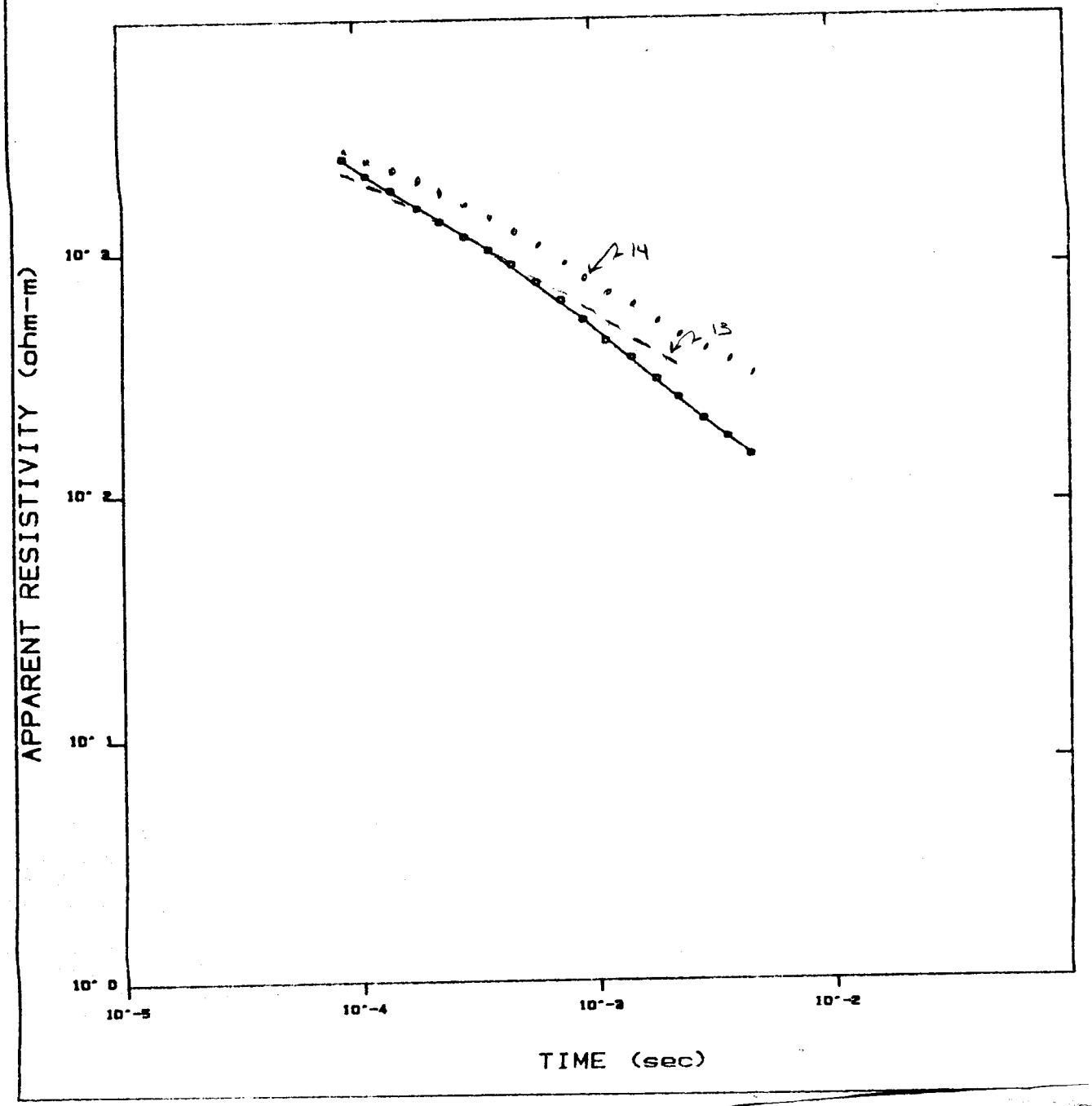
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		1886.7	6190.0		
1818.35	508.3	1378.5	4522.5	.3	.3
410.10	308.2	1070.2	3511.2	.8	1.0
153.96					

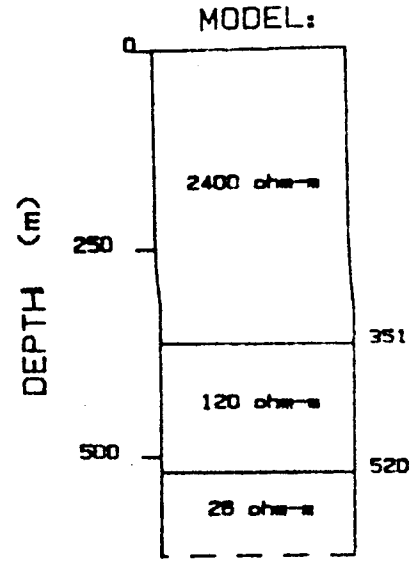
TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.34E+00	0.34E+00	-0.206	0.20E+04
0.11E-03	0.20E+00	0.20E+00	+1.018	0.20E+04
0.14E-03	0.11E+00	0.11E+00	-1.424	0.20E+04
0.18E-03	0.65E-01	0.65E-01	+0.298	0.19E+04
0.22E-03	0.40E-01	0.40E-01	+0.353	0.18E+04
0.28E-03	0.25E-01	0.24E-01	+0.766	0.17E+04
0.35E-03	0.15E-01	0.15E-01	-0.578	0.16E+04
0.44E-03	0.94E-02	0.95E-02	-1.141	0.15E+04
0.56E-03	0.60E-02	0.60E-02	+0.798	0.13E+04
0.71E-03	0.39E-02	0.39E-02	+0.220	0.12E+04
0.88E-03	0.27E-02	0.27E-02	-0.154	0.11E+04
0.11E-02	0.19E-02	0.19E-02	+1.470	0.96E+03
0.14E-02	0.12E-02	0.12E-02	-1.637	0.86E+03
0.18E-02	0.80E-03	0.81E-03	-0.505	0.74E+03
0.22E-02	0.56E-03	0.56E-03	+0.001	0.66E+03
.0145 0.29E-02	0.37E-03	0.37E-03	+0.696	0.58E+03

R: 168. X: 0. Y: 0. DL: 0. REQ: 165. CF: 1.0000
TDHZ ARRAY. 16 DATA POINTS. SYSTEM: NONE DATA: L4005180
JOB #685143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 4 SAT 18 OCT. 16, 1985
RMS LOG ERROR: 3.74E-03, ANTILOG YIELDS .8650 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	1.00					
P 2	.00	.99				
P 3	.00	-.01	.99			
T 1	.00	.00	.00	1.00		
T 2	.00	.00	.00	.00	1.00	
F 0	.00	.00	.00	.00	.00	.00





ERROR= 1.5307 %
LOOP RADIUS= 168m

FIELD DATA
MODEL CURVE

THE EARTH TECHNOLOGY CO

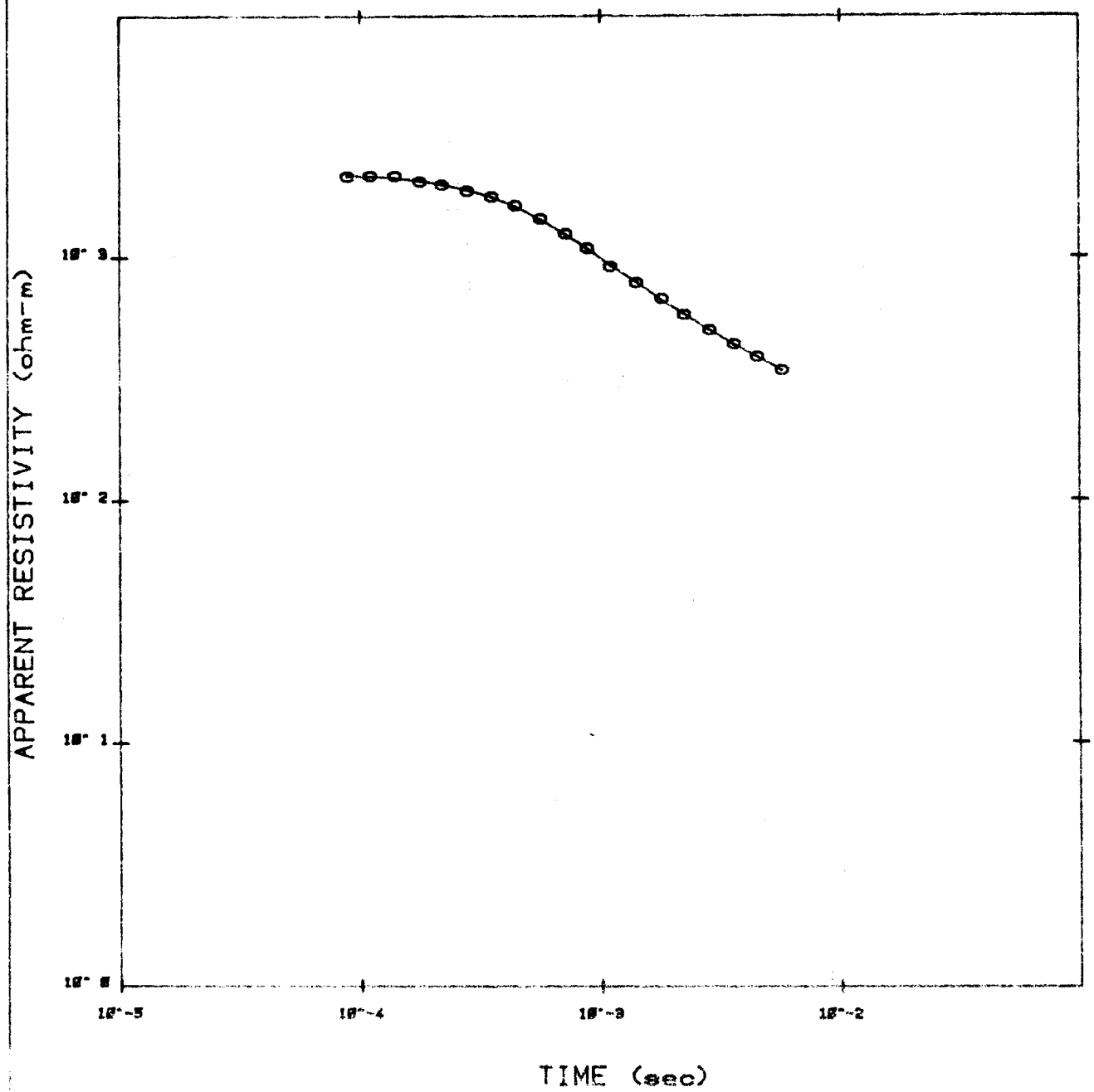
UNOCAL Geothermal

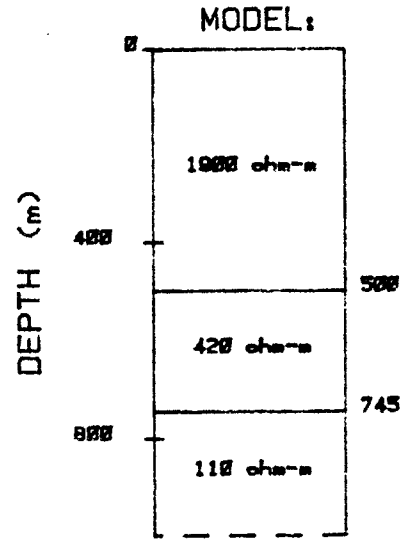
Medicine Lake CA

LINE: 4 STA.: 12

APPARENT RESISTIVITY CURVE

JOB #G85143 Fig





ERROR= 1.1995 %
LOOP RADIUS= 100m

• FIELD DATA

— MODEL CURVE

THE EARTH TECHNOLOGY CORP.

UNOCAL Geothermal

Medicine Lake CA

LINE: 5 STA.: 1

APPARENT RESISTIVITY CURVE

JOB #G85143 Fig.

L5005010

MODEL: 3 LAYERS

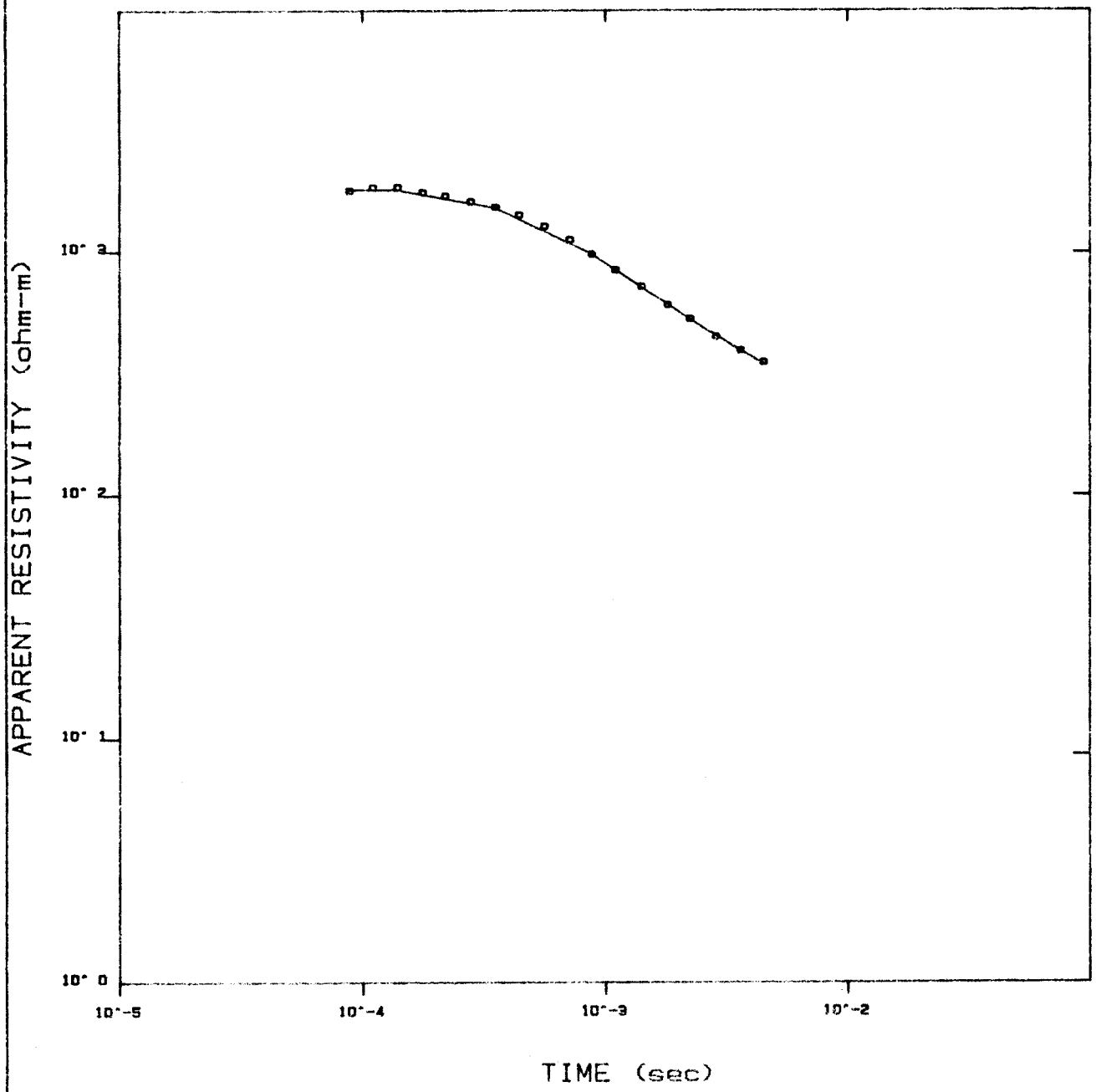
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		1996.4	6550.0		
1946.13	500.3	1496.1	4908.5	.3	.3
415.92	245.0	1251.1	4104.5	.6	.8
105.27					

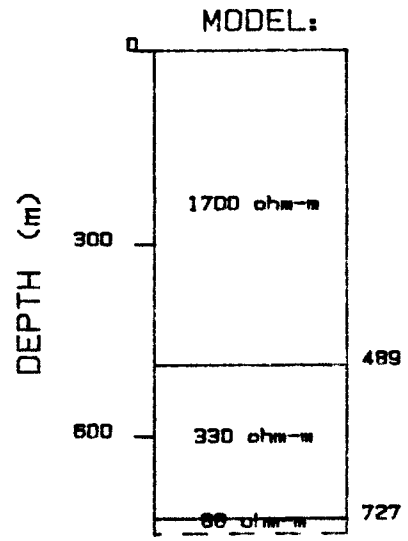
TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.31E+00	0.30E+00	+1.176	0.21E+04
0.11E-03	0.18E+00	0.18E+00	-0.873	0.22E+04
0.14E-03	0.98E-01	0.10E+00	-2.571	0.21E+04
0.18E-03	0.58E-01	0.57E-01	+1.364	0.20E+04
0.22E-03	0.36E-01	0.36E-01	+1.098	0.20E+04
0.28E-03	0.21E-01	0.21E-01	+1.203	0.19E+04
0.35E-03	0.13E-01	0.13E-01	-0.500	0.18E+04
0.44E-03	0.84E-02	0.85E-02	-1.262	0.16E+04
0.56E-03	0.55E-02	0.56E-02	-0.689	0.14E+04
0.71E-03	0.38E-02	0.38E-02	-0.578	0.12E+04
0.88E-03	0.27E-02	0.27E-02	-0.531	0.11E+04
0.11E-02	0.20E-02	0.20E-02	+2.126	0.91E+03
0.14E-02	0.14E-02	0.13E-02	+1.671	0.78E+03
0.18E-02	0.93E-03	0.94E-03	-1.426	0.67E+03
0.22E-02	0.68E-03	0.67E-03	+0.843	0.58E+03
0.29E-02	0.46E-03	0.46E-03	-0.165	0.50E+03
0.36E-02	0.31E-03	0.31E-03	-0.821	0.44E+03
0.45E-02	0.21E-03	0.21E-03	+0.149	0.39E+03
0.57E-02	0.14E-03	0.14E-03	+0.104	0.34E+03

R: 168. X: 0. Y: 0. DL: 0. REQ: 168. CF: 1.0000
TDHZ ARRAY, 19 DATA POINTS, SYSTEM: NONE DATA: L5005010
JOB #G85143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 5 STA 1 OCT. 19, 1985
RMS LOG ERROR: 5.18E-03, ANTILOG YIELDS 1.1995 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	1.00					
P 2	.00	.96				
P 3	.00	.00	1.00			
T 1	.00	.01	.00	1.00		
T 2	.00	-.01	.00	.00	1.00	
F 0	.00	.00	.00	.00	.00	.00





ERROR= 1.4425 %
LOOP RADIUS= 168m

o FIELD DATA

— MODEL CURVE

THE EARTH TECHNOLOGY CORP

UNOCAL Geothermal

Medicine Lake CA

LINE: 5 STA.: 2

APPARENT RESISTIVITY CURVE

JOB #G85143 Fig.

L5005020

MODEL: 3 LAYERS

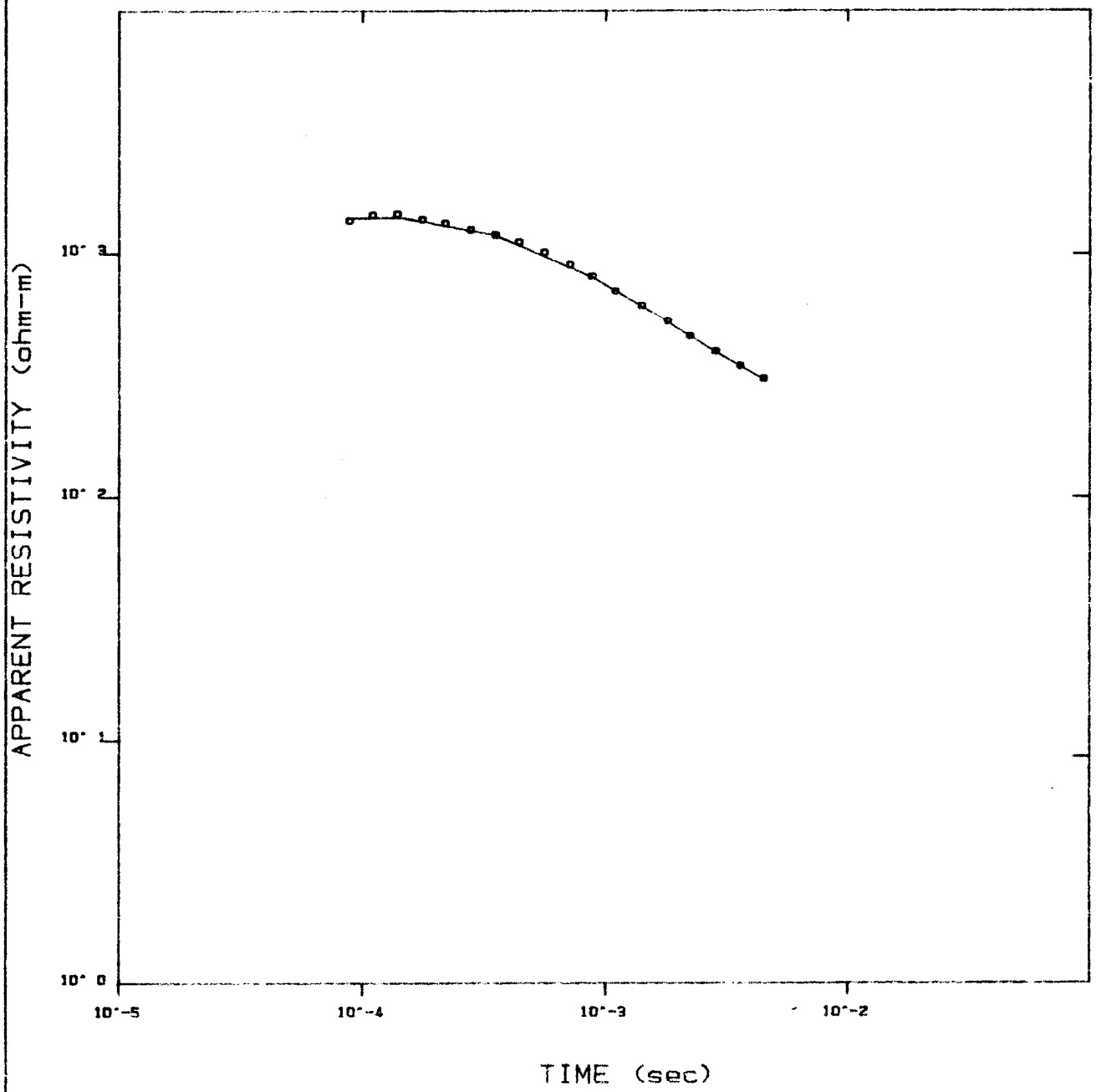
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		2011.7	6600.0		
1657.75	488.5	1523.2	4997.4	.3	.3
334.25	238.8	1284.4	4214.0	.7	1.0
88.45					

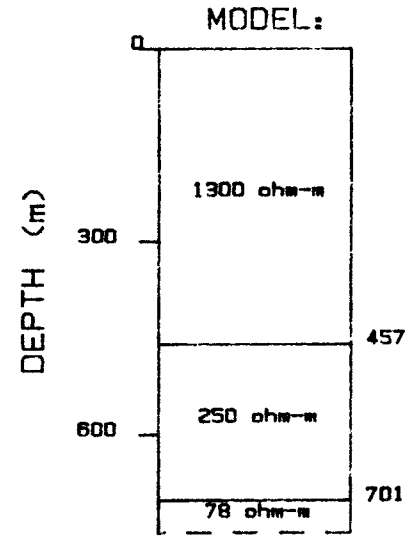
TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.40E+00	0.39E+00	+2.574	0.18E+04
0.11E-03	0.22E+00	0.22E+00	-1.412	0.19E+04
0.14E-03	0.12E+00	0.13E+00	-3.076	0.19E+04
0.18E-03	0.72E-01	0.72E-01	+0.166	0.18E+04
0.22E-03	0.45E-01	0.44E-01	+1.412	0.17E+04
0.28E-03	0.26E-01	0.26E-01	+1.703	0.16E+04
0.35E-03	0.16E-01	0.16E-01	-0.509	0.15E+04
0.44E-03	0.10E-01	0.10E-01	-0.612	0.14E+04
0.56E-03	0.65E-02	0.66E-02	-0.567	0.13E+04
0.71E-03	0.44E-02	0.44E-02	-1.067	0.11E+04
0.88E-03	0.32E-02	0.32E-02	+0.084	0.98E+03
0.11E-02	0.23E-02	0.23E-02	+0.683	0.84E+03
0.14E-02	0.16E-02	0.16E-02	-0.028	0.72E+03
0.18E-02	0.11E-02	0.11E-02	+0.558	0.60E+03
0.22E-02	0.78E-03	0.78E-03	-0.524	0.53E+03
0.29E-02	0.54E-03	0.53E-03	+2.557	0.45E+03
0.36E-02	0.37E-03	0.37E-03	+0.233	0.39E+03
0.45E-02	0.25E-03	0.26E-03	-2.037	0.35E+03

R: 168. X: 0. Y: 0. DL: 0. REQ: 168. CF: 1.0000
TDHZ ARRAY, 18 DATA POINTS, SYSTEM: NONE DATA: L5005020
JOB #685143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 5 STA 2 OCT. 19, 1985
RMS LOG ERROR: 6.22E-03, ANTILOG YIELDS 1.4425 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	1.00					
P 2	.00	.97				
P 3	.00	.00	1.00			
T 1	.00	.01	.00	1.00		
T 2	.00	-.01	.00	.00	1.00	
F 0	.00	.00	.00	.00	.00	.00





ERROR= 1.7974 %
LOOP RADIUS= 168m

o FIELD DATA

—— MODEL CURVE

THE EARTH TECHNOLOGY CORP

UNOCAL Geothermal

Medicine Lake CA

LINE: 5 STA.: 3

APPARENT RESISTIVITY CURVE

JOB #G85143 Fig.

L5005030

MODEL: 3 LAYERS

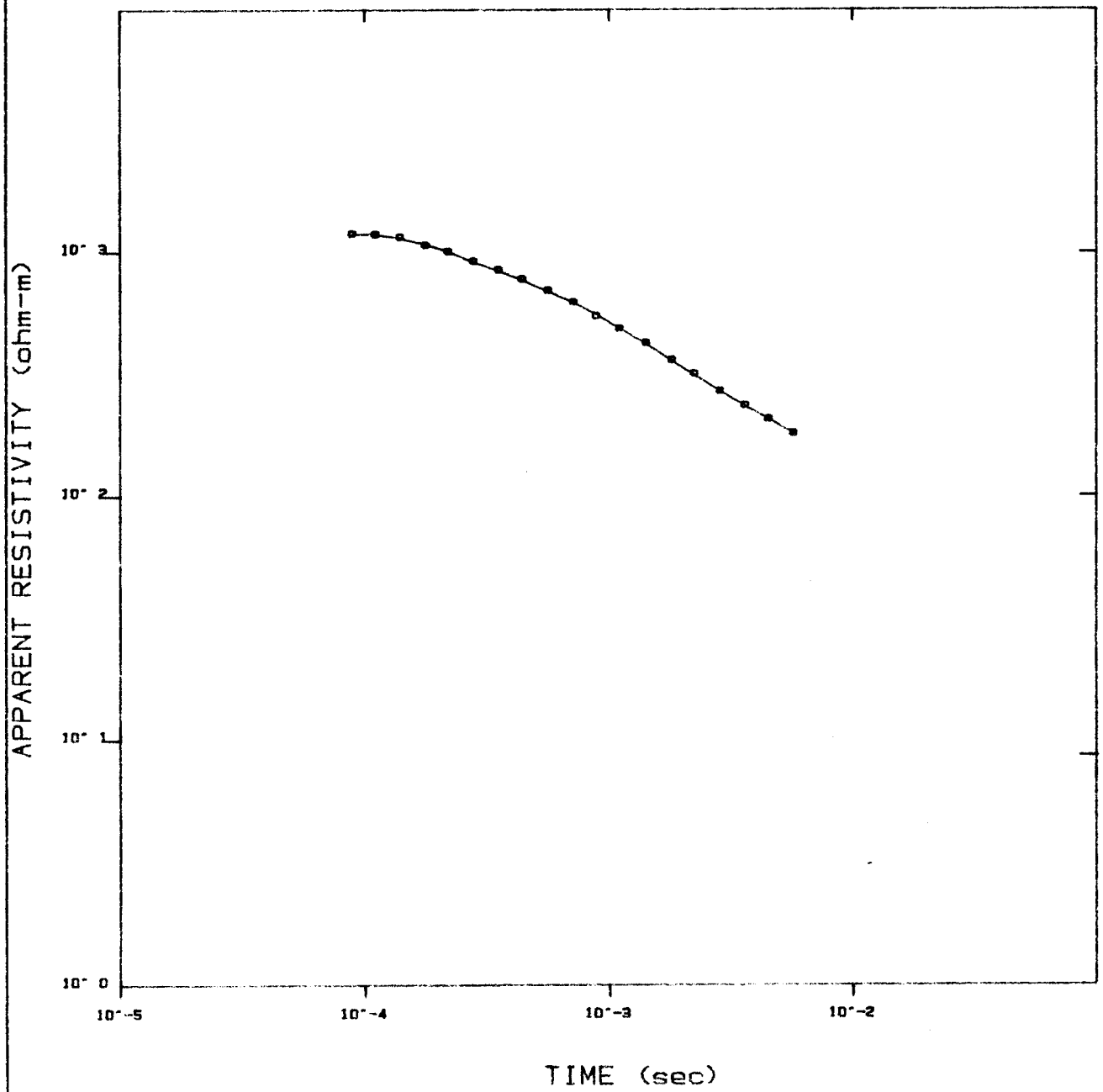
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		2005.6	6580.0		
1272.13	456.9	1548.7	5080.9	.4	.4
245.10	243.8	1304.9	4281.0	1.0	1.4
78.11					

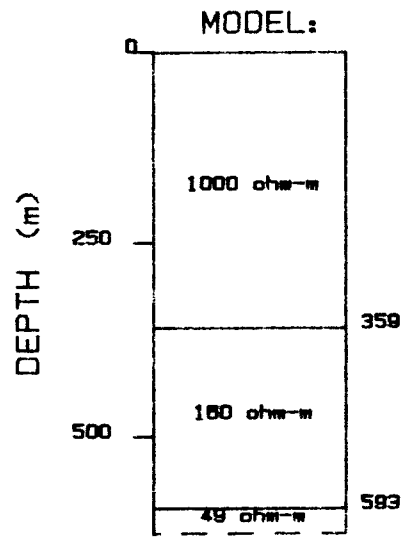
TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.60E+00	0.58E+00	+4.556	0.14E+04
0.11E-03	0.32E+00	0.33E+00	-2.592	0.14E+04
0.14E-03	0.19E+00	0.18E+00	-3.796	0.15E+04
0.18E-03	0.11E+00	0.10E+00	+0.601	0.14E+04
0.22E-03	0.65E-01	0.65E-01	+0.397	0.13E+04
0.28E-03	0.39E-01	0.38E-01	+2.599	0.12E+04
0.35E-03	0.23E-01	0.23E-01	+0.086	0.12E+04
0.44E-03	0.15E-01	0.15E-01	-1.901	0.11E+04
0.56E-03	0.93E-02	0.94E-02	-0.527	0.10E+04
0.71E-03	0.61E-02	0.61E-02	+0.318	0.90E+03
0.88E-03	0.42E-02	0.43E-02	-0.420	0.80E+03
0.11E-02	0.30E-02	0.30E-02	+1.422	0.70E+03
0.14E-02	0.20E-02	0.20E-02	+0.103	0.61E+03
0.18E-02	0.14E-02	0.14E-02	-1.061	0.52E+03
0.22E-02	0.98E-03	0.98E-03	+0.587	0.45E+03
0.29E-02	0.66E-03	0.66E-03	-0.301	0.39E+03
0.36E-02	0.45E-03	0.45E-03	+0.523	0.34E+03
0.45E-02	0.31E-03	0.31E-03	-0.453	0.30E+03

R: 168. X: 0. Y: 0. DL: 0. REQ: 168. CF: 1.0000
TDHZ ARRAY, 18 DATA POINTS, SYSTEM: NONE DATA: L5005030
JOB #685143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 5 STA 3 OCT. 19, 1985
RMS LOG ERROR: 7.74E-03, ANTILOG YIELDS 1.7974 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	F 3	T 1	T 2	F 0
P 1	1.00					
P 2	.00	.99				
F 3	.00	.00	1.00			
T 1	.00	.00	.00	1.00		
T 2	.00	.00	.00	.00	1.00	
F 0	.00	.00	.00	.00	.00	.00





ERROR= 1.0265 %
LOOP RADIUS= 168m

o FIELD DATA

—— MODEL CURVE

THE EARTH TECHNOLOGY CORP

UNOCAL Geothermal

Medicine Lake CA

LINE: 5 STA.: 4

APPARENT RESISTIVITY CURVE

JOB #G85143 Fig.

L500S040

MODEL: 3 LAYERS

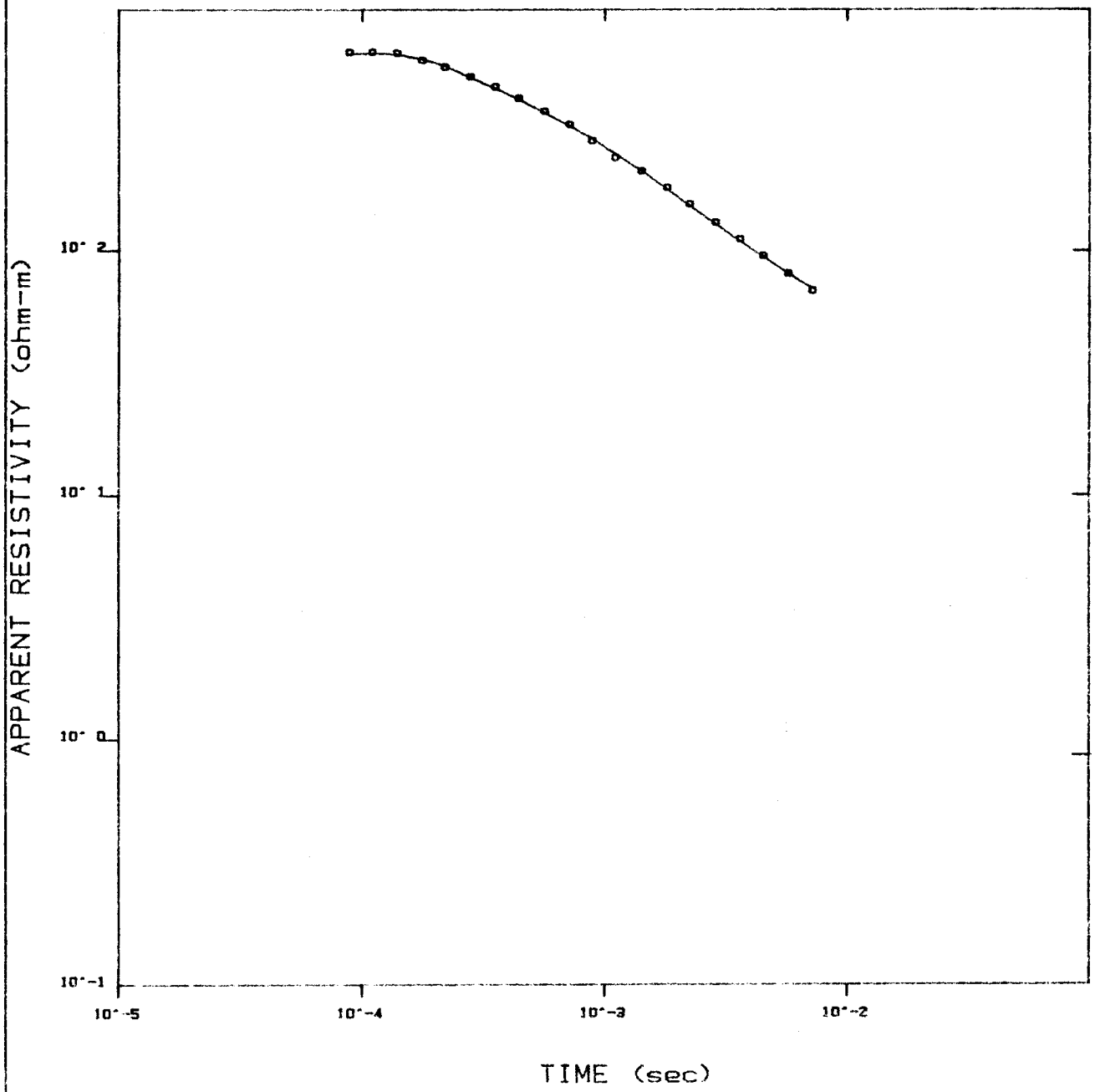
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		2011.7	6600.0		
1033.80	358.7	1653.0	5423.3	.3	.3
163.95	234.7	1418.3	4653.4	1.4	1.8
49.37					

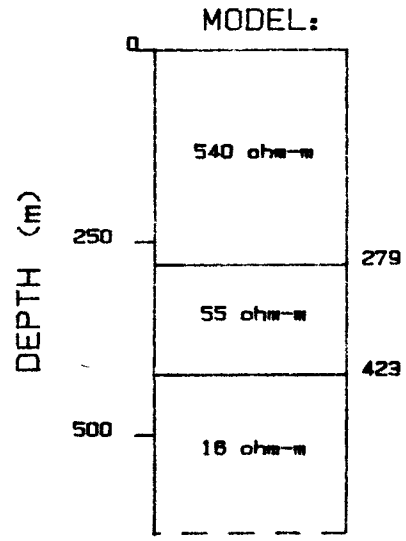
TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.74E+00	0.74E+00	+0.203	0.12E+04
0.11E-03	0.43E+00	0.43E+00	-0.036	0.12E+04
0.14E-03	0.25E+00	0.25E+00	-1.275	0.12E+04
0.18E-03	0.15E+00	0.15E+00	+1.666	0.11E+04
0.22E-03	0.99E-01	0.98E-01	+0.738	0.10E+04
0.28E-03	0.62E-01	0.62E-01	-0.484	0.92E+03
0.35E-03	0.39E-01	0.39E-01	-1.058	0.85E+03
0.44E-03	0.25E-01	0.26E-01	-0.548	0.77E+03
0.56E-03	0.16E-01	0.16E-01	-0.477	0.70E+03
0.71E-03	0.11E-01	0.11E-01	-0.099	0.62E+03
0.88E-03	0.75E-02	0.73E-02	+2.950	0.55E+03
0.11E-02	0.52E-02	0.52E-02	+0.681	0.48E+03
0.14E-02	0.34E-02	0.34E-02	-0.586	0.42E+03
0.18E-02	0.24E-02	0.24E-02	-0.801	0.36E+03
0.22E-02	0.17E-02	0.17E-02	-1.386	0.32E+03
0.29E-02	0.12E-02	0.12E-02	-0.102	0.27E+03
0.36E-02	0.80E-03	0.80E-03	-0.279	0.23E+03
0.45E-02	0.55E-03	0.55E-03	+0.158	0.21E+03
0.57E-02	0.38E-03	0.37E-03	+0.996	0.18E+03

R: 168. X: 0. Y: 0. DL: 0. REQ: 168. CF: 1.0000
TDHZ ARRAY, 19 DATA POINTS, SYSTEM: NONE DATA: L500S040
JOB #G85143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 5 STA 4 OCT. 16, 1985
RMS LOG ERROR: 4.44E-03, ANTILOG YIELDS 1.0265 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	1.00					
P 2	.00	1.00				
P 3	.00	.00	1.00			
T 1	.00	.00	.00	1.00		
T 2	.00	.00	.00	.00	1.00	
F 0	.00	.00	.00	.00	.00	.00





ERROR= 2.4247 %
LOOP RADIUS= 168m

o FIELD DATA

—— MODEL CURVE

THE EARTH TECHNOLOGY CORP

UNOCAL Geothermal

Medicine Lake CA

LINE: 5 STA.: 5

APPARENT RESISTIVITY CURVE

JOB #G85143 Fig.

L500S050

MODEL: 3 LAYERS

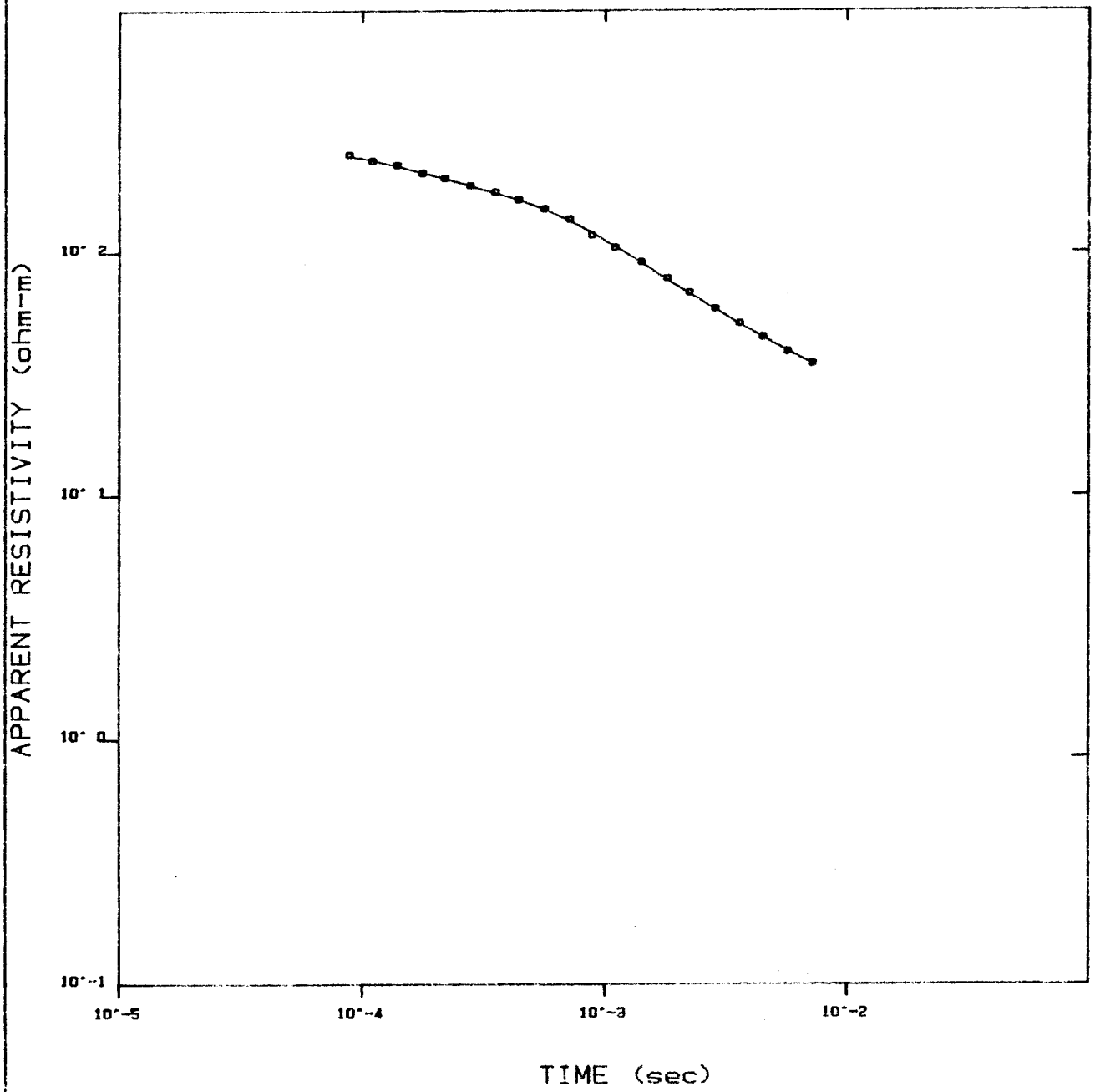
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		2011.7	6600.0		
540.72	279.0	1732.7	5684.7	.5	.5
54.83	144.4	1588.3	5210.9	2.6	3.1
15.69					

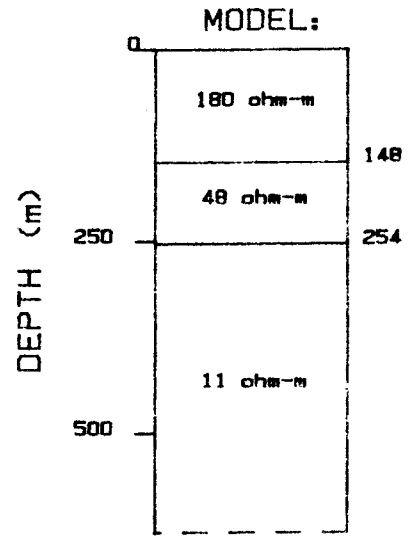
TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.18E+01	0.18E+01	-0.479	0.66E+03
0.11E-03	0.10E+01	0.10E+01	-0.078	0.67E+03
0.14E-03	0.58E+00	0.59E+00	-1.179	0.66E+03
0.18E-03	0.35E+00	0.34E+00	+2.372	0.62E+03
0.22E-03	0.23E+00	0.22E+00	+2.177	0.58E+03
0.28E-03	0.14E+00	0.14E+00	-0.467	0.53E+03
0.35E-03	0.91E-01	0.93E-01	-1.801	0.48E+03
0.44E-03	0.61E-01	0.62E-01	-1.188	0.43E+03
0.56E-03	0.40E-01	0.41E-01	-2.082	0.38E+03
0.71E-03	0.27E-01	0.27E-01	-1.920	0.33E+03
0.88E-03	0.20E-01	0.19E-01	+4.023	0.29E+03
0.11E-02	0.15E-01	0.14E-01	+6.401	0.24E+03
0.14E-02	0.96E-02	0.95E-02	+0.749	0.21E+03
0.18E-02	0.66E-02	0.68E-02	-2.038	0.18E+03
0.22E-02	0.49E-02	0.50E-02	-2.293	0.16E+03
0.29E-02	0.35E-02	0.35E-02	-1.802	0.13E+03
0.36E-02	0.25E-02	0.25E-02	-2.769	0.11E+03
0.45E-02	0.18E-02	0.18E-02	-1.003	0.95E+02
0.57E-02	0.13E-02	0.13E-02	+1.244	0.80E+02
0.72E-02	0.91E-03	0.87E-03	+3.507	0.68E+02

R: 168. X: 0. Y: 0. DL: 0. REQ: 168. CF: 1.0000
TDHZ ARRAY, 20 DATA POINTS, SYSTEM: NONE DATA: L500S050
JOB #G85143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 5 STA 5 OCT. 18, 1985
RMS LOG ERROR: 1.04E-02, ANTILOG YIELDS 2.4247 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	1.00					
P 2	.00	1.00				
P 3	.00	.00	1.00			
T 1	.00	.00	.00	1.00		
T 2	.00	.00	.00	.00	1.00	
F 0	.00	.00	.00	.00	.00	.00





ERROR= 1.3577 %
LOOP RADIUS= 168m

o FIELD DATA

— MODEL CURVE

THE EARTH TECHNOLOGY CORP

UNOCAL Geothermal

Medicine Lake CA

LINE: 5 STA.: 6

APPARENT RESISTIVITY CURVE

JOB #G85143 Fig.

L5005060

MODEL: 3 LAYERS

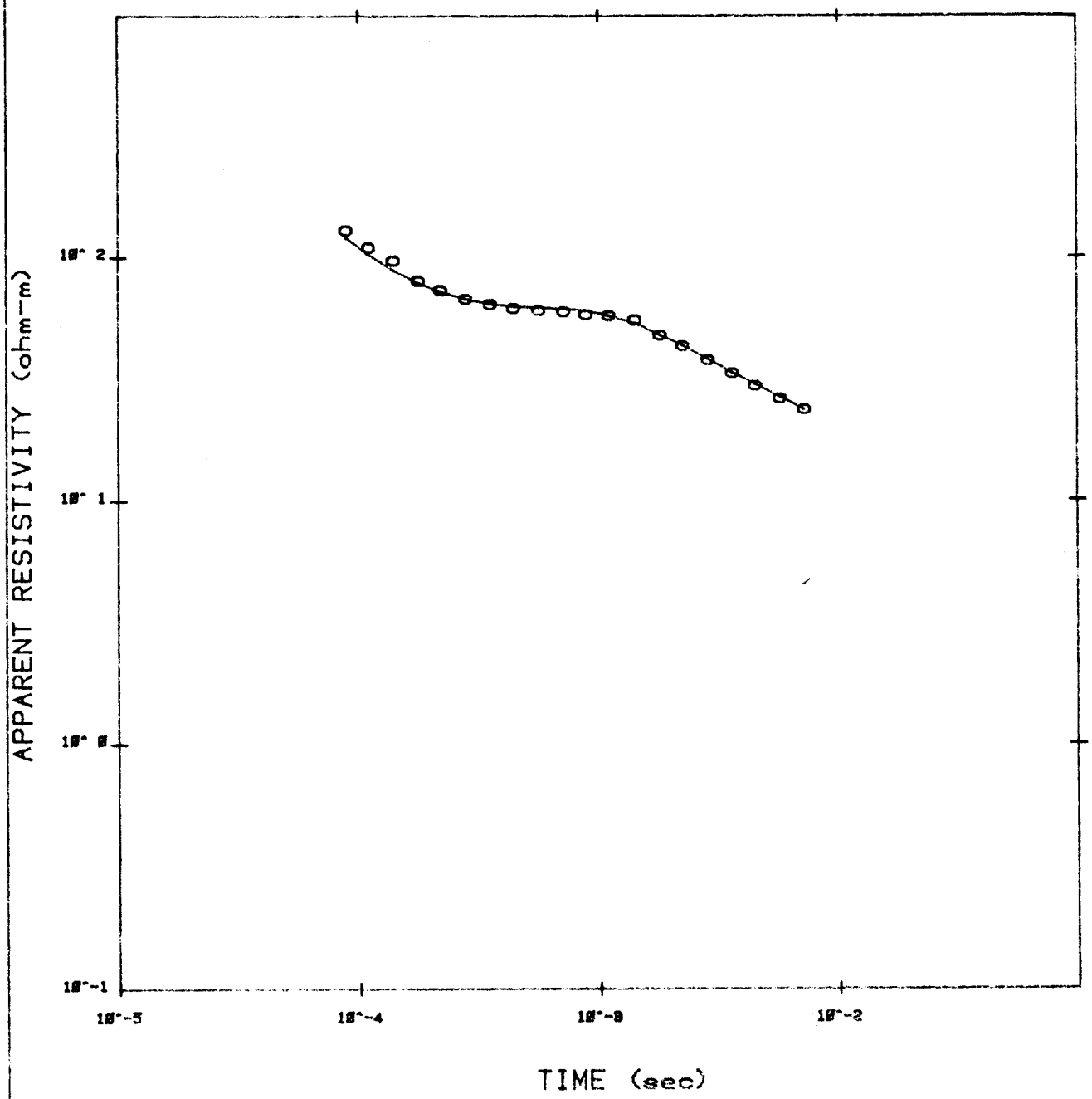
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		2011.7	6600.0		
179.11	148.2	1863.4	6113.7	.8	.8
47.93	105.4	1758.1	5768.0	2.2	3.0
11.38					

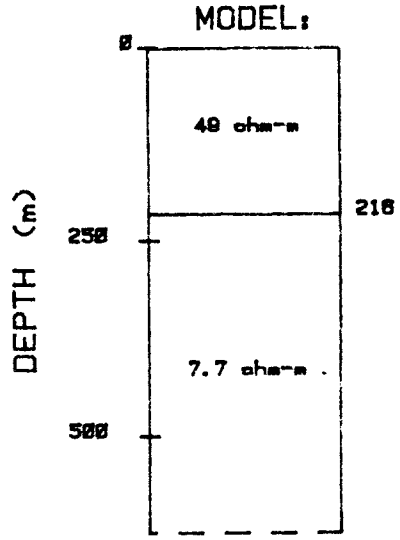
TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.75E+01	0.76E+01	-0.811	0.25E+03
0.11E-03	0.48E+01	0.47E+01	+1.196	0.24E+03
0.14E-03	0.28E+01	0.29E+01	-0.973	0.23E+03
0.18E-03	0.17E+01	0.17E+01	+0.969	0.21E+03
0.22E-03	0.11E+01	0.11E+01	+0.160	0.20E+03
0.28E-03	0.66E+00	0.67E+00	-0.384	0.19E+03
0.35E-03	0.40E+00	0.41E+00	-1.014	0.18E+03
0.44E-03	0.26E+00	0.26E+00	+0.431	0.16E+03
0.56E-03	0.16E+00	0.16E+00	-0.548	0.15E+03
0.71E-03	0.10E+00	0.11E+00	-1.679	0.14E+03
0.88E-03	0.76E-01	0.73E-01	+4.266	0.12E+03
0.11E-02	0.53E-01	0.52E-01	+1.453	0.10E+03
0.14E-02	0.35E-01	0.35E-01	-0.493	0.90E+02
0.18E-02	0.24E-01	0.24E-01	-1.550	0.77E+02
0.22E-02	0.17E-01	0.17E-01	-1.379	0.67E+02
0.29E-02	0.12E-01	0.12E-01	-0.280	0.57E+02
0.36E-02	0.81E-02	0.82E-02	-1.156	0.50E+02
0.45E-02	0.57E-02	0.56E-02	+0.465	0.44E+02
0.57E-02	0.38E-02	0.38E-02	+1.392	0.38E+02
0.72E-02	0.25E-02	0.25E-02	+0.379	0.34E+02

R: 168. X: 0. Y: 0. DL: 0. REQ: 168. CF: 1.0000
TDH7 ARRAY, 20 DATA POINTS, SYSTEM: NONE DATA: L5005060
JOB #695143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 5 STA 6 OCT. 18, 1983
RMS LOG ERROR: 5.86E-03, ANTILOG YIELDS 1.3577 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	1.00					
P 2	.00	.99				
P 3	.00	.00	1.00			
T 1	.00	.00	.00	1.00		
T 2	.00	.00	.00	.00	1.00	
F 0	.00	.00	.00	.00	.00	.00





ERROR= 4.9531 %
LOOP RADIUS= 168m

• FIELD DATA

— MODEL CURVE

THE EARTH TECHNOLOGY CORP.

UNOCAL Geothermal

Medicine Lake CA

LINE: 5 STA.: 7

APPARENT RESISTIVITY CURVE

JOB #G85143 Fig.

L500S070

MODEL: 2 LAYERS

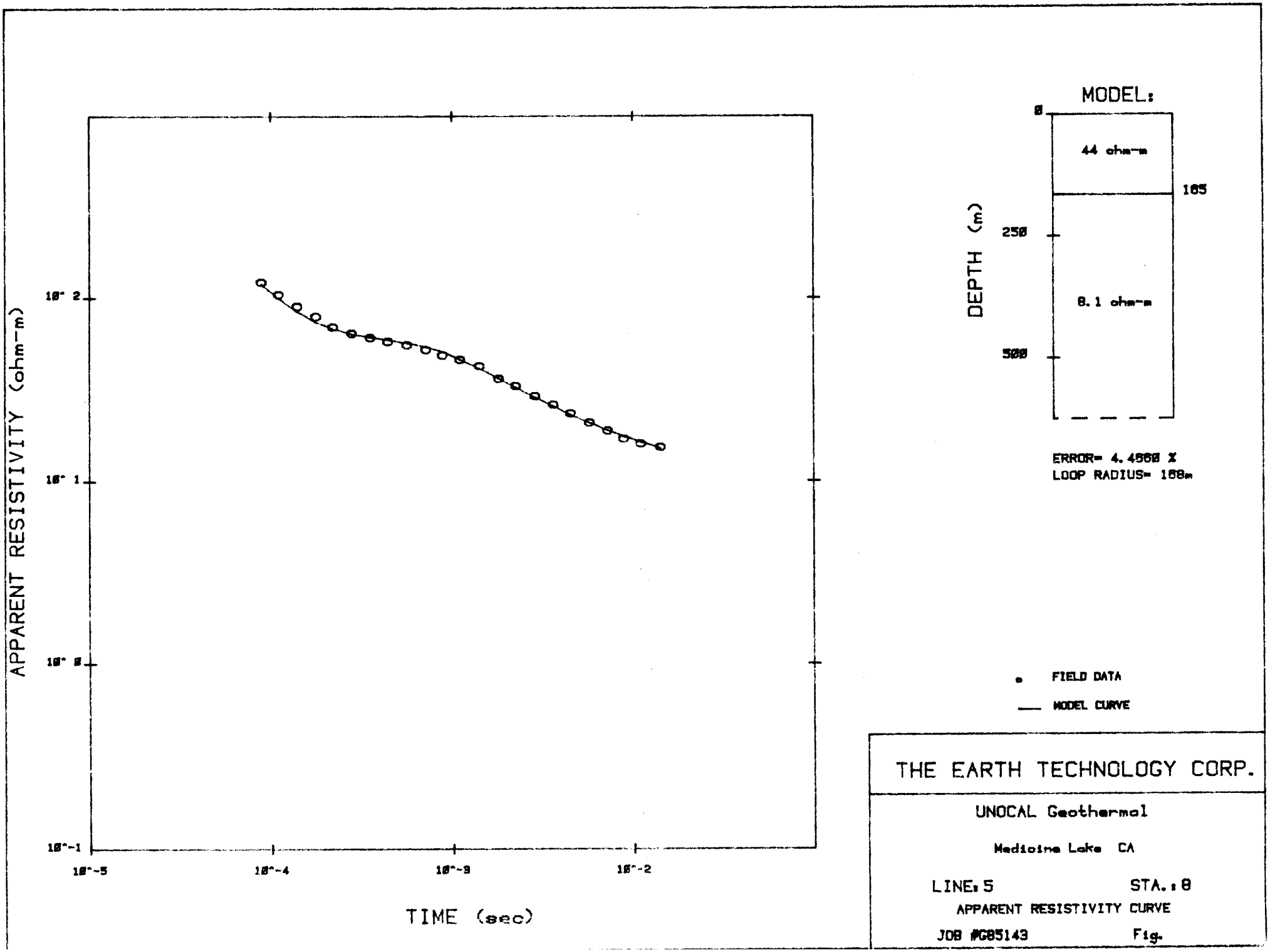
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		2030.0	6660.0		
49.27	216.1	1813.8	5950.9	4.4	4.4
7.74					

TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.21E+02	0.23E+02	-9.368	0.13E+03
0.11E-03	0.15E+02	0.17E+02	-9.452	0.11E+03
0.14E-03	0.10E+02	0.12E+02	-12.122	0.97E+02
0.18E-03	0.75E+01	0.77E+01	-2.542	0.80E+02
0.22E-03	0.50E+01	0.51E+01	-1.869	0.73E+02
0.28E-03	0.31E+01	0.31E+01	-0.052	0.68E+02
0.35E-03	0.19E+01	0.18E+01	+1.046	0.64E+02
0.44E-03	0.11E+01	0.11E+01	+2.747	0.62E+02
0.56E-03	0.63E+00	0.61E+00	+4.140	0.61E+02
0.71E-03	0.35E+00	0.34E+00	+4.085	0.60E+02
0.88E-03	0.22E+00	0.21E+00	+5.109	0.58E+02
0.11E-02	0.13E+00	0.13E+00	+0.226	0.58E+02
0.14E-02	0.73E-01	0.76E-01	-3.766	0.55E+02
0.18E-02	0.49E-01	0.49E-01	+0.532	0.48E+02
0.22E-02	0.33E-01	0.33E-01	+0.854	0.43E+02
0.29E-02	0.22E-01	0.22E-01	+2.036	0.38E+02
0.36E-02	0.15E-01	0.15E-01	+0.864	0.33E+02
0.45E-02	0.10E-01	0.10E-01	+1.544	0.29E+02
0.57E-02	0.68E-02	0.66E-02	+2.525	0.26E+02
0.72E-02	0.44E-02	0.44E-02	-0.029	0.24E+02

R: 168. X: 0. Y: 0. DL: 0. REQ: 168. CF: 1.0000
TDHZ ARRAY, 20 DATA POINTS, SYSTEM: NONE DATA: L500S070
JOB #685143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 5 STA 7 OCT. 18, 1985
RMS LOG ERROR: 2.10E-02, ANTILOG YIELDS 4.9531 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	T 1	F 0
P 1	1.00			
P 2	.00	1.00		
T 1	.00	.00	1.00	
F 0	.00	.00	.00	.00


APPARENT RESISTIVITY (ohm-m)
10^2
10^1
10^0
10^-1
10^-5
10^-4
10^-3
10^-2
TIME (sec)
MODEL:
0
44 ohm-m
165
250
DEPTH (m)
8.1 ohm-m
500
ERROR= 4.4560 %
LOOP RADIUS= 100m
FIELD DATA
MODEL CURVE
THE EARTH TECHNOLOGY CORP.
UNOCAL Geothermal
Medicine Lake CA
LINE: 5
STA.: 0
APPARENT RESISTIVITY CURVE
JOB #G85143
Fig.

L500S080

MODEL: 2 LAYERS

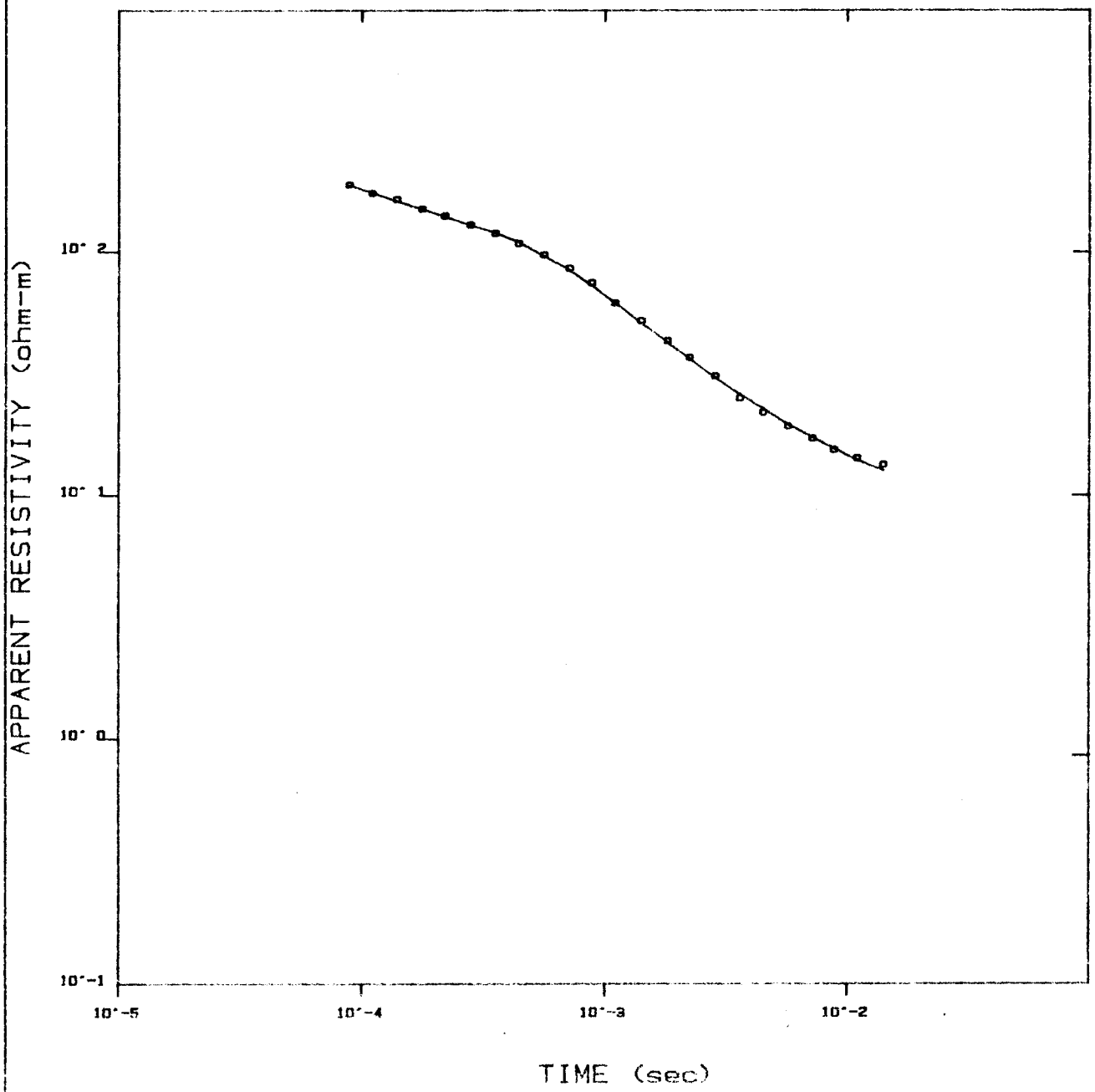
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		2036.1	6680.0		
43.53	164.6	1871.5	6140.1	3.8	3.8
8.11					

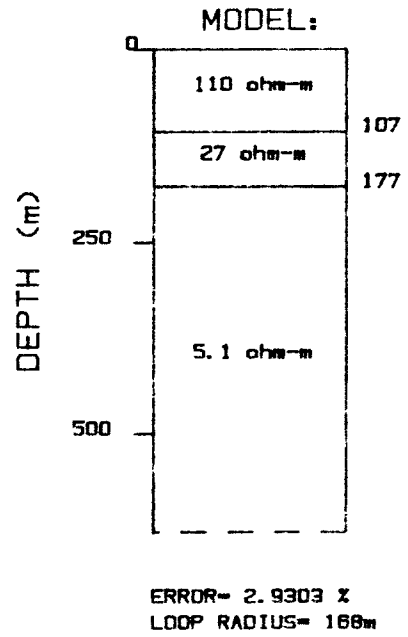
TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.23E+02	0.23E+02	-3.505	0.12E+03
0.11E-03	0.17E+02	0.18E+02	-6.612	0.10E+03
0.14E-03	0.11E+02	0.13E+02	-9.226	0.90E+02
0.18E-03	0.75E+01	0.83E+01	-9.566	0.80E+02
0.22E-03	0.54E+01	0.55E+01	-2.745	0.70E+02
0.28E-03	0.33E+01	0.33E+01	-0.747	0.64E+02
0.35E-03	0.20E+01	0.20E+01	+0.861	0.61E+02
0.44E-03	0.12E+01	0.12E+01	+2.990	0.58E+02
0.56E-03	0.71E+00	0.69E+00	+4.092	0.56E+02
0.71E-03	0.43E+00	0.41E+00	+6.059	0.53E+02
0.88E-03	0.28E+00	0.26E+00	+6.891	0.49E+02
0.11E-02	0.18E+00	0.18E+00	+0.300	0.46E+02
0.14E-02	0.11E+00	0.11E+00	-3.317	0.43E+02
0.18E-02	0.74E-01	0.73E-01	+0.735	0.36E+02
0.22E-02	0.50E-01	0.51E-01	-2.246	0.33E+02
0.29E-02	0.32E-01	0.33E-01	-1.586	0.29E+02
0.36E-02	0.21E-01	0.22E-01	-2.212	0.26E+02
0.45E-02	0.14E-01	0.15E-01	-2.073	0.24E+02
0.57E-02	0.95E-02	0.94E-02	+0.434	0.21E+02
0.72E-02	0.62E-02	0.61E-02	+1.721	0.19E+02
0.88E-02	0.43E-02	0.41E-02	+5.100	0.17E+02
0.11E-01	0.27E-02	0.26E-02	+3.373	0.16E+02
0.14E-01	0.16E-02	0.16E-02	-1.968	0.15E+02

R: 168. X: 0. Y: 0. DL: 0. REQ: 168. CF: 1.0000
TDHZ ARRAY, 23 DATA POINTS, SYSTEM: NONE DATA: L500S080
JOB #685143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 5 STA 8 OCT. 18, 1985
RMS LOG ERROR: 1.90E-02, ANTILOG YIELDS 4.4660 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	T 1	F 0
P 1	1.00			
P 2	.00	1.00		
T 1	.00	.00	1.00	
F 0	.00	.00	.00	.00





o FIELD DATA

— MODEL CURVE

THE EARTH TECHNOLOGY CORP

UNOCAL Geothermal

Medicine Lake CA

LINE: 5 STA.: 9

APPARENT RESISTIVITY CURVE

JOB #G85143 Fig.

L5008090

MODEL: 3 LAYERS

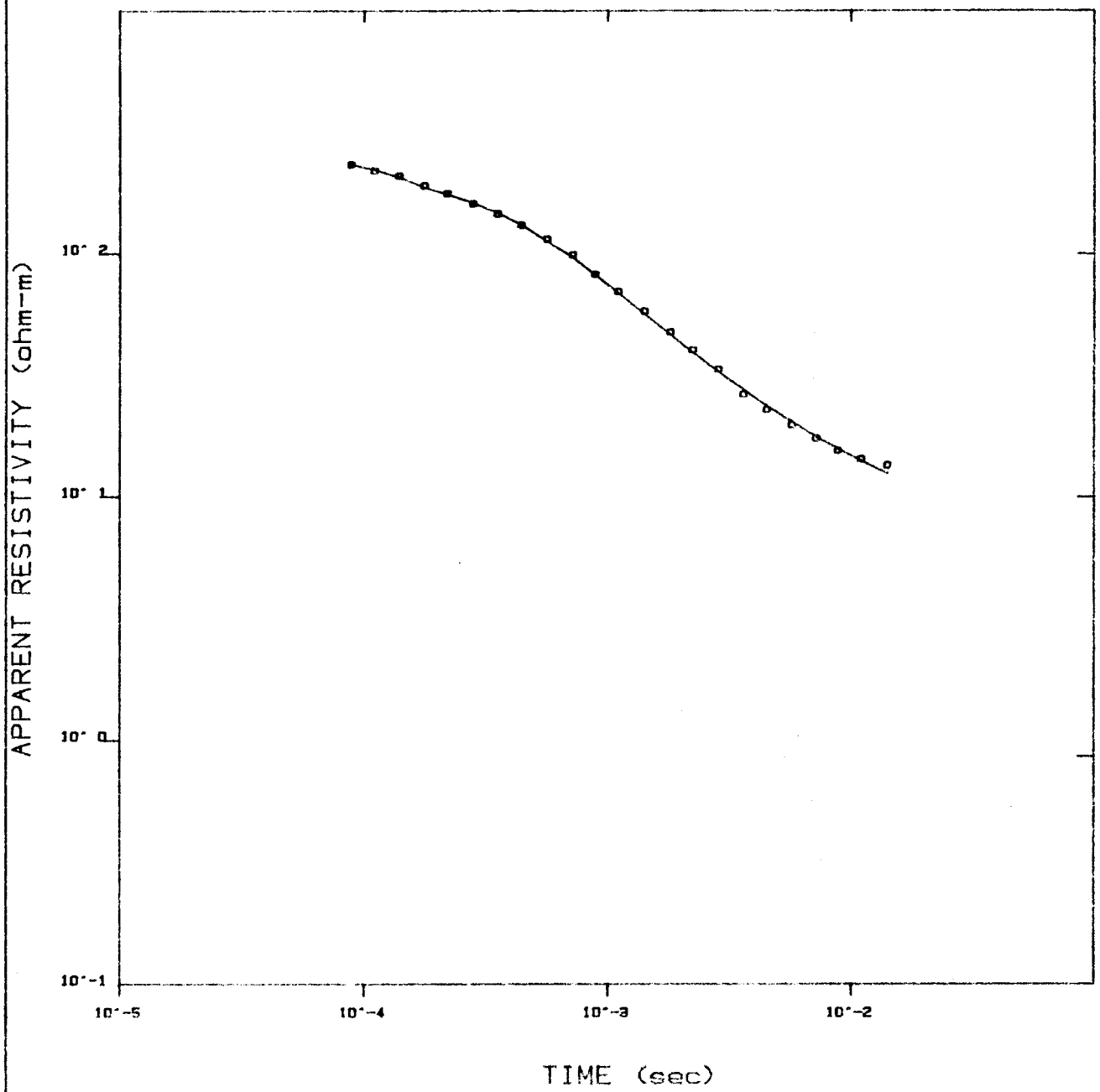
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		2017.8	6620.0		
112.85	106.8	1911.0	6269.7	.9	.9
27.45	70.2	1840.8	6039.4	2.6	3.5
5.05					

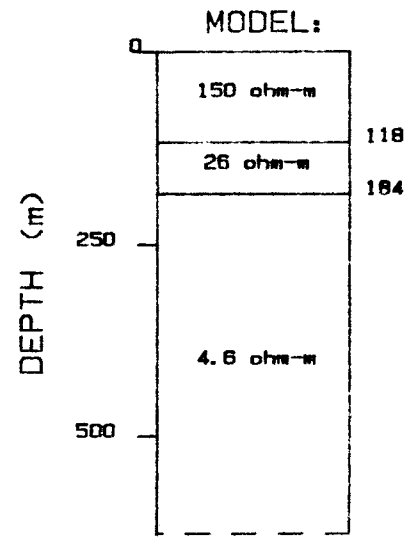
TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.12E+02	0.12E+02	+0.443	0.19E+03
0.11E-03	0.76E+01	0.75E+01	+1.127	0.18E+03
0.14E-03	0.46E+01	0.47E+01	-1.678	0.16E+03
0.18E-03	0.29E+01	0.29E+01	+0.112	0.15E+03
0.22E-03	0.19E+01	0.19E+01	-0.685	0.14E+03
0.28E-03	0.12E+01	0.12E+01	+0.215	0.13E+03
0.35E-03	0.74E+00	0.72E+00	+1.708	0.12E+03
0.44E-03	0.49E+00	0.48E+00	+2.297	0.11E+03
0.56E-03	0.31E+00	0.31E+00	-0.161	0.97E+02
0.71E-03	0.21E+00	0.21E+00	-2.484	0.85E+02
0.88E-03	0.15E+00	0.16E+00	-3.181	0.74E+02
0.11E-02	0.12E+00	0.12E+00	+0.034	0.61E+02
0.14E-02	0.80E-01	0.82E-01	-1.650	0.52E+02
0.18E-02	0.58E-01	0.59E-01	-1.677	0.43E+02
0.22E-02	0.43E-01	0.43E-01	-1.352	0.37E+02
0.29E-02	0.30E-01	0.31E-01	-1.582	0.31E+02
0.36E-02	0.23E-01	0.22E-01	+6.150	0.25E+02
0.45E-02	0.16E-01	0.15E-01	+5.474	0.22E+02
0.57E-02	0.11E-01	0.11E-01	+3.425	0.19E+02
0.72E-02	0.72E-02	0.70E-02	+1.975	0.17E+02
0.88E-02	0.51E-02	0.50E-02	+2.456	0.15E+02
0.11E-01	0.33E-02	0.34E-02	-2.151	0.14E+02
.07 0.14E-01	0.19E-02	0.21E-02	-7.592	0.13E+02

R: 168. X: 0. Y: 0. DL: 0. REQ: 168. CF: 1.0000
TDHZ ARRAY, 23 DATA POINTS, SYSTEM: NONE DATA: L5008090
JOB #685143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 5 STA 9 OCT. 10, 1985
RMS LOG ERROR: 1.25E-02, ANTILOG YIELDS 2.9302 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	1.00					
P 2	.00	.99				
P 3	.00	.00	1.00			
T 1	.00	.01	.00	1.00		
T 2	.00	-.01	.00	.00	1.00	
F 0	.00	.00	.00	.00	.00	.00





ERROR= 3.9241 %
LOOP RADIUS= 168m

o FIELD DATA

— MODEL CURVE

THE EARTH TECHNOLOGY CORP

UNOCAL Geothermal

Medicine Lake CA

LINE: 5 STA.: 10

APPARENT RESISTIVITY CURVE

JOB #G85143 Fig.

L500S100

MODEL: 3 LAYERS

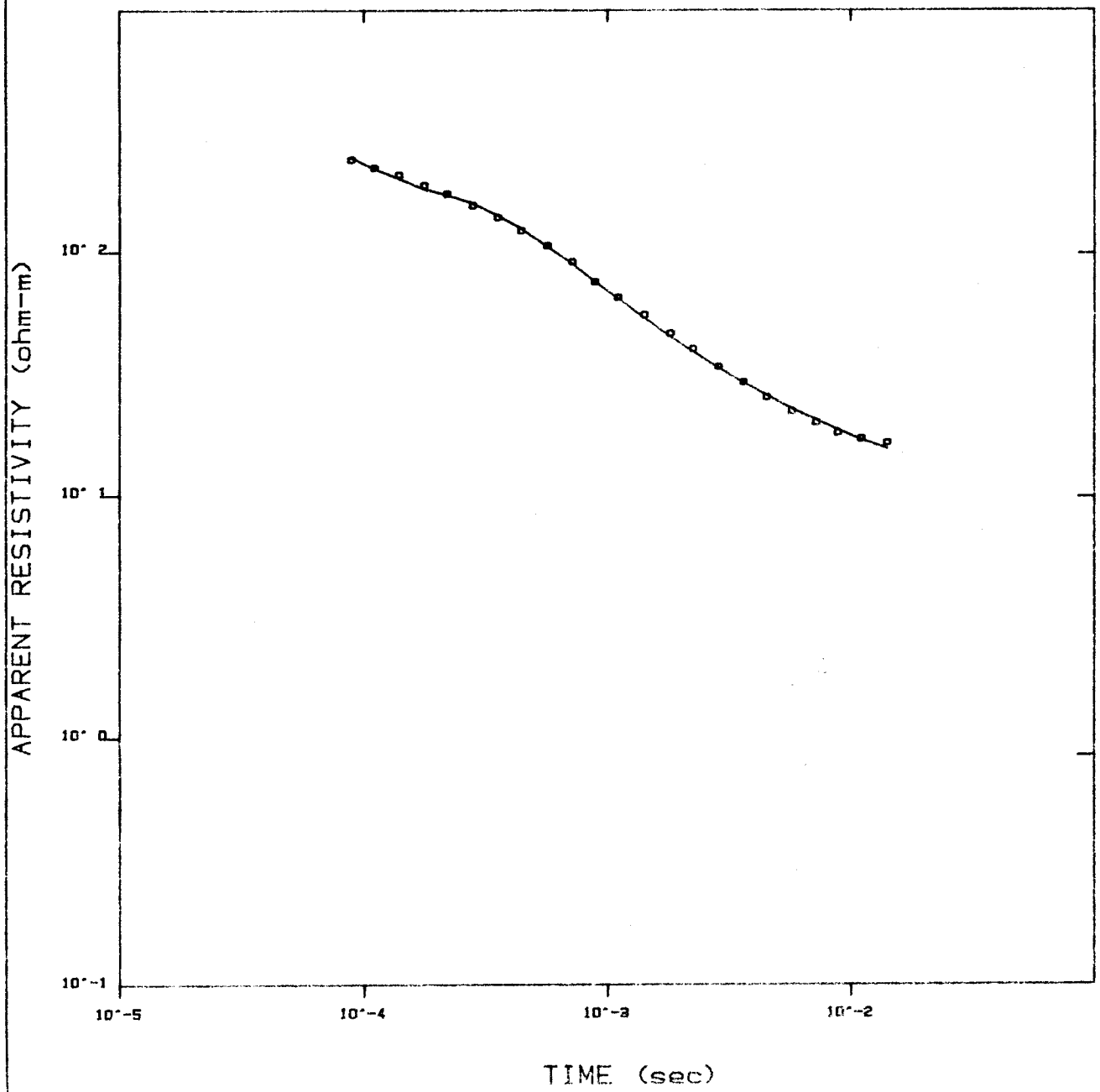
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		1993.4	6540.0		
148.60	118.4	1875.0	6151.6	.8	.8
26.36	66.0	1809.0	5935.2	2.5	3.3
4.57					

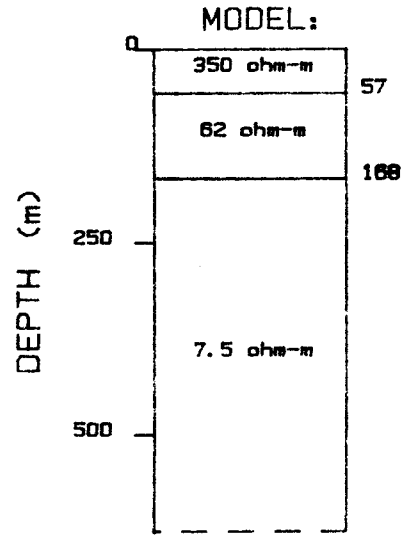
TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.86E+01	0.86E+01	+1.058	0.23E+03
0.11E-03	0.55E+01	0.54E+01	+1.700	0.22E+03
0.14E-03	0.33E+01	0.33E+01	-1.363	0.21E+03
0.18E-03	0.21E+01	0.21E+01	-1.484	0.19E+03
0.22E-03	0.14E+01	0.14E+01	-0.956	0.18E+03
0.28E-03	0.85E+00	0.83E+00	+2.219	0.16E+03
0.35E-03	0.55E+00	0.54E+00	+1.866	0.15E+03
0.44E-03	0.37E+00	0.36E+00	+1.293	0.13E+03
0.56E-03	0.24E+00	0.25E+00	-0.398	0.11E+03
0.71E-03	0.17E+00	0.17E+00	-3.137	0.98E+02
0.89E-03	0.13E+00	0.13E+00	+0.536	0.82E+02
0.11E-02	0.97E-01	0.98E-01	-1.529	0.69E+02
0.14E-02	0.69E-01	0.71E-01	-2.971	0.57E+02
0.18E-02	0.51E-01	0.52E-01	-2.581	0.47E+02
0.22E-02	0.38E-01	0.39E-01	-3.063	0.40E+02
0.29E-02	0.27E-01	0.28E-01	-2.855	0.33E+02
0.36E-02	0.22E-01	0.20E-01	+7.549	0.26E+02
0.45E-02	0.15E-01	0.15E-01	+6.430	0.23E+02
0.57E-02	0.11E-01	0.99E-02	+6.024	0.20E+02
0.72E-02	0.71E-02	0.69E-02	+3.181	0.17E+02
0.88E-02	0.50E-02	0.49E-02	+3.324	0.15E+02
0.11E-01	0.33E-02	0.33E-02	-1.876	0.14E+02
0.14E-01	0.19E-02	0.22E-02	-10.569	0.13E+02

R: 168. X: 0. Y: 0. DL: 0. REQ: 168. CF: 1.0000
TDHZ ARRAY, 23 DATA POINTS, SYSTEM: NONE DATA: L500S100
JOB #G85143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 5 STA 10 OCT. 18, 1985
RMS LOG ERROR: 1.67E-02, ANTILOG YIELDS 3.9241 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	1.00					
P 2	.00	.98				
P 3	.00	.00	1.00			
T 1	.00	.01	.00	1.00		
T 2	.00	-.01	.00	.00	1.00	
F 0	.00	.00	.00	.00	.00	.00





ERROR= 3.4248 %
LOOP RADIUS= 168m

o FIELD DATA

— MODEL CURVE

THE EARTH TECHNOLOGY CORP

UNOCAL Geothermal

Medicine Lake CA

LINE: 5 STA.: 11

APPARENT RESISTIVITY CURVE

JOB #G85143 Fig.

L5005110

MODEL: 3 LAYERS

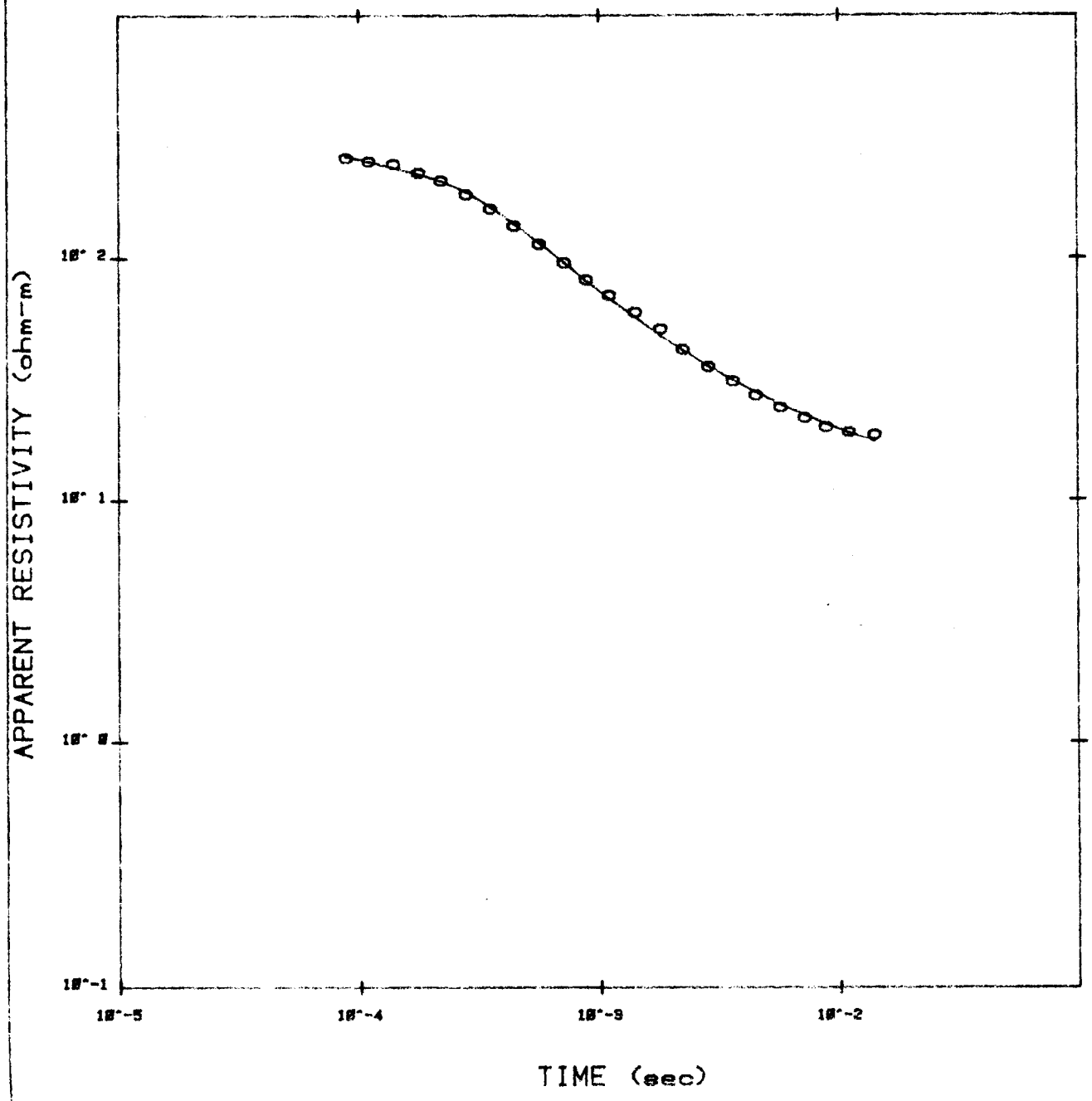
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		1962.9	6440.0		
353.25	57.2	1905.7	6252.4	.2	.2
61.79	110.8	1794.9	5888.9	1.8	2.0
7.49					

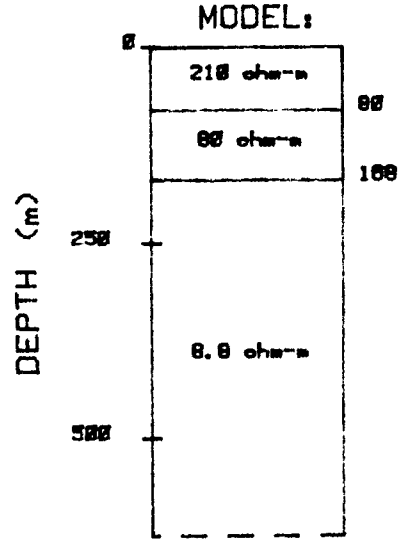
TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.82E+01	0.79E+01	+3.976	0.24E+03
0.11E-03	0.53E+01	0.53E+01	-0.507	0.22E+03
0.14E-03	0.33E+01	0.34E+01	-4.538	0.21E+03
0.18E-03	0.21E+01	0.22E+01	-3.779	0.19E+03
0.22E-03	0.14E+01	0.14E+01	-0.688	0.17E+03
0.28E-03	0.88E+00	0.85E+00	+3.743	0.16E+03
0.35E-03	0.58E+00	0.56E+00	+3.144	0.14E+03
0.44E-03	0.40E+00	0.39E+00	+3.968	0.12E+03
0.56E-03	0.27E+00	0.27E+00	+1.136	0.11E+03
0.71E-03	0.19E+00	0.19E+00	-2.178	0.91E+02
0.88E-03	0.15E+00	0.14E+00	+0.989	0.76E+02
0.11E-02	0.11E+00	0.11E+00	-1.414	0.65E+02
0.14E-02	0.73E-01	0.75E-01	-3.406	0.55E+02
0.18E-02	0.51E-01	0.53E-01	-3.858	0.46E+02
0.22E-02	0.38E-01	0.39E-01	-2.644	0.40E+02
0.29E-02	0.26E-01	0.27E-01	-0.731	0.34E+02
0.36E-02	0.18E-01	0.18E-01	+0.461	0.29E+02
0.45E-02	0.13E-01	0.13E-01	+3.336	0.25E+02
0.57E-02	0.87E-02	0.84E-02	+4.264	0.22E+02
0.72E-02	0.57E-02	0.55E-02	+4.231	0.20E+02
0.88E-02	0.39E-02	0.38E-02	+5.083	0.18E+02
0.11E-01	0.25E-02	0.25E-02	-1.130	0.17E+02
0.14E-01	0.14E-02	0.15E-02	-7.115	0.16E+02

R: 168. X: 0. Y: 0. DL: 0. REQ: 168. CF: 1.0000
TDHZ ARRAY, 23 DATA POINTS, SYSTEM: NONE DATA: L5005110
JOB #685143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 5 STA 11 OCT. 18, 1985
RMS LOG ERROR: 1.46E-02, ANTILOG YIELDS 3.4248 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	.99					
P 2	.00	1.00				
P 3	.00	.00	1.00			
T 1	.00	.00	.00	1.00		
T 2	.00	.00	.00	.00	1.00	
F 0	.00	.00	.00	.00	.00	.00





ERROR= 4.1200 %
LOOP RADIUS= 160m

FIELD DATA

MODEL CURVE

THE EARTH TECHNOLOGY CORP.

UNOCAL Geothermal

Medicine Lake CA

LINE: 5 STA.: 12

APPARENT RESISTIVITY CURVE

JOB #G85143 Fig.

L500S120

MODEL: 3 LAYERS

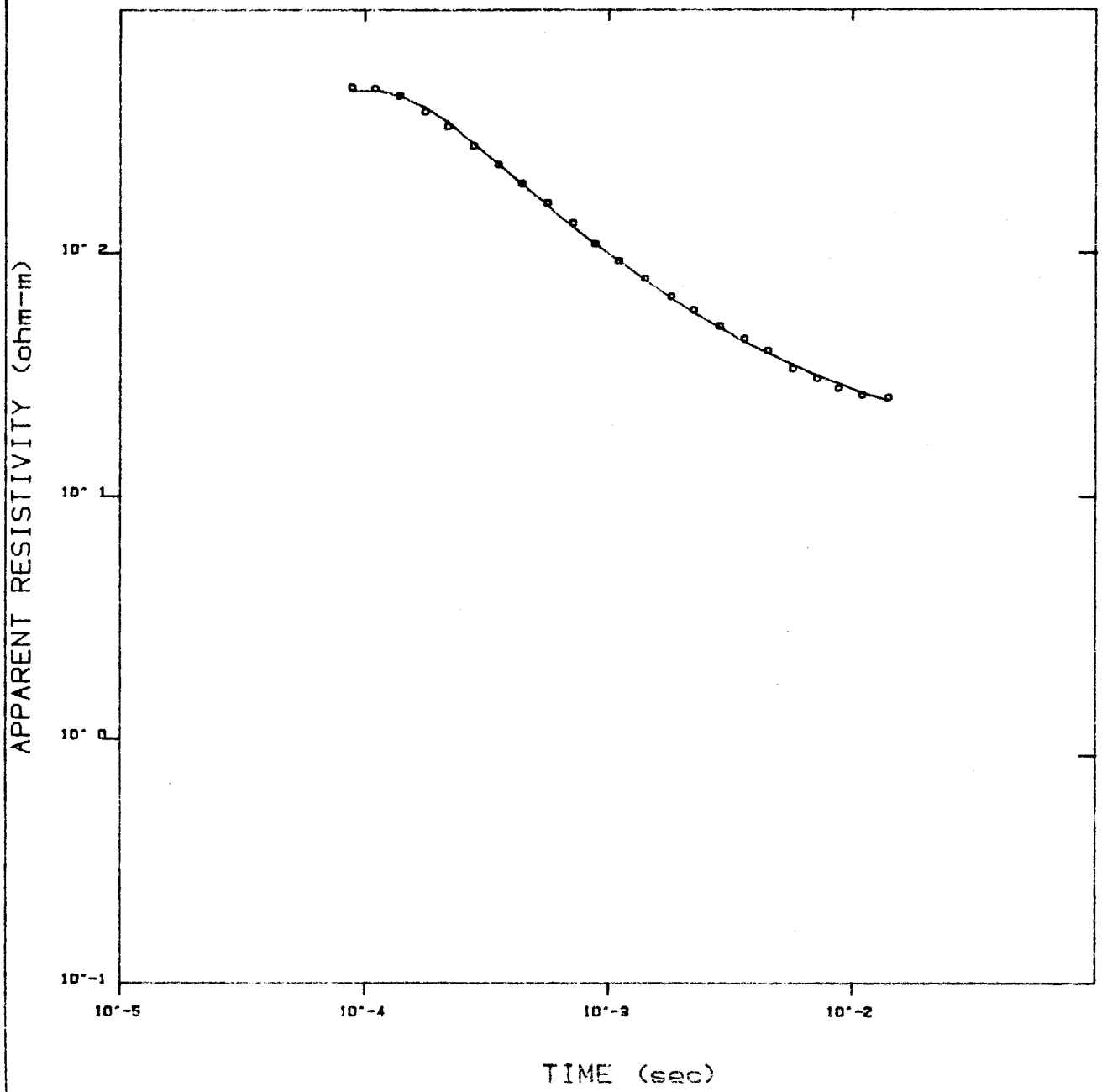
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		1981.2	6500.0		
209.00	80.4	1900.8	6236.3	.4	.4
80.22	87.1	1813.7	5950.5	1.1	1.5
8.85					

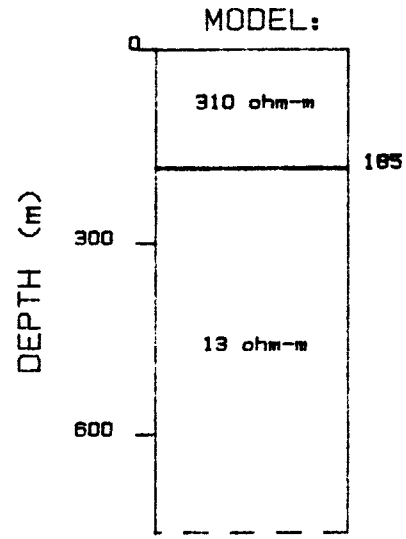
TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.72E+01	0.71E+01	+2.143	0.26E+03
0.11E-03	0.44E+01	0.44E+01	-0.196	0.25E+03
0.14E-03	0.26E+01	0.27E+01	-4.625	0.25E+03
0.18E-03	0.16E+01	0.16E+01	-2.053	0.23E+03
0.22E-03	0.10E+01	0.10E+01	+0.719	0.21E+03
0.28E-03	0.69E+00	0.67E+00	+3.747	0.18E+03
0.35E-03	0.48E+00	0.46E+00	+3.458	0.16E+03
0.44E-03	0.35E+00	0.33E+00	+3.470	0.14E+03
0.56E-03	0.24E+00	0.24E+00	+2.083	0.11E+03
0.71E-03	0.18E+00	0.17E+00	+0.143	0.96E+02
0.88E-03	0.13E+00	0.13E+00	-0.495	0.82E+02
0.11E-02	0.94E-01	0.98E-01	-4.090	0.70E+02
0.14E-02	0.64E-01	0.68E-01	-6.170	0.60E+02
0.18E-02	0.44E-01	0.48E-01	-8.755	0.51E+02
0.22E-02	0.35E-01	0.35E-01	-0.165	0.42E+02
0.29E-02	0.24E-01	0.24E-01	+0.932	0.36E+02
0.36E-02	0.16E-01	0.16E-01	+2.221	0.31E+02
0.45E-02	0.12E-01	0.11E-01	+4.667	0.27E+02
0.57E-02	0.76E-02	0.73E-02	+4.313	0.24E+02
0.72E-02	0.49E-02	0.47E-02	+4.862	0.22E+02
0.88E-02	0.34E-02	0.32E-02	+5.039	0.20E+02
0.11E-01	0.21E-02	0.21E-02	-1.112	0.19E+02
0.14E-01	0.12E-02	0.13E-02	-7.901	0.19E+02

R: 168. X: 0. Y: 0. DL: 0. REQ: 168. CF: 1.0000
TDHZ ARRAY, 23 DATA POINTS, SYSTEM: NONE DATA: L500S120
JOB #885143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 5 STA 12 OCT. 18, 1985
RMS LOG ERROR: 1.75E-02, ANTILOG YIELDS 4.1206 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	.92					
P 2	-.10	.66				
P 3	.00	-.01	.99			
T 1	.14	.31	.00	.68		
T 2	-.12	-.26	.00	.28	.76	
F 0	.00	.00	.00	.00	.00	.00





ERROR= 3.8919 %
LOOP RADIUS= 168m

o FIELD DATA

—— MODEL CURVE

THE EARTH TECHNOLOGY CORP

UNOCAL Geothermal

Medicine Lake CA

LINE: 5 STA.: 13

APPARENT RESISTIVITY CURVE

JOB #G85143 Fig.

L5009130

MODEL: 2 LAYERS

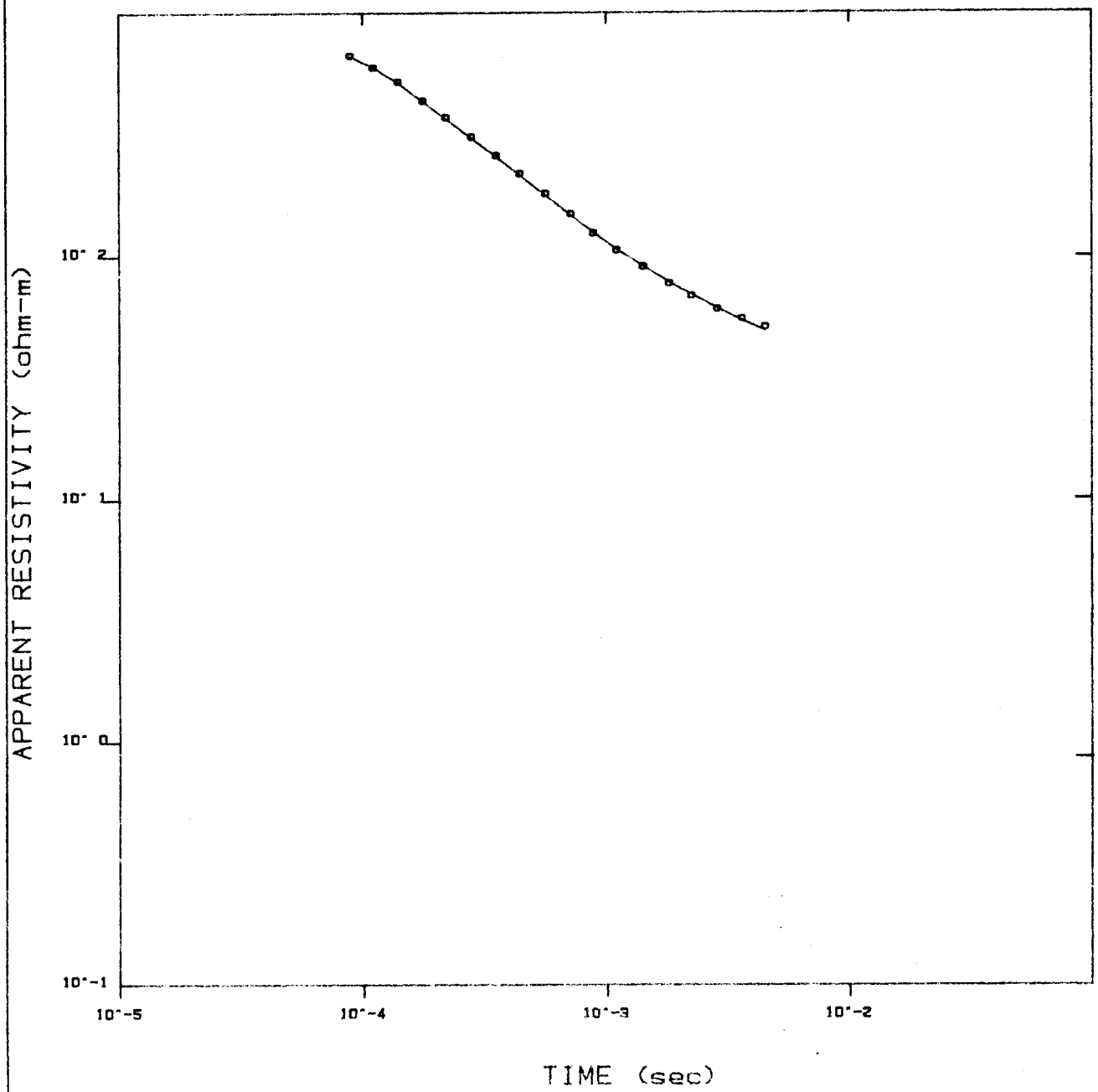
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		1993.4	6540.0		
313.29	184.7	1808.7	5934.1	.6	.6
12.84					

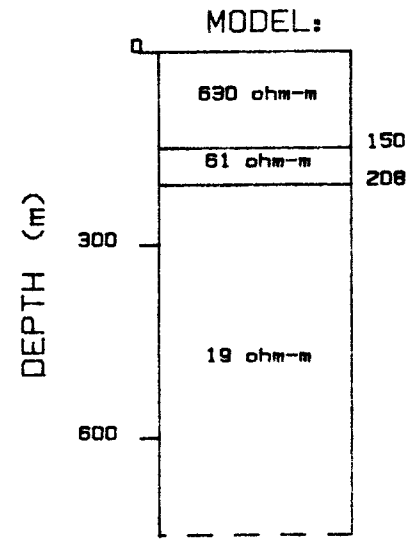
TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.29E+01	0.30E+01	-4.003	0.48E+03
0.11E-03	0.17E+01	0.17E+01	-1.123	0.47E+03
0.14E-03	0.11E+01	0.11E+01	+0.331	0.44E+03
0.18E-03	0.72E+00	0.68E+00	+6.189	0.38E+03
0.22E-03	0.52E+00	0.49E+00	+7.466	0.33E+03
0.28E-03	0.37E+00	0.36E+00	+3.593	0.28E+03
0.35E-03	0.27E+00	0.27E+00	+1.385	0.23E+03
0.44E-03	0.20E+00	0.20E+00	-0.605	0.19E+03
0.56E-03	0.15E+00	0.15E+00	-3.716	0.16E+03
0.71E-03	0.11E+00	0.11E+00	-4.950	0.13E+03
0.88E-03	0.85E-01	0.85E-01	+0.211	0.11E+03
0.11E-02	0.63E-01	0.64E-01	-1.676	0.92E+02
0.14E-02	0.43E-01	0.44E-01	-2.139	0.78E+02
0.18E-02	0.30E-01	0.31E-01	-2.343	0.66E+02
0.22E-02	0.22E-01	0.22E-01	-3.257	0.58E+02
0.29E-02	0.15E-01	0.15E-01	-1.864	0.50E+02
0.36E-02	0.98E-02	0.10E-01	-3.425	0.44E+02
0.45E-02	0.67E-02	0.69E-02	-2.928	0.39E+02
0.57E-02	0.48E-02	0.45E-02	+6.010	0.33E+02
0.72E-02	0.31E-02	0.29E-02	+4.509	0.30E+02
0.88E-02	0.21E-02	0.20E-02	+7.065	0.28E+02
0.11E-01	0.13E-02	0.13E-02	+3.174	0.26E+02
0.14E-01	0.74E-03	0.77E-03	-3.912	0.25E+02

R: 168. X: 0. Y: 0. DL: 0. RED: 168. CF: 1.0000
TDHZ ARRAY. 23 DATA POINTS. SYSTEM: NONE DATA: L5009130
JOB #695143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 5 STA 13 OCT. 17, 1985
RMS LOG ERROR: 1.66E-02. ANTILOG YIELDS 3.8919 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	T 1	F 0
P 1	1.00			
P 2	.00	1.00		
T 1	.00	.00	1.00	
F 0	.00	.00	.00	.00





ERROR= 2.1211 %
LOOP RADIUS= 168m

o FIELD DATA

—— MODEL CURVE

THE EARTH TECHNOLOGY CORP

UNOCAL Geothermal

Medicine Lake CA

LINE: 5 STA.: 14

APPARENT RESISTIVITY CURVE

JOB #G85143 Fig.

L500S140

MODEL: 3 LAYERS

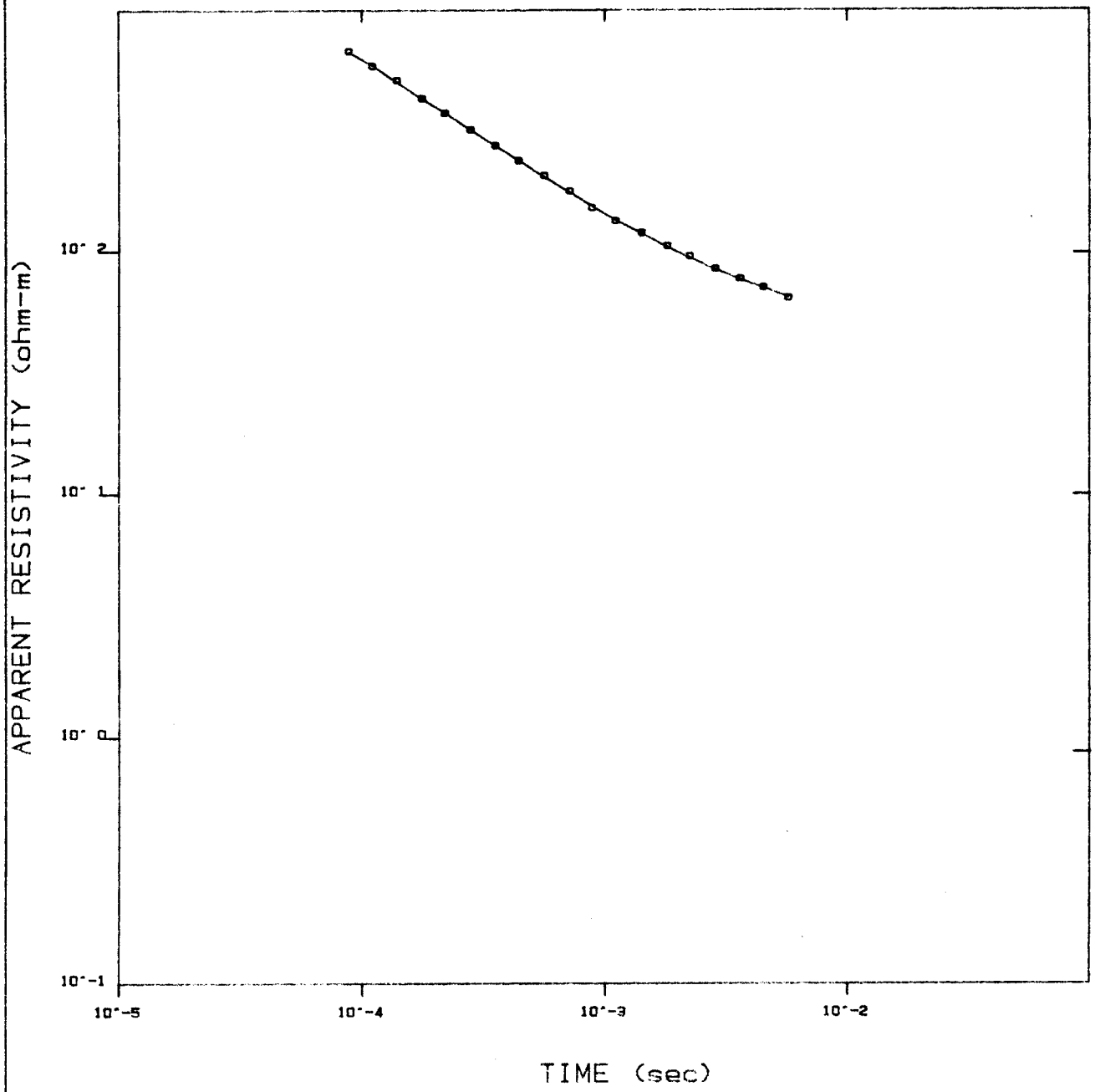
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		1999.5	6560.0		
632.47	150.2	1849.2	6067.1	.2	.2
60.60	56.1	1791.2	5876.5	1.0	1.2
18.64					

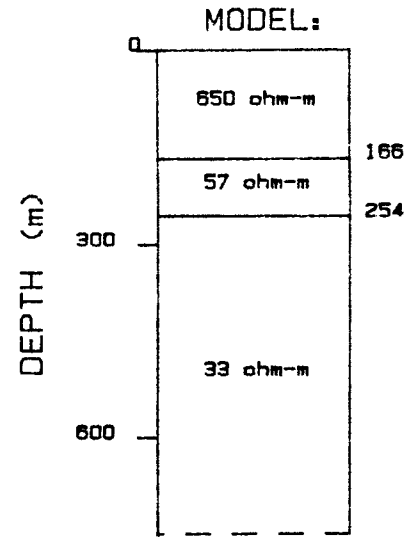
TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.18E+01	0.18E+01	-0.293	0.66E+03
0.11E-03	0.12E+01	0.12E+01	+0.329	0.59E+03
0.14E-03	0.84E+00	0.85E+00	-0.787	0.51E+03
0.18E-03	0.60E+00	0.60E+00	+1.203	0.43E+03
0.22E-03	0.45E+00	0.44E+00	+1.320	0.37E+03
0.28E-03	0.32E+00	0.32E+00	+0.273	0.31E+03
0.35E-03	0.23E+00	0.24E+00	-1.513	0.26E+03
0.44E-03	0.17E+00	0.18E+00	-2.066	0.22E+03
0.56E-03	0.12E+00	0.13E+00	-3.128	0.18E+03
0.71E-03	0.91E-01	0.93E-01	-1.799	0.15E+03
0.88E-03	0.70E-01	0.69E-01	+1.517	0.12E+03
0.11E-02	0.51E-01	0.50E-01	+2.078	0.11E+03
0.14E-02	0.35E-01	0.34E-01	+2.499	0.90E+02
0.18E-02	0.24E-01	0.24E-01	+2.740	0.77E+02
0.22E-02	0.17E-01	0.16E-01	+2.518	0.68E+02
0.29E-02	0.11E-01	0.11E-01	+1.889	0.60E+02
0.36E-02	0.71E-02	0.72E-02	-1.860	0.55E+02
0.45E-02	0.46E-02	0.48E-02	-4.590	0.51E+02

R: 168. X: 0. Y: 0. DL: 0. REQ: 168. CF: 1.0000
TDHZ ARRAY, 18 DATA POINTS, SYSTEM: NONE DATA: L500S140
JOB #685143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 5 STA 14 OCT. 17, 1985
RMS LOG ERROR: 9.12E-03, ANTILOG YIELDS 2.1211 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	.98					
P 2	-.06	.78				
P 3	.00	-.01	1.00			
T 1	.02	.05	.00	.99		
T 2	-.03	-.08	.00	.02	.96	
F 0	.00	.00	.00	.00	.00	.00





ERROR= 1.1824 %
LOOP RADIUS= 168m

o FIELD DATA

— MODEL CURVE

THE EARTH TECHNOLOGY CORP

UNOCAL Geothermal

Medicine Lake CA

LINE: 5 STA.: 15

APPARENT RESISTIVITY CURVE

JOB #G85143 Fig.

L500S150

MODEL: 3 LAYERS

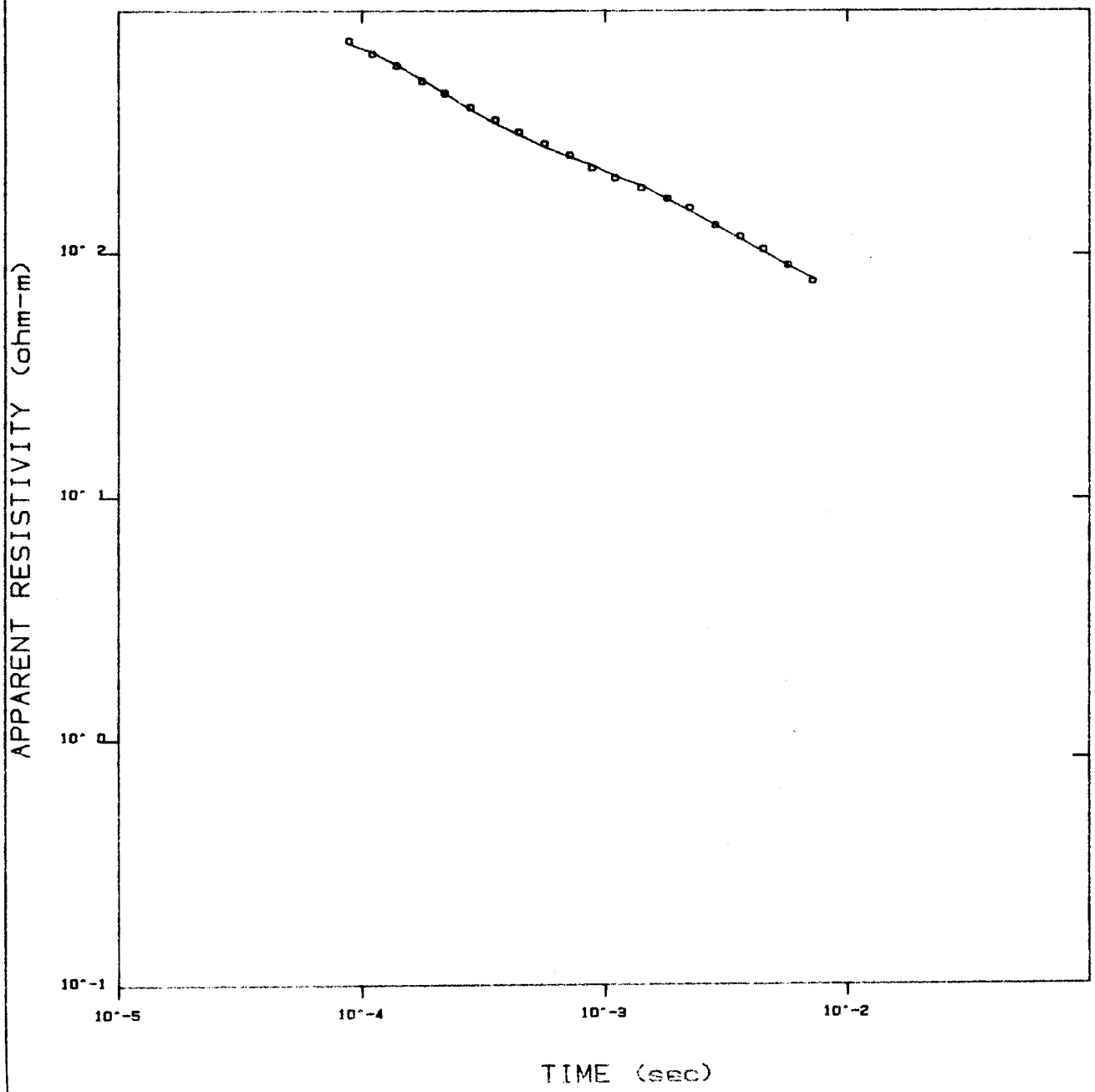
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		1987.3	6520.0		
654.00	166.0	1821.3	5975.2	.3	.3
57.32	88.3	1733.0	5685.5	1.5	1.8
32.54					

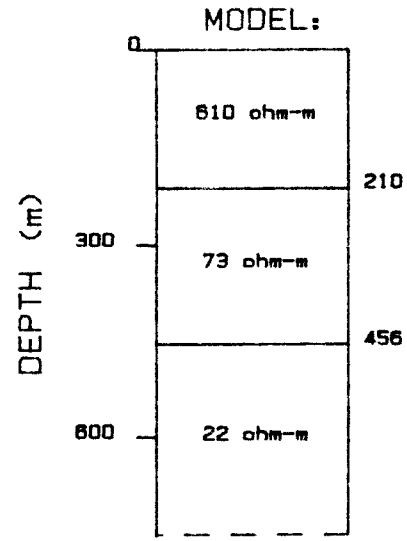
TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.17E+01	0.17E+01	+0.078	0.67E+03
0.11E-03	0.12E+01	0.12E+01	+1.071	0.59E+03
0.14E-03	0.85E+00	0.86E+00	-1.736	0.51E+03
0.18E-03	0.60E+00	0.60E+00	-0.009	0.43E+03
0.22E-03	0.43E+00	0.43E+00	+0.826	0.37E+03
0.28E-03	0.30E+00	0.30E+00	+0.399	0.32E+03
0.35E-03	0.21E+00	0.21E+00	-0.083	0.27E+03
0.44E-03	0.15E+00	0.15E+00	+0.393	0.24E+03
0.56E-03	0.10E+00	0.10E+00	-1.395	0.21E+03
0.71E-03	0.70E-01	0.71E-01	-1.426	0.18E+03
0.88E-03	0.52E-01	0.50E-01	+3.000	0.15E+03
0.11E-02	0.36E-01	0.35E-01	+1.496	0.13E+03
0.14E-02	0.23E-01	0.23E-01	-0.145	0.12E+03
0.18E-02	0.15E-01	0.15E-01	-1.142	0.11E+03
0.22E-02	0.10E-01	0.10E-01	-1.415	0.96E+02
0.29E-02	0.66E-02	0.66E-02	-0.302	0.85E+02
0.36E-02	0.42E-02	0.42E-02	-0.565	0.78E+02
0.45E-02	0.27E-02	0.27E-02	-0.011	0.71E+02
0.57E-02	0.18E-02	0.17E-02	+1.522	0.65E+02

R: 168. X: 0. Y: 0. DL: 0. REQ: 168. CF: 1.0000
TDHZ ARRAY, 19 DATA POINTS, SYSTEM: NONE DATA: L500S150
JOB #685143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 5 STA 15 OCT. 17, 1985
RMS LOG ERROR: 5.10E-03, ANTILOG YIELDS 1.1824 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	.99					
P 2	-.02	.98				
P 3	.00	.00	1.00			
T 1	.01	.01	.00	1.00		
T 2	.00	.00	.00	.00	1.00	
F 0	.00	.00	.00	.00	.00	.00





ERROR= 3.1659 %
LOOP RADIUS= 168m

o FIELD DATA

—— MODEL CURVE

THE EARTH TECHNOLOGY CORP

UNOCAL Geothermal

Medicine Lake CA

LINE: 5 STA.: 16

APPARENT RESISTIVITY CURVE

JOB #G85143 Fig.

L500S160

MODEL: 3 LAYERS

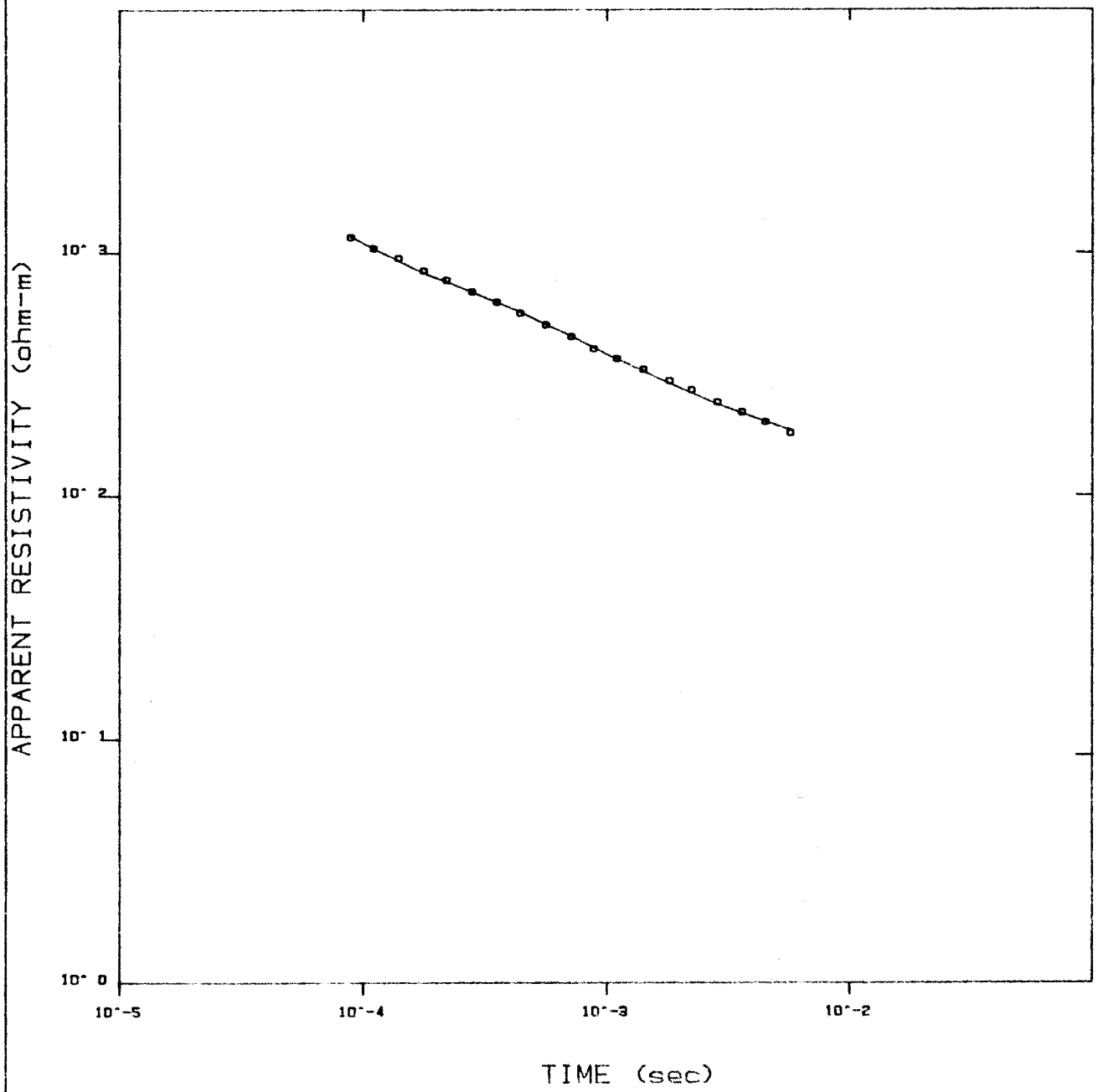
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		1999.5	6560.0		
609.34	209.6	1789.8	5872.2	.3	.3
72.57	246.7	1543.2	5062.9	3.4	3.7
21.69					

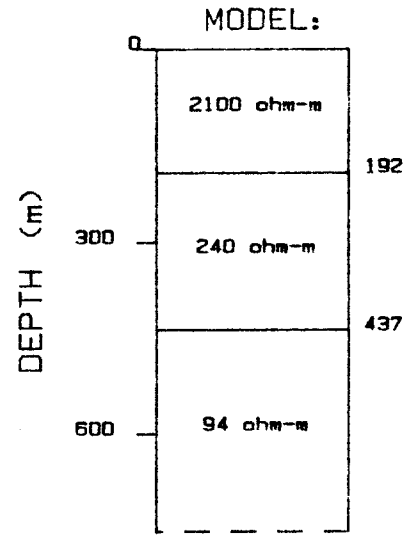
TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.15E+01	0.15E+01	-3.305	0.75E+03
0.11E-03	0.10E+01	0.10E+01	+2.808	0.66E+03
0.14E-03	0.68E+00	0.66E+00	+2.463	0.59E+03
0.18E-03	0.46E+00	0.45E+00	+3.463	0.51E+03
0.22E-03	0.32E+00	0.32E+00	+1.205	0.46E+03
0.28E-03	0.21E+00	0.22E+00	-1.722	0.40E+03
0.35E-03	0.14E+00	0.15E+00	-3.558	0.36E+03
0.44E-03	0.95E-01	0.99E-01	-3.280	0.32E+03
0.56E-03	0.61E-01	0.64E-01	-4.299	0.29E+03
0.71E-03	0.40E-01	0.41E-01	-1.615	0.26E+03
0.88E-03	0.28E-01	0.27E-01	+5.164	0.23E+03
0.11E-02	0.19E-01	0.18E-01	+3.952	0.21E+03
0.14E-02	0.12E-01	0.11E-01	+3.872	0.19E+03
0.18E-02	0.74E-02	0.74E-02	-0.293	0.17E+03
0.22E-02	0.50E-02	0.51E-02	-3.609	0.15E+03
0.29E-02	0.34E-02	0.34E-02	+0.957	0.13E+03
0.36E-02	0.23E-02	0.23E-02	-2.472	0.12E+03
0.45E-02	0.16E-02	0.16E-02	-2.769	0.10E+03
0.57E-02	0.11E-02	0.11E-02	-0.177	0.89E+02
0.72E-02	0.76E-03	0.72E-03	+4.987	0.76E+02

R: 168. X: 0. Y: 0. DL: 0. RED: 168. CF: 1.0000
TDHZ ARRAY, 20 DATA POINTS, SYSTEM: NONE DATA: L500S160
JOB #685143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE E STA 16 OCT. 17, 1985
RMS LOG ERROR: 1.35E-02, ANTILOG YIELDS 3.1659 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	1.00					
P 2	.00	1.00				
P 3	.00	.00	1.00			
T 1	.00	.00	.00	1.00		
T 2	.00	.00	.00	.00	1.00	
F 0	.00	.00	.00	.00	.00	.00





ERROR= 2.1765 %
LOOP RADIUS= 168m

o FIELD DATA

—— MODEL CURVE

THE EARTH TECHNOLOGY CORP

UNOCAL Geothermal

Medicine Lake CA

LINE: 5 STA.: 17

APPARENT RESISTIVITY CURVE

JOB #G85143 Fig.

L500S170

MODEL: 3 LAYERS

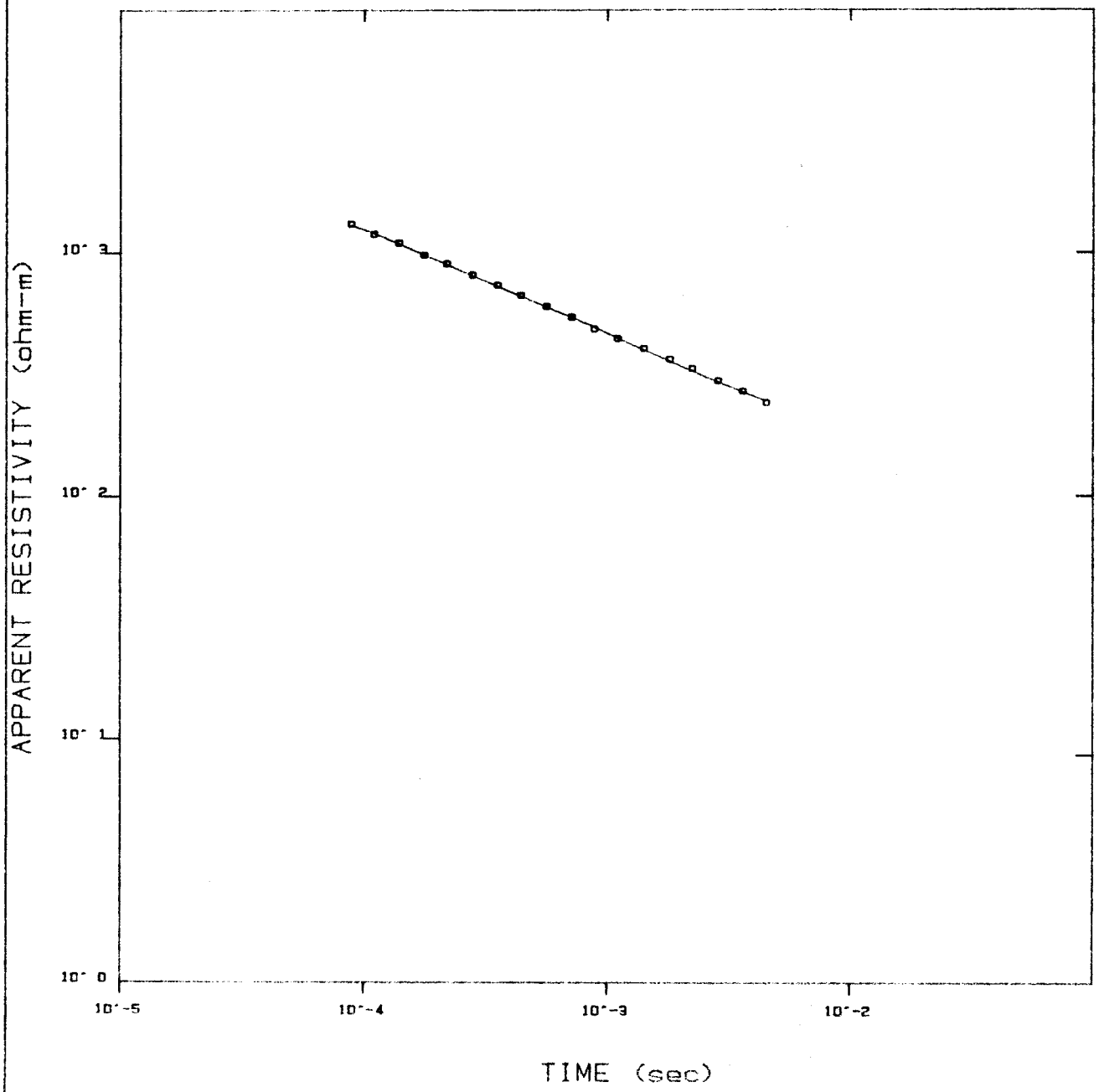
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		2017.8	6620.0		
2073.46	191.7	1826.1	5991.2	.1	.1
238.88	244.8	1581.3	5188.1	1.0	1.1
93.64					

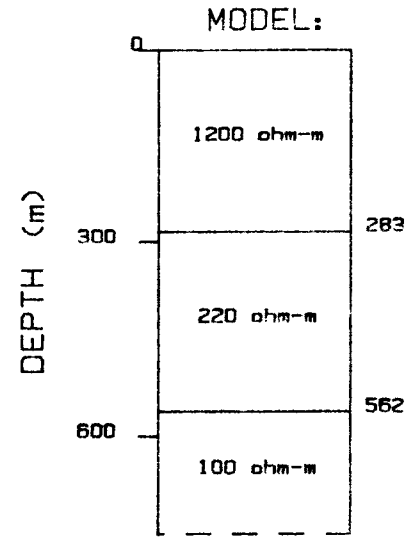
TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.77E+00	0.75E+00	+2.472	0.12E+04
0.11E-03	0.53E+00	0.52E+00	+0.731	0.10E+04
0.14E-03	0.34E+00	0.35E+00	-2.700	0.95E+03
0.18E-03	0.22E+00	0.23E+00	-2.463	0.84E+03
0.22E-03	0.15E+00	0.15E+00	-0.898	0.77E+03
0.28E-03	0.96E-01	0.95E-01	+0.222	0.68E+03
0.35E-03	0.62E-01	0.62E-01	+0.460	0.62E+03
0.44E-03	0.41E-01	0.40E-01	+2.433	0.56E+03
0.56E-03	0.27E-01	0.26E-01	+1.466	0.50E+03
0.71E-03	0.17E-01	0.17E-01	+1.120	0.45E+03
0.88E-03	0.12E-01	0.12E-01	+2.636	0.40E+03
0.11E-02	0.81E-02	0.81E-02	+0.058	0.36E+03
0.14E-02	0.51E-02	0.51E-02	-1.542	0.33E+03
0.18E-02	0.32E-02	0.33E-02	-3.012	0.29E+03
0.22E-02	0.22E-02	0.22E-02	-3.407	0.27E+03
0.29E-02	0.14E-02	0.14E-02	-1.862	0.24E+03
0.36E-02	0.89E-03	0.89E-03	-1.023	0.22E+03
0.45E-02	0.58E-03	0.58E-03	+1.461	0.20E+03
0.57E-02	0.38E-03	0.36E-03	+4.623	0.18E+03

R: 168. X: 0. Y: 0. DL: 0. REQ: 168. CF: 1.0000
TDHZ ARRAY, 19 DATA POINTS, SYSTEM: NONE DATA: L500S170
JOB #G85143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 5 STA 17 OCT. 17, 1985
RMS LOG ERROR: 9.35E-03, ANTILOG YIELDS 2.1765 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	.98					
P 2	.00	1.00				
P 3	.00	.00	1.00			
T 1	.00	.00	.00	1.00		
T 2	.00	.00	.00	.00	1.00	
F 0	.00	.00	.00	.00	.00	.00





ERROR= 1.7809 %
LOOP RADIUS= 168m

o FIELD DATA

—— MODEL CURVE

THE EARTH TECHNOLOGY CORP.

UNOCAL Geothermal

Medicine Lake CA

LINE: 5 STA.: 18

APPARENT RESISTIVITY CURVE

JOB #G85143 Fig.

L5005180

MODEL: 3 LAYERS

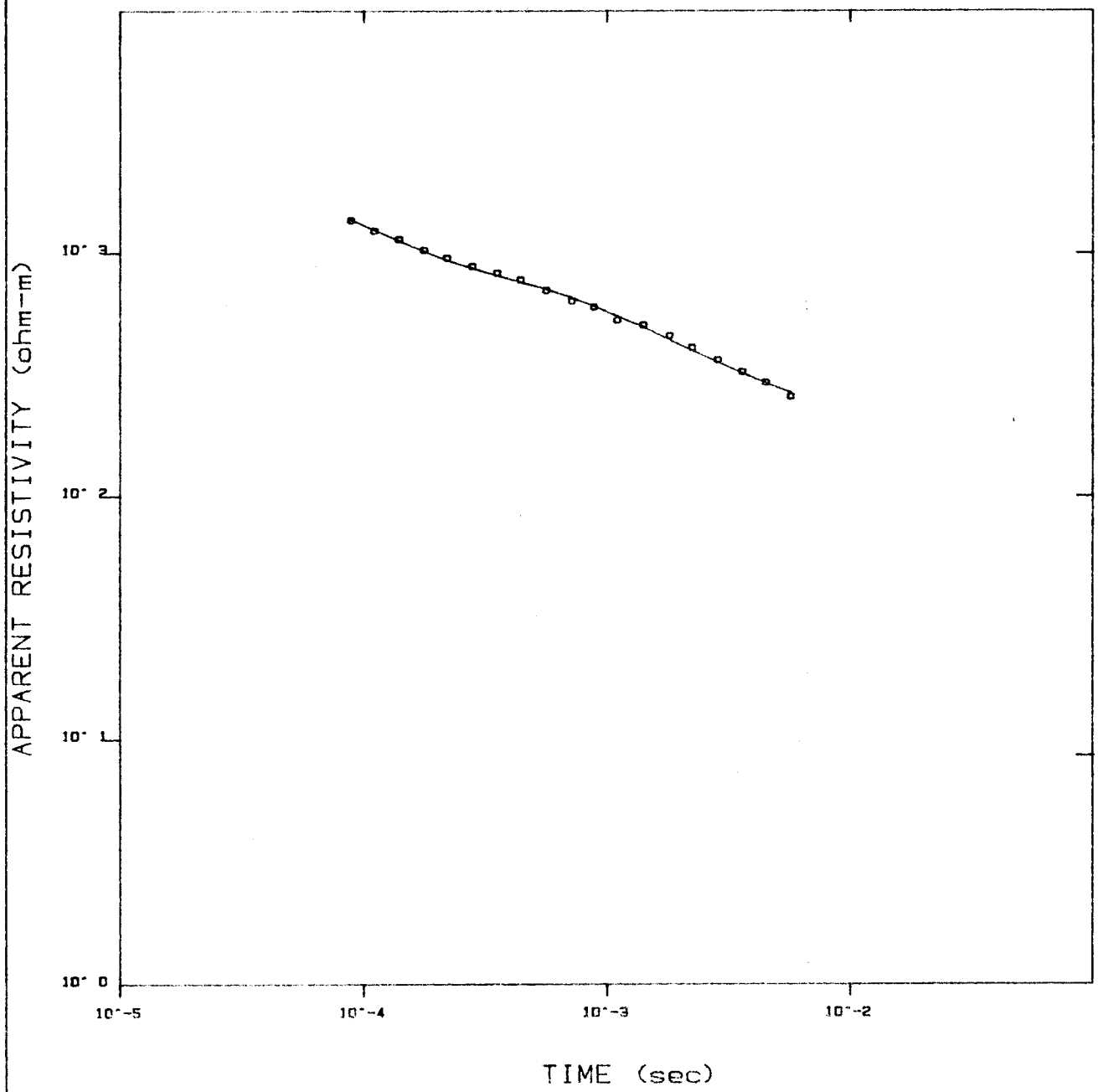
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		2033.0	6670.0		
1199.78	283.0	1750.0	5741.5	.2	.2
216.47	279.2	1470.9	4825.6	1.3	1.5
104.85					

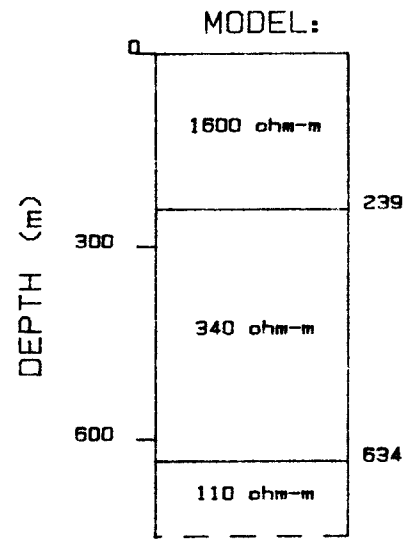
TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.64E+00	0.65E+00	-0.820	0.13E+04
0.11E-03	0.43E+00	0.42E+00	+2.221	0.12E+04
0.14E-03	0.27E+00	0.27E+00	-0.319	0.11E+04
0.18E-03	0.18E+00	0.17E+00	+1.065	0.97E+03
0.22E-03	0.12E+00	0.12E+00	-1.066	0.90E+03
0.28E-03	0.75E-01	0.76E-01	-1.429	0.81E+03
0.35E-03	0.48E-01	0.49E-01	-1.165	0.73E+03
0.44E-03	0.32E-01	0.32E-01	-0.015	0.67E+03
0.56E-03	0.20E-01	0.20E-01	-0.496	0.60E+03
0.71E-03	0.13E-01	0.13E-01	+1.729	0.54E+03
0.88E-03	0.91E-02	0.88E-02	+3.562	0.48E+03
0.11E-02	0.60E-02	0.59E-02	+0.975	0.44E+03
0.14E-02	0.37E-02	0.37E-02	-0.264	0.40E+03
0.18E-02	0.23E-02	0.24E-02	-2.556	0.36E+03
0.22E-02	0.16E-02	0.16E-02	-2.914	0.33E+03
0.29E-02	0.10E-02	0.10E-02	-1.037	0.30E+03
0.36E-02	0.65E-03	0.65E-03	-0.342	0.27E+03
0.45E-02	0.44E-03	0.43E-03	+3.474	0.24E+03

R: 168. X: 0. Y: 0. DL: 0. REQ: 168. CF: 1.0000
TDHZ ARRAY, 18 DATA POINTS, SYSTEM: NONE DATA: L5005180
JOB #685143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 5 STA 18 OCT. 17, 1985
RMS LOG ERROR: 7.67E-03, ANTILOG YIELDS 1.7809 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	1.00					
P 2	.00	1.00				
P 3	.00	.00	1.00			
T 1	.00	.00	.00	1.00		
T 2	.00	.00	.00	.00	1.00	
F 0	.00	.00	.00	.00	.00	.00





ERROR= 3.4615 %
LOOP RADIUS= 168m

o FIELD DATA

—— MODEL CURVE

THE EARTH TECHNOLOGY CORP.

UNOCAL Geothermal

Medicine Lake CA

LINE: 5 STA.: 19

APPARENT RESISTIVITY CURVE

JOB #G85143 Fig.

L5005190

MODEL: 3 LAYERS

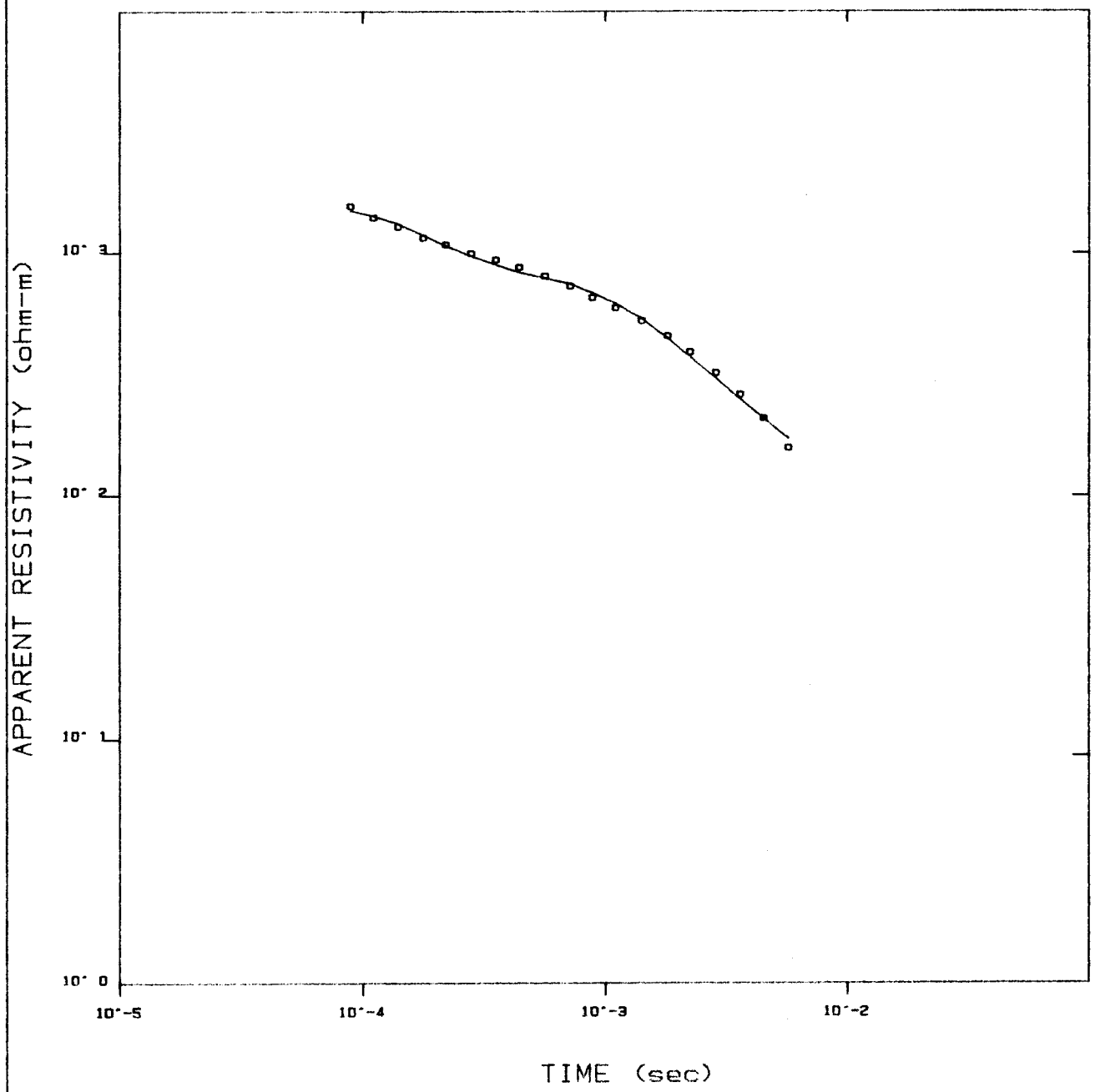
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		2042.2	6700.0		
1592.10	239.4	1802.8	5914.6	.2	.2
336.90	394.1	1408.6	4621.5	1.2	1.3
108.52					

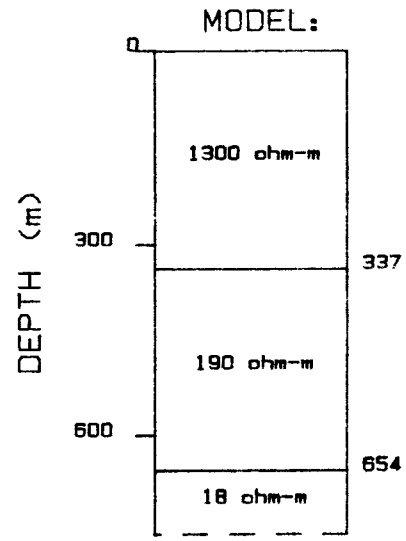
TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.60E+00	0.59E+00	+2.363	0.14E+04
0.11E-03	0.41E+00	0.40E+00	+1.763	0.12E+04
0.14E-03	0.26E+00	0.26E+00	-1.288	0.11E+04
0.18E-03	0.16E+00	0.17E+00	-1.384	0.10E+04
0.22E-03	0.11E+00	0.11E+00	-3.072	0.95E+03
0.28E-03	0.66E-01	0.67E-01	-1.886	0.88E+03
0.35E-03	0.40E-01	0.41E-01	-3.102	0.83E+03
0.44E-03	0.25E-01	0.26E-01	-3.162	0.77E+03
0.56E-03	0.16E-01	0.16E-01	+2.569	0.70E+03
0.71E-03	0.10E-01	0.98E-02	+5.105	0.63E+03
0.88E-03	0.66E-02	0.65E-02	+1.977	0.60E+03
0.11E-02	0.46E-02	0.43E-02	+6.723	0.53E+03
0.14E-02	0.26E-02	0.27E-02	-2.258	0.51E+03
0.18E-02	0.17E-02	0.18E-02	-5.192	0.46E+03
0.22E-02	0.12E-02	0.12E-02	-3.504	0.41E+03
0.29E-02	0.74E-03	0.76E-03	-3.020	0.36E+03
0.36E-02	0.49E-03	0.50E-03	-1.492	0.33E+03
0.45E-02	0.33E-03	0.33E-03	-0.081	0.29E+03
0.57E-02	0.22E-03	0.21E-03	+6.432	0.26E+03

R: 168. X: 0. Y: 0. DL: 0. REG: 168. CF: 1.0000
TDHZ ARRAY, 19 DATA POINTS, SYSTEM: NONE DATA: L5005190
JOB #685143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 5 STA 19 OCT. 17, 1985
RMS LOG ERROR: 1.48E-02, ANTILOG YIELDS 3.4615 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	.99					
P 2	.00	1.00				
P 3	.00	.00	1.00			
T 1	.01	.00	.00	1.00		
T 2	.00	.00	.00	.00	1.00	
F 0	.00	.00	.00	.00	.00	.00





ERROR= 5.8970 %
LOOP RADIUS= 168m

o FIELD DATA

—— MODEL CURVE

THE EARTH TECHNOLOGY CORP

UNOCAL Geothermal

Medicine Lake CA

LINE: 5 STA.: 20

APPARENT RESISTIVITY CURVE

JOB #G85143 Fig.

L500S200

MODEL: 3 LAYERS

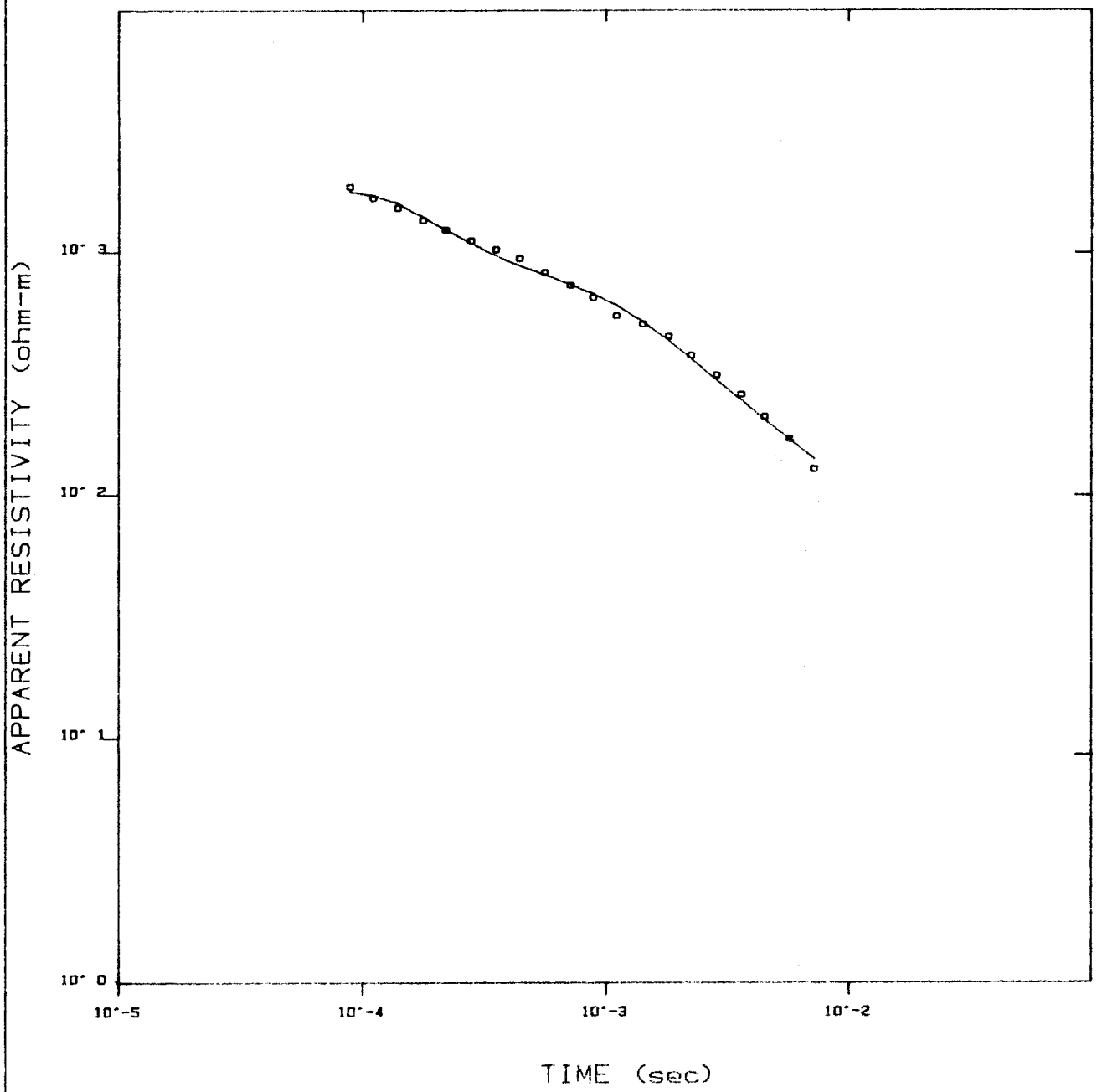
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		2065.0	6775.0		
1322.08	336.7	1728.4	5670.5	.3	.3
192.77	317.4	1411.0	4629.1	1.6	1.9
18.22					

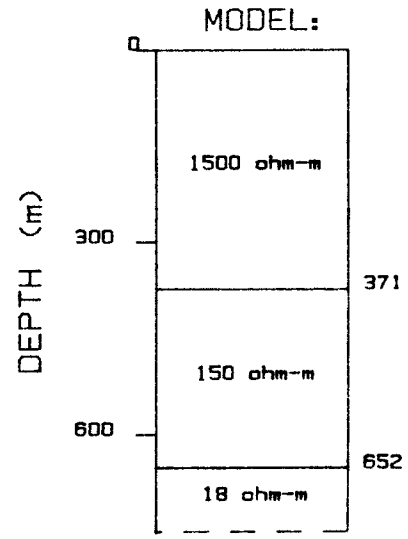
TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.86E-04	0.49E+00	0.52E+00	-4.694	0.16E+04
0.11E-03	0.34E+00	0.33E+00	+3.234	0.14E+04
0.14E-03	0.21E+00	0.20E+00	+5.233	0.13E+04
0.18E-03	0.14E+00	0.13E+00	+4.816	0.12E+04
0.22E-03	0.89E-01	0.90E-01	-0.861	0.11E+04
0.28E-03	0.55E-01	0.57E-01	-3.462	0.99E+03
0.35E-03	0.34E-01	0.36E-01	-6.026	0.93E+03
0.44E-03	0.22E-01	0.23E-01	-6.442	0.86E+03
0.56E-03	0.13E-01	0.14E-01	-2.756	0.79E+03
0.71E-03	0.85E-02	0.82E-02	+3.953	0.72E+03
0.88E-03	0.59E-02	0.55E-02	+7.442	0.65E+03
0.11E-02	0.39E-02	0.37E-02	+7.086	0.59E+03
0.14E-02	0.25E-02	0.24E-02	+3.645	0.52E+03
0.18E-02	0.17E-02	0.18E-02	-2.425	0.45E+03
0.22E-02	0.13E-02	0.13E-02	-6.029	0.39E+03
0.29E-02	0.91E-03	0.97E-03	-6.589	0.32E+03
0.36E-02	0.68E-03	0.73E-03	-5.895	0.26E+03
0.45E-02	0.55E-03	0.55E-03	-0.158	0.21E+03
0.57E-02	0.46E-03	0.40E-03	+14.531	0.16E+03

R: 168. X: 0. Y: 0. DL: 0. REC: 168. CF: 1.0000
TDH2 ARRAY, 19 DATA POINTS, SYSTEM: NONE DATA: L500S200
JOB #GS5143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 5 STA 20 OCT. 17, 1985
RMS LOG ERROR: 2.49E-02, ANTILOG YIELDS 5.8970 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	1.00					
P 2	.00	1.00				
P 3	.00	.00	.99			
T 1	.00	.00	.00	1.00		
T 2	.00	.00	.00	.00	1.00	
F 0	.00	.00	.00	.00	.00	.00





ERROR= 7.2801 %
LOOP RADIUS= 168m

o FIELD DATA

—— MODEL CURVE

THE EARTH TECHNOLOGY CORP

UNOCAL Geothermal

Medicine Lake CA

LINE: 5 STA.: 21

APPARENT RESISTIVITY CURVE

JOB #G85143 Fig.

L5005210

MODEL: 3 LAYERS

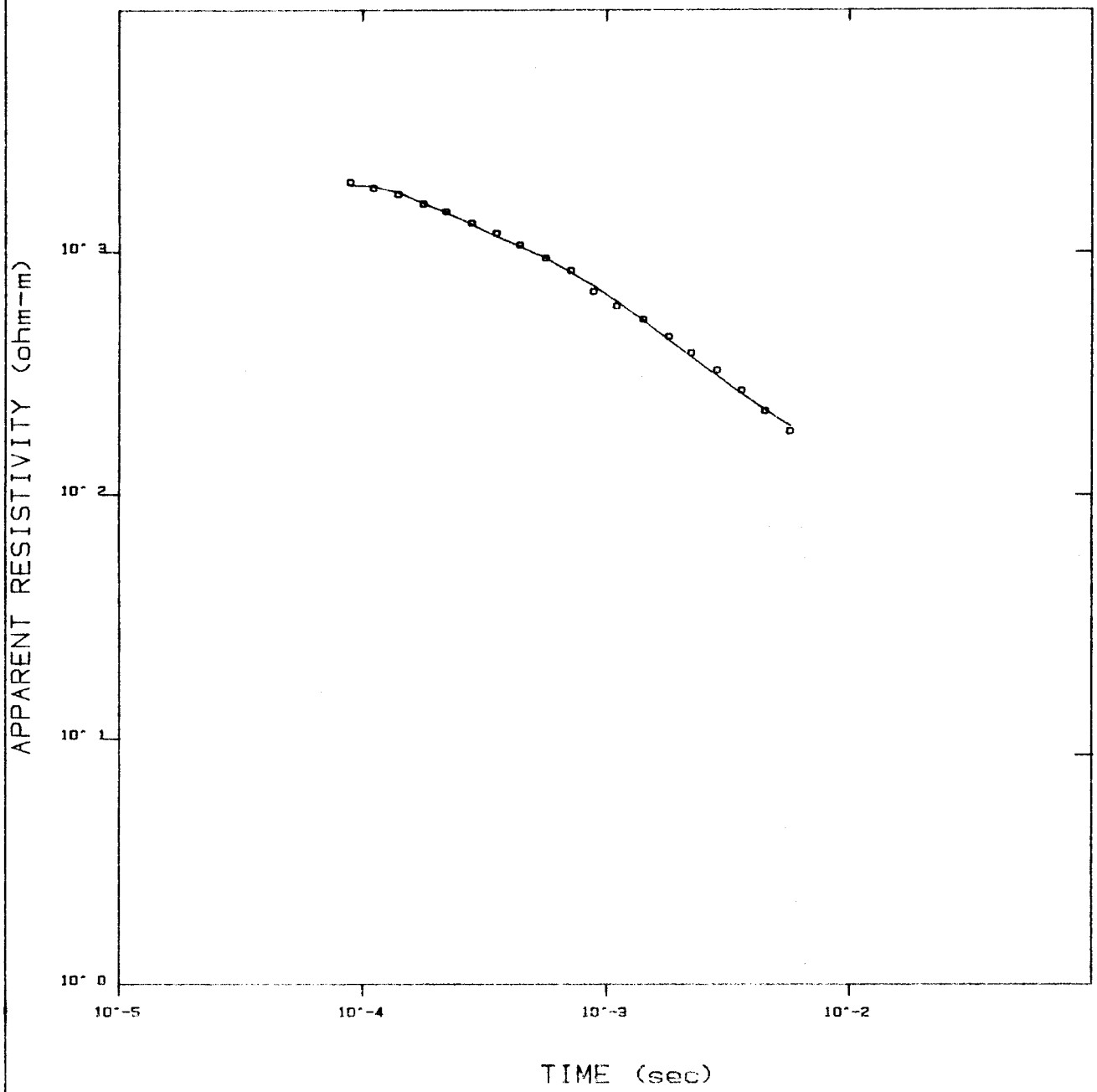
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		2049.3	6720.0		
1501.50	371.3	1676.9	5501.8	.2	.2
145.08	280.6	1396.4	4581.3	1.9	2.2
17.80					

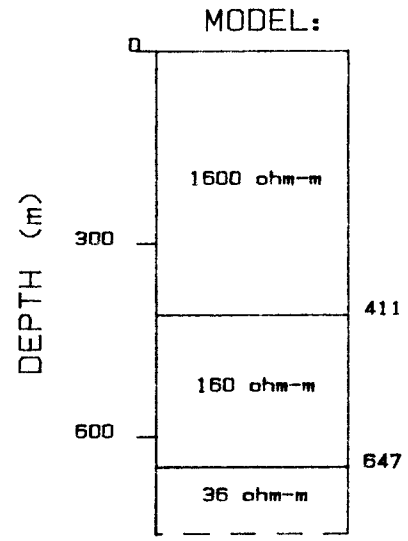
TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.38E+00	0.41E+00	-5.623	0.18E+04
0.11E-03	0.26E+00	0.25E+00	+3.670	0.17E+04
0.14E-03	0.17E+00	0.16E+00	+7.006	0.15E+04
0.18E-03	0.11E+00	0.10E+00	+4.764	0.13E+04
0.22E-03	0.73E-01	0.72E-01	+0.894	0.12E+04
0.28E-03	0.46E-01	0.48E-01	-2.764	0.11E+04
0.35E-03	0.29E-01	0.32E-01	-7.943	0.10E+04
0.44E-03	0.19E-01	0.21E-01	-9.536	0.94E+03
0.56E-03	0.13E-01	0.13E-01	-1.906	0.82E+03
0.71E-03	0.84E-02	0.82E-02	+1.782	0.73E+03
0.88E-03	0.59E-02	0.55E-02	+6.215	0.65E+03
0.11E-02	0.44E-02	0.37E-02	+17.033	0.54E+03
0.14E-02	0.27E-02	0.26E-02	+4.216	0.50E+03
0.18E-02	0.17E-02	0.18E-02	-5.299	0.45E+03
0.22E-02	0.13E-02	0.14E-02	-3.729	0.37E+03
0.29E-02	0.94E-03	0.10E-02	-6.267	0.31E+03
0.36E-02	0.70E-03	0.75E-03	-7.482	0.26E+03
0.45E-02	0.55E-03	0.57E-03	-3.271	0.21E+03
0.57E-02	0.41E-03	0.41E-03	-0.132	0.17E+03
0.72E-02	0.35E-03	0.30E-03	+16.412	0.13E+03

R: 168. X: 0. Y: 0. DL: 0. REC: 168. CF: 1.0000
TDHZ ARRAY, 20 DATA POINTS, SYSTEM: NONE DATA: L5005210
JOB #685143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 5 STA 21 OCT. 17, 1985
RMS LOG ERROR: 3.05E-02, ANTILOG YIELDS 7.2601 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	1.00					
P 2	.00	1.00				
P 3	.00	.00	1.00			
T 1	.00	.00	.00	1.00		
T 2	.00	.00	.00	.00	1.00	
F 0	.00	.00	.00	.00	.00	.00





ERROR= 4.4482 %
LOOP RADIUS= 168m

o FIELD DATA

—— MODEL CURVE

THE EARTH TECHNOLOGY CORP

UNOCAL Geothermal

Medicine Lake CA

LINE: 5 STA.: 22

APPARENT RESISTIVITY CURVE

JOB #G85143 Fig.

L5005220

MODEL: 3 LAYERS

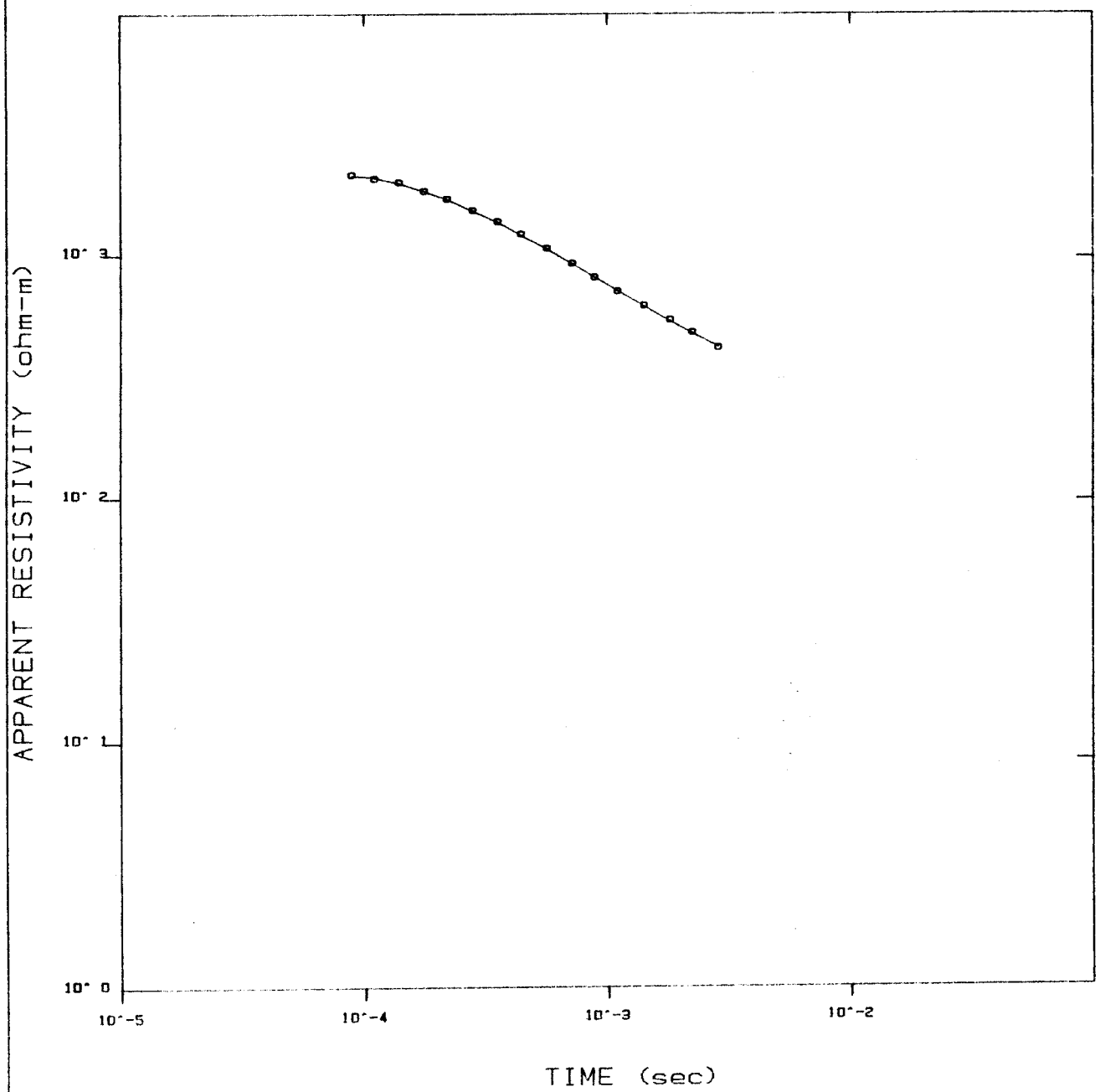
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		2051.3	6730.0		
1601.24	410.6	1640.7	5383.0	.3	.3
162.75	236.7	1404.0	4606.4	1.5	1.7
36.36					

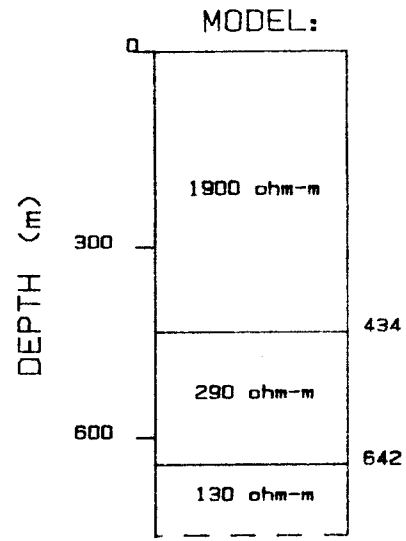
TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.36E+00	0.37E+00	-3.102	0.19E+04
0.11E-03	0.23E+00	0.22E+00	+2.745	0.18E+04
0.14E-03	0.14E+00	0.13E+00	+2.712	0.17E+04
0.18E-03	0.86E-01	0.85E-01	+1.520	0.16E+04
0.22E-03	0.57E-01	0.57E-01	-0.344	0.15E+04
0.28E-03	0.36E-01	0.37E-01	-1.636	0.13E+04
0.35E-03	0.23E-01	0.24E-01	-3.531	0.12E+04
0.44E-03	0.16E-01	0.16E-01	-1.774	0.11E+04
0.56E-03	0.10E-01	0.10E-01	+0.536	0.94E+03
0.71E-03	0.69E-02	0.70E-02	-2.005	0.83E+03
0.88E-03	0.54E-02	0.50E-02	+9.721	0.68E+03
0.11E-02	0.38E-02	0.36E-02	+7.218	0.59E+03
0.14E-02	0.25E-02	0.25E-02	-0.538	0.52E+03
0.18E-02	0.17E-02	0.18E-02	-3.632	0.45E+03
0.22E-02	0.13E-02	0.13E-02	-4.777	0.38E+03
0.29E-02	0.88E-03	0.94E-03	-6.891	0.32E+03
0.36E-02	0.65E-03	0.68E-03	-4.050	0.27E+03
0.45E-02	0.50E-03	0.49E-03	+2.820	0.22E+03
0.57E-02	0.37E-03	0.34E-03	+8.154	0.18E+03

R: 168. X: 0. Y: 0. DL: 0. REQ: 168. CF: 1.0000
TDHZ ARRAY, 19 DATA POINTS, SYSTEM: NONE DATA: L5005220
JOB #G85143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 5 STA 23 OCT. 17, 1985
RMS LOG ERROR: 1.89E-02, ANTILOG YIELDS 4.4482 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	1.00					
P 2	.00	1.00				
P 3	.00	.00	1.00			
T 1	.00	.00	.00	1.00		
T 2	.00	.00	.00	.00	1.00	
F 0	.00	.00	.00	.00	.00	.00





ERROR= .8588 %
LOOP RADIUS= 168m

o FIELD DATA

— MODEL CURVE

THE EARTH TECHNOLOGY CORP

UNOCAL Geothermal

Medicine Lake CA

LINE: 5 STA.: 23

APPARENT RESISTIVITY CURVE

JOB #G85143 Fig.

L400S230

MODEL: 3 LAYERS

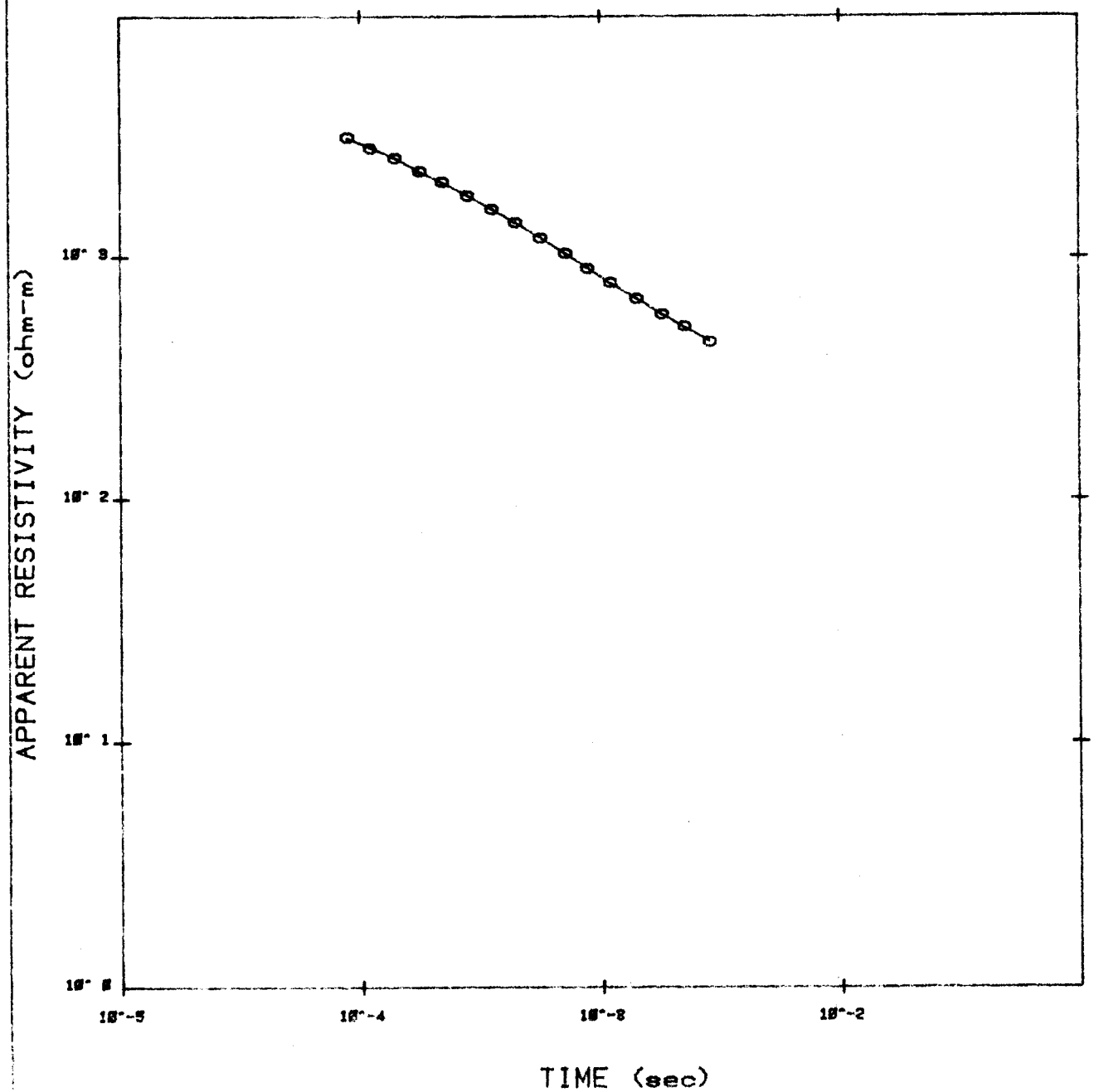
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		2060.4	6760.0		
1927.85	434.0	1626.4	5336.0	.2	.2
292.26	208.1	1418.3	4653.3	.7	.9
128.31					

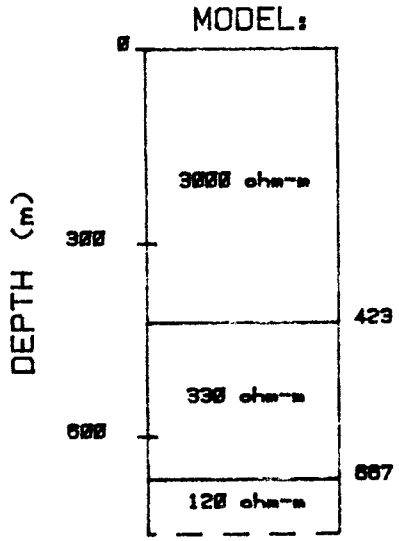
TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.30E+00	0.30E+00	-0.728	0.22E+04
0.11E-03	0.18E+00	0.18E+00	+2.056	0.21E+04
0.14E-03	0.11E+00	0.11E+00	-0.902	0.20E+04
0.18E-03	0.66E-01	0.66E-01	+0.137	0.19E+04
0.22E-03	0.44E-01	0.44E-01	+0.069	0.17E+04
0.28E-03	0.28E-01	0.28E-01	-0.323	0.16E+04
0.35E-03	0.18E-01	0.18E-01	-0.253	0.14E+04
0.44E-03	0.13E-01	0.13E-01	+0.471	0.12E+04
0.56E-03	0.84E-02	0.85E-02	-0.635	0.11E+04
0.71E-03	0.58E-02	0.58E-02	-0.022	0.93E+03
0.88E-03	0.42E-02	0.41E-02	+1.219	0.81E+03
0.11E-02	0.29E-02	0.29E-02	-0.292	0.71E+03
0.14E-02	0.19E-02	0.19E-02	+0.043	0.62E+03
0.18E-02	0.13E-02	0.13E-02	-1.280	0.54E+03
0.22E-02	0.89E-03	0.90E-03	-0.523	0.48E+03
0.29E-02	0.60E-03	0.59E-03	+1.385	0.42E+03

R: 168. X: 0. Y: 0. DL: 0. REB: 168. CF: 1.0000
TDHZ ARRAY, 16 DATA POINTS, SYSTEM: NONE DATA: L400S230
JOB #685143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 5 STA 23 OCT. 16, 1985
RMS LOG ERROR: 3.71E-03, ANTILOG YIELDS .8588 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	1.00					
P 2	.00	.98				
P 3	.00	-.01	1.00			
T 1	.00	.01	.00	1.00		
T 2	.00	.00	.00	.00	1.00	
F 0	.00	.00	.00	.00	.00	.00





ERROR= .9961 %
LOOP RADIUS= 168m

• FIELD DATA

—— MODEL CURVE

THE EARTH TECHNOLOGY CORP.

UNOCAL Geothermal

Medicine Lake CA

LINE: 5 STA.: 24

APPARENT RESISTIVITY CURVE

JOB #G85143 Fig.

L500S240

MODEL: 3 LAYERS

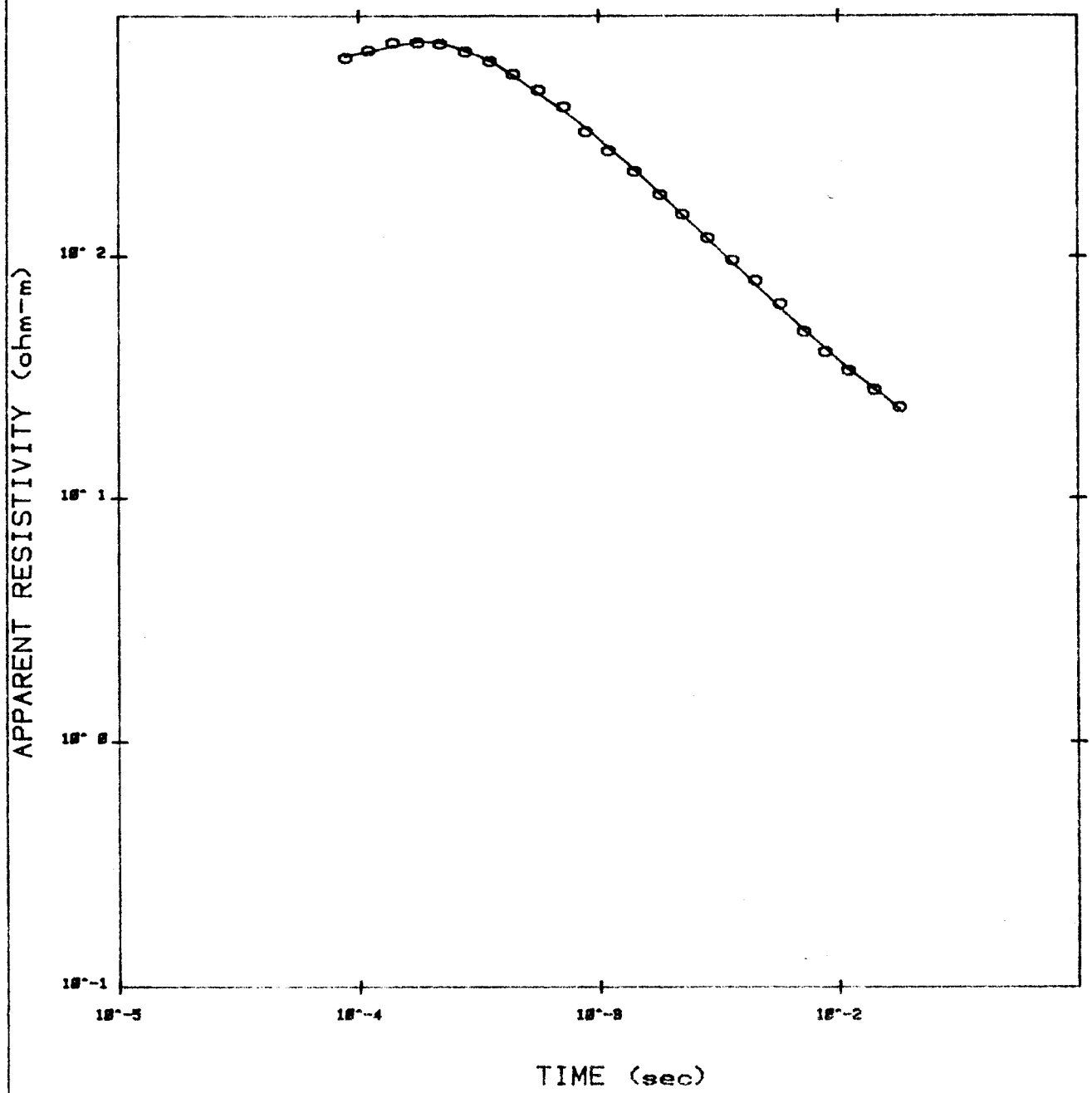
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		2072.6	6800.0		
3008.90	423.3	1649.3	5411.2	.1	.1
333.55	243.4	1405.9	4612.7	.7	.9
122.04					

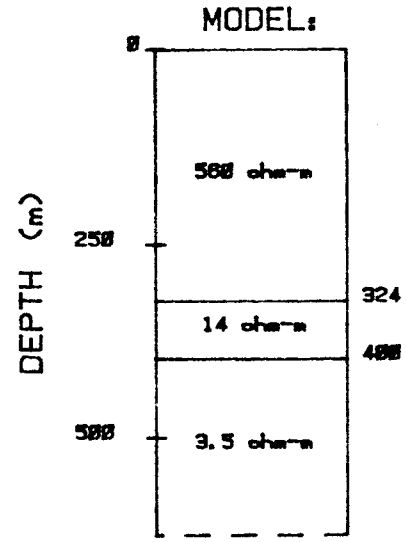
TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.17E+00	0.18E+00	-1.542	0.31E+04
0.11E-03	0.12E+00	0.12E+00	+2.213	0.28E+04
0.14E-03	0.75E-01	0.75E-01	-0.065	0.26E+04
0.18E-03	0.49E-01	0.50E-01	-1.037	0.23E+04
0.22E-03	0.34E-01	0.34E-01	-0.948	0.21E+04
0.28E-03	0.22E-01	0.22E-01	+0.603	0.18E+04
0.35E-03	0.15E-01	0.15E-01	+0.529	0.16E+04
0.44E-03	0.11E-01	0.11E-01	+0.067	0.14E+04
0.56E-03	0.72E-02	0.71E-02	+0.759	0.12E+04
0.71E-03	0.49E-02	0.50E-02	-0.646	0.10E+04
0.88E-03	0.36E-02	0.36E-02	+1.146	0.90E+03
0.11E-02	0.25E-02	0.26E-02	-0.469	0.78E+03
0.14E-02	0.17E-02	0.17E-02	-0.063	0.67E+03
0.18E-02	0.12E-02	0.12E-02	-0.196	0.58E+03
0.22E-02	0.81E-03	0.82E-03	-1.092	0.51E+03
0.29E-02	0.55E-03	0.54E-03	+1.462	0.44E+03

R: 168. X: 0. Y: 0. DL: 0. REQ: 168. CF: 1.0000
TDHZ ARRAY, 16 DATA POINTS, SYSTEM: NONE DATA: L500S240
JOB #G85143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 5 STA 24 OCT. 16, 1985
RMS LOG ERROR: 4.30E-03, ANTILOG YIELDS .9961 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	.92					
P 2	-.14	.63				
P 3	-.03	-.10	.87			
T 1	.05	.12	.02	.96		
T 2	-.03	-.02	.05	.01	.94	
F 0	.00	.00	.00	.00	.00	.00





ERROR= 3.5710 %
LOOP RADIUS= 100m

• FIELD DATA

— MODEL CURVE

THE EARTH TECHNOLOGY CORP.

UNOCAL Geothermal

Medicine Lake CA

LINE: 6 STA.: 1

APPARENT RESISTIVITY CURVE

JOB #G05143 Fig.

L6005010

MODEL: 3 LAYERS

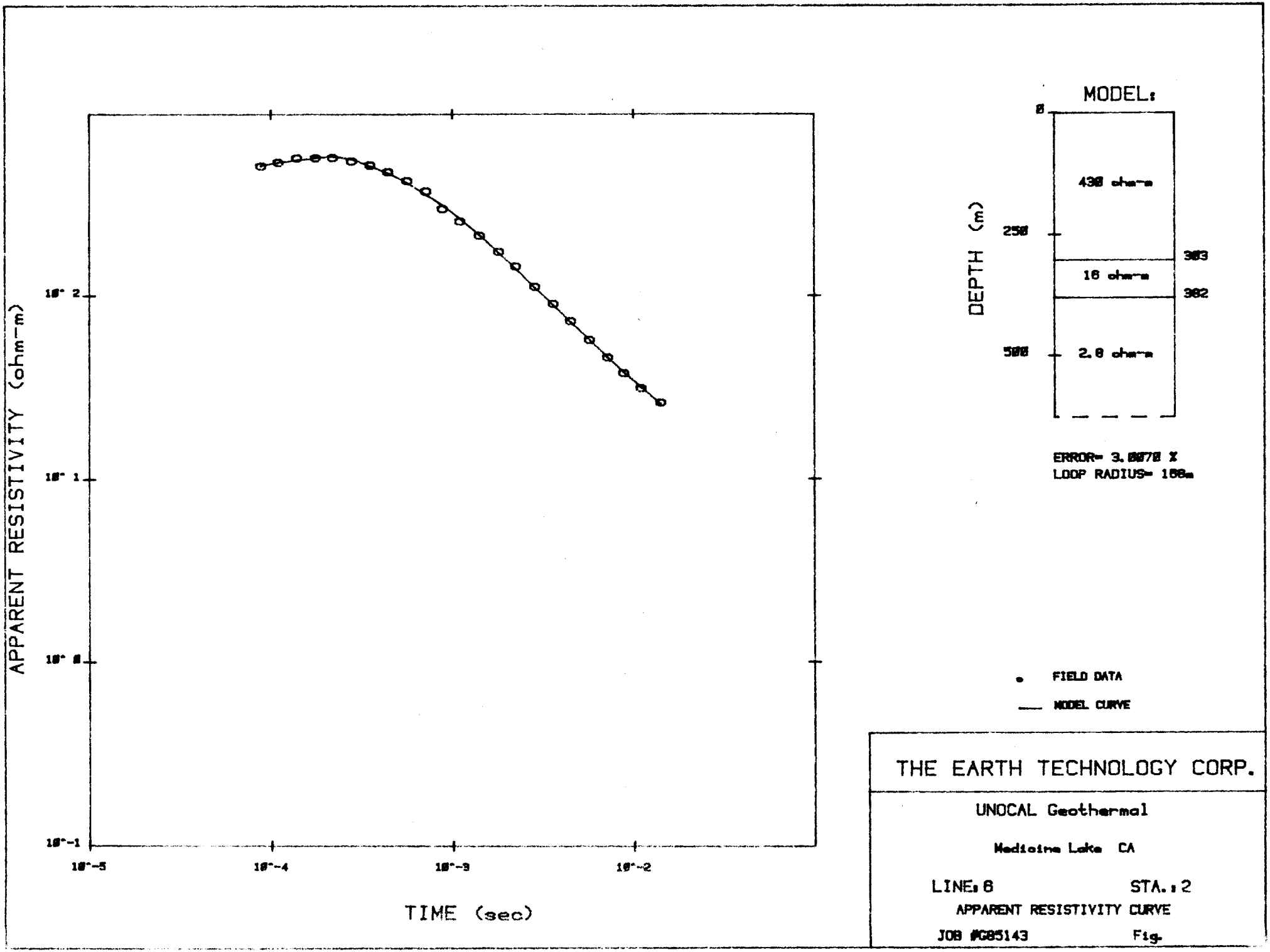
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		2121.4	6960.0		
558.48	324.5	1796.9	5895.2	.6	.6
13.86	75.2	1721.7	5648.5	5.4	6.0
3.52					

TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.18E+01	0.17E+01	+2.988	0.67E+03
0.11E-03	0.91E+00	0.93E+00	-1.542	0.72E+03
0.14E-03	0.45E+00	0.48E+00	-4.540	0.77E+03
0.18E-03	0.25E+00	0.24E+00	+1.750	0.77E+03
0.22E-03	0.15E+00	0.14E+00	+2.672	0.77E+03
0.28E-03	0.90E-01	0.89E-01	+1.932	0.71E+03
0.35E-03	0.58E-01	0.57E-01	+1.191	0.65E+03
0.44E-03	0.40E-01	0.40E-01	-1.688	0.57E+03
0.56E-03	0.27E-01	0.29E-01	-5.054	0.49E+03
0.71E-03	0.19E-01	0.20E-01	-5.151	0.42E+03
0.88E-03	0.16E-01	0.15E-01	+6.641	0.33E+03
0.11E-02	0.12E-01	0.12E-01	+4.758	0.28E+03
0.14E-02	0.88E-02	0.85E-02	+2.914	0.23E+03
0.18E-02	0.66E-02	0.65E-02	+1.942	0.18E+03
0.22E-02	0.52E-02	0.52E-02	-0.742	0.15E+03
0.29E-02	0.39E-02	0.40E-02	-1.481	0.12E+03
0.36E-02	0.30E-02	0.31E-02	-3.608	0.97E+02
0.45E-02	0.23E-02	0.25E-02	-4.741	0.79E+02
0.57E-02	0.18E-02	0.19E-02	-5.160	0.64E+02
0.72E-02	0.15E-02	0.14E-02	+2.572	0.49E+02
0.88E-02	0.12E-02	0.11E-02	+4.902	0.41E+02
0.11E-01	0.88E-03	0.86E-03	+3.079	0.34E+02
0.14E-01	0.62E-03	0.61E-03	+1.606	0.28E+02
0.18E-01	0.43E-03	0.44E-03	-2.300	0.24E+02

R: 168. X: 0. Y: 0. DL: 0. REQ: 168. CF: 1.0000
TDHZ ARRAY, 24 DATA POINTS, SYSTEM: NONE DATA: L6005010
JOB #685143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 6 STA 1 OCT. 19, 1985
RMS LOG ERROR: 1.52E-02, ANTILOG YIELDS 3.5710 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	1.00					
P 2	.00	.99				
P 3	.00	.00	1.00			
T 1	.00	.00	.00	1.00		
T 2	.00	.00	.00	.00	1.00	
F 0	.00	.00	.00	.00	.00	.00


APPARENT RESISTIVITY (ohm-m)
10^2
10^1
10^0
10^-1
10^-5
10^-4
10^-3
10^-2
TIME (sec)
MODEL:
0
430 ohm-m
250
383
16 ohm-m
382
500
2.0 ohm-m
DEPTH (m)
ERROR= 3.0070 %
LOOP RADIUS= 100m
FIELD DATA
MODEL CURVE
THE EARTH TECHNOLOGY CORP.
UNOCAL Geothermal
Medicine Lake CA
LINE: 6
STA.: 2
APPARENT RESISTIVITY CURVE
JOB #G85143
Fig.

L6005020

MODEL: 3 LAYERS

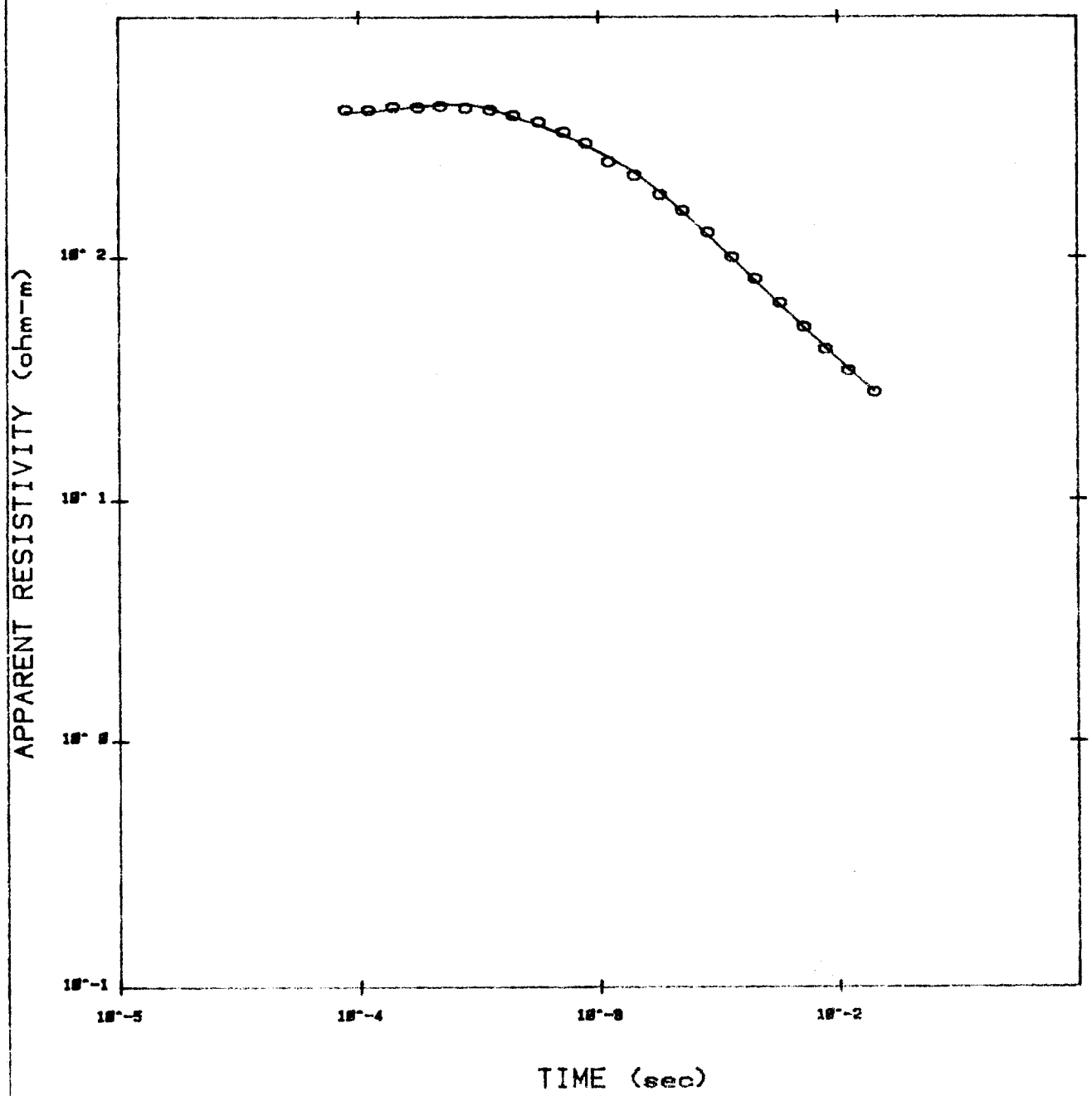
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		2103.1	6900.0		
431.31	302.8	1800.3	5906.6	.7	.7
16.42	78.7	1721.7	5648.5	4.8	5.5
2.83					

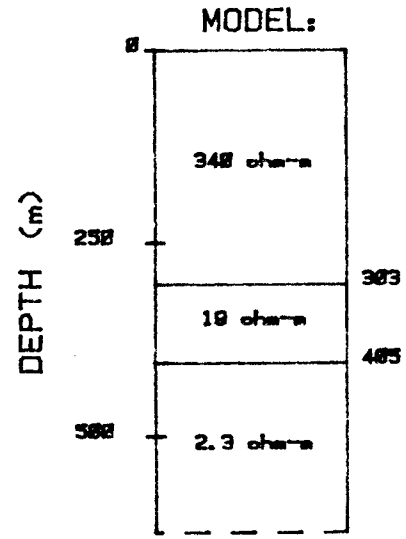
TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.26E+01	0.26E+01	+1.141	0.51E+03
0.11E-03	0.14E+01	0.14E+01	+0.056	0.54E+03
0.14E-03	0.72E+00	0.75E+00	-3.767	0.57E+03
0.18E-03	0.39E+00	0.39E+00	+0.185	0.57E+03
0.22E-03	0.23E+00	0.22E+00	+2.386	0.57E+03
0.28E-03	0.13E+00	0.13E+00	+3.834	0.55E+03
0.35E-03	0.80E-01	0.82E-01	-1.485	0.52E+03
0.44E-03	0.52E-01	0.53E-01	-1.989	0.48E+03
0.56E-03	0.34E-01	0.35E-01	-2.839	0.43E+03
0.71E-03	0.23E-01	0.24E-01	-5.227	0.38E+03
0.88E-03	0.19E-01	0.17E-01	+7.396	0.30E+03
0.11E-02	0.13E-01	0.13E-01	+5.556	0.26E+03
0.14E-02	0.94E-02	0.93E-02	+1.590	0.22E+03
0.18E-02	0.70E-02	0.71E-02	-1.794	0.18E+03
0.22E-02	0.54E-02	0.56E-02	-4.058	0.15E+03
0.29E-02	0.43E-02	0.44E-02	-0.938	0.11E+03
0.36E-02	0.34E-02	0.34E-02	-1.483	0.90E+02
0.45E-02	0.27E-02	0.27E-02	-1.128	0.72E+02
0.57E-02	0.21E-02	0.21E-02	+0.143	0.57E+02
0.72E-02	0.16E-02	0.16E-02	+0.561	0.46E+02
0.88E-02	0.13E-02	0.13E-02	+2.832	0.38E+02
0.11E-01	0.10E-02	0.98E-03	+2.079	0.31E+02
0.14E-01	0.70E-03	0.71E-03	-1.676	0.26E+02

R: 168. X: 0. Y: 0. DL: 0. REQ: 168. CF: 1.0000
TDHZ ARRAY, 23 DATA POINTS, SYSTEM: NONE DATA: L6005020
JOB #G85143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 6 STA 2 OCT. 19, 1985
RMS LOG ERROR: 1.29E-02, ANTILOG YIELDS 3.0070 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	1.00					
P 2	.00	.99				
P 3	.00	.00	.99			
T 1	.00	.00	.00	1.00		
T 2	.00	.00	.00	.00	1.00	
F 0	.00	.00	.00	.00	.00	.00





ERROR= 3.2478 %
LOOP RADIUS= 100m

• FIELD DATA

— MODEL CURVE

THE EARTH TECHNOLOGY CORP.

UNOCAL Geothermal

Medicine Lake CA

LINE: 6 STA.: 3

APPARENT RESISTIVITY CURVE

JOB #G85143 Fig.

L600S030

MODEL: 3 LAYERS

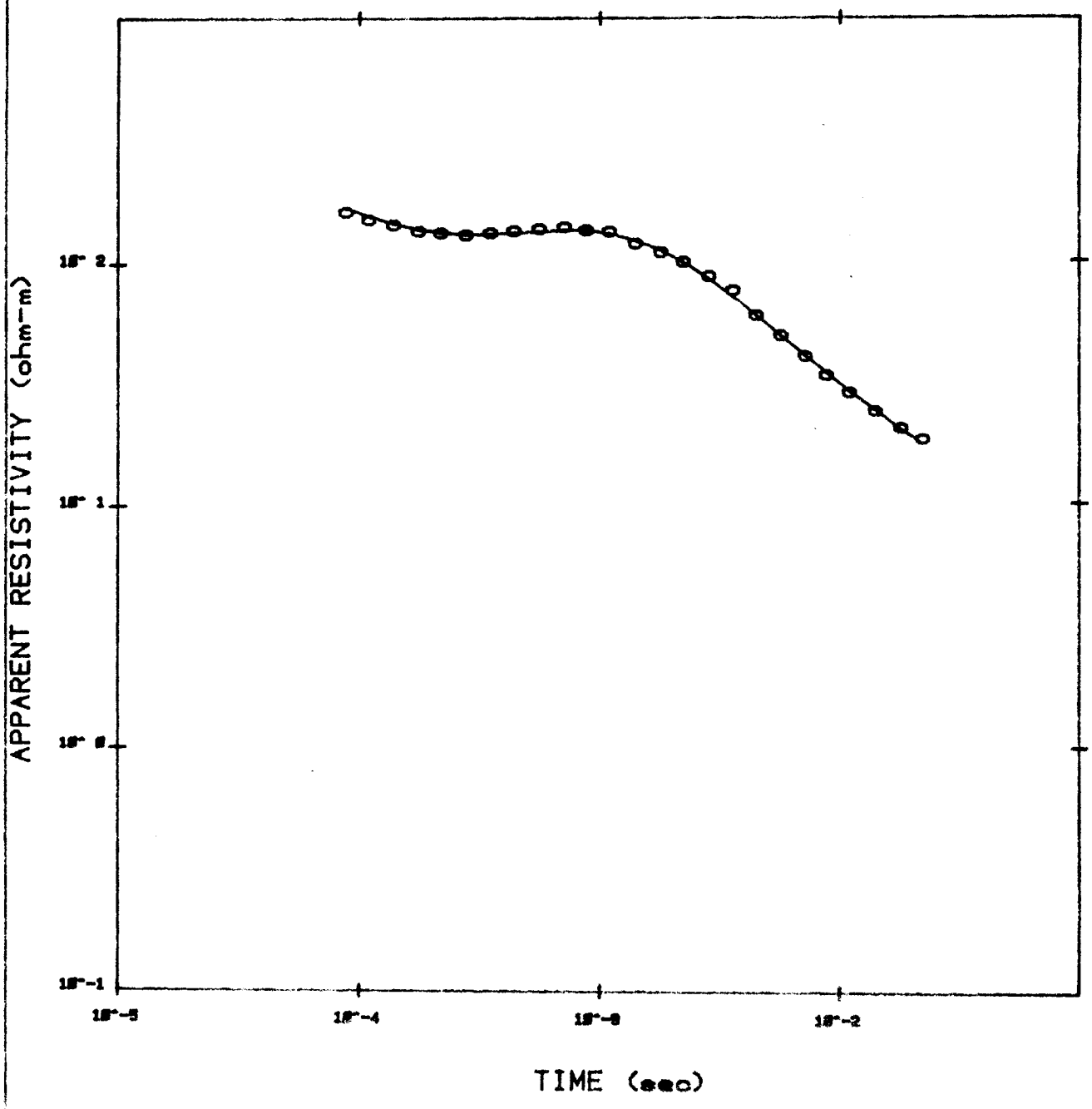
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		2132.1	6995.0		
336.95	303.0	1829.1	6000.9	.9	.9
19.12	101.9	1727.2	5666.6	5.3	6.2
2.32					

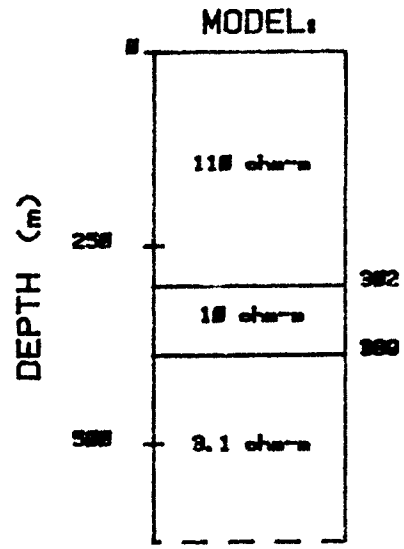
TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.37E+01	0.38E+01	-3.159	0.41E+03
0.11E-03	0.21E+01	0.22E+01	-1.597	0.41E+03
0.14E-03	0.11E+01	0.12E+01	-2.618	0.42E+03
0.18E-03	0.63E+00	0.62E+00	+1.288	0.42E+03
0.22E-03	0.36E+00	0.35E+00	+1.957	0.42E+03
0.28E-03	0.20E+00	0.19E+00	+5.633	0.41E+03
0.35E-03	0.12E+00	0.11E+00	+2.994	0.41E+03
0.44E-03	0.72E-01	0.73E-01	-1.808	0.39E+03
0.56E-03	0.43E-01	0.45E-01	-4.378	0.36E+03
0.71E-03	0.27E-01	0.29E-01	-3.334	0.33E+03
0.88E-03	0.19E-01	0.20E-01	-3.308	0.30E+03
0.11E-02	0.14E-01	0.13E-01	+6.161	0.25E+03
0.14E-02	0.93E-02	0.88E-02	+5.155	0.22E+03
0.18E-02	0.66E-02	0.64E-02	+3.842	0.18E+03
0.22E-02	0.48E-02	0.49E-02	-1.281	0.16E+03
0.29E-02	0.36E-02	0.37E-02	-3.701	0.13E+03
0.36E-02	0.29E-02	0.29E-02	-1.852	0.10E+03
0.45E-02	0.22E-02	0.23E-02	-2.475	0.82E+02
0.57E-02	0.18E-02	0.18E-02	-2.229	0.65E+02
0.72E-02	0.14E-02	0.14E-02	-0.716	0.51E+02
0.88E-02	0.11E-02	0.11E-02	+2.722	0.42E+02
0.11E-01	0.90E-03	0.87E-03	+2.835	0.34E+02
0.14E-01	0.65E-03	0.64E-03	+1.811	0.28E+02

R: 168. X: 0. Y: 0. DL: 0. REQ: 168. CF: 1.0000
TDHZ ARRAY, 23 DATA POINTS, SYSTEM: NONE DATA: L600S030
JOB #G85143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 6 STA 3 OCT. 19, 1985
RMS LOG ERROR: 1.39E-02, ANTILOG YIELDS 3.2478 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	1.00					
P 2	.00	.99				
P 3	.00	.00	.99			
T 1	.00	.00	.00	1.00		
T 2	.00	.00	.00	.00	1.00	
F 0	.00	.00	.00	.00	.00	.00





FIELD DATA

MODEL CURVE

THE EARTH TECHNOLOGY CORP.

UNOCAL Geothermal

Medicine Lake CA

LINE: 6 STA.: 4

APPARENT RESISTIVITY CURVE

JOB #G85143 Fig.

L6005040

MODEL: 3 LAYERS

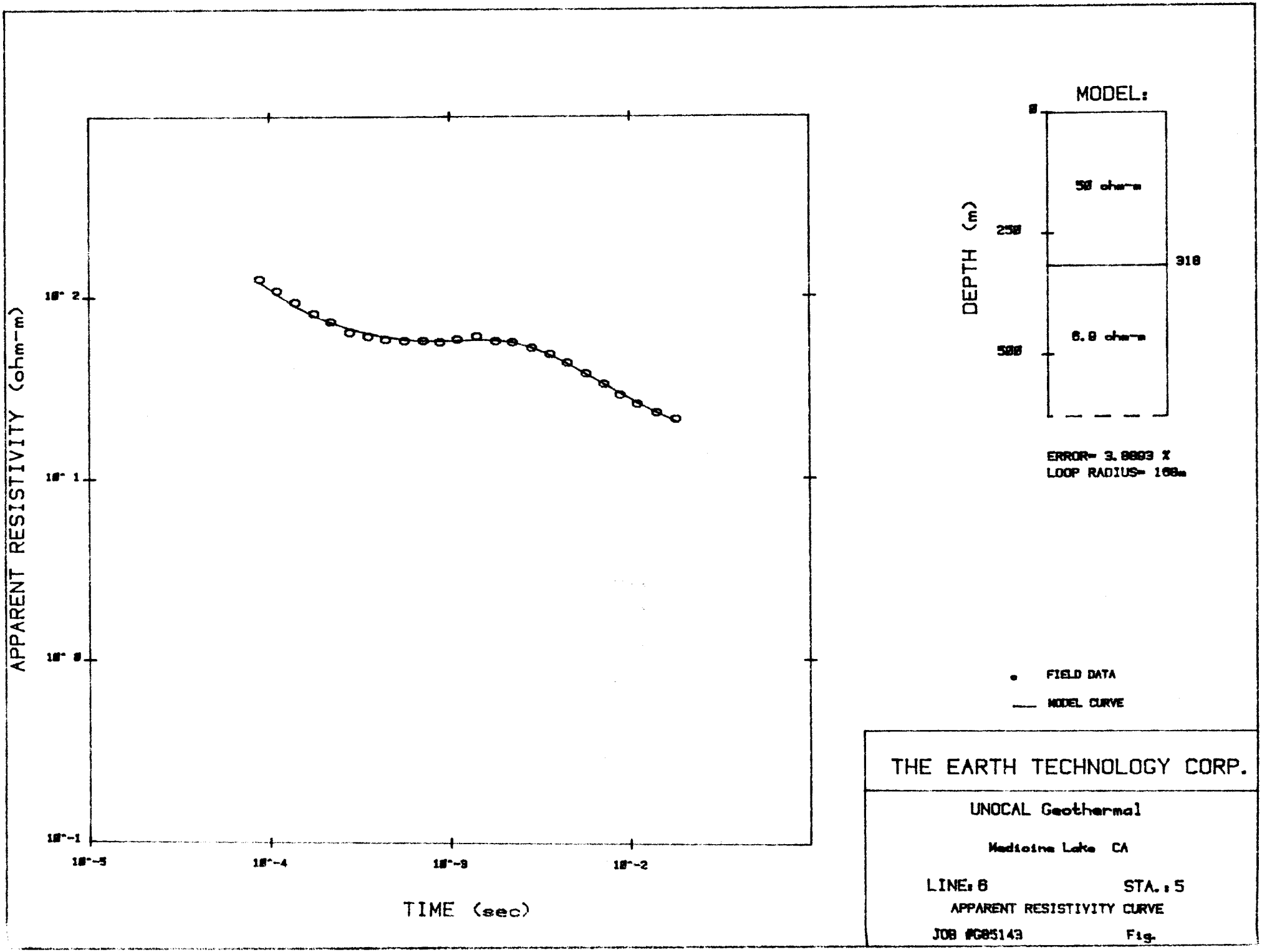
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		2097.0	6880.0		
110.79	301.8	1795.3	5889.9	2.7	2.7
10.48	86.9	1708.4	5605.0	8.3	11.0
3.11					

TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.15E+02	0.14E+02	+6.174	0.16E+03
0.11E-03	0.95E+01	0.90E+01	+5.476	0.15E+03
0.14E-03	0.57E+01	0.56E+01	+1.967	0.14E+03
0.18E-03	0.34E+01	0.33E+01	+2.897	0.13E+03
0.22E-03	0.21E+01	0.20E+01	+0.846	0.13E+03
0.28E-03	0.12E+01	0.11E+01	+0.651	0.13E+03
0.35E-03	0.62E+00	0.63E+00	-1.738	0.13E+03
0.44E-03	0.35E+00	0.36E+00	-2.136	0.13E+03
0.56E-03	0.19E+00	0.19E+00	-3.595	0.14E+03
0.71E-03	0.10E+00	0.10E+00	-3.935	0.14E+03
0.88E-03	0.61E-01	0.61E-01	+0.022	0.14E+03
0.11E-02	0.36E-01	0.37E-01	-2.532	0.13E+03
0.14E-02	0.23E-01	0.22E-01	+5.013	0.12E+03
0.18E-02	0.14E-01	0.14E-01	+3.391	0.11E+03
0.22E-02	0.94E-02	0.94E-02	-0.228	0.10E+03
0.29E-02	0.62E-02	0.65E-02	-3.572	0.88E+02
0.36E-02	0.43E-02	0.46E-02	-8.446	0.77E+02
0.45E-02	0.35E-02	0.35E-02	+0.981	0.61E+02
0.57E-02	0.26E-02	0.26E-02	+0.493	0.50E+02
0.72E-02	0.19E-02	0.19E-02	+2.056	0.41E+02
0.88E-02	0.15E-02	0.14E-02	+4.042	0.34E+02
0.11E-01	0.11E-02	0.11E-02	+3.004	0.29E+02
0.14E-01	0.78E-03	0.77E-03	+2.118	0.24E+02
0.18E-01	0.54E-03	0.55E-03	-1.184	0.21E+02
0.22E-01	0.38E-03	0.40E-03	-5.714	0.19E+02

R: 168. X: 0. Y: 0. DL: 0. REQ: 168. CF: 1.0000
TDHZ ARRAY, 25 DATA POINTS, SYSTEM: NONE DATA: L6005040
JOB #685143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 6 STA 4 OCT. 19, 1985
RMS LOG ERROR: 1.55E-02, ANTILOG YIELDS 3.6269 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	1.00					
P 2	-.01	.33				
P 3	.00	-.09	.85			
T 1	.00	.09	.00	.99		
T 2	.00	-.08	.07	.02	.89	
F 0	.00	.00	.00	.00	.00	.00


APPARENT RESISTIVITY (ohm-m)
10^2
10^1
10^0
10^-1
10^-5
10^-4
10^-3
10^-2
TIME (sec)
MODEL:
0
50 ohm-m
250
318
6.0 ohm-m
500
DEPTH (m)
ERROR= 3.0003 %
LOOP RADIUS= 100m
FIELD DATA
MODEL CURVE
THE EARTH TECHNOLOGY CORP.
UNOCAL Geothermal
Medicine Lake CA
LINE: 6
STA.: 5
APPARENT RESISTIVITY CURVE
JOB #G85143
Fig.

L600S050

MODEL: 2 LAYERS

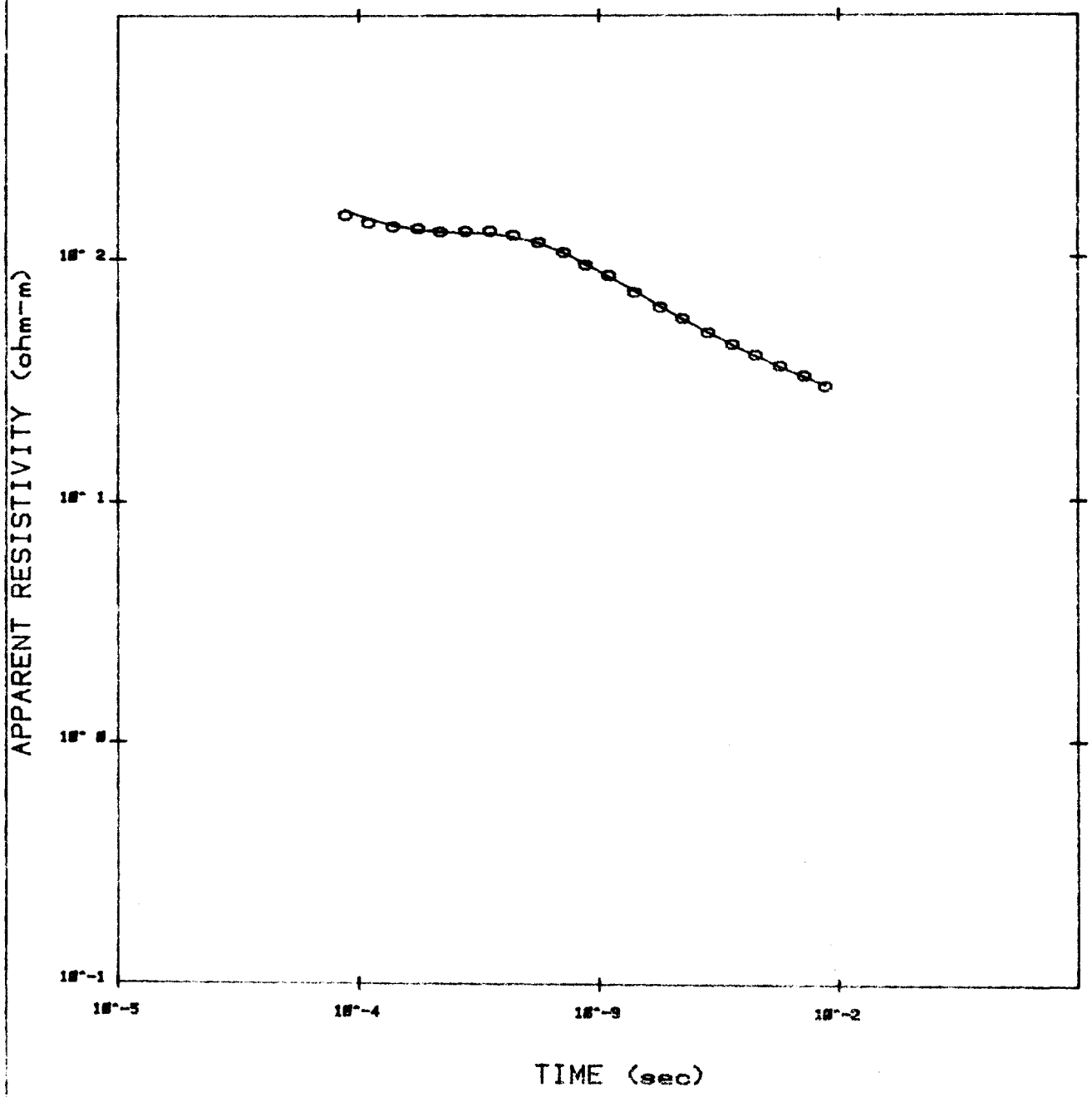
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		2060.4	6760.0		
49.70	318.0	1742.4	5716.5	6.4	6.4
6.94					

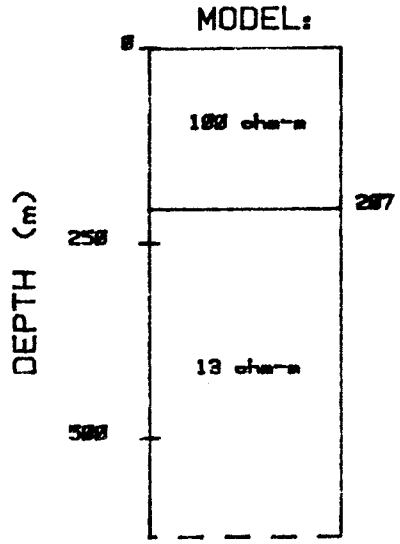
TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.21E+02	0.23E+02	-5.544	0.13E+03
0.11E-03	0.16E+02	0.17E+02	-6.452	0.11E+03
0.14E-03	0.11E+02	0.12E+02	-6.494	0.94E+02
0.18E-03	0.73E+01	0.76E+01	-3.826	0.81E+02
0.22E-03	0.50E+01	0.51E+01	-1.065	0.73E+02
0.28E-03	0.34E+01	0.31E+01	+7.463	0.64E+02
0.35E-03	0.20E+01	0.19E+01	+6.061	0.61E+02
0.44E-03	0.12E+01	0.12E+01	+4.736	0.58E+02
0.56E-03	0.68E+00	0.67E+00	+2.193	0.57E+02
0.71E-03	0.38E+00	0.38E+00	-0.254	0.58E+02
0.88E-03	0.23E+00	0.22E+00	+2.445	0.57E+02
0.11E-02	0.12E+00	0.13E+00	-2.530	0.59E+02
0.14E-02	0.63E-01	0.67E-01	-5.903	0.61E+02
0.18E-02	0.37E-01	0.37E-01	+1.458	0.57E+02
0.22E-02	0.23E-01	0.22E-01	+0.382	0.56E+02
0.29E-02	0.14E-01	0.14E-01	+0.027	0.53E+02
0.36E-02	0.85E-02	0.86E-02	-1.670	0.49E+02
0.45E-02	0.57E-02	0.58E-02	-1.089	0.44E+02
0.57E-02	0.39E-02	0.39E-02	-1.101	0.38E+02
0.72E-02	0.26E-02	0.26E-02	-0.090	0.33E+02
0.86E-02	0.19E-02	0.19E-02	+3.794	0.29E+02
0.11E-01	0.13E-02	0.13E-02	+2.330	0.26E+02
0.14E-01	0.84E-03	0.83E-03	+0.551	0.23E+02
0.18E-01	0.51E-03	0.54E-03	-4.575	0.22E+02

R: 168. X: 0. Y: 0. DL: 0. REQ: 168. CF: 1.0000
TDHZ ARRAY, 24 DATA POINTS, SYSTEM: NONE DATA: L600S050
JOB #685143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 6 STA 5 OCT. 20. 1985
RMS LOG ERROR: 1.66E-02, ANTILOG YIELDS 3.8893 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	F 1	F 2	T 1	F 0
F 1	1.00			
F 2	.00	1.00		
T 1	.00	.00	1.00	
F 0	.00	.00	.00	.00





ERROR= 2.5788 %
LOOP RADIUS= 100m

• FIELD DATA

— MODEL CURVE

THE EARTH TECHNOLOGY CORP.

UNOCAL Geothermal

Medicine Lake CA

LINE: 6 STA.: 6

APPARENT RESISTIVITY CURVE

JOB #G85143 Fig.

L600S060

MODEL: 2 LAYERS

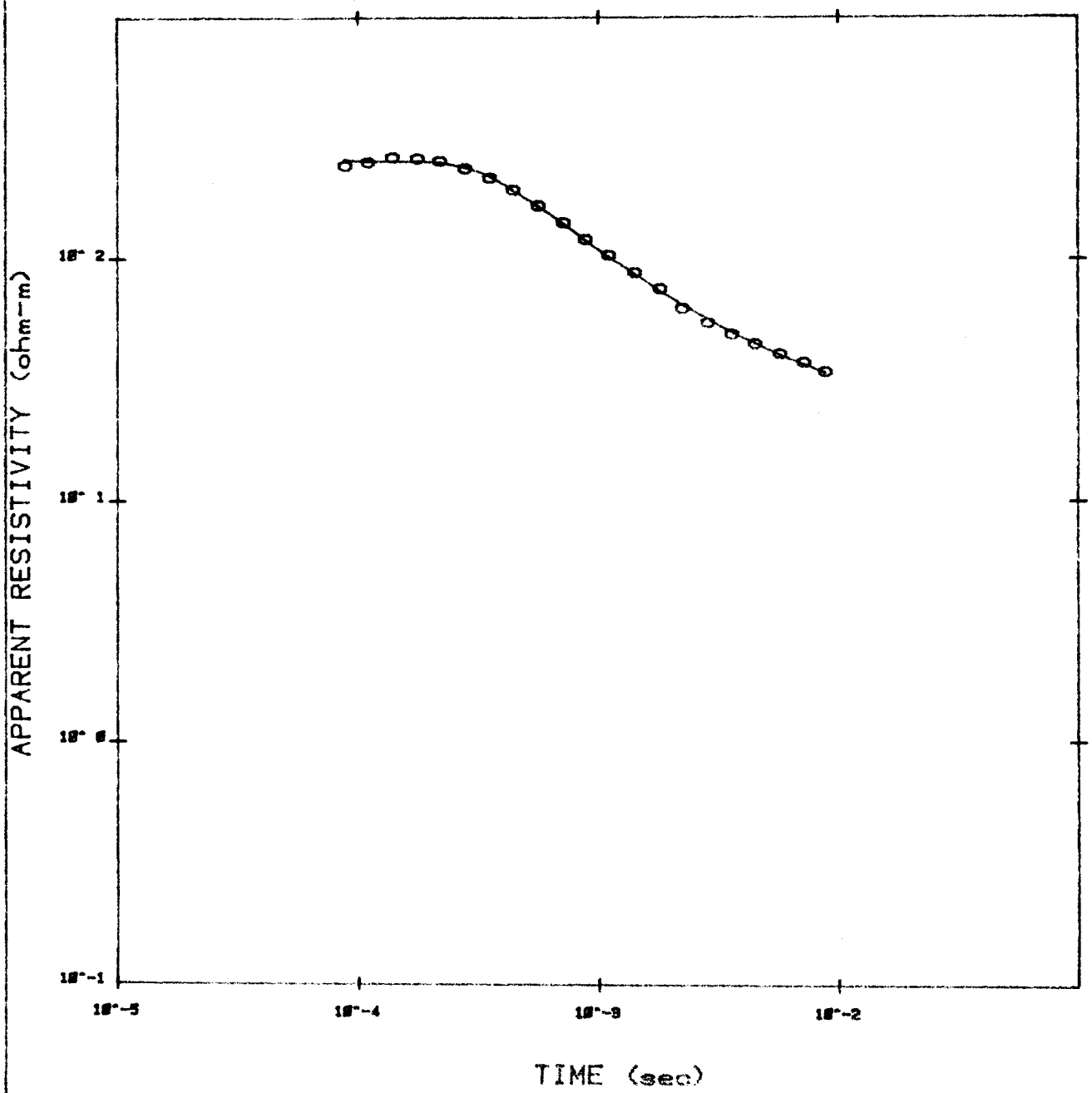
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		2087.9	6850.0		
99.62	207.0	1880.9	6170.9	2.1	2.1
13.40					

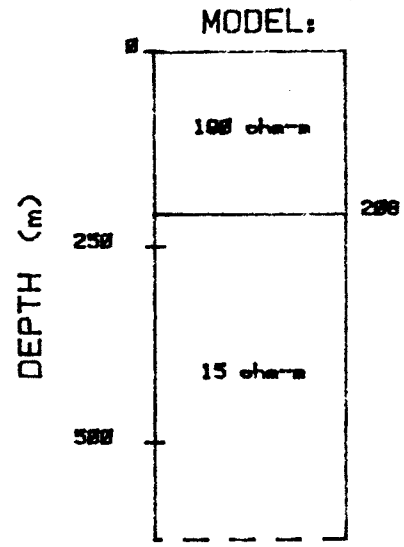
TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.16E+02	0.15E+02	+6.589	0.15E+03
0.11E-03	0.11E+02	0.99E+01	+6.483	0.14E+03
0.14E-03	0.62E+01	0.61E+01	+1.659	0.14E+03
0.18E-03	0.35E+01	0.35E+01	-2.226	0.13E+03
0.22E-03	0.21E+01	0.21E+01	+0.257	0.13E+03
0.28E-03	0.12E+01	0.12E+01	-1.082	0.13E+03
0.35E-03	0.64E+00	0.66E+00	-3.507	0.13E+03
0.44E-03	0.39E+00	0.40E+00	-2.717	0.13E+03
0.56E-03	0.24E+00	0.24E+00	-0.911	0.12E+03
0.71E-03	0.15E+00	0.15E+00	-0.305	0.11E+03
0.88E-03	0.11E+00	0.10E+00	+1.536	0.94E+02
0.11E-02	0.71E-01	0.72E-01	-1.623	0.85E+02
0.14E-02	0.49E-01	0.48E-01	+2.672	0.72E+02
0.18E-02	0.33E-01	0.32E-01	+0.817	0.63E+02
0.22E-02	0.23E-01	0.23E-01	-0.072	0.56E+02
0.29E-02	0.15E-01	0.15E-01	+0.584	0.49E+02
0.36E-02	0.98E-02	0.10E-01	-1.807	0.44E+02
0.45E-02	0.66E-02	0.67E-02	-1.118	0.40E+02
0.57E-02	0.43E-02	0.43E-02	-1.378	0.36E+02
0.72E-02	0.28E-02	0.28E-02	-1.331	0.32E+02
0.88E-02	0.19E-02	0.19E-02	+2.114	0.29E+02

R: 168. X: 0. Y: 0. DL: 0. REQ: 168. CF: 1.0000
TDHZ ARRAY, 21 DATA POINTS, SYSTEM: NONE DATA: L600S060
JOB #G85143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 6 STA 6 OCT. 20, 1985
RMS LOG ERROR: 1.11E-02, ANTILOG YIELDS 2.5786 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	T 1	F 0
P 1	1.00			
P 2	.00	1.00		
T 1	.00	.00	1.00	
F 0	.00	.00	.00	.00





ERROR= 3.2175 %
LOOP RADIUS= 100m

• FIELD DATA

— MODEL CURVE

THE EARTH TECHNOLOGY CORP.

UNOCAL Geothermal

Medicine Lake CA

LINE: 8 STA.: 7

APPARENT RESISTIVITY CURVE

JOB #G85143 Fig.

L6005070

MODEL: 2 LAYERS

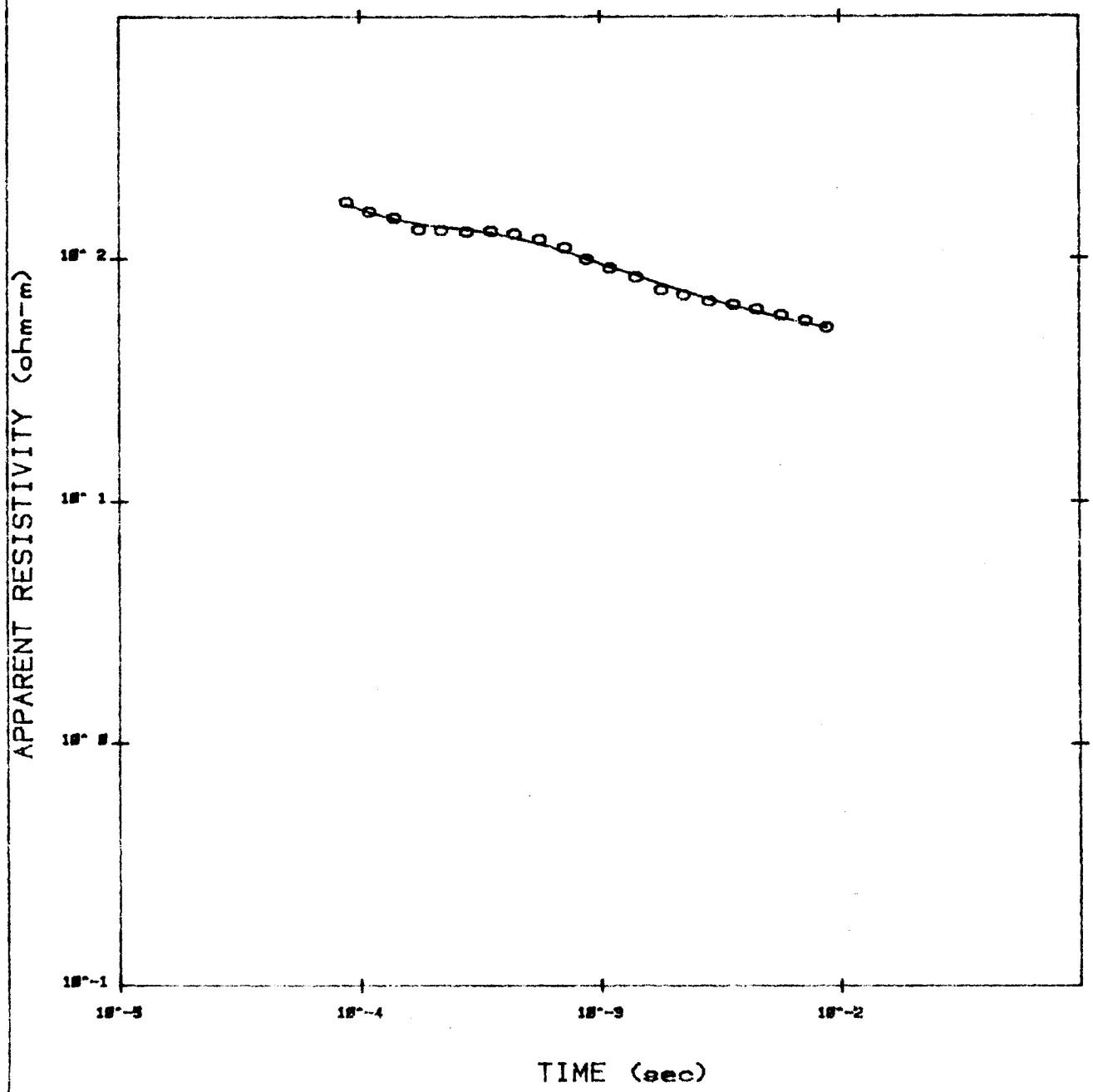
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		2066.5	6780.0		
189.13	208.5	1858.1	6096.1	1.1	1.1
15.26					

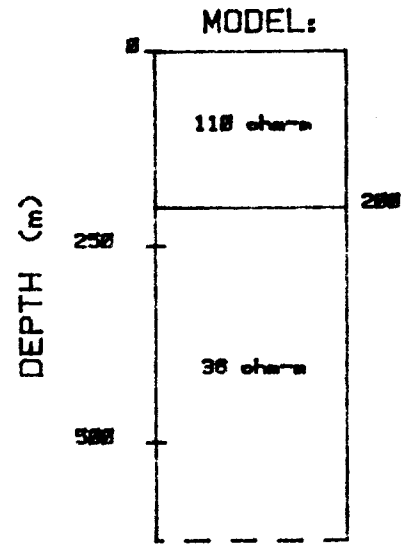
TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.81E+01	0.75E+01	+8.338	0.24E+03
0.11E-03	0.45E+01	0.44E+01	+1.207	0.25E+03
0.14E-03	0.23E+01	0.24E+01	-4.997	0.26E+03
0.18E-03	0.13E+01	0.13E+01	-3.289	0.26E+03
0.22E-03	0.79E+00	0.80E+00	-1.920	0.25E+03
0.28E-03	0.48E+00	0.47E+00	+2.222	0.23E+03
0.35E-03	0.30E+00	0.29E+00	+2.242	0.21E+03
0.44E-03	0.21E+00	0.21E+00	+0.068	0.19E+03
0.56E-03	0.14E+00	0.14E+00	-1.226	0.17E+03
0.71E-03	0.98E-01	0.99E-01	-1.311	0.14E+03
0.88E-03	0.73E-01	0.74E-01	-1.132	0.12E+03
0.11E-02	0.53E-01	0.54E-01	-2.092	0.10E+03
0.14E-02	0.36E-01	0.37E-01	-1.378	0.88E+02
0.18E-02	0.25E-01	0.25E-01	-3.086	0.76E+02
0.22E-02	0.19E-01	0.18E-01	+5.056	0.63E+02
0.29E-02	0.13E-01	0.12E-01	+5.621	0.55E+02
0.36E-02	0.83E-02	0.81E-02	+2.155	0.49E+02
0.45E-02	0.55E-02	0.55E-02	+0.892	0.45E+02
0.57E-02	0.35E-02	0.36E-02	-1.375	0.41E+02
0.72E-02	0.22E-02	0.23E-02	-3.011	0.37E+02
0.88E-02	0.15E-02	0.15E-02	-1.554	0.34E+02

R: 168. X: 0. Y: 0. DL: 0. REQ: 168. CF: 1.0000
TDHZ ARRAY, 21 DATA POINTS, SYSTEM: NONE DATA: L6005070
JOB #G85143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 6 STA 7 OCT. 20, 1985
RMS LOG ERROR: 1.38E-02, ANTILOG YIELDS 3.2175 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	T 1	F 0
P 1	1.00			
P 2	.00	1.00		
T 1	.00	.00	1.00	
F 0	.00	.00	.00	.00





ERROR= 4.3210 %
LOOP RADIUS= 100m

• FIELD DATA

— MODEL CURVE

THE EARTH TECHNOLOGY CORP.

UNOCAL Geothermal

Medicine Lake CA

LINE: 6 STA.: 0

APPARENT RESISTIVITY CURVE

JOB #C85143 Fig.

L600S080

MODEL: 2 LAYERS

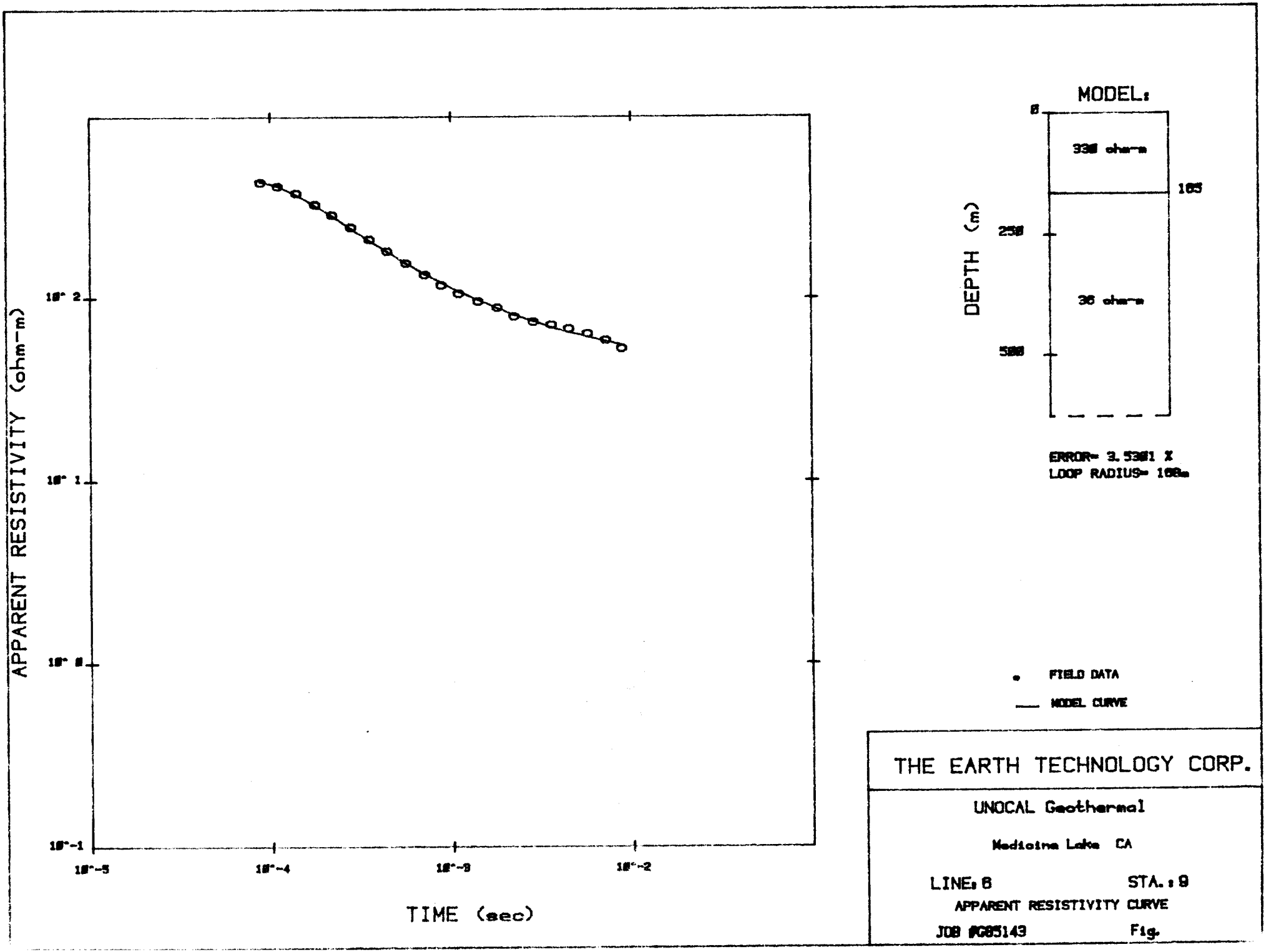
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		2057.4	6750.0		
107.94	199.6	1857.8	6095.0	1.8	1.8
35.74					

TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.14E+02	0.14E+02	-3.530	0.17E+03
0.11E-03	0.90E+01	0.91E+01	-0.926	0.16E+03
0.14E-03	0.55E+01	0.56E+01	-1.811	0.15E+03
0.18E-03	0.36E+01	0.33E+01	+8.259	0.13E+03
0.22E-03	0.21E+01	0.20E+01	+5.301	0.13E+03
0.28E-03	0.12E+01	0.11E+01	+2.807	0.13E+03
0.35E-03	0.65E+00	0.67E+00	-3.048	0.13E+03
0.44E-03	0.38E+00	0.41E+00	-5.894	0.13E+03
0.56E-03	0.23E+00	0.24E+00	-6.393	0.12E+03
0.71E-03	0.14E+00	0.15E+00	-4.946	0.11E+03
0.88E-03	0.98E-01	0.97E-01	+0.790	0.99E+02
0.11E-02	0.64E-01	0.63E-01	+1.572	0.91E+02
0.14E-02	0.39E-01	0.38E-01	+3.036	0.84E+02
0.18E-02	0.25E-01	0.23E-01	+7.986	0.75E+02
0.22E-02	0.16E-01	0.15E-01	+5.375	0.71E+02
0.29E-02	0.94E-02	0.91E-02	+3.269	0.67E+02
0.36E-02	0.55E-02	0.56E-02	-2.254	0.65E+02
0.45E-02	0.34E-02	0.35E-02	-3.127	0.62E+02
0.57E-02	0.20E-02	0.21E-02	-3.513	0.59E+02
0.72E-02	0.12E-02	0.13E-02	-2.909	0.56E+02
0.88E-02	0.80E-03	0.80E-03	+0.227	0.52E+02

R: 168. X: 0. Y: 0. DL: 0. REQ: 168. CF: 1.0000
TDHZ ARRAY, 21 DATA POINTS, SYSTEM: NONE DATA: L600S080
JOB #G85143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 6 STA 8 OCT. 20, 1985
RMS LOG ERROR: 1.84E-02, ANTILOG YIELDS 4.3218 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	T 1	F 0
P 1	1.00			
P 2	.00	1.00		
T 1	.00	.00	1.00	
F 0	.00	.00	.00	.00


APPARENT RESISTIVITY (ohm-m)
10^2
10^1
10^0
10^-1
10^-5
10^-4
10^-3
10^-2
TIME (sec)
MODEL:
0
330 ohm-m
105
DEPTH (m)
250
36 ohm-m
500
ERROR= 3.5301 %
LOOP RADIUS= 100m
FIELD DATA
MODEL CURVE
THE EARTH TECHNOLOGY CORP.
UNOCAL Geothermal
Medicine Lake CA
LINE: 6
STA.: 9
APPARENT RESISTIVITY CURVE
JOB #G85143
Fig.

L600S090

MODEL: 2 LAYERS

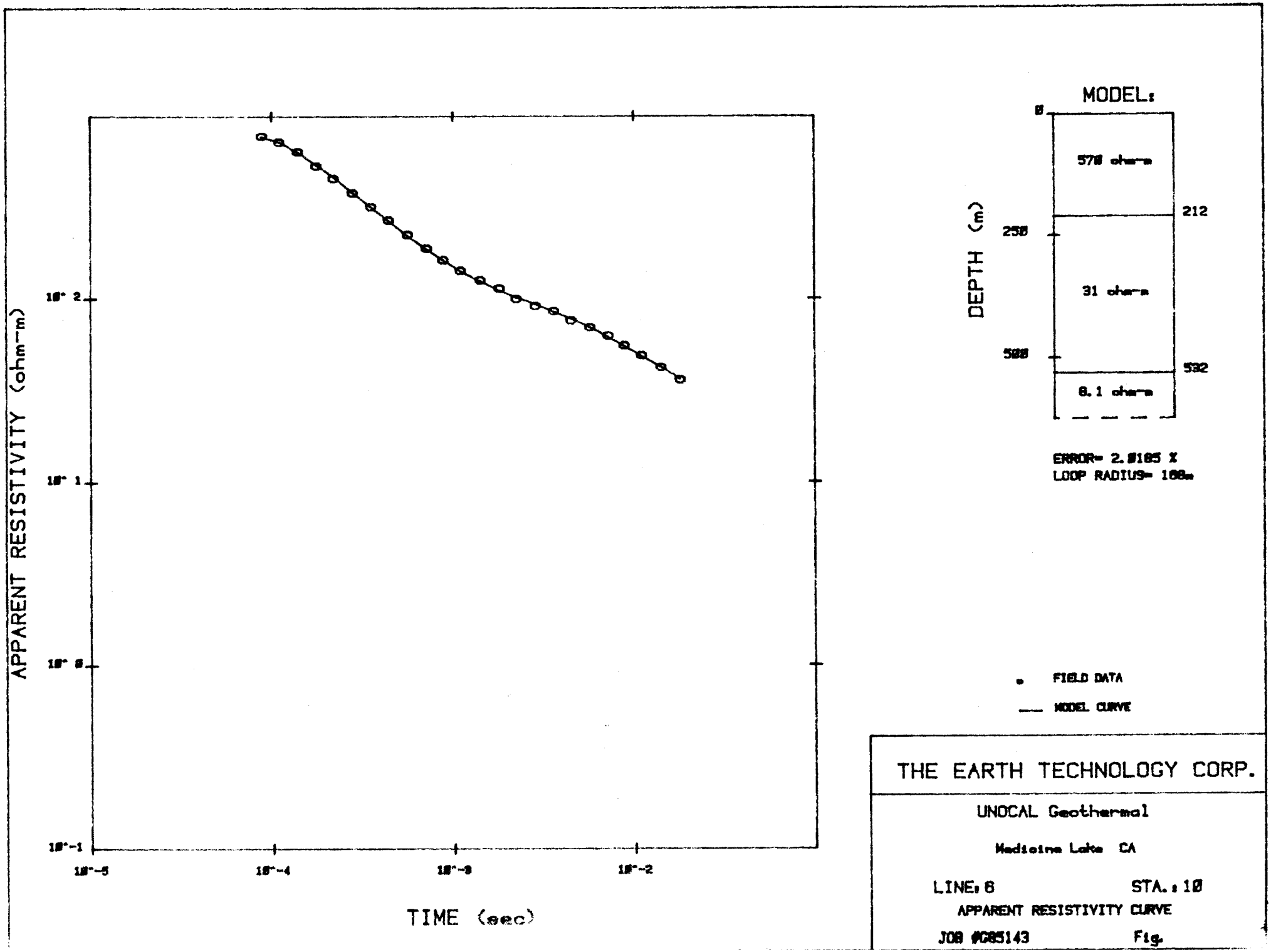
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		2072.6	6800.0		
326.38	164.9	1907.7	6258.8	.5	.5
36.33					

TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.33E+01	0.33E+01	+2.117	0.44E+03
0.11E-03	0.21E+01	0.21E+01	+0.313	0.41E+03
0.14E-03	0.13E+01	0.14E+01	-2.807	0.38E+03
0.18E-03	0.90E+00	0.91E+00	-1.293	0.33E+03
0.22E-03	0.64E+00	0.65E+00	-1.047	0.29E+03
0.28E-03	0.44E+00	0.45E+00	-2.255	0.25E+03
0.35E-03	0.31E+00	0.32E+00	-2.146	0.21E+03
0.44E-03	0.22E+00	0.22E+00	-0.813	0.18E+03
0.56E-03	0.15E+00	0.15E+00	-0.012	0.16E+03
0.71E-03	0.10E+00	0.10E+00	+1.954	0.13E+03
0.88E-03	0.75E-01	0.71E-01	+5.841	0.12E+03
0.11E-02	0.51E-01	0.49E-01	+3.877	0.11E+03
0.14E-02	0.32E-01	0.31E-01	+3.842	0.96E+02
0.18E-02	0.20E-01	0.20E-01	-0.826	0.88E+02
0.22E-02	0.14E-01	0.13E-01	+3.670	0.79E+02
0.29E-02	0.81E-02	0.80E-02	+1.754	0.74E+02
0.36E-02	0.48E-02	0.50E-02	-4.535	0.71E+02
0.45E-02	0.30E-02	0.32E-02	-6.001	0.68E+02
0.57E-02	0.18E-02	0.19E-02	-5.893	0.63E+02
0.72E-02	0.11E-02	0.12E-02	-1.940	0.58E+02
0.88E-02	0.80E-03	0.75E-03	+6.927	0.53E+02

R: 168. X: 0. Y: 0. DL: 0. REQ: 168. CF: 1.0000
TDHZ ARRAY, 21 DATA POINTS, SYSTEM: NONE DATA: L600S090
JOB #G85143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 6 STA 9 OCT. 20, 1985
RMS LOG ERROR: 1.51E-02, ANTILOG YIELDS 3.5301 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	T 1	F 0
P 1	1.00			
P 2	.00	1.00		
T 1	.00	.00	1.00	
F 0	.00	.00	.00	.00


APPARENT RESISTIVITY (ohm-m)
10^2
10^1
10^0
10^-1
10^-5
10^-4
10^-3
10^-2
TIME (sec)
MODEL:
0
570 ohm-m
212
250
31 ohm-m
500
532
8.1 ohm-m
DEPTH (m)
ERROR= 2.0185 %
LOOP RADIUS= 100m
FIELD DATA
MODEL CURVE
THE EARTH TECHNOLOGY CORP.
UNOCAL Geothermal
Medicine Lake CA
LINE: 6
STA.: 10
APPARENT RESISTIVITY CURVE
JOB #C85143
Fig.

L600S100

MODEL: 3 LAYERS

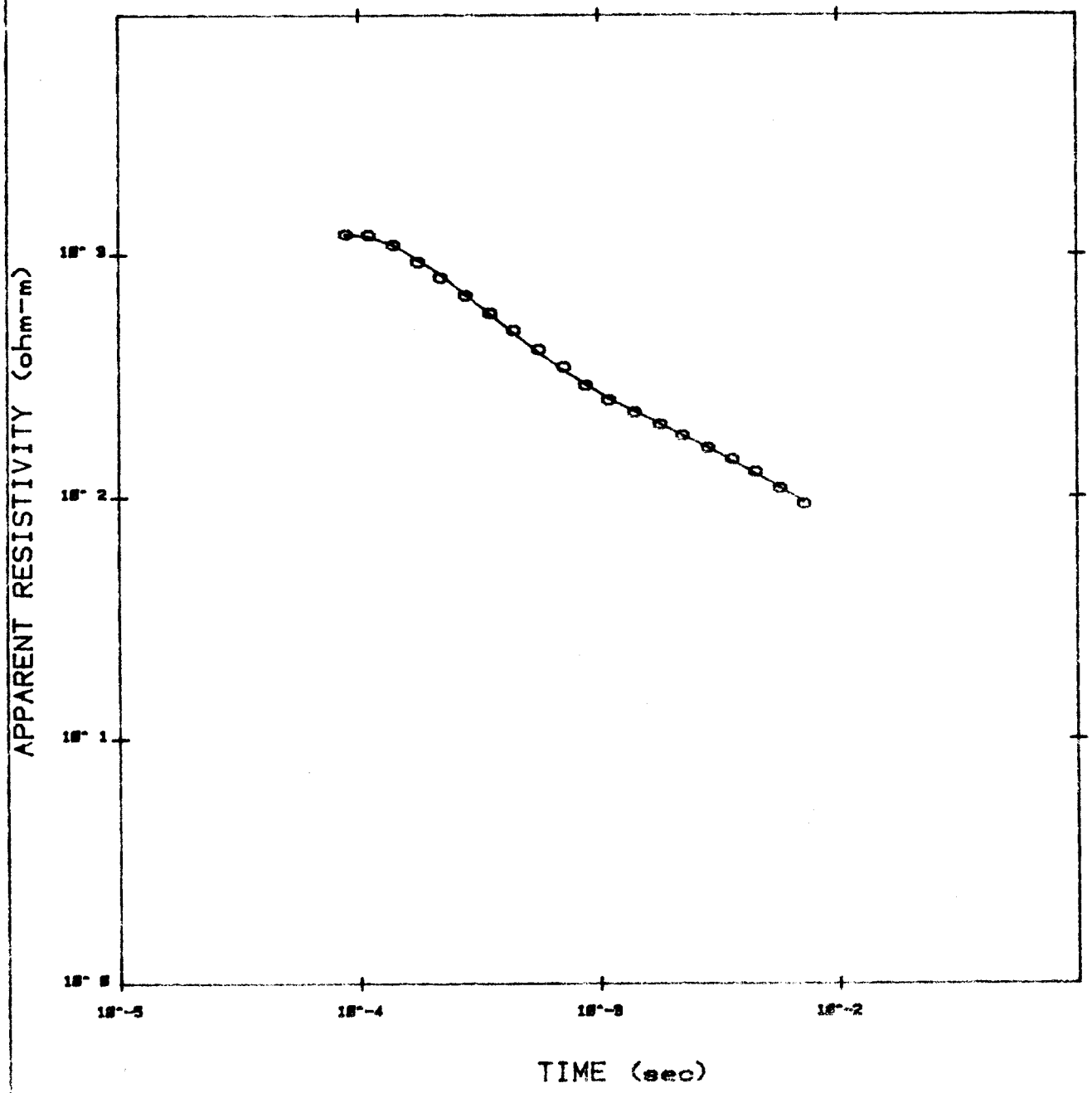
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		2078.7	6820.0		
568.05	211.6	1867.1	6125.7	.4	.4
31.06	320.6	1546.5	5073.8	10.3	10.7
8.12					

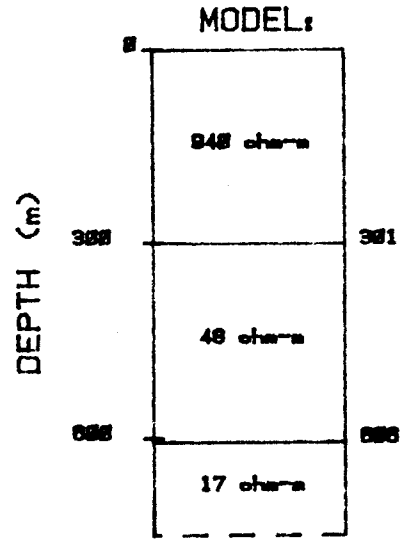
TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.14E+01	0.14E+01	-1.356	0.77E+03
0.11E-03	0.92E+00	0.91E+00	+0.513	0.72E+03
0.14E-03	0.62E+00	0.62E+00	-0.504	0.63E+03
0.18E-03	0.44E+00	0.43E+00	+2.299	0.53E+03
0.22E-03	0.33E+00	0.32E+00	+3.116	0.45E+03
0.28E-03	0.24E+00	0.23E+00	+0.859	0.37E+03
0.35E-03	0.17E+00	0.17E+00	-0.645	0.31E+03
0.44E-03	0.13E+00	0.13E+00	-0.854	0.27E+03
0.56E-03	0.90E-01	0.92E-01	-1.702	0.22E+03
0.71E-03	0.64E-01	0.65E-01	-1.578	0.19E+03
0.88E-03	0.47E-01	0.47E-01	+0.077	0.16E+03
0.11E-02	0.33E-01	0.33E-01	-1.581	0.14E+03
0.14E-02	0.21E-01	0.22E-01	-1.718	0.13E+03
0.18E-02	0.13E-01	0.14E-01	-3.971	0.11E+03
0.22E-02	0.95E-02	0.93E-02	+3.157	0.10E+03
0.29E-02	0.59E-02	0.57E-02	+3.671	0.91E+02
0.36E-02	0.36E-02	0.37E-02	-1.270	0.86E+02
0.45E-02	0.25E-02	0.24E-02	+3.278	0.76E+02
0.57E-02	0.16E-02	0.16E-02	+0.315	0.70E+02
0.72E-02	0.10E-02	0.10E-02	-2.753	0.63E+02
0.88E-02	0.74E-03	0.74E-03	-0.641	0.55E+02
0.11E-01	0.51E-03	0.52E-03	-0.927	0.49E+02
0.14E-01	0.35E-03	0.34E-03	+0.541	0.42E+02
0.18E-01	0.24E-03	0.23E-03	+2.347	0.36E+02

R: 168. X: 0. Y: 0. DL: 0. REQ: 168. CF: 1.0000
TDHZ ARRAY, 24 DATA POINTS, SYSTEM: NONE DATA: L600S100
JOB #G85143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 6 STA 10 OCT. 20, 1985
RMS LOG ERROR: 8.68E-03, ANTILOG YIELDS 2.0185 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	1.00					
P 2	.00	1.00				
P 3	.00	.00	.99			
T 1	.00	.00	.00	1.00		
T 2	.00	.00	.00	.00	1.00	
F 0	.00	.00	.00	.00	.00	.00





ERROR= 2.4675 %
LOOP RADIUS= 100m

• FIELD DATA
— MODEL CURVE

THE EARTH TECHNOLOGY CORP.

UNOCAL Geothermal

Medicine Lake CA

LINE: 6 STA.: 11

APPARENT RESISTIVITY CURVE

JOB #G85143 Fig.

L600S110

MODEL: 3 LAYERS

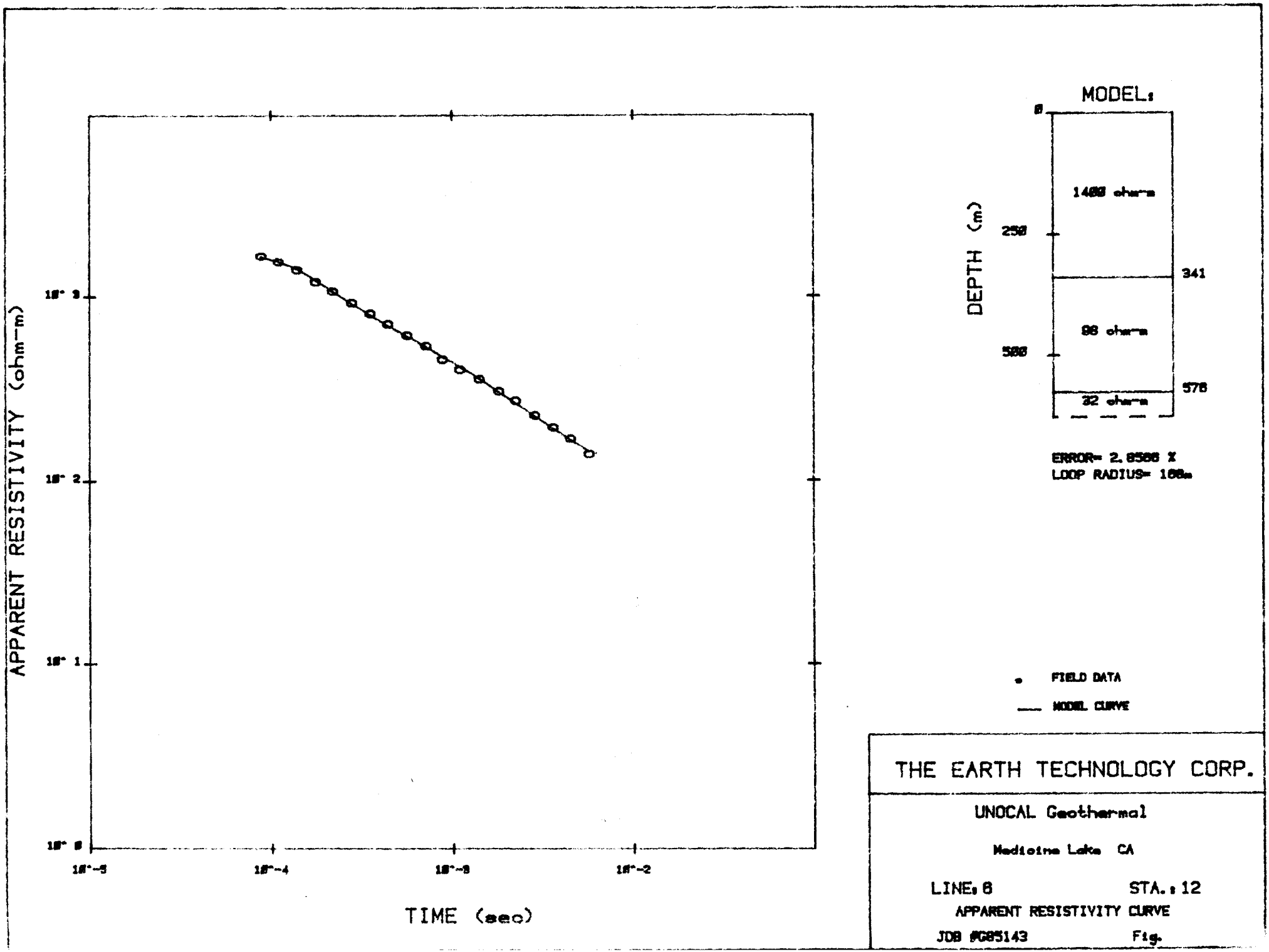
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		2084.8	6840.0		
935.65	301.4	1783.5	5851.3	.3	.3
48.34	304.9	1478.5	4850.8	6.3	6.6
16.57					

TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.72E+00	0.72E+00	-0.261	0.12E+04
0.11E-03	0.42E+00	0.43E+00	-2.224	0.12E+04
0.14E-03	0.27E+00	0.27E+00	+0.342	0.11E+04
0.18E-03	0.19E+00	0.18E+00	+3.364	0.94E+03
0.22E-03	0.14E+00	0.13E+00	+4.856	0.81E+03
0.28E-03	0.96E-01	0.95E-01	+1.843	0.68E+03
0.35E-03	0.68E-01	0.69E-01	-1.500	0.58E+03
0.44E-03	0.50E-01	0.51E-01	-3.193	0.49E+03
0.56E-03	0.35E-01	0.37E-01	-3.968	0.41E+03
0.71E-03	0.25E-01	0.26E-01	-4.554	0.35E+03
0.88E-03	0.19E-01	0.19E-01	+1.264	0.29E+03
0.11E-02	0.14E-01	0.13E-01	+2.209	0.26E+03
0.14E-02	0.88E-02	0.86E-02	+1.761	0.23E+03
0.18E-02	0.57E-02	0.56E-02	+0.901	0.20E+03
0.22E-02	0.39E-02	0.39E-02	-0.169	0.18E+03
0.29E-02	0.25E-02	0.25E-02	+0.765	0.16E+03
0.36E-02	0.17E-02	0.17E-02	-1.677	0.14E+03
0.45E-02	0.11E-02	0.12E-02	-2.417	0.13E+03
0.57E-02	0.80E-03	0.79E-03	+0.942	0.11E+03
0.72E-02	0.56E-03	0.55E-03	+2.342	0.94E+02

R: 168. X: 0. Y: 0. DL: 0. REQ: 168. CF: 1.0000
TDHZ ARRAY, 20 DATA POINTS, SYSTEM: NONE DATA: L600S110
JOB #G85143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 6 STA 11 OCT. 21, 1985
RMS LOG ERROR: 1.06E-02, ANTILOG YIELDS 2.4675 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	1.00					
P 2	.00	1.00				
P 3	.00	-.01	.96			
T 1	.00	.00	.00	1.00		
T 2	.00	.00	.00	.00	1.00	
F 0	.00	.00	.00	.00	.00	.00


APPARENT RESISTIVITY (ohm-m)
TIME (sec)
MODEL:
DEPTH (m)
0
250
500
341
576
1400 ohm-m
98 ohm-m
32 ohm-m
ERROR= 2.8500 %
LOOP RADIUS= 100m
FIELD DATA
MODEL CURVE
THE EARTH TECHNOLOGY CORP.
UNOCAL Geothermal
Medicine Lake CA
LINE: 8
STA.: 12
APPARENT RESISTIVITY CURVE
JOB #G85143
Fig.

L600S120

MODEL: 3 LAYERS

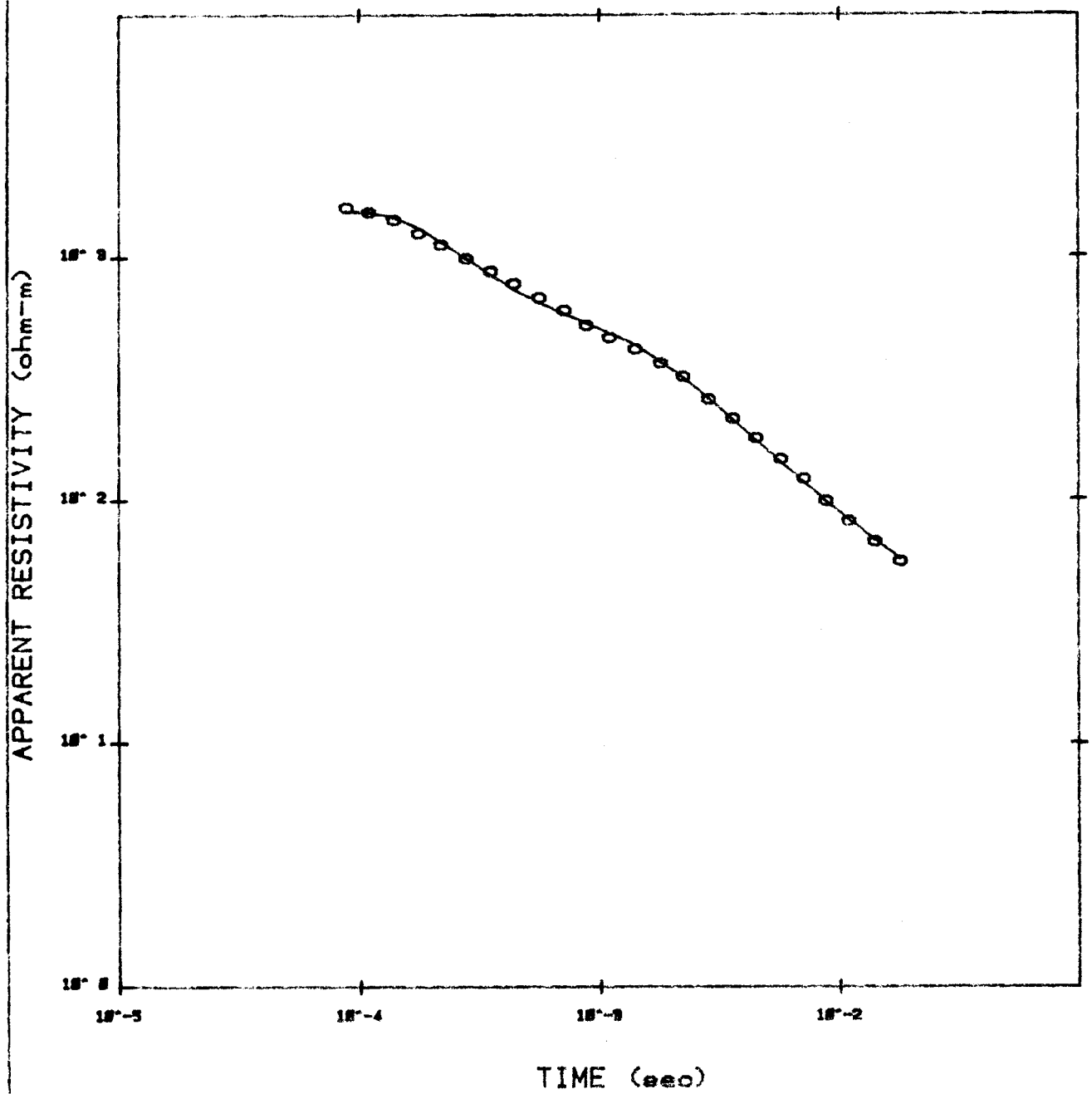
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		2133.6	7000.0		
1358.26	340.8	1792.8	5881.7	.3	.3
97.65	234.7	1558.0	5111.6	2.4	2.7
31.79					

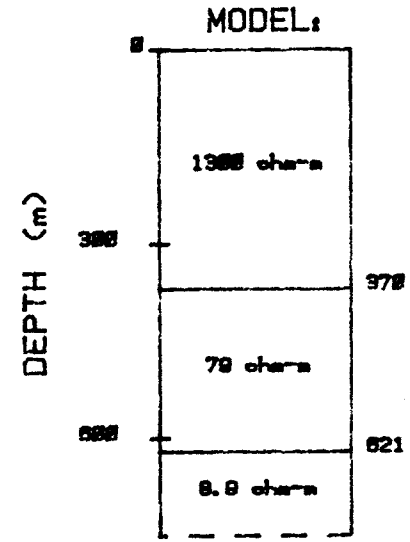
TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.44E+00	0.45E+00	-1.560	0.17E+04
0.11E-03	0.28E+00	0.28E+00	-0.149	0.16E+04
0.14E-03	0.19E+00	0.18E+00	+2.128	0.14E+04
0.18E-03	0.13E+00	0.12E+00	+2.945	0.12E+04
0.22E-03	0.90E-01	0.90E-01	+0.207	0.11E+04
0.28E-03	0.61E-01	0.62E-01	-0.949	0.92E+03
0.35E-03	0.42E-01	0.43E-01	-2.657	0.81E+03
0.44E-03	0.29E-01	0.30E-01	-3.141	0.71E+03
0.56E-03	0.20E-01	0.20E-01	-1.731	0.61E+03
0.71E-03	0.13E-01	0.13E-01	-0.923	0.54E+03
0.88E-03	0.99E-02	0.94E-02	+5.226	0.45E+03
0.11E-02	0.69E-02	0.66E-02	+5.449	0.40E+03
0.14E-02	0.45E-02	0.44E-02	+0.772	0.36E+03
0.18E-02	0.30E-02	0.31E-02	-1.117	0.31E+03
0.22E-02	0.21E-02	0.22E-02	-4.332	0.27E+03
0.29E-02	0.15E-02	0.15E-02	-1.111	0.23E+03
0.36E-02	0.10E-02	0.11E-02	-1.769	0.20E+03
0.45E-02	0.75E-03	0.76E-03	-1.896	0.17E+03
0.57E-02	0.55E-03	0.52E-03	+5.574	0.14E+03

R: 168. X: 0. Y: 0. DL: 0. REQ: 168. CF: 1.0000
TDHZ ARRAY, 19 DATA POINTS, SYSTEM: NONE DATA: L600S120
JOB #G85143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 6 STA 12 OCT. 21, 1985
RMS LOG ERROR: 1.22E-02, ANTILOG YIELDS 2.8566 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	1.00					
P 2	.00	1.00				
P 3	.00	.00	.99			
T 1	.00	.00	.00	1.00		
T 2	.00	.00	.00	.00	1.00	
F 0	.00	.00	.00	.00	.00	.00





ERROR= 4.4872 %
LOOP RADIUS= 100m

• FIELD DATA
— MODEL CURVE

THE EARTH TECHNOLOGY CORP.

UNOCAL Geothermal

Medicine Lake CA

LINE: 8 STA.: 13

APPARENT RESISTIVITY CURVE

JOB #G85143 Fig.

L600S130

MODEL: 3 LAYERS

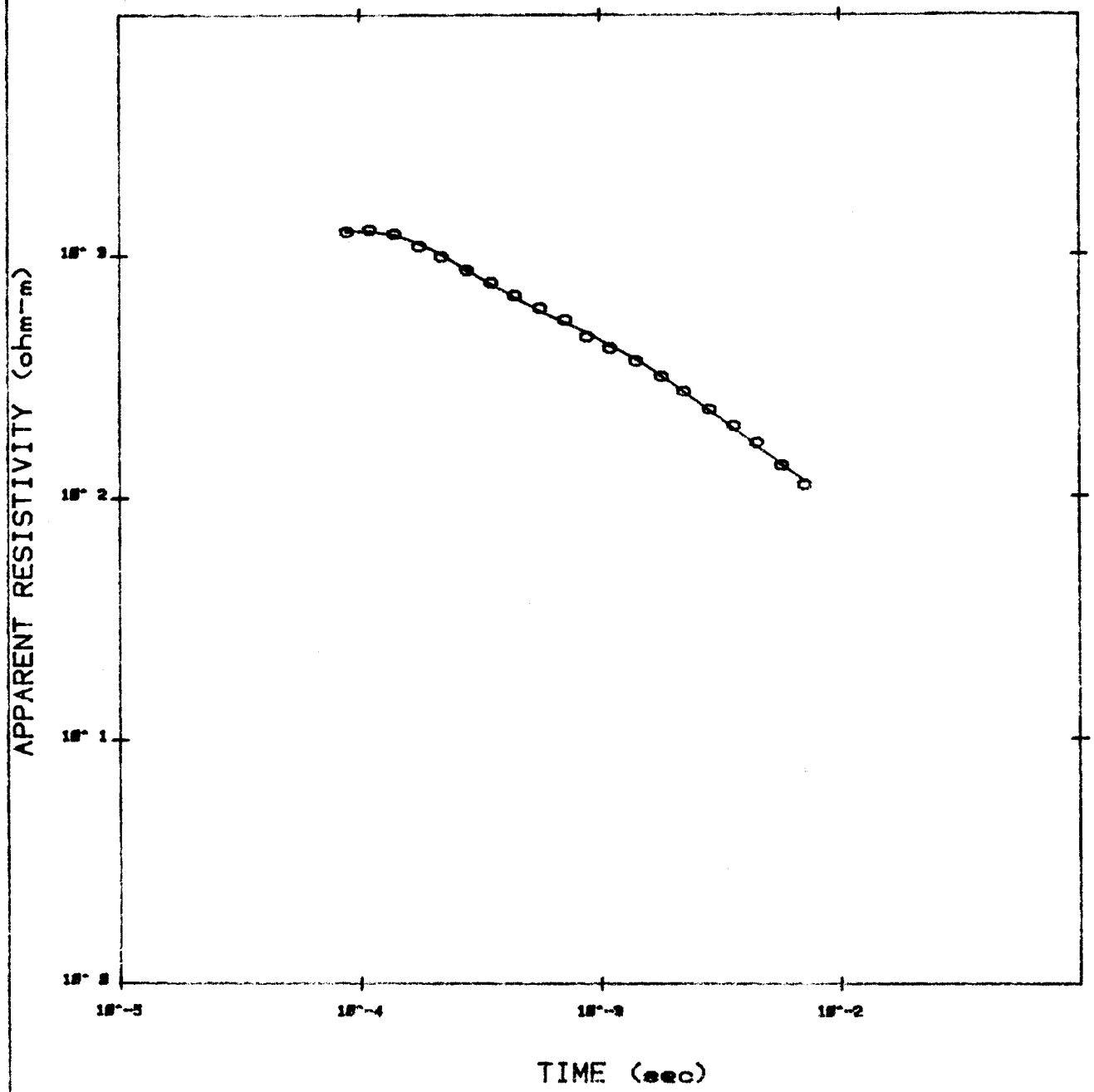
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		2136.6	7010.0		
1251.23	369.7	1766.9	5797.0	.3	.3
78.69	251.4	1515.5	4972.3	3.2	3.5
8.88					

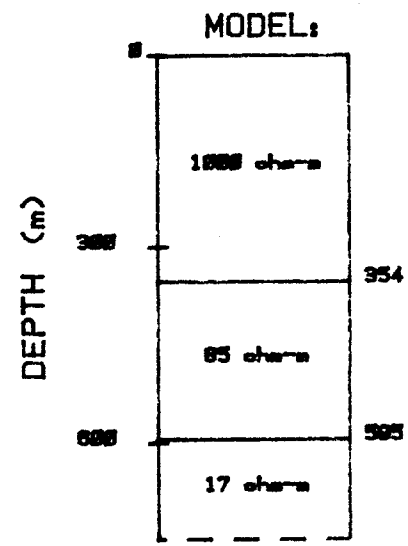
TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.47E+00	0.50E+00	-5.257	0.16E+04
0.11E-03	0.29E+00	0.29E+00	-0.251	0.15E+04
0.14E-03	0.18E+00	0.17E+00	+3.946	0.14E+04
0.18E-03	0.12E+00	0.11E+00	+8.206	0.13E+04
0.22E-03	0.83E-01	0.80E-01	+3.913	0.11E+04
0.28E-03	0.55E-01	0.55E-01	+0.470	0.99E+03
0.35E-03	0.37E-01	0.39E-01	-4.653	0.87E+03
0.44E-03	0.25E-01	0.27E-01	-8.033	0.78E+03
0.56E-03	0.17E-01	0.18E-01	-6.495	0.68E+03
0.71E-03	0.11E-01	0.12E-01	-3.863	0.60E+03
0.88E-03	0.81E-02	0.79E-02	+2.779	0.52E+03
0.11E-02	0.55E-02	0.52E-02	+6.685	0.46E+03
0.14E-02	0.35E-02	0.33E-02	+6.532	0.42E+03
0.18E-02	0.23E-02	0.23E-02	+2.132	0.36E+03
0.22E-02	0.17E-02	0.17E-02	-1.602	0.32E+03
0.29E-02	0.12E-02	0.12E-02	+2.126	0.26E+03
0.36E-02	0.92E-03	0.93E-03	-0.971	0.21E+03
0.45E-02	0.69E-03	0.71E-03	-2.626	0.18E+03
0.57E-02	0.52E-03	0.53E-03	-3.481	0.15E+03
0.71E-02	0.39E-03	0.41E-03	-4.239	0.12E+03
0.88E-02	0.31E-03	0.31E-03	-0.109	0.99E+02
0.11E-01	0.24E-03	0.23E-03	+1.592	0.82E+02
0.14E-01	0.17E-03	0.17E-03	+3.317	0.67E+02
0.18E-01	0.12E-03	0.12E-03	+4.359	0.55E+02

R: 168. X: 0. Y: 0. DL: 0. REQ: 168. CF: 1.0000
TDHZ ARRAY, 24 DATA POINTS, SYSTEM: NONE DATA: L600S130
JOB #G85143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 6 STA 13 OCT. 21, 1985
RMS LOG ERROR: 1.87E-02, ANTILOG YIELDS 4.4072 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	1.00					
P 2	.00	1.00				
P 3	.00	.00	1.00			
T 1	.00	.00	.00	1.00		
T 2	.00	.00	.00	.00	1.00	
F 0	.00	.00	.00	.00	.00	.00





ERROR= 3.2281 %
LOOP RADIUS= 100m

• FIELD DATA
—— MODEL CURVE

THE EARTH TECHNOLOGY CORP.

UNOCAL Geothermal

Medicine Lake CA

LINE: 6 STA.: 14

APPARENT RESISTIVITY CURVE

JOB #GB5143 Fig.

L600S140

MODEL: 3 LAYERS

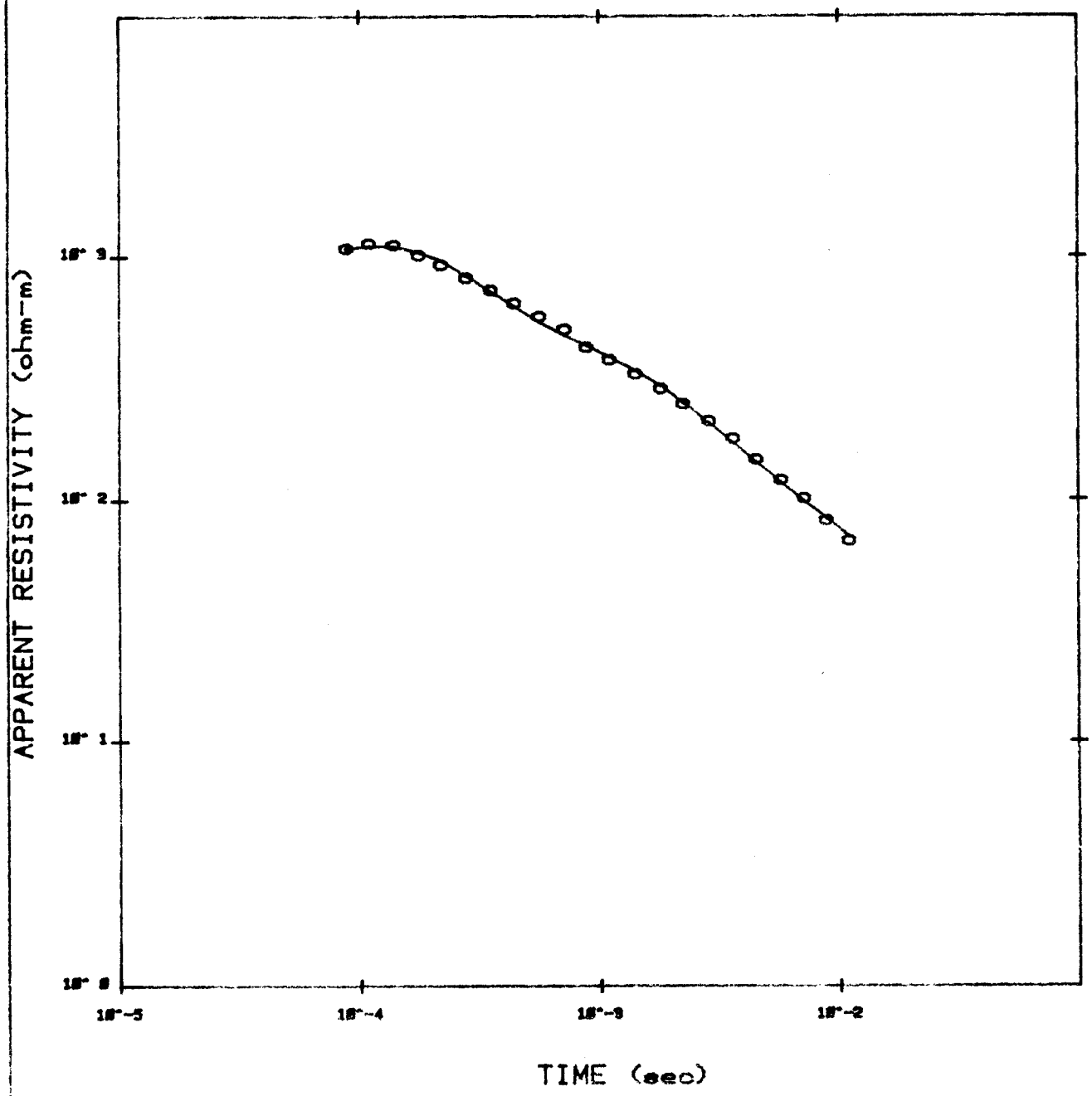
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		2090.9	6860.0		
1038.20	353.6	1737.3	5699.8	.3	.3
85.11	241.0	1496.3	4909.1	2.8	3.2
17.08					

TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.68E+00	0.68E+00	+0.641	0.13E+04
0.11E-03	0.38E+00	0.39E+00	-2.280	0.13E+04
0.14E-03	0.23E+00	0.23E+00	-1.203	0.12E+04
0.18E-03	0.15E+00	0.14E+00	+3.839	0.11E+04
0.22E-03	0.10E+00	0.97E-01	+3.560	0.99E+03
0.28E-03	0.67E-01	0.67E-01	+0.464	0.87E+03
0.35E-03	0.44E-01	0.45E-01	-1.661	0.77E+03
0.44E-03	0.30E-01	0.31E-01	-3.064	0.69E+03
0.56E-03	0.20E-01	0.21E-01	-4.645	0.61E+03
0.71E-03	0.13E-01	0.13E-01	-3.651	0.55E+03
0.88E-03	0.96E-02	0.91E-02	+5.737	0.46E+03
0.11E-02	0.65E-02	0.63E-02	+3.321	0.42E+03
0.14E-02	0.42E-02	0.41E-02	+3.084	0.37E+03
0.18E-02	0.29E-02	0.29E-02	+0.638	0.32E+03
0.22E-02	0.21E-02	0.21E-02	-0.505	0.27E+03
0.29E-02	0.15E-02	0.15E-02	-1.333	0.23E+03
0.36E-02	0.10E-02	0.11E-02	-3.725	0.20E+03
0.45E-02	0.76E-03	0.80E-03	-4.408	0.17E+03
0.57E-02	0.58E-03	0.57E-03	+1.575	0.13E+03
0.71E-02	0.44E-03	0.42E-03	+5.478	0.11E+03

R: 168. X: 0. Y: 0. DL: 0. REQ: 168. CF: 1.0000
TDHZ ARRAY, 20 DATA POINTS, SYSTEM: NONE DATA: L600S140
JOB #G85143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 6 STA 14 OCT. 21, 1985
RMS LOG ERROR: 1.38E-02, ANTILOG YIELDS 3.2261 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	1.00					
P 2	.00	1.00				
P 3	.00	.00	.99			
T 1	.00	.00	.00	1.00		
T 2	.00	.00	.00	.00	1.00	
F 0	.00	.00	.00	.00	.00	.00



ERROR= 4.5184 %
LOOP RADIUS= 168m

• FIELD DATA
— MODEL CURVE

THE EARTH TECHNOLOGY CORP.

UNOCAL Geothermal

Medicine Lake CA

LINE: 6 STA.: 15

APPARENT RESISTIVITY CURVE

JOB #G85143 Fig.

L600S150

MODEL: 3 LAYERS

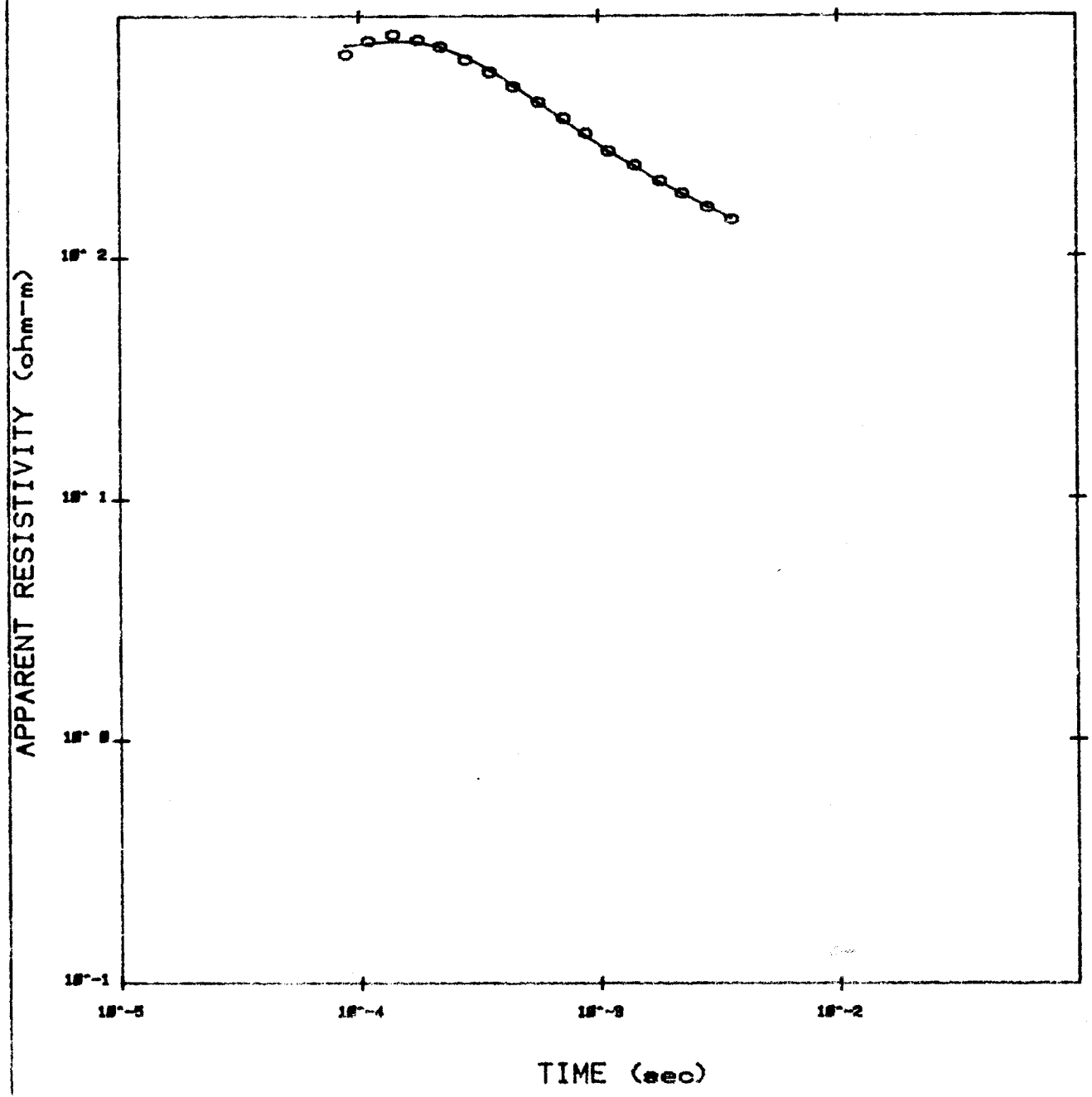
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		2072.6	6800.0		
893.31	354.9	1717.8	5635.8	.4	.4
57.36	217.6	1500.2	4921.8	3.8	4.2
8.89					

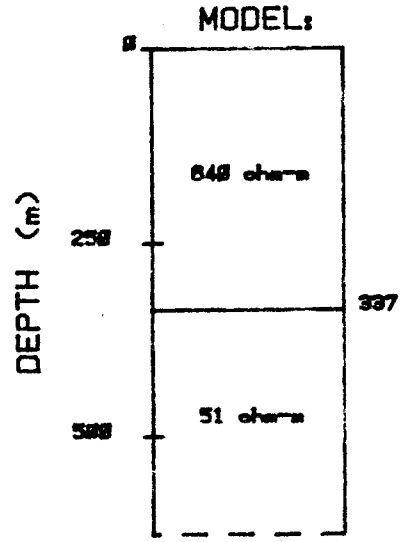
TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.85E+00	0.85E+00	-0.005	0.11E+04
0.11E-03	0.46E+00	0.47E+00	-3.533	0.11E+04
0.14E-03	0.26E+00	0.27E+00	-1.604	0.11E+04
0.18E-03	0.17E+00	0.16E+00	+4.095	0.10E+04
0.22E-03	0.11E+00	0.10E+00	+6.946	0.93E+03
0.28E-03	0.73E-01	0.71E-01	+3.630	0.82E+03
0.35E-03	0.48E-01	0.49E-01	-1.663	0.73E+03
0.44E-03	0.33E-01	0.34E-01	-4.065	0.65E+03
0.56E-03	0.22E-01	0.23E-01	-7.148	0.57E+03
0.71E-03	0.14E-01	0.16E-01	-7.640	0.51E+03
0.88E-03	0.11E-01	0.11E-01	+3.208	0.43E+03
0.11E-02	0.75E-02	0.72E-02	+4.418	0.38E+03
0.14E-02	0.50E-02	0.47E-02	+5.524	0.33E+03
0.18E-02	0.33E-02	0.32E-02	+4.202	0.29E+03
0.22E-02	0.24E-02	0.23E-02	+2.552	0.25E+03
0.29E-02	0.16E-02	0.17E-02	-1.731	0.21E+03
0.36E-02	0.12E-02	0.12E-02	-5.568	0.18E+03
0.45E-02	0.92E-03	0.94E-03	-2.528	0.15E+03
0.57E-02	0.68E-03	0.70E-03	-2.529	0.12E+03
0.71E-02	0.51E-03	0.53E-03	-3.327	0.10E+03
0.88E-02	0.41E-03	0.40E-03	+3.891	0.82E+02
0.11E-01	0.32E-03	0.30E-03	+6.910	0.67E+02

R: 168. X: 0. Y: 0. DL: 0. REQ: 168. CF: 1.0000
TDHZ ARRAY, 22 DATA POINTS, SYSTEM: NONE DATA: L600S150
JOB #G85143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 6 STA 15 OCT. 21, 1985
RMS LOG ERROR: 1.92E-02, ANTILOG YIELDS 4.5104 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	1.00					
P 2	.00	1.00				
P 3	.00	.00	.99			
T 1	.00	.00	.00	1.00		
T 2	.00	.00	.00	.00	1.00	
F 0	.00	.00	.00	.00	.00	.00





ERROR= 4.4623 %
LOOP RADIUS= 100m

• FIELD DATA
— MODEL CURVE

THE EARTH TECHNOLOGY CORP.

UNOCAL Geothermal

Medicine Lake CA

LINE: 8 STA.: 16

APPARENT RESISTIVITY CURVE

JOB #G85143 Fig.

L600S160

MODEL: 2 LAYERS

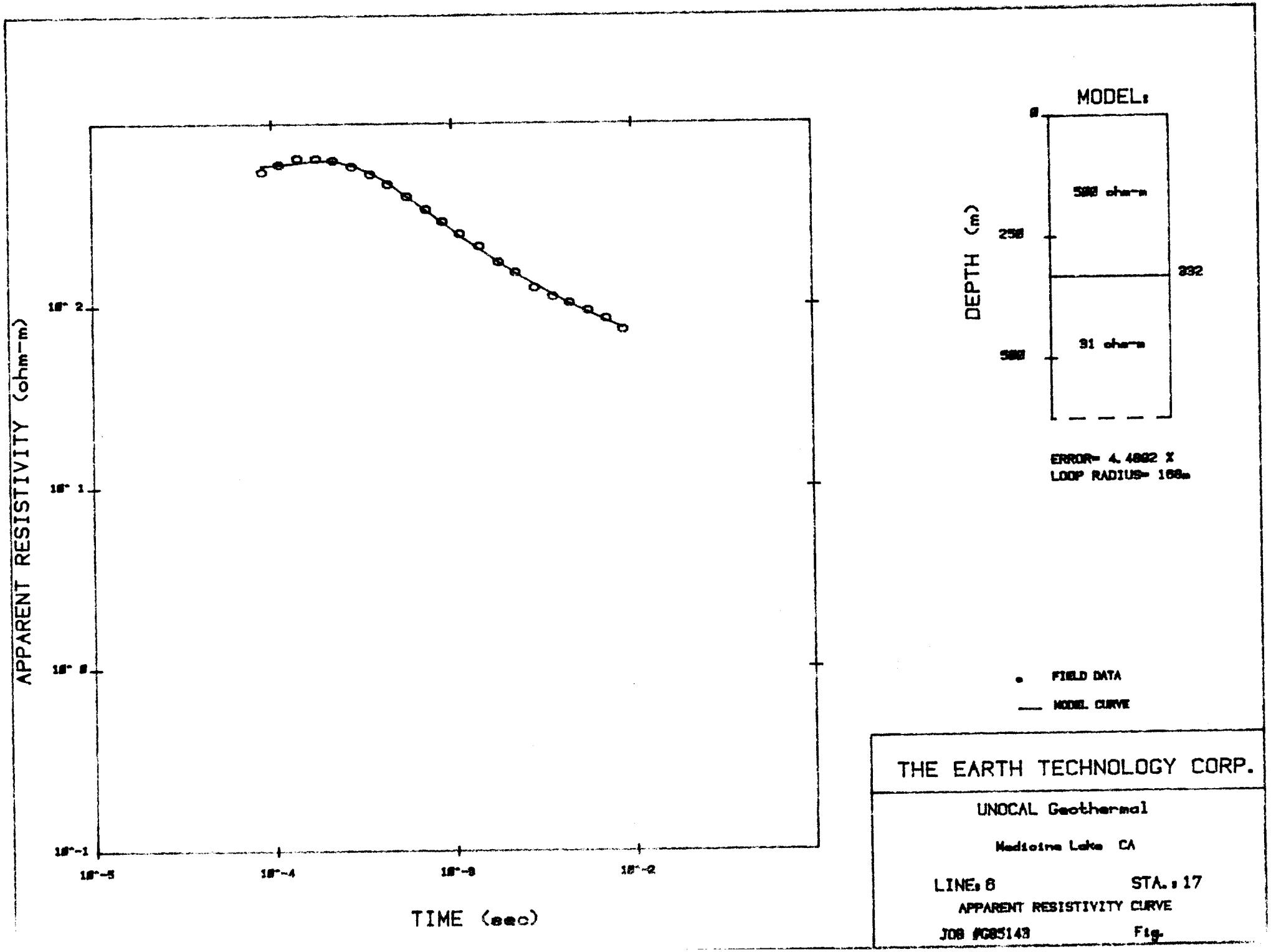
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		2130.6	6990.0		
641.51	336.9	1793.6	5884.6	.5	.5
51.09					

TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.17E+01	0.15E+01	+13.383	0.69E+03
0.11E-03	0.80E+00	0.82E+00	-3.184	0.79E+03
0.14E-03	0.41E+00	0.44E+00	-8.859	0.84E+03
0.18E-03	0.24E+00	0.25E+00	-3.278	0.79E+03
0.22E-03	0.16E+00	0.16E+00	-0.511	0.74E+03
0.28E-03	0.10E+00	0.98E-01	+4.010	0.66E+03
0.35E-03	0.68E-01	0.65E-01	+4.101	0.58E+03
0.44E-03	0.48E-01	0.47E-01	+1.794	0.51E+03
0.56E-03	0.32E-01	0.33E-01	-0.633	0.44E+03
0.71E-03	0.22E-01	0.23E-01	-2.510	0.38E+03
0.88E-03	0.16E-01	0.17E-01	-2.955	0.33E+03
0.11E-02	0.12E-01	0.12E-01	-0.110	0.28E+03
0.14E-02	0.80E-02	0.80E-02	-1.003	0.24E+03
0.18E-02	0.54E-02	0.55E-02	-1.504	0.21E+03
0.22E-02	0.38E-02	0.38E-02	-0.355	0.19E+03
0.29E-02	0.25E-02	0.25E-02	+0.823	0.16E+03
0.36E-02	0.17E-02	0.16E-02	+1.916	0.14E+03

R: 168. X: 0. Y: 0. DL: 0. REQ: 168. CF: 1.0000
TDHZ ARRAY, 17 DATA POINTS, SYSTEM: NONE DATA: L600S160
JOB #685143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 6 STA 16 OCT. 21, 1985
RMS LOG ERROR: 1.90E-02, ANTILOG YIELDS 4.4623 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	T 1	F 0
P 1	1.00			
P 2	.00	1.00		
T 1	.00	.00	1.00	
F 0	.00	.00	.00	.00



APPARENT RESISTIVITY (ohm-m)
10^ 2
10^ 1
10^ 0
10^-1
10^-5
10^-4
10^-3
10^-2
TIME (sec)
MODEL:
DEPTH (m)
0
250
500
500 ohm-m
31 ohm-m
332
ERROR= 4.4802 %
LOOP RADIUS= 168m
FIELD DATA
MODEL CURVE
THE EARTH TECHNOLOGY CORP.
UNOCAL Geothermal
Medicine Lake CA
LINE: 8
STA.: 17
APPARENT RESISTIVITY CURVE
JOB #G85143
Fig.

L600S170

MODEL: 2 LAYERS

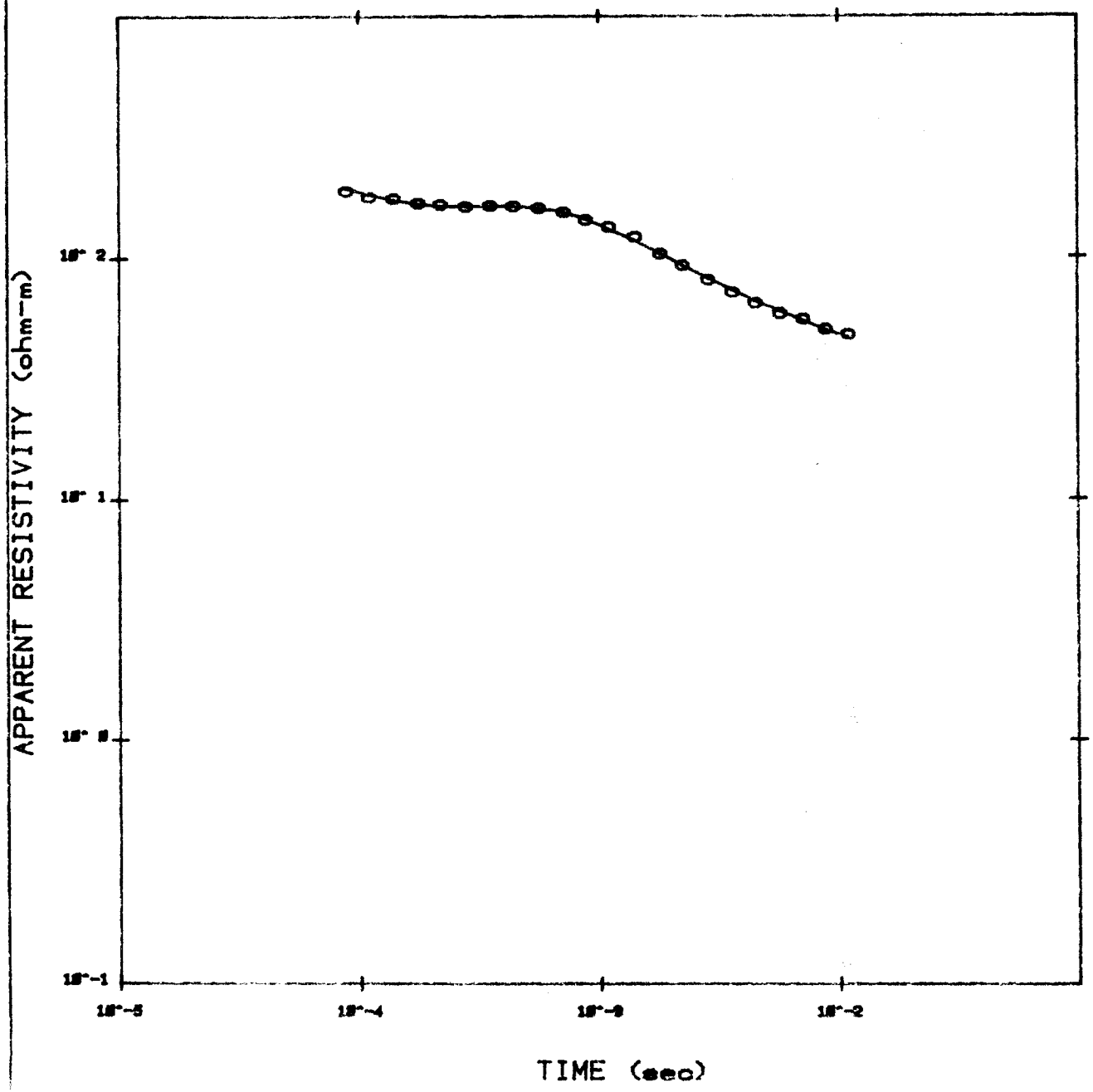
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		2136.6	7010.0		
497.07	331.7	1804.9	5921.7	.7	.7
31.39					

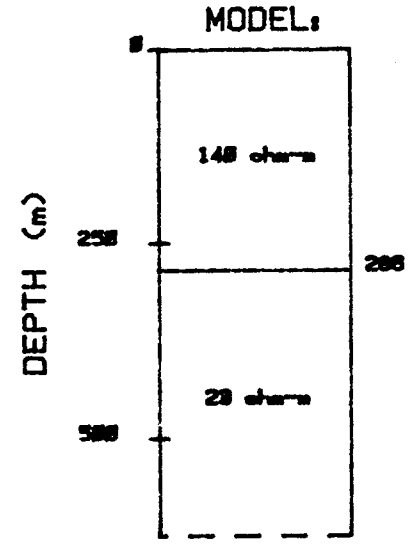
TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.24E+01	0.22E+01	+11.943	0.54E+03
0.11E-03	0.12E+01	0.12E+01	-0.491	0.59E+03
0.14E-03	0.60E+00	0.66E+00	-8.324	0.64E+03
0.18E-03	0.33E+00	0.35E+00	-4.403	0.64E+03
0.22E-03	0.20E+00	0.20E+00	-0.609	0.62E+03
0.28E-03	0.12E+00	0.12E+00	+2.841	0.58E+03
0.35E-03	0.80E-01	0.77E-01	+3.468	0.52E+03
0.44E-03	0.55E-01	0.53E-01	+3.614	0.46E+03
0.56E-03	0.38E-01	0.38E-01	+0.148	0.39E+03
0.71E-03	0.27E-01	0.27E-01	-1.045	0.33E+03
0.88E-03	0.20E-01	0.20E-01	-1.607	0.29E+03
0.11E-02	0.14E-01	0.15E-01	-3.386	0.25E+03
0.14E-02	0.98E-02	0.10E-01	-5.265	0.21E+03
0.18E-02	0.72E-02	0.71E-02	+0.514	0.17E+03
0.22E-02	0.51E-02	0.52E-02	-1.084	0.15E+03
0.29E-02	0.37E-02	0.35E-02	+6.928	0.12E+03
0.36E-02	0.24E-02	0.23E-02	+3.819	0.11E+03
0.44E-02	0.16E-02	0.16E-02	-1.396	0.10E+03
0.56E-02	0.10E-02	0.11E-02	-2.701	0.94E+02
0.71E-02	0.67E-03	0.70E-03	-3.865	0.85E+02
0.88E-02	0.49E-03	0.46E-03	+4.449	0.73E+02

R: 168. X: 0. Y: 0. DL: 0. REQ: 168. CF: 1.0000
TDHZ ARRAY, 21 DATA POINTS, SYSTEM: NONE DATA: L600S170
JOB #G85143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 6 STA 17 OCT. 21, 1985
RMS LOG ERROR: 1.91E-02, ANTILOG YIELDS 4.4892 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	T 1	F 0
P 1	1.00			
P 2	.00	1.00		
T 1	.00	.00	1.00	
F 0	.00	.00	.00	.00





ERROR= 2.5400 %
LOOP RADIUS= 100m

• FIELD DATA
— MODEL CURVE

THE EARTH TECHNOLOGY CORP.

UNOCAL Geothermal

Medicine Lake CA

LINE: 6 STA.: 10

APPARENT RESISTIVITY CURVE

JOB #G8514B Fig.

L6005180

MODEL: 2 LAYERS

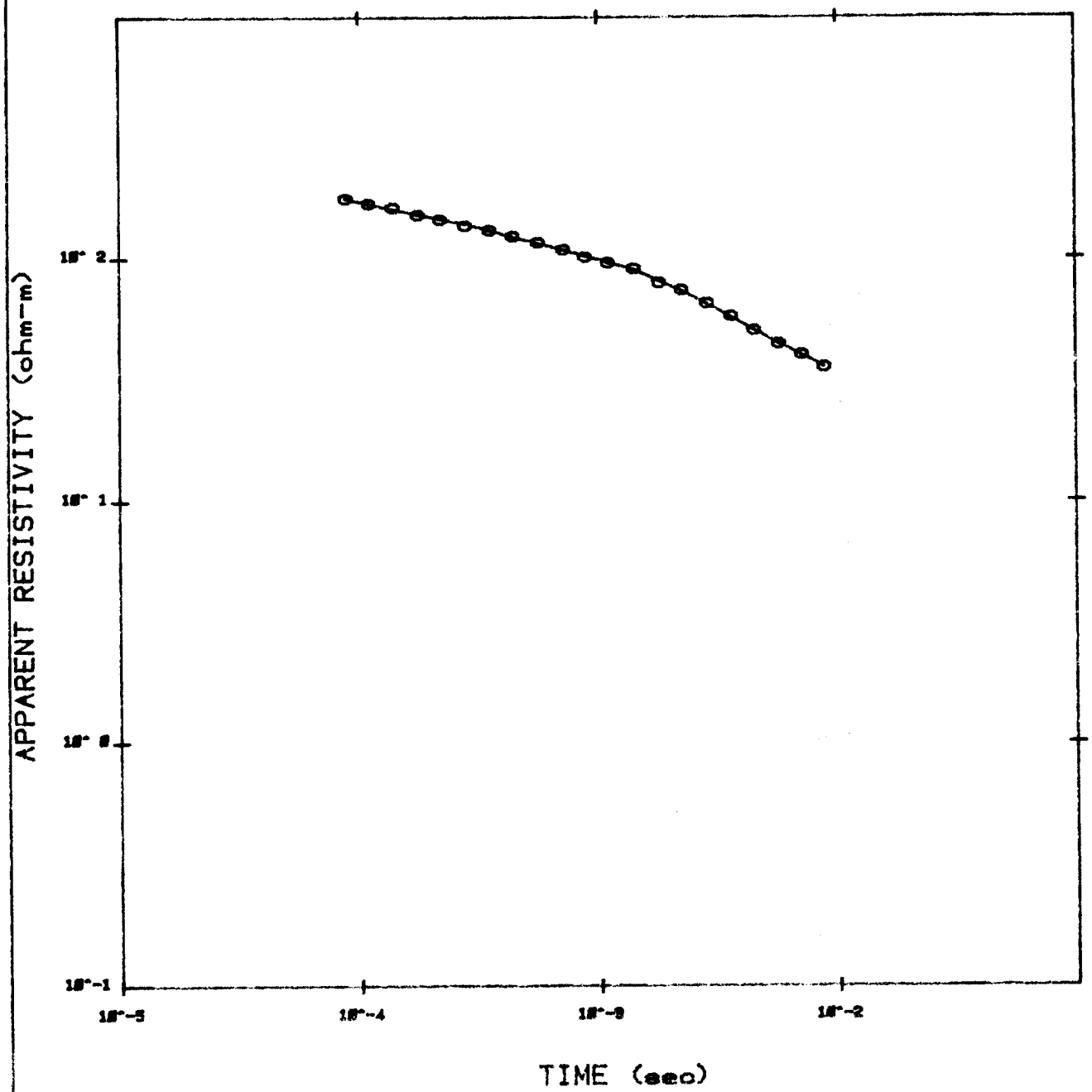
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		2097.0	6880.0		
138.65	285.9	1811.2	5942.1	2.1	2.1
22.72					

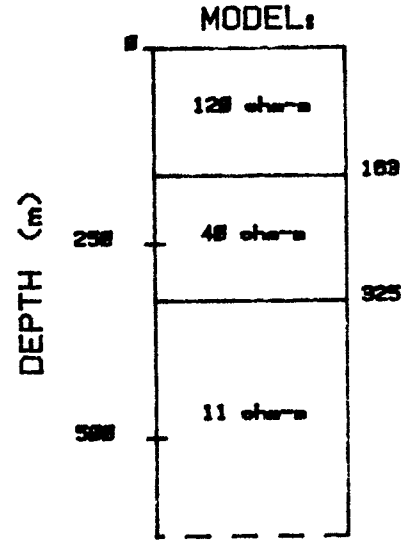
TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.12E+02	0.11E+02	+4.545	0.19E+03
0.11E-03	0.74E+01	0.71E+01	+4.162	0.18E+03
0.14E-03	0.42E+01	0.43E+01	-1.782	0.18E+03
0.18E-03	0.25E+01	0.25E+01	-1.096	0.17E+03
0.22E-03	0.15E+01	0.15E+01	-1.748	0.17E+03
0.28E-03	0.83E+00	0.82E+00	+0.144	0.16E+03
0.35E-03	0.45E+00	0.45E+00	-0.044	0.16E+03
0.44E-03	0.26E+00	0.26E+00	-0.434	0.16E+03
0.56E-03	0.15E+00	0.15E+00	-0.570	0.16E+03
0.71E-03	0.86E-01	0.86E-01	-0.427	0.15E+03
0.88E-03	0.57E-01	0.56E-01	+1.887	0.14E+03
0.11E-02	0.36E-01	0.37E-01	-2.847	0.13E+03
0.14E-02	0.22E-01	0.23E-01	-4.662	0.12E+03
0.18E-02	0.15E-01	0.15E-01	+0.601	0.10E+03
0.22E-02	0.11E-01	0.11E-01	-0.655	0.93E+02
0.29E-02	0.71E-02	0.69E-02	+2.203	0.81E+02
0.36E-02	0.47E-02	0.46E-02	+3.621	0.72E+02
0.45E-02	0.32E-02	0.31E-02	+2.783	0.65E+02
0.57E-02	0.20E-02	0.19E-02	+3.189	0.59E+02
0.71E-02	0.12E-02	0.13E-02	-2.577	0.56E+02
0.88E-02	0.85E-03	0.85E-03	-0.212	0.51E+02
0.11E-01	0.53E-03	0.55E-03	-4.087	0.48E+02

R: 168. X: 0. Y: 0. DL: 0. REQ: 168. CF: 1.0000
TDHZ ARRAY, 22 DATA POINTS, SYSTEM: NONE DATA: L6005180
JOB #685143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 6 STA 18 OCT. 22, 1985
RMS LOG ERROR: 1.09E-02, ANTILOG YIELDS 2.5469 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	T 1	F 0
P 1	1.00			
P 2	.00	1.00		
T 1	.00	.00	1.00	
F 0	.00	.00	.00	.00





ERROR= 1.3794 %
LOOP RADIUS= 160m

• FIELD DATA

— MODEL CURVE

THE EARTH TECHNOLOGY CORP.

UNOCAL Geothermal

Medicine Lake CA

LINE: 6 STA.: 19

APPARENT RESISTIVITY CURVE

JOB #C85143 Fig.

L6005190

MODEL: 3 LAYERS

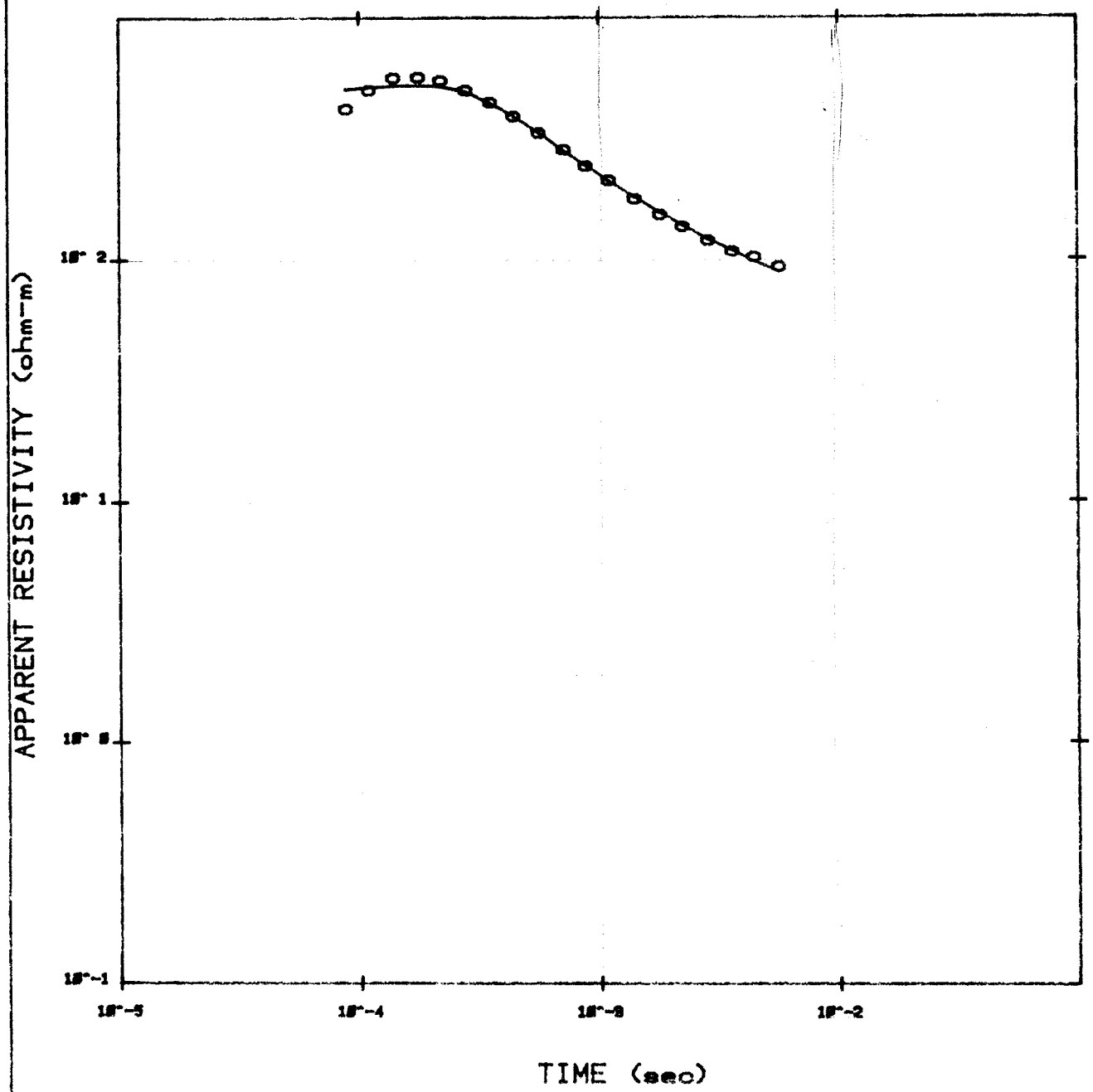
RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		2097.0	6880.0		
118.11	163.0	1934.1	6345.4	1.4	1.4
39.53	161.6	1772.5	5815.2	4.1	5.5
11.07					

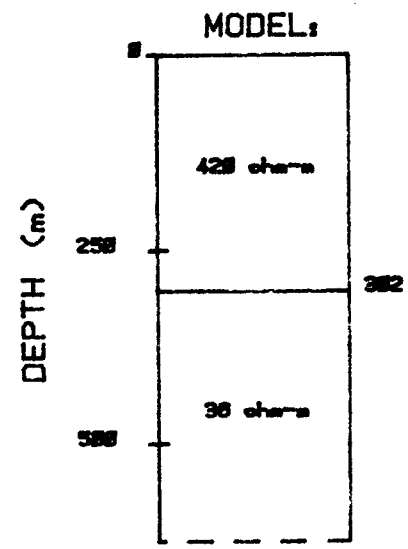
TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.13E+02	0.13E+02	+0.492	0.18E+03
0.11E-03	0.80E+01	0.80E+01	-0.521	0.17E+03
0.14E-03	0.47E+01	0.48E+01	-2.360	0.16E+03
0.18E-03	0.28E+01	0.28E+01	+0.615	0.15E+03
0.22E-03	0.18E+01	0.18E+01	+1.225	0.15E+03
0.28E-03	0.11E+01	0.10E+01	+2.536	0.14E+03
0.35E-03	0.63E+00	0.63E+00	+0.060	0.13E+03
0.44E-03	0.40E+00	0.40E+00	-1.545	0.12E+03
0.56E-03	0.24E+00	0.24E+00	-1.817	0.12E+03
0.71E-03	0.14E+00	0.14E+00	-0.950	0.11E+03
0.88E-03	0.95E-01	0.93E-01	+2.146	0.10E+03
0.11E-02	0.59E-01	0.59E-01	+0.363	0.96E+02
0.14E-02	0.35E-01	0.35E-01	-1.245	0.91E+02
0.18E-02	0.23E-01	0.22E-01	+2.643	0.79E+02
0.22E-02	0.15E-01	0.15E-01	-0.508	0.74E+02
0.29E-02	0.97E-02	0.98E-02	-0.887	0.65E+02
0.36E-02	0.65E-02	0.66E-02	-1.337	0.58E+02
0.45E-02	0.46E-02	0.45E-02	+0.634	0.51E+02
0.57E-02	0.30E-02	0.30E-02	+1.111	0.45E+02
0.71E-02	0.20E-02	0.20E-02	-0.807	0.40E+02
0.88E-02	0.14E-02	0.14E-02	+0.454	0.36E+02

R: 168. X: 0. Y: 0. DL: 0. REQ: 168. CF: 1.0000
TDHZ ARRAY, 21 DATA POINTS, SYSTEM: NONE DATA: L6005190
JOB #G85143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 6 STA 19 OCT. 22, 1985
RMS LOG ERROR: 5.95E-03, ANTILOG YIELDS 1.3794 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	1.00					
P 2	.00	1.00				
P 3	.00	.00	1.00			
T 1	.00	.00	.00	1.00		
T 2	.00	.00	.00	.00	1.00	
F 0	.00	.00	.00	.00	.00	.00





DEPTH (m)

ERROR= 8.4420 %
LOOP RADIUS= 100m

● FIELD DATA

— MODEL CURVE

THE EARTH TECHNOLOGY CORP.

UNOCAL Geothermal

Medicine Lake CA

LINE: 6 STA.: 20

APPARENT RESISTIVITY CURVE

JOB #C85143 Fig.

L600S200

MODEL: 2 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S/M) LAYER	CONDUCTANCE (S/M) TOTAL
		2072.6	6800.0		
424.97	302.3	1770.4	5808.4	.7	.7
35.67					

TIMES	DATA EARLY	CALC EARLY	% ERROR	DATA LATE
0.88E-04	0.36E+01	0.27E+01	+32.465	0.42E+03
0.11E-03	0.16E+01	0.15E+01	+4.419	0.50E+03
0.14E-03	0.74E+00	0.83E+00	-10.769	0.56E+03
0.18E-03	0.40E+00	0.45E+00	-10.869	0.56E+03
0.22E-03	0.25E+00	0.27E+00	-7.746	0.54E+03
0.28E-03	0.16E+00	0.16E+00	-2.106	0.50E+03
0.35E-03	0.10E+00	0.10E+00	-1.495	0.44E+03
0.44E-03	0.71E-01	0.71E-01	+0.657	0.39E+03
0.56E-03	0.49E-01	0.49E-01	+0.645	0.33E+03
0.71E-03	0.34E-01	0.34E-01	-0.454	0.28E+03
0.88E-03	0.25E-01	0.25E-01	+1.359	0.24E+03
0.11E-02	0.18E-01	0.18E-01	-0.518	0.21E+03
0.14E-02	0.13E-01	0.12E-01	+3.238	0.18E+03
0.18E-02	0.86E-02	0.83E-02	+3.264	0.15E+03
0.22E-02	0.59E-02	0.58E-02	+2.405	0.14E+03
0.29E-02	0.39E-02	0.39E-02	+2.149	0.12E+03
0.36E-02	0.26E-02	0.25E-02	+1.334	0.11E+03
0.44E-02	0.16E-02	0.17E-02	-5.093	0.10E+03
0.56E-02	0.10E-02	0.11E-02	-6.272	0.93E+02

R: 168. X: 0. Y: 0. DL: 0. REQ: 168. CF: 1.0000
TDHZ ARRAY, 19 DATA POINTS, SYSTEM: NONE DATA: L600S200
JOB #G85143 UNOCAL GEOTHERMAL - MT. SHASTA CALIF
LINE 6 STA 20 OCT. 21, 1985
RMS LOG ERROR: 3.52E-02, ANTILOG YIELDS 5.4420 %

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	T 1	F 0
P 1	1.00			
P 2	.00	1.00		
T 1	.00	.00	1.00	
F 0	.00	.00	.00	.00

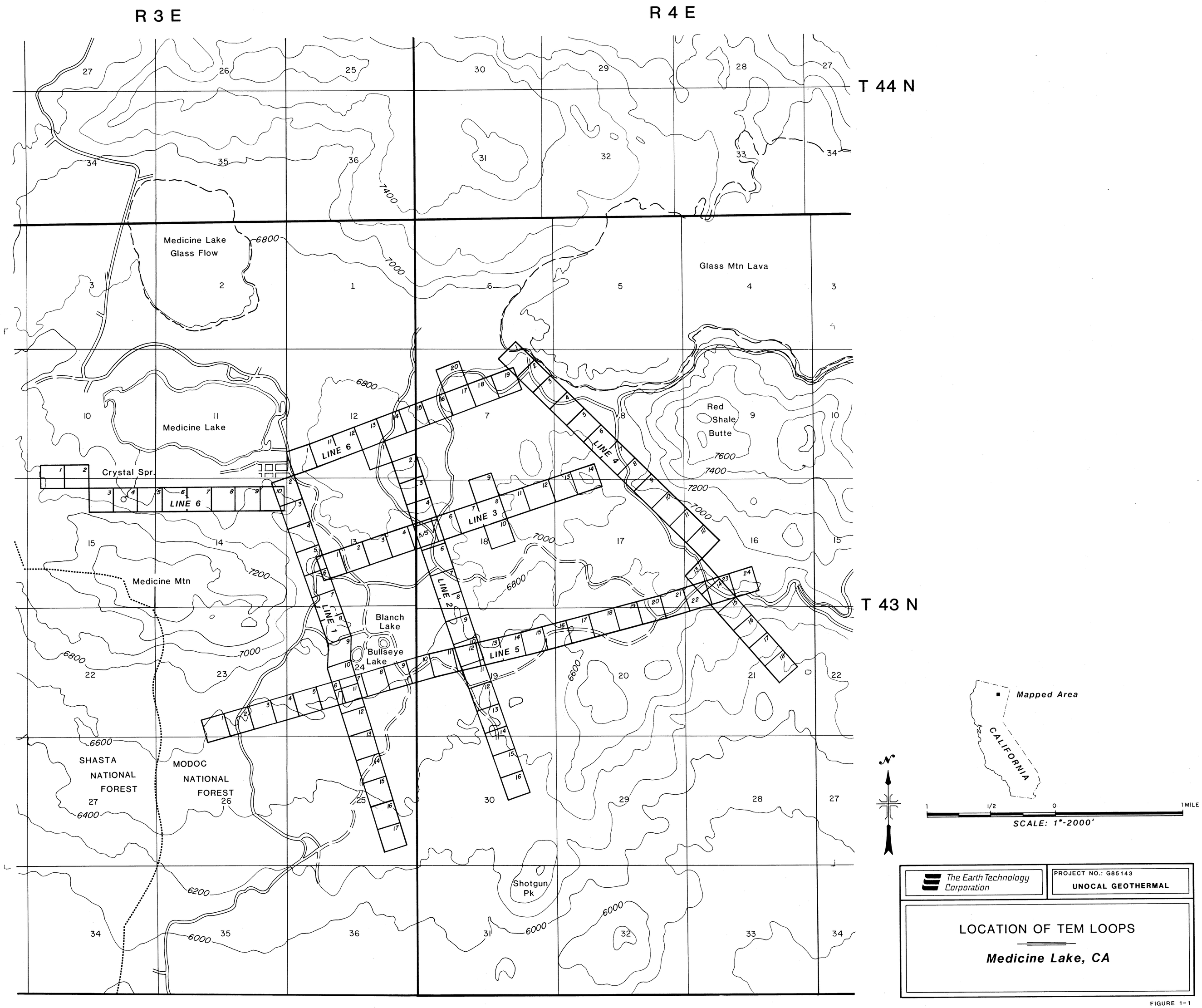


FIGURE 1-1

ET '85

APPENDIX G:
TEM Survey Medicine Lake Highland, California. Prepared for Unocal Geothermal Division, Santa Rosa CA. Job # G86179

Attachment VI

CEC-500-2007-XXX-ATVI

TEM Survey Medicine Lake Highland, California. Prepared for Unocal Geothermal Division, Santa Rosa CA. Job # G86179

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MEDICINE LAKE HIGHLANDS,
CALIFORNIA
TEM SURVEY

38.06

TEM SURVEY
MEDICINE LAKE HIGHLAND, CALIFORNIA

Prepared For:
UNOCAL Geothermal Division
Santa Rosa, California

Prepared By:
The Earth Technology Corporation
Geophysics Department
2801 Youngfield, #390
Golden, Colorado 80401

September 1986
G86179

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2.1	FIELD CREW	-2-
2.2	GEOPHYSICAL SURVEY	-2-
3.0	INVERSIONS OF TEM DATA	-3-
4.0	COMPARISON WITH PREVIOUS TEM DATA	-5-
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APPENDICES

Appendix A - EM-37 Manufacturer's Specifications

Appendix B - Calculation of Apparent Resistivity

ATTACHMENTS

Attachment 1 - Inverted TEM Solutions

LIST OF FIGURES

Figure 1-1 Location of TEM Loop Soundings

Figure 3-1 Transmitter Current Waveform

Figure 4-1 Comparison of 1986 TEM Data to 1985 TEM Data - Site 24

Figure 4-2 Comparison of 1986 TEM Data to 1985 TEM Data - Site 17

Figure 4-3 Comparison of 1986 TEM Data to 1985 TEM Data - Site 22

1.0 INTRODUCTION

This report contains the results of a transient electromagnetic survey performed in the Medicine Lake Highland area, California during August, 1986. A total of 61 soundings were measured in the center of 300m by 300m loops. The locations of the loops are shown in Figure 1-1. The locations of 108 TEM soundings surveyed in 1985 are also shown on Figure 1-1.

The objective of this survey was to expand the aerial coverage of TEM data in the area.

The work was authorized by Master Agreement for Geoscientific Services #3285b between Union Oil of California and The Earth Technology Corporation.

2.0 LOGISTICS AND DATA ACQUISITION

2.1 FIELD CREW

A crew of five people was used to perform the field work. This crew consisted of a geophysical crew chief, one geophysical technician, two surveyors and a data processor. The loop corners were surveyed using a compass and prechained lengths of wire. The centers were located using a compass and pace procedure.

2.2 GEOPHYSICAL SURVEY

Measurements were made of the time derivative of the vertical magnetic field in the center of 61 transmitter loops. Measurements of background noise were also taken. The instrument used for the survey was the Geonics EM-37 operating at base frequencies of 30 hz and 3 hz. The manufacturer's specifications for the EM-37 are given in Appendix A.

The transmitter loop used was constructed with 10 gauge copper wire. Two different receiver coils were utilized with effective areas of $100m^2$ and $1,000m^2$. A summary of field activities is given in Table 2-1.

TABLE 2-1

DAILY FIELD LOG

Date	Field Work Performed
8/11-12/86	Mobilize from Golden, Colorado to Mt. Shasta, California
8/13/86	Began survey. Read loops 10, 15, 11, 9, 8 and 12 (6 loops)
8/14/86	Read loops 17, 16, 14, 13, 7, 6 and 5 (7 loops)
8/15/86	Read loops 1, 18, 2, 3, 4, 24 and 25 (7 loops)
8/16/86	Read loops 22, 23, 60, 61, 20, 19 and 21 (7 loops)
8/17/86	Read loops 32, 33, 59, 31, 58, 29 and 30 (7 loops)
8/18/86	Read loops 34, 26, 27, 28, 37 and 36 (6 loops)
8/19/86	Read loops 41, 42, 43, 44, 45, 35, 38 and 50 (8 loops)
8/20/86	Read loops 56, 57, 54, 55, 53, 52 and 51 (7 loops)
8/21/86	Read loops 49, 48, 47, 40, 46 and 39 (6 loops)
8/22/86	Mobilize from Mt. Shasta to Chester, California

3.0 INVERSIONS OF TEM DATA

The processing of TEM data consists of the following steps:

a) Correction for Ramp Turn-Off Time

The system waveform used in the Geonics EM 37 is shown in Figure 3-1. Two base frequencies were used in collection of the UNOCAL data, 30 Hz and 3 Hz. The turn-off is a linear ramp, and the ramp time was recorded for each sounding. The measured electromotive forces are deconvoluted for the turn-off ramp. At the present time our forward modeling and inversion programs use a perfect step turn-off, so that the experimental data is corrected to correspond to a step function.

The correction factor K(t) applied to the data is:

$$K(t) = \frac{R(t)}{Q(t)}$$

where R(t) is the response for a finite linear ramp turn-off
Q(t) is the response for a step turn-off

The response measured in the field corresponds to R(t). The response used for inversion and for comparison with forward models is:

$$Q(t) = \frac{R(t)}{K(t)}$$

At late time, this correction for the ramp turn-off approaches a decay of $t^{-5/2}$.

The above deconvolution procedure for the turn-off ramp has proven more accurate than incorporating the deconvolution into the inversion program.

b) Computation of Apparent Resistivities. The equations for the calculation of apparent resistivities are discussed in Appendix B.

c) Early time apparent resistivities are entered in the ARRTI inversion program. The input required for this program are the number of layers and a first guess solutions. Subsequent iterations preserve the number of layers, but the resistivities and thicknesses of each layer can either freely float or can be fixed at some value. In the solutions of this report all values were allowed to float. The solution is somewhat influenced by the parameters of the first guess solution, therefore albums of forward model curves are used for arriving at the first guess solution.

A summary of the inverted solutions is given in Table 3-1. A printout and plot of the field data along with the best fit model are given in Attachment 1.

TABLE 3-1

SUMMARY OF SOLUTIONS

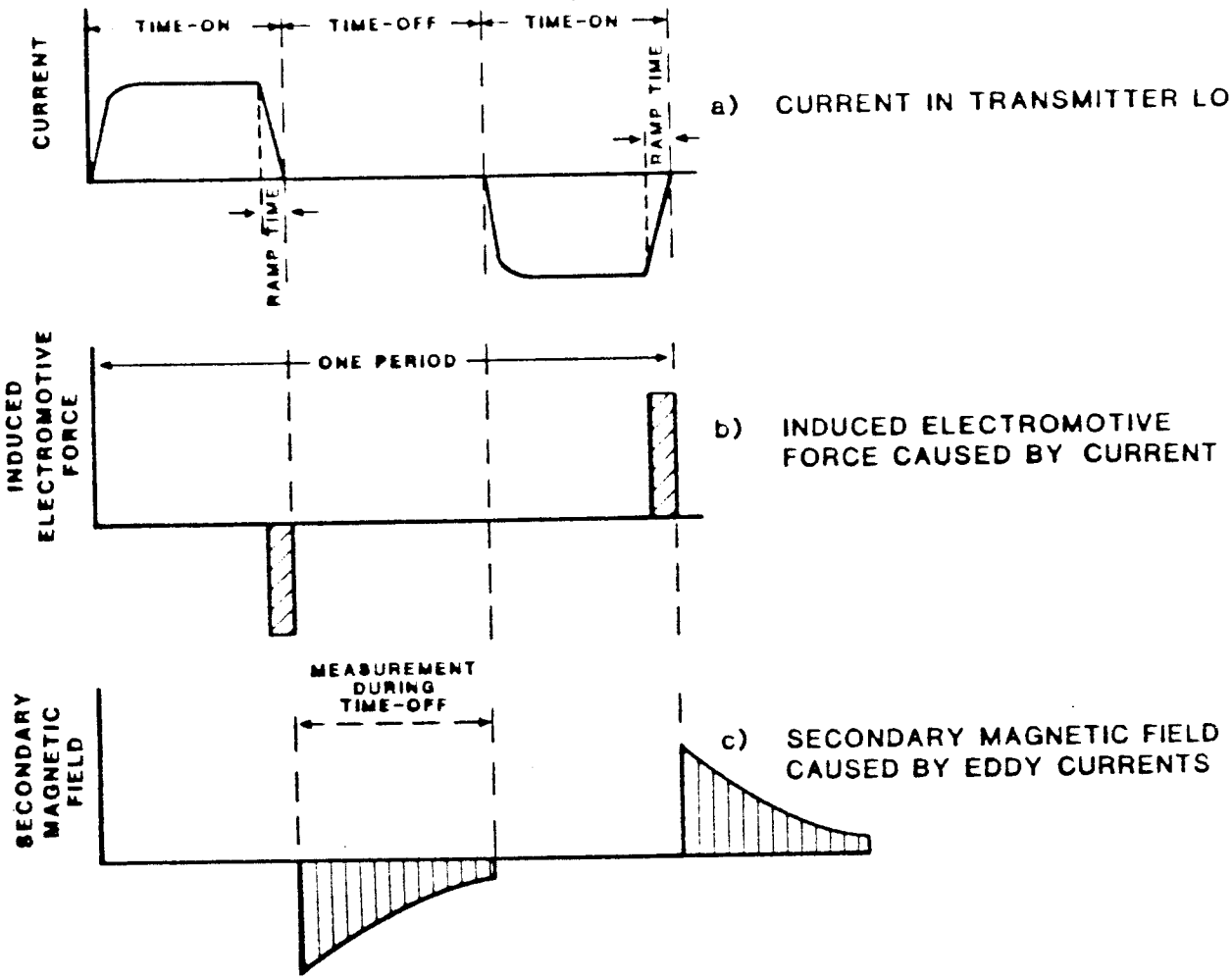
Site #	# Layers	Resistivities (ohm-m)				Thicknesses (m)		
		ρ_1	ρ_2	ρ_3	ρ_4	h_1	h_2	h_3
1	1	602						
2	2	1149	257			630		
3	3	384	1045	79		96	976	
4	4	329	2017	371	77	89	300	491
5	4	7013	150	573	46	273	210	31
6	3	3354	259	56		290	517	
7	4	413	33	10	1.4	190	116	174
8	4	1446	130	7.5	18	124	123	105
9	3	412	32	12		149	52	
10	3	1192	83	16		173	129	
11	3	321	13	2.5		211	389	
12	3	423	19	1.5		196	409	
13	4	866	149	807	46	125	234	217
14	4	807	339	791	51	173	212	215
15	3	506	39	16		218	167	
16	3	1695	790	141		433	321	
17	3	1588	696	114		518	340	
18	3	1751	467	205		332	239	
19	3	4472	966	54		138	483	
20	3	3434	1250	52		84	587	
21	3	542	48	7		261	143	
22	3	595	24	3.1		298	101	
23	3	650	54	15		210	59	
24	3	936	24	8.2		334	83	
25	3	799	20	3.8		369	157	
26	4	315	421	112	4.9	119	135	136
27	3	541	55	4.5		202	179	
28	3	1418	231	67		373	236	
29	3	5864	414	95		198	396	
30	2	816	97			626		
31	3	654	1700	226		122	669	
32	3	680	217	42		417	263	
33	3	293	6377	326		75	636	
34	3	870	71	6.3		393	245	
35	2	2033	91			517		
36	2	1970	149			469		
37	2	1287	115			412		
38	3	4904	277	44		259	228	

TABLE 3-1

SUMMARY OF SOLUTIONS

(Continued)

Site #	# Layers	Resistivities (ohm-m)				Thicknesses (m)		
		ρ_1	ρ_2	ρ_3	ρ_4	h_1	h_2	h_3
39	3	2405	253	51		533	214	
40	3	1931	516	155		373	141	
41	3	1100	41	2.1		244	85	
42	3	727	42	7.9		355	168	
43	3	1367	269	72		406	255	
44	3	874	201	111		328	333	
45	2	1525	308			359		
46	3	2368	290	48		467	260	
47	2	1919	210			528		
48	3	1656	320	136		427	312	
49	3	1481	258	101		535	443	
50	2	1016	117			524		
51	3	3289	568	98		80	347	
52	2	1193	190			601		
53	3	1550	594	216		354	532	
54	3	7909	926	181		128	803	
55	3	1873	806	174		154	614	
56	3	829	1377	203		110	593	
57	3	655	343	170		345	277	
58	3	362	2544	163		89	639	
59	3	277	2491	167		120	858	
60	3	4220	760	185		423	522	
61	3	6275	1080	260		250	644	



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PROJECT NO.: G86179

UNOCAL GEOTHERMAL

TRANSMITTER CURRENT WAVEFORM

Medicine Lake Highland, TEM Survey

FIGURE 3-

4.0 COMPARISON WITH PREVIOUS TEM DATA

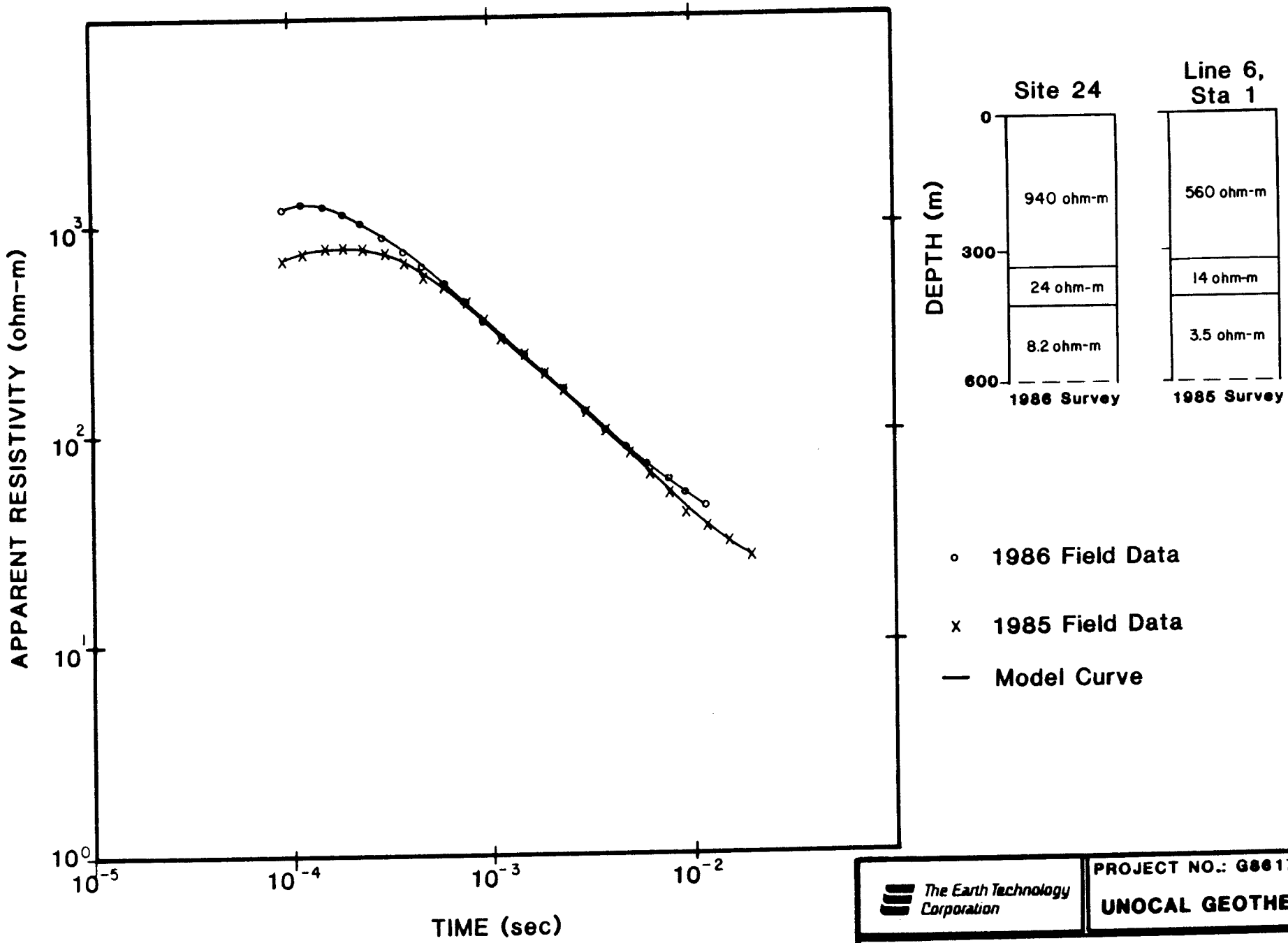
Three of the sites from the 1986 survey were located near loops measured during the 1985 TEM survey. To investigate the repeatability of the TEM data, the solutions and data curves from the two surveys have been compared. Table 4-1 shows the loop numbers compared, the distance between the two loops, and the inverted solutions, for all three locations. In addition, the Table also lists the number of the figure which illustrates the differences in the measured curves.

As the Table and figures show, there is good agreement between both the measured data and the inverted solutions at all three sites.

TABLE 4-1

COMPARISON BETWEEN 1985 TEM AND 1986 TEM SURVEY RESULTS

1986 Site #	1985 Loop		Dist. Apart (Ft.)	1986 Results						1985 Results					Fig. #
	Line #	Sta. #		ρ_1 (ohm-m)	h_1 (m)	ρ_2	h_2 (m)	ρ_3		ρ_1	h_1	ρ_2	h_2	ρ_3	
24	6	1	2000	940	334	24	84	8.2		560	324	14	75	3.5	4-1
17	5	1	3000	1600	518	700	340	110		1900	500	420	245	110	4-2
22	4	6	3000	600	298	24	101	3.1		550	237	15	74	1.4	4-3
22	4	7	3000	600	298	24	101	3.1		690	240	29	84	1.6	4-3



The Earth Technology Corporation

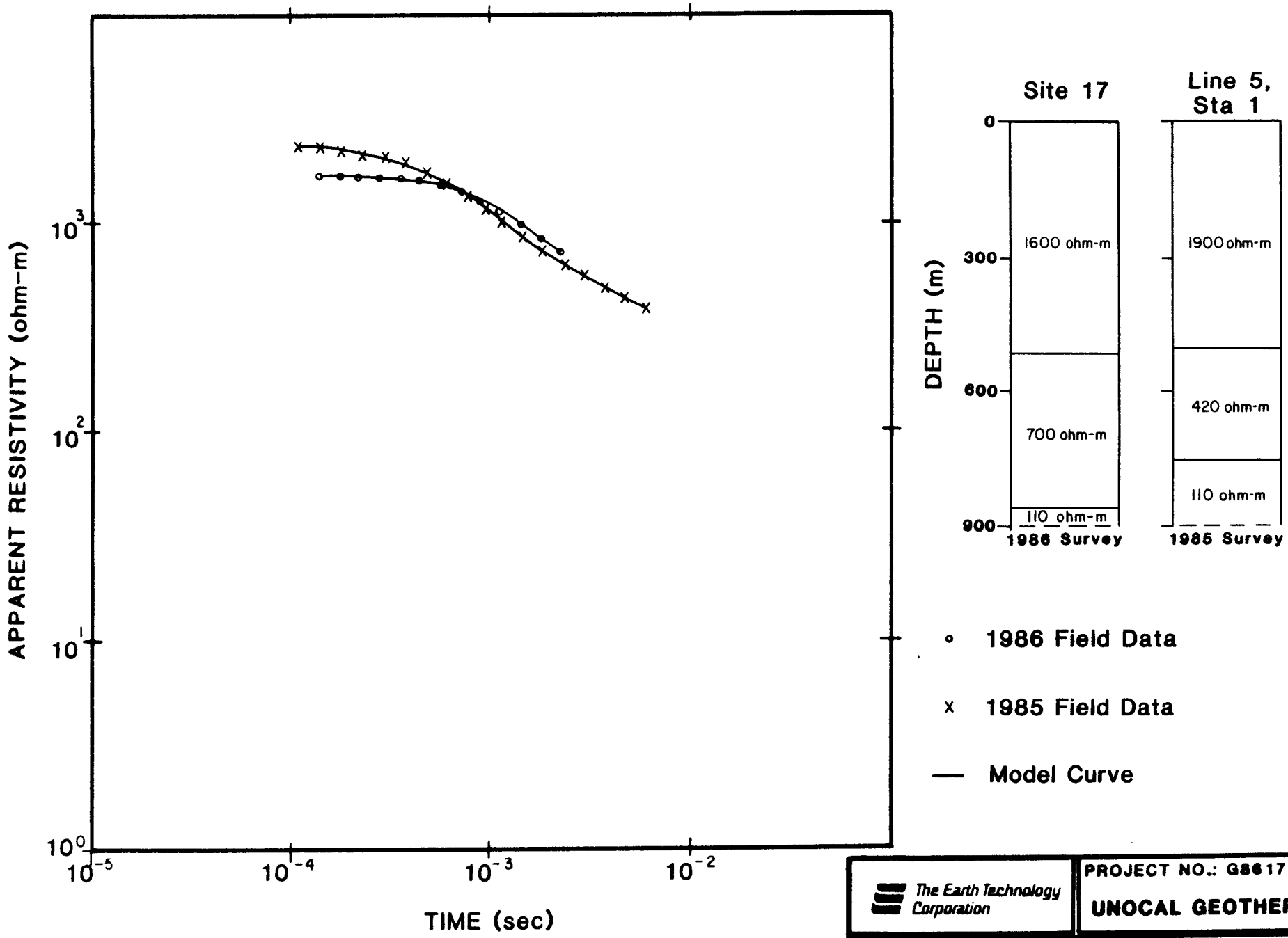
PROJECT NO.: G86179

UNOCAL GEOTHERMAL

Comparison of 1986 TEM Data to 1985 TEM Data Site 24

Medicine Lake Highland, TEM Survey

FIGURE 4-1



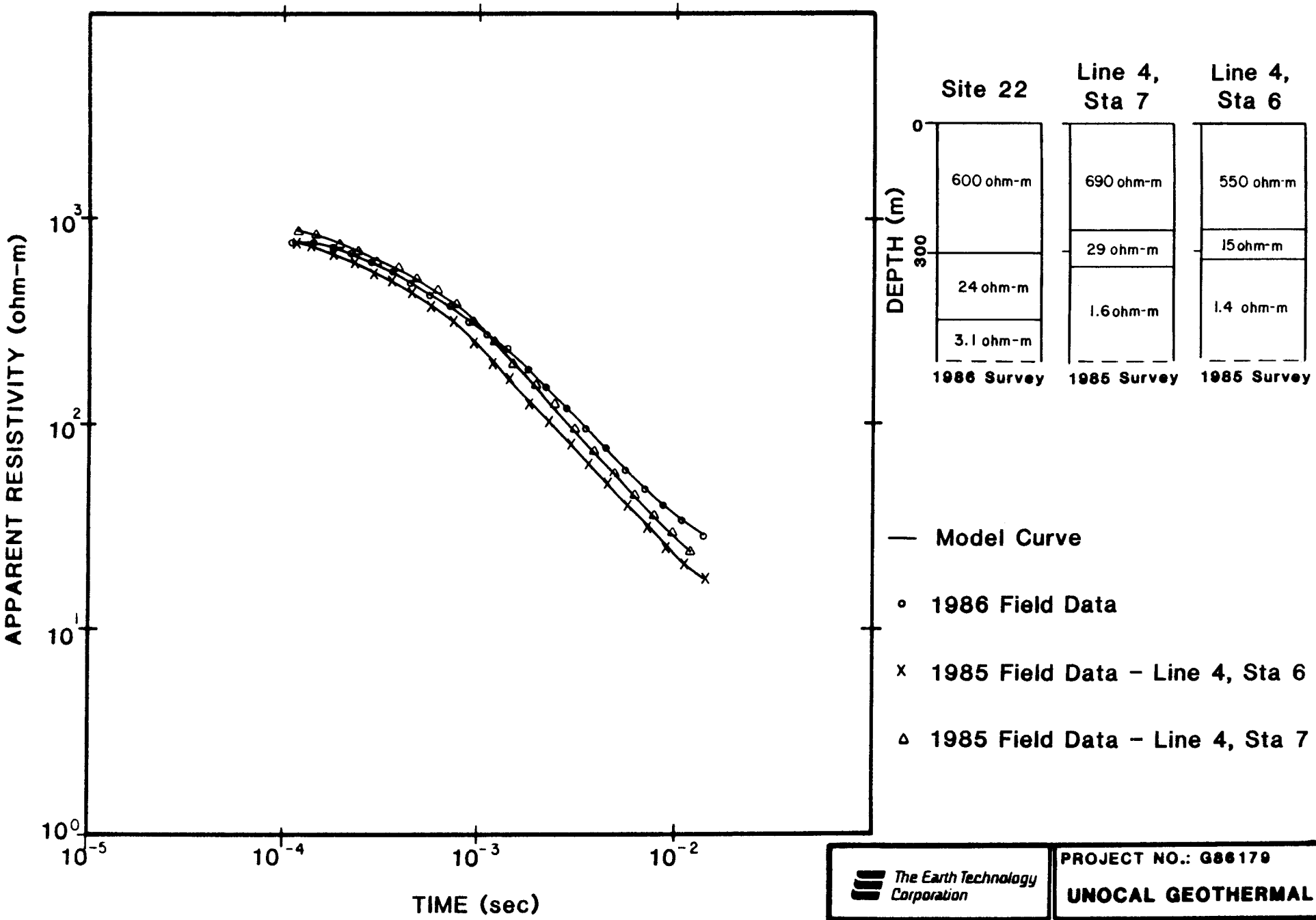
The Earth Technology Corporation

PROJECT NO.: G86179

UNOCAL GEOTHERMAL

Comparison of 1986 TEM Data to 1985 TEM Data
SITE 17
Medicine Lake Highland, TEM Survey

FIGURE 4-2



The Earth Technology Corporation

PROJECT NO.: G86179

UNOCAL GEOTHERMAL

Comparison of 1986 TEM Data to 1985 TEM Data Site 22

Medicine Lake Highland, TEM Survey

FIGURE 4-3

5.0 SUMMARY

A total of 61 TEM soundings were measured in the Medicine Lake area of California. All of the loops could be interpreted using one-dimensional horizontally layered models.

A comparison between the loops surveyed this year and nearby loops from the 1985 TEM survey shows good agreement.

GEONICS LIMITED

EM37 Ground Transient Electromagnetic System
Technical Specifications

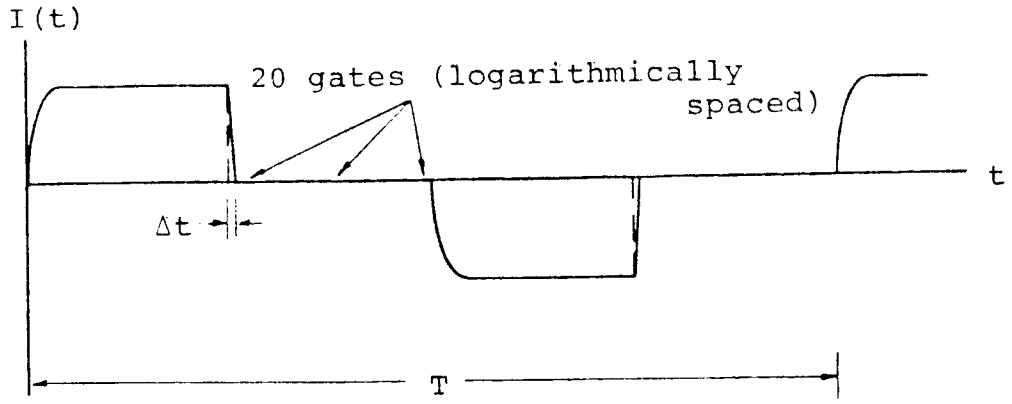
Transmitter

Current Waveform	See Figure 1
Repetition Rate	3Hz or 30Hz in countries using 60 Hz power line frequency; 2.5Hz or 25Hz in countries using 50Hz power line frequency; all four base frequencies are switch selectable.
Turn-off Time (Δt)	fast linear turn-ff of maximum 300 usec. at 20 amps into 300x600m loop. Decreases proportionally with current and loop area$^{\frac{1}{2}}$ to minimum of 20 usec. Actual value of t read on front panel meter.
Transmitter Loop	any dimensions from 40mx40m to 300mx600m maximum at 20 amps. Larger dimensions at reduced current. Transmitter output voltage switch adjustabe for smaller loops. Value of loop resistance read from front panel meter; resistance must be greater than 1 ohm on lowest voltage setting to prevent overload.
Transmitter Protection	circuit breaker protection against input over-voltage; instantaneous solid state protection against output short circuit; automatically resets on removal of short circuit. Input voltage, output voltage and current indicated on front panel meter.
Transmitter Output Voltage	160 volts (zero to peak) maximum; 20 volts (zero to peak) minimum
Transmitter Output Power	2.8 kw maximum
Transmitter Wire Supplied	1800m. #10 copper wire PVC insulated with nylon jacket; transmitter wire contained on 6 reels (supplied); 2 reel winders supplied.
Transmitter Motor Generator	5 HP Honda gasoline engine coupled to 120 volt, 3 phase, 400Hz alternator. Approximately 8 hours continuous operation from full (built-in) fuel tank.

GEONICS LIMITED

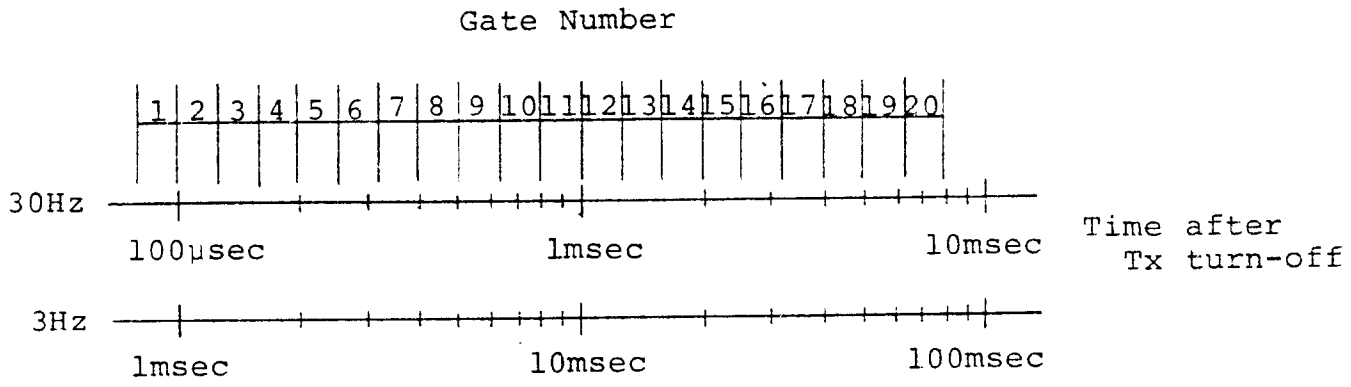
Receiver

Measured Quantity	time rate of decay of magnetic flux along 3 axes.
Sensor	air-cored coil of bandwidth 40 kHz; 1m dia. by 7cmx5cm cross-section. Coil holder supplied to facilitate measurement along 3 axes.
Time Channels	20 time channels with locations and widths as shown in Figure 2. Successive operation at 30Hz, then 3Hz, effectively gives 30 channels covering range from 80 usec. to 80msec.
Output Display	4 digit plus sign LED display; display also shows channel number and gain.
Integration Time	2^n cycles at 30 Hz; n=4,6,8,10,12,14 (switch selectable); similar integration times at other base frequencies.
Receiver Output Noise	typically 1.5×10^{-10} volt/m^2 at last gate at 30 Hz with integration time of 34 seconds. Noise will be higher during intense local spherics activity.
Output Connector	all 20 channels in analog format and house-keeping functions in digital format available from output connector.
Synchronization to TX	any of the following (switch selectable) (1) reference cable (2) primary pulse (3) 27 MHz radio link (40 channels) (4) high stability (oven controlled) quartz crystals.
Noise Rejection Circuitry	Selective clipping of atmospheric noise pluses at all times. Audio output of RX coil (transmitter pulse blanked out) is available on built-in loud speaker for ready indentification of interference.
Receiver Batteries	12 volt rechargeable Gel-cell; 9 hours continuous operating time at 17°C. Two batteries and a battery charger supplied to permit charging of second battery from transmitter motor generator during survey.



Transmitter Current Waveform

FIG. 1



Gate Location and Widths (30 and 3Hz)

FIG. 2

APPENDIX B

CALCULATION OF APPARENT RESISTIVITY

I. LATE STAGE

Late stage apparent resistivity can be calculated by using the following equation:

$$\rho_t = \left(\frac{E\phi^{h.s.}}{E\phi}\right)^{2/3} \rho_1 = \frac{\mu_0}{4\pi t} \left(\frac{r\mu_0 M_t}{5t\ E\phi}\right)^{2/3} \qquad [1]$$

where:

$E\phi^{h.s.}$ is the late stage time derivative of the electrical field over uniform half-space of resistivity ρ_1.

$E\phi$ is the late stage time derivative of the electrical field over layered ground.

r is the separation between transmitter and receiver dipoles.

M_t is the moment of the transmitter.

t is the time.

μ_0 is the magnetic susceptibility $= 4\pi \times 10^{-7}\ \frac{\text{henry}}{\text{m}}$

Solving for $E\phi$ we get:

$$E\phi = \frac{\mu_0^{3/2}}{(4\pi t)^{3/2}} \quad \frac{r\mu_0 M_t}{5t} \quad \frac{1}{\rho^{3/2}}$$

$$E\phi = \frac{\mu_0^{5/2}\ r\ M_t\ \sigma^{3/2}}{8\ t^{3/2}\ \pi^{3/2}\ 5\ t}$$

$$E\phi = \frac{\mu^{5/2}\ r\ M_t \sigma^{3/2}}{40\ \pi\sqrt{\pi}\ t^{5/2}} \qquad [2]$$

(Kaufman and Keller, Frequency and Transient Soundings, 1983, p. 334)

Assuming from the theory of reciprocity that the receiver loop can be considered the transmitter and vice versa, we sum $E\phi$ around the loop:

$$EMF = E\phi(2\pi r) = \frac{\mu_0^{5/2}\ \sigma^{3/2}\ r\ M_t\ (2\pi r)}{40\ \pi\sqrt{\pi}\ \ t^{5/2}}$$

$$= \frac{\mu_0^{5/2}\ \sigma^{3/2}\ M_t\ (2\pi r^2)}{40\ \pi\sqrt{\pi}\ \ t^{5/2}}$$

$\pi r^2 = Mr$, moment of the receiver

$$EMF = \frac{\mu_0^{5/2}\ \sigma^{3/2}\ M_t\ Mr}{20\ \pi\sqrt{\pi}\ \ t^{5/2}} \qquad [3]$$

Using equation 3, we can arrive at the voltage reading:

$$V = EMF = \frac{\mu_0^{5/2}\ \sigma^{3/2}\ M_t\ Mr}{20\ \pi\sqrt{\pi}\ \ t^{5/2}}$$

And from this we can calculate apparent resistivity from voltage:

$$\rho^{3/2} = \frac{\mu_0^{5/2}\ M_t\ Mr}{20\ \pi^{3/2}\ t^{5/2}\ V}$$

$$\rho_a = \frac{\mu^{5/3}\ Mr^{2/3}}{20^{2/3}\ \pi}\ \frac{M_t^{2/3}}{t^{5/3}\ V^{2/3}} \qquad [4]$$

The terms in the paranthesis in equation [4] are constants which only depend on the receiver coil used and on the preamplification factor of 52.1 built into the Geonic's EM 37. Since the EM 37 reads millivolts and milliseconds and the equations are in terms of volts and seconds, these conversions can also be built into this constant.

$$K_{loop} = \frac{\mu^{5/3}\ Mr^{2/3}}{20^{2/3}\ \pi}\left(\frac{1000msec}{sec}\right)^{5/3}\left(\frac{1000mV}{V}\right)^{2/3}$$

$$K_{loop} = \frac{4\ \pi\times10^{-7}\ ^{5/3}\ Mr^{2/3}}{20^{2/3}\ \pi}\left(\frac{1000msec}{sec}\right)^{5/3}\left(\frac{1000mV}{V}\right)^{2/3}$$

$$K_{loop} = 6.322 \times 10^{-5}\ Mr^{2/3}$$

For a receiver coil with an effective area of $100m^2$,

$$Mr = 100m^2 \times 52.1 = 5210 \text{ and}$$
$$K_{loop} = 6.322 \times 10^{-5} (5210)^{2/3} = 1.9 \times 10^{-2}$$

For a receiver coil with an effective area of $1000m^2$,

$$Mr = 1000m^2 \times 52.1 = 52100 \text{ and}$$
$$K_{loop} = 6.322 \times 10^{-5} (52100)^{2/3} = 8.82 \times 10^{-2}$$

Using the constants calculated above in equation [4], we now have an equation for late stage apparent resistivity:

$$\rho_a = K_{loop} \frac{M_t^{2/3}}{t^{5/3} V^{2/3}} \qquad [5]$$

Using the sounding data from Table 1, we can calculate ρ_a:

Frequency = 30 Hz
Gain = 3
Current = 17.5 amps
Receiver Coil = $100m^2$
Loop = 500m X 500m

At channel #5, t = 0.22 msec and the voltage corrected for turnoff = 3747 millivolts.

To calculate ρ_a:

1. Convert from a square loop to a circular loop:

$$r = 1.12 \frac{L}{2} = 1.12 (250m) = 280m$$

2. $M_t = A_t \times I = \pi (280)^2 (17.5 \text{ amps}) = 4.310 \times 10^6$

3. Correct the voltage for the gain:

$$V = V\, 2^{-G} = 3747(2)^{-3} = 468.4$$

4. Substitute into equation [5]:

$$\rho_a = 1.9 \times 10^{-2} \quad \frac{(4.310 \times 10^6)^{2/3}}{(.22)^{5/3}\ (468.4)^{2/3}}$$

$$\rho_a = 104.3 \text{ ohm-m}$$

II. EARLY STAGE

During early stage, the asympototic expression for $E\phi$ due to a vertical dipole source is:

$$E\phi = \frac{3M\rho}{2\pi r^4} \qquad [1]$$

(Kaufman and Keller, Frequency and Transient Soundings, 1983, p. 331)

where:

M is the moment of source and integrating around the loop yields.

$$V = 2\pi r E\phi = \frac{6\pi M \rho r}{2\pi r^4}$$

$$V = \frac{6\pi r^2 M\rho}{2\pi r^5}$$

$$V = \frac{6\ Mr\ M_t\ \rho}{2\pi r^5}$$

$$M_t = \pi r^2 I$$

$$Mr = A \text{ receiver} \times 52.1 \times 2^G$$

$$V = \frac{6\pi r^2 \times I \times A_{rec} \times 52.1\ \ 2^G \times \rho}{2\pi r^5}$$

$$V = \text{Reading} \times 10^{-3}$$

$$\rho = \frac{V \times 10^{-3} \times 2\pi r^5}{6\pi r^2\ A_{rec} \times 2^G \times I \times 52.1}$$

$$\rho = \frac{V \times 10^{-3}\ r^3}{3 \times 52.1 \times A_{rec} \times 2^G \times I}$$

$$\rho = 6.4 \times 10^{-6} \quad \frac{V \times r^3}{A_{rec} \times 2^G \times I}$$

For Ch. 5 on Table 1

$V = 3447$ mvolts

$r = 280$ m

$A_{rec} = 100\ m^2$

Gain = 3

$I = 17.5$ amps

$$\rho = \frac{6.4 \times 10^{-6}\ 1(3447)(280)^3}{100 \times 2^3 \times 17.5}$$

$\rho = 37.6$ ohm-m

3805 ??

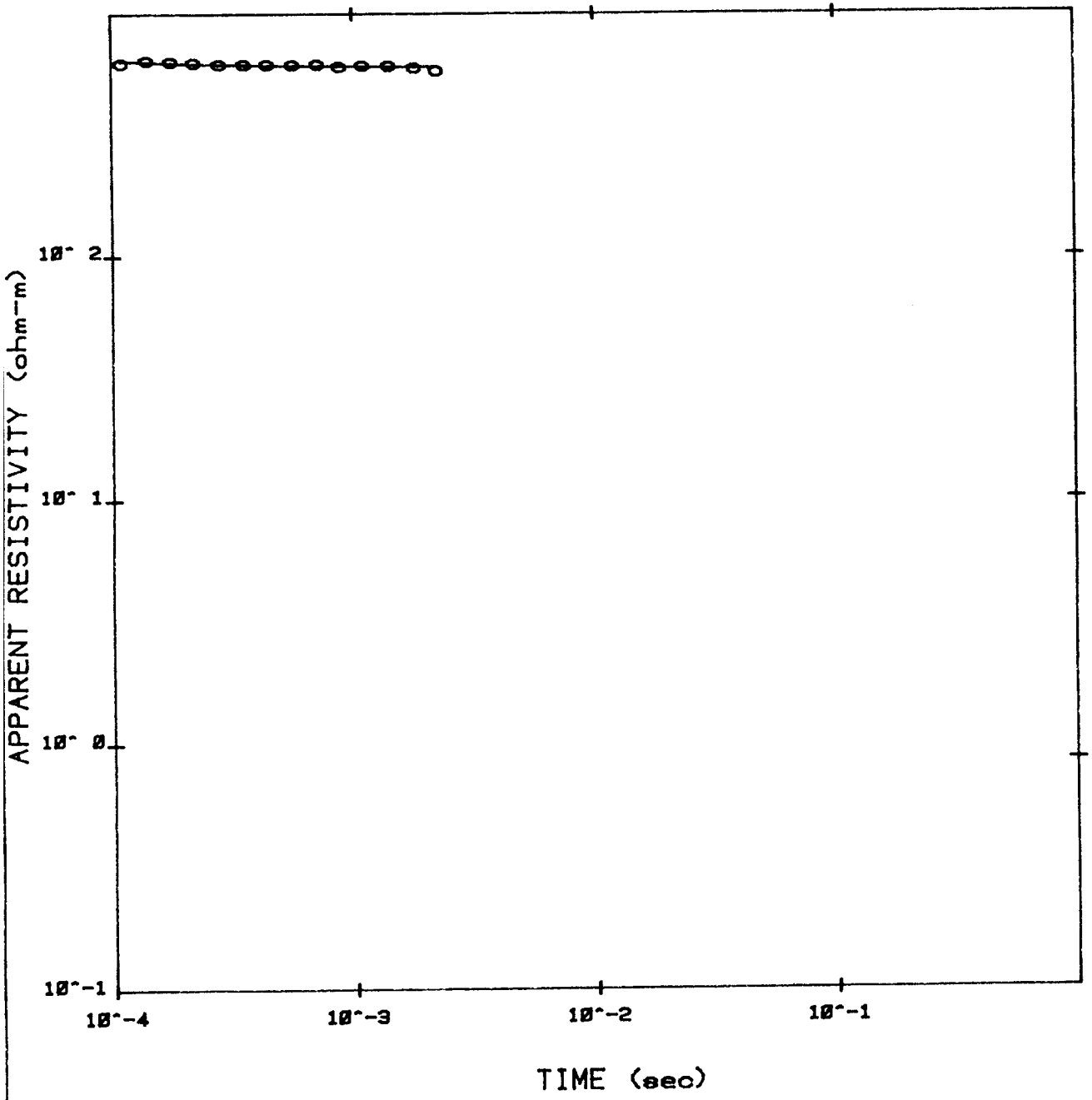
ATTACHMENT 1 GM 38.07

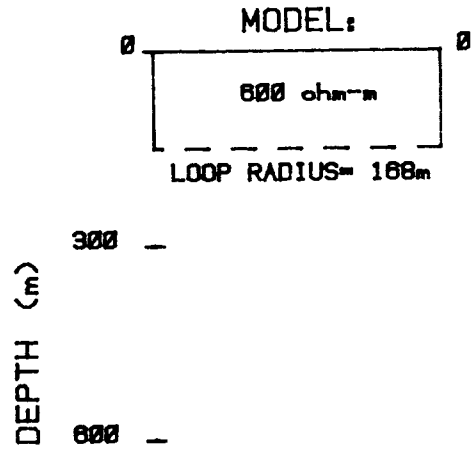
TEM SURVEY
MEDICINE LAKE HIGHLAND, CALIFORNIA

Prepared For:
UNOCAL Geothermal Division
Santa Rosa, California

Prepared By:
The Earth Technology Corporation
Geophysics Department
2801 Youngfield, #390
Golden, Colorado 80401

September 1986
G86179





o FIELD DATA

— MODEL CURVE

THE EARTH TECHNOLOGY CORP.

UNOCAL GEOTHERMAL

MEDICINE LAKE HIGHLAND

APPARENT RESISTIVITY CURVE

SITE: LOOP 1

JOB #G88179 Fig.

LOOP1

MODEL: 1 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
601.52		.0	.0		

TIMES	DATA LATE	CALC LATE	% ERROR	DATA EARLY
1.10E-04	6.23E+02	6.41E+02	-2.825	1.13E+00
1.40E-04	6.41E+02	6.33E+02	+1.255	5.92E-01
1.77E-04	6.33E+02	6.26E+02	+1.061	3.36E-01
2.20E-04	6.28E+02	6.21E+02	+1.020	1.97E-01
2.80E-04	6.18E+02	6.17E+02	+0.164	1.11E-01
3.55E-04	6.18E+02	6.14E+02	+0.782	6.11E-02
4.43E-04	6.16E+02	6.11E+02	+0.805	3.53E-02
5.64E-04	6.15E+02	6.09E+02	+0.917	1.93E-02
7.13E-04	6.17E+02	6.08E+02	+1.444	1.07E-02
8.81E-04	6.03E+02	6.07E+02	-0.602	6.53E-03
1.10E-03	6.10E+02	6.06E+02	+0.691	3.69E-03
1.41E-03	6.08E+02	6.05E+02	+0.501	1.99E-03
1.80E-03	5.97E+02	6.04E+02	-1.124	1.11E-03
2.22E-03	5.80E+02	6.04E+02	-3.919	6.87E-04

R: 168. X: 0. Y: 0. DL: 0. REQ: 0. CF: 1.0000
TDHZ ARRAY, 14 DATA POINTS, SYSTEM: NONE DATA: LOOP1
MEDICINE LAKE HIGHLAND
UNOCAL GEOTHERMAL 8-15-86
RMS LOG ERROR: 1.02E-02, ANTILOG YIELDS 2.3800 %
LATE TIME PARAMETERS

IGS: ARRTI

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	F 0
P 1	.98	
F 0	.00	.00

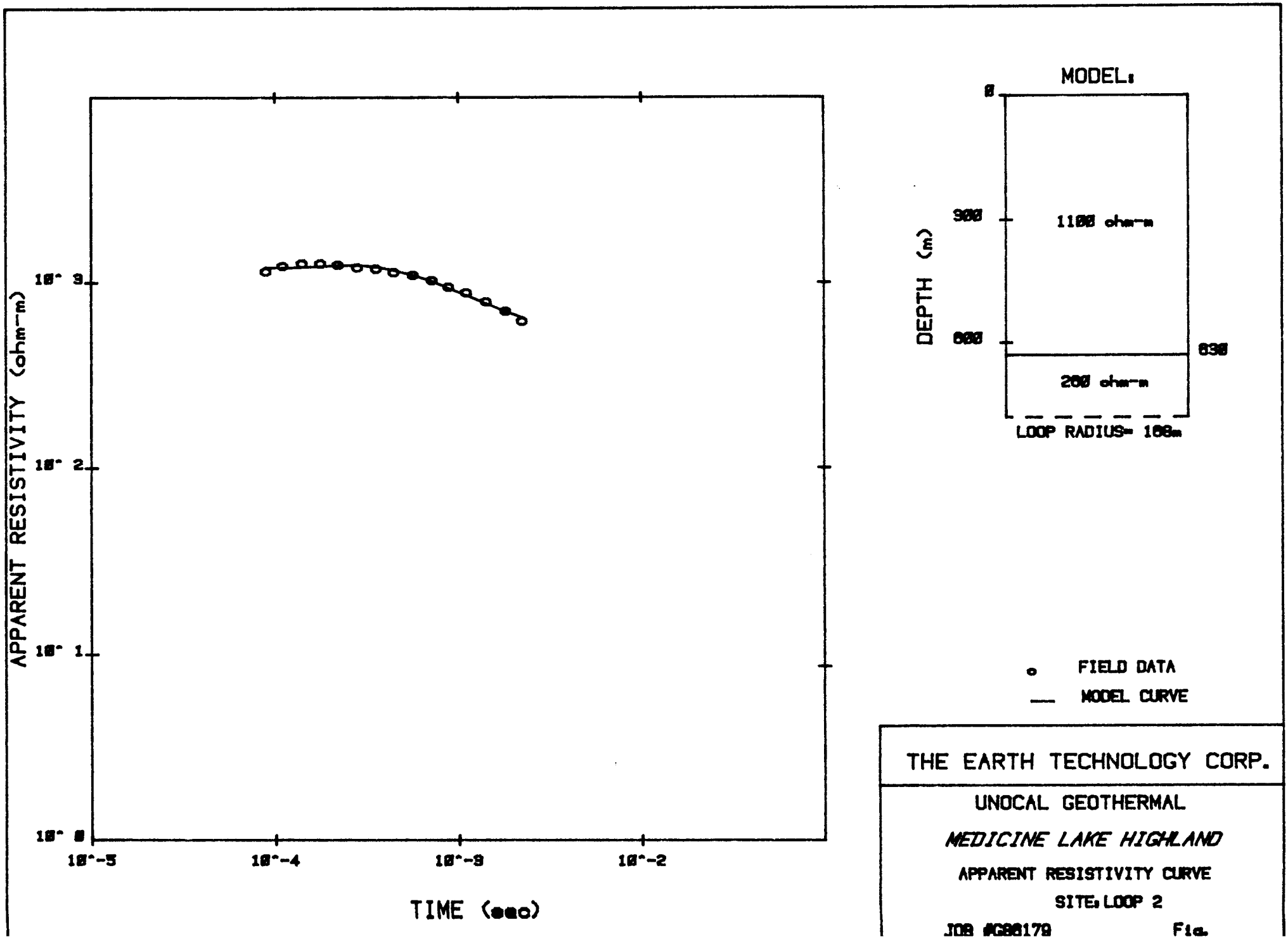
LINE: 0001
STA.: 0000

FREQUENCY = 30 hz
LOOP SIZE = 300 x 300 m
CURRENT = 22 amps
SPACING = 168 m

CH.	TIME(msec)	V(Volts/A-m^2)	RHOA-LATE	RHOA-EARLY
1	0.0890	1.5751E-06	523.40	2.4977E+00
2	0.1100	7.1179E-07	624.41	1.1289E+00
3	0.1400	3.7350E-07	642.12	5.9248E-01
4	0.1770	2.1164E-07	634.37	3.3581E-01
5	0.2200	1.2436E-07	629.32	1.9738E-01
6	0.2800	6.9647E-08	619.67	1.1058E-01
7	0.3550	3.8421E-08	620.30	6.1018E-02
8	0.4430	2.2198E-08	618.22	3.5264E-02
9	0.5640	1.2170E-08	617.11	1.9339E-02
10	0.7130	6.7435E-09	618.90	1.0719E-02
11	0.8810	4.1078E-09	605.33	6.5307E-03
12	1.0960	2.3392E-09	612.31	3.7200E-03
13	1.4110	1.2501E-09	610.26	1.9892E-03
14	1.7950	7.0255E-10	599.98	1.1183E-03
15	2.2240	4.2902E-10	583.20	6.8341E-04
16	2.8500	2.6409E-10	533.06	4.2068E-04
17	3.6000	1.6334E-10	497.50	2.6033E-04
18	4.4900	1.0652E-10	457.78	1.7052E-04
19	5.7000	7.2609E-11	397.11	1.1620E-04
20	7.1900	4.6622E-11	362.31	7.4750E-05

THE EARTH TECHNOLOGY CORP.

Job #:G86179
Client:UNOCAL
Location:MEDICINE LAKE HIGHLAND
File:MLHIGH3.DAT


APPARENT RESISTIVITY (ohm-m)
10^3
10^2
10^1
10^0
10^-5
10^-4
10^-3
10^-2
TIME (sec)
MODEL:
0
300
600
630
DEPTH (m)
1100 ohm-m
200 ohm-m
LOOP RADIUS= 100m
FIELD DATA
MODEL CURVE
THE EARTH TECHNOLOGY CORP.
UNOCAL GEOTHERMAL
MEDICINE LAKE HIGHLAND
APPARENT RESISTIVITY CURVE
SITE: LOOP 2
JOB #G88179
Fig.

LOOP2

MODEL: 2 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		.0	.0		
1149.43	629.7	-629.7	-2066.1	.5	.5
257.05					

TIMES	DATA LATE	CALC LATE	% ERROR	DATA EARLY
8.90E-05	1.15E+03	1.21E+03	-4.622	7.65E-01
1.10E-04	1.23E+03	1.21E+03	+2.025	4.07E-01
1.40E-04	1.27E+03	1.22E+03	+4.476	2.12E-01
1.77E-04	1.27E+03	1.23E+03	+3.003	1.18E-01
2.20E-04	1.25E+03	1.24E+03	+0.488	7.02E-02
2.80E-04	1.21E+03	1.25E+03	-2.596	4.04E-02
3.55E-04	1.19E+03	1.22E+03	-2.767	2.29E-02
4.43E-04	1.14E+03	1.17E+03	-2.436	1.40E-02
5.64E-04	1.10E+03	1.10E+03	-0.862	8.09E-03
7.13E-04	1.03E+03	1.02E+03	+1.168	4.97E-03
8.81E-04	9.47E+02	9.33E+02	+1.491	3.32E-03
1.10E-03	8.82E+02	8.57E+02	+2.948	2.12E-03
1.41E-03	7.88E+02	7.71E+02	+2.123	1.35E-03
1.80E-03	6.99E+02	6.98E+02	+0.109	8.77E-04
2.22E-03	6.18E+02	6.47E+02	-4.391	6.25E-04

R: 168. X: 0. Y: 0. DL: 0. REQ: 0. CF: 1.0000
TDHZ ARRAY, 15 DATA POINTS, SYSTEM: NONE DATA: LOOP2
MEDICINE LAKE HIGHLAND
UNOCAL GEOTHERMAL 8-15-86
RMS LOG ERROR: 1.79E-02, ANTILOG YIELDS 4.1985 %
LATE TIME PARAMETERS

IGS: ARRT1

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	T 1	F 0
P 1	.97			
P 2	-.02	.27		
T 1	.02	.17	.88	
F 0	.00	.00	.00	.00

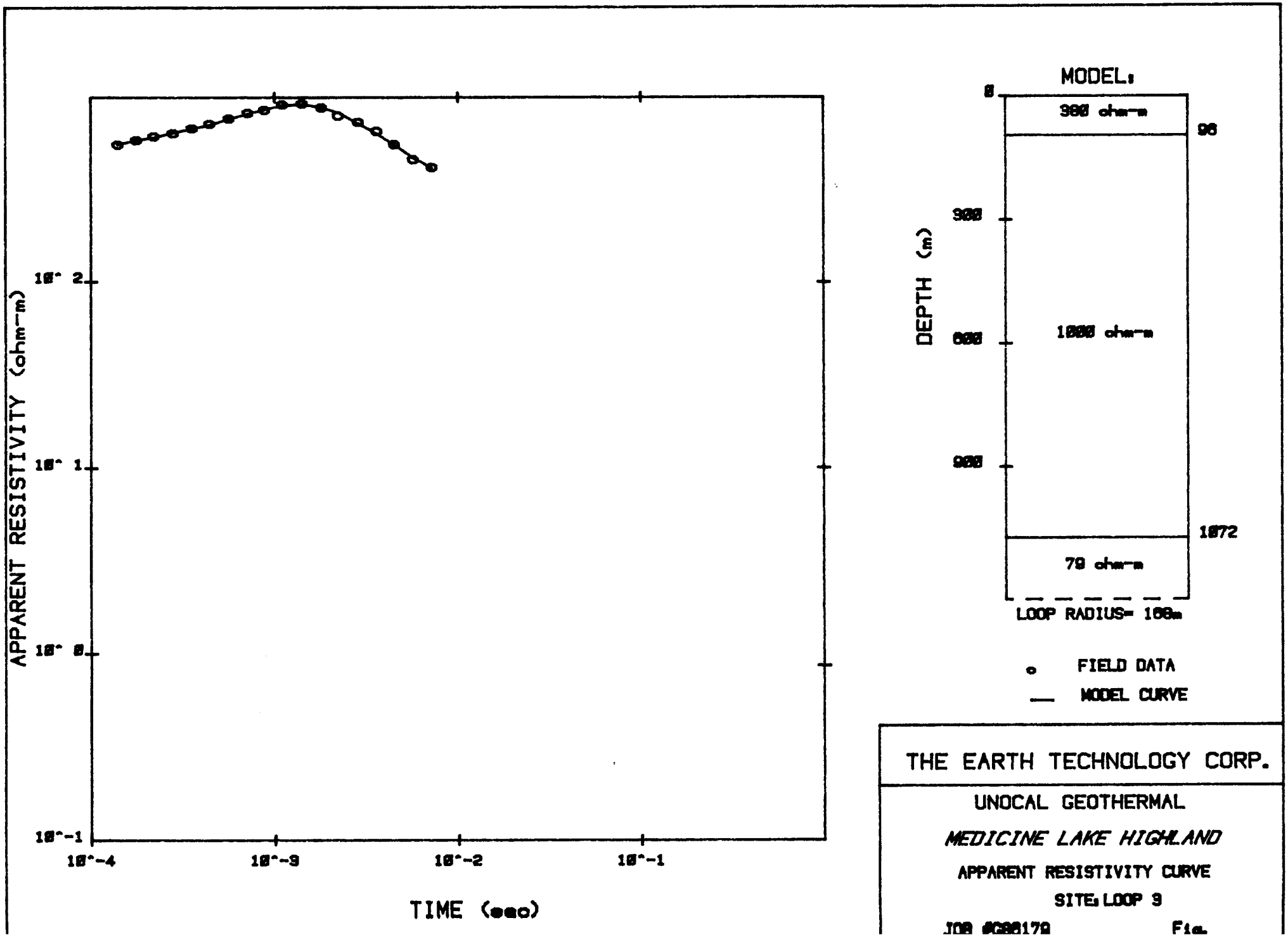
LINE: 0002
STA.: 0000

FREQUENCY = 30 hz
LOOP SIZE = 300 x 300 m
CURRENT = 22 amps
SPACING = 168 m

CH.	TIME(msec)	V(Volts/A-m^2)	RHOA-LATE	RHOA-EARLY
1	0.0890	4.8201E-07	1152.59	7.6450E-01
2	0.1100	2.5601E-07	1234.61	4.0615E-01
3	0.1400	1.3356E-07	1274.56	2.1196E-01
4	0.1770	7.4659E-08	1270.62	1.1852E-01
5	0.2200	4.4270E-08	1252.89	7.0304E-02
6	0.2800	2.5293E-08	1217.39	4.0174E-02
7	0.3550	1.4445E-08	1190.77	2.2951E-02
8	0.4430	8.7665E-09	1148.51	1.3931E-02
9	0.5640	5.1156E-09	1099.76	8.1332E-03
10	0.7130	3.1326E-09	1031.83	4.9812E-03
11	0.8810	2.0856E-09	951.13	3.3168E-03
12	1.0960	1.3440E-09	885.94	2.1381E-03
13	1.4110	8.4689E-10	791.16	1.3475E-03
14	1.7950	5.5527E-10	701.86	8.8365E-04
15	2.2240	3.9036E-10	621.09	6.2145E-04
16	2.8500	2.6647E-10	529.90	4.2438E-04
17	3.6000	1.7977E-10	466.71	2.8634E-04
18	4.4900	1.2789E-10	405.24	2.0373E-04
19	5.7000	8.8003E-11	349.33	1.4038E-04
20	7.1900	6.0332E-11	305.10	9.6727E-05

THE EARTH TECHNOLOGY CORP.

Job #:G86179
Client:UNOCAL
Location:MEDICINE LAKE HIGHLAND
File:MLHIGH3.DAT


APPARENT RESISTIVITY (ohm-m)
10^2
10^1
10^0
10^-1
10^-4
10^-3
10^-2
10^-1
TIME (sec)
MODEL:
0
300 ohm-m
96
300
1000 ohm-m
600
900
1872
79 ohm-m
LOOP RADIUS= 100m
DEPTH (m)
FIELD DATA
MODEL CURVE
THE EARTH TECHNOLOGY CORP.
UNOCAL GEOTHERMAL
MEDICINE LAKE HIGHLAND
APPARENT RESISTIVITY CURVE
SITE: LOOP 3
JOB #C88179
Fig.

LOOP3

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		.0	.0		
383.98	95.9	-95.9	-314.7	.2	.2
1045.25	975.8	-1071.7	-3516.1	.9	1.2
79.14					

TIMES	DATA LATE	CALC LATE	% ERROR	DATA EARLY
1.40E-04	5.52E+02	5.55E+02	-0.594	7.41E-01
1.77E-04	5.84E+02	5.85E+02	-0.248	3.79E-01
2.20E-04	6.13E+02	6.05E+02	+1.272	2.05E-01
2.80E-04	6.38E+02	6.43E+02	-0.809	1.05E-01
3.55E-04	6.78E+02	6.77E+02	+0.076	5.32E-02
4.43E-04	7.17E+02	7.08E+02	+1.251	2.81E-02
5.64E-04	7.67E+02	7.67E+02	-0.049	1.39E-02
7.13E-04	8.23E+02	8.15E+02	+0.992	6.95E-03
8.81E-04	8.55E+02	8.62E+02	-0.827	3.87E-03
1.10E-03	9.14E+02	9.04E+02	+1.136	2.01E-03
1.41E-03	9.25E+02	9.20E+02	+0.481	1.06E-03
1.80E-03	8.81E+02	8.82E+02	-0.184	6.20E-04
2.22E-03	7.95E+02	8.28E+02	-4.068	4.28E-04
2.85E-03	7.36E+02	7.24E+02	+1.673	2.57E-04
3.60E-03	6.57E+02	6.36E+02	+3.222	1.70E-04
4.49E-03	5.54E+02	5.51E+02	+0.449	1.27E-04
5.70E-03	4.60E+02	4.70E+02	-2.171	9.21E-05
7.19E-03	4.16E+02	4.14E+02	+0.401	5.99E-05

R: 168. X: 0. Y: 0. DL: 0. REQ: 0. CF: 1.0000
TDHZ ARRAY, 18 DATA POINTS, SYSTEM: NONE DATA: LOOP3
MEDICINE LAKE HIGHLAND
UNOCAL GEOTHERMAL 8-15-86
RMS LOG ERROR: 1.00E-02, ANTILOG YIELDS 2.3364 %
LATE TIME PARAMETERS

IGS: ARRTI

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	1.00					
P 2	.00	1.00				
P 3	.00	.00	1.00			
T 1	-.01	.00	.00	.99		
T 2	.00	.00	.00	.00	1.00	
F 0	.00	.00	.00	.00	.00	.00

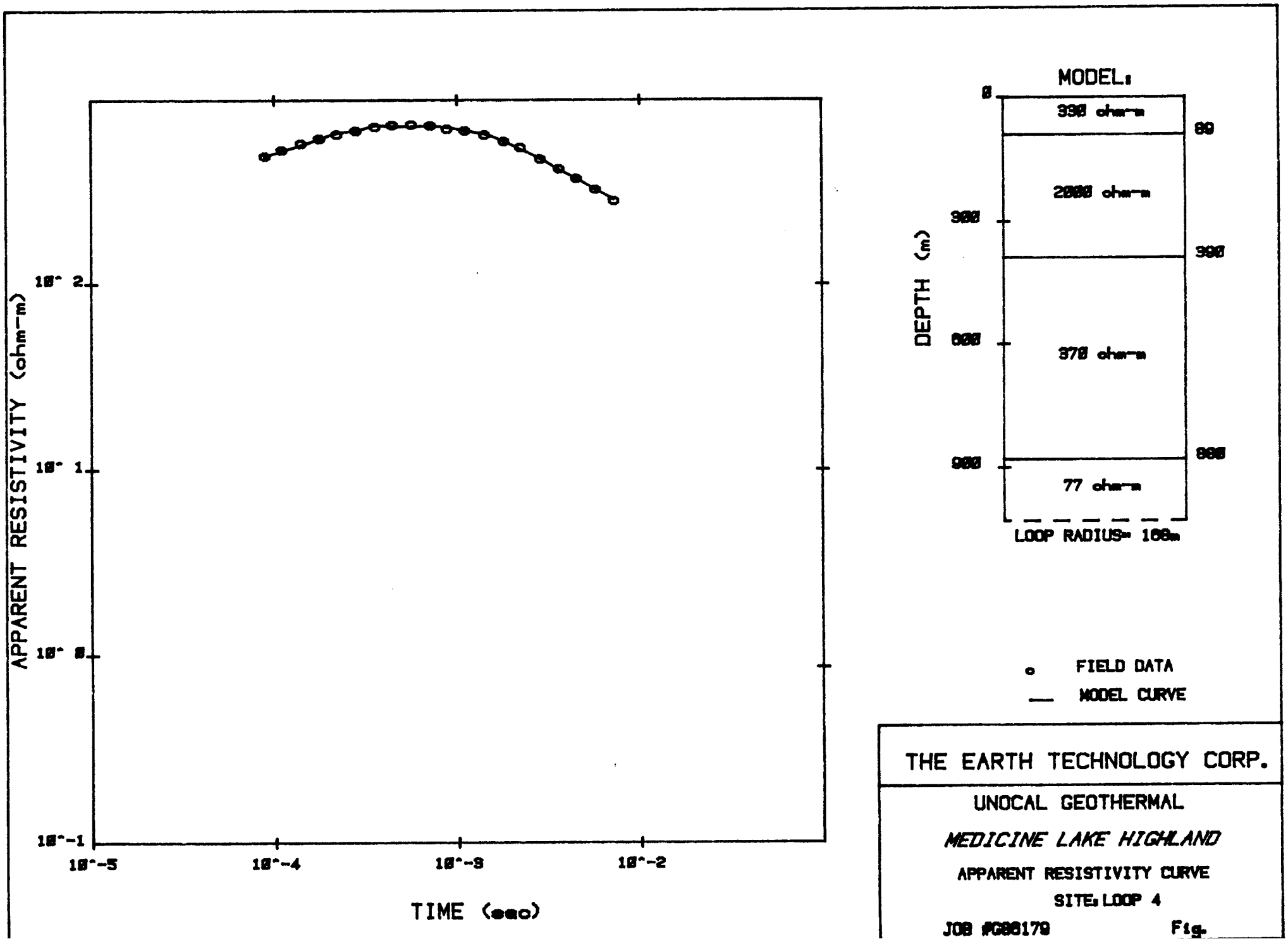
LINE: 0003
STA.: 0000

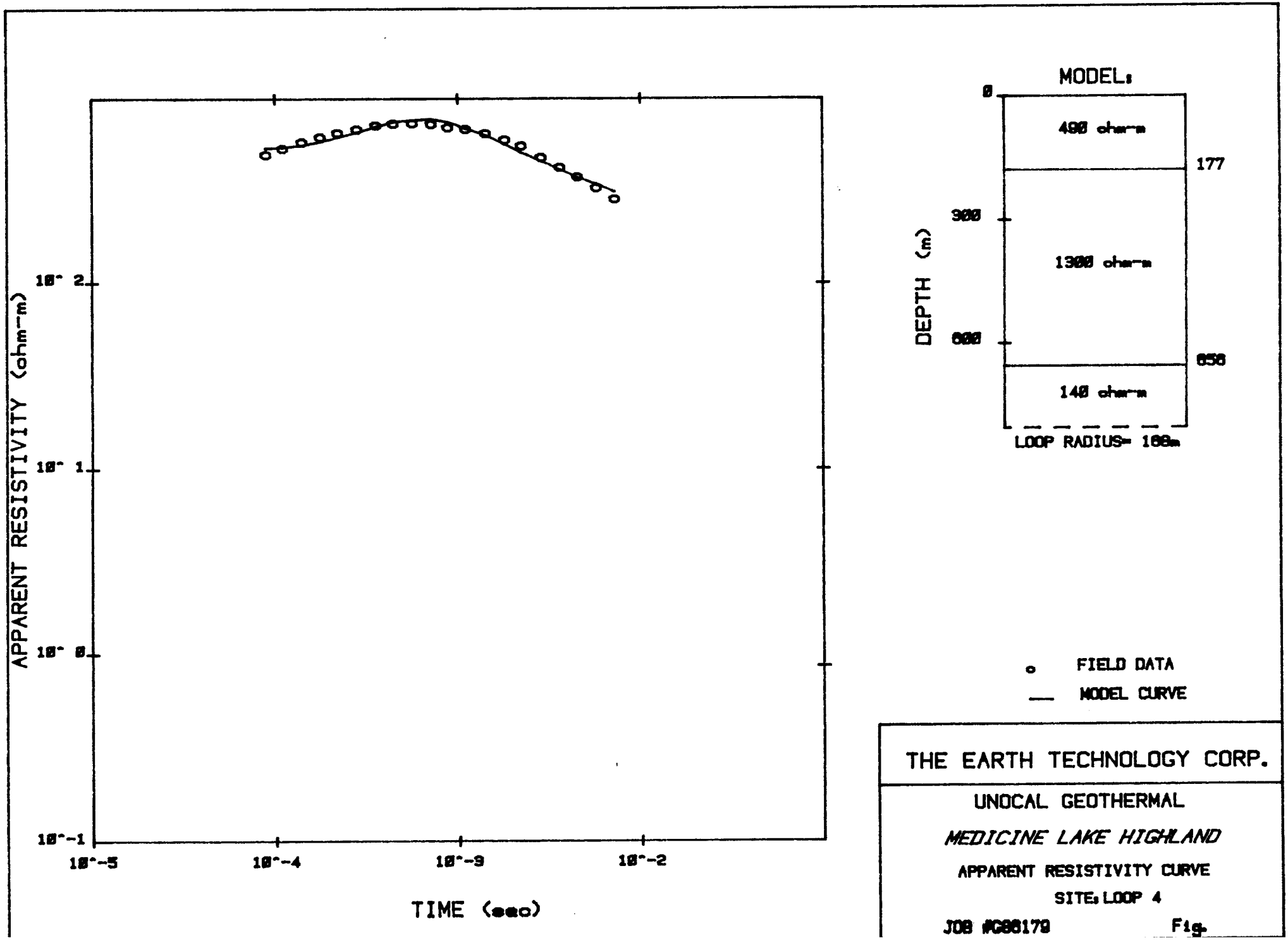
FREQUENCY = 30 hz
LOOP SIZE = 300 x 300 m
CURRENT = 22 amps
SPACING = 168 m

CH.	TIME(msec)	V(Volts/A-m^2)	RHOA-LATE	RHOA-EARLY
1	0.0890	2.0353E-06	441.19	3.2271E+00
2	0.1100	9.8625E-07	502.40	1.5638E+00
3	0.1400	4.6675E-07	553.46	7.4036E-01
4	0.1770	2.3868E-07	585.50	3.7873E-01
5	0.2200	1.2894E-07	614.32	2.0466E-01
6	0.2800	6.6440E-08	639.45	1.0549E-01
7	0.3550	3.3460E-08	680.18	5.3148E-02
8	0.4430	1.7697E-08	719.03	2.8119E-02
9	0.5640	8.7378E-09	769.65	1.3889E-02
10	0.7130	4.3703E-09	826.43	6.9497E-03
11	0.8810	2.4331E-09	858.28	3.8701E-03
12	1.0960	1.2726E-09	918.78	2.0266E-03
13	1.4110	6.6456E-10	929.95	1.0594E-03
14	1.7950	3.9117E-10	886.50	6.2439E-04
15	2.2240	2.6612E-10	801.82	4.2631E-04
16	2.8500	1.6115E-10	740.97	2.5743E-04
17	3.6000	1.0653E-10	661.51	1.7025E-04
18	4.4900	7.8948E-11	558.97	1.2651E-04
19	5.7000	5.6180E-11	471.17	9.1985E-05
20	7.1900	3.6762E-11	424.50	5.9892E-05

THE EARTH TECHNOLOGY CORP.

Job #:G86179
Client:UNOCAL
Location:MEDICINE LAKE HIGHLAND
File:MLHIGH3.DAT


APPARENT RESISTIVITY (ohm-m)
10^2
10^1
10^0
10^-1
10^-5
10^-4
10^-3
10^-2
TIME (sec)
MODEL:
0
330 ohm-m
80
2000 ohm-m
300
390
DEPTH (m)
600
370 ohm-m
900
800
77 ohm-m
LOOP RADIUS= 100m
FIELD DATA
MODEL CURVE
THE EARTH TECHNOLOGY CORP.
UNOCAL GEOTHERMAL
MEDICINE LAKE HIGHLAND
APPARENT RESISTIVITY CURVE
SITE: LOOP 4
JOB #G88179
Fig.


APPARENT RESISTIVITY (ohm-m)
10^2
10^1
10^0
10^-1
10^-5
10^-4
10^-3
10^-2
TIME (sec)
MODEL:
0
490 ohm-m
177
300
1300 ohm-m
DEPTH (m)
600
650
140 ohm-m
LOOP RADIUS= 100m
FIELD DATA
MODEL CURVE
THE EARTH TECHNOLOGY CORP.
UNOCAL GEOTHERMAL
MEDICINE LAKE HIGHLAND
APPARENT RESISTIVITY CURVE
SITE: LOOP 4
JOB #C88179
Fig.

LOOP4

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		.0	.0		
485.37	177.4	-177.4	-582.0	.4	.4
1311.85	478.1	-655.5	-2150.6	.4	.7
142.42					

TIMES	DATA LATE	CALC LATE	% ERROR	DATA EARLY
8.90E-05	4.99E+02	5.43E+02	-7.961	2.68E+00
1.10E-04	5.40E+02	5.50E+02	-1.794	1.40E+00
1.40E-04	5.85E+02	5.64E+02	+3.646	6.79E-01
1.77E-04	6.21E+02	5.90E+02	+5.384	3.45E-01
2.20E-04	6.56E+02	6.22E+02	+5.426	1.85E-01
2.80E-04	6.85E+02	6.62E+02	+3.415	9.47E-02
3.55E-04	7.18E+02	7.09E+02	+1.339	4.88E-02
4.43E-04	7.35E+02	7.54E+02	-2.601	2.71E-02
5.64E-04	7.39E+02	7.69E+02	-3.891	1.47E-02
7.13E-04	7.30E+02	7.79E+02	-6.257	8.32E-03
8.81E-04	7.01E+02	7.50E+02	-6.502	5.21E-03
1.10E-03	6.86E+02	6.95E+02	-1.358	3.09E-03
1.41E-03	6.51E+02	6.37E+02	+2.250	1.80E-03
1.80E-03	6.01E+02	5.69E+02	+5.557	1.10E-03
2.22E-03	5.58E+02	5.13E+02	+8.590	7.28E-04
2.85E-03	4.83E+02	4.61E+02	+4.767	4.84E-04
3.60E-03	4.27E+02	4.16E+02	+2.572	3.25E-04
4.49E-03	3.79E+02	3.77E+02	+0.656	2.24E-04
5.70E-03	3.30E+02	3.48E+02	-5.076	1.52E-04
7.19E-03	2.87E+02	3.16E+02	-9.230	1.05E-04

R: 168. X: 0. Y: 0. DL: 0. REQ: 0. CF: 1.0000
TDHZ ARRAY, 20 DATA POINTS, SYSTEM: NONE DATA: LOOP4
MEDICINE LAKE HIGHLAND
UNOCAL GEOTHERMAL 8-15-86
RMS LOG ERROR: 3.31E-02, ANTILOG YIELDS 7.9205 %
LATE TIME PARAMETERS

IGS: ARRTI

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	.87					
P 2	.06	.20				
P 3	.03	-.04	.48			
T 1	-.22	-.16	.10	.34		
T 2	.05	.18	.17	.16	.79	
F 0	.00	.00	.00	.00	.00	.00

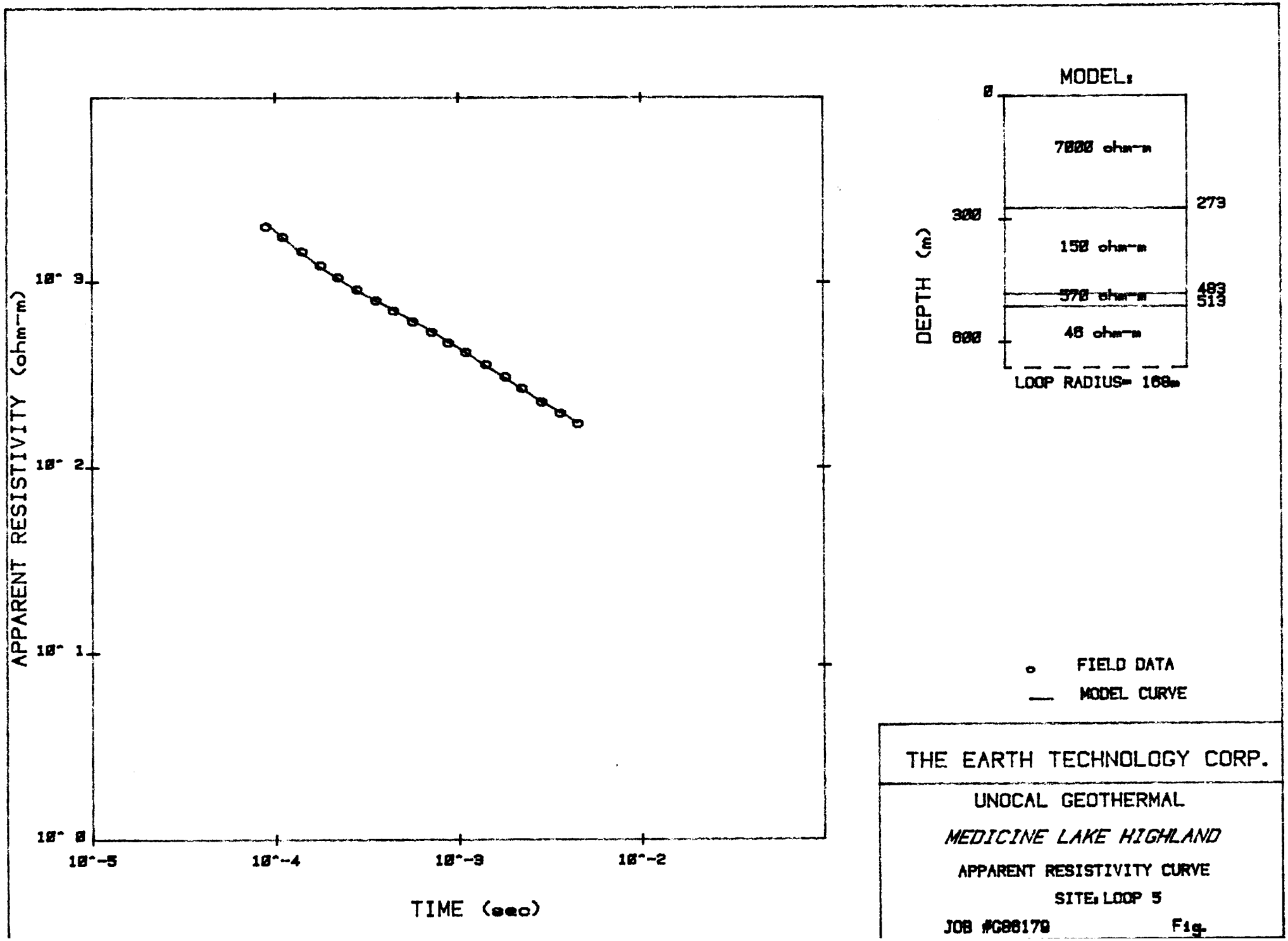
LINE: 0004
STA.: 0000

FREQUENCY = 30 hz
LOOP SIZE = 300 x 300 m
CURRENT = 22 amps
SPACING = 168 m

CH.	TIME(msec)	V(Volts/A-m^2)	RHOA-LATE	RHOA-EARLY
1	0.0890	1.6845E-06	500.50	2.6710E+00
2	0.1100	8.8220E-07	541.16	1.3988E+00
3	0.1400	4.2820E-07	586.21	6.7910E-01
4	0.1770	2.1746E-07	622.99	3.4501E-01
5	0.2200	1.1641E-07	657.67	1.8473E-01
6	0.2800	5.9690E-08	686.79	9.4760E-02
7	0.3550	3.0676E-08	720.75	4.8713E-02
8	0.4430	1.7045E-08	737.25	2.7078E-02
9	0.5640	9.2303E-09	742.02	1.4667E-02
10	0.7130	5.2329E-09	732.91	8.3173E-03
11	0.8810	3.2772E-09	703.71	5.2101E-03
12	1.0960	1.9622E-09	688.40	3.1201E-03
13	1.4110	1.1277E-09	653.64	1.7939E-03
14	1.7950	6.9682E-10	603.26	1.1087E-03
15	2.2240	4.5591E-10	560.03	7.2549E-04
16	2.8500	3.0383E-10	485.51	4.8370E-04
17	3.6000	2.0407E-10	428.89	3.2504E-04
18	4.4900	1.3991E-10	381.70	2.2310E-04
19	5.7000	9.4794E-11	332.44	1.5142E-04
20	7.1900	6.5041E-11	290.19	1.0437E-04

THE EARTH TECHNOLOGY CORP.

Job #:G86179
Client:UNOCAL
Location:MEDICINE LAKE HIGHLAND
File:MLHIGH3.DAT


APPARENT RESISTIVITY (ohm-m)
10^ 3
10^ 2
10^ 1
10^ 0
10^-5
10^-4
10^-3
10^-2
TIME (sec)
MODEL:
0
7000 ohm-m
273
300
150 ohm-m
483
570 ohm-m
513
600
48 ohm-m
DEPTH (m)
LOOP RADIUS= 168m
FIELD DATA
MODEL CURVE
THE EARTH TECHNOLOGY CORP.
UNOCAL GEOTHERMAL
MEDICINE LAKE HIGHLAND
APPARENT RESISTIVITY CURVE
SITE: LOOP 5
JOB #C86179
Fig.

LOOP5

MODEL: 4 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		.0	.0		
7012.51	272.8	-272.8	-895.0	.0	.0
149.81	209.9	-482.7	-1583.6	1.4	1.4
572.67	30.6	-513.3	-1684.1	.1	1.5
46.29					

TIMES	DATA LATE	CALC LATE	% ERROR	DATA EARLY
8.90E-05	1.99E+03	2.08E+03	-4.335	3.36E-01
1.10E-04	1.75E+03	1.74E+03	+0.968	2.40E-01
1.40E-04	1.46E+03	1.43E+03	+2.290	1.72E-01
1.77E-04	1.23E+03	1.20E+03	+2.214	1.24E-01
2.20E-04	1.06E+03	1.05E+03	+1.481	8.99E-02
2.80E-04	9.11E+02	9.00E+02	+1.199	6.18E-02
3.55E-04	7.93E+02	7.95E+02	-0.313	4.20E-02
4.43E-04	6.97E+02	7.07E+02	-1.448	2.93E-02
5.64E-04	6.09E+02	6.17E+02	-1.311	1.96E-02
7.13E-04	5.35E+02	5.44E+02	-1.508	1.33E-02
8.81E-04	4.68E+02	4.76E+02	-1.757	9.55E-03
1.10E-03	4.16E+02	4.15E+02	+0.234	6.54E-03
1.41E-03	3.58E+02	3.53E+02	+1.349	4.41E-03
1.80E-03	3.07E+02	3.02E+02	+1.536	3.01E-03
2.22E-03	2.67E+02	2.64E+02	+1.387	2.20E-03
2.85E-03	2.25E+02	2.26E+02	-0.245	1.52E-03
3.60E-03	1.96E+02	1.98E+02	-0.925	1.04E-03
4.49E-03	1.72E+02	1.75E+02	-1.559	7.31E-04

R: 168. X: 0. Y: 0. DL: 0. REQ: 0. CF: 1.0000
TDHZ ARRAY, 18 DATA POINTS, SYSTEM: NONE DATA: LOOP5
MEDICINE LAKE HIGHLAND
UNOCAL GEOTHERMAL 8-14-86
RMS LOG ERROR: 1.12E-02, ANTILOG YIELDS 2.6061 %
LATE TIME PARAMETERS

IGS: ARRTI

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	P 4	T 1	T 2	T 3	F 0
P 1	.30							
P 2	-.03	.97						
P 3	.00	.01	.00					
P 4	-.02	-.02	.00	.86				
T 1	.03	.01	.00	.00	1.00			
T 2	-.03	.00	.02	.07	.00	.90		
T 3	-.01	.04	.01	-.03	-.01	.23	.09	
F 0	.00	.00	.00	.00	.00	.00	.00	.00

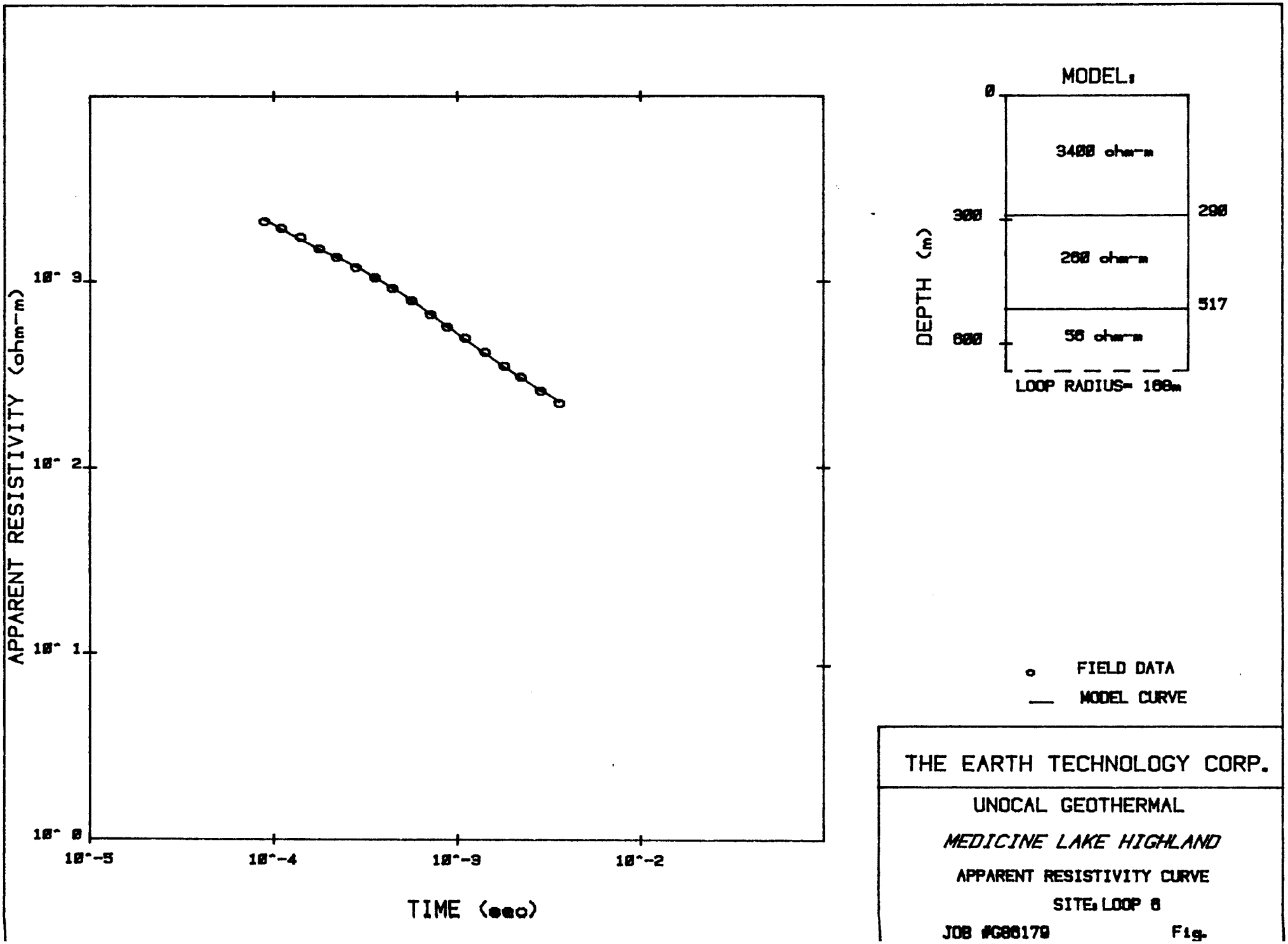
LINE: 0005
STA.: 0000

FREQUENCY = 30 hz
LOOP SIZE = 300 x 300 m
CURRENT = 20 amps
SPACING = 168 m

CH.	TIME(msec)	V(Volts/A-m^2)	RHOA-LATE	RHOA-EARLY
1	0.0890	2.1181E-07	1994.08	3.3599E-01
2	0.1100	1.5064E-07	1758.22	2.3900E-01
3	0.1400	1.0824E-07	1466.29	1.7175E-01
4	0.1770	7.8157E-08	1232.42	1.2404E-01
5	0.2200	5.6587E-08	1063.76	8.9823E-02
6	0.2800	3.8882E-08	913.96	6.1730E-02
7	0.3550	2.6468E-08	795.25	4.2029E-02
8	0.4430	1.8461E-08	699.07	2.9319E-02
9	0.5640	1.2340E-08	611.42	1.9603E-02
10	0.7130	8.3347E-09	537.38	1.3243E-02
11	0.8810	6.0090E-09	469.75	9.5488E-03
12	1.0960	4.1518E-09	417.69	6.5989E-03
13	1.4110	2.7714E-09	358.94	4.4057E-03
14	1.7950	1.9126E-09	307.72	3.0411E-03
15	2.2240	1.3740E-09	268.41	2.1851E-03
16	2.8500	9.5394E-10	226.43	1.5174E-03
17	3.6000	6.5621E-10	196.86	1.0440E-03
18	4.4900	4.5904E-10	172.87	7.3040E-04
19	5.7000	3.0083E-10	153.94	4.7880E-04
20	7.1900	1.9548E-10	139.34	3.1121E-04

THE EARTH TECHNOLOGY CORP.

Job #:686179
Client:UNOCAL
Location:MEDICINE LAKE HIGHLAND
File:MLHIGH2.DAT


APPARENT RESISTIVITY (ohm-m)
10^3
10^2
10^1
10^0
10^-5
10^-4
10^-3
10^-2
TIME (sec)
MODEL:
0
3400 ohm-m
300
290
200 ohm-m
517
600
50 ohm-m
DEPTH (m)
LOOP RADIUS= 100m
FIELD DATA
MODEL CURVE
THE EARTH TECHNOLOGY CORP.
UNOCAL GEOTHERMAL
MEDICINE LAKE HIGHLAND
APPARENT RESISTIVITY CURVE
SITE: LOOP 6
JOB #C86179
Fig.

LOOP6

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		.0	.0		
3353.57	289.7	-289.7	-950.4	.1	.1
259.11	227.0	-516.7	-1695.2	.9	1.0
55.92					

TIMES	DATA LATE	CALC LATE	% ERROR	DATA EARLY
8.90E-05	2.10E+03	2.16E+03	-2.959	3.10E-01
1.10E-04	1.94E+03	1.91E+03	+1.727	2.06E-01
1.40E-04	1.73E+03	1.68E+03	+3.005	1.34E-01
1.77E-04	1.50E+03	1.49E+03	+0.961	9.20E-02
2.20E-04	1.35E+03	1.35E+03	-0.061	6.26E-02
2.80E-04	1.19E+03	1.21E+03	-1.673	4.14E-02
3.55E-04	1.05E+03	1.05E+03	-0.598	2.76E-02
4.43E-04	9.20E+02	9.28E+02	-0.813	1.93E-02
5.64E-04	7.92E+02	7.91E+02	+0.157	1.32E-02
7.13E-04	6.67E+02	6.70E+02	-0.595	9.53E-03
8.81E-04	5.72E+02	5.76E+02	-0.678	7.07E-03
1.10E-03	4.99E+02	4.92E+02	+1.512	4.98E-03
1.41E-03	4.19E+02	4.12E+02	+1.641	3.48E-03
1.80E-03	3.53E+02	3.49E+02	+1.151	2.44E-03
2.22E-03	3.07E+02	3.04E+02	+1.245	1.78E-03
2.85E-03	2.58E+02	2.60E+02	-0.899	1.24E-03
3.60E-03	2.22E+02	2.27E+02	-2.176	8.66E-04

R: 168. X: 0. Y: 0. DL: 0. REQ: 0. CF: 1.0000
TDHZ ARRAY, 17 DATA POINTS, SYSTEM: NONE DATA: LOOP6
MEDICINE LAKE HIGHLAND
UNOCAL GEOTHERMAL 8-14-86
RMS LOG ERROR: 9.96E-03, ANTILOG YIELDS 2.3201 %
LATE TIME PARAMETERS

IGS: ARRTI

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	.52					
P 2	-.12	.89				
P 3	.01	-.04	.92			
T 1	.09	.05	.01	.98		
T 2	-.10	-.03	.02	.02	.97	
F 0	.00	.00	.00	.00	.00	.00

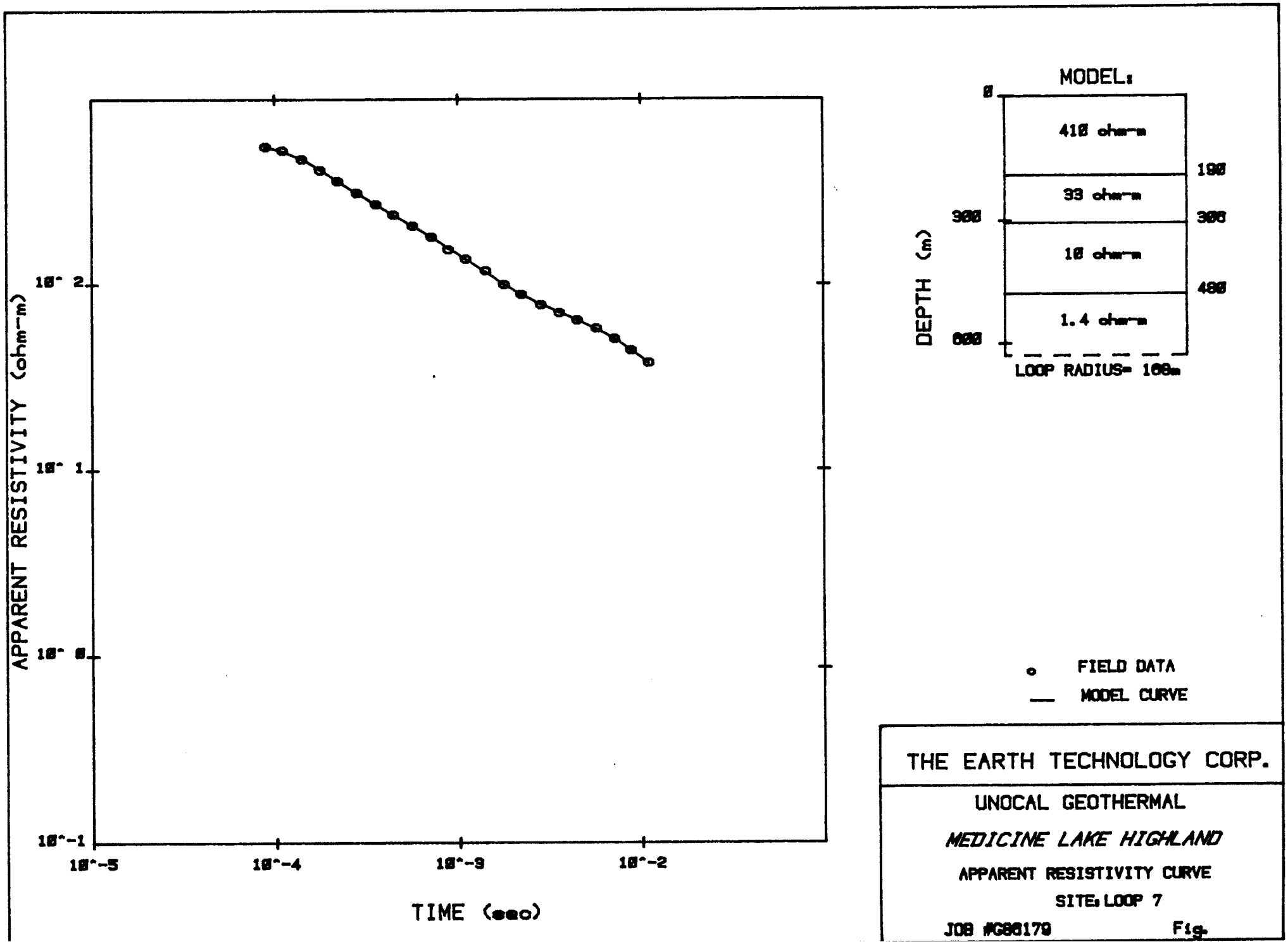
LINE: 0006
STA.: 0000

FREQUENCY = 30 hz
LOOP SIZE = 300 x 300 m
CURRENT = 22 amps
SPACING = 168 m

CH.	TIME(msec)	V(Volts/A-m^2)	RHOA-LATE	RHOA-EARLY
1	0.0890	1.9552E-07	2103.36	3.1008E-01
2	0.1100	1.2957E-07	1944.00	2.0553E-01
3	0.1400	8.4113E-08	1734.75	1.3345E-01
4	0.1770	5.7894E-08	1505.38	9.1874E-02
5	0.2200	3.9626E-08	1348.98	6.2897E-02
6	0.2800	2.6148E-08	1190.71	4.1512E-02
7	0.3550	1.7440E-08	1050.24	2.7693E-02
8	0.4430	1.2163E-08	923.25	1.9318E-02
9	0.5640	8.3305E-09	794.53	1.3233E-02
10	0.7130	6.0024E-09	668.84	9.5371E-03
11	0.8810	4.4500E-09	573.88	7.0709E-03
12	1.0960	3.1606E-09	500.99	5.0231E-03
13	1.4110	2.1871E-09	420.30	3.4767E-03
14	1.7950	1.5502E-09	353.99	2.4646E-03
15	2.2240	1.1140E-09	308.71	1.7716E-03
16	2.8500	7.7928E-10	259.11	1.2394E-03
17	3.6000	5.4542E-10	222.69	8.6729E-04
18	4.4900	3.8211E-10	195.35	6.0776E-04
19	5.7000	2.5637E-10	171.26	4.0784E-04
20	7.1900	1.7178E-10	151.88	2.7331E-04

THE EARTH TECHNOLOGY CORP.

Job #:G86179
Client:UNOCAL
Location:MEDICINE LAKE HIGHLAND
File:MLHIGH2.DAT


APPARENT RESISTIVITY (ohm-m)
10^2
10^1
10^0
10^-1
10^-5
10^-4
10^-3
10^-2
TIME (sec)
MODEL:
0
410 ohm-m
190
33 ohm-m
300
300
10 ohm-m
480
1.4 ohm-m
600
DEPTH (m)
LOOP RADIUS= 100m
FIELD DATA
MODEL CURVE
THE EARTH TECHNOLOGY CORP.
UNOCAL GEOTHERMAL
MEDICINE LAKE HIGHLAND
APPARENT RESISTIVITY CURVE
SITE: LOOP 7
JOB #G88179
Fig.

LOOP7

MODEL: 4 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		.0	.0		
413.28	189.8	-189.8	-622.8	.5	.5
32.65	115.8	-305.6	-1002.7	3.5	4.0
10.17	174.3	-479.9	-1574.5	17.1	21.2
1.40					

TIMES	DATA LATE	CALC LATE	% ERROR	DATA EARLY
8.90E-05	5.55E+02	5.57E+02	-0.408	2.26E+00
1.10E-04	5.31E+02	5.26E+02	+0.934	1.44E+00
1.40E-04	4.78E+02	4.80E+02	-0.315	9.19E-01
1.77E-04	4.17E+02	4.21E+02	-0.908	6.28E-01
2.20E-04	3.65E+02	3.64E+02	+0.301	4.45E-01
2.80E-04	3.15E+02	3.15E+02	+0.084	3.04E-01
3.55E-04	2.74E+02	2.73E+02	+0.376	2.07E-01
4.43E-04	2.40E+02	2.39E+02	+0.447	1.45E-01
5.64E-04	2.09E+02	2.09E+02	+0.140	9.76E-02
7.13E-04	1.82E+02	1.82E+02	-0.062	6.69E-02
8.85E-04	1.55E+02	1.58E+02	-1.894	4.96E-02
1.10E-03	1.38E+02	1.38E+02	-0.197	3.43E-02
1.41E-03	1.19E+02	1.17E+02	+2.126	2.30E-02
1.78E-03	1.00E+02	1.00E+02	-0.054	1.67E-02
2.21E-03	8.84E+01	8.85E+01	-0.110	1.17E-02
2.83E-03	7.75E+01	7.81E+01	-0.772	7.67E-03
3.57E-03	7.03E+01	7.07E+01	-0.590	4.96E-03
4.46E-03	6.41E+01	6.40E+01	+0.252	3.27E-03
5.67E-03	5.79E+01	5.73E+01	+0.957	2.09E-03
7.16E-03	5.09E+01	5.09E+01	-0.011	1.41E-03
8.81E-03	4.41E+01	4.43E+01	-0.360	1.04E-03
1.10E-02	3.78E+01	3.78E+01	-0.048	7.56E-04

R: 168. X: 0. Y: 0. DL: 0. REQ: 0. CF: 1.0000
TDHZ ARRAY, 22 DATA POINTS, SYSTEM: NONE DATA: LOOP7
MEDICINE LAKE HIGHLAND
UNOCAL GEOTHERMAL 8-14-86
RMS LOG ERROR: 4.93E-03, ANTILOG YIELDS 1.1421 %
LATE TIME PARAMETERS

IGS: ARRTI

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	P 4	T 1	T 2	T 3	F 0
P 1	1.00							
P 2	.00	1.00						
P 3	.00	-.01	.98					
P 4	.00	-.01	-.05	.89				
T 1	.00	.00	.00	.00	1.00			
T 2	.00	.00	.00	.00	.00	1.00		
T 3	.00	.00	-.01	-.02	.00	.00	.99	
F 0	.00	.00	.00	.00	.00	.00	.00	.00

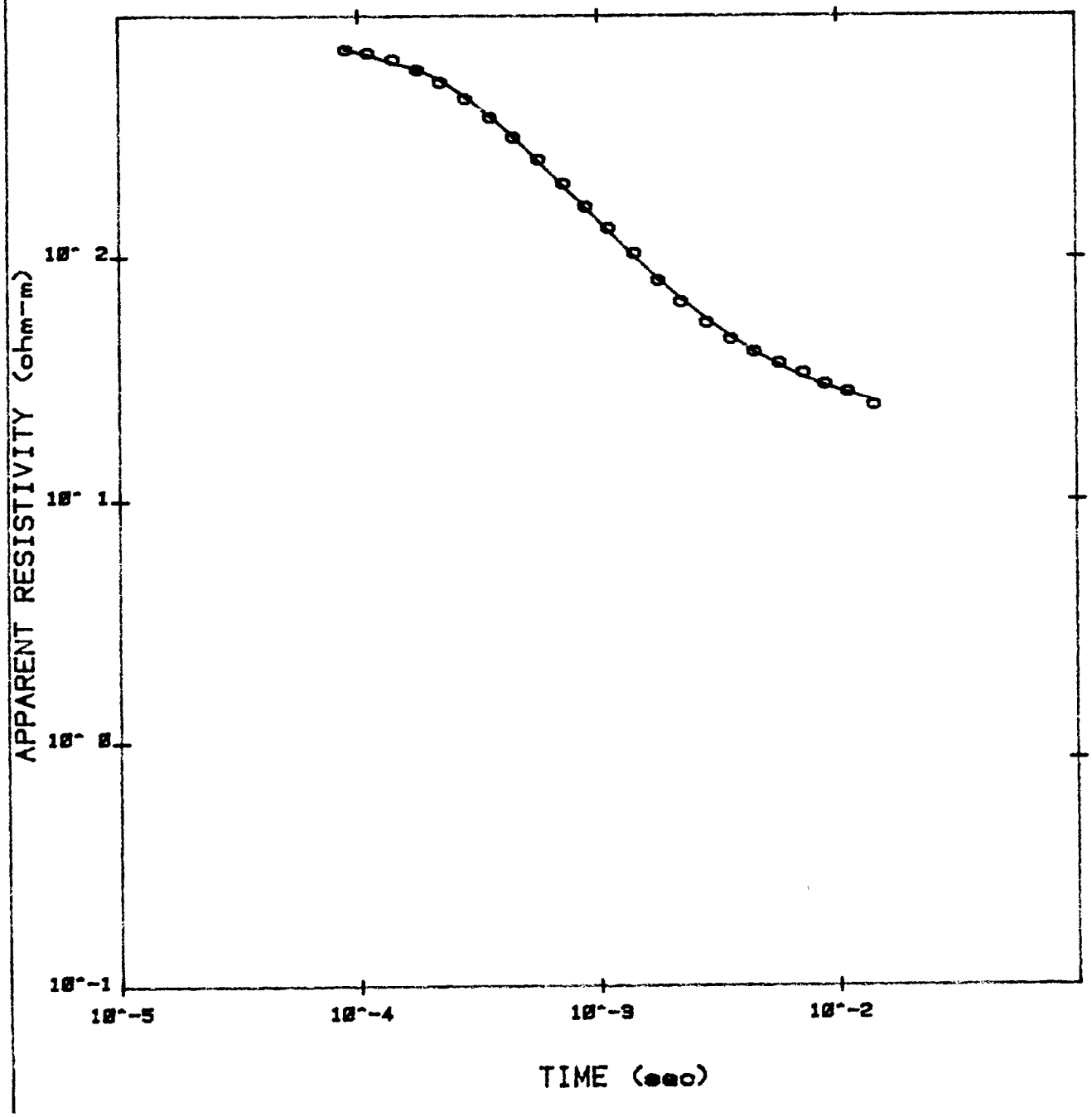
LINE: 0007
STA.: 0000

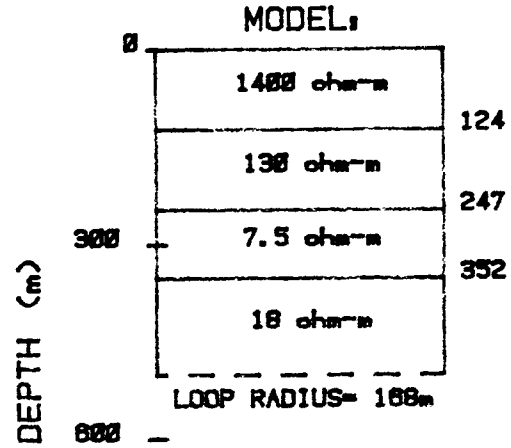
FREQUENCY = comb freq.
LOOP SIZE = 300 x 300 m
CURRENT = 20 amps
SPACING = 168 m

CH.	TIME(msec)	V(Volts/A-m^2)	RHOA-LATE	RHOA-EARLY
1	0.0890	1.4389E-06	555.93	2.2816E+00
2	0.1100	9.0395E-07	532.45	1.4336E+00
3	0.1400	5.7926E-07	479.25	9.1882E-01
4	0.1770	3.9589E-07	417.85	6.2809E-01
5	0.2200	2.8051E-07	365.89	4.4512E-01
6	0.2800	1.9125E-07	316.00	3.0353E-01
7	0.3550	1.3042E-07	274.64	2.0702E-01
8	0.4430	9.1427E-08	240.60	1.4516E-01
9	0.5640	6.1535E-08	209.48	9.7716E-02
10	0.7130	4.1974E-08	182.90	6.6667E-02
11	0.8855	3.1112E-08	155.63	4.9452E-02
12	1.0980	2.1731E-08	138.14	3.4560E-02
13	1.4055	1.4496E-08	119.90	2.3066E-02
14	1.7825	1.0236E-08	101.75	1.6542E-02
15	2.2120	7.2291E-09	89.54	1.1638E-02
16	2.8250	4.7395E-09	78.92	7.6982E-03
17	3.5750	3.0588E-09	71.37	4.9458E-03
18	4.4600	2.0194E-09	65.11	3.2640E-03
19	5.6700	1.2975E-09	58.61	2.0905E-03
20	7.1600	8.8172E-10	51.40	1.4159E-03
21	8.8100	6.5599E-10	44.31	1.0425E-03
22	10.9600	4.7924E-10	37.96	7.6177E-04
23	14.1100	3.3620E-10	31.56	5.3449E-04
24	17.9500	2.4844E-10	25.85	3.9502E-04
25	22.2400	1.9152E-10	21.51	3.0456E-04
30	71.9000	4.1551E-11	8.43	6.6127E-05

THE EARTH TECHNOLOGY CORP.

Job #:G86179
Client:UNOCAL
Location:MEDICINE LAKE HIGHLAND
File:MLHIGH2.DAT





o FIELD DATA

— MODEL CURVE

THE EARTH TECHNOLOGY CORP.

UNOCAL GEOTHERMAL

MEDICINE LAKE HIGHLAND

APPARENT RESISTIVITY CURVE

SITE: LOOP 8

JOB #G86179 Fig.

LOOP8

MODEL: 4 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		.0	.0		
1445.51	123.8	-123.8	-406.3	.1	.1
130.31	122.9	-246.7	-809.5	.9	1.0
7.51	104.9	-351.6	-1153.6	14.0	15.0
18.25					

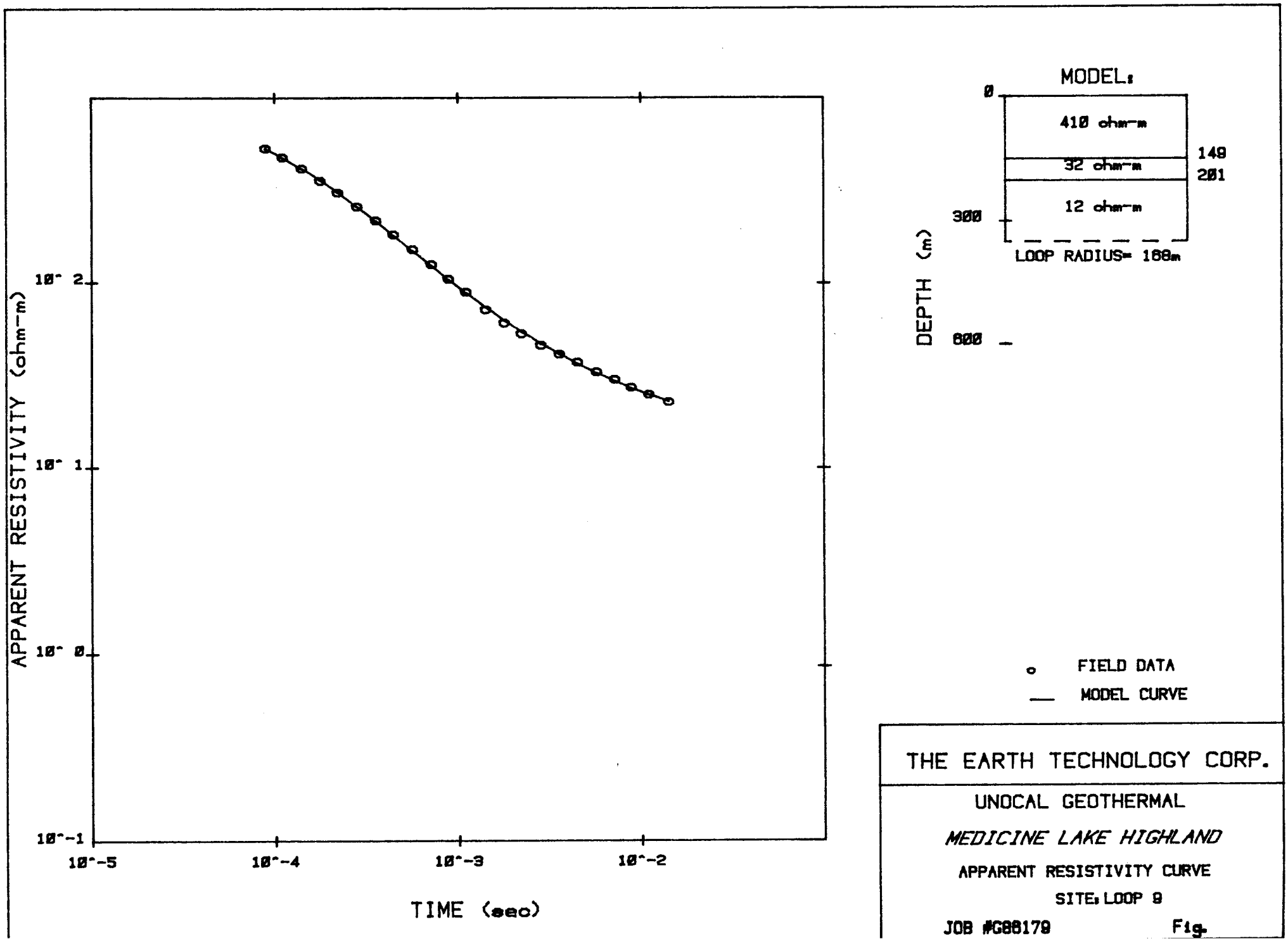
TIMES	DATA LATE	CALC LATE	% ERROR	DATA EARLY
8.90E-05	7.23E+02	7.30E+02	-0.934	1.53E+00
1.10E-04	7.02E+02	6.90E+02	+1.731	9.44E-01
1.40E-04	6.58E+02	6.39E+02	+2.985	5.69E-01
1.77E-04	5.95E+02	5.99E+02	-0.784	3.68E-01
2.20E-04	5.28E+02	5.44E+02	-3.022	2.56E-01
2.80E-04	4.51E+02	4.61E+02	-2.092	1.77E-01
3.55E-04	3.78E+02	3.83E+02	-1.312	1.28E-01
4.43E-04	3.13E+02	3.15E+02	-0.646	9.74E-02
5.64E-04	2.53E+02	2.50E+02	+1.159	7.33E-02
7.13E-04	2.02E+02	1.98E+02	+1.987	5.72E-02
8.85E-04	1.62E+02	1.60E+02	+1.090	4.64E-02
1.10E-03	1.32E+02	1.29E+02	+2.564	3.66E-02
1.41E-03	1.04E+02	1.01E+02	+2.912	2.81E-02
1.78E-03	8.00E+01	8.14E+01	-1.696	2.33E-02
2.21E-03	6.54E+01	6.74E+01	-2.915	1.84E-02
2.83E-03	5.38E+01	5.56E+01	-3.236	1.33E-02
3.57E-03	4.60E+01	4.71E+01	-2.215	9.38E-03
4.46E-03	4.08E+01	4.08E+01	-0.132	6.44E-03
5.67E-03	3.66E+01	3.60E+01	+1.620	4.16E-03
7.16E-03	3.34E+01	3.21E+01	+3.789	2.66E-03
8.81E-03	3.00E+01	2.96E+01	+1.541	1.86E-03
1.10E-02	2.79E+01	2.77E+01	+1.026	1.19E-03
1.41E-02	2.47E+01	2.56E+01	-3.242	7.69E-04

R: 168. X: 0. Y: 0. DL: 0. REQ: 0. CF: 1.0000
TDHZ ARRAY, 23 DATA POINTS, SYSTEM: NONE DATA: LOOP8
MEDICINE LAKE HIGHLAND
UNOCAL GEOTHERMAL 8-13-86
RMS LOG ERROR: 1.41E-02, ANTILOG YIELDS 3.3095 %
LATE TIME PARAMETERS

IGS: ARRTI

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	P 4	T 1	T 2	T 3	F 0
P 1	.70							
P 2	-.07	.57						
P 3	.01	-.03	.97					
P 4	.00	-.01	-.03	.64				
T 1	.07	.20	.01	.00	.90			
T 2	-.07	-.18	.00	.00	.09	.91		
T 3	.01	-.06	-.07	-.22	.02	-.01	.72	
F 0	.00	.00	.00	.00	.00	.00	.00	.00


APPARENT RESISTIVITY (ohm-m)
10^ 2
10^ 1
10^ 0
10^-1
10^-5
10^-4
10^-3
10^-2
TIME (sec)
MODEL:
0
410 ohm-m
149
32 ohm-m
201
12 ohm-m
300
600
DEPTH (m)
LOOP RADIUS= 188m
FIELD DATA
MODEL CURVE
THE EARTH TECHNOLOGY CORP.
UNOCAL GEOTHERMAL
MEDICINE LAKE HIGHLAND
APPARENT RESISTIVITY CURVE
SITE: LOOP 9
JOB #G88179
Fig.

LOOP9

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		.0	.0		
411.74	148.6	-148.6	-487.4	.4	.4
31.73	52.3	-200.8	-658.8	1.6	2.0
11.74					

TIMES	DATA LATE	CALC LATE	% ERROR	DATA EARLY
8.90E-05	5.35E+02	5.35E+02	+0.065	2.41E+00
1.10E-04	4.80E+02	4.77E+02	+0.566	1.67E+00
1.40E-04	4.18E+02	4.17E+02	+0.234	1.12E+00
1.77E-04	3.58E+02	3.63E+02	-1.380	7.89E-01
2.20E-04	3.09E+02	3.11E+02	-0.755	5.71E-01
2.80E-04	2.60E+02	2.60E+02	-0.219	4.05E-01
3.55E-04	2.18E+02	2.17E+02	+0.297	2.92E-01
4.43E-04	1.83E+02	1.81E+02	+1.105	2.18E-01
5.64E-04	1.52E+02	1.49E+02	+1.911	1.57E-01
7.13E-04	1.26E+02	1.24E+02	+1.947	1.16E-01
8.85E-04	1.05E+02	1.04E+02	+0.972	8.89E-02
1.10E-03	8.95E+01	8.87E+01	+0.932	6.56E-02
1.41E-03	7.19E+01	7.40E+01	-2.847	4.90E-02
1.78E-03	6.09E+01	6.29E+01	-3.213	3.51E-02
2.21E-03	5.34E+01	5.48E+01	-2.624	2.49E-02
2.83E-03	4.63E+01	4.71E+01	-1.768	1.66E-02
3.57E-03	4.14E+01	4.15E+01	-0.317	1.10E-02
4.46E-03	3.75E+01	3.69E+01	+1.603	7.31E-03
5.67E-03	3.33E+01	3.29E+01	+1.430	4.79E-03
7.16E-03	3.04E+01	2.98E+01	+2.131	3.06E-03
8.81E-03	2.75E+01	2.72E+01	+0.743	2.12E-03
1.10E-02	2.52E+01	2.52E+01	-0.071	1.39E-03
1.41E-02	2.30E+01	2.32E+01	-0.916	8.56E-04

R: 168. X: 0. Y: 0. DL: 0. REQ: 0. CF: 1.0000
TDHZ ARRAY, 23 DATA POINTS, SYSTEM: NONE DATA: LOOP9
MEDICINE LAKE HIGHLAND
UNOCAL GEOTHERMAL 8-13-86
RMS LOG ERROR: 9.90E-03, ANTILOG YIELDS 2.3048 %
LATE TIME PARAMETERS

IGS: ARRTI

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	.91					
P 2	-.19	.23				
P 3	.00	-.02	.99			
T 1	.05	.15	.00	.97		
T 2	-.09	-.16	.01	.04	.86	
F 0	.00	.00	.00	.00	.00	.00

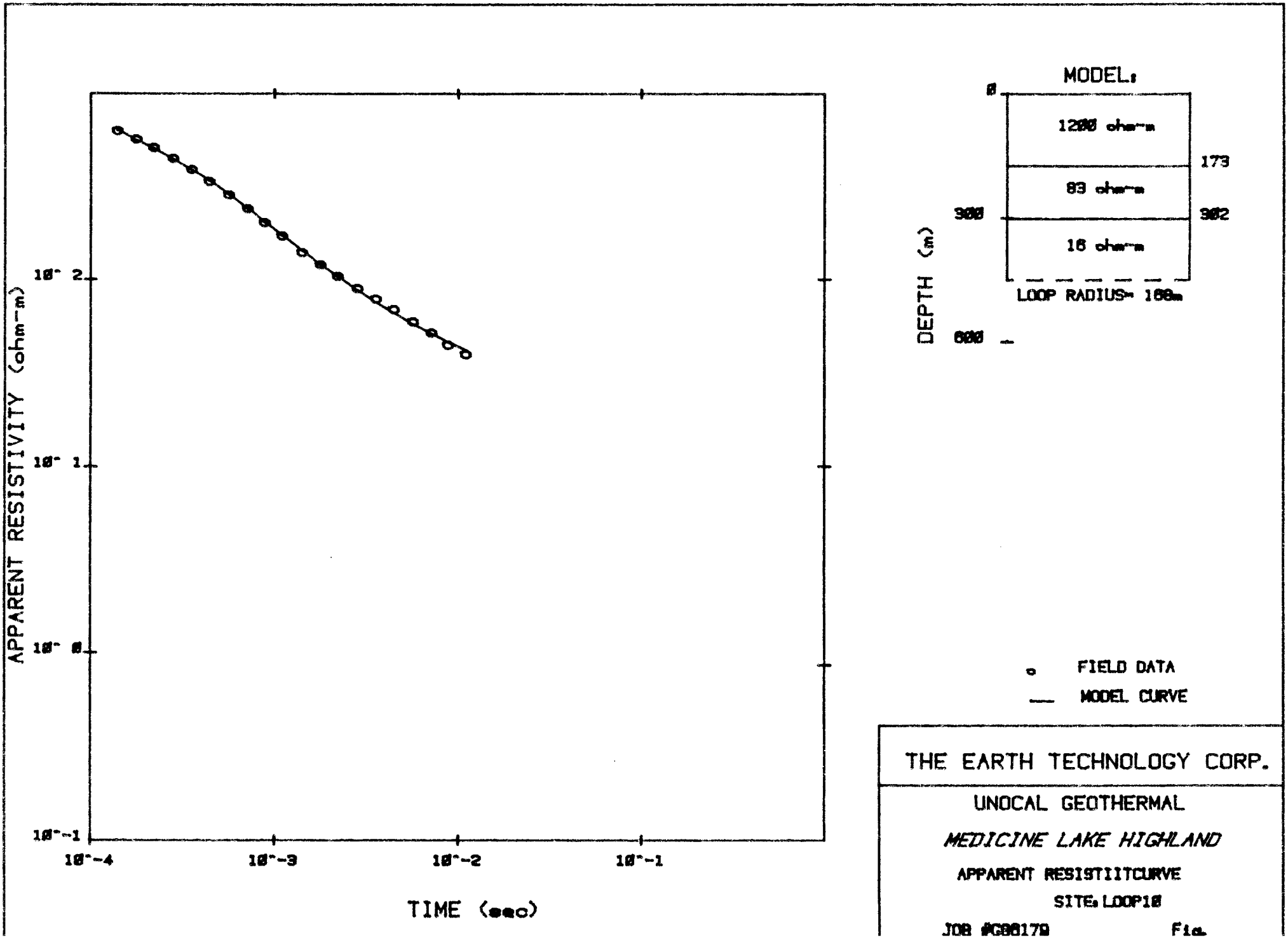
LINE: 0009
STA.: 0000

FREQUENCY = comb freq.
LOOP SIZE = 300 x 300 m
CURRENT = 20 amps
SPACING = 168 m

CH.	TIME(msec)	V(Volts/A-m^2)	RHOA-LATE	RHOA-EARLY
1	0.0890	1.5198E-06	536.01	2.4089E+00
2	0.1100	1.0527E-06	481.03	1.6688E+00
3	0.1400	7.0869E-07	418.96	1.1237E+00
4	0.1770	4.9782E-07	358.66	7.8946E-01
5	0.2200	3.6075E-07	309.40	5.7220E-01
6	0.2800	2.5589E-07	260.25	4.0594E-01
7	0.3550	1.8432E-07	218.07	2.9244E-01
8	0.4430	1.3708E-07	183.67	2.1753E-01
9	0.5640	9.9278E-08	152.29	1.5757E-01
10	0.7130	7.3001E-08	126.47	1.1588E-01
11	0.8855	5.5821E-08	105.40	8.8626E-02
12	1.0980	4.1456E-08	89.80	6.5819E-02
13	1.4055	3.0739E-08	72.64	4.9339E-02
14	1.7825	2.1591E-08	61.87	3.4928E-02
15	2.2120	1.5382E-08	54.12	2.4805E-02
16	2.8250	1.0260E-08	47.16	1.6688E-02
17	3.5750	6.7672E-09	42.04	1.0961E-02
18	4.4600	4.5152E-09	38.08	7.3128E-03
19	5.6700	2.9651E-09	33.78	4.7788E-03
20	7.1600	1.9068E-09	30.74	3.0650E-03
21	8.8100	1.3361E-09	27.57	2.1261E-03
22	10.9600	8.7862E-10	25.34	1.3977E-03
23	14.1100	5.3822E-10	23.06	8.5623E-04
24	17.9500	3.4448E-10	20.79	5.4877E-04
25	22.2400	2.2834E-10	19.13	3.6523E-04

THE EARTH TECHNOLOGY CORP.

Job #:G86179
Client:UNOCAL
Location:MEDICINE LAKE HIGHLAND
File:MLHIGH1.DAT


APPARENT RESISTIVITY (ohm-m)
10^2
10^1
10^0
10^-1
10^-4
10^-3
10^-2
10^-1
TIME (sec)
MODEL:
0
1200 ohm-m
173
83 ohm-m
300
302
16 ohm-m
LOOP RADIUS= 100m
DEPTH (m)
600
FIELD DATA
MODEL CURVE
THE EARTH TECHNOLOGY CORP.
UNOCAL GEOTHERMAL
MEDICINE LAKE HIGHLAND
APPARENT RESISTIITCURVE
SITE: LOOP10
JOB #G00179
Fig.

LOOP10

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		.0	.0		
1191.91	173.2	-173.2	-568.3	.1	.1
83.09	128.5	-301.7	-989.8	1.5	1.7
15.93					

TIMES	DATA LATE	CALC LATE	% ERROR	DATA EARLY
1.40E-04	6.30E+02	6.38E+02	-1.247	6.08E-01
1.77E-04	5.68E+02	5.62E+02	+0.976	3.95E-01
2.20E-04	5.14E+02	5.09E+02	+1.000	2.66E-01
2.80E-04	4.50E+02	4.47E+02	+0.705	1.78E-01
3.55E-04	3.92E+02	3.91E+02	+0.050	1.21E-01
4.43E-04	3.38E+02	3.43E+02	-1.316	8.68E-02
5.64E-04	2.86E+02	2.88E+02	-0.601	6.10E-02
7.13E-04	2.41E+02	2.42E+02	-0.427	4.39E-02
8.85E-04	2.03E+02	2.05E+02	-1.034	3.31E-02
1.10E-03	1.72E+02	1.73E+02	-1.034	2.46E-02
1.41E-03	1.40E+02	1.44E+02	-2.323	1.80E-02
1.78E-03	1.20E+02	1.20E+02	-0.669	1.27E-02
2.21E-03	1.04E+02	1.04E+02	+0.572	9.15E-03
2.83E-03	8.94E+01	8.75E+01	+2.227	6.19E-03
3.57E-03	7.85E+01	7.54E+01	+4.055	4.21E-03
4.46E-03	6.90E+01	6.61E+01	+4.319	2.93E-03
5.67E-03	5.93E+01	5.76E+01	+3.013	2.02E-03
7.16E-03	5.18E+01	5.13E+01	+0.973	1.38E-03
8.81E-03	4.46E+01	4.63E+01	-3.671	1.03E-03
1.10E-02	3.99E+01	4.20E+01	-4.982	6.97E-04

R: 168. X: 0. Y: 0. DL: 0. REQ: 0. CF: 1.0000
TDHZ ARRAY, 20 DATA POINTS, SYSTEM: NONE DATA: LOOP10
MEDICINE LAKE HIGHLAND
UNOCAL GEOTHERMAL 8-13-86
RMS LOG ERROR: 1.48E-02, ANTILOG YIELDS 3.4653 %
LATE TIME PARAMETERS

IGS: ARRTI

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	.55					
P 2	-.07	.71				
P 3	.01	-.03	.98			
T 1	.07	.10	.01	.96		
T 2	-.09	-.08	.00	.04	.96	
F 0	.00	.00	.00	.00	.00	.00

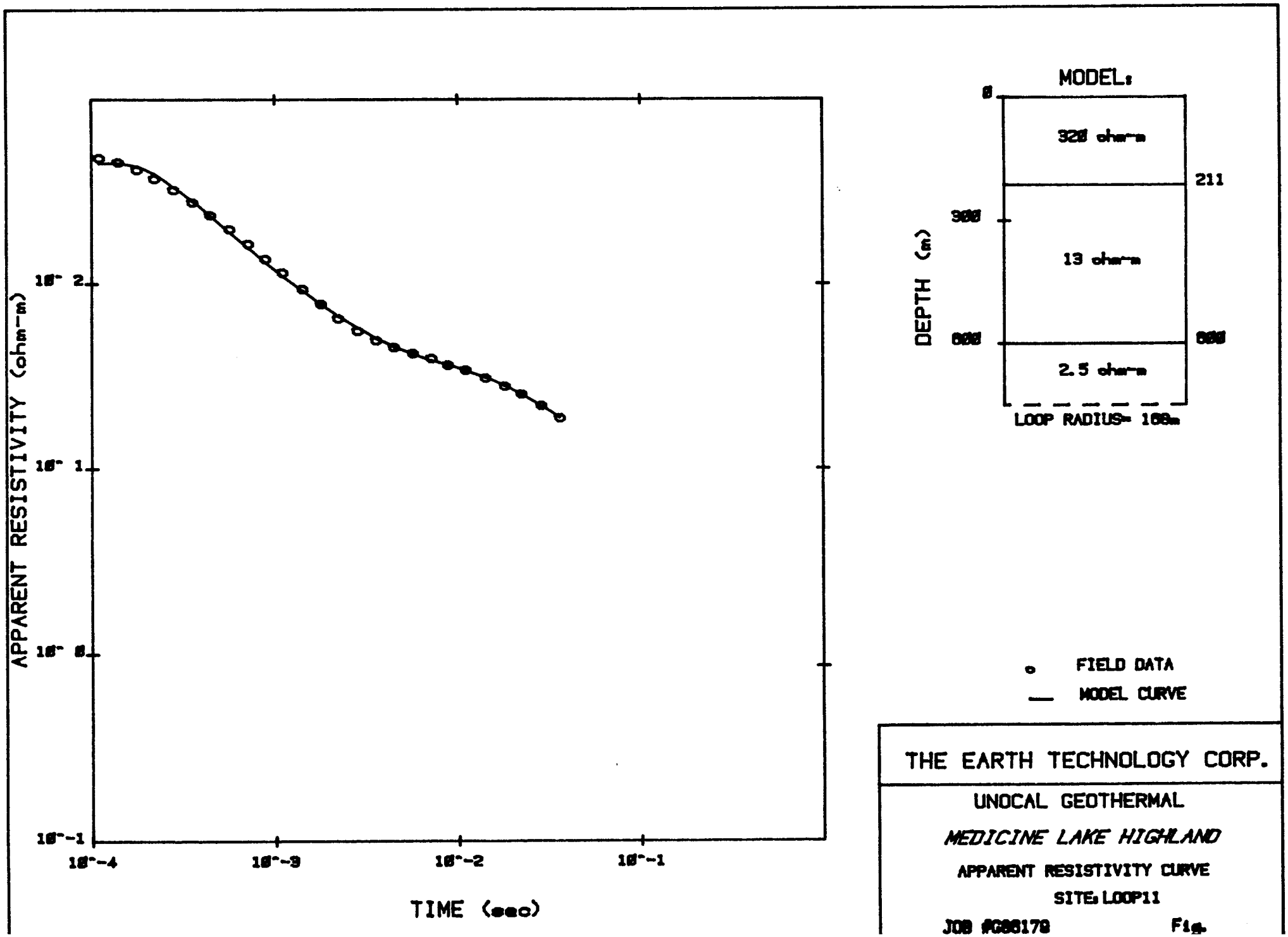
LINE: 0010
STA.: 0000

FREQUENCY = comb freq.
LOOP SIZE = 300 x 300 m
CURRENT = 21.5 amps
SPACING = 168 m

CH.	TIME(msec)	V(Volts/A-m^2)	RHOA-LATE	RHOA-EARLY
3	0.1400	3.8277E-07	631.71	6.0748E-01
4	0.1770	2.4878E-07	569.55	3.9492E-01
5	0.2200	1.6781E-07	515.36	2.6647E-01
6	0.2800	1.1198E-07	451.50	1.7786E-01
7	0.3550	7.6221E-08	392.88	1.2108E-01
8	0.4430	5.4603E-08	339.27	8.6754E-02
9	0.5640	3.8341E-08	287.15	6.0928E-02
10	0.7130	2.7595E-08	241.91	4.3856E-02
11	0.8855	2.0561E-08	205.12	3.3102E-02
12	1.0980	1.5579E-08	172.45	2.4787E-02
13	1.4055	1.1294E-08	141.61	1.8113E-02
14	1.7825	7.8595E-09	121.35	1.2706E-02
15	2.2120	5.6545E-09	105.47	9.1106E-03
16	2.8250	3.8195E-09	91.13	6.2112E-03
17	3.5750	2.5874E-09	79.80	4.1921E-03
18	4.4600	1.8060E-09	70.14	2.9273E-03
19	5.6700	1.2443E-09	60.27	2.0129E-03
20	7.1600	8.5038E-10	52.65	1.3764E-03
21	8.8100	6.3948E-10	45.07	1.0280E-03
22	10.9600	4.3370E-10	40.57	7.0289E-04
23	14.1100	2.7710E-10	35.90	4.5365E-04
24	17.9500	1.7831E-10	32.24	2.9668E-04
25	22.2400	1.2103E-10	29.21	2.0474E-04

THE EARTH TECHNOLOGY CORP.

Job #:G86179
Client:UNOCAL
Location:MEDICINE LAKE HIGHLAND
File:MLHIGH1.DAT


APPARENT RESISTIVITY (ohm-m)
10^2
10^1
10^0
10^-1
10^-4
10^-3
10^-2
10^-1
TIME (sec)
MODEL:
0
320 ohm-m
211
300
13 ohm-m
DEPTH (m)
600
600
2.5 ohm-m
LOOP RADIUS= 100m
FIELD DATA
MODEL CURVE
THE EARTH TECHNOLOGY CORP.
UNOCAL GEOTHERMAL
MEDICINE LAKE HIGHLAND
APPARENT RESISTIVITY CURVE
SITE: LOOP11
JOB #G86170
Fig.

LOOP11

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		.0	.0		
321.03	211.1	-211.1	-692.5	.7	.7
13.36	388.9	-600.0	-1968.5	29.1	29.8
2.47					

TIMES	DATA LATE	CALC LATE	% ERROR	DATA EARLY
1.10E-04	4.83E+02	4.53E+02	+6.406	1.65E+00
1.40E-04	4.58E+02	4.53E+02	+1.059	9.80E-01
1.77E-04	4.15E+02	4.37E+02	-5.145	6.32E-01
2.20E-04	3.72E+02	3.97E+02	-6.372	4.33E-01
2.80E-04	3.23E+02	3.36E+02	-3.995	2.93E-01
3.55E-04	2.77E+02	2.83E+02	-1.972	2.04E-01
4.43E-04	2.36E+02	2.34E+02	+0.862	1.49E-01
5.64E-04	1.97E+02	1.90E+02	+3.801	1.07E-01
7.13E-04	1.64E+02	1.56E+02	+4.498	7.82E-02
8.85E-04	1.36E+02	1.31E+02	+3.647	6.03E-02
1.10E-03	1.15E+02	1.10E+02	+3.955	4.50E-02
1.41E-03	9.39E+01	9.21E+01	+1.968	3.28E-02
1.78E-03	7.79E+01	7.75E+01	+0.546	2.42E-02
2.21E-03	6.50E+01	6.70E+01	-2.993	1.85E-02
2.83E-03	5.55E+01	5.80E+01	-4.308	1.27E-02
3.57E-03	4.94E+01	5.07E+01	-2.693	8.43E-03
4.46E-03	4.53E+01	4.59E+01	-1.487	5.50E-03
5.67E-03	4.20E+01	4.17E+01	+0.769	3.38E-03
7.16E-03	3.96E+01	3.86E+01	+2.630	2.06E-03
8.81E-03	3.64E+01	3.66E+01	-0.581	1.39E-03
1.10E-02	3.42E+01	3.40E+01	+0.389	8.78E-04
1.41E-02	3.10E+01	3.13E+01	-0.976	5.47E-04
1.80E-02	2.80E+01	2.83E+01	-1.093	3.46E-04
2.22E-02	2.54E+01	2.53E+01	+0.689	2.37E-04
2.85E-02	2.20E+01	2.19E+01	+0.663	1.57E-04
3.60E-02	1.88E+01	1.90E+01	-1.150	1.11E-04

R: 168. X: 0. Y: 0. DL: 0. REQ: 0. CF: 1.0000
TDHZ ARRAY, 26 DATA POINTS, SYSTEM: NONE DATA: LOOP11
MEDICINE LAKE HIGHLAND
UNOCAL GEOTHERMAL 8-13-86
RMS LOG ERROR: 2.01E-02, ANTILOG YIELDS 4.7418 %
LATE TIME PARAMETERS

IGS: ARRTI

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	.81					
P 2	-.04	.78				
P 3	-.01	-.08	.03			
T 1	.02	.05	.00	.96		
T 2	-.01	-.02	.00	.00	.57	
F 0	.00	.00	.00	.00	.00	.00

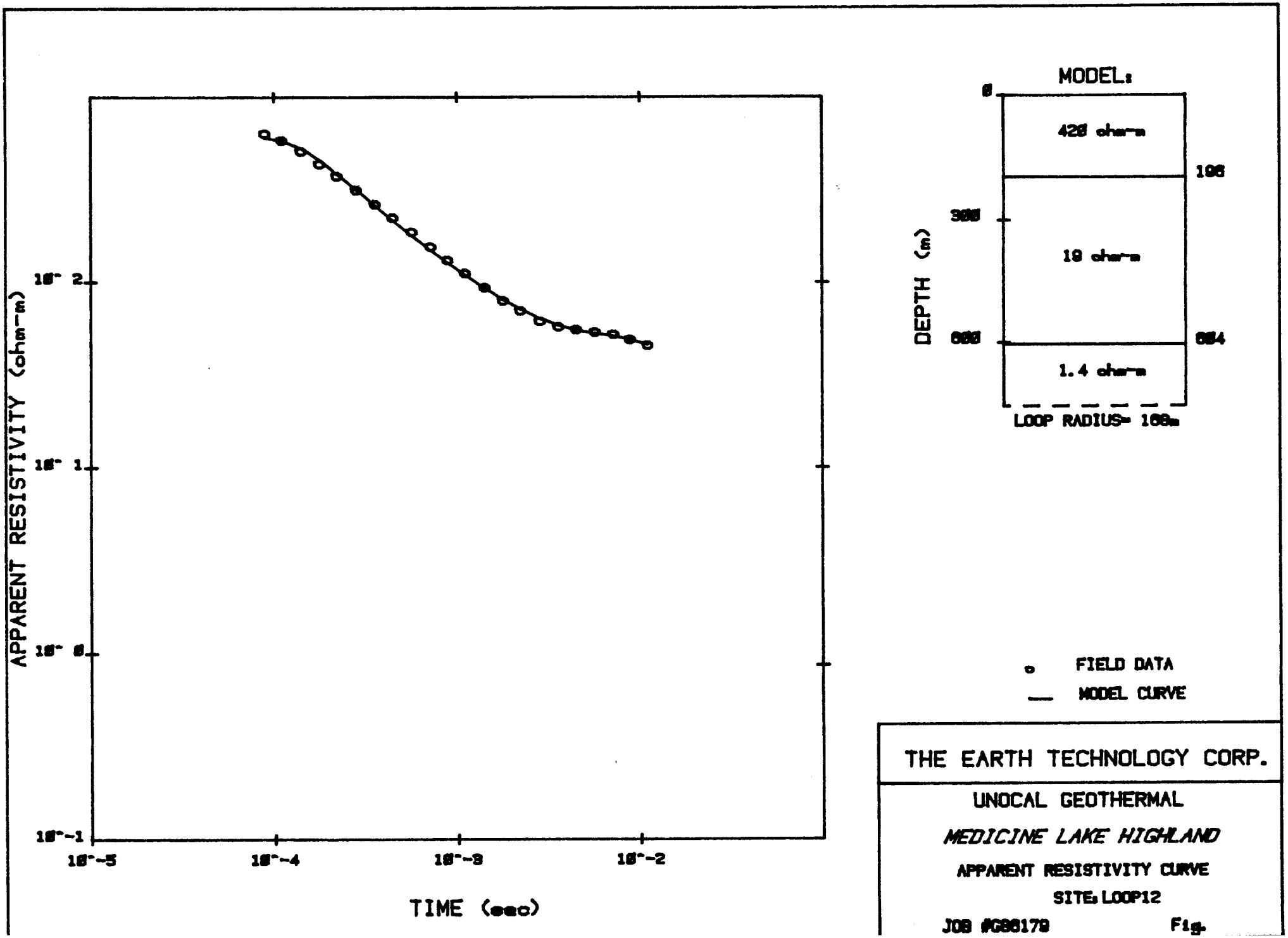
LINE: 0011
STA.: 0000

FREQUENCY = comb freq.
LOOP SIZE = 300 x 300 m
CURRENT = 20 amps
SPACING = 168 m

CH.	TIME(msec)	V(Volts/A-m^2)	RHOA-LATE	RHOA-EARLY
2	0.1100	1.0438E-06	483.74	1.6560E+00
3	0.1400	6.1771E-07	459.15	9.8018E-01
4	0.1770	3.9871E-07	415.88	6.3281E-01
5	0.2200	2.7260E-07	372.94	4.3274E-01
6	0.2800	1.8458E-07	323.58	2.9306E-01
7	0.3550	1.2810E-07	277.93	2.0343E-01
8	0.4430	9.3564E-08	236.93	1.4860E-01
9	0.5640	6.7133E-08	197.67	1.0664E-01
10	0.7130	4.9396E-08	164.09	7.8477E-02
11	0.8855	3.7922E-08	136.39	6.0235E-02
12	1.0980	2.8585E-08	115.06	4.5407E-02
13	1.4055	2.0808E-08	94.22	3.3058E-02
14	1.7825	1.5182E-08	78.24	2.4134E-02
15	2.2120	1.1470E-08	65.82	1.8459E-02
16	2.8250	7.8291E-09	56.47	1.2711E-02
17	3.5750	5.2002E-09	50.11	8.4049E-03
18	4.4600	3.4083E-09	45.93	5.5062E-03
19	5.6700	2.1005E-09	42.51	3.3820E-03
20	7.1600	1.2807E-09	40.07	2.0571E-03
21	8.8100	8.7494E-10	36.57	1.3910E-03
22	10.9600	5.5759E-10	34.31	8.8684E-04
23	14.1100	3.4340E-10	31.11	5.4642E-04
24	17.9500	2.1902E-10	28.11	3.4851E-04
25	22.2400	1.4793E-10	25.55	2.3545E-04
26	28.5000	9.8860E-11	22.11	1.5737E-04
27	36.0000	7.0017E-11	18.85	1.1148E-04

THE EARTH TECHNOLOGY CORP.

Job #:G86179
Client:UNOCAL
Location:MT SHASTA HIGHLANDS
File:SHASTA1.DAT


APPARENT RESISTIVITY (ohm-m)
10^2
10^1
10^0
10^-1
10^-5
10^-4
10^-3
10^-2
TIME (sec)
MODEL:
0
420 ohm-m
100
300
19 ohm-m
DEPTH (m)
600
604
1.4 ohm-m
LOOP RADIUS= 100m
FIELD DATA
MODEL CURVE
THE EARTH TECHNOLOGY CORP.
UNOCAL GEOTHERMAL
MEDICINE LAKE HIGHLAND
APPARENT RESISTIVITY CURVE
SITE: LOOP12
JOB #G88179
Fig.

LOOP12

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		.0	.0		
422.92	195.5	-195.5	-641.3	.5	.5
19.43	408.5	-604.0	-1981.6	21.0	21.5
1.45					

TIMES	DATA LATE	CALC LATE	% ERROR	DATA EARLY
8.90E-05	6.34E+02	6.06E+02	+4.750	1.87E+00
1.10E-04	5.84E+02	5.81E+02	+0.401	1.24E+00
1.40E-04	5.11E+02	5.34E+02	-4.377	8.32E-01
1.77E-04	4.37E+02	4.61E+02	-5.108	5.85E-01
2.20E-04	3.76E+02	3.88E+02	-3.065	4.26E-01
2.80E-04	3.17E+02	3.21E+02	-1.515	3.01E-01
3.55E-04	2.66E+02	2.63E+02	+1.411	2.16E-01
4.43E-04	2.25E+02	2.18E+02	+3.307	1.60E-01
5.64E-04	1.88E+02	1.80E+02	+4.327	1.14E-01
7.13E-04	1.56E+02	1.50E+02	+3.954	8.43E-02
8.85E-04	1.32E+02	1.28E+02	+3.334	6.31E-02
1.10E-03	1.12E+02	1.10E+02	+1.584	4.68E-02
1.41E-03	9.36E+01	9.31E+01	+0.468	3.30E-02
1.78E-03	7.93E+01	8.07E+01	-1.750	2.36E-02
2.21E-03	7.01E+01	7.19E+01	-2.466	1.65E-02
2.83E-03	6.14E+01	6.38E+01	-3.749	1.09E-02
3.57E-03	5.75E+01	5.88E+01	-2.243	6.71E-03
4.46E-03	5.54E+01	5.52E+01	+0.499	4.07E-03
5.67E-03	5.38E+01	5.30E+01	+1.603	2.33E-03
7.16E-03	5.23E+01	5.14E+01	+1.741	1.36E-03
8.81E-03	4.90E+01	4.90E+01	-0.043	8.92E-04
1.10E-02	4.57E+01	4.64E+01	-1.494	5.68E-04

R: 168. X: 0. Y: 0. DL: 0. REQ: 0. CF: 1.0000
TDHZ ARRAY, 22 DATA POINTS, SYSTEM: NONE DATA: LOOP12
MEDICINE LAKE HIGHLAND
UNOCAL GEOTHERMAL 8-13-86
RMS LOG ERROR: 1.85E-02, ANTILOG YIELDS 4.3507 %
LATE TIME PARAMETERS

IGS: ARRTI

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	1.00					
P 2	.00	1.00				
P 3	.00	.00	.98			
T 1	.00	.00	.00	1.00		
T 2	.00	.00	.00	.00	1.00	
F 0	.00	.00	.00	.00	.00	.00

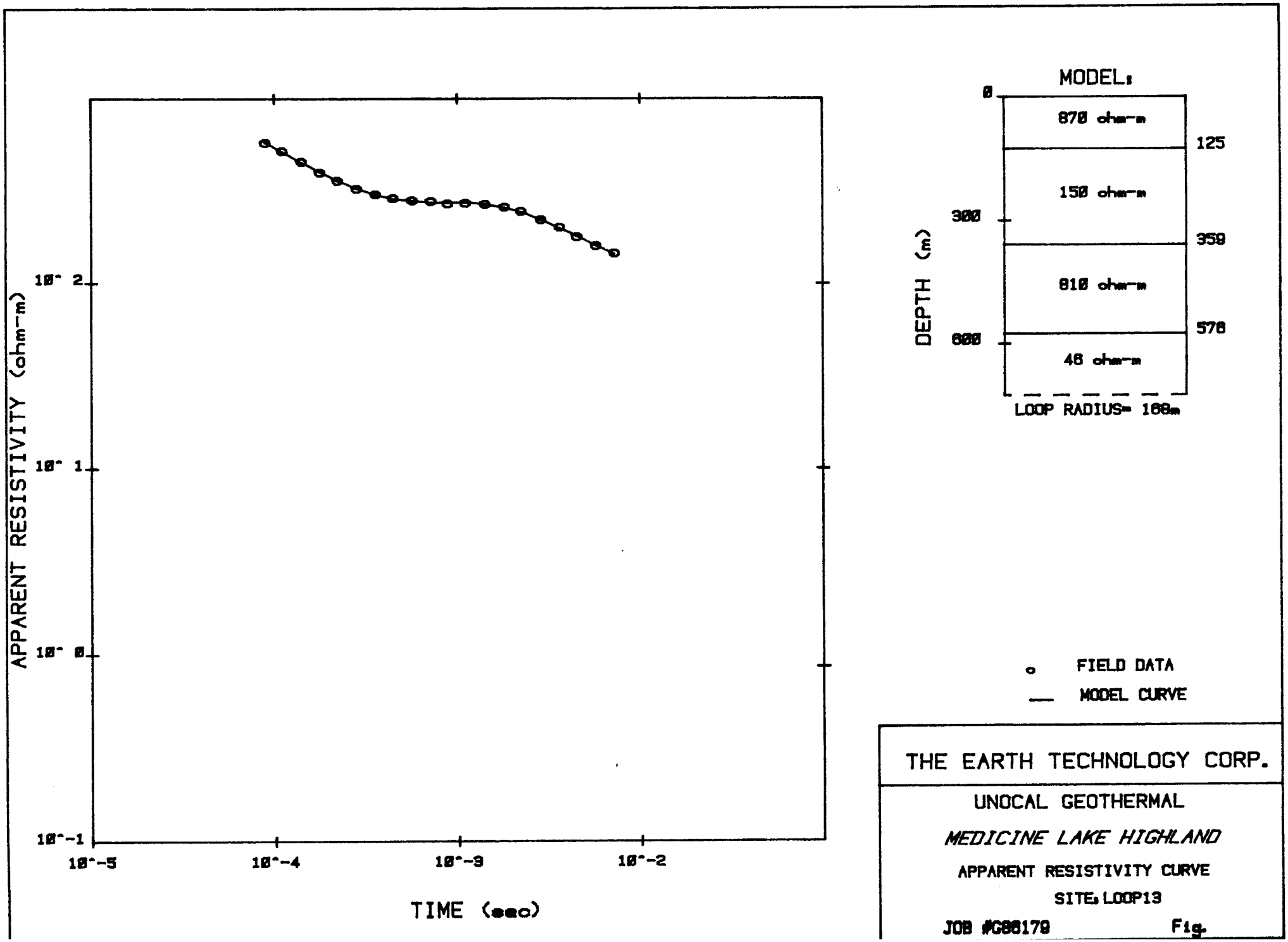
LINE: 0012
STA.: 0000

FREQUENCY = comb freq.
LOOP SIZE = 300 x 300 m
CURRENT = 18 amps
SPACING = 168 m

CH.	TIME(msec)	V(Volts/A-m^2)	RHOA-LATE	RHOA-EARLY
1	0.0890	1.1763E-06	635.88	1.8658E+00
2	0.1100	7.8464E-07	585.14	1.2447E+00
3	0.1400	5.2435E-07	512.15	8.3198E-01
4	0.1770	3.6837E-07	438.41	5.8460E-01
5	0.2200	2.6830E-07	376.91	4.2586E-01
6	0.2800	1.8989E-07	317.52	3.0145E-01
7	0.3550	1.3598E-07	267.10	2.1590E-01
8	0.4430	1.0043E-07	226.01	1.5948E-01
9	0.5640	7.2201E-08	188.31	1.1468E-01
10	0.7130	5.3004E-08	156.56	8.4198E-02
11	0.8855	3.9729E-08	132.22	6.3128E-02
12	1.0980	2.9661E-08	112.26	4.7128E-02
13	1.4055	2.0920E-08	93.88	3.3237E-02
14	1.7825	1.4803E-08	79.57	2.3519E-02
15	2.2120	1.0376E-08	70.37	1.6489E-02
16	2.8250	6.7139E-09	62.57	1.0903E-02
17	3.5750	4.1334E-09	58.39	6.6816E-03
18	4.4600	2.5148E-09	56.25	4.0636E-03
19	5.6700	1.4469E-09	54.50	2.3304E-03
20	7.1600	8.4549E-10	52.86	1.3586E-03
21	8.8100	5.6081E-10	49.19	8.9181E-04
22	10.9600	3.5996E-10	45.94	5.7252E-04
23	14.1100	2.2414E-10	41.35	3.5657E-04
24	17.9500	1.5099E-10	36.03	2.4046E-04
25	22.2400	1.0303E-10	32.52	1.6405E-04
26	28.5000	7.0707E-11	27.65	1.1269E-04
27	36.0000	4.9398E-11	23.79	7.8830E-05

THE EARTH TECHNOLOGY CORP.

Job #:G86179
Client:UNOCAL
Location:MEDICINE LAKE HIGHLAND
File:MLHIGH1.DAT


APPARENT RESISTIVITY (ohm-m)
10^2
10^1
10^0
10^-1
10^-5
10^-4
10^-3
10^-2
TIME (sec)
MODEL:
0
870 ohm-m
125
150 ohm-m
300
359
810 ohm-m
600
578
46 ohm-m
DEPTH (m)
LOOP RADIUS= 100m
FIELD DATA
MODEL CURVE
THE EARTH TECHNOLOGY CORP.
UNOCAL GEOTHERMAL
MEDICINE LAKE HIGHLAND
APPARENT RESISTIVITY CURVE
SITE: LOOP13
JOB #C00179
Fig.

LOOP13

MODEL: 4 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		.0	.0		
866.15	125.0	-125.0	-410.1	.1	.1
149.25	233.6	-358.6	-1176.6	1.6	1.7
806.66	217.0	-575.7	-1888.7	.3	2.0
45.52					

TIMES	DATA LATE	CALC LATE	% ERROR	DATA EARLY
8.90E-05	5.78E+02	5.82E+02	-0.725	2.15E+00
1.10E-04	5.21E+02	5.16E+02	+0.896	1.48E+00
1.40E-04	4.56E+02	4.52E+02	+0.880	9.87E-01
1.77E-04	3.99E+02	4.02E+02	-0.751	6.71E-01
2.20E-04	3.59E+02	3.61E+02	-0.578	4.56E-01
2.80E-04	3.25E+02	3.27E+02	-0.655	2.90E-01
3.55E-04	3.03E+02	3.02E+02	+0.151	1.78E-01
4.43E-04	2.89E+02	2.87E+02	+0.813	1.10E-01
5.64E-04	2.81E+02	2.80E+02	+0.163	6.26E-02
7.13E-04	2.78E+02	2.74E+02	+1.297	3.54E-02
8.81E-04	2.70E+02	2.74E+02	-1.324	2.18E-02
1.10E-03	2.72E+02	2.75E+02	-1.101	1.24E-02
1.41E-03	2.68E+02	2.68E+02	-0.050	6.80E-03
1.80E-03	2.59E+02	2.57E+02	+0.858	3.89E-03
2.22E-03	2.46E+02	2.44E+02	+0.548	2.49E-03
2.85E-03	2.21E+02	2.21E+02	-0.098	1.56E-03
3.60E-03	2.01E+02	1.99E+02	+0.829	1.01E-03
4.49E-03	1.79E+02	1.81E+02	-1.361	6.89E-04
5.70E-03	1.60E+02	1.61E+02	-0.553	4.49E-04
7.19E-03	1.46E+02	1.45E+02	+0.724	2.88E-04

R: 168. X: 0. Y: 0. DL: 0. REQ: 0. CF: 1.0000
TDHZ ARRAY, 20 DATA POINTS, SYSTEM: NONE DATA: LOOP13
MEDICINE LAKE HIGHLAND
UNOCAL GEOTHERMAL 8-14-86
RMS LOG ERROR: 5.30E-03, ANTILOG YIELDS 1.2272 %
LATE TIME PARAMETERS

IGS: ARRTI

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	P 4	T 1	T 2	T 3	F 0
P 1	.12							
P 2	.02	.82						
P 3	.00	.03	.01					
P 4	-.02	.00	.01	.21				
T 1	.19	.12	-.01	.01	.82			
T 2	-.02	-.20	-.01	.17	.12	.41		
T 3	-.04	.11	.06	.17	-.03	.21	.61	
F 0	.00	.00	.00	.00	.00	.00	.00	.00

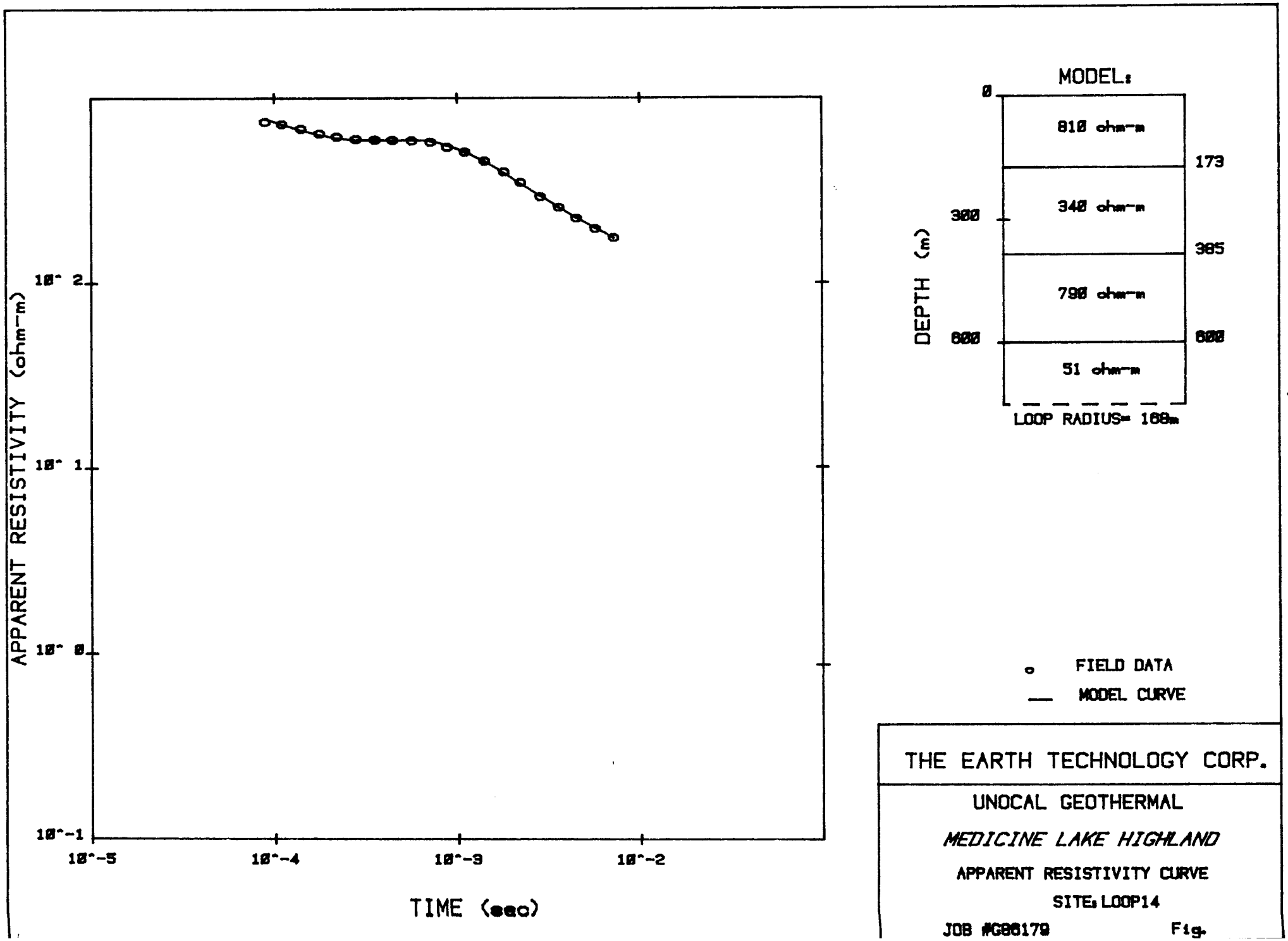
LINE: 0013
STA.: 0000

FREQUENCY = 30 hz
LOOP SIZE = 300 x 300 m
CURRENT = 20 amps
SPACING = 168 m

CH.	TIME(msec)	V(Volts/A-m^2)	RHOA-LATE	RHOA-EARLY
1	0.0890	1.3530E-06	579.22	2.1451E+00
2	0.1100	9.3163E-07	521.85	1.4773E+00
3	0.1400	6.2278E-07	456.65	9.8775E-01
4	0.1770	4.2269E-07	400.00	6.7053E-01
5	0.2200	2.8787E-07	359.63	4.5675E-01
6	0.2800	1.8272E-07	325.76	2.8999E-01
7	0.3550	1.1208E-07	303.83	1.7792E-01
8	0.4430	6.9182E-08	289.75	1.0985E-01
9	0.5640	3.9497E-08	281.53	6.2729E-02
10	0.7130	2.2328E-08	278.60	3.5472E-02
11	0.8810	1.3703E-08	271.13	2.1775E-02
12	1.0960	7.8456E-09	273.27	1.2471E-02
13	1.4110	4.2617E-09	269.42	6.7765E-03
14	1.7950	2.4557E-09	260.50	3.9059E-03
15	2.2240	1.5596E-09	246.67	2.4812E-03
16	2.8500	9.8080E-10	222.28	1.5609E-03
17	3.6000	6.3267E-10	201.71	1.0071E-03
18	4.4900	4.3341E-10	179.62	6.8967E-04
19	5.7000	2.8207E-10	160.69	4.4893E-04
20	7.1900	1.8066E-10	146.86	2.8770E-04

THE EARTH TECHNOLOGY CORP.

Job #:G86179
Client:UNOCAL
Location:MEDICINE LAKE HIGHLAND
File:MLHIGH2.DAT


APPARENT RESISTIVITY (ohm-m)
10^ 2
10^ 1
10^ 0
10^-1
10^-5
10^-4
10^-3
10^-2
TIME (sec)
MODEL:
0
810 ohm-m
173
300
340 ohm-m
385
DEPTH (m)
790 ohm-m
600
600
51 ohm-m
LOOP RADIUS= 168m
FIELD DATA
MODEL CURVE
THE EARTH TECHNOLOGY CORP.
UNOCAL GEOTHERMAL
MEDICINE LAKE HIGHLAND
APPARENT RESISTIVITY CURVE
SITE: LOOP14
JOB #G86179
Fig.

LOOP14

MODEL: 4 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		.0	.0		
806.77	172.7	-172.7	-566.6	.2	.2
339.12	212.1	-384.8	-1262.4	.6	.8
791.26	215.0	-599.8	-1967.8	.3	1.1
50.72					

TIMES	DATA LATE	CALC LATE	% ERROR	DATA EARLY
8.90E-05	7.45E+02	7.73E+02	-3.658	1.47E+00
1.10E-04	7.24E+02	7.22E+02	+0.276	9.01E-01
1.40E-04	6.83E+02	6.72E+02	+1.599	5.38E-01
1.77E-04	6.44E+02	6.34E+02	+1.501	3.27E-01
2.20E-04	6.20E+02	6.08E+02	+2.062	2.01E-01
2.80E-04	6.00E+02	5.94E+02	+1.059	1.16E-01
3.55E-04	5.97E+02	5.96E+02	+0.078	6.43E-02
4.43E-04	5.94E+02	5.92E+02	+0.363	3.73E-02
5.64E-04	5.90E+02	5.96E+02	-0.944	2.06E-02
7.13E-04	5.80E+02	5.89E+02	-1.391	1.18E-02
8.81E-04	5.45E+02	5.58E+02	-2.323	7.60E-03
1.10E-03	5.13E+02	5.14E+02	-0.178	4.78E-03
1.41E-03	4.60E+02	4.58E+02	+0.400	3.03E-03
1.80E-03	4.01E+02	3.96E+02	+1.334	2.02E-03
2.22E-03	3.53E+02	3.46E+02	+1.999	1.45E-03
2.85E-03	2.95E+02	2.98E+02	-0.933	1.01E-03
3.60E-03	2.58E+02	2.58E+02	-0.016	6.92E-04
4.49E-03	2.25E+02	2.26E+02	-0.485	4.89E-04
5.70E-03	1.97E+02	1.99E+02	-1.121	3.29E-04
7.19E-03	1.76E+02	1.76E+02	+0.016	2.18E-04

R: 168. X: 0. Y: 0. DL: 0. REQ: 0. CF: 1.0000
TDHZ ARRAY, 20 DATA POINTS, SYSTEM: NONE DATA: LOOP14
MEDICINE LAKE HIGHLAND
UNOCAL GEOTHERMAL 8-14-86
RMS LOG ERROR: 9.30E-03, ANTILOG YIELDS 2.1642 %
LATE TIME PARAMETERS

IGS: ARRTI

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	P 4	T 1	T 2	T 3	F 0
P 1	.54							
P 2	.07	.73						
P 3	-.04	.08	.03					
P 4	-.03	-.04	-.02	.44				
T 1	.32	.17	.00	.06	.46			
T 2	-.05	-.19	.00	.12	.18	.36		
T 3	-.16	.09	.08	.05	.16	.32	.52	
F 0	.00	.00	.00	.00	.00	.00	.00	.00

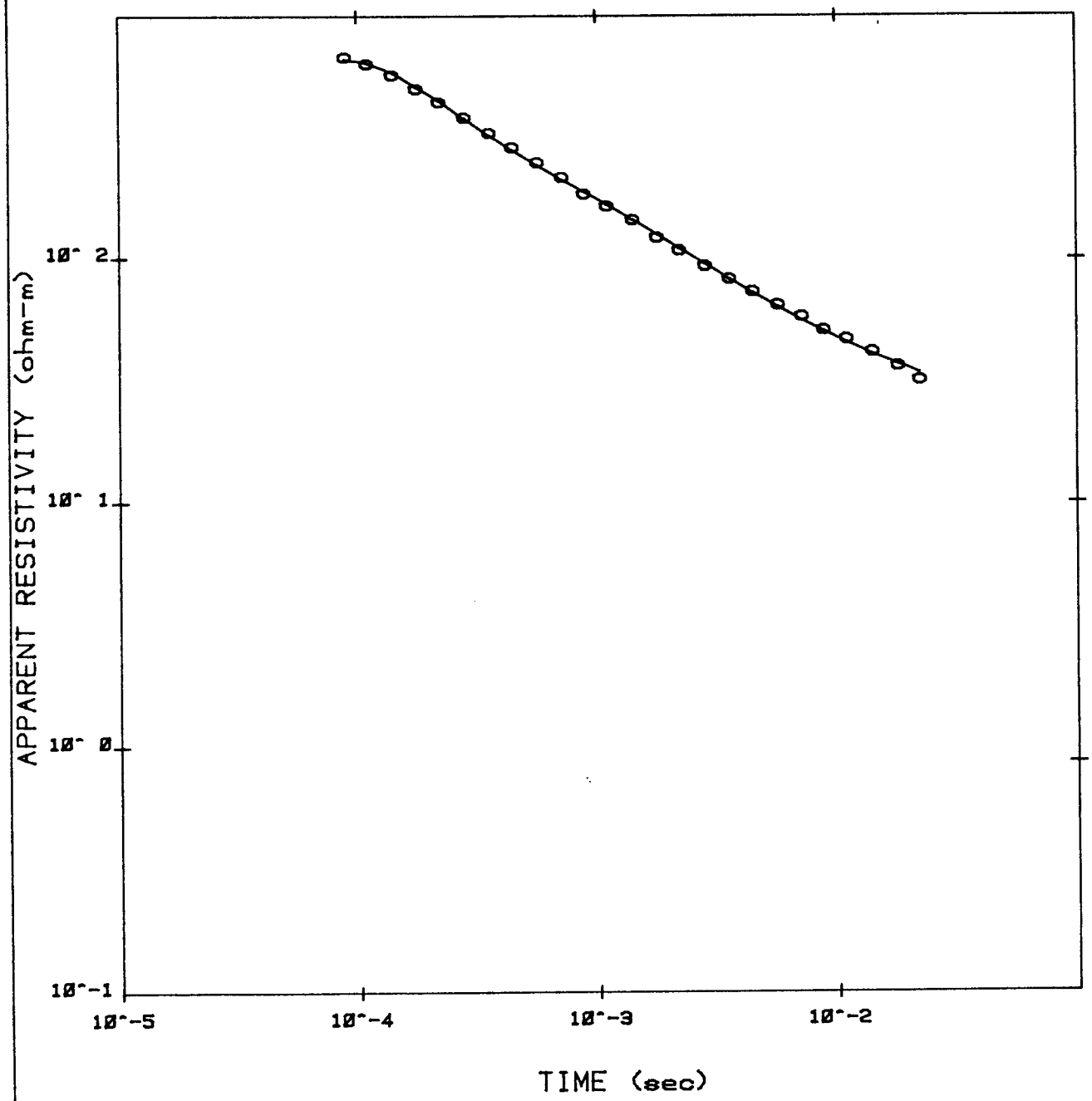
LINE: 0014
STA.: 0000

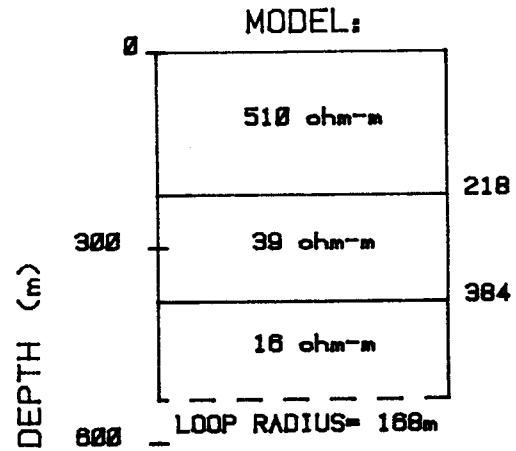
FREQUENCY = 30 hz
LOOP SIZE = 300 x 300 m
CURRENT = 20 amps
SPACING = 168 m

CH.	TIME(msec)	V(Volts/A-m^2)	RHOA-LATE	RHOA-EARLY
1	0.0890	9.2439E-07	746.69	1.4659E+00
2	0.1100	5.6856E-07	725.31	9.0184E-01
3	0.1400	3.3945E-07	684.38	5.3855E-01
4	0.1770	2.0618E-07	645.51	3.2719E-01
5	0.2200	1.2655E-07	622.04	2.0087E-01
6	0.2800	7.2740E-08	601.98	1.1549E-01
7	0.3550	4.0523E-08	598.65	6.4357E-02
8	0.4430	2.3429E-08	596.37	3.7220E-02
9	0.5640	1.2939E-08	592.43	2.0560E-02
10	0.7130	7.3833E-09	582.61	1.1736E-02
11	0.8810	4.7838E-09	546.87	7.6055E-03
12	1.0960	3.0279E-09	515.52	4.8151E-03
13	1.4110	1.8993E-09	461.76	3.0214E-03
14	1.7950	1.2774E-09	402.74	2.0322E-03
15	2.2240	9.0587E-10	354.34	1.4415E-03
16	2.8500	6.3650E-10	296.54	1.0129E-03
17	3.6000	4.3485E-10	259.00	6.9219E-04
18	4.4900	3.0693E-10	226.08	4.8868E-04
19	5.7000	2.0665E-10	197.73	3.2910E-04
20	7.1900	1.3696E-10	176.64	2.1818E-04

THE EARTH TECHNOLOGY CORP.

Job #:G86179
Client:UNOCAL
Location:MEDICINE LAKE HIGHLAND
File:MLHIGH2.DAT





o FIELD DATA

— MODEL CURVE

THE EARTH TECHNOLOGY CORP.

UNOCAL GEOTHERMAL

MEDICINE LAKE HIGHLAND

APPARENT RESISTIVITY CURVE

SITE: LOOP15

JOB #G86179 Fig.

LOOP15

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		.0	.0		
506.45	217.5	-217.5	-713.6	.4	.4
38.52	166.7	-384.2	-1260.6	4.3	4.8
15.62					

TIMES	DATA LATE	CALC LATE	% ERROR	DATA EARLY
8.90E-05	6.80E+02	6.64E+02	+2.419	1.68E+00
1.10E-04	6.37E+02	6.43E+02	-0.962	1.09E+00
1.40E-04	5.74E+02	5.89E+02	-2.554	6.99E-01
1.77E-04	5.04E+02	5.14E+02	-1.998	4.73E-01
2.20E-04	4.44E+02	4.51E+02	-1.574	3.32E-01
2.80E-04	3.83E+02	3.81E+02	+0.401	2.27E-01
3.55E-04	3.31E+02	3.23E+02	+2.560	1.56E-01
4.43E-04	2.88E+02	2.81E+02	+2.601	1.10E-01
5.64E-04	2.49E+02	2.43E+02	+2.514	7.51E-02
7.13E-04	2.16E+02	2.11E+02	+2.220	5.17E-02
8.85E-04	1.84E+02	1.88E+02	-2.568	3.83E-02
1.10E-03	1.64E+02	1.67E+02	-1.761	2.64E-02
1.41E-03	1.44E+02	1.44E+02	-0.410	1.73E-02
1.78E-03	1.22E+02	1.26E+02	-3.406	1.24E-02
2.21E-03	1.08E+02	1.10E+02	-2.194	8.65E-03
2.83E-03	9.35E+01	9.51E+01	-1.757	5.79E-03
3.57E-03	8.27E+01	8.25E+01	+0.228	3.89E-03
4.46E-03	7.36E+01	7.26E+01	+1.470	2.66E-03
5.67E-03	6.50E+01	6.36E+01	+2.221	1.76E-03
7.16E-03	5.83E+01	5.60E+01	+4.017	1.15E-03
8.81E-03	5.13E+01	5.07E+01	+1.145	8.33E-04
1.10E-02	4.72E+01	4.57E+01	+3.230	5.42E-04
1.41E-02	4.19E+01	4.09E+01	+2.579	3.48E-04
1.80E-02	3.66E+01	3.73E+01	-1.943	2.32E-04
2.22E-02	3.21E+01	3.43E+01	-6.597	1.67E-04

R: 168. X: 0. Y: 0. DL: 0. REQ: 0. CF: 1.0000
TDHZ ARRAY, 25 DATA POINTS, SYSTEM: NONE DATA: LOOP15
MEDICINE LAKE HIGHLAND
UNOCAL GEOTHERMAL 8-13-86
RMS LOG ERROR: 1.67E-02, ANTILOG YIELDS 3.9295 %
LATE TIME PARAMETERS

IGS: ARRTI

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	.99					
P 2	-.01	.96				
P 3	.00	-.01	.97			
T 1	.00	.01	.00	1.00		
T 2	.00	.02	.03	.00	.96	
F 0	.00	.00	.00	.00	.00	.00

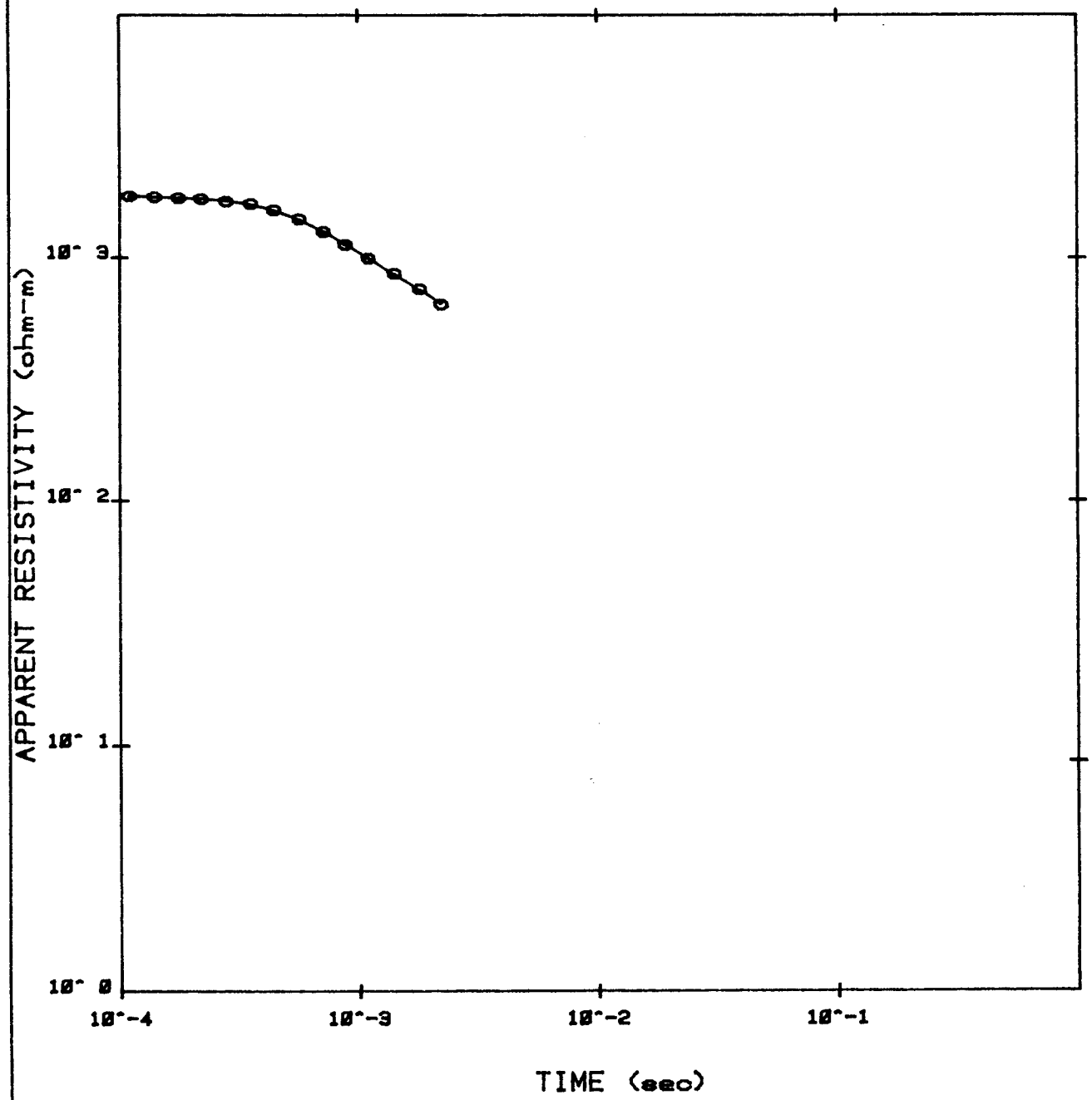
LINE: 0015
STA.: 0000

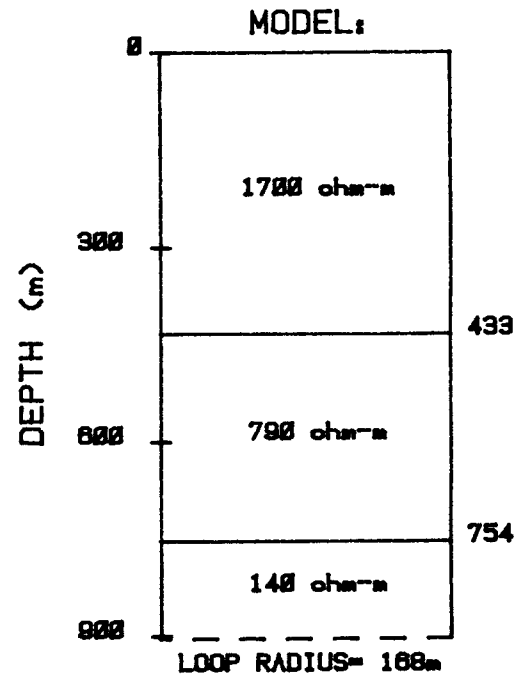
FREQUENCY = comb freq.
LOOP SIZE = 300 x 300 m
CURRENT = 20 amps
SPACING = 168 m

CH.	TIME(msec)	V(Volts/A-m^2)	RHOA-LATE	RHOA-EARLY
1	0.0890	1.0604E-06	681.37	1.6827E+00
2	0.1100	6.8833E-07	638.52	1.0922E+00
3	0.1400	4.4049E-07	575.25	6.9911E-01
4	0.1770	2.9747E-07	505.56	4.7222E-01
5	0.2200	2.0909E-07	445.08	3.3198E-01
6	0.2800	1.4283E-07	383.90	2.2681E-01
7	0.3550	9.8124E-08	331.99	1.5585E-01
8	0.4430	6.9418E-08	289.09	1.1027E-01
9	0.5640	4.7310E-08	249.61	7.5166E-02
10	0.7130	3.2623E-08	216.37	5.1841E-02
11	0.8855	2.4156E-08	184.23	3.8402E-02
12	1.0980	1.6717E-08	164.53	2.6587E-02
13	1.4055	1.0996E-08	144.15	1.7492E-02
14	1.7825	7.6552E-09	123.50	1.2373E-02
15	2.2120	5.3792E-09	109.04	8.6608E-03
16	2.8250	3.5774E-09	95.19	5.8109E-03
17	3.5750	2.3975E-09	83.96	3.8769E-03
18	4.4600	1.6424E-09	74.73	2.6547E-03
19	5.6700	1.0896E-09	65.85	1.7552E-03
20	7.1600	7.1839E-10	58.92	1.1542E-03
21	8.8100	5.2389E-10	51.47	8.3324E-04
22	10.9600	3.4339E-10	47.40	5.4622E-04
23	14.1100	2.1783E-10	42.14	3.4669E-04
24	17.9500	1.4654E-10	36.75	2.3332E-04
25	22.2400	1.0442E-10	32.23	1.6633E-04

THE EARTH TECHNOLOGY CORP.

Job #:G86179
Client:UNOCAL
Location:MT SHASTA HIGHLANDS
File:SHASTA1.DAT





o FIELD DATA

— MODEL CURVE

THE EARTH TECHNOLOGY CORP.

UNOCAL GEOTHERMAL

MEDICINE LAKE HIGHLAND

APPARENT RESISTIVITY CURVE

SITE: LOOP16

JOB #G86179 Fig.

LOOP16

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		.0	.0		
1694.90	432.9	-432.9	-1420.3	.3	.3
790.04	321.2	-754.1	-2474.2	.4	.7
140.67					

TIMES	DATA LATE	CALC LATE	% ERROR	DATA EARLY
1.10E-04	1.78E+03	1.78E+03	-0.262	2.34E-01
1.40E-04	1.77E+03	1.77E+03	+0.471	1.29E-01
1.77E-04	1.75E+03	1.75E+03	+0.020	7.30E-02
2.20E-04	1.74E+03	1.74E+03	+0.084	4.28E-02
2.80E-04	1.70E+03	1.71E+03	-0.820	2.42E-02
3.55E-04	1.66E+03	1.65E+03	+0.288	1.39E-02
4.43E-04	1.57E+03	1.56E+03	+0.322	8.67E-03
5.64E-04	1.44E+03	1.43E+03	+0.271	5.40E-03
7.13E-04	1.28E+03	1.28E+03	-0.291	3.58E-03
8.81E-04	1.13E+03	1.14E+03	-0.929	2.55E-03
1.10E-03	9.97E+02	9.96E+02	+0.117	1.76E-03
1.41E-03	8.63E+02	8.56E+02	+0.871	1.18E-03
1.80E-03	7.45E+02	7.38E+02	+0.844	7.97E-04
2.22E-03	6.44E+02	6.51E+02	-1.034	5.87E-04

R: 168. X: 0. Y: 0. DL: 0. REQ: 0. CF: 1.0000
TDHZ ARRAY, 14 DATA POINTS, SYSTEM: NONE DATA: LOOP16
MEDICINE LAKE HIGHLAND
UNOCAL GEOTHERMAL 8-14-86
RMS LOG ERROR: 3.79E-03, ANTILOG YIELDS .8769 %
LATE TIME PARAMETERS

IGS: ARRTI

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	.99					
P 2	-.03	.51				
P 3	.00	-.08	.88			
T 1	.03	.30	.02	.79		
T 2	-.04	-.31	.02	.24	.70	
F 0	.00	.00	.00	.00	.00	.00

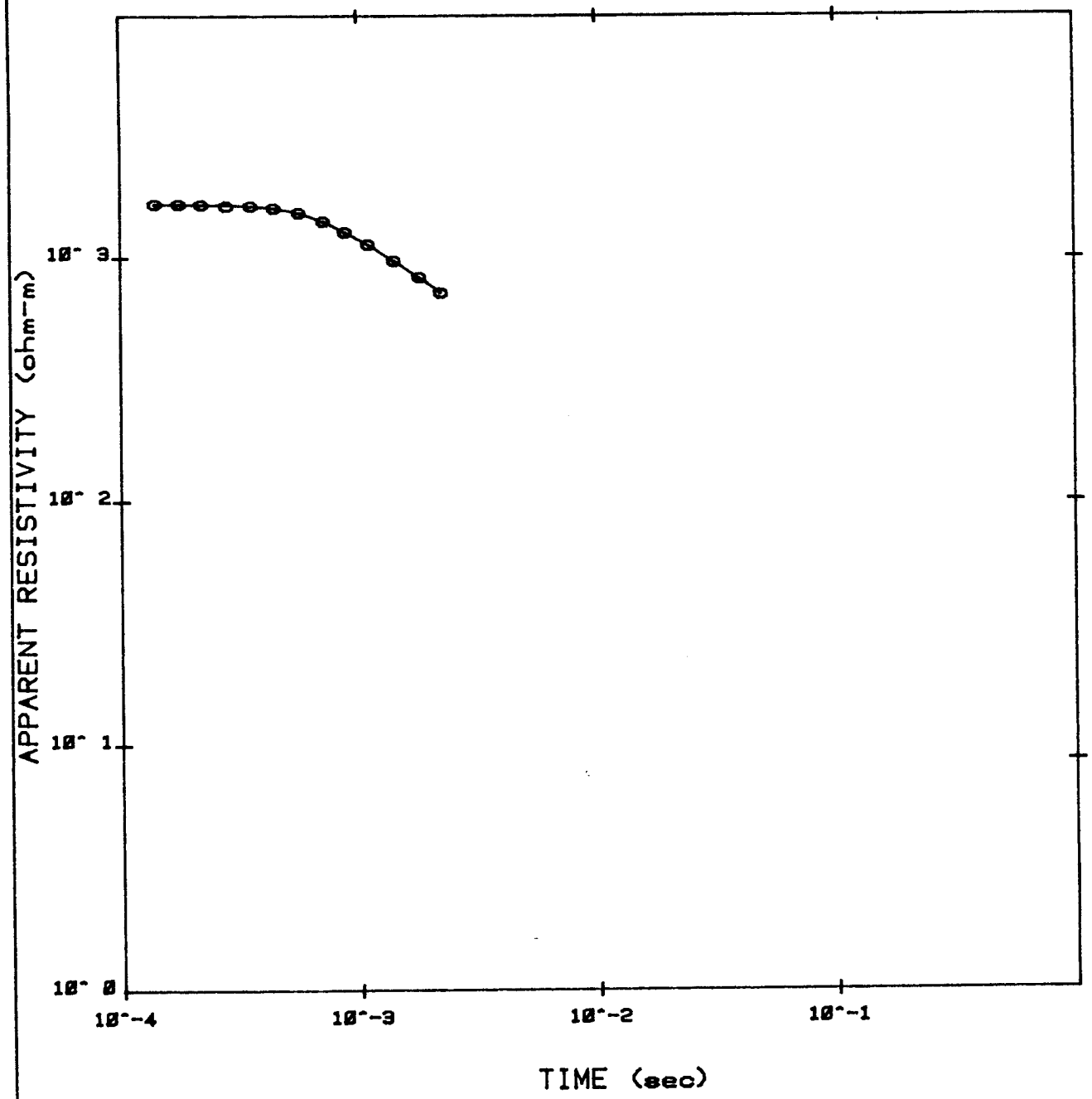
LINE: 0016
STA.: 0000

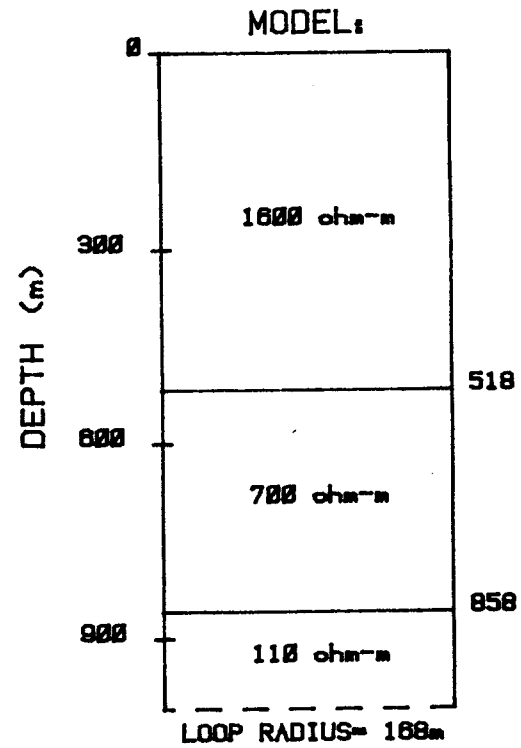
FREQUENCY = 30 hz
LOOP SIZE = 300 x 300 m
CURRENT = 22 amps
SPACING = 168 m

CH.	TIME(msec)	V(Volts/A-m^2)	RHOA-LATE	RHOA-EARLY
1	0.0890	2.7437E-07	1678.11	4.3534E-01
2	0.1100	1.4754E-07	1782.74	2.3418E-01
3	0.1400	8.1020E-08	1778.63	1.2861E-01
4	0.1770	4.6135E-08	1751.39	7.3257E-02
5	0.2200	2.6992E-08	1742.48	4.2878E-02
6	0.2800	1.5297E-08	1702.22	2.4305E-02
7	0.3550	8.7369E-09	1664.97	1.3886E-02
8	0.4430	5.4572E-09	1575.33	8.6744E-03
9	0.5640	3.3985E-09	1444.45	5.4037E-03
10	0.7130	2.2601E-09	1282.69	3.5943E-03
11	0.8810	1.6107E-09	1129.95	2.5619E-03
12	1.0960	1.1184E-09	1001.39	1.7796E-03
13	1.4110	7.3785E-10	867.30	1.1745E-03
14	1.7950	5.0431E-10	748.38	8.0310E-04
15	2.2240	3.6727E-10	646.87	5.8466E-04

THE EARTH TECHNOLOGY CORP.

Job #:G86179
Client:UNOCAL
Location:MEDICINE LAKE HIGHLAND
File:MLHIGH2.DAT





o FIELD DATA

— MODEL CURVE

THE EARTH TECHNOLOGY CORP.

UNOCAL GEOTHERMAL

MEDICINE LAKE HIGHLAND

APPARENT RESISTIVITY CURVE

SITE: LOOP17

JOB #G86179 Fig.

LOOP17

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		.0	.0		
1588.36	518.1	-518.1	-1699.7	.3	.3
696.44	340.3	-858.4	-2816.2	.5	.8
114.08					

TIMES	DATA LATE	CALC LATE	% ERROR	DATA EARLY
1.40E-04	1.67E+03	1.67E+03	-0.112	1.41E-01
1.77E-04	1.67E+03	1.67E+03	+0.579	7.83E-02
2.20E-04	1.66E+03	1.66E+03	+0.028	4.59E-02
2.80E-04	1.64E+03	1.66E+03	-1.081	2.56E-02
3.55E-04	1.64E+03	1.64E+03	-0.167	1.41E-02
4.43E-04	1.61E+03	1.61E+03	+0.403	8.35E-03
5.64E-04	1.54E+03	1.54E+03	+0.255	4.88E-03
7.13E-04	1.42E+03	1.42E+03	-0.343	3.07E-03
8.81E-04	1.28E+03	1.28E+03	-0.318	2.11E-03
1.10E-03	1.14E+03	1.14E+03	+0.035	1.44E-03
1.41E-03	9.73E+02	9.74E+02	-0.139	9.84E-04
1.80E-03	8.34E+02	8.32E+02	+0.150	6.73E-04
2.22E-03	7.21E+02	7.24E+02	-0.456	4.96E-04

R: 168. X: 0. Y: 0. DL: 0. REQ: 0. CF: 1.0000
TDHZ ARRAY, 13 DATA POINTS, SYSTEM: NONE DATA: LOOP17
MEDICINE LAKE HIGHLAND
UNOCAL GEOTHERMAL 8-14-86
RMS LOG ERROR: 2.71E-03, ANTILOG YIELDS .6265 %
LATE TIME PARAMETERS

IGS: ARRTI

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	1.00					
P 2	-.02	.43				
P 3	.00	-.14	.77			
T 1	.02	.27	.02	.85		
T 2	-.02	-.30	.03	.19	.73	
F 0	.00	.00	.00	.00	.00	.00

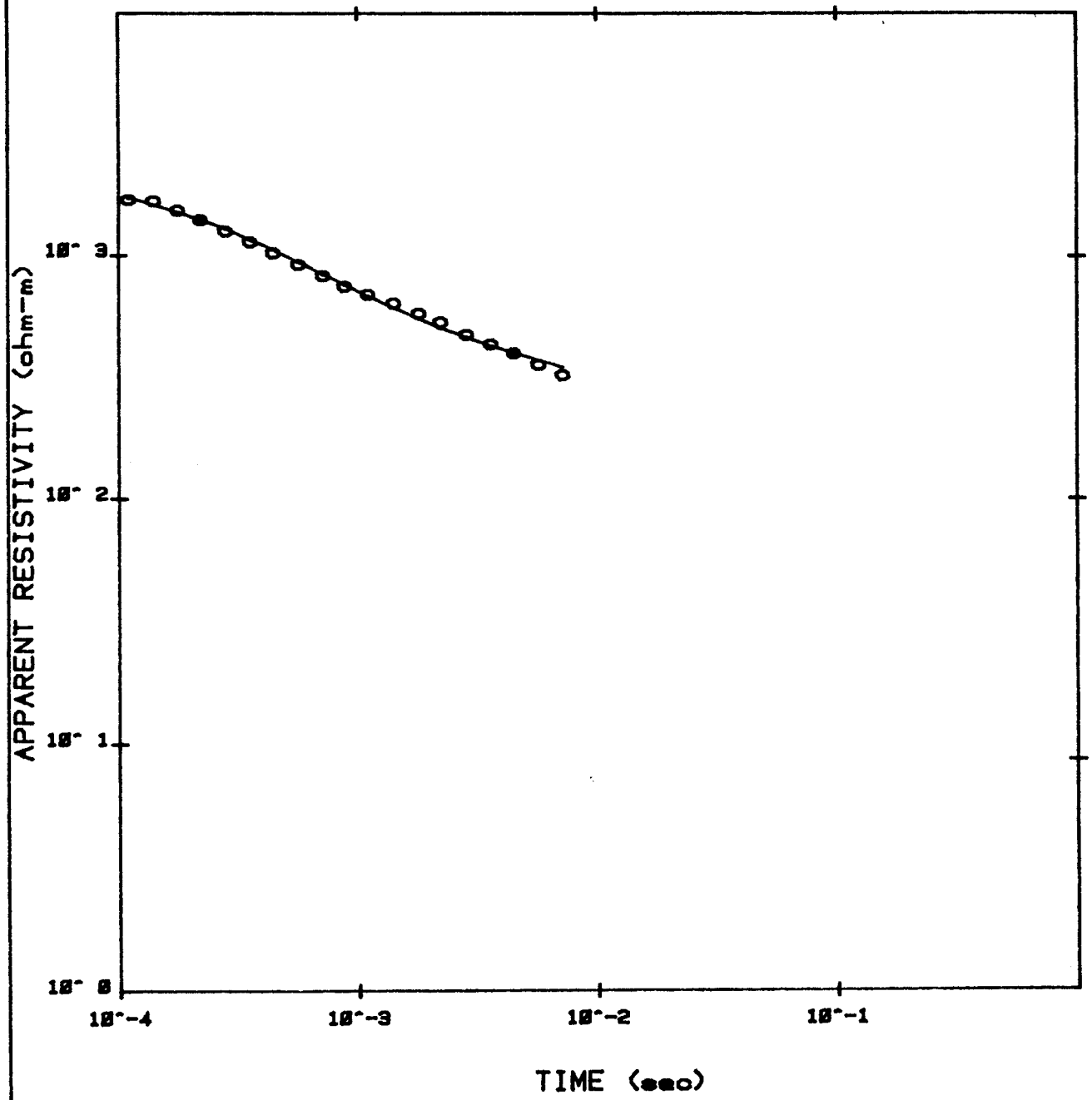
LINE: 0017
STA.: 0000

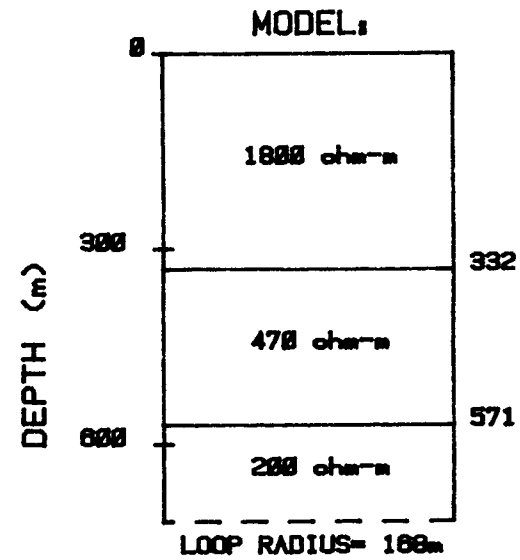
FREQUENCY = 30 hz
LOOP SIZE = 300 x 300 m
CURRENT = 22 amps
SPACING = 168 m

CH.	TIME(msec)	V(Volts/A-m^2)	RHOA-LATE	RHOA-EARLY
3	0.1400	8.8611E-08	1675.54	1.4061E-01
4	0.1770	4.9123E-08	1679.63	7.7969E-02
5	0.2200	2.8800E-08	1668.77	4.5723E-02
6	0.2800	1.6117E-08	1644.01	2.5596E-02
7	0.3550	8.9159E-09	1642.61	1.4164E-02
8	0.4430	5.2352E-09	1619.56	8.3187E-03
9	0.5640	3.0698E-09	1545.79	4.8794E-03
10	0.7130	1.9389E-09	1420.73	3.0824E-03
11	0.8810	1.3283E-09	1284.90	2.1121E-03
12	1.0960	9.1886E-10	1141.59	1.4614E-03
13	1.4110	6.1688E-10	977.26	9.8144E-04
14	1.7950	4.2620E-10	837.22	6.7812E-04
15	2.2240	3.0993E-10	724.36	4.9330E-04

THE EARTH TECHNOLOGY CORP.

Job #:G86179
Client:UNOCAL
Location:MEDICINE LAKE HIGHLAND
File:MLHIGH2.DAT





o FIELD DATA

— MODEL CURVE

THE EARTH TECHNOLOGY CORP.

UNOCAL GEOTHERMAL

MEDICINE LAKE HIGHLAND

APPARENT RESISTIVITY CURVE

SITE: LOOP18

JOB #G86179 Fig.

LOOP18

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		.0	.0		
1751.43	332.0	-332.0	-1089.3	.2	.2
466.90	239.0	-571.1	-1873.6	.5	.7
204.69					

TIMES	DATA LATE	CALC LATE	% ERROR	DATA EARLY
1.10E-04	1.69E+03	1.72E+03	-1.492	2.53E-01
1.40E-04	1.67E+03	1.61E+03	+3.347	1.41E-01
1.77E-04	1.53E+03	1.50E+03	+2.276	8.93E-02
2.20E-04	1.40E+03	1.40E+03	-0.056	5.93E-02
2.80E-04	1.26E+03	1.29E+03	-2.290	3.80E-02
3.55E-04	1.14E+03	1.16E+03	-2.412	2.44E-02
4.43E-04	1.03E+03	1.06E+03	-2.931	1.63E-02
5.64E-04	9.23E+02	9.45E+02	-2.347	1.05E-02
7.13E-04	8.31E+02	8.44E+02	-1.464	6.85E-03
8.81E-04	7.53E+02	7.65E+02	-1.533	4.68E-03
1.10E-03	6.98E+02	6.88E+02	+1.411	3.01E-03
1.41E-03	6.43E+02	6.17E+02	+4.259	1.83E-03
1.80E-03	5.86E+02	5.57E+02	+5.238	1.14E-03
2.22E-03	5.39E+02	5.10E+02	+5.744	7.67E-04
2.85E-03	4.79E+02	4.67E+02	+2.423	4.90E-04
3.60E-03	4.38E+02	4.30E+02	+2.055	3.13E-04
4.49E-03	4.02E+02	4.02E+02	-0.103	2.05E-04
5.70E-03	3.61E+02	3.75E+02	-3.658	1.32E-04
7.19E-03	3.26E+02	3.52E+02	-7.524	8.64E-05

R: 168. X: 0. Y: 0. DL: 0. REQ: 0. CF: 1.0000
TDHZ ARRAY, 19 DATA POINTS, SYSTEM: NONE DATA: LOOP18
MEDICINE LAKE HIGHLAND
UNOCAL GEOTHERMAL 8-15-86
RMS LOG ERROR: 2.17E-02, ANTILOG YIELDS 5.1148 %
LATE TIME PARAMETERS

IGS: ARRTI

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	.64					
P 2	-.01	.17				
P 3	-.05	-.04	.77			
T 1	.18	.30	.05	.75		
T 2	-.20	.04	.15	.17	.28	
F 0	.00	.00	.00	.00	.00	.00

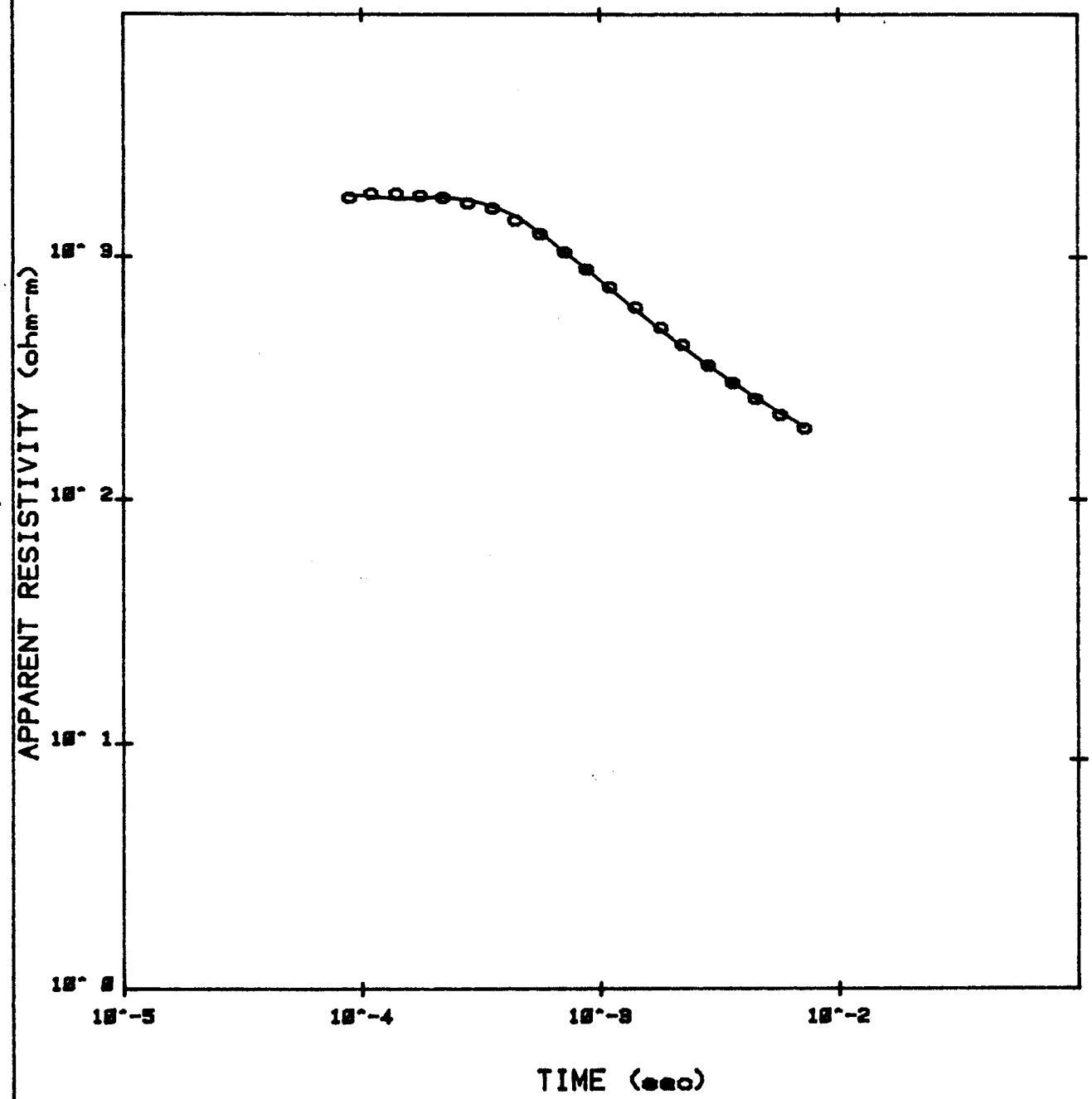
LINE: 0018
STA.: 0000

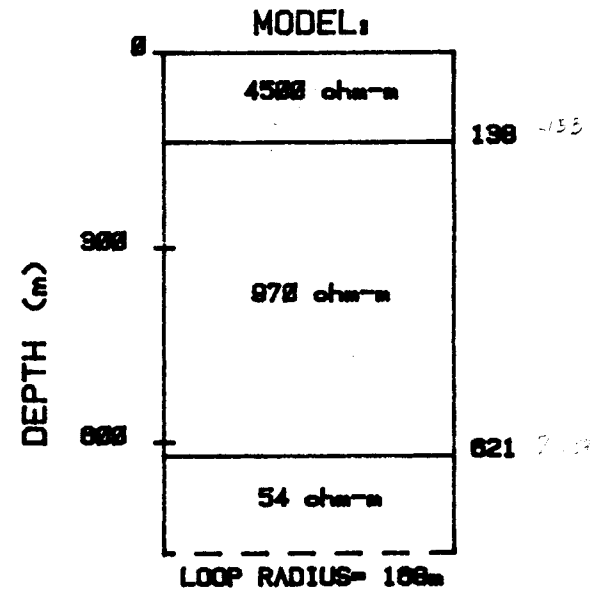
FREQUENCY = 30 hz
LOOP SIZE = 300 x 300 m
CURRENT = 22 amps
SPACING = 168 m

CH.	TIME(msec)	V(Volts/A-m^2)	RHOA-LATE	RHOA-EARLY
2	0.1100	1.5870E-07	1698.22	2.5183E-01
3	0.1400	8.8832E-08	1672.76	1.4100E-01
4	0.1770	5.6100E-08	1537.32	8.9073E-02
5	0.2200	3.7391E-08	1402.19	5.9383E-02
6	0.2800	2.4011E-08	1260.36	3.8141E-02
7	0.3550	1.5429E-08	1139.59	2.4516E-02
8	0.4430	1.0332E-08	1029.33	1.6419E-02
9	0.5640	6.6124E-09	926.81	1.0511E-02
10	0.7130	4.3064E-09	834.58	6.8471E-03
11	0.8810	2.9428E-09	756.06	4.6799E-03
12	1.0960	1.9096E-09	700.99	3.0374E-03
13	1.4110	1.1478E-09	645.99	1.8273E-03
14	1.7950	7.2334E-10	588.42	1.1514E-03
15	2.2240	4.7932E-10	541.65	7.6299E-04
16	2.8500	3.0812E-10	480.99	4.9038E-04
17	3.6000	1.9593E-10	440.68	3.1210E-04
18	4.4900	1.2875E-10	403.44	2.0497E-04
19	5.7000	8.2919E-11	363.47	1.3218E-04
20	7.1900	5.4241E-11	327.54	8.6438E-05

THE EARTH TECHNOLOGY CORP.

Job #:G86179
Client:UNOCAL
Location:MEDICINE LAKE HIGHLAND
File:MLHIGH3.DAT





o FIELD DATA

— MODEL CURVE

THE EARTH TECHNOLOGY CORP.

UNOCAL GEOTHERMAL

MEDICINE LAKE HIGHLAND

APPARENT RESISTIVITY CURVE

SITE: LOOP19

JOB #C88179 Fig.

LOOP19

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		.0	.0		
4472.09	138.2	-138.2	-453.5	.0	.0
965.81	483.1	-621.3	-2038.5	.5	.5
53.79					

TIMES	DATA LATE	CALC LATE	% ERROR	DATA EARLY
8.90E-05	1.75E+03	1.81E+03	-3.398	4.07E-01
1.10E-04	1.82E+03	1.77E+03	+2.802	2.26E-01
1.40E-04	1.82E+03	1.74E+03	+4.628	1.24E-01
1.77E-04	1.79E+03	1.75E+03	+2.090	7.06E-02
2.20E-04	1.75E+03	1.77E+03	-0.952	4.24E-02
2.80E-04	1.67E+03	1.72E+03	-2.679	2.49E-02
3.55E-04	1.59E+03	1.62E+03	-2.260	1.48E-02
4.43E-04	1.42E+03	1.48E+03	-3.678	1.01E-02
5.64E-04	1.25E+03	1.26E+03	-0.447	6.67E-03
7.13E-04	1.05E+03	1.05E+03	+0.047	4.83E-03
8.81E-04	8.93E+02	8.95E+02	-0.181	3.62E-03
1.10E-03	7.55E+02	7.44E+02	+1.452	2.68E-03
1.41E-03	6.23E+02	6.07E+02	+2.633	1.92E-03
1.80E-03	5.12E+02	5.03E+02	+1.791	1.40E-03
2.22E-03	4.36E+02	4.27E+02	+1.989	1.05E-03
2.85E-03	3.58E+02	3.57E+02	+0.100	7.59E-04
3.60E-03	3.04E+02	3.05E+02	-0.385	5.41E-04
4.49E-03	2.61E+02	2.63E+02	-1.063	3.91E-04
5.70E-03	2.24E+02	2.29E+02	-2.027	2.71E-04
7.19E-03	1.97E+02	2.00E+02	-1.432	1.84E-04

R: 168. X: 0. Y: 0. DL: 0. REQ: 0. CF: 1.0000
TDHZ ARRAY, 20 DATA POINTS, SYSTEM: NONE DATA: LOOP19
MEDICINE LAKE HIGHLAND
UNOCAL GEOTHERMAL 8-16-86
RMS LOG ERROR: 1.42E-02, ANTILOG YIELDS 3.3333 %
LATE TIME PARAMETERS

IGS: ARRTI

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	.66					
P 2	-.02	.93				
P 3	-.01	-.01	.97			
T 1	.13	.12	.02	.75		
T 2	-.04	-.03	.00	.07	.98	
F 0	.00	.00	.00	.00	.00	.00

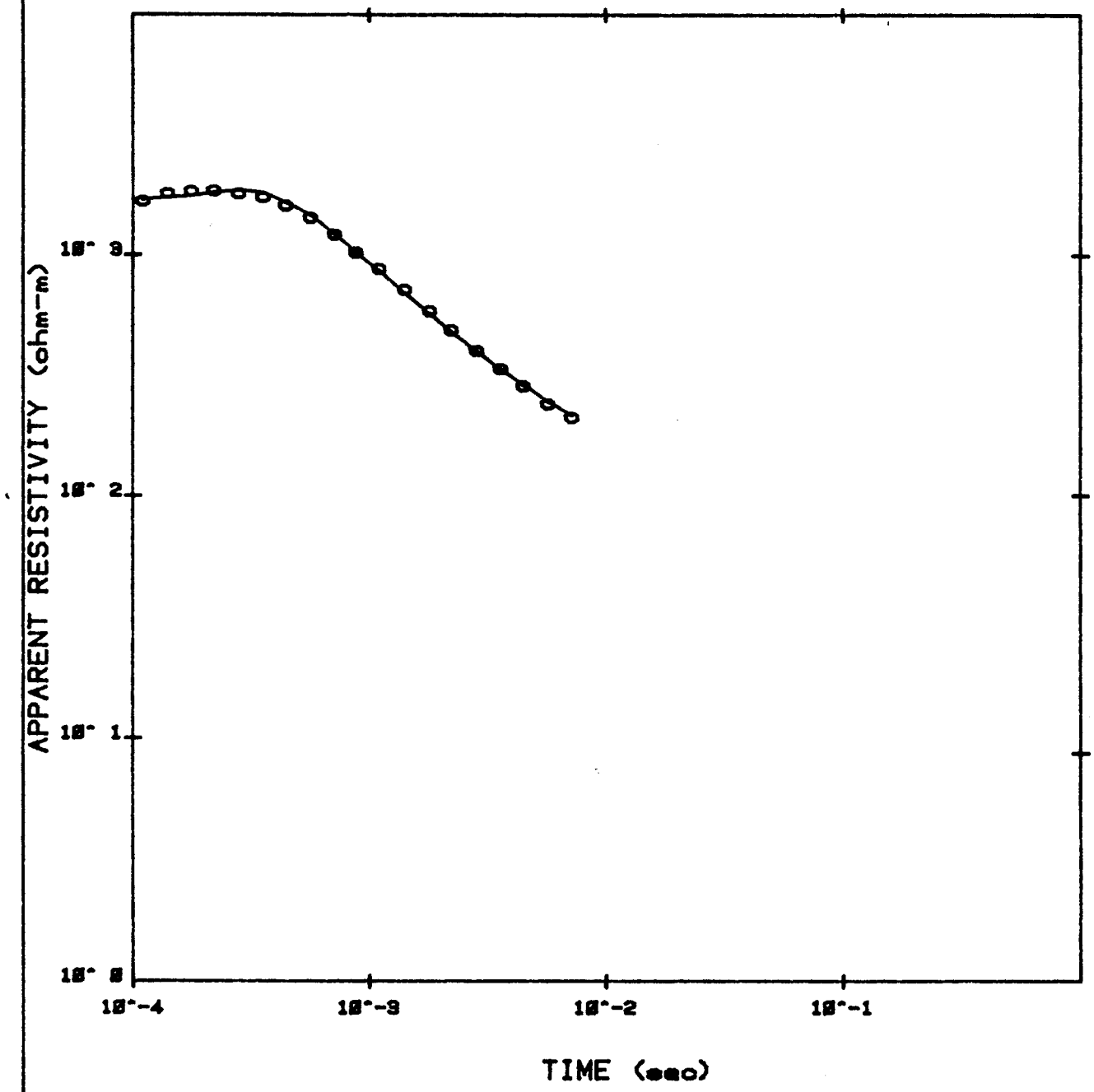
LINE: 0019
STA.: 0000

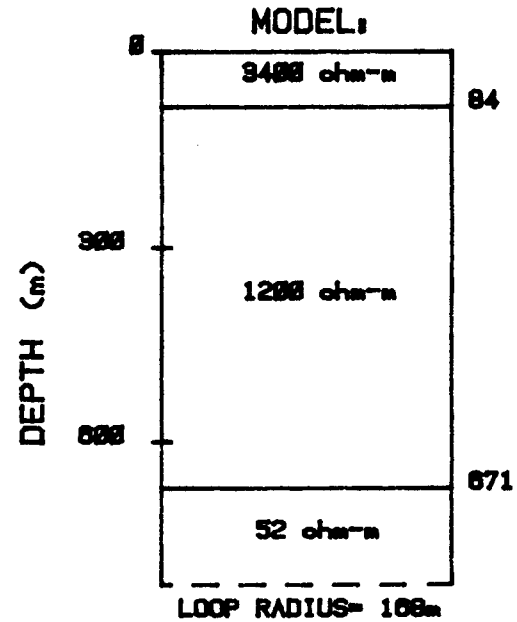
FREQUENCY = 30 hz
LOOP SIZE = 300 x 300 m
CURRENT = 21 amps
SPACING = 168 m

CH.	TIME(msec)	V(Volts/A-m^2)	RHOA-LATE	RHOA-EARLY
1	0.0890	2.5660E-07	1754.73	4.0707E-01
2	0.1100	1.4213E-07	1827.76	2.2552E-01
3	0.1400	7.7980E-08	1824.55	1.2377E-01
4	0.1770	4.4432E-08	1795.86	7.0552E-02
5	0.2200	2.6720E-08	1754.28	4.2436E-02
6	0.2800	1.5642E-08	1677.16	2.4849E-02
7	0.3550	9.3384E-09	1592.69	1.4844E-02
8	0.4430	6.3178E-09	1428.81	1.0041E-02
9	0.5640	4.1941E-09	1255.46	6.6680E-03
10	0.7130	3.0194E-09	1057.46	4.8008E-03
11	0.8810	2.2792E-09	896.48	3.6241E-03
12	1.0960	1.6989E-09	757.82	2.7019E-03
13	1.4110	1.2038E-09	625.82	1.9147E-03
14	1.7950	8.8415E-10	514.72	1.4067E-03
15	2.2240	6.5965E-10	437.78	1.0495E-03
16	2.8500	4.7717E-10	359.34	7.5936E-04
17	3.6000	3.3970E-10	305.35	5.4067E-04
18	4.4900	2.4623E-10	261.85	3.9195E-04
19	5.7000	1.6984E-10	225.36	2.7049E-04
20	7.1900	1.1511E-10	198.34	1.8340E-04

THE EARTH TECHNOLOGY CORP.

Job #:G86179
Client:UNOCAL
Location:MEDICINE LAKE HIGHLAND
File:MLHIGH4.DAT





o FIELD DATA

— MODEL CURVE

THE EARTH TECHNOLOGY CORP.

UNOCAL GEOTHERMAL

MEDICINE LAKE HIGHLAND

APPARENT RESISTIVITY CURVE

SITE: LOOP20

JOB #G86179 Fig.

LOOP20

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		.0	.0		
3434.27	84.2	-84.2	-276.4	.0	.0
1249.68	586.8	-671.0	-2201.6	.5	.5
52.39					

TIMES	DATA LATE	CALC LATE	% ERROR	DATA EARLY
1.10E-04	1.67E+03	1.70E+03	-1.831	2.57E-01
1.40E-04	1.80E+03	1.73E+03	+4.329	1.26E-01
1.77E-04	1.84E+03	1.77E+03	+4.027	6.77E-02
2.20E-04	1.85E+03	1.82E+03	+1.776	3.90E-02
2.80E-04	1.80E+03	1.87E+03	-3.347	2.22E-02
3.55E-04	1.74E+03	1.82E+03	-4.367	1.29E-02
4.43E-04	1.61E+03	1.66E+03	-2.782	8.35E-03
5.64E-04	1.43E+03	1.47E+03	-2.573	5.46E-03
7.13E-04	1.22E+03	1.23E+03	-0.774	3.85E-03
8.81E-04	1.03E+03	1.03E+03	-0.152	2.93E-03
1.10E-03	8.81E+02	8.65E+02	+1.746	2.12E-03
1.41E-03	7.22E+02	6.98E+02	+3.409	1.54E-03
1.80E-03	5.90E+02	5.74E+02	+2.803	1.13E-03
2.22E-03	4.93E+02	4.85E+02	+1.579	8.77E-04
2.85E-03	4.05E+02	4.02E+02	+0.723	6.31E-04
3.60E-03	3.41E+02	3.39E+02	+0.426	4.55E-04
4.49E-03	2.89E+02	2.93E+02	-1.043	3.36E-04
5.70E-03	2.43E+02	2.50E+02	-2.737	2.40E-04
7.19E-03	2.13E+02	2.18E+02	-2.457	1.64E-04

R: 168. X: 0. Y: 0. DL: 0. REQ: 0. CF: 1.0000
TDHZ ARRAY, 19 DATA POINTS, SYSTEM: NONE DATA: LOOP20
MEDICINE LAKE HIGHLAND
UNOCAL GEOTHERMAL 8-16-86
RMS LOG ERROR: 1.68E-02, ANTILOG YIELDS 3.9540 %
LATE TIME PARAMETERS

IGS: ARRTI

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	.69					
P 2	.03	.96				
P 3	.02	.00	.96			
T 1	.07	.16	.00	.23		
T 2	-.01	-.02	.00	.11	.98	
F 0	.00	.00	.00	.00	.00	.00

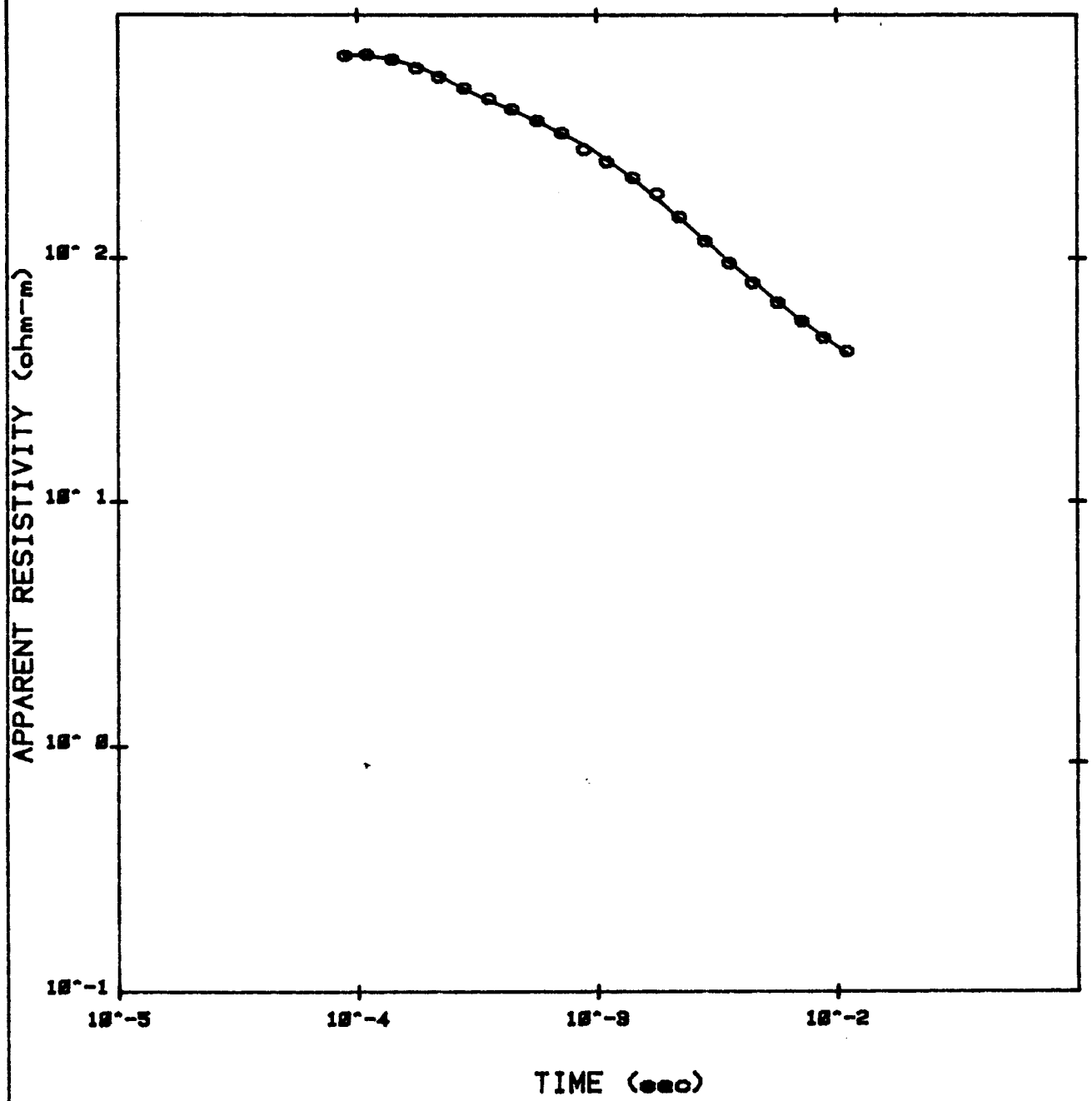
LINE: 0020
STA.: 0000

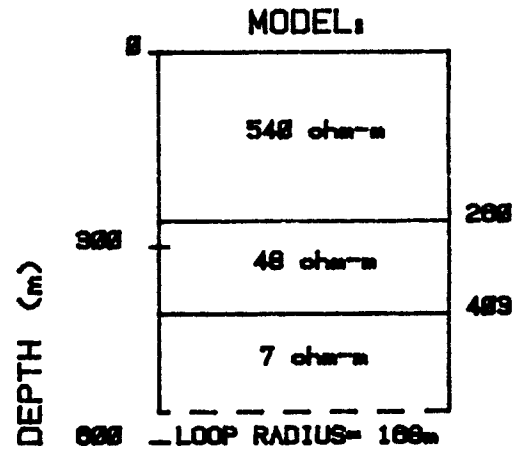
FREQUENCY = 30 hz
LOOP SIZE = 300 x 300 m
CURRENT = 21 amps
SPACING = 168 m

CH.	TIME(msec)	V(Volts/A-m^2)	RHOA-LATE	RHOA-EARLY
2	0.1100	1.6265E-07	1670.60	2.5809E-01
3	0.1400	7.9157E-08	1806.42	1.2565E-01
4	0.1770	4.2564E-08	1848.02	6.7580E-02
5	0.2200	2.4477E-08	1859.87	3.8877E-02
6	0.2800	1.3965E-08	1808.86	2.2187E-02
7	0.3550	8.1490E-09	1744.12	1.2951E-02
8	0.4430	5.2296E-09	1620.71	8.3155E-03
9	0.5640	3.4231E-09	1437.51	5.4431E-03
10	0.7130	2.4188E-09	1225.97	3.8465E-03
11	0.8810	1.8445E-09	1032.32	2.9335E-03
12	1.0960	1.3470E-09	884.62	2.1436E-03
13	1.4110	9.6465E-10	725.38	1.5352E-03
14	1.7950	7.1575E-10	592.57	1.1395E-03
15	2.2240	5.4851E-10	495.08	8.7284E-04
16	2.8500	3.9628E-10	406.70	6.3086E-04
17	3.6000	2.8630E-10	342.22	4.5584E-04
18	4.4900	2.1021E-10	290.97	3.3478E-04
19	5.7000	1.5053E-10	244.24	2.3967E-04
20	7.1900	1.0283E-10	213.83	1.6374E-04

THE EARTH TECHNOLOGY CORP.

Job #:G86179
Client:UNOCAL
Location:MEDICINE LAKE HIGHLAND
File:MLHIGH4.DAT





FIELD DATA

MODEL CURVE

THE EARTH TECHNOLOGY CORP.

UNOCAL GEOTHERMAL

MEDICINE LAKE HIGHLAND

APPARENT RESISTIVITY CURVE

SITE: LOOP21

JOB #G88179 Fig.

LOOP21

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		.0	.0		
542.48	260.5	-260.5	-854.6	.5	.5
47.85	142.7	-403.1	-1322.6	3.0	3.5
7.02					

TIMES	DATA LATE	CALC LATE	% ERROR	DATA EARLY
8.90E-05	6.80E+02	6.81E+02	-0.182	1.68E+00
1.10E-04	6.88E+02	6.82E+02	+0.902	9.73E-01
1.40E-04	6.57E+02	6.57E+02	+0.033	5.71E-01
1.77E-04	6.04E+02	6.14E+02	-1.554	3.60E-01
2.20E-04	5.54E+02	5.63E+02	-1.634	2.38E-01
2.80E-04	4.99E+02	4.96E+02	+0.762	1.52E-01
3.55E-04	4.52E+02	4.44E+02	+1.784	9.77E-02
4.43E-04	4.10E+02	4.06E+02	+0.989	6.50E-02
5.64E-04	3.67E+02	3.64E+02	+0.917	4.20E-02
7.13E-04	3.27E+02	3.25E+02	+0.604	2.78E-02
8.85E-04	2.79E+02	2.92E+02	-4.401	2.05E-02
1.10E-03	2.48E+02	2.54E+02	-2.440	1.42E-02
1.41E-03	2.14E+02	2.12E+02	+1.160	9.54E-03
1.78E-03	1.84E+02	1.75E+02	+5.060	6.68E-03
2.21E-03	1.48E+02	1.46E+02	+1.596	5.39E-03
2.83E-03	1.18E+02	1.19E+02	-0.764	4.08E-03
3.57E-03	9.60E+01	9.70E+01	-1.061	3.11E-03
4.46E-03	7.97E+01	8.10E+01	-1.553	2.36E-03
5.67E-03	6.61E+01	6.68E+01	-0.952	1.71E-03
7.16E-03	5.57E+01	5.57E+01	+0.004	1.24E-03
9.81E-03	4.76E+01	4.80E+01	-1.003	9.31E-04
1.10E-02	4.18E+01	4.11E+01	+1.603	6.50E-04

R: 168. X: 0. Y: 0. DL: 0. REQ: 0. CF: 1.0000
TDHZ ARRAY, 22 DATA POINTS, SYSTEM: NONE DATA: LOOP21
MEDICINE LAKE HIGHLAND
UNOCAL GEOTHERMAL 8-16-86
RMS LOG ERROR: 1.20E-02, ANTILOG YIELDS 2.8096 %
LATE TIME PARAMETERS

IGS: ARRTI

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	1.00					
P 2	.00	1.00				
P 3	.00	.00	1.00			
T 1	.00	.00	.00	1.00		
T 2	.00	.00	.00	.00	1.00	
F 0	.00	.00	.00	.00	.00	.00

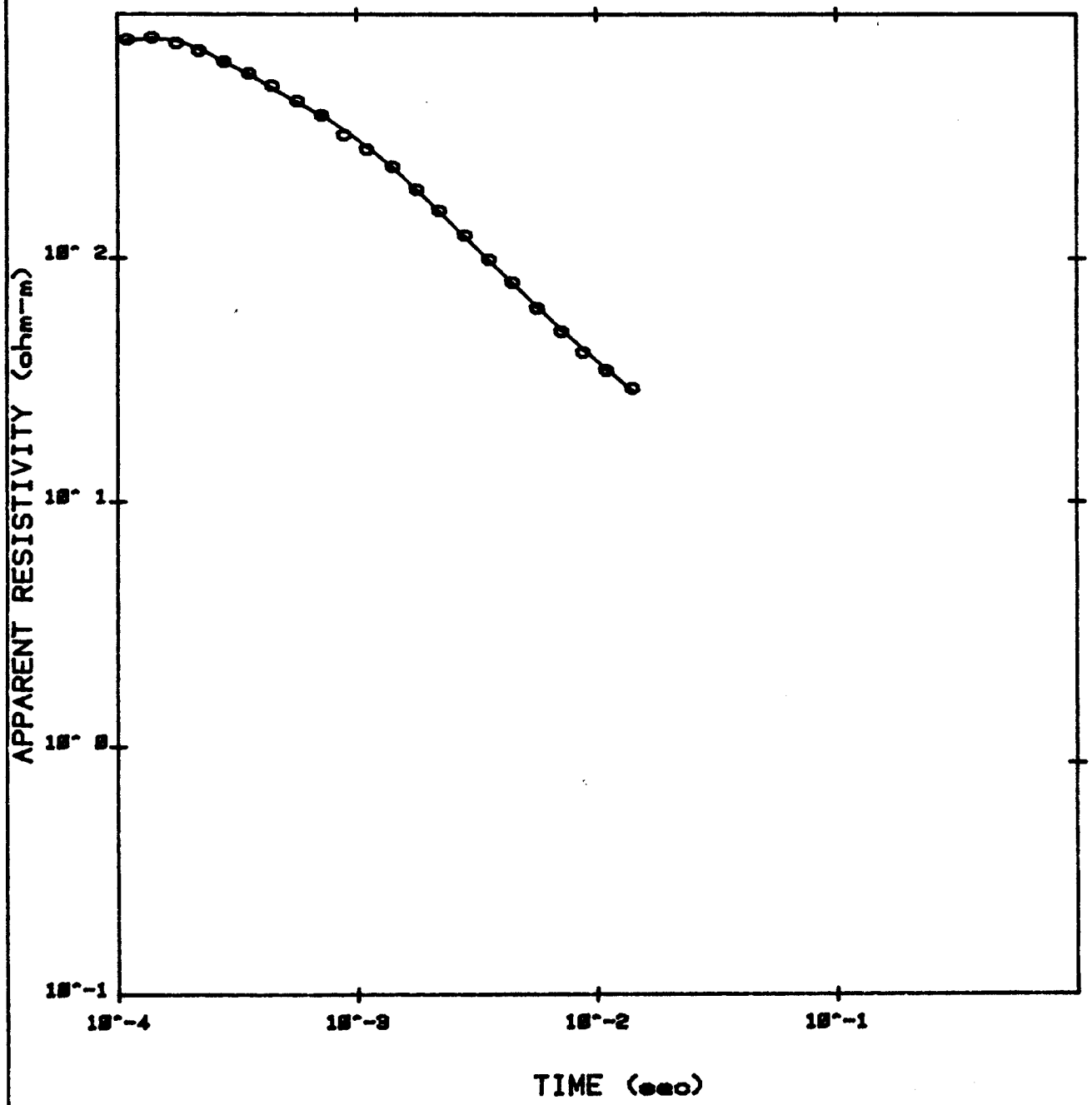
LINE: 0021
STA.: 0000

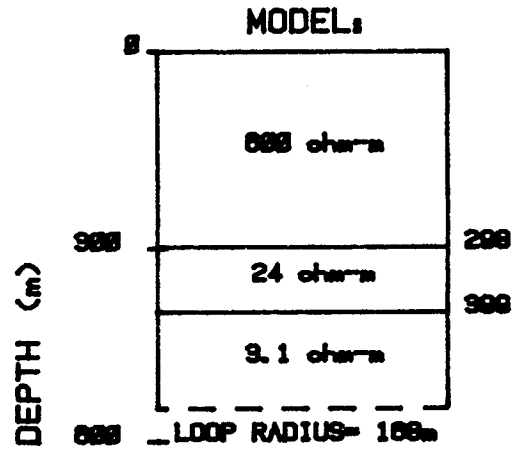
FREQUENCY = comb freq.
LOOP SIZE = 300 x 300 m
CURRENT = 20 amps
SPACING = 168 m

CH.	TIME(msec)	V(Volts/A-m^2)	RHOA-LATE	RHOA-EARLY
1	0.0890	1.0600E-06	681.56	1.6808E+00
2	0.1100	6.1358E-07	689.38	9.7296E-01
3	0.1400	3.5947E-07	658.72	5.7015E-01
4	0.1770	2.2669E-07	605.97	3.5964E-01
5	0.2200	1.4996E-07	555.48	2.3797E-01
6	0.2800	9.5874E-08	500.76	1.5217E-01
7	0.3550	6.1427E-08	453.67	9.7517E-02
8	0.4430	4.0965E-08	410.91	6.5045E-02
9	0.5640	2.6421E-08	368.07	4.1961E-02
10	0.7130	1.7453E-08	328.32	2.7725E-02
11	0.8855	1.2868E-08	280.36	2.0461E-02
12	1.0980	8.9839E-09	248.91	1.4290E-02
13	1.4055	6.0391E-09	214.94	9.6026E-03
14	1.7825	4.1841E-09	184.74	6.6505E-03
15	2.2120	3.3267E-09	150.21	5.3579E-03
16	2.8250	2.5317E-09	119.87	4.1117E-03
17	3.5750	1.9166E-09	97.47	3.0987E-03
18	4.4600	1.4574E-09	80.93	2.3550E-03
19	5.6700	1.0630E-09	66.94	1.7117E-03
20	7.1600	7.6835E-10	56.34	1.2341E-03
21	8.8100	5.8645E-10	47.74	9.3246E-04
22	10.9600	4.1280E-10	41.93	6.5639E-04
23	14.1100	2.6876E-10	36.64	4.2753E-04
24	17.9500	1.7364E-10	32.82	2.7634E-04
25	22.2400	1.0394E-10	32.33	1.6566E-04

THE EARTH TECHNOLOGY CORP.

Job #:G86179
Client:UNOCAL
Location:MEDICINE LAKE HIGHLAND
File:MLHIGH4.DAT





o FIELD DATA

— MODEL CURVE

THE EARTH TECHNOLOGY CORP.

UNOCAL GEOTHERMAL

MEDICINE LAKE HIGHLAND

APPARENT RESISTIVITY CURVE

SITE: LOOP22

JOB #G88179 Fig.

LOOP22

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		.0	.0		
595.17	297.8	-297.8	-976.9	.5	.5
23.71	101.0	-398.8	-1308.4	4.3	4.8
3.11					

TIMES	DATA LATE	CALC LATE	% ERROR	DATA EARLY
1.10E-04	7.87E+02	7.78E+02	+1.048	7.95E-01
1.40E-04	8.01E+02	7.94E+02	+0.888	4.24E-01
1.77E-04	7.59E+02	7.81E+02	-2.792	2.56E-01
2.20E-04	7.08E+02	7.22E+02	-2.028	1.65E-01
2.80E-04	6.40E+02	6.37E+02	+0.560	1.05E-01
3.55E-04	5.74E+02	5.68E+02	+1.133	6.82E-02
4.43E-04	5.11E+02	4.98E+02	+2.489	4.67E-02
5.64E-04	4.43E+02	4.36E+02	+1.704	3.16E-02
7.13E-04	3.88E+02	3.86E+02	+0.505	2.15E-02
8.85E-04	3.22E+02	3.38E+02	-4.916	1.66E-02
1.10E-03	2.81E+02	2.88E+02	-2.374	1.18E-02
1.41E-03	2.39E+02	2.37E+02	+1.069	8.08E-03
1.78E-03	1.93E+02	1.91E+02	+0.810	6.22E-03
2.21E-03	1.58E+02	1.56E+02	+1.430	4.89E-03
2.83E-03	1.25E+02	1.23E+02	+1.795	3.74E-03
3.57E-03	9.93E+01	9.78E+01	+1.586	2.96E-03
4.46E-03	7.99E+01	7.92E+01	+0.870	2.35E-03
5.67E-03	6.24E+01	6.30E+01	-0.878	1.87E-03
7.16E-03	4.99E+01	5.09E+01	-2.112	1.46E-03
8.81E-03	4.11E+01	4.23E+01	-2.964	1.16E-03
1.10E-02	3.47E+01	3.50E+01	-1.059	8.59E-04
1.41E-02	2.93E+01	2.86E+01	+2.483	5.95E-04

R: 168. X: 0. Y: 0. DL: 0. REQ: 0. CF: 1.0000
TDHZ ARRAY, 22 DATA POINTS, SYSTEM: NONE DATA: LOOP22
MEDICINE LAKE HIGHLAND
UNOCAL GEOTHERMAL 8-16-86
RMS LOG ERROR: 1.30E-02, ANTILOG YIELDS 3.0408 %
LATE TIME PARAMETERS

IGS: ARRTI

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	1.00					
P 2	.00	.99				
P 3	.00	.00	1.00			
T 1	.00	.00	.00	1.00		
T 2	.00	.00	.00	.00	1.00	
F 0	.00	.00	.00	.00	.00	.00

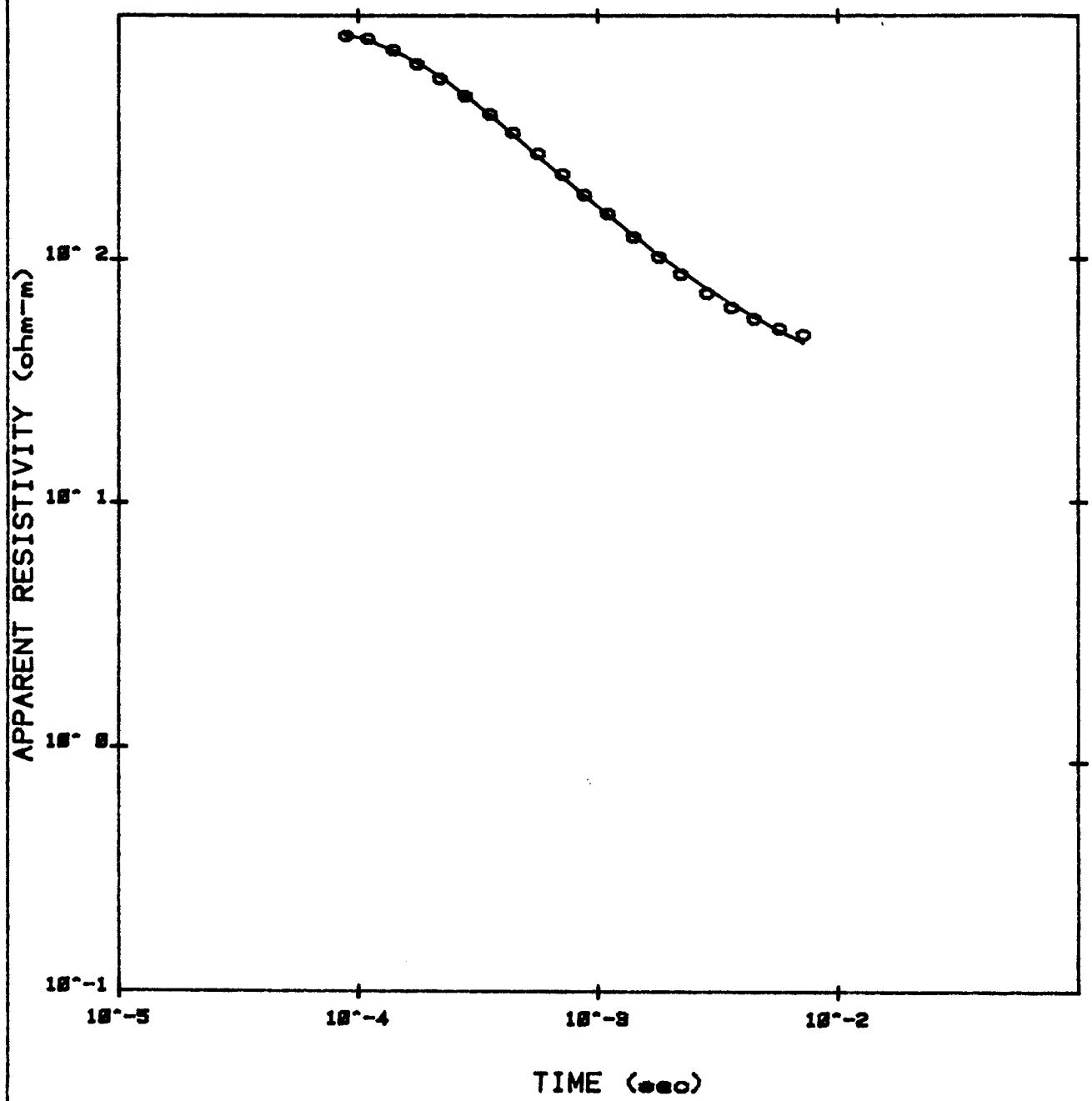
LINE: 0022 RECEIVER COIL @ ANGLE
STA.: 0000 OF THE HILL

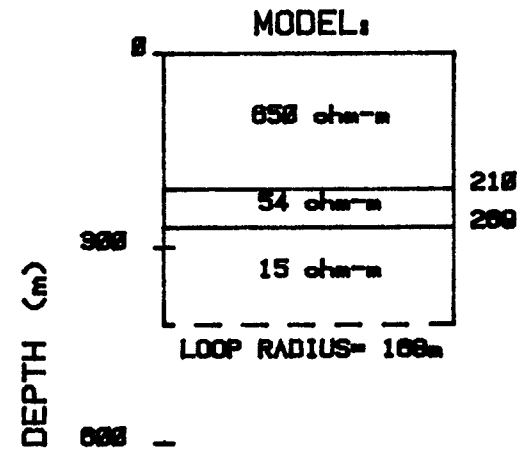
FREQUENCY = comb freq.
LOOP SIZE = 300 x 300 m
CURRENT = 22 amps
SPACING = 168 m

CH.	TIME(msec)	V(Volts/A-m^2)	RHOA-LATE	RHOA-EARLY
1	0.0890	1.2011E-06	627.10	1.9063E+00
2	0.1100	5.0165E-07	788.45	7.9568E-01
3	0.1400	2.6712E-07	802.93	4.2381E-01
4	0.1770	1.6114E-07	760.78	2.5574E-01
5	0.2200	1.0380E-07	709.88	1.6478E-01
6	0.2800	6.5982E-08	642.41	1.0476E-01
7	0.3550	4.2960E-08	575.80	6.8225E-02
8	0.4430	2.9413E-08	512.46	4.6724E-02
9	0.5640	1.9877E-08	444.97	3.1579E-02
10	0.7130	1.3536E-08	388.95	2.1509E-02
11	0.8855	1.0383E-08	323.47	1.6543E-02
12	1.0980	7.4155E-09	282.88	1.1834E-02
13	1.4055	5.0871E-09	240.99	8.1299E-03
14	1.7825	3.8377E-09	195.70	6.2101E-03
15	2.2120	3.0255E-09	160.02	4.8738E-03
16	2.8250	2.3071E-09	127.53	3.7506E-03
17	3.5750	1.8193E-09	100.91	2.9440E-03
18	4.4600	1.4526E-09	81.10	2.3495E-03
19	5.6700	1.1571E-09	63.26	1.8651E-03
20	7.1600	9.0706E-10	50.44	1.4585E-03
21	8.8100	7.2946E-10	41.28	1.1610E-03
22	10.9600	5.4429E-10	34.87	8.6802E-04
23	14.1100	3.7271E-10	29.46	5.9421E-04
24	17.9500	2.5415E-10	25.46	4.0453E-04
25	22.2400	2.0016E-10	20.89	3.1830E-04
26	28.5000	1.3037E-10	18.39	2.0736E-04

THE EARTH TECHNOLOGY CORP.

Job #:G86179
Client:UNOCAL
Location:MEDICINE LAKE HIGHLAND
File:MLHIGH4.DAT





o FIELD DATA

— MODEL CURVE

THE EARTH TECHNOLOGY CORP.

UNOCAL GEOTHERMAL

MEDICINE LAKE HIGHLAND

APPARENT RESISTIVITY CURVE

SITE: LOOP23

JOB #C88179 Fig.

LOOP23

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		.0	.0		
650.41	209.5	-209.5	-687.4	.3	.3
54.40	59.3	-268.9	-882.1	1.1	1.4
15.25					

TIMES	DATA LATE	CALC LATE	% ERROR	DATA EARLY
8.90E-05	8.27E+02	8.34E+02	-0.842	1.25E+00
1.10E-04	8.05E+02	7.92E+02	+1.610	7.69E-01
1.40E-04	7.23E+02	7.17E+02	+0.941	4.94E-01
1.77E-04	6.31E+02	6.42E+02	-1.666	3.37E-01
2.20E-04	5.50E+02	5.60E+02	-1.895	2.41E-01
2.80E-04	4.66E+02	4.70E+02	-0.822	1.69E-01
3.55E-04	3.93E+02	3.90E+02	+0.860	1.20E-01
4.43E-04	3.30E+02	3.24E+02	+1.912	9.00E-02
5.64E-04	2.71E+02	2.63E+02	+3.025	6.61E-02
7.13E-04	2.22E+02	2.16E+02	+2.552	4.96E-02
8.81E-04	1.83E+02	1.81E+02	+1.169	3.91E-02
1.10E-03	1.53E+02	1.52E+02	+0.705	2.93E-02
1.41E-03	1.23E+02	1.25E+02	-1.150	2.19E-02
1.80E-03	1.02E+02	1.04E+02	-2.211	1.57E-02
2.22E-03	8.67E+01	8.97E+01	-3.444	1.19E-02
2.85E-03	7.25E+01	7.59E+01	-4.449	8.33E-03
3.60E-03	6.35E+01	6.57E+01	-3.428	5.66E-03
4.49E-03	5.69E+01	5.80E+01	-1.878	3.84E-03
5.70E-03	5.19E+01	5.08E+01	+2.286	2.43E-03
7.19E-03	4.90E+01	4.55E+01	+7.564	1.48E-03

R: 168. X: 0. Y: 0. DL: 0. REO: 0. CF: 1.0000
TDHZ ARRAY, 20 DATA POINTS, SYSTEM: NONE DATA: LOOP23
MEDICINE LAKE HIGHLAND
UNOCAL GEOTHERMAL 8-16-86
RMS LOG ERROR: 1.76E-02, ANTILOG YIELDS 4.1371 %
LATE TIME PARAMETERS

IGS: ARRTI

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	.97					
P 2	-.08	.14				
P 3	.00	-.03	.97			
T 1	.02	.13	.00	.98		
T 2	-.06	-.25	.03	.05	.81	
F 0	.00	.00	.00	.00	.00	.00

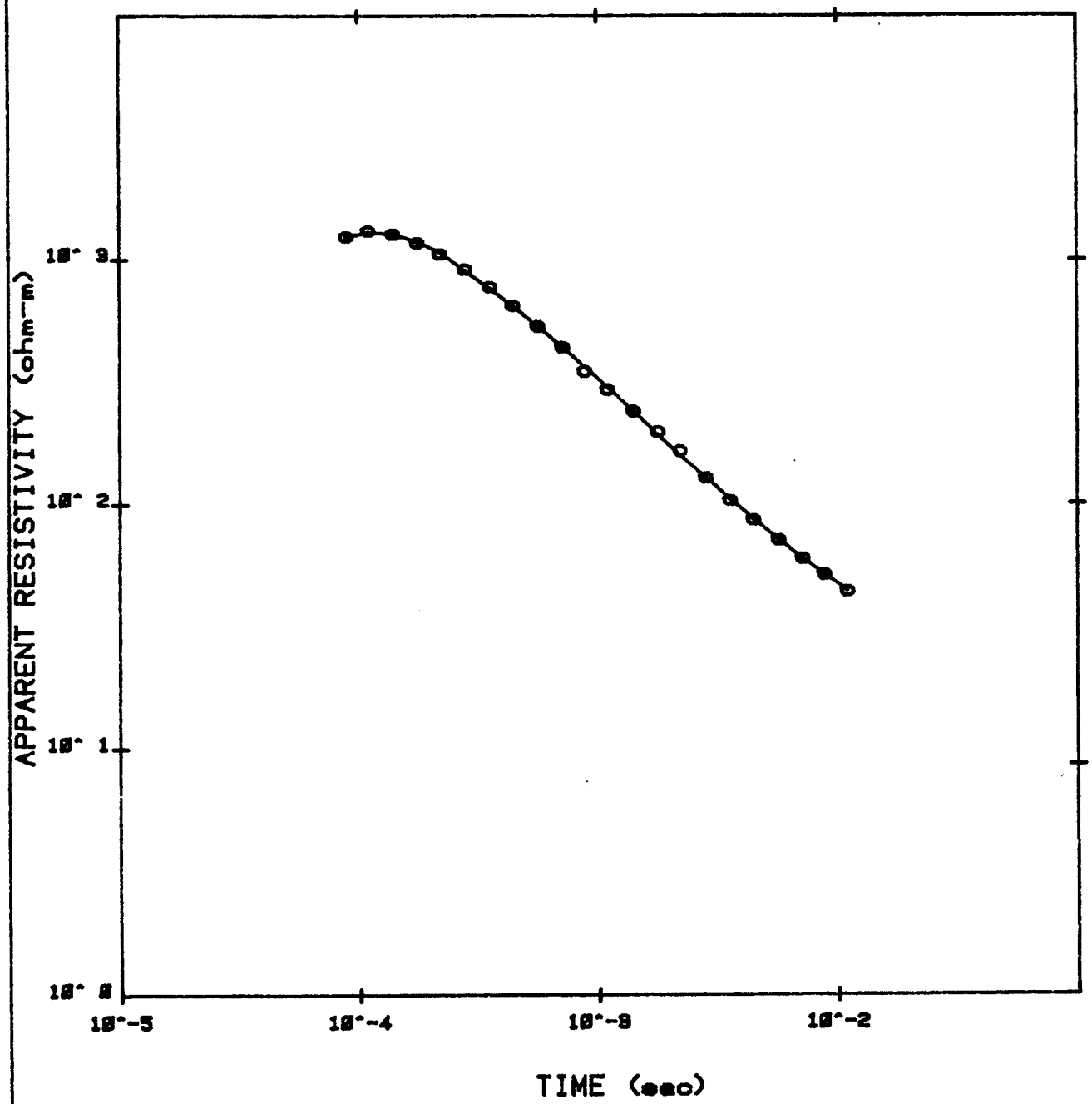
LINE: 0023
STA.: 0000

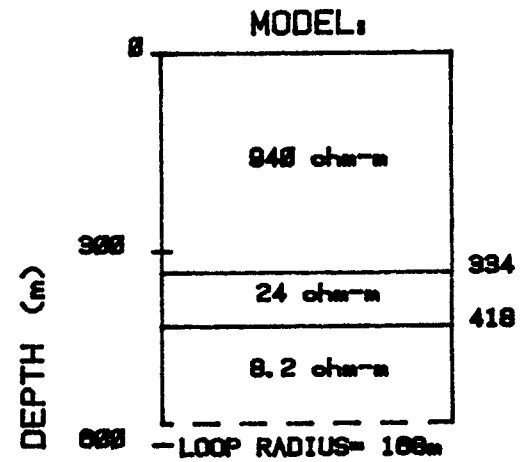
FREQUENCY = 30 hz
LOOP SIZE = 300 x 300 m
CURRENT = 22 amps
SPACING = 168 m

CH.	TIME(msec)	V(Volts/A-m^2)	RHOA-LATE	RHOA-EARLY
1	0.0890	7.9024E-07	828.97	1.2533E+00
2	0.1100	4.8443E-07	807.02	7.6843E-01
3	0.1400	3.1120E-07	725.19	4.9376E-01
4	0.1770	2.1236E-07	632.92	3.3702E-01
5	0.2200	1.5167E-07	551.31	2.4074E-01
6	0.2800	1.0619E-07	467.78	1.6858E-01
7	0.3550	7.5829E-08	394.24	1.2040E-01
8	0.4430	5.6590E-08	331.28	8.9868E-02
9	0.5640	4.1555E-08	272.15	6.6001E-02
10	0.7130	3.1260E-08	222.61	4.9656E-02
11	0.8810	2.4572E-08	183.70	3.9036E-02
12	1.0960	1.8686E-08	153.23	2.9690E-02
13	1.4110	1.3692E-08	123.74	2.1759E-02
14	1.7950	1.0017E-08	102.03	1.5921E-02
15	2.2240	7.4479E-09	86.98	1.1839E-02
16	2.8500	5.2317E-09	72.81	8.3179E-03
17	3.6000	3.5610E-09	63.75	5.6626E-03
18	4.4900	2.4179E-09	57.10	3.8456E-03
19	5.7000	1.5263E-09	52.14	2.4280E-03
20	7.1900	9.3215E-10	49.18	1.4833E-03

THE EARTH TECHNOLOGY CORP.

Job #:G86179
Client:UNOCAL
Location:MEDICINE LAKE HIGHLAND
File:MLHIGH4.DAT





o FIELD DATA

— MODEL CURVE

THE EARTH TECHNOLOGY CORP.

UNOCAL GEOTHERMAL

MEDICINE LAKE HIGHLAND

APPARENT RESISTIVITY CURVE

SITE: LOOP24

JOB #C86179 Fig.

LOOP24

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		.0	.0		
935.51	334.3	-334.3	-1096.9	.4	.4
24.18	83.3	-417.6	-1370.2	3.4	3.8
8.19					

TIMES	DATA LATE	CALC LATE	% ERROR	DATA EARLY
8.90E-05	1.25E+03	1.25E+03	-0.125	6.75E-01
1.10E-04	1.32E+03	1.30E+03	+0.856	3.66E-01
1.40E-04	1.28E+03	1.28E+03	-0.149	2.10E-01
1.77E-04	1.18E+03	1.19E+03	-0.920	1.32E-01
2.20E-04	1.06E+03	1.08E+03	-1.489	8.99E-02
2.80E-04	9.18E+02	9.06E+02	+1.361	6.11E-02
3.55E-04	7.78E+02	7.64E+02	+1.898	4.32E-02
4.43E-04	6.53E+02	6.50E+02	+0.464	3.23E-02
5.64E-04	5.37E+02	5.36E+02	+0.259	2.37E-02
7.13E-04	4.41E+02	4.40E+02	+0.187	1.77E-02
8.85E-04	3.50E+02	3.66E+02	-4.375	1.46E-02
1.10E-03	2.95E+02	3.02E+02	-2.181	1.10E-02
1.41E-03	2.41E+02	2.41E+02	-0.027	7.98E-03
1.78E-03	1.99E+02	1.94E+02	+2.338	5.94E-03
2.21E-03	1.66E+02	1.59E+02	+4.348	4.54E-03
2.83E-03	1.29E+02	1.29E+02	-0.044	3.57E-03
3.57E-03	1.04E+02	1.05E+02	-0.614	2.76E-03
4.46E-03	8.66E+01	8.72E+01	-0.705	2.08E-03
5.67E-03	7.17E+01	7.20E+01	-0.418	1.52E-03
7.16E-03	6.02E+01	6.01E+01	+0.215	1.10E-03
8.81E-03	5.19E+01	5.19E+01	-0.152	8.18E-04
1.10E-02	4.43E+01	4.46E+01	-0.629	5.96E-04

R: 168. X: 0. Y: 0. DL: 0. REQ: 0. CF: 1.0000
TDHZ ARRAY, 22 DATA POINTS, SYSTEM: NONE DATA: LOOP24
MEDICINE LAKE HIGHLAND
UNOCAL GEOTHERMAL 8-15-86
RMS LOG ERROR: 1.07E-02, ANTILOG YIELDS 2.4955 %
LATE TIME PARAMETERS

IGS: ARRTI

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	.99					
P 2	-.03	.68				
P 3	-.01	-.08	.87			
T 1	.00	.03	.00	1.00		
T 2	.00	.03	.06	.00	.93	
F 0	.00	.00	.00	.00	.00	.00

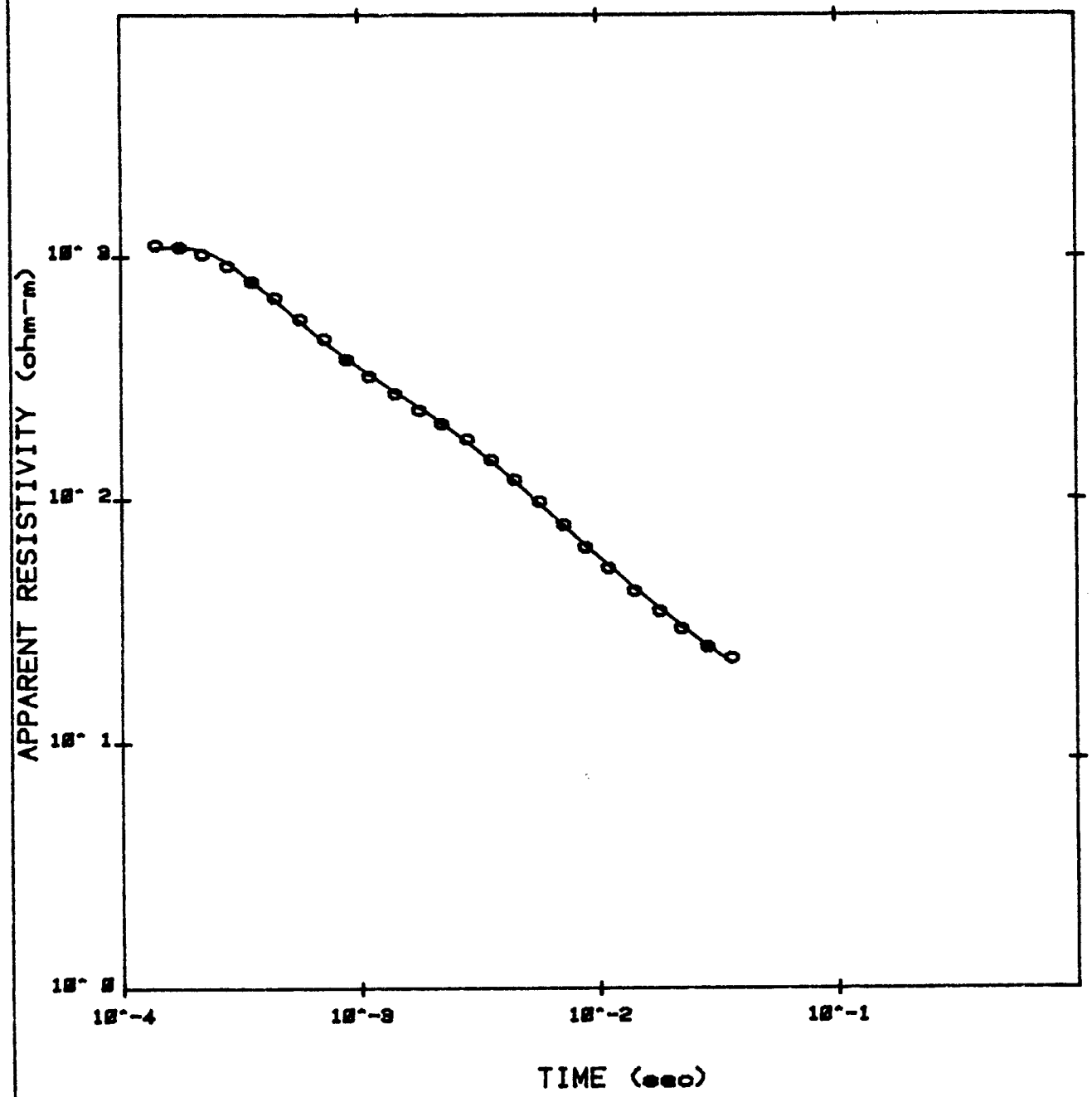
LINE: 0024
STA.: 0000

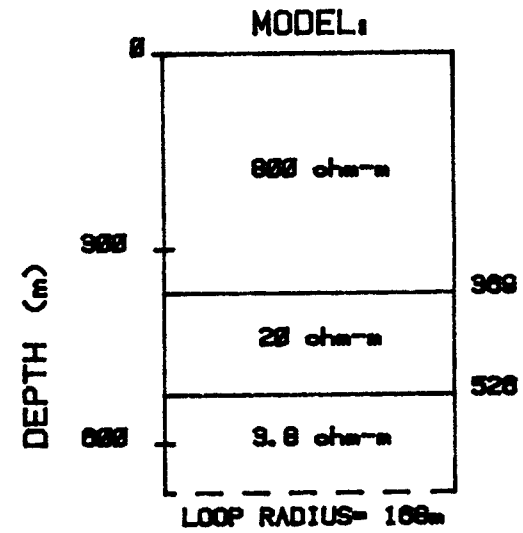
FREQUENCY = comb freq.
LOOP SIZE = 300 x 300 m
CURRENT = 22 amps
SPACING = 168 m

CH.	TIME(msec)	V(Volts/A-m^2)	RHOA-LATE	RHOA-EARLY
1	0.0890	4.2387E-07	1255.70	6.7205E-01
2	0.1100	2.3205E-07	1318.21	3.6803E-01
3	0.1400	1.3225E-07	1282.98	2.0980E-01
4	0.1770	8.3185E-08	1182.25	1.3200E-01
5	0.2200	5.6493E-08	1064.93	8.9661E-02
6	0.2800	3.8429E-08	921.13	6.1003E-02
7	0.3550	2.7226E-08	780.41	4.3226E-02
8	0.4430	2.0338E-08	655.35	3.2295E-02
9	0.5640	1.4926E-08	538.61	2.3704E-02
10	0.7130	1.1170E-08	442.09	1.7742E-02
11	0.8855	9.1454E-09	352.03	1.4567E-02
12	1.0980	6.9025E-09	296.72	1.0993E-02
13	1.4055	5.0472E-09	242.26	8.0421E-03
14	1.7825	3.7176E-09	199.89	5.9246E-03
15	2.2120	2.8271E-09	167.43	4.5127E-03
16	2.8250	2.2179E-09	130.93	3.6030E-03
17	3.5750	1.6988E-09	105.64	2.7468E-03
18	4.4600	1.2883E-09	87.86	2.0820E-03
19	5.6700	9.4192E-10	72.56	1.5170E-03
20	7.1600	6.8368E-10	60.90	1.0983E-03
21	8.8100	5.1360E-10	52.16	8.1857E-04
22	10.9600	3.7749E-10	44.50	6.0030E-04
23	14.1100	2.5155E-10	38.29	4.0016E-04
24	17.9500	1.6943E-10	33.36	2.6967E-04
25	22.2400	1.1506E-10	30.21	1.8314E-04
26	28.5000	7.6979E-11	26.12	1.2258E-04
27	36.0000	5.0162E-11	23.55	7.9988E-05

THE EARTH TECHNOLOGY CORP.

Job #:G86179
Client:UNOCAL
Location:MEDICINE LAKE HIGHLAND
File:MLHIGH3.DAT





o FIELD DATA

— MODEL CURVE

THE EARTH TECHNOLOGY CORP.

UNOCAL GEOTHERMAL

MEDICINE LAKE HIGHLAND

APPARENT RESISTIVITY CURVE

SITE: LOOP25

JOB #G86179 Fig.

LOOP25

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		.0	.0		
799.06	368.6	-368.6	-1209.3	.5	.5
19.81	157.2	-525.8	-1725.1	7.9	8.4
3.75					

TIMES	DATA LATE	CALC LATE	% ERROR	DATA EARLY
1.40E-04	1.12E+03	1.09E+03	+2.848	2.56E-01
1.77E-04	1.10E+03	1.10E+03	+0.192	1.47E-01
2.20E-04	1.03E+03	1.07E+03	-3.297	9.39E-02
2.80E-04	9.20E+02	9.55E+02	-3.691	6.09E-02
3.55E-04	7.94E+02	7.94E+02	-0.052	4.19E-02
4.43E-04	6.81E+02	6.69E+02	+1.890	3.04E-02
5.64E-04	5.57E+02	5.44E+02	+2.479	2.24E-02
7.13E-04	4.63E+02	4.48E+02	+3.345	1.65E-02
8.85E-04	3.81E+02	3.83E+02	-0.472	1.29E-02
1.10E-03	3.25E+02	3.31E+02	-1.706	9.48E-03
1.41E-03	2.75E+02	2.80E+02	-1.612	6.55E-03
1.78E-03	2.35E+02	2.42E+02	-2.912	4.63E-03
2.21E-03	2.07E+02	2.08E+02	-0.870	3.26E-03
2.83E-03	1.78E+02	1.73E+02	+3.229	2.20E-03
3.57E-03	1.46E+02	1.44E+02	+1.442	1.66E-03
4.46E-03	1.21E+02	1.19E+02	+2.420	1.26E-03
5.67E-03	9.84E+01	9.61E+01	+2.426	9.43E-04
7.16E-03	7.89E+01	7.80E+01	+1.158	7.33E-04
8.81E-03	6.37E+01	6.49E+01	-1.849	6.02E-04
1.10E-02	5.23E+01	5.38E+01	-2.801	4.64E-04
1.41E-02	4.21E+01	4.34E+01	-2.967	3.46E-04
1.80E-02	3.49E+01	3.58E+01	-2.459	2.49E-04
2.22E-02	2.96E+01	3.02E+01	-2.003	1.88E-04
2.85E-02	2.50E+01	2.51E+01	-0.440	1.30E-04
3.60E-02	2.25E+01	2.14E+01	+5.237	8.49E-05

R: 168. X: 0. Y: 0. DL: 0. REQ: 0. CF: 1.0000
TDHZ ARRAY, 25 DATA POINTS, SYSTEM: NONE DATA: LOOP25
MEDICINE LAKE HIGHLAND
UNOCAL GEOTHERMAL 8-15-86
RMS LOG ERROR: 1.60E-02, ANTILOG YIELDS 3.7562 %
LATE TIME PARAMETERS

IGS: ARRTI

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	.99					
P 2	-.01	.93				
P 3	-.01	-.04	.87			
T 1	.00	.01	.00	1.00		
T 2	.00	.00	.02	.00	.98	
F 0	.00	.00	.00	.00	.00	.00

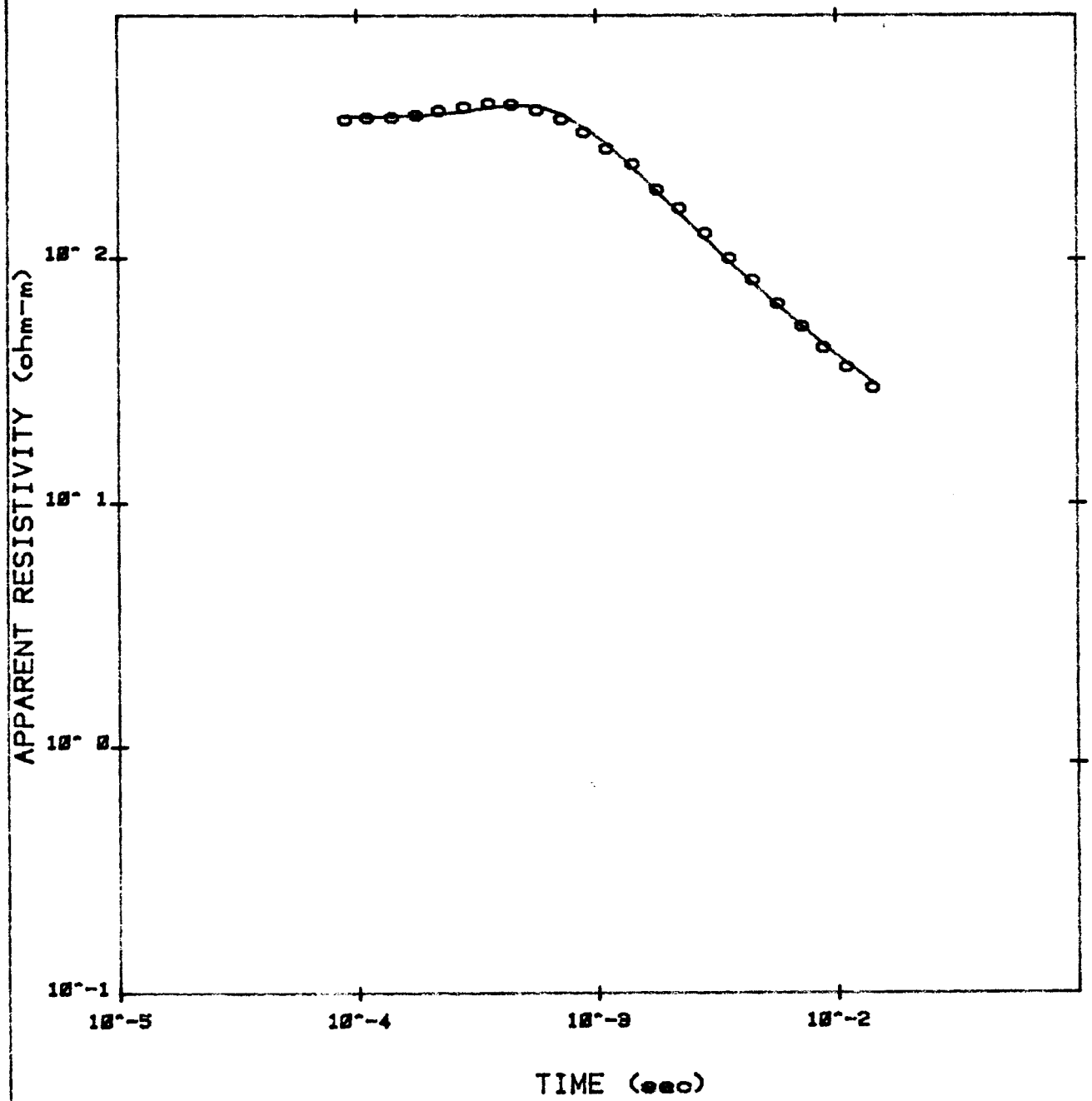
LINE: 0025
STA.: 0000

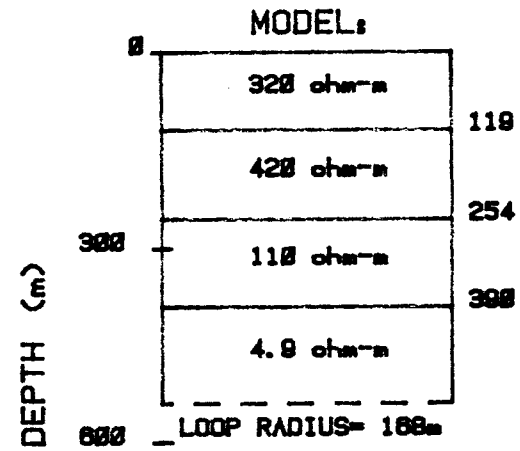
FREQUENCY = comb freq.
LOOP SIZE = 300 x 300 m
CURRENT = 20 amps
SPACING = 168 m

CH.	TIME(msec)	V(Volts/A-m^2)	RHOA-LATE	RHOA-EARLY
3	0.1400	1.6195E-07	1120.88	2.5710E-01
4	0.1770	9.2094E-08	1104.72	1.4624E-01
5	0.2200	5.8964E-08	1034.98	9.3655E-02
6	0.2800	3.8293E-08	923.31	6.0836E-02
7	0.3550	2.6401E-08	796.59	4.1950E-02
8	0.4430	1.9088E-08	683.68	3.0335E-02
9	0.5640	1.4100E-08	559.44	2.2411E-02
10	0.7130	1.0360E-08	464.84	1.6469E-02
11	0.8855	7.9604E-09	386.15	1.2819E-02
12	1.0980	5.9492E-09	327.63	9.5034E-03
13	1.4055	4.1786E-09	274.76	6.5813E-03
14	1.7825	2.9510E-09	233.17	4.6129E-03
15	2.2120	2.0775E-09	205.60	3.2609E-03
16	2.8250	1.3851E-09	179.20	2.2033E-03
17	3.5750	1.0244E-09	148.00	1.6573E-03
18	4.4600	7.7485E-10	123.31	1.2530E-03
19	5.6700	5.8512E-10	99.67	9.4292E-04
20	7.1600	4.5630E-10	79.74	7.3332E-04
21	8.8100	3.7780E-10	64.01	6.0089E-04
22	10.9600	2.9457E-10	52.51	4.6862E-04
23	14.1100	2.1687E-10	42.27	3.4511E-04
24	17.9500	1.5737E-10	35.05	2.5046E-04
25	22.2400	1.1770E-10	29.76	1.8740E-04
26	28.5000	8.1425E-11	25.16	1.2967E-04
27	36.0000	5.3145E-11	22.66	8.4709E-05

THE EARTH TECHNOLOGY CORP.

Job #:G86179
Client:UNOCAL
Location:MEDICINE LAKE HIGHLAND
File:MLHIGH3.DAT





o FIELD DATA

— MODEL CURVE

THE EARTH TECHNOLOGY CORP.

UNOCAL GEOTHERMAL

MEDICINE LAKE HIGHLAND

APPARENT RESISTIVITY CURVE

SITE: LOOP26

JOB #G86179 Fig.

LOOP26

MODEL: 4 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		.0	.0		
315.02	119.1	-119.1	-390.9	.4	.4
420.60	135.3	-254.4	-834.6	.3	.7
112.20	135.6	-390.0	-1279.4	1.2	1.9
4.92					

TIMES	DATA LATE	CALC LATE	% ERROR	DATA EARLY
8.90E-05	3.72E+02	3.84E+02	-3.103	4.16E+00
1.10E-04	3.79E+02	3.82E+02	-0.975	2.38E+00
1.40E-04	3.81E+02	3.83E+02	-0.593	1.29E+00
1.77E-04	3.89E+02	3.88E+02	+0.198	6.97E-01
2.20E-04	4.06E+02	3.95E+02	+2.784	3.79E-01
2.80E-04	4.20E+02	4.03E+02	+4.270	1.97E-01
3.55E-04	4.35E+02	4.18E+02	+4.159	1.03E-01
4.43E-04	4.31E+02	4.28E+02	+0.570	6.03E-02
5.64E-04	4.09E+02	4.25E+02	-3.853	3.57E-02
7.13E-04	3.75E+02	3.95E+02	-5.241	2.26E-02
8.85E-04	3.32E+02	3.48E+02	-4.434	1.58E-02
1.10E-03	2.84E+02	2.98E+02	-4.383	1.16E-02
1.41E-03	2.46E+02	2.38E+02	+3.027	7.74E-03
1.78E-03	1.93E+02	1.90E+02	+1.966	6.22E-03
2.21E-03	1.62E+02	1.55E+02	+4.944	4.71E-03
2.83E-03	1.28E+02	1.22E+02	+4.518	3.61E-03
3.57E-03	1.01E+02	9.79E+01	+3.642	2.88E-03
4.46E-03	8.23E+01	8.02E+01	+2.685	2.25E-03
5.67E-03	6.57E+01	6.48E+01	+1.467	1.73E-03
7.16E-03	5.30E+01	5.31E+01	-0.230	1.33E-03
8.81E-03	4.34E+01	4.49E+01	-3.493	1.07E-03
1.10E-02	3.63E+01	3.78E+01	-3.865	8.03E-04
1.41E-02	2.98E+01	3.15E+01	-5.421	5.80E-04

R: 168. X: 0. Y: 0. DL: 0. REQ: 0. CF: 1.0000
TDHZ ARRAY, 23 DATA POINTS, SYSTEM: NONE DATA: LOOP26
MEDICINE LAKE HIGHLAND
UNOCAL GEOTHERMAL 8-18-86
RMS LOG ERROR: 2.25E-02, ANTILOG YIELDS 5.3241 %
LATE TIME PARAMETERS

IGS: ARRTI

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	P 4	T 1	T 2	T 3	F 0
P 1	.86							
P 2	.18	.17						
P 3	.01	.12	.16					
P 4	-.01	-.04	-.09	.39				
T 1	-.07	.03	.09	-.03	.32			
T 2	.06	.11	.14	-.05	.37	.46		
T 3	.00	-.15	-.16	.10	.22	.20	.53	
F 0	.00	.00	.00	.00	.00	.00	.00	.00

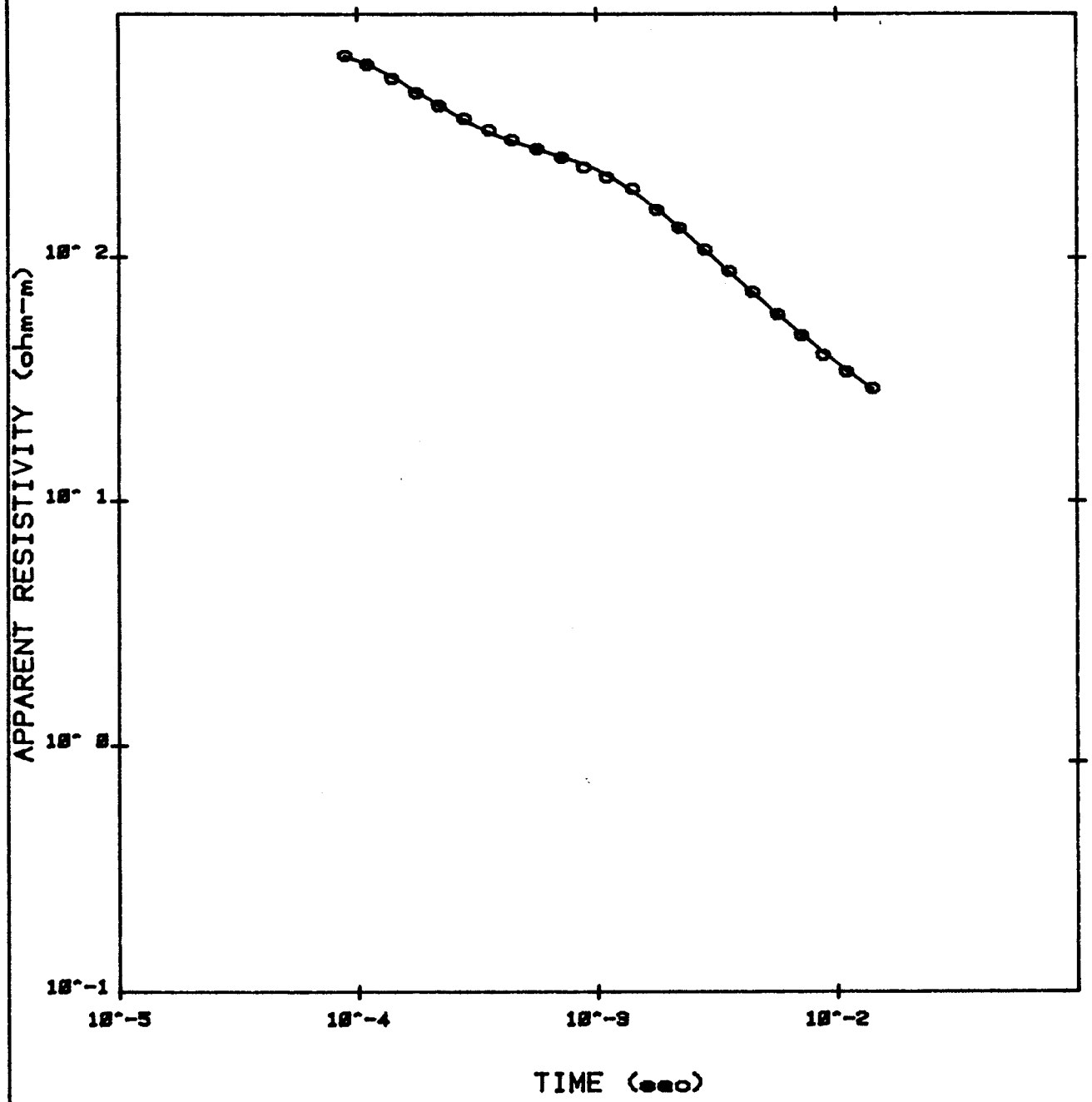
LINE: 0026
STA.: 0000

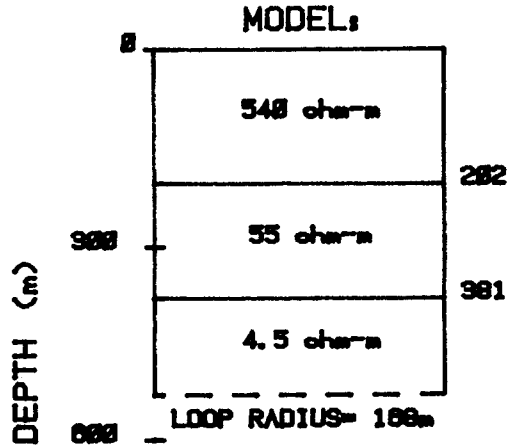
FREQUENCY = comb freq.
LOOP SIZE = 300 x 300 m
CURRENT = 21 amps
SPACING = 168 m

CH.	TIME(msec)	V(Volts/A-m^2)	RHOA-LATE	RHOA-EARLY
1	0.0890	2.6177E-06	373.04	4.1485E+00
2	0.1100	1.5030E-06	379.37	2.3826E+00
3	0.1400	8.1556E-07	381.51	1.2931E+00
4	0.1770	4.3949E-07	389.74	6.9703E-01
5	0.2200	2.3940E-07	406.67	3.7980E-01
6	0.2800	1.2419E-07	421.41	1.9709E-01
7	0.3550	6.5043E-08	436.70	1.0326E-01
8	0.4430	3.8010E-08	431.94	6.0355E-02
9	0.5640	2.2479E-08	409.93	3.5704E-02
10	0.7130	1.4248E-08	375.88	2.2634E-02
11	0.8855	9.7873E-09	336.46	1.5751E-02
12	1.0980	7.2795E-09	286.39	1.1622E-02
13	1.4055	4.8959E-09	247.22	7.8174E-03
14	1.7825	3.8161E-09	196.44	6.1764E-03
15	2.2120	2.9080E-09	164.31	4.6841E-03
16	2.8250	2.2323E-09	130.36	3.6280E-03
17	3.5750	1.7635E-09	103.04	2.8524E-03
18	4.4600	1.3874E-09	83.63	2.2449E-03
19	5.6700	1.0712E-09	66.60	1.7278E-03
20	7.1600	8.2817E-10	53.59	1.3322E-03
21	8.8100	6.7237E-10	43.58	1.0705E-03
22	10.9600	5.0796E-10	36.51	8.0910E-04
23	14.1100	3.6350E-10	29.96	5.7926E-04
24	17.9500	2.6176E-10	24.96	4.1806E-04
25	22.2400	1.9025E-10	21.61	3.0361E-04
26	28.5000	1.3512E-10	17.95	2.1545E-04
27	36.0000	1.0420E-10	14.46	1.6576E-04
29	57.0000	6.2646E-11	9.44	9.9676E-05
30	71.9000	4.6501E-11	7.82	7.3999E-05

THE EARTH TECHNOLOGY CORP.

Job #:G86179
Client:UNOCAL
Location:MEDICINE LAKE HIGHLAND
File:MLHIGH6.DAT





o FIELD DATA

— MODEL CURVE

THE EARTH TECHNOLOGY CORP.

UNOCAL GEOTHERMAL

MEDICINE LAKE HIGHLAND

APPARENT RESISTIVITY CURVE

SITE: LOOP27

JOB #G86179 Fig.

LOOP27

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		.0	.0		
541.41	201.8	-201.8	-662.1	.4	.4
55.04	178.8	-380.6	-1248.7	3.2	3.6
4.54					

TIMES	DATA LATE	CALC LATE	% ERROR	DATA EARLY
8.90E-05	6.77E+02	6.71E+02	+0.855	1.69E+00
1.10E-04	6.23E+02	6.28E+02	-0.720	1.13E+00
1.40E-04	5.46E+02	5.56E+02	-1.875	7.53E-01
1.77E-04	4.77E+02	4.82E+02	-1.190	5.13E-01
2.20E-04	4.24E+02	4.26E+02	-0.475	3.56E-01
2.80E-04	3.76E+02	3.70E+02	+1.760	2.33E-01
3.55E-04	3.38E+02	3.29E+02	+2.784	1.51E-01
4.43E-04	3.08E+02	3.04E+02	+1.289	9.98E-02
5.64E-04	2.83E+02	2.82E+02	+0.322	6.20E-02
7.13E-04	2.61E+02	2.61E+02	+0.215	3.89E-02
8.85E-04	2.37E+02	2.46E+02	-3.652	2.62E-02
1.10E-03	2.16E+02	2.21E+02	-2.397	1.75E-02
1.41E-03	1.94E+02	1.89E+02	+2.706	1.10E-02
1.78E-03	1.58E+02	1.59E+02	-0.741	8.39E-03
2.21E-03	1.33E+02	1.33E+02	+0.180	6.33E-03
2.83E-03	1.08E+02	1.07E+02	+0.986	4.66E-03
3.57E-03	8.82E+01	8.71E+01	+1.250	3.53E-03
4.46E-03	7.24E+01	7.19E+01	+0.745	2.72E-03
5.67E-03	5.85E+01	5.84E+01	+0.214	2.06E-03
7.16E-03	4.79E+01	4.81E+01	-0.485	1.55E-03
8.81E-03	3.98E+01	4.09E+01	-2.540	1.22E-03
1.10E-02	3.41E+01	3.45E+01	-1.006	8.82E-04
1.41E-02	2.91E+01	2.88E+01	+1.037	6.01E-04

R: 168. X: 0. Y: 0. DL: 0. REQ: 0. CF: 1.0000
TDHZ ARRAY, 23 DATA POINTS, SYSTEM: NONE DATA: LOOP27
MEDICINE LAKE HIGHLAND
UNOCAL GEOTHERMAL 8-18-86
RMS LOG ERROR: 1.04E-02, ANTILOG YIELDS 2.4179 %
LATE TIME PARAMETERS

IGS: ARRTI

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	1.00					
P 2	.00	1.00				
P 3	.00	.00	1.00			
T 1	.00	.00	.00	1.00		
T 2	.00	.00	.00	.00	1.00	
F 0	.00	.00	.00	.00	.00	.00

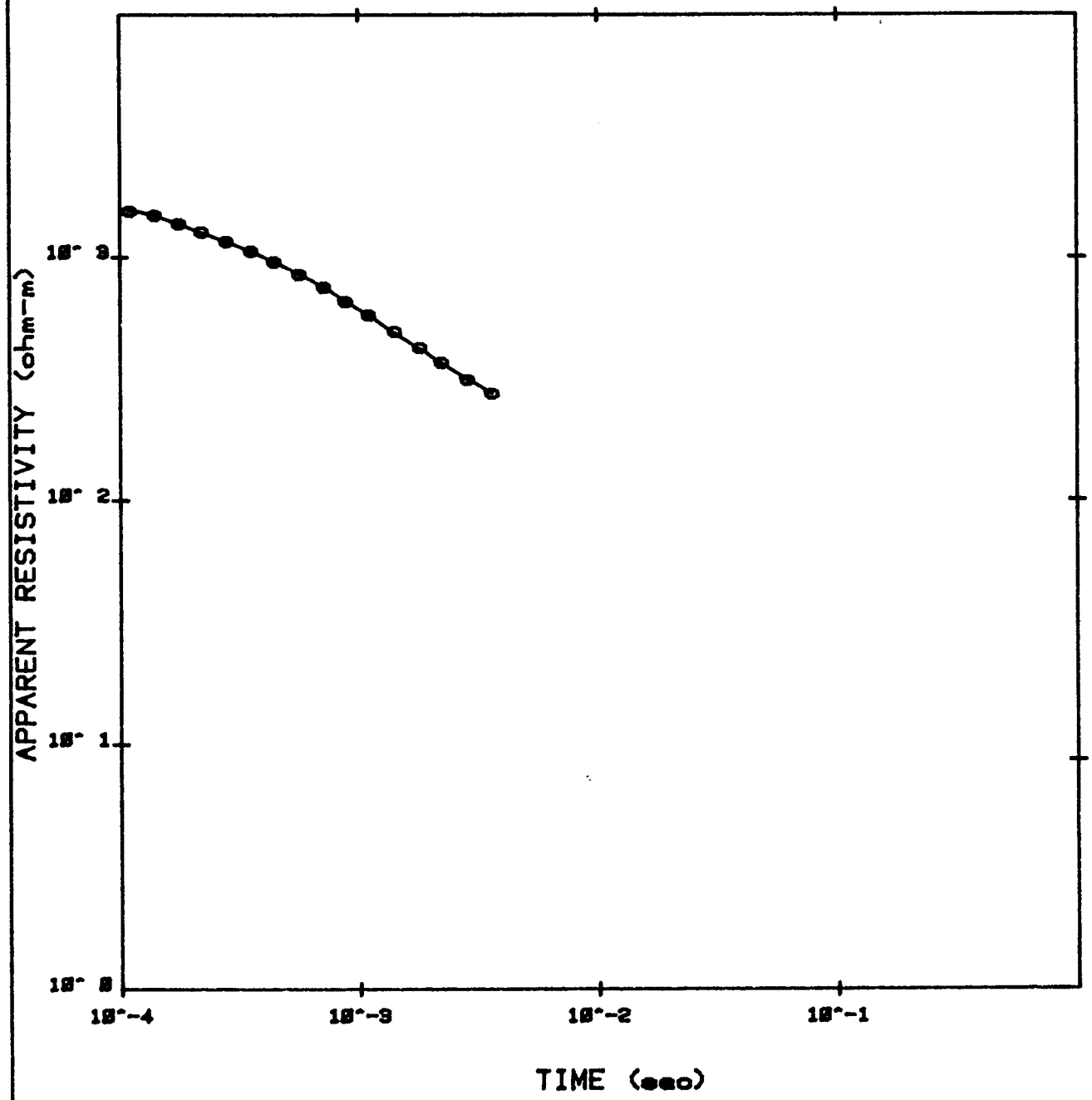
LINE: 0027
STA.: 0000

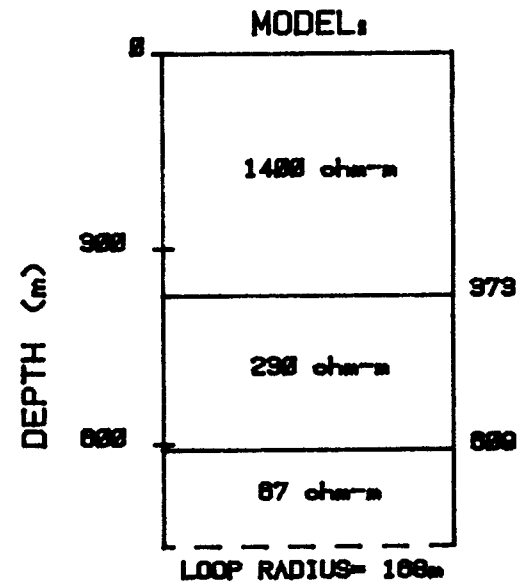
FREQUENCY = comb freq.
LOOP SIZE = 300 x 300 m
CURRENT = 22 amps
SPACING = 168 m

CH.	TIME(msec)	V(Volts/A-m^2)	RHOA-LATE	RHOA-EARLY
1	0.0890	1.0681E-06	678.11	1.6932E+00
2	0.1100	7.1144E-07	624.61	1.1280E+00
3	0.1400	4.7488E-07	547.13	7.5298E-01
4	0.1770	3.2387E-07	477.70	5.1365E-01
5	0.2200	2.2435E-07	424.66	3.5587E-01
6	0.2800	1.4656E-07	377.36	2.3256E-01
7	0.3550	9.5007E-08	339.21	1.5077E-01
8	0.4430	6.2743E-08	309.25	9.9588E-02
9	0.5640	3.9087E-08	283.49	6.2055E-02
10	0.7130	2.4463E-08	262.14	3.8846E-02
11	0.8855	1.6305E-08	239.42	2.6229E-02
12	1.0980	1.1035E-08	217.02	1.7556E-02
13	1.4055	6.9720E-09	195.31	1.1095E-02
14	1.7825	5.1739E-09	160.36	8.3648E-03
15	2.2120	3.9035E-09	135.02	6.2846E-03
16	2.8250	2.8701E-09	110.25	4.6615E-03
17	3.5750	2.1776E-09	89.52	3.5207E-03
18	4.4600	1.6843E-09	73.48	2.7216E-03
19	5.6700	1.2760E-09	59.27	2.0548E-03
20	7.1600	9.6504E-10	48.40	1.5499E-03
21	8.8100	7.6534E-10	39.98	1.2165E-03
22	10.9600	5.5890E-10	34.26	8.8852E-04
23	14.1100	3.7804E-10	29.18	6.0117E-04
24	17.9500	2.5009E-10	25.74	3.9792E-04
25	22.2400	1.6526E-10	23.73	2.6336E-04
26	28.5000	1.0474E-10	21.27	1.6670E-04
27	36.0000	6.1741E-11	20.50	9.8335E-05
30	71.9000	5.7707E-11	6.77	9.1977E-05

THE EARTH TECHNOLOGY CORP.

Job #:G86179
Client:UNOCAL
Location:MEDICINE LAKE HIGHLAND
File:MLHIGH6.DAT





o FIELD DATA

— MODEL CURVE

THE EARTH TECHNOLOGY CORP.

UNOCAL GEOTHERMAL

MEDICINE LAKE HIGHLAND

APPARENT RESISTIVITY CURVE

SITE: LOOP28

JOB #G86179 Fig.

LINE: 0028
STA.: 0000

FREQUENCY = 30 hz
LOOP SIZE = 300 x 300 m
CURRENT = 20 amps
SPACING = 168 m

CH.	TIME(msec)	V(Volts/A-m^2)	RHOA-LATE	RHOA-EARLY
1	0.0890	3.2306E-07	1504.95	5.1240E-01
2	0.1100	1.8235E-07	1547.99	2.8925E-01
3	0.1400	1.0670E-07	1480.39	1.6929E-01
4	0.1770	6.6581E-08	1371.42	1.0567E-01
5	0.2200	4.3384E-08	1269.90	6.8873E-02
6	0.2800	2.7228E-08	1159.00	4.3235E-02
7	0.3550	1.7156E-08	1061.79	2.7247E-02
8	0.4430	1.1387E-08	964.76	1.8089E-02
9	0.5640	7.3993E-09	859.87	1.1756E-02
10	0.7130	4.9585E-09	759.70	7.8802E-03
11	0.8810	3.5824E-09	663.15	5.6942E-03
12	1.0960	2.5042E-09	585.10	3.9808E-03
13	1.4110	1.6824E-09	500.64	2.6751E-03
14	1.7950	1.1575E-09	430.10	1.8409E-03
15	2.2240	8.3761E-10	373.34	1.3322E-03
16	2.8500	5.7361E-10	317.84	9.1254E-04
17	3.6000	3.8996E-10	278.51	6.2052E-04
18	4.4900	2.6912E-10	246.78	4.2829E-04
19	5.7000	1.7628E-10	219.84	2.8068E-04
20	7.1900	1.1361E-10	200.08	1.8097E-04

THE EARTH TECHNOLOGY CORP.

Job #:686179
Client:UNOCAL
Location:MEDICINE LAKE HIGHLAND
File:MLHIGH6.DAT

LOOP28

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		.0	.0		
1417.67	373.1	-373.1	-1224.0	.3	.3
231.36	236.0	-609.1	-1998.3	1.0	1.3
67.11					

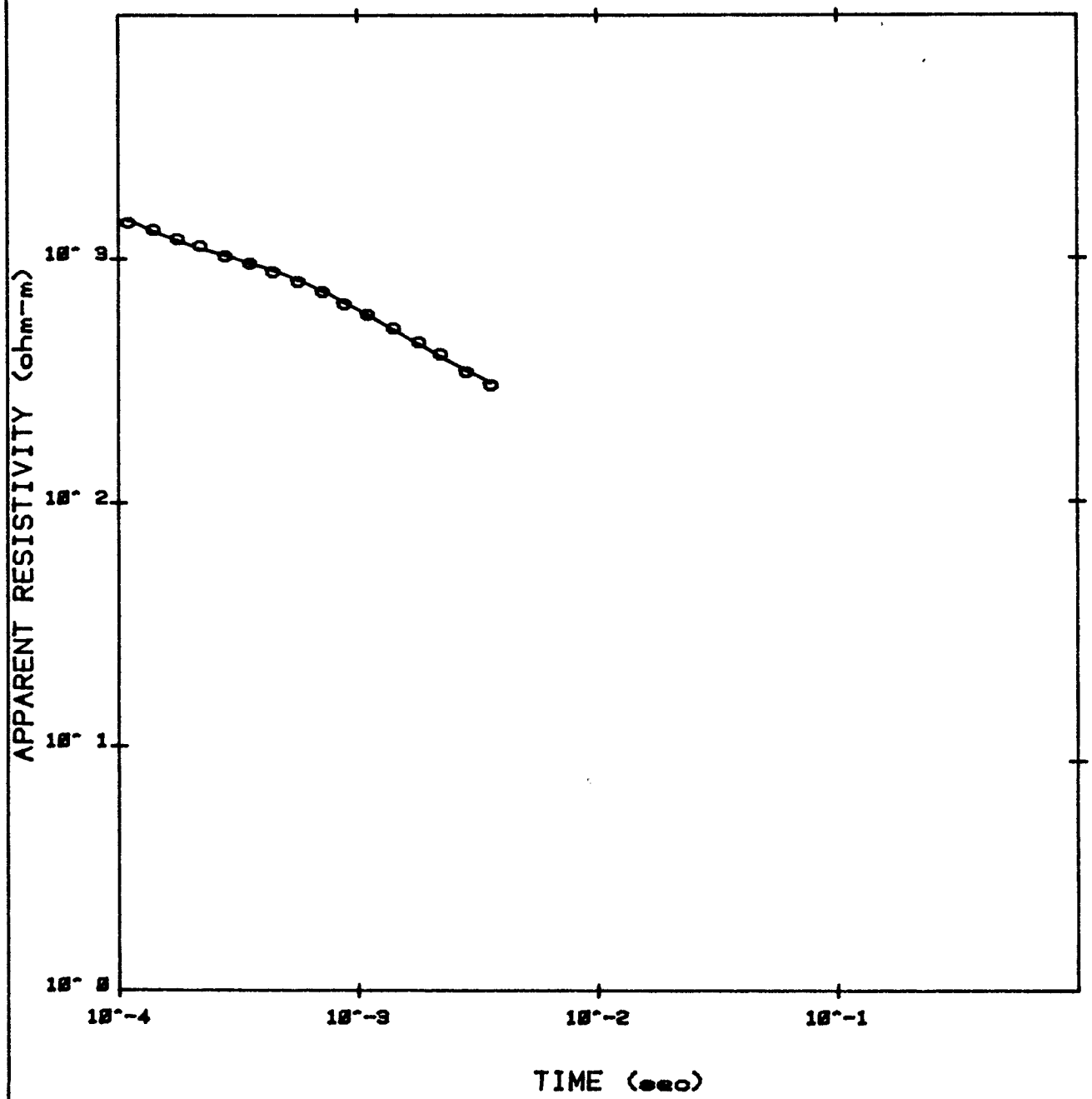
TIMES	DATA LATE	CALC LATE	% ERROR	DATA EARLY
1.10E-04	1.54E+03	1.56E+03	-0.739	2.91E-01
1.40E-04	1.48E+03	1.48E+03	-0.156	1.69E-01
1.77E-04	1.37E+03	1.37E+03	+0.037	1.05E-01
2.20E-04	1.27E+03	1.26E+03	+0.279	6.86E-02
2.80E-04	1.16E+03	1.16E+03	-0.779	4.30E-02
3.55E-04	1.06E+03	1.06E+03	-0.274	2.72E-02
4.43E-04	9.61E+02	9.61E+02	+0.046	1.81E-02
5.64E-04	8.57E+02	8.60E+02	-0.408	1.18E-02
7.13E-04	7.57E+02	7.57E+02	-0.020	7.88E-03
8.81E-04	6.61E+02	6.65E+02	-0.667	5.69E-03
1.10E-03	5.83E+02	5.82E+02	+0.153	3.94E-03
1.41E-03	4.99E+02	4.93E+02	+1.116	2.68E-03
1.80E-03	4.28E+02	4.24E+02	+1.108	1.83E-03
2.22E-03	3.72E+02	3.70E+02	+0.574	1.34E-03
2.85E-03	3.16E+02	3.18E+02	-0.569	9.15E-04
3.60E-03	2.77E+02	2.79E+02	-0.728	6.22E-04

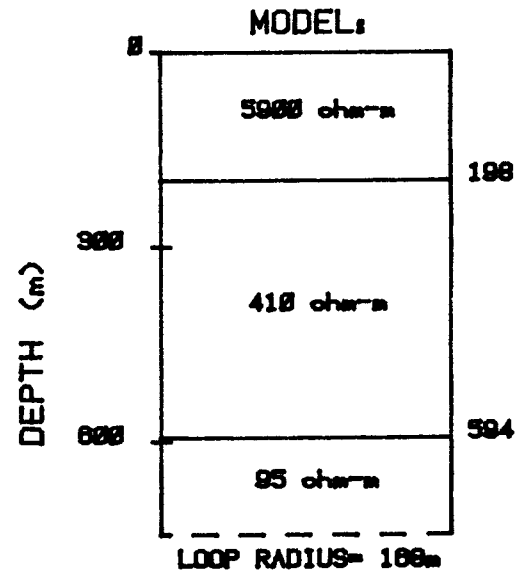
R: 168. X: 0. Y: 0. DL: 0. REQ: 0. CF: 1.0000
TDHZ ARRAY, 16 DATA POINTS, SYSTEM: NONE DATA: LOOP28
MEDICINE LAKE HIGHLAND
UNOCAL GEOTHERMAL 8-18-86
RMS LOG ERROR: 3.86E-03, ANTILOG YIELDS .8923 %
LATE TIME PARAMETERS

IGS: ARRTI

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	.96					
P 2	-.11	.61				
P 3	-.02	-.09	.90			
T 1	.05	.16	.03	.94		
T 2	-.04	-.11	.01	.05	.94	
F 0	.00	.00	.00	.00	.00	.00





o FIELD DATA

— MODEL CURVE

THE EARTH TECHNOLOGY CORP.

UNOCAL GEOTHERMAL

MEDICINE LAKE HIGHLAND

APPARENT RESISTIVITY CURVE

SITE: LOOP20

JOB #G86179 Fig.

LOOP29

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		.0	.0		
5864.45	198.0	-198.0	-649.7	.0	.0
414.26	395.9	-593.9	-1948.6	1.0	1.0
95.11					

TIMES	DATA LATE	CALC LATE	% ERROR	DATA EARLY
1.10E-04	1.41E+03	1.45E+03	-2.981	3.32E-01
1.40E-04	1.32E+03	1.30E+03	+1.406	2.00E-01
1.77E-04	1.21E+03	1.19E+03	+2.479	1.27E-01
2.20E-04	1.13E+03	1.10E+03	+2.021	8.17E-02
2.80E-04	1.03E+03	1.04E+03	-0.236	5.14E-02
3.55E-04	9.60E+02	9.60E+02	-0.033	3.16E-02
4.43E-04	8.87E+02	9.00E+02	-1.492	2.04E-02
5.64E-04	8.09E+02	8.22E+02	-1.580	1.28E-02
7.13E-04	7.33E+02	7.38E+02	-0.587	8.27E-03
8.81E-04	6.53E+02	6.63E+02	-1.426	5.80E-03
1.10E-03	5.92E+02	5.90E+02	+0.309	3.86E-03
1.41E-03	5.21E+02	5.11E+02	+2.029	2.51E-03
1.80E-03	4.56E+02	4.46E+02	+2.172	1.66E-03
2.22E-03	4.07E+02	3.97E+02	+2.396	1.17E-03
2.85E-03	3.43E+02	3.49E+02	-1.606	8.09E-04
3.60E-03	3.03E+02	3.10E+02	-2.332	5.43E-04

R: 168. X: 0. Y: 0. DL: 0. REQ: 0. CF: 1.0000
TDHZ ARRAY, 16 DATA POINTS, SYSTEM: NONE DATA: LOOP29
MEDICINE LAKE HIGHLAND
UNOCAL GEOTHERMAL 8-17-86
RMS LOG ERROR: 1.16E-02, ANTILOG YIELDS 2.7119 %
LATE TIME PARAMETERS

IGS: ARRTI

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	.56					
P 2	-.02	.97				
P 3	.00	-.02	.93			
T 1	.05	.02	.01	.98		
T 2	-.02	.00	.02	.00	.99	
F 0	.00	.00	.00	.00	.00	.00

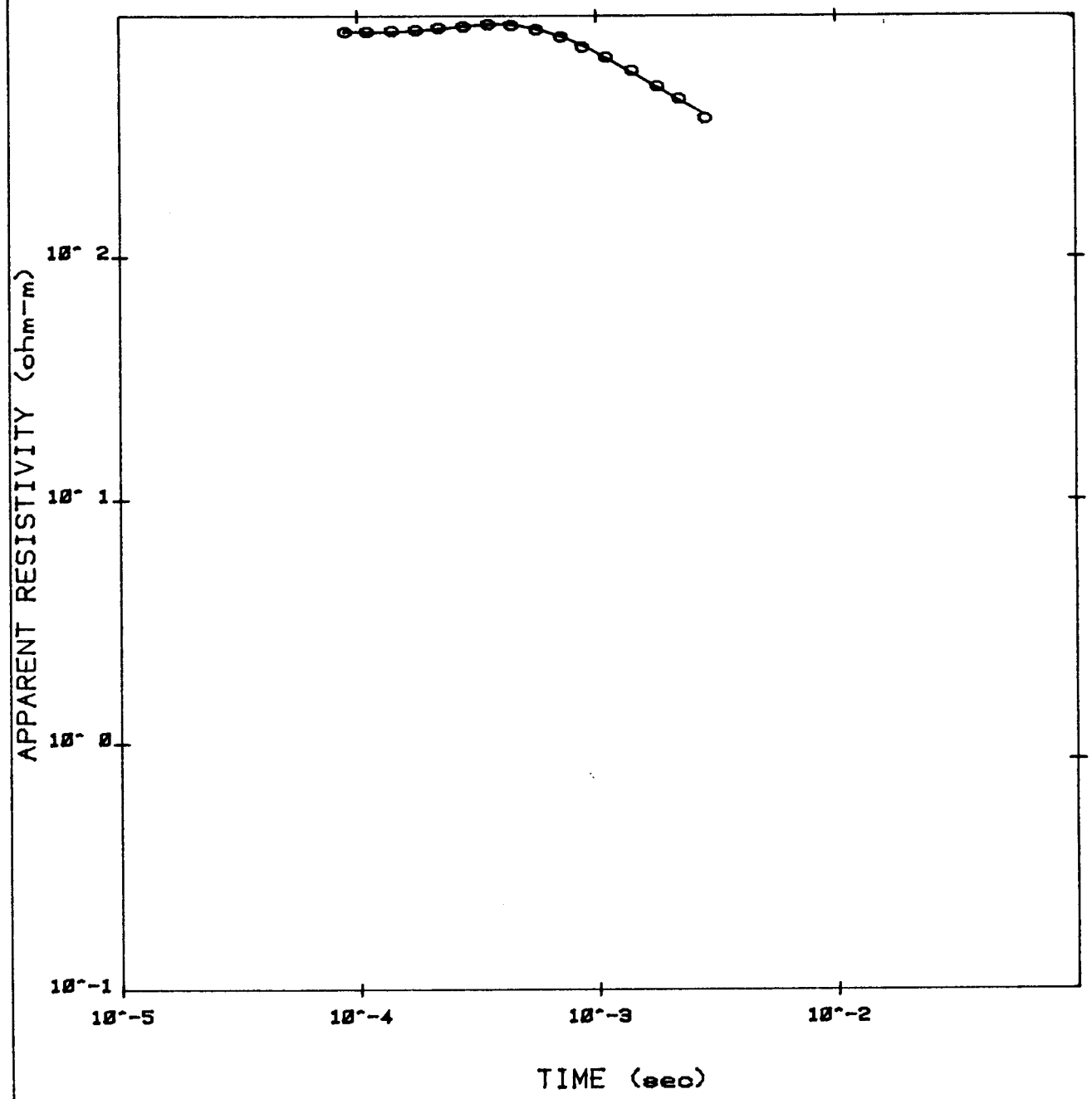
LINE: 0029
STA.: 0000

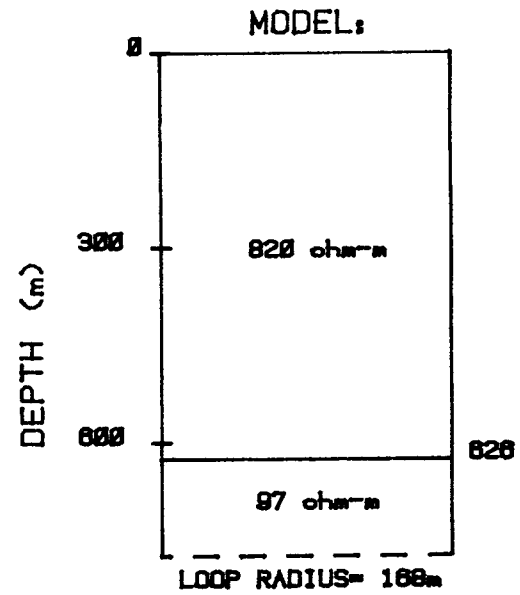
FREQUENCY = 30 hz
LOOP SIZE = 300 x 300 m
CURRENT = 20 amps
SPACING = 168 m

CH.	TIME(msec)	V(Volts/A-m^2)	RHOA-LATE	RHOA-EARLY
1	0.0890	3.6035E-07	1399.23	5.7166E-01
2	0.1100	2.0970E-07	1410.27	3.3271E-01
3	0.1400	1.2578E-07	1326.63	1.9959E-01
4	0.1770	7.9539E-08	1218.10	1.2625E-01
5	0.2200	5.1720E-08	1129.48	8.2115E-02
6	0.2800	3.2150E-08	1037.48	5.1053E-02
7	0.3550	1.9853E-08	963.28	3.1535E-02
8	0.4430	1.2855E-08	889.83	2.0422E-02
9	0.5640	8.0584E-09	812.32	1.2806E-02
10	0.7130	5.1990E-09	736.09	8.2637E-03
11	0.8810	3.6425E-09	655.84	5.7907E-03
12	1.0960	2.4483E-09	593.96	3.8930E-03
13	1.4110	1.5737E-09	523.44	2.5030E-03
14	1.7950	1.0549E-09	457.57	1.6784E-03
15	2.2240	7.3067E-10	408.93	1.1634E-03
16	2.8500	5.0787E-10	344.71	8.0830E-04
17	3.6000	3.4119E-10	304.46	5.4324E-04
18	4.4900	2.3360E-10	271.21	3.7187E-04
19	5.7000	1.5052E-10	244.25	2.3961E-04
20	7.1900	9.2926E-11	228.76	1.4795E-04

THE EARTH TECHNOLOGY CORP.

Job #:G86179
Client:UNOCAL
Location:MEDICINE LAKE HIGHLAND
File:MLHIGH5.DAT





o FIELD DATA

— MODEL CURVE

THE EARTH TECHNOLOGY CORP.

UNOCAL GEOTHERMAL

MEDICINE LAKE HIGHLAND

APPARENT RESISTIVITY CURVE

SITE: LOOP30

JOB #G88179 Fig.

LOOP30

MODEL: 2 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		.0	.0		
816.32	625.8	-625.8	-2053.1	.8	.8
97.46					

TIMES	DATA LATE	CALC LATE	% ERROR	DATA EARLY
8.90E-05	8.60E+02	8.66E+02	-0.715	1.18E+00
1.10E-04	8.62E+02	8.60E+02	+0.219	6.94E-01
1.40E-04	8.70E+02	8.61E+02	+1.048	3.74E-01
1.77E-04	8.77E+02	8.71E+02	+0.729	2.06E-01
2.20E-04	8.94E+02	8.86E+02	+0.867	1.16E-01
2.80E-04	9.06E+02	9.08E+02	-0.171	6.23E-02
3.55E-04	9.23E+02	9.26E+02	-0.289	3.35E-02
4.43E-04	9.16E+02	9.23E+02	-0.777	1.95E-02
5.64E-04	8.79E+02	8.85E+02	-0.662	1.13E-02
7.13E-04	8.19E+02	8.27E+02	-0.968	7.00E-03
8.81E-04	7.44E+02	7.56E+02	-1.622	4.77E-03
1.10E-03	6.76E+02	6.70E+02	+0.883	3.16E-03
1.41E-03	5.95E+02	5.83E+02	+2.001	2.06E-03
1.80E-03	5.14E+02	5.08E+02	+1.194	1.39E-03
2.22E-03	4.56E+02	4.48E+02	+1.783	9.86E-04
2.85E-03	3.78E+02	3.92E+02	-3.528	6.99E-04

R: 168. X: 0. Y: 0. DL: 0. REQ: 0. CF: 1.0000
TDHZ ARRAY, 16 DATA POINTS, SYSTEM: NONE DATA: LOOP30
MEDICINE LAKE HIGHLAND
UNOCAL GEOTHERMAL
RMS LOG ERROR: 8.90E-03, ANTILOG YIELDS 2.0697 %
LATE TIME PARAMETERS

IGS: ARRTI

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	T 1	F 0
P 1	1.00			
P 2	.00	1.00		
T 1	.00	.00	1.00	
F 0	.00	.00	.00	.00

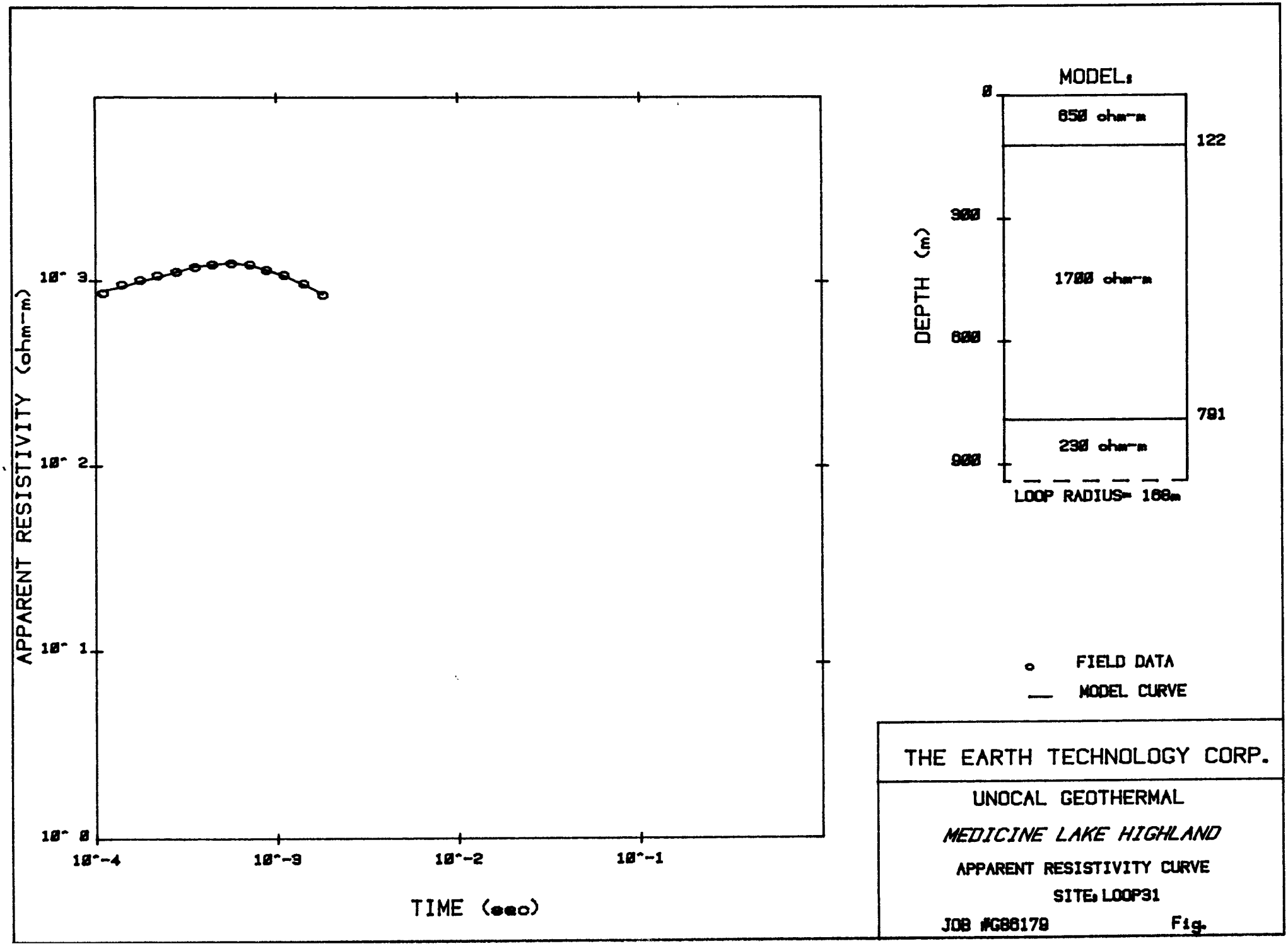
LINE: 0030
STA.: 0000

FREQUENCY = 30 hz
LOOP SIZE = 300 x 300 m
CURRENT = 19 amps
SPACING = 168 m

CH.	TIME(msec)	V(Volts/A-m^2)	RHOA-LATE	RHOA-EARLY
1	0.0890	7.4566E-07	861.68	1.1824E+00
2	0.1100	4.3765E-07	863.55	6.9412E-01
3	0.1400	2.3608E-07	871.86	3.7452E-01
4	0.1770	1.2963E-07	879.55	2.0572E-01
5	0.2200	7.3145E-08	896.46	1.1611E-01
6	0.2800	3.9214E-08	908.81	6.2265E-02
7	0.3550	2.1059E-08	926.17	3.3447E-02
8	0.4430	1.2254E-08	918.71	1.9467E-02
9	0.5640	7.1203E-09	882.19	1.1316E-02
10	0.7130	4.4034E-09	822.27	6.9993E-03
11	0.8810	2.9982E-09	746.73	4.7665E-03
12	1.0960	2.0062E-09	678.30	3.1901E-03
13	1.4110	1.2916E-09	597.11	2.0542E-03
14	1.7950	8.8037E-10	516.19	1.4006E-03
15	2.2240	6.1621E-10	458.12	9.8077E-04
16	2.8500	4.3975E-10	379.44	6.9978E-04
17	3.6000	3.0208E-10	330.20	4.8084E-04
18	4.4900	2.1703E-10	284.84	3.4551E-04
19	5.7000	1.5030E-10	244.49	2.3932E-04
20	7.1900	1.0674E-10	208.58	1.7003E-04

THE EARTH TECHNOLOGY CORP.

Job #:G86179
Client:UNOCAL
Location:MEDICINE LAKE HIGHLAND
File:MLHIGH5.DAT


APPARENT RESISTIVITY (ohm-m)
10^3
10^2
10^1
10^0
10^-4
10^-3
10^-2
10^-1
TIME (sec)
MODEL:
0
650 ohm-m
122
300
1700 ohm-m
600
791
230 ohm-m
900
DEPTH (m)
LOOP RADIUS= 100m
FIELD DATA
MODEL CURVE
THE EARTH TECHNOLOGY CORP.
UNOCAL GEOTHERMAL
MEDICINE LAKE HIGHLAND
APPARENT RESISTIVITY CURVE
SITE: LOOP31
JOB #G86179
Fig.

LOOP31

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		.0	.0		
653.58	122.4	-122.4	-401.5	.2	.2
1700.22	668.7	-791.1	-2595.5	.4	.6
225.66					

TIMES	DATA LATE	CALC LATE	% ERROR	DATA EARLY
1.10E-04	8.57E+02	8.87E+02	-3.476	7.00E-01
1.40E-04	9.54E+02	9.30E+02	+2.529	3.26E-01
1.77E-04	1.01E+03	9.97E+02	+1.552	1.67E-01
2.20E-04	1.07E+03	1.05E+03	+1.737	8.87E-02
2.80E-04	1.12E+03	1.12E+03	-0.795	4.53E-02
3.55E-04	1.19E+03	1.20E+03	-1.191	2.29E-02
4.43E-04	1.23E+03	1.23E+03	+0.015	1.25E-02
5.64E-04	1.25E+03	1.26E+03	-0.789	6.67E-03
7.13E-04	1.23E+03	1.22E+03	+0.673	3.81E-03
8.81E-04	1.15E+03	1.15E+03	-0.363	2.48E-03
1.10E-03	1.08E+03	1.07E+03	+0.832	1.56E-03
1.41E-03	9.71E+02	9.60E+02	+1.120	9.87E-04
1.80E-03	8.43E+02	8.55E+02	-1.453	6.62E-04

R: 168. X: 0. Y: 0. DL: 0. REQ: 0. CF: 1.0000
TDHZ ARRAY, 13 DATA POINTS, SYSTEM: NONE DATA: LOOP31
MEDICINE LAKE HIGHLAND
UNOCAL GEOTHERMAL 8-17-86
RMS LOG ERROR: 1.01E-02, ANTILOG YIELDS 2.3603 %
LATE TIME PARAMETERS

IGS: ARRTI

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	.92					
P 2	-.04	.92				
P 3	.00	-.07	.75			
T 1	-.17	-.13	-.05	.57		
T 2	.04	.05	.06	.11	.96	
F 0	.00	.00	.00	.00	.00	.00

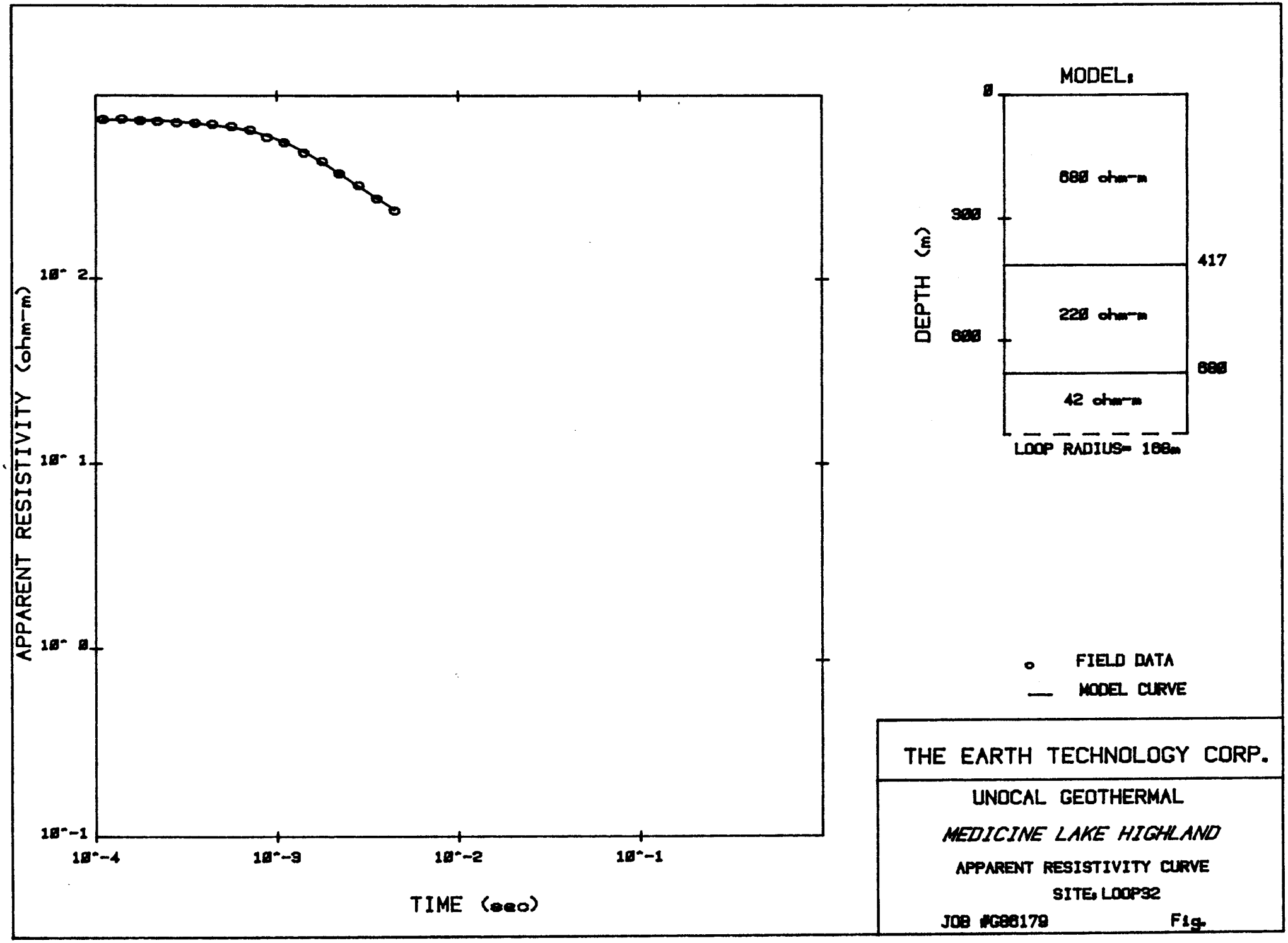
LINE: 0031
STA.: 0000

FREQUENCY = 30 hz
LOOP SIZE = 300 x 300 m
CURRENT = 20 amps
SPACING = 168 m

CH.	TIME(msec)	V(Volts/A-m^2)	RHOA-LATE	RHOA-EARLY
1	0.0890	9.5280E-07	731.77	1.5114E+00
2	0.1100	4.4138E-07	858.68	7.0010E-01
3	0.1400	2.0549E-07	956.37	3.2602E-01
4	0.1770	1.0447E-07	1015.64	1.6581E-01
5	0.2200	5.5981E-08	1071.42	8.8891E-02
6	0.2800	2.8679E-08	1119.56	4.5548E-02
7	0.3550	1.4462E-08	1189.87	2.2975E-02
8	0.4430	7.8409E-09	1237.21	1.2461E-02
9	0.5640	4.1785E-09	1258.58	6.6465E-03
10	0.7130	2.4054E-09	1230.50	3.8245E-03
11	0.8810	1.5615E-09	1153.56	2.4839E-03
12	1.0960	9.8864E-10	1087.22	1.5728E-03
13	1.4110	6.1864E-10	975.41	9.8454E-04
14	1.7950	4.1931E-10	846.38	6.6724E-04
15	2.2240	2.8878E-10	759.31	4.5991E-04
16	2.8500	1.9410E-10	654.55	3.0912E-04
17	3.6000	1.3619E-10	561.59	2.1698E-04
18	4.4900	9.5348E-11	492.88	1.5204E-04
19	5.7000	6.1601E-11	443.11	9.8123E-05
20	7.1900	4.2981E-11	382.50	6.8463E-05

THE EARTH TECHNOLOGY CORP.

Job #:G86179
Client:UNOCAL
Location:MEDICINE LAKE HIGHLAND
File:MLHIGH5.DAT


APPARENT RESISTIVITY (ohm-m)
10^2
10^1
10^0
10^-1
10^-4
10^-3
10^-2
10^-1
TIME (sec)
MODEL:
0
300
600
417
880
880 ohm-m
220 ohm-m
42 ohm-m
DEPTH (m)
LOOP RADIUS= 100m
FIELD DATA
MODEL CURVE
THE EARTH TECHNOLOGY CORP.
UNOCAL GEOTHERMAL
MEDICINE LAKE HIGHLAND
APPARENT RESISTIVITY CURVE
SITE: LOOP32
JOB #G88179
Fig.

LOOP32

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		.0	.0		
679.94	416.6	-416.6	-1366.9	.6	.6
216.70	263.1	-679.8	-2230.2	1.2	1.8
42.32					

TIMES	DATA LATE	CALC LATE	% ERROR	DATA EARLY
1.10E-04	7.42E+02	7.38E+02	+0.425	8.69E-01
1.40E-04	7.48E+02	7.39E+02	+1.296	4.70E-01
1.77E-04	7.34E+02	7.37E+02	-0.365	2.69E-01
2.20E-04	7.27E+02	7.33E+02	-0.779	1.58E-01
2.80E-04	7.13E+02	7.25E+02	-1.674	8.92E-02
3.55E-04	7.12E+02	7.10E+02	+0.268	4.94E-02
4.43E-04	7.02E+02	6.92E+02	+1.485	2.90E-02
5.64E-04	6.83E+02	6.74E+02	+1.343	1.65E-02
7.13E-04	6.54E+02	6.47E+02	+1.031	9.82E-03
8.85E-04	5.95E+02	6.10E+02	-2.462	6.59E-03
1.10E-03	5.59E+02	5.63E+02	-0.661	4.20E-03
1.41E-03	4.92E+02	5.00E+02	-1.705	2.74E-03
1.78E-03	4.43E+02	4.36E+02	+1.721	1.79E-03
2.21E-03	3.80E+02	3.80E+02	-0.031	1.31E-03
2.83E-03	3.28E+02	3.23E+02	+1.582	8.81E-04
3.57E-03	2.77E+02	2.78E+02	-0.399	6.35E-04
4.46E-03	2.38E+02	2.41E+02	-1.417	4.57E-04

R: 168. X: 0. Y: 0. DL: 0. REQ: 0. CF: 1.0000
TDHZ ARRAY, 17 DATA POINTS, SYSTEM: NONE DATA: LOOP32
MEDICINE LAKE HIGHLAND
UNOCAL GEOTHERMAL 8-17-86
RMS LOG ERROR: 8.31E-03, ANTILOG YIELDS 1.9329 %
LATE TIME PARAMETERS

IGS: ARRTI

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	1.00					
P 2	.00	.98				
P 3	.00	-.01	.99			
T 1	.00	.01	.00	1.00		
T 2	.00	-.01	.00	.00	1.00	
F 0	.00	.00	.00	.00	.00	.00

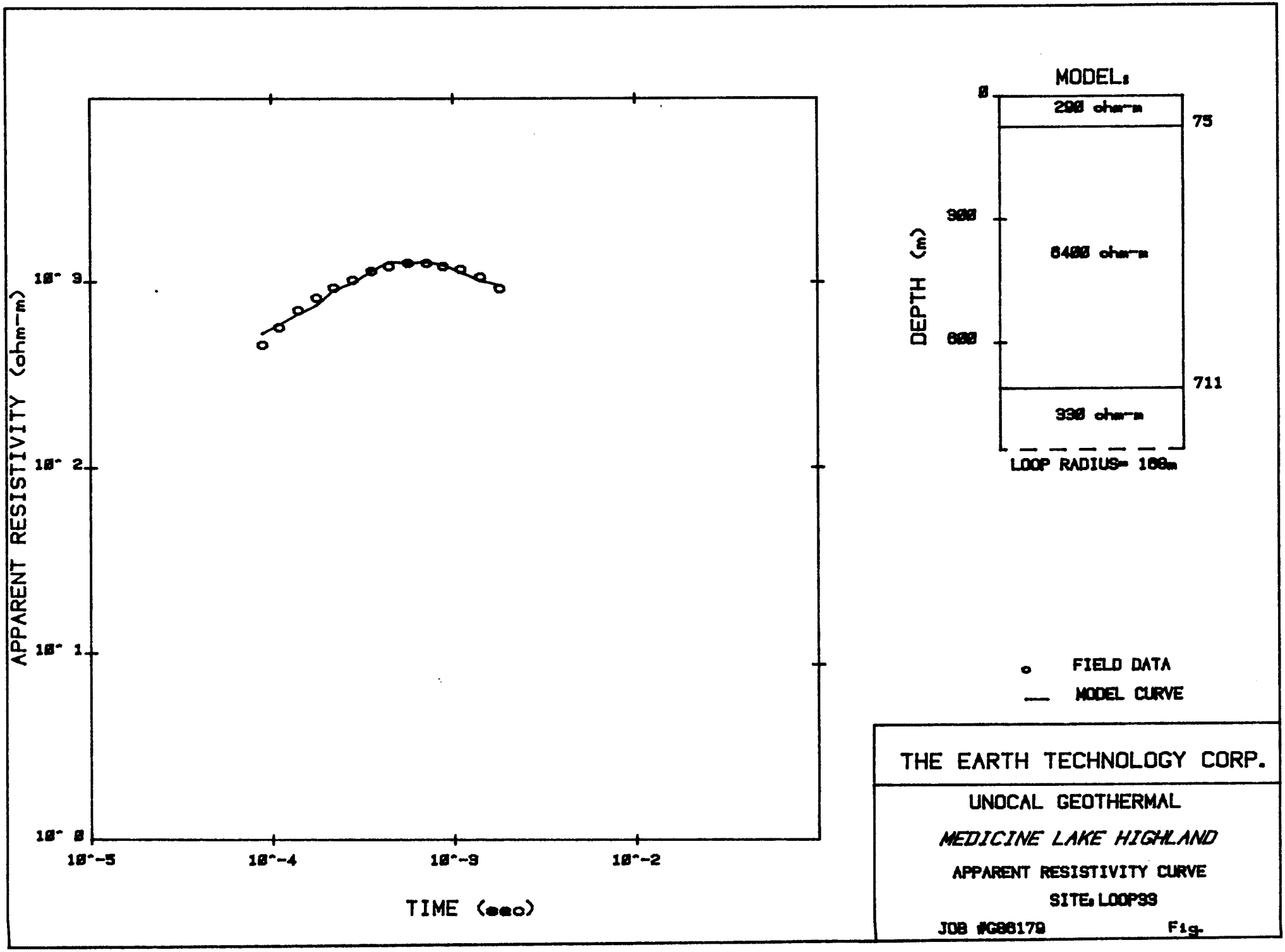
LINE: 0032
STA.: 0000

FREQUENCY = comb freq.
LOOP SIZE = 300 x 300 m
CURRENT = 20 amps
SPACING = 168 m

CH.	TIME(msec)	V(Volts/A-m^2)	RHOA-LATE	RHOA-EARLY
2	0.1100	5.4812E-07	743.22	8.6923E-01
3	0.1400	2.9575E-07	750.23	4.6914E-01
4	0.1770	1.6928E-07	736.21	2.6861E-01
5	0.2200	9.9762E-08	728.92	1.5835E-01
6	0.2800	5.6213E-08	714.83	8.9251E-02
7	0.3550	3.1121E-08	713.86	4.9425E-02
8	0.4430	1.8250E-08	704.44	2.8991E-02
9	0.5640	1.0393E-08	685.58	1.6516E-02
10	0.7130	6.1757E-09	656.28	9.8162E-03
11	0.8855	4.0821E-09	602.73	6.5726E-03
12	1.0980	2.6408E-09	563.03	4.2197E-03
13	1.4055	1.7331E-09	494.03	2.7569E-03
14	1.7825	1.1182E-09	445.28	1.7794E-03
15	2.2120	8.1148E-10	384.77	1.3080E-03
16	2.8250	5.4288E-10	334.60	8.8281E-04
17	3.5750	3.9097E-10	281.28	6.3291E-04
18	4.4600	2.8288E-10	241.40	4.5769E-04
19	5.6700	1.8351E-10	215.91	2.9592E-04
20	7.1600	1.2460E-10	189.45	2.0041E-04
21	8.8100	9.2280E-11	163.81	1.4689E-04
22	10.9600	5.9214E-11	153.01	9.4279E-05
23	14.1100	3.6076E-11	139.75	5.7453E-05
24	17.9500	2.0791E-11	135.10	3.3120E-05

THE EARTH TECHNOLOGY CORP.

Job #:G86179
Client:UNOCAL
Location:MEDICINE LAKE HIGHLAND
File:MLHIGH5.DAT


APPARENT RESISTIVITY (ohm-m)
10^3
10^2
10^1
10^0
10^-5
10^-4
10^-3
10^-2
TIME (sec)
MODEL:
0
200 ohm-m
75
300
6400 ohm-m
600
711
330 ohm-m
DEPTH (m)
LOOP RADIUS= 100m
FIELD DATA
MODEL CURVE
THE EARTH TECHNOLOGY CORP.
UNOCAL GEOTHERMAL
MEDICINE LAKE HIGHLAND
APPARENT RESISTIVITY CURVE
SITE: LOOP33
JOB #G88179
Fig.

LOOP33

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		.0	.0		
293.19	74.9	-74.9	-245.7	.3	.3
6376.56	636.0	-710.9	-2332.2	.1	.4
325.92					

TIMES	DATA LATE	CALC LATE	% ERROR	DATA EARLY
8.90E-05	4.62E+02	5.33E+02	-13.242	3.00E+00
1.10E-04	5.74E+02	5.95E+02	-3.471	1.28E+00
1.40E-04	7.07E+02	6.77E+02	+4.453	5.11E-01
1.77E-04	8.25E+02	7.52E+02	+9.703	2.26E-01
2.20E-04	9.35E+02	9.07E+02	+3.099	1.09E-01
2.80E-04	1.03E+03	9.92E+02	+4.099	5.14E-02
3.55E-04	1.15E+03	1.15E+03	+0.072	2.41E-02
4.43E-04	1.22E+03	1.29E+03	-5.220	1.27E-02
5.64E-04	1.27E+03	1.27E+03	+0.537	6.52E-03
7.13E-04	1.27E+03	1.29E+03	-0.873	3.63E-03
8.81E-04	1.22E+03	1.24E+03	-1.651	2.27E-03
1.10E-03	1.18E+03	1.13E+03	+4.259	1.37E-03
1.41E-03	1.07E+03	1.02E+03	+4.293	8.53E-04
1.80E-03	9.25E+02	9.66E+02	-4.224	5.76E-04

R: 168. X: 0. Y: 0. DL: 0. REQ: 0. CF: 1.0000
TDHZ ARRAY, 14 DATA POINTS, SYSTEM: NONE DATA: LOOP33
MEDICINE LAKE HIGHLAND
UNOCAL GEOTHERMAL
RMS LOG ERROR: 3.61E-02, ANTILOG YIELDS 8.6758 %
LATE TIME PARAMETERS

IGS: ARRTI

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	.98					
P 2	-.02	.34				
P 3	.00	-.17	.71			
T 1	-.02	-.10	-.01	.96		
T 2	.00	.10	.08	.01	.97	
F 0	.00	.00	.00	.00	.00	.00

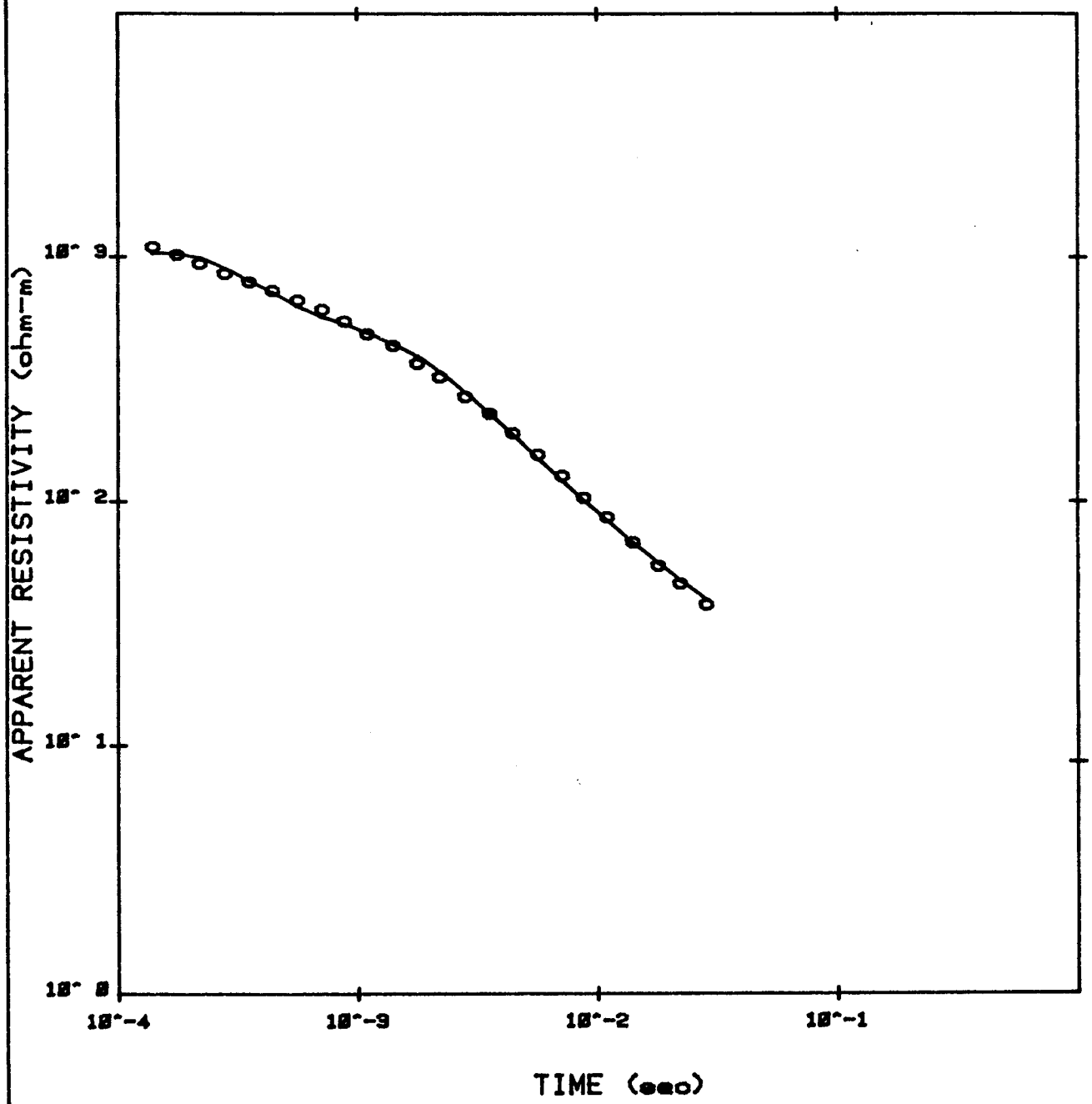
LINE: 0033
STA.: 0000

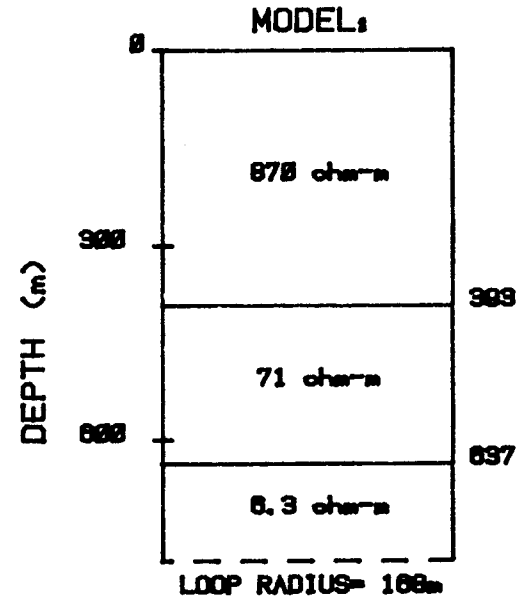
FREQUENCY = 30 hz
LOOP SIZE = 300 x 300 m
CURRENT = 20 amps
SPACING = 168 m

CH.	TIME(msec)	V(Volts/A-m^2)	RHOA-LATE	RHOA-EARLY
1	0.0890	1.8905E-06	463.44	2.9976E+00
2	0.1100	8.0482E-07	575.32	1.2766E+00
3	0.1400	3.2198E-07	708.92	5.1087E-01
4	0.1770	1.4222E-07	826.86	2.2574E-01
5	0.2200	6.8334E-08	938.06	1.0851E-01
6	0.2800	3.2190E-08	1036.61	5.1132E-02
7	0.3550	1.5168E-08	1152.64	2.4102E-02
8	0.4430	7.9218E-09	1228.76	1.2592E-02
9	0.5640	4.0833E-09	1278.07	6.4936E-03
10	0.7130	2.2663E-09	1280.34	3.6050E-03
11	0.8810	1.4203E-09	1228.82	2.2593E-03
12	1.0960	8.7150E-10	1182.58	1.3869E-03
13	1.4110	5.3612E-10	1073.09	8.5327E-04
14	1.7950	3.6428E-10	929.60	5.7999E-04
15	2.2240	2.5632E-10	822.13	4.0825E-04
16	2.8500	1.8705E-10	670.88	2.9788E-04
17	3.6000	1.3066E-10	577.33	2.0820E-04
18	4.4900	9.9385E-11	479.44	1.5846E-04
19	5.7000	6.5933E-11	423.48	1.0511E-04
20	7.1900	4.5046E-11	370.71	7.1797E-05

THE EARTH TECHNOLOGY CORP.

Job #:G86179
Client:UNOCAL
Location:MEDICINE LAKE HIGHLAND
File:MLHIGH5.DAT





o FIELD DATA

— MODEL CURVE

THE EARTH TECHNOLOGY CORP.

UNOCAL GEOTHERMAL

MEDICINE LAKE HIGHLAND

APPARENT RESISTIVITY CURVE

SITE: LOOP34

JOB #G86179 Fig.

LOOP34

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		.0	.0		
869.61	392.6	-392.6	-1288.1	.5	.5
71.27	244.5	-637.2	-2090.4	3.4	3.9
6.33					

TIMES	DATA LATE	CALC LATE	% ERROR	DATA EARLY
1.40E-04	1.10E+03	1.04E+03	+5.479	2.63E-01
1.77E-04	1.02E+03	1.03E+03	-1.289	1.64E-01
2.20E-04	9.39E+02	9.94E+02	-5.456	1.08E-01
2.80E-04	8.55E+02	9.00E+02	-4.989	6.79E-02
3.55E-04	7.88E+02	7.97E+02	-1.111	4.24E-02
4.43E-04	7.27E+02	7.13E+02	+1.896	2.75E-02
5.64E-04	6.64E+02	6.28E+02	+5.755	1.72E-02
7.13E-04	6.07E+02	5.67E+02	+7.088	1.10E-02
8.85E-04	5.45E+02	5.30E+02	+2.806	7.52E-03
1.10E-03	4.85E+02	4.91E+02	-1.312	5.20E-03
1.41E-03	4.35E+02	4.40E+02	-1.021	3.29E-03
1.78E-03	3.68E+02	3.94E+02	-6.665	2.36E-03
2.21E-03	3.23E+02	3.40E+02	-5.232	1.67E-03
2.83E-03	2.69E+02	2.80E+02	-3.990	1.19E-03
3.57E-03	2.30E+02	2.29E+02	+0.447	8.39E-04
4.46E-03	1.91E+02	1.88E+02	+1.548	6.36E-04
5.67E-03	1.56E+02	1.50E+02	+3.623	4.72E-04
7.16E-03	1.28E+02	1.22E+02	+5.468	3.55E-04
8.81E-03	1.04E+02	1.01E+02	+2.907	2.88E-04
1.10E-02	8.65E+01	8.38E+01	+3.307	2.18E-04
1.41E-02	6.81E+01	6.77E+01	+0.590	1.68E-04
1.80E-02	5.46E+01	5.60E+01	-2.469	1.27E-04
2.22E-02	4.61E+01	4.74E+01	-2.656	9.70E-05
2.85E-02	3.78E+01	3.97E+01	-4.863	6.99E-05

R: 168. X: 0. Y: 0. DL: 0. REQ: 0. CF: 1.0000
TDHZ ARRAY, 24 DATA POINTS, SYSTEM: NONE DATA: LOOP34
MEDICINE LAKE HIGHLAND
UNOCAL GEOTHERMAL 8-18-86
RMS LOG ERROR: 2.59E-02, ANTILOG YIELDS 6.1113 %
LATE TIME PARAMETERS

IGS: ARRTI

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	.99					
P 2	-.02	.91				
P 3	.00	-.04	.91			
T 1	.00	.02	.00	.99		
T 2	-.01	-.03	.00	.01	.99	
F 0	.00	.00	.00	.00	.00	.00

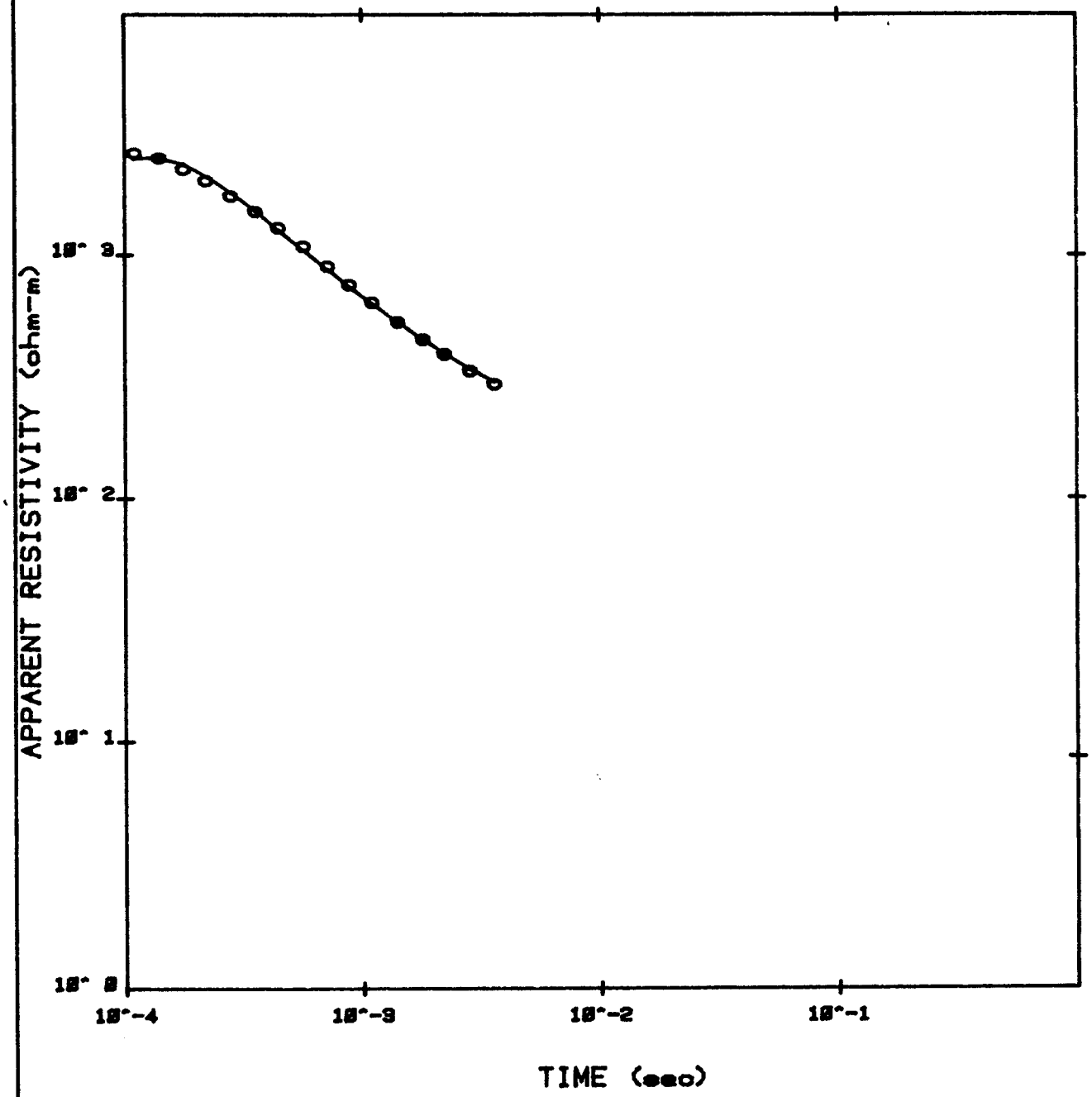
LINE: 0034
STA.: 0000

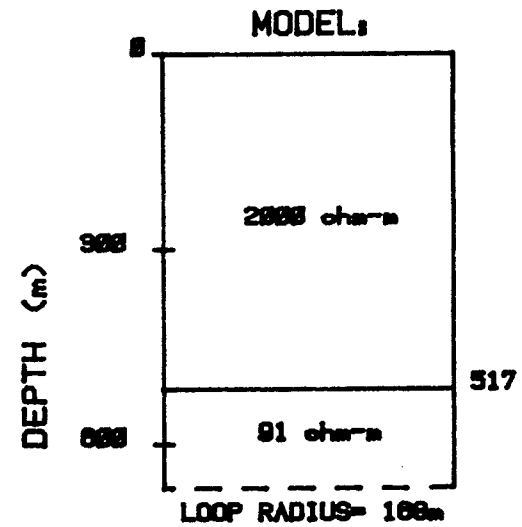
FREQUENCY = comb freq.
LOOP SIZE = 300 x 300 m
CURRENT = 22 amps
SPACING = 168 m

CH.	TIME(msec)	V(Volts/A-m^2)	RHOA-LATE	RHOA-EARLY
3	0.1400	1.6605E-07	1102.35	2.6340E-01
4	0.1770	1.0339E-07	1022.69	1.6405E-01
5	0.2200	6.7905E-08	942.01	1.0776E-01
6	0.2800	4.2758E-08	857.87	6.7870E-02
7	0.3550	2.6723E-08	790.16	4.2429E-02
8	0.4430	1.7334E-08	729.03	2.7528E-02
9	0.5640	1.0851E-08	666.18	1.7235E-02
10	0.7130	6.8986E-09	609.59	1.0960E-02
11	0.8855	4.6684E-09	551.15	7.5135E-03
12	1.0980	3.2799E-09	487.28	5.2262E-03
13	1.4055	2.0766E-09	437.94	3.3100E-03
14	1.7825	1.4527E-09	373.98	2.3508E-03
15	2.2120	1.0360E-09	326.94	1.6702E-03
16	2.8250	7.3170E-10	274.23	1.1901E-03
17	3.5750	5.1675E-10	233.55	8.3667E-04
18	4.4600	3.9365E-10	193.67	6.3754E-04
19	5.6700	2.9271E-10	158.16	4.7270E-04
20	7.1600	2.1970E-10	129.80	3.5330E-04
21	8.8100	1.8045E-10	104.75	2.8722E-04
22	10.9600	1.3815E-10	86.98	2.2001E-04
23	14.1100	1.0472E-10	68.68	1.6751E-04
24	17.9500	8.0010E-11	55.02	1.2792E-04
25	22.2400	6.0201E-11	46.53	9.6472E-05
26	28.5000	4.3656E-11	38.13	6.9994E-05
27	36.0000	4.0516E-11	27.15	6.4651E-05

THE EARTH TECHNOLOGY CORP.

Job #:G86179
Client:UNOCAL
Location:MEDICINE LAKE HIGHLAND
File:MLHIGH6.DAT





FIELD DATA

MODEL CURVE

THE EARTH TECHNOLOGY CORP.

UNOCAL GEOTHERMAL

MEDICINE LAKE HIGHLAND

APPARENT RESISTIVITY CURVE

SITE: LOOP35

JOB #G88179 Fig.

LOOP35

MODEL: 2 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		.0	.0		
2033.41	516.8	-516.8	-1695.5	.3	.3
90.54					

TIMES	DATA LATE	CALC LATE	% ERROR	DATA EARLY
1.10E-04	2.66E+03	2.54E+03	+4.721	1.28E-01
1.40E-04	2.54E+03	2.53E+03	+0.299	7.51E-02
1.77E-04	2.28E+03	2.40E+03	-4.995	4.91E-02
2.20E-04	2.04E+03	2.13E+03	-4.470	3.37E-02
2.80E-04	1.76E+03	1.82E+03	-3.101	2.30E-02
3.55E-04	1.52E+03	1.53E+03	-0.380	1.58E-02
4.43E-04	1.30E+03	1.27E+03	+2.510	1.15E-02
5.64E-04	1.09E+03	1.05E+03	+3.661	8.20E-03
7.13E-04	9.01E+02	8.74E+02	+2.995	6.07E-03
8.81E-04	7.56E+02	7.42E+02	+1.834	4.65E-03
1.10E-03	6.40E+02	6.32E+02	+1.168	3.43E-03
1.41E-03	5.34E+02	5.33E+02	+0.228	2.42E-03
1.80E-03	4.54E+02	4.53E+02	+0.242	1.68E-03
2.22E-03	3.96E+02	3.99E+02	-0.928	1.22E-03
2.85E-03	3.38E+02	3.45E+02	-2.114	8.27E-04
3.60E-03	2.98E+02	3.05E+02	-2.316	5.57E-04

R: 168. X: 0. Y: 0. DL: 0. REQ: 0. CF: 1.0000
TDHZ ARRAY, 16 DATA POINTS, SYSTEM: NONE DATA: LOOP35
MEDICINE LAKE HIGHLAND
UNOCAL GEOTHERMAL 8-19-86
RMS LOG ERROR: 1.80E-02, ANTILOG YIELDS 4.2302 %
LATE TIME PARAMETERS

IGS: ARRTI

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	T 1	F 0
P 1	.82			
P 2	-.08	.43		
T 1	.03	.07	.97	
F 0	.00	.00	.00	.00

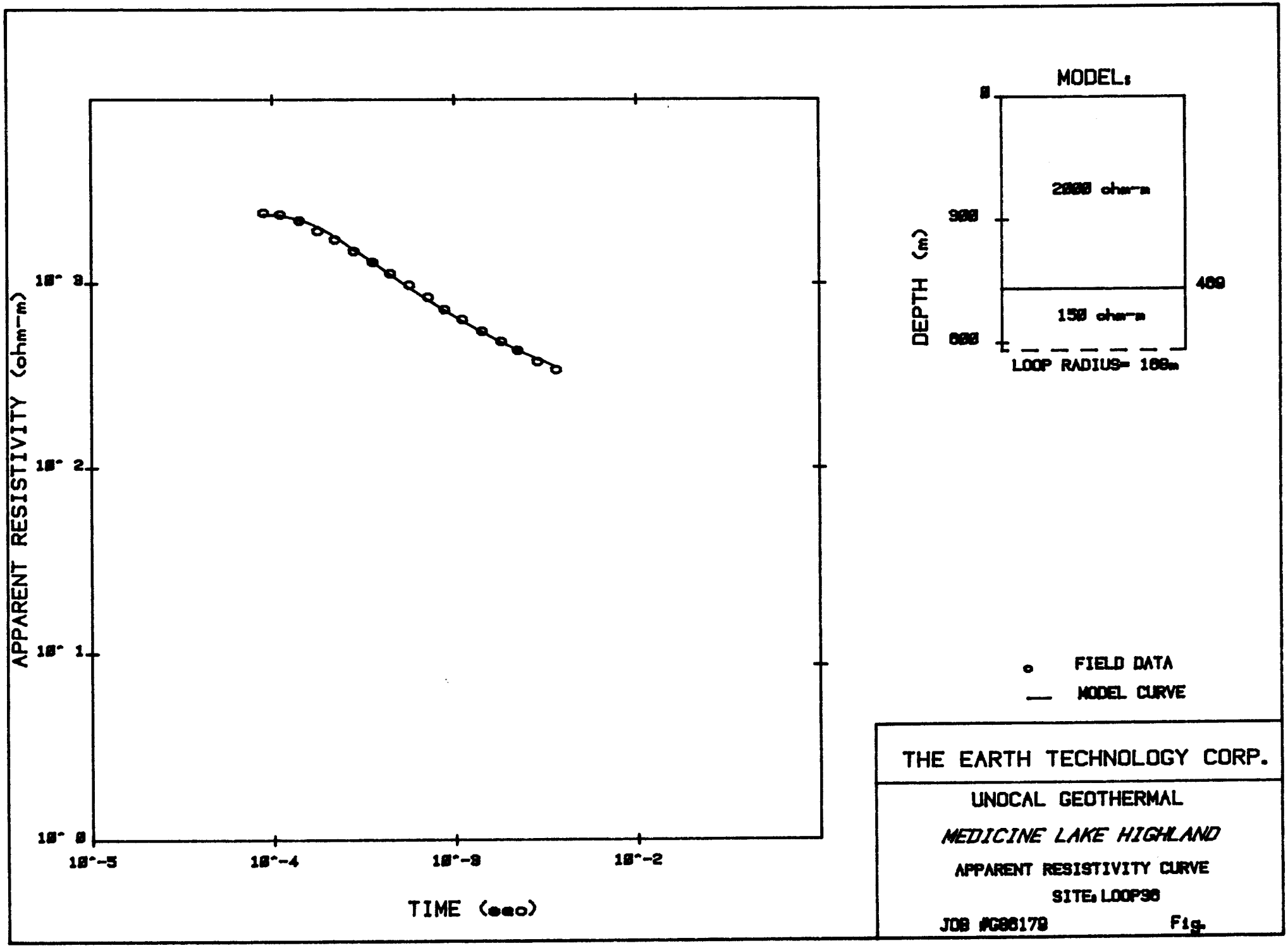
LINE: 0035
STA.: 0000

FREQUENCY = 30 hz
LOOP SIZE = 300 x 300 m
CURRENT = 20 amps
SPACING = 168 m

CH.	TIME(msec)	V(Volts/A-m^2)	RHOA-LATE	RHOA-EARLY
1	0.0890	1.4784E-07	2534.19	2.3459E-01
2	0.1100	8.0557E-08	2668.72	1.2785E-01
3	0.1400	4.7276E-08	2547.13	7.5051E-02
4	0.1770	3.0905E-08	2287.63	4.9070E-02
5	0.2200	2.1214E-08	2046.01	3.3693E-02
6	0.2800	1.4462E-08	1767.14	2.2973E-02
7	0.3550	9.9531E-09	1526.41	1.5814E-02
8	0.4430	7.2163E-09	1307.60	1.1469E-02
9	0.5640	5.1885E-09	1089.42	8.2463E-03
10	0.7130	3.8192E-09	904.12	6.0712E-03
11	0.8810	2.9266E-09	758.85	4.6524E-03
12	1.0960	2.1786E-09	642.03	3.4629E-03
13	1.4110	1.5171E-09	536.37	2.4120E-03
14	1.7950	1.0602E-09	456.03	1.6858E-03
15	2.2240	7.6306E-10	397.28	1.2136E-03
16	2.8500	5.1973E-10	339.44	8.2672E-04
17	3.6000	3.5006E-10	299.29	5.5694E-04
18	4.4900	2.3467E-10	270.38	3.7354E-04
19	5.7000	1.5806E-10	236.42	2.5165E-04
20	7.1900	1.0434E-10	211.75	1.6616E-04

THE EARTH TECHNOLOGY CORP.

Job #:686179
Client:UNOCAL
Location:MEDICINE LAKE HIGHLAND
File:MLHIGH7.DAT


APPARENT RESISTIVITY (ohm-m)
10^3
10^2
10^1
10^0
10^-5
10^-4
10^-3
10^-2
TIME (sec)
MODEL:
0
2000 ohm-m
300
400
150 ohm-m
600
DEPTH (m)
LOOP RADIUS= 100m
FIELD DATA
MODEL CURVE
THE EARTH TECHNOLOGY CORP.
UNOCAL GEOTHERMAL
MEDICINE LAKE HIGHLAND
APPARENT RESISTIVITY CURVE
SITE: LOOP30
JOB #G86179
Fig.

LOOP36

MODEL: 2 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		.0	.0		
1969.72	468.8	-468.8	-1537.9	.2	.2
148.86					

TIMES	DATA LATE	CALC LATE	% ERROR	DATA EARLY
8.90E-05	2.42E+03	2.36E+03	+2.596	2.51E-01
1.10E-04	2.37E+03	2.34E+03	+1.387	1.52E-01
1.40E-04	2.20E+03	2.22E+03	-0.714	9.31E-02
1.77E-04	1.93E+03	2.04E+03	-5.137	6.31E-02
2.20E-04	1.73E+03	1.80E+03	-4.195	4.31E-02
2.80E-04	1.50E+03	1.53E+03	-2.121	2.92E-02
3.55E-04	1.31E+03	1.31E+03	+0.015	1.98E-02
4.43E-04	1.14E+03	1.12E+03	+1.903	1.40E-02
5.64E-04	9.85E+02	9.50E+02	+3.679	9.54E-03
7.13E-04	8.48E+02	8.20E+02	+3.407	6.65E-03
8.81E-04	7.29E+02	7.18E+02	+1.545	4.91E-03
1.10E-03	6.43E+02	6.29E+02	+2.293	3.41E-03
1.41E-03	5.56E+02	5.50E+02	+1.066	2.28E-03
1.80E-03	4.89E+02	4.83E+02	+1.063	1.50E-03
2.22E-03	4.38E+02	4.38E+02	-0.048	1.05E-03
2.85E-03	3.80E+02	3.93E+02	-3.134	6.94E-04
3.60E-03	3.42E+02	3.56E+02	-3.934	4.53E-04

R: 168. X: 0. Y: 0. DL: 0. REQ: 0. CF: 1.0000
TDHZ ARRAY, 17 DATA POINTS, SYSTEM: NONE DATA: LOOP36
MEDICINE LAKE HIGHLAND
UNOCAL GEOTHERMAL 8-18-86
RMS LOG ERROR: 1.76E-02, ANTILOG YIELDS 4.1270 %
LATE TIME PARAMETERS

IGS: ARRTI

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	T 1	F 0
P 1	1.00			
P 2	.00	.98		
T 1	.00	.00	1.00	
F 0	.00	.00	.00	.00

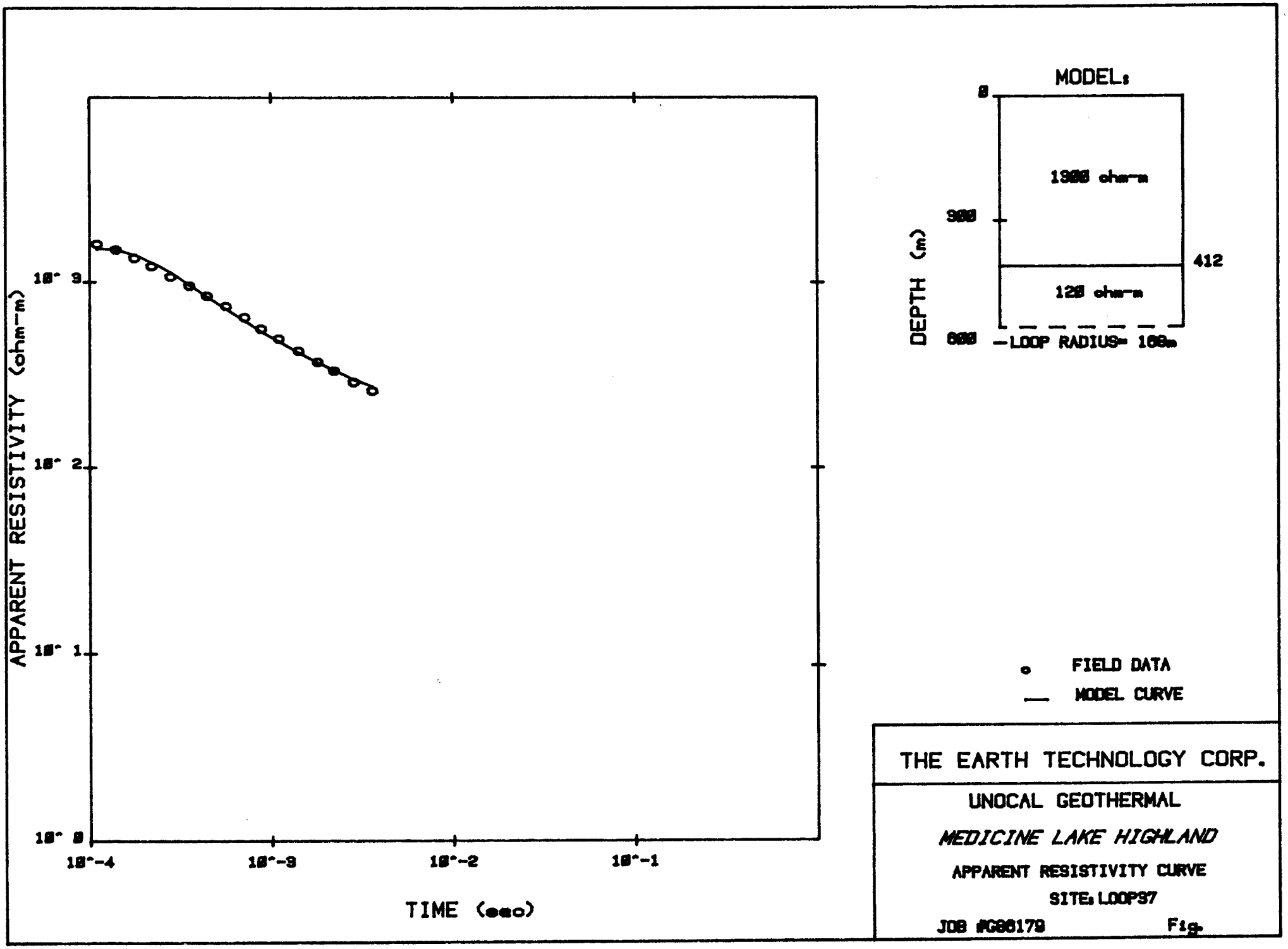
LINE: 0036
STA.: 0000

FREQUENCY = 30 hz
LOOP SIZE = 300 x 300 m
CURRENT = 21 amps
SPACING = 168 m

CH.	TIME(msec)	V(Volts/A-m^2)	RHOA-LATE	RHOA-EARLY
1	0.0890	1.5751E-07	2429.42	2.5007E-01
2	0.1100	9.5648E-08	2380.05	1.5189E-01
3	0.1400	5.8537E-08	2208.98	9.2928E-02
4	0.1770	3.9620E-08	1938.47	6.2912E-02
5	0.2200	2.7253E-08	1731.30	4.3290E-02
6	0.2800	1.8396E-08	1505.27	2.9221E-02
7	0.3550	1.2428E-08	1316.37	1.9746E-02
8	0.4430	8.7646E-09	1148.68	1.3927E-02
9	0.5640	5.9976E-09	989.10	9.5322E-03
10	0.7130	4.1826E-09	850.97	6.6493E-03
11	0.8810	3.0910E-09	731.70	4.9143E-03
12	1.0960	2.1595E-09	645.80	3.4343E-03
13	1.4110	1.4274E-09	558.61	2.2708E-03
14	1.7950	9.5000E-10	490.65	1.5114E-03
15	2.2240	6.5487E-10	439.91	1.0416E-03
16	2.8500	4.3556E-10	381.87	6.9290E-04
17	3.6000	2.8431E-10	343.82	4.5239E-04
18	4.4900	1.9032E-10	310.90	3.0298E-04
19	5.7000	1.2741E-10	272.95	2.0289E-04
20	7.1900	8.3338E-11	245.99	1.3272E-04

THE EARTH TECHNOLOGY CORP.

Job #:G86179
Client:UNOCAL
Location:MEDICINE LAKE HIGHLAND
File:MLHIGH6.DAT


APPARENT RESISTIVITY (ohm-m)
10^3
10^2
10^1
10^0
10^-4
10^-3
10^-2
10^-1
TIME (sec)
MODEL:
0
1300 ohm-m
300
412
120 ohm-m
600
LOOP RADIUS= 100m
DEPTH (m)
FIELD DATA
MODEL CURVE
THE EARTH TECHNOLOGY CORP.
UNOCAL GEOTHERMAL
MEDICINE LAKE HIGHLAND
APPARENT RESISTIVITY CURVE
SITE: LOOP37
JOB #G88179
Fig.

LOOP37

MODEL: 2 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		.0	.0		
1286.55	412.4	-412.4	-1352.9	.3	.3
115.25					

TIMES	DATA LATE	CALC LATE	% ERROR	DATA EARLY
1.10E-04	1.61E+03	1.52E+03	+5.398	2.72E-01
1.40E-04	1.50E+03	1.50E+03	+0.125	1.65E-01
1.77E-04	1.35E+03	1.41E+03	-4.381	1.08E-01
2.20E-04	1.22E+03	1.28E+03	-4.830	7.28E-02
2.80E-04	1.07E+03	1.13E+03	-4.824	4.85E-02
3.55E-04	9.55E+02	9.70E+02	-1.595	3.18E-02
4.43E-04	8.45E+02	8.36E+02	+1.053	2.20E-02
5.64E-04	7.42E+02	7.17E+02	+3.465	1.46E-02
7.13E-04	6.46E+02	6.19E+02	+4.460	1.00E-02
8.81E-04	5.60E+02	5.42E+02	+3.466	7.30E-03
1.10E-03	4.96E+02	4.80E+02	+3.421	5.03E-03
1.41E-03	4.27E+02	4.17E+02	+2.336	3.38E-03
1.80E-03	3.72E+02	3.69E+02	+0.802	2.26E-03
2.22E-03	3.33E+02	3.35E+02	-0.559	1.58E-03
2.85E-03	2.89E+02	2.99E+02	-3.243	1.05E-03
3.60E-03	2.59E+02	2.74E+02	-5.427	6.88E-04

R: 168. X: 0. Y: 0. DL: 0. REQ: 0. CF: 1.0000
TDHZ ARRAY, 16 DATA POINTS, SYSTEM: NONE DATA: LOOP37
MEDICINE LAKE HIGHLAND
UNOCAL GEOTHERMAL 8-18-86
RMS LOG ERROR: 2.32E-02, ANTILOG YIELDS 5.4775 %
LATE TIME PARAMETERS

IGS: ARRTI

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	T 1	F 0
P 1	.85			
P 2	-.07	.58		
T 1	.05	.10	.94	
F 0	.00	.00	.00	.00

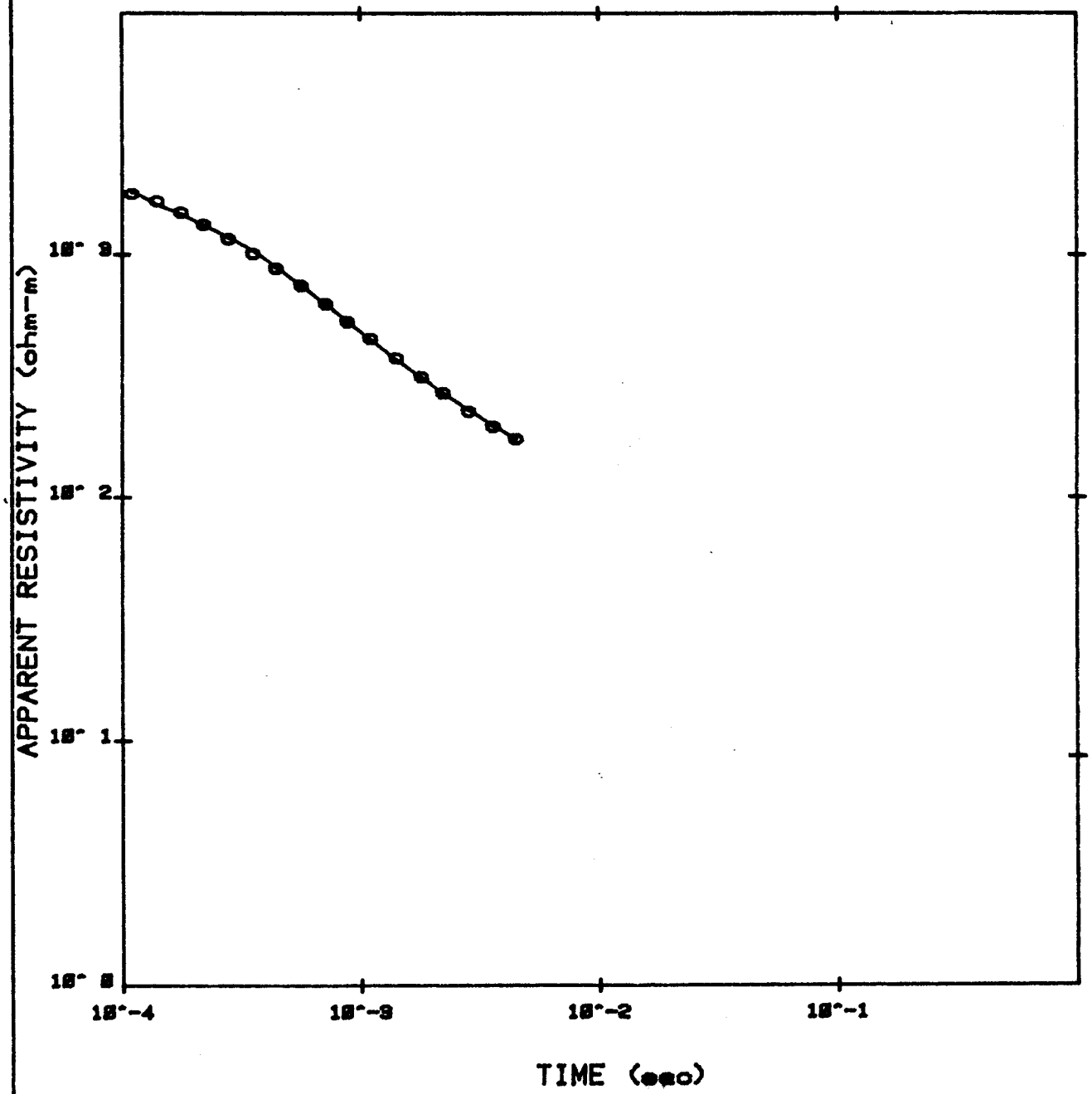
LINE: 0037
STA.: 0000

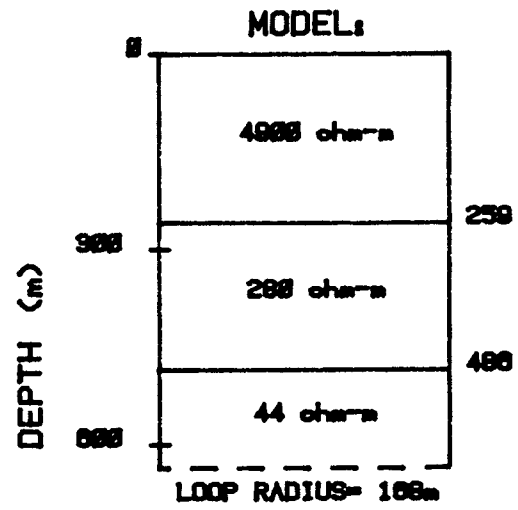
FREQUENCY = 30 hz
LOOP SIZE = 300 x 300 m
CURRENT = 20 amps
SPACING = 168 m

CH.	TIME(msec)	V(Volts/A-m^2)	RHOA-LATE	RHOA-EARLY
2	0.1100	1.7184E-07	1610.47	2.7263E-01
3	0.1400	1.0371E-07	1508.69	1.6457E-01
4	0.1770	6.7856E-08	1354.18	1.0770E-01
5	0.2200	4.6081E-08	1219.84	7.3154E-02
6	0.2800	3.0370E-08	1077.61	4.8225E-02
7	0.3550	2.0027E-08	957.71	3.1806E-02
8	0.4430	1.3819E-08	847.94	2.1951E-02
9	0.5640	9.1786E-09	744.81	1.4583E-02
10	0.7130	6.2860E-09	648.58	9.9887E-03
11	0.8810	4.5861E-09	562.47	7.2887E-03
12	1.0960	3.1892E-09	497.99	5.0698E-03
13	1.4110	2.1223E-09	428.82	3.3749E-03
14	1.7950	1.4281E-09	373.89	2.2725E-03
15	2.2240	9.8710E-10	334.63	1.5697E-03
16	2.8500	6.5620E-10	290.58	1.0441E-03
17	3.6000	4.3101E-10	260.53	6.8603E-04
18	4.4900	2.9243E-10	233.49	4.6555E-04
19	5.7000	1.8692E-10	211.41	2.9773E-04
20	7.1900	1.2076E-10	192.10	1.9231E-04

THE EARTH TECHNOLOGY CORP.

Job #:G86179
Client:UNOCAL
Location:MEDICINE LAKE HIGHLAND
File:MLHIGH6.DAT





o FIELD DATA

— MODEL CURVE

THE EARTH TECHNOLOGY CORP.

UNOCAL GEOTHERMAL

MEDICINE LAKE HIGHLAND

APPARENT RESISTIVITY CURVE

SITE: LOOP90

JOB #G90179 Fig.

LOOP38

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		.0	.0		
4904.24	258.6	-258.6	-848.4	.1	.1
276.80	227.8	-486.4	-1595.8	.8	.9
44.39					

TIMES	DATA LATE	CALC LATE	% ERROR	DATA EARLY
1.10E-04	1.78E+03	1.82E+03	-2.254	2.34E-01
1.40E-04	1.66E+03	1.61E+03	+2.891	1.42E-01
1.77E-04	1.49E+03	1.47E+03	+1.401	9.30E-02
2.20E-04	1.33E+03	1.32E+03	+0.734	6.40E-02
2.80E-04	1.16E+03	1.18E+03	-1.434	4.30E-02
3.55E-04	1.01E+03	1.04E+03	-2.222	2.92E-02
4.43E-04	8.80E+02	8.93E+02	-1.442	2.07E-02
5.64E-04	7.51E+02	7.53E+02	-0.248	1.43E-02
7.13E-04	6.35E+02	6.30E+02	+0.704	1.03E-02
8.81E-04	5.35E+02	5.36E+02	-0.072	7.82E-03
1.10E-03	4.57E+02	4.52E+02	+1.127	5.68E-03
1.41E-03	3.79E+02	3.74E+02	+1.270	4.05E-03
1.80E-03	3.17E+02	3.15E+02	+0.682	2.87E-03
2.22E-03	2.72E+02	2.71E+02	+0.500	2.14E-03
2.85E-03	2.28E+02	2.31E+02	-1.241	1.49E-03
3.60E-03	1.97E+02	1.99E+02	-0.976	1.04E-03
4.49E-03	1.75E+02	1.75E+02	-0.291	7.13E-04

R: 168. X: 0. Y: 0. DL: 0. REQ: 0. CF: 1.0000
TDHZ ARRAY, 17 DATA POINTS, SYSTEM: NONE DATA: LOOP38
MEDICINE LAKE HIGHLAND
UNOCAL GEOTHERMAL 8-19-86
RMS LOG ERROR: 8.90E-03, ANTILOG YIELDS 2.0714 %
LATE TIME PARAMETERS

IGS: ARRTI

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	.98					
P 2	.00	.99				
P 3	.00	.00	1.00			
T 1	.00	.00	.00	1.00		
T 2	.00	.00	.00	.00	1.00	
F 0	.00	.00	.00	.00	.00	.00

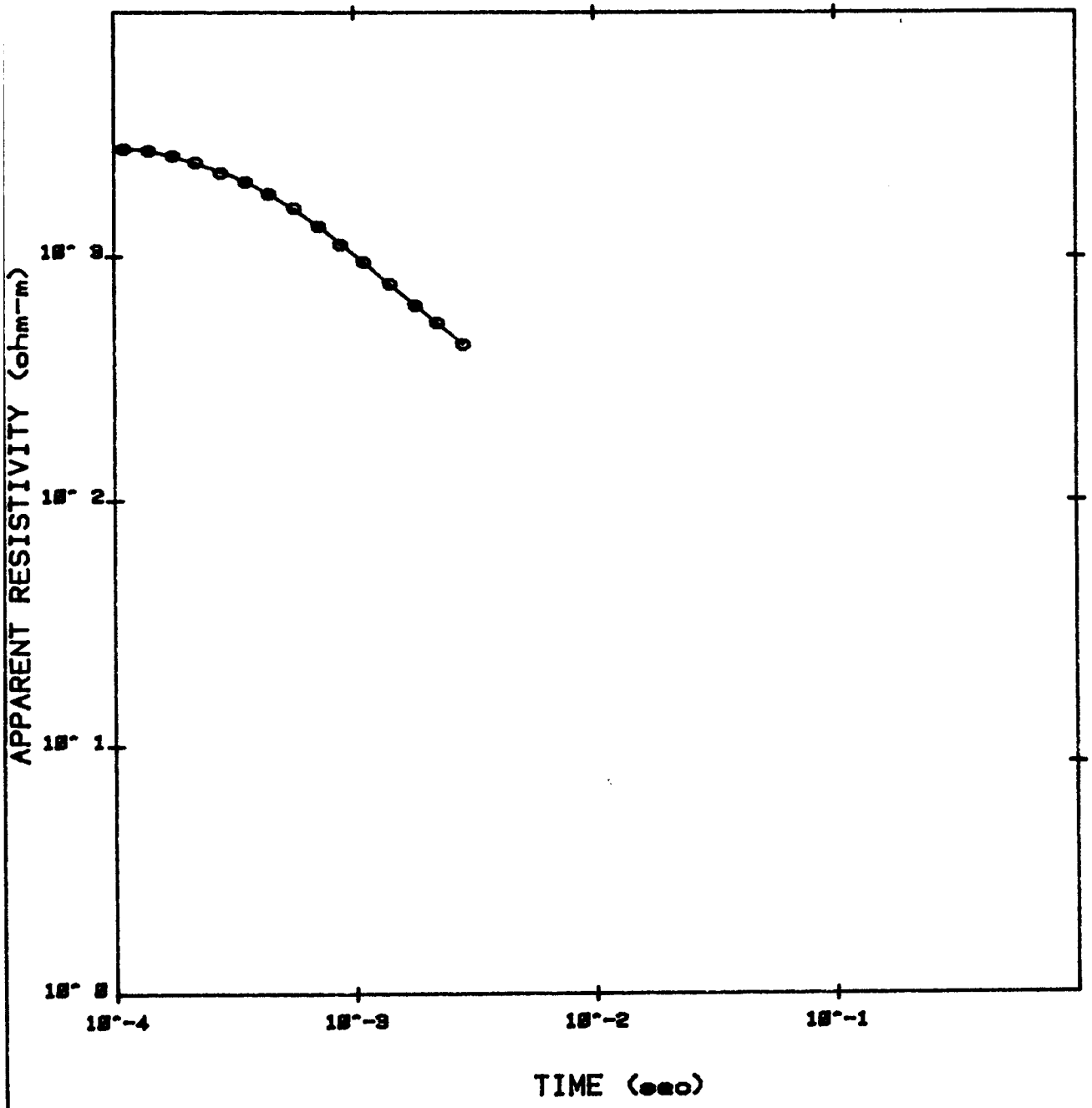
LINE: 0038
STA.: 0000

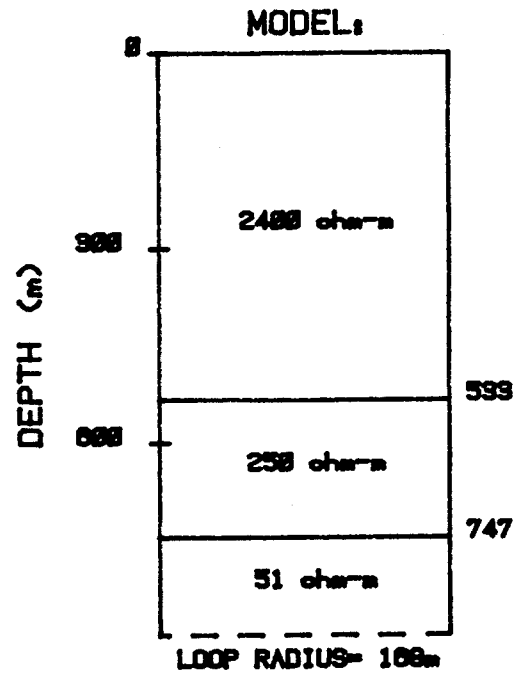
FREQUENCY = 30 hz
LOOP SIZE = 300 x 300 m
CURRENT = 20 amps
SPACING = 168 m

CH.	TIME(msec)	V(Volts/A-m^2)	RHOA-LATE	RHOA-EARLY
1	0.0890	2.5364E-07	1768.34	4.0236E-01
2	0.1100	1.4778E-07	1780.83	2.3441E-01
3	0.1400	8.9759E-08	1661.21	1.4241E-01
4	0.1770	5.8745E-08	1490.81	9.3222E-02
5	0.2200	4.0304E-08	1333.79	6.3971E-02
6	0.2800	2.7014E-08	1165.12	4.2885E-02
7	0.3550	1.8289E-08	1017.46	2.9040E-02
8	0.4430	1.2998E-08	883.27	2.0642E-02
9	0.5640	9.0235E-09	753.31	1.4333E-02
10	0.7130	6.4577E-09	637.03	1.0259E-02
11	0.8810	4.9128E-09	537.25	7.8058E-03
12	1.0960	3.6049E-09	458.93	5.7286E-03
13	1.4110	2.5399E-09	380.43	4.0369E-03
14	1.7950	1.8196E-09	318.13	2.8925E-03
15	2.2240	1.3394E-09	273.01	2.1296E-03
16	2.8500	9.3983E-10	228.69	1.4945E-03
17	3.6000	6.4975E-10	198.16	1.0336E-03
18	4.4900	4.4961E-10	175.28	7.1536E-04
19	5.7000	2.9807E-10	154.89	4.7443E-04
20	7.1900	1.9575E-10	139.21	3.1167E-04

THE EARTH TECHNOLOGY CORP.

Job #:G86179
Client:UNOCAL
Location:MEDICINE LAKE HIGHLAND
File:MLHIGH7.DAT





FIELD DATA

MODEL CURVE

THE EARTH TECHNOLOGY CORP.

UNOCAL GEOTHERMAL

MEDICINE LAKE HIGHLAND

APPARENT RESISTIVITY CURVE

SITE: LOOP90

JOB #G86179 Fig.

LOOP39

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		.0	.0		
2405.02	533.2	-533.2	-1749.3	.2	.2
252.72	214.2	-747.4	-2452.1	.8	1.1
50.98					

TIMES	DATA LATE	CALC LATE	% ERROR	DATA EARLY
1.10E-04	2.75E+03	2.76E+03	-0.354	1.22E-01
1.40E-04	2.71E+03	2.71E+03	-0.144	6.81E-02
1.77E-04	2.58E+03	2.57E+03	+0.350	4.08E-02
2.20E-04	2.43E+03	2.40E+03	+1.159	2.59E-02
2.80E-04	2.20E+03	2.23E+03	-1.595	1.65E-02
3.55E-04	2.02E+03	2.03E+03	-0.123	1.03E-02
4.43E-04	1.81E+03	1.81E+03	+0.351	7.01E-03
5.64E-04	1.58E+03	1.56E+03	+0.700	4.70E-03
7.13E-04	1.33E+03	1.33E+03	-0.196	3.38E-03
8.81E-04	1.12E+03	1.13E+03	-0.904	2.58E-03
1.10E-03	9.52E+02	9.49E+02	+0.350	1.89E-03
1.41E-03	7.75E+02	7.70E+02	+0.664	1.38E-03
1.80E-03	6.33E+02	6.35E+02	-0.206	1.02E-03
2.22E-03	5.37E+02	5.34E+02	+0.463	7.71E-04
2.85E-03	4.38E+02	4.41E+02	-0.592	5.61E-04

R: 168. X: 0. Y: 0. DL: 0. REQ: 0. CF: 1.0000
TDHZ ARRAY, 15 DATA POINTS, SYSTEM: NONE DATA: LOOP39
MEDICINE LAKE HIGHLAND
UNOCAL GEOTHERMAL 8-21-86
RMS LOG ERROR: 4.40E-03, ANTILOG YIELDS 1.0179 %
LATE TIME PARAMETERS

IGS: ARRTI

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	.99					
P 2	-.07	.37				
P 3	-.01	-.15	.76			
T 1	.02	.12	.01	.97		
T 2	-.03	-.18	.01	.04	.91	
F 0	.00	.00	.00	.00	.00	.00

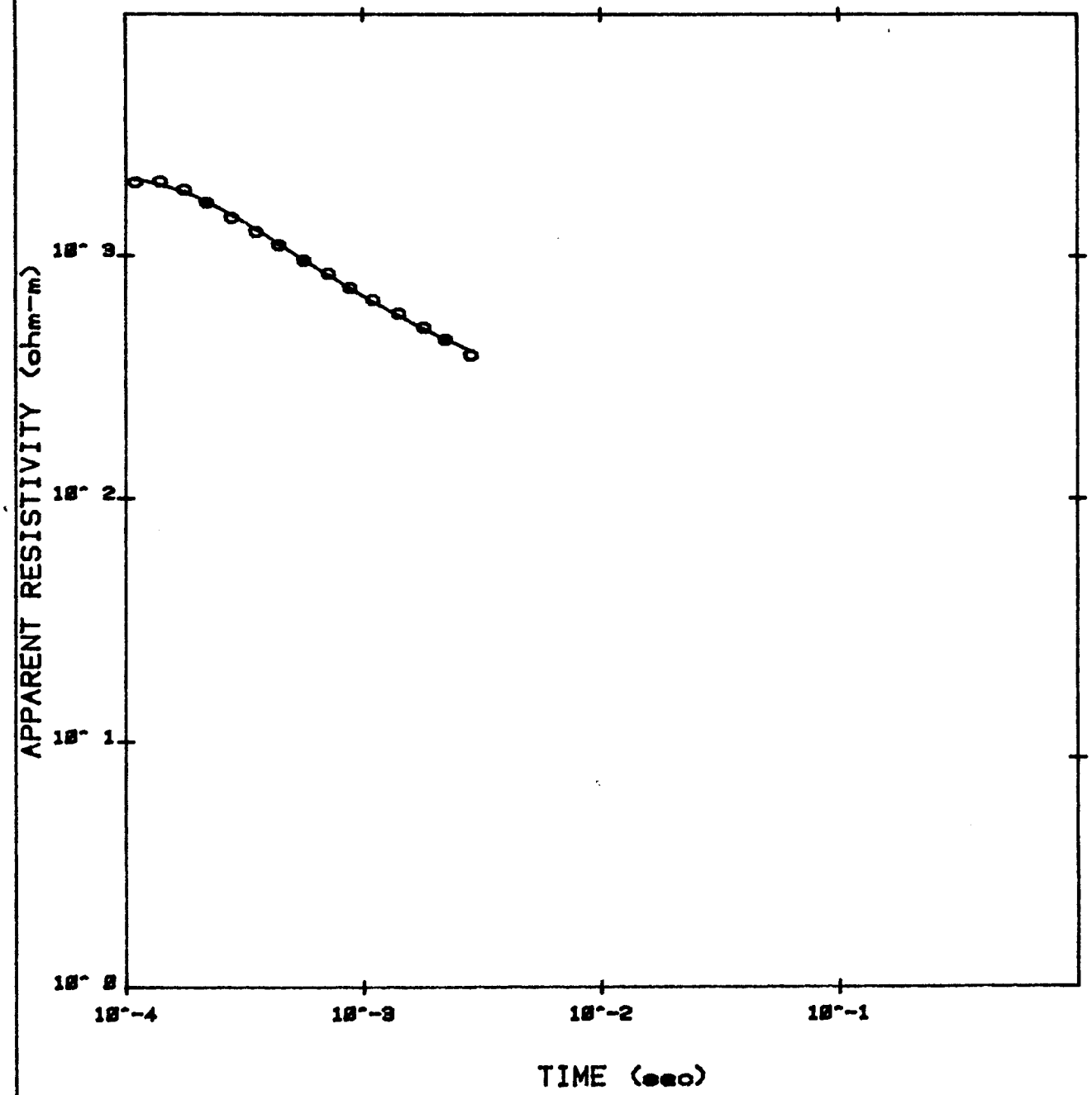
LINE: 0039
STA.: 0000

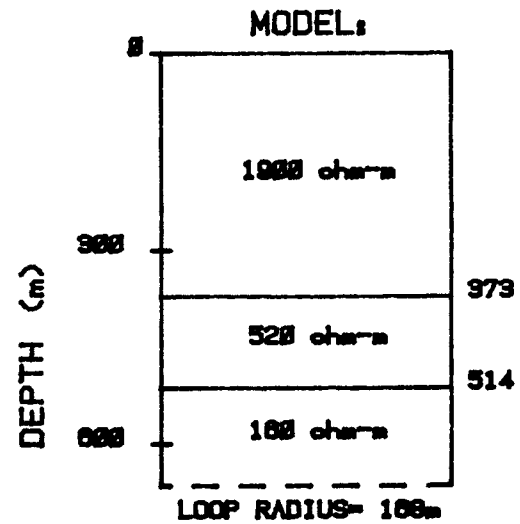
FREQUENCY = 30 hz
LOOP SIZE = 300 x 300 m
CURRENT = 21 amps
SPACING = 168 m

CH.	TIME(msec)	V(Volts/A-m^2)	RHOA-LATE	RHOA-EARLY
2	0.1100	7.6476E-08	2762.83	1.2150E-01
3	0.1400	4.2895E-08	2717.75	6.8166E-02
4	0.1770	2.5620E-08	2592.27	4.0725E-02
5	0.2200	1.6318E-08	2437.16	2.5912E-02
6	0.2800	1.0374E-08	2205.23	1.6478E-02
7	0.3550	6.4909E-09	2029.75	1.0312E-02
8	0.4430	4.3960E-09	1819.61	6.9852E-03
9	0.5640	2.9670E-09	1581.29	4.7157E-03
10	0.7130	2.1303E-09	1334.29	3.3874E-03
11	0.8810	1.6254E-09	1123.14	2.5848E-03
12	1.0960	1.1993E-09	955.85	1.9069E-03
13	1.4110	8.6742E-10	778.63	1.3801E-03
14	1.7950	6.4377E-10	635.96	1.0241E-03
15	2.2240	4.8257E-10	539.22	7.6775E-04
16	2.8500	3.5192E-10	440.21	5.6017E-04
17	3.6000	2.5539E-10	369.31	4.0683E-04
18	4.4900	1.8713E-10	314.43	2.9831E-04
19	5.7000	1.2346E-10	278.75	1.9671E-04
20	7.1900	8.2028E-11	248.60	1.3099E-04

THE EARTH TECHNOLOGY CORP.

Job #:686179
Client:UNOCAL
Location:MEDICINE LAKE HIGHLAND
File:MLHIGH9.DAT





o FIELD DATA

— MODEL CURVE

THE EARTH TECHNOLOGY CORP.

UNOCAL GEOTHERMAL

MEDICINE LAKE HIGHLAND

APPARENT RESISTIVITY CURVE

SITE: LOOP40

JOB #G86179 Fig.

LOOP40

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		.0	.0		
1930.90	373.0	-373.0	-1223.6	.2	.2
516.46	141.1	-514.0	-1686.5	.3	.5
155.33					

TIMES	DATA LATE	CALC LATE	% ERROR	DATA EARLY
1.10E-04	2.03E+03	2.09E+03	-2.780	1.92E-01
1.40E-04	2.05E+03	1.98E+03	+3.427	1.04E-01
1.77E-04	1.89E+03	1.85E+03	+2.486	6.51E-02
2.20E-04	1.67E+03	1.68E+03	-0.784	4.55E-02
2.80E-04	1.44E+03	1.48E+03	-2.726	3.11E-02
3.55E-04	1.26E+03	1.29E+03	-2.142	2.10E-02
4.43E-04	1.11E+03	1.12E+03	-1.009	1.46E-02
5.64E-04	9.61E+02	9.61E+02	-0.058	9.90E-03
7.13E-04	8.49E+02	8.35E+02	+1.697	6.64E-03
8.81E-04	7.40E+02	7.36E+02	+0.592	4.81E-03
1.10E-03	6.60E+02	6.47E+02	+1.982	3.27E-03
1.41E-03	5.80E+02	5.68E+02	+2.122	2.14E-03
1.80E-03	5.09E+02	5.00E+02	+1.612	1.41E-03
2.22E-03	4.54E+02	4.54E+02	+0.063	9.92E-04
2.85E-03	3.91E+02	4.08E+02	-4.282	6.65E-04

R: 168. X: 0. Y: 0. DL: 0. REQ: 0. CF: 1.0000
TDHZ ARRAY, 15 DATA POINTS, SYSTEM: NONE DATA: LOOP40
MEDICINE LAKE HIGHLAND
UNOCAL GEOTHERMAL 8-21-86
RMS LOG ERROR: 1.43E-02, ANTILOG YIELDS 3.3519 %
LATE TIME PARAMETERS

IGS: ARRTI

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	.97					
P 2	.00	.18				
P 3	.01	-.04	.97			
T 1	.03	.18	.00	.93		
T 2	-.11	-.22	.05	.16	.49	
F 0	.00	.00	.00	.00	.00	.00

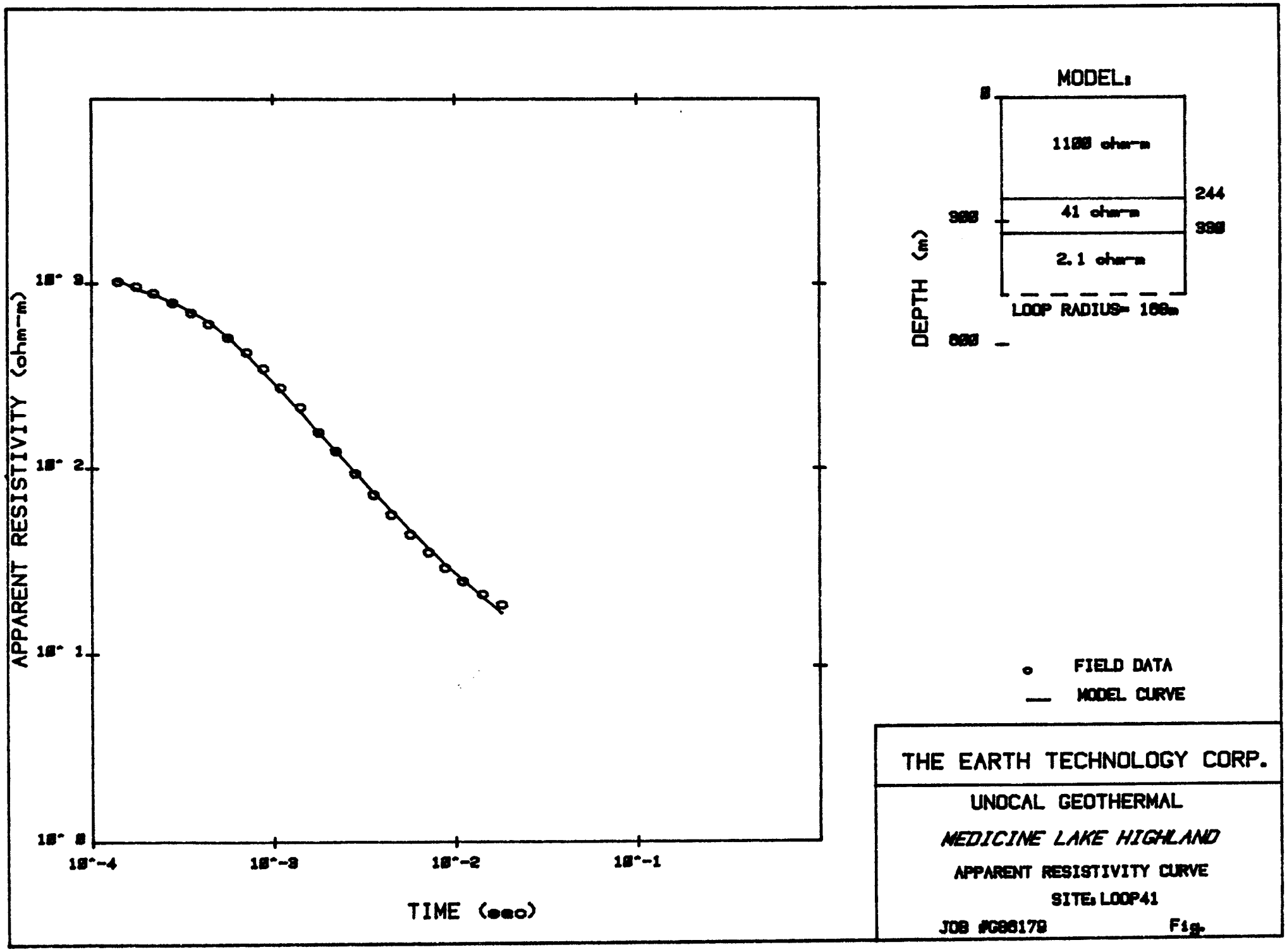
LINE: 0040
STA.: 0000

FREQUENCY = 30 hz
LOOP SIZE = 300 x 300 m
CURRENT = 20 amps
SPACING = 168 m

CH.	TIME(msec)	V(Volts/A-m^2)	RHOA-LATE	RHOA-EARLY
2	0.1100	1.2088E-07	2036.14	1.9199E-01
3	0.1400	6.5004E-08	2059.92	1.0328E-01
4	0.1770	4.0851E-08	1899.33	6.4872E-02
5	0.2200	2.8665E-08	1674.00	4.5520E-02
6	0.2800	1.9608E-08	1442.58	3.1144E-02
7	0.3550	1.3209E-08	1263.98	2.0989E-02
8	0.4430	9.1752E-09	1114.14	1.4585E-02
9	0.5640	6.2331E-09	964.03	9.9059E-03
10	0.7130	4.1744E-09	852.08	6.6368E-03
11	0.8810	3.0215E-09	742.88	4.8043E-03
12	1.0960	2.0780E-09	662.60	3.3030E-03
13	1.4110	1.3415E-09	582.22	2.1329E-03
14	1.7950	8.9468E-10	510.67	1.4229E-03
15	2.2240	6.1983E-10	456.34	9.8592E-04
16	2.8500	4.1813E-10	392.42	6.6525E-04
17	3.6000	2.8306E-10	344.82	4.5044E-04
18	4.4900	1.9258E-10	308.47	3.0670E-04
19	5.7000	1.3401E-10	263.92	2.1333E-04
20	7.1900	8.9614E-11	234.36	1.4295E-04

THE EARTH TECHNOLOGY CORP.

Job #:G86179
Client:UNOCAL
Location:MEDICINE LAKE HIGHLAND
File:MLHIGH9.DAT


APPARENT RESISTIVITY (ohm-m)
TIME (sec)
MODEL:
1100 ohm-m
41 ohm-m
2.1 ohm-m
244
DEPTH (m)
LOOP RADIUS= 100m
FIELD DATA
MODEL CURVE
THE EARTH TECHNOLOGY CORP.
UNOCAL GEOTHERMAL
MEDICINE LAKE HIGHLAND
APPARENT RESISTIVITY CURVE
SITE: LOOP41
JOB #G88179
Fig.

LOOP41

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		.0	.0		
1100.09	244.3	-244.3	-801.4	.2	.2
41.49	85.3	-329.6	-1081.3	2.1	2.3
2.06					

TIMES	DATA LATE	CALC LATE	% ERROR	DATA EARLY
1.40E-04	1.02E+03	1.04E+03	-2.048	2.95E-01
1.77E-04	9.62E+02	9.39E+02	+2.440	1.79E-01
2.20E-04	8.88E+02	8.73E+02	+1.689	1.17E-01
2.80E-04	7.90E+02	7.94E+02	-0.561	7.65E-02
3.55E-04	6.97E+02	7.09E+02	-1.721	5.10E-02
4.43E-04	6.07E+02	6.28E+02	-3.473	3.61E-02
5.64E-04	5.13E+02	5.17E+02	-0.823	2.54E-02
7.13E-04	4.27E+02	4.14E+02	+3.115	1.86E-02
8.85E-04	3.49E+02	3.33E+02	+5.087	1.47E-02
1.10E-03	2.74E+02	2.65E+02	+3.321	1.22E-02
1.41E-03	2.15E+02	2.03E+02	+5.875	9.47E-03
1.78E-03	1.57E+02	1.56E+02	+0.206	8.47E-03
2.21E-03	1.24E+02	1.24E+02	+0.096	7.03E-03
2.83E-03	9.40E+01	9.56E+01	-1.698	5.74E-03
3.57E-03	7.25E+01	7.47E+01	-2.938	4.74E-03
4.46E-03	5.67E+01	5.97E+01	-5.040	3.93E-03
5.67E-03	4.45E+01	4.69E+01	-5.083	3.10E-03
7.16E-03	3.58E+01	3.76E+01	-4.607	2.40E-03
8.81E-03	2.95E+01	3.09E+01	-4.596	1.91E-03
1.10E-02	2.50E+01	2.54E+01	-1.476	1.40E-03
1.41E-02	2.12E+01	2.05E+01	+3.116	9.67E-04
1.80E-02	1.86E+01	1.68E+01	+10.256	6.39E-04

R: 168. X: 0. Y: 0. DL: 0. REQ: 0. CF: 1.0000
TDHZ ARRAY, 22 DATA POINTS, SYSTEM: NONE DATA: LOOP41
MEDICINE LAKE HIGHLAND
UNOCAL GEOTHERMAL 8-19-86
RMS LOG ERROR: 2.50E-02, ANTILOG YIELDS 5.9240 %
LATE TIME PARAMETERS

IGS: ARRTI

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	.64					
P 2	-.23	.41				
P 3	.03	-.04	.91			
T 1	.06	.10	.00	.98		
T 2	-.17	-.26	.00	.05	.86	
F 0	.00	.00	.00	.00	.00	.00

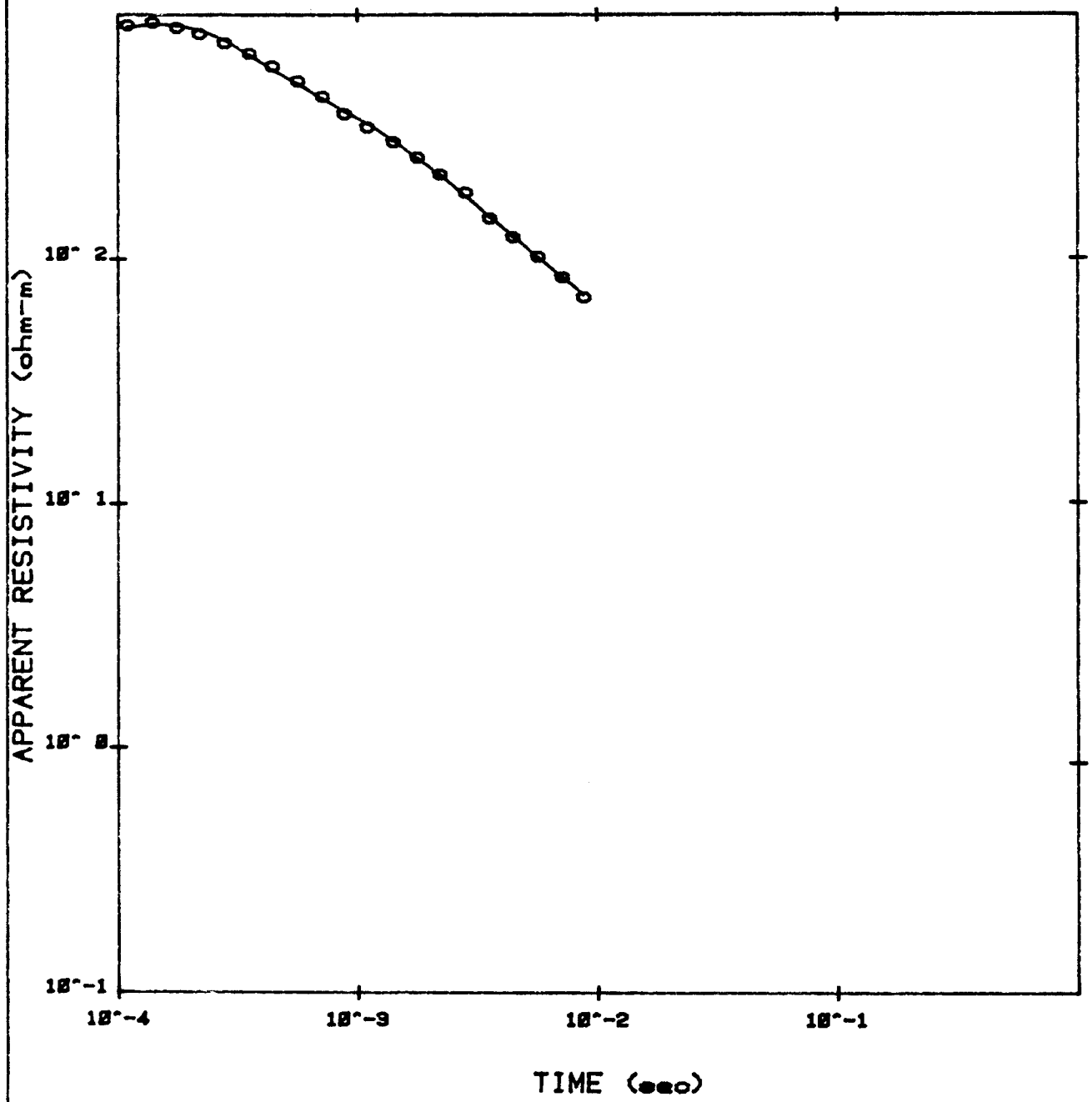
LINE: 0041
STA.: 0000

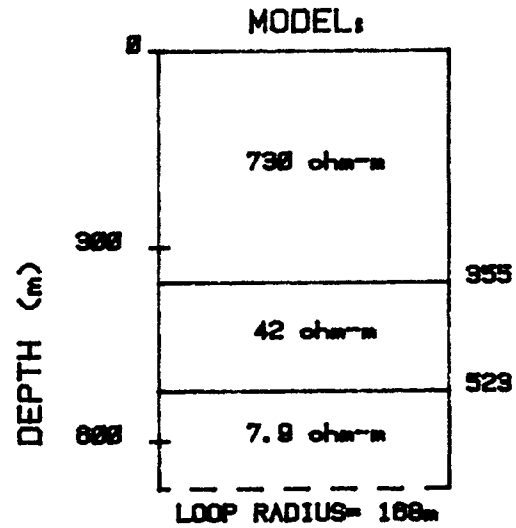
FREQUENCY = comb freq.
LOOP SIZE = 300 x 300 m
CURRENT = 21 amps
SPACING = 168 m

CH.	TIME(msec)	V(Volts/A-m^2)	RHOA-LATE	RHOA-EARLY
2	0.1100	3.6345E-07	977.41	5.7659E-01
3	0.1400	1.8651E-07	1020.18	2.9592E-01
4	0.1770	1.1282E-07	964.91	1.7904E-01
5	0.2200	7.3853E-08	890.72	1.1724E-01
6	0.2800	4.8186E-08	792.16	7.6505E-02
7	0.3550	3.2118E-08	699.01	5.1003E-02
8	0.4430	2.2731E-08	608.52	3.6103E-02
9	0.5640	1.5984E-08	514.57	2.5391E-02
10	0.7130	1.1694E-08	428.77	1.8580E-02
11	0.8855	9.0804E-09	353.70	1.4613E-02
12	1.0980	7.7069E-09	275.70	1.2316E-02
13	1.4055	5.9829E-09	216.29	9.5665E-03
14	1.7825	5.2295E-09	159.22	8.4565E-03
15	2.2120	4.3377E-09	125.86	6.9835E-03
16	2.8250	3.5484E-09	95.71	5.7628E-03
17	3.5750	2.9180E-09	73.65	4.7186E-03
18	4.4600	2.4318E-09	57.52	3.9275E-03
19	5.6700	1.9239E-09	45.07	3.0963E-03
20	7.1600	1.4920E-09	36.20	2.3950E-03
21	8.8100	1.1999E-09	29.62	1.9062E-03
22	10.9600	8.8939E-10	25.14	1.4131E-03
23	14.1100	6.0816E-10	21.26	9.6647E-04
24	17.9500	4.0549E-10	18.65	6.4453E-04
25	22.2400	2.7046E-10	17.09	4.3002E-04
26	28.5000	1.6473E-10	15.73	2.6198E-04
27	36.0000	9.1688E-11	15.75	1.4587E-04

THE EARTH TECHNOLOGY CORP.

Job #:686179
Client:UNOCAL
Location:MEDICINE LAKE HIGHLAND
File:MLHIGH7.DAT





o FIELD DATA

— MODEL CURVE

THE EARTH TECHNOLOGY CORP.

UNOCAL GEOTHERMAL

MEDICINE LAKE HIGHLAND

APPARENT RESISTIVITY CURVE

SITE: LOOP42

JOB #G86179 Fig.

LOOP42

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		.0	.0		
727.33	355.4	-355.4	-1166.0	.5	.5
41.67	167.6	-523.0	-1715.9	4.0	4.5
7.87					

TIMES	DATA LATE	CALC LATE	% ERROR	DATA EARLY
1.10E-04	9.06E+02	8.88E+02	+1.965	6.44E-01
1.40E-04	9.31E+02	9.15E+02	+1.745	3.38E-01
1.77E-04	8.87E+02	9.05E+02	-2.062	2.02E-01
2.20E-04	8.35E+02	8.63E+02	-3.299	1.29E-01
2.80E-04	7.65E+02	7.88E+02	-2.878	8.03E-02
3.55E-04	6.94E+02	6.83E+02	+1.593	5.13E-02
4.43E-04	6.18E+02	5.98E+02	+3.314	3.51E-02
5.64E-04	5.39E+02	5.25E+02	+2.638	2.36E-02
7.13E-04	4.66E+02	4.58E+02	+1.696	1.63E-02
8.85E-04	3.97E+02	4.06E+02	-2.210	1.21E-02
1.10E-03	3.50E+02	3.63E+02	-3.578	8.48E-03
1.41E-03	3.05E+02	3.10E+02	-1.821	5.60E-03
1.78E-03	2.64E+02	2.61E+02	+1.116	3.89E-03
2.21E-03	2.24E+02	2.23E+02	+0.720	2.90E-03
2.83E-03	1.88E+02	1.82E+02	+3.706	2.03E-03
3.57E-03	1.47E+02	1.49E+02	-1.464	1.64E-03
4.46E-03	1.23E+02	1.24E+02	-0.139	1.23E-03
5.67E-03	1.02E+02	1.01E+02	+0.279	8.94E-04
7.16E-03	8.41E+01	8.38E+01	+0.418	6.66E-04
8.81E-03	6.95E+01	7.10E+01	-2.120	5.28E-04

R: 168. X: 0. Y: 0. DL: 0. REQ: 0. CF: 1.0000
TDHZ ARRAY, 20 DATA POINTS, SYSTEM: NONE DATA: LOOP42
MEDICINE LAKE HIGHLAND
UNOCAL GEOTHERMAL 8-19-86
RMS LOG ERROR: 1.44E-02, ANTILOG YIELDS 3.3641 %
LATE TIME PARAMETERS

IGS: ARRTI

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	.13					
P 2	.00	.02				
P 3	.00	-.01	.00			
T 1	.04	.07	-.02	.43		
T 2	-.01	.00	.00	.01	.03	
F 0	.00	.00	.00	.00	.00	.00

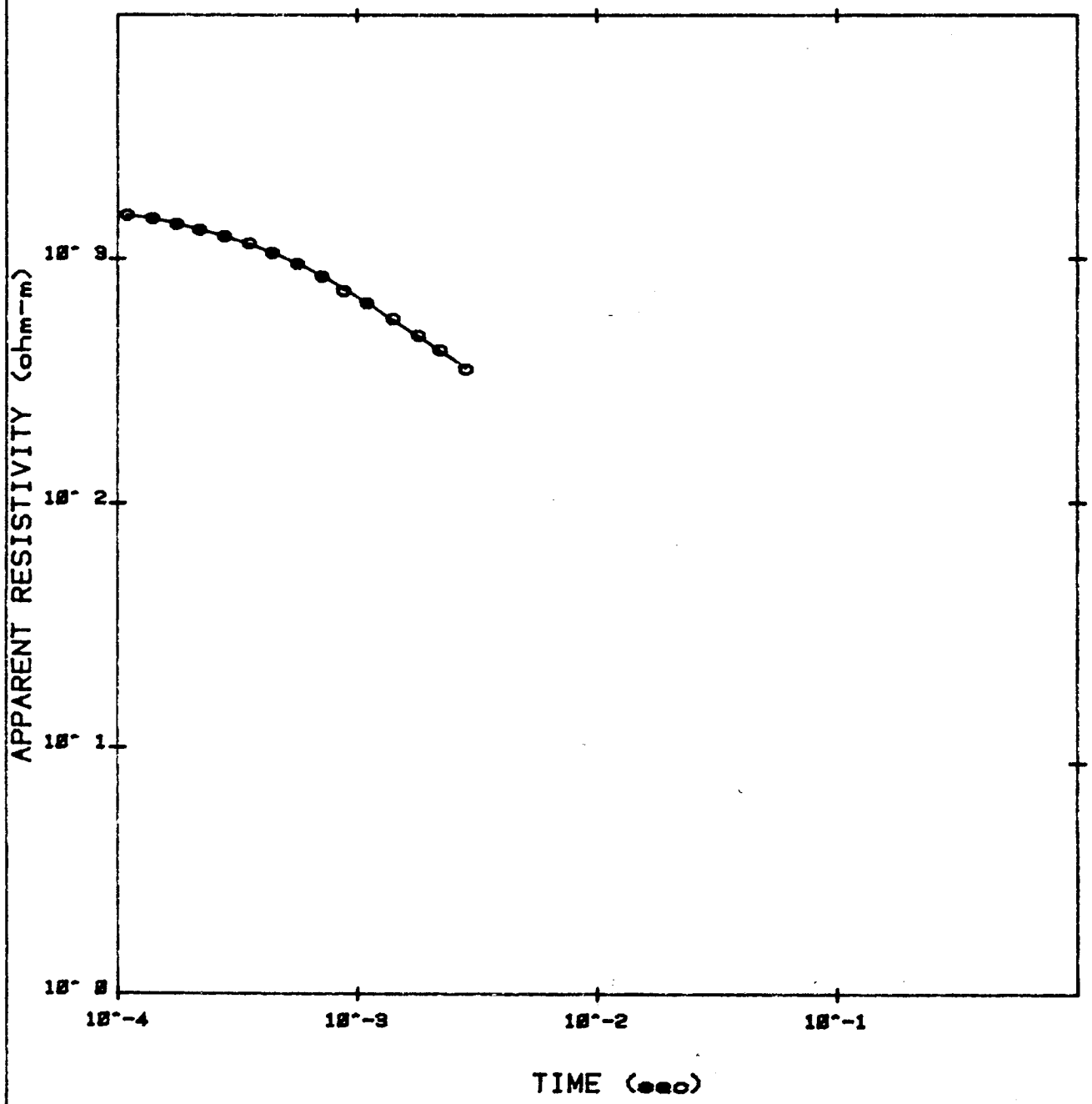
Loop.
~~LINE:~~ 0042
STA.: 0000

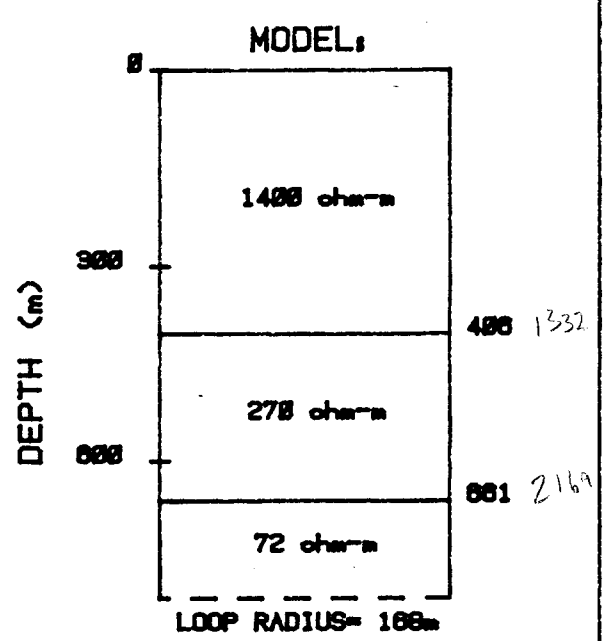
FREQUENCY = comb freq.
LOOP SIZE = 300 x 300 m
CURRENT = 22 amps
SPACING = 168 m

CH.	TIME(msec)	V(Volts/A-m^2)	RHOA-LATE	RHOA-EARLY
1	0.0890	9.7721E-07	719.53	1.5490E+00
2	0.1100	4.0623E-07	907.52	6.4417E-01
3	0.1400	2.1325E-07	933.02	3.3823E-01
4	0.1770	1.2762E-07	888.78	2.0247E-01
5	0.2200	8.1095E-08	836.87	1.2869E-01
6	0.2800	5.0520E-08	767.57	8.0187E-02
7	0.3550	3.2332E-08	695.91	5.1330E-02
8	0.4430	2.2092E-08	620.20	3.5079E-02
9	0.5640	1.4858E-08	540.25	2.3596E-02
10	0.7130	1.0261E-08	467.82	1.6299E-02
11	0.8855	7.5924E-09	398.53	1.2064E-02
12	1.0980	5.3617E-09	351.14	8.5204E-03
13	1.4055	3.5594E-09	305.77	5.6575E-03
14	1.7825	2.4308E-09	265.34	3.8640E-03
15	2.2120	1.8076E-09	225.58	2.8809E-03
16	2.8250	1.2674E-09	190.13	2.0309E-03
17	3.5750	1.0118E-09	149.23	1.6359E-03
18	4.4600	7.5726E-10	125.21	1.2238E-03
19	5.6700	5.5854E-10	102.81	8.9965E-04
20	7.1600	4.1440E-10	85.03	6.6578E-04
21	8.8100	3.3170E-10	69.81	5.2753E-04
22	10.9600	2.5188E-10	58.28	4.0110E-04
23	14.1100	1.7978E-10	47.90	2.8698E-04
24	17.9500	1.2960E-10	39.89	2.0792E-04
25	22.2400	9.6050E-11	34.08	1.5610E-04
30	71.9000	4.2641E-11	8.28	6.8053E-05

THE EARTH TECHNOLOGY CORP.

Job #:686179
Client:UNOCAL
Location:MEDICINE LAKE HIGHLAND
File:MLHIGH7.DAT





o FIELD DATA

— MODEL CURVE

THE EARTH TECHNOLOGY CORP.

UNOCAL GEOTHERMAL

MEDICINE LAKE HIGHLAND

APPARENT RESISTIVITY CURVE

SITE: LOOP43

JOB #G86179 Fig.

LOOP43

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		.0	.0		
1367.05	405.9	-405.9	-1331.8	.3	.3
268.81	255.1	-661.0	-2168.6	.9	1.2
72.27					

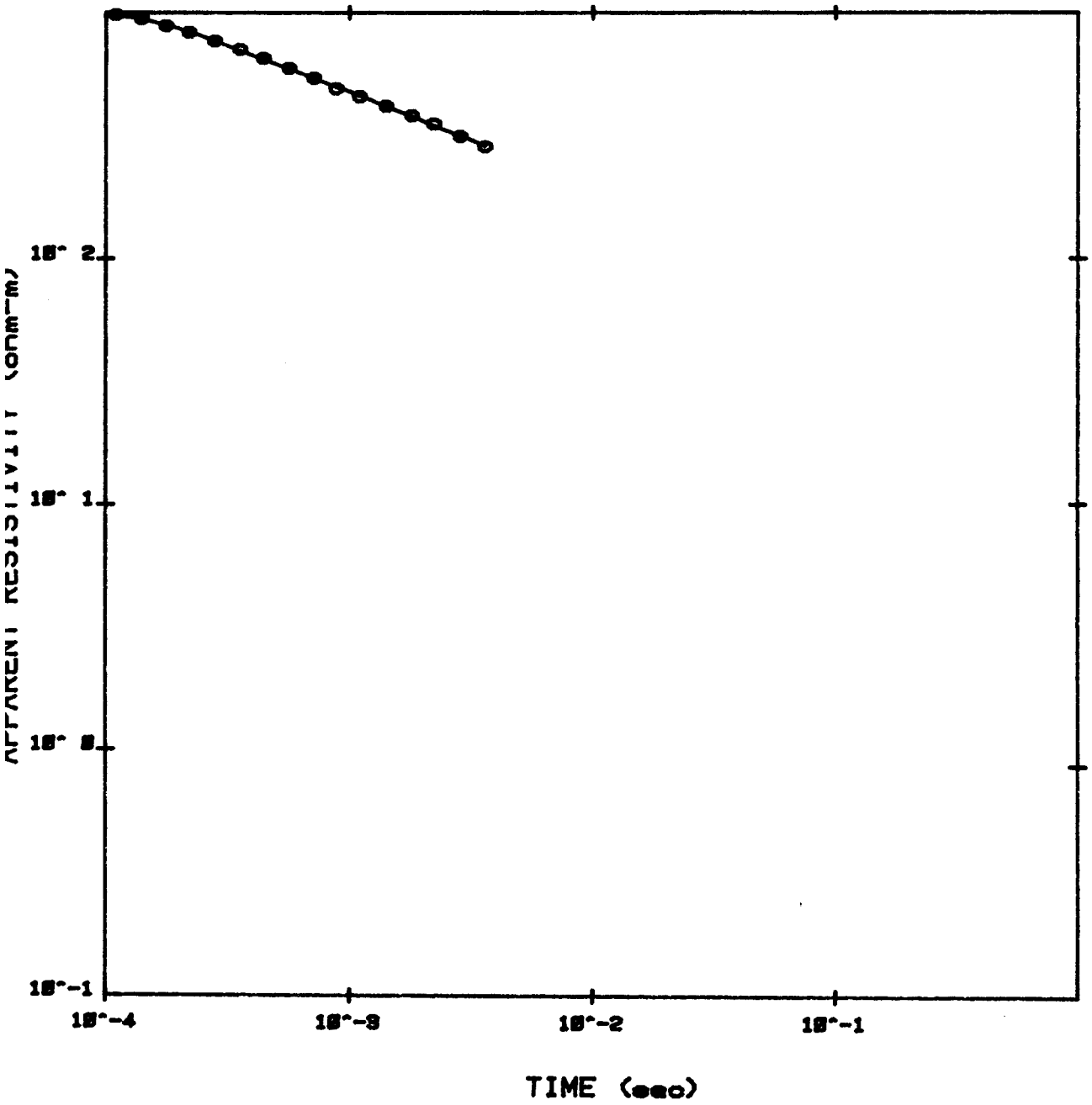
TIMES	DATA LATE	CALC LATE	% ERROR	DATA EARLY
1.10E-04	1.52E+03	1.51E+03	+0.524	2.96E-01
1.40E-04	1.47E+03	1.47E+03	-0.201	1.70E-01
1.77E-04	1.39E+03	1.40E+03	-0.703	1.03E-01
2.20E-04	1.32E+03	1.32E+03	+0.317	6.47E-02
2.80E-04	1.24E+03	1.24E+03	-0.120	3.89E-02
3.55E-04	1.16E+03	1.15E+03	+0.959	2.38E-02
4.43E-04	1.06E+03	1.06E+03	+0.613	1.56E-02
5.64E-04	9.56E+02	9.60E+02	-0.378	9.98E-03
7.13E-04	8.52E+02	8.57E+02	-0.627	6.60E-03
8.81E-04	7.44E+02	7.58E+02	-1.838	4.77E-03
1.10E-03	6.65E+02	6.66E+02	-0.064	3.24E-03
1.41E-03	5.74E+02	5.66E+02	+1.417	2.17E-03
1.80E-03	4.90E+02	4.86E+02	+0.951	1.49E-03
2.22E-03	4.28E+02	4.23E+02	+1.047	1.08E-03
2.85E-03	3.57E+02	3.63E+02	-1.852	7.62E-04

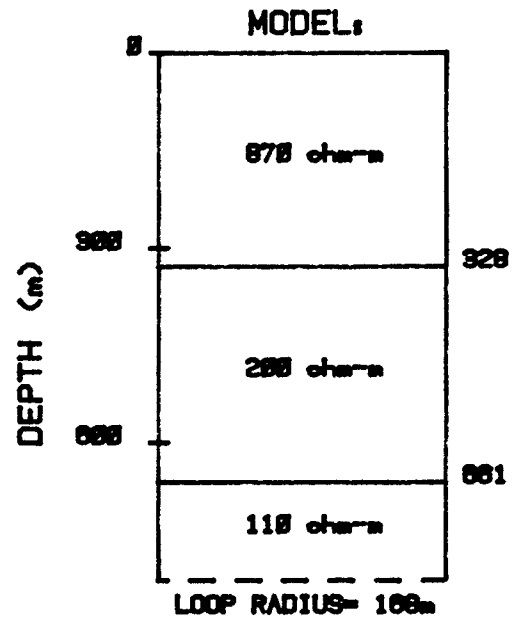
R: 168. X: 0. Y: 0. DL: 0. REQ: 0. CF: 1.0000
TDHZ ARRAY, 15 DATA POINTS, SYSTEM: NONE DATA: LOOP43
MEDICINE LAKE HIGHLAND
UNOCAL GEOTHERMAL 8-19-86
RMS LOG ERROR: 6.21E-03, ANTILOG YIELDS 1.4410 %
LATE TIME PARAMETERS

IGS: ARRTI

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	1.00					
P 2	.00	.98				
P 3	.00	-.01	.99			
T 1	.00	.00	.00	1.00		
T 2	.00	.00	.00	.00	1.00	
F 0	.00	.00	.00	.00	.00	.00





o FIELD DATA

— MODEL CURVE

THE EARTH TECHNOLOGY CORP.

UNOCAL GEOTHERMAL

MEDICINE LAKE HIGHLAND

APPARENT RESISTIVITY CURVE

SITE: LOOP44

JOB #C88179 Fig.

LOOP44

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		.0	.0		
873.86	328.4	-328.4	-1077.3	.4	.4
200.61	332.6	-661.0	-2168.6	1.7	2.0
110.71					

TIMES	DATA LATE	CALC LATE	% ERROR	DATA EARLY
1.10E-04	9.83E+02	9.77E+02	+0.571	5.70E-01
1.40E-04	9.45E+02	9.45E+02	-0.052	3.31E-01
1.77E-04	8.86E+02	8.92E+02	-0.728	2.03E-01
2.20E-04	8.32E+02	8.38E+02	-0.724	1.29E-01
2.80E-04	7.66E+02	7.69E+02	-0.403	8.01E-02
3.55E-04	7.08E+02	6.99E+02	+1.200	4.98E-02
4.43E-04	6.52E+02	6.45E+02	+0.965	3.24E-02
5.64E-04	5.94E+02	5.91E+02	+0.451	2.04E-02
7.13E-04	5.42E+02	5.40E+02	+0.290	1.30E-02
8.81E-04	4.92E+02	5.01E+02	-1.839	8.86E-03
1.10E-03	4.57E+02	4.63E+02	-1.307	5.68E-03
1.41E-03	4.19E+02	4.17E+02	+0.403	3.48E-03
1.80E-03	3.83E+02	3.81E+02	+0.584	2.16E-03
2.22E-03	3.55E+02	3.49E+02	+1.865	1.43E-03
2.85E-03	3.16E+02	3.17E+02	-0.143	9.15E-04
3.60E-03	2.87E+02	2.90E+02	-0.999	5.89E-04

R: 168. X: 0. Y: 0. DL: 0. REQ: 0. CF: 1.0000
TDHZ ARRAY, 16 DATA POINTS, SYSTEM: NONE DATA: LOOP44
MEDICINE LAKE HIGHLAND
UNOCAL GEOTHERMAL 8-19-86
RMS LOG ERROR: 6.16E-03, ANTILOG YIELDS 1.4285 %
LATE TIME PARAMETERS

IGS: ARRTI

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	.21					
P 2	.02	.09				
P 3	.00	.00	.01			
T 1	.13	.14	.00	.30		
T 2	.00	.01	.01	.01	.01	
F 0	.00	.00	.00	.00	.00	.00

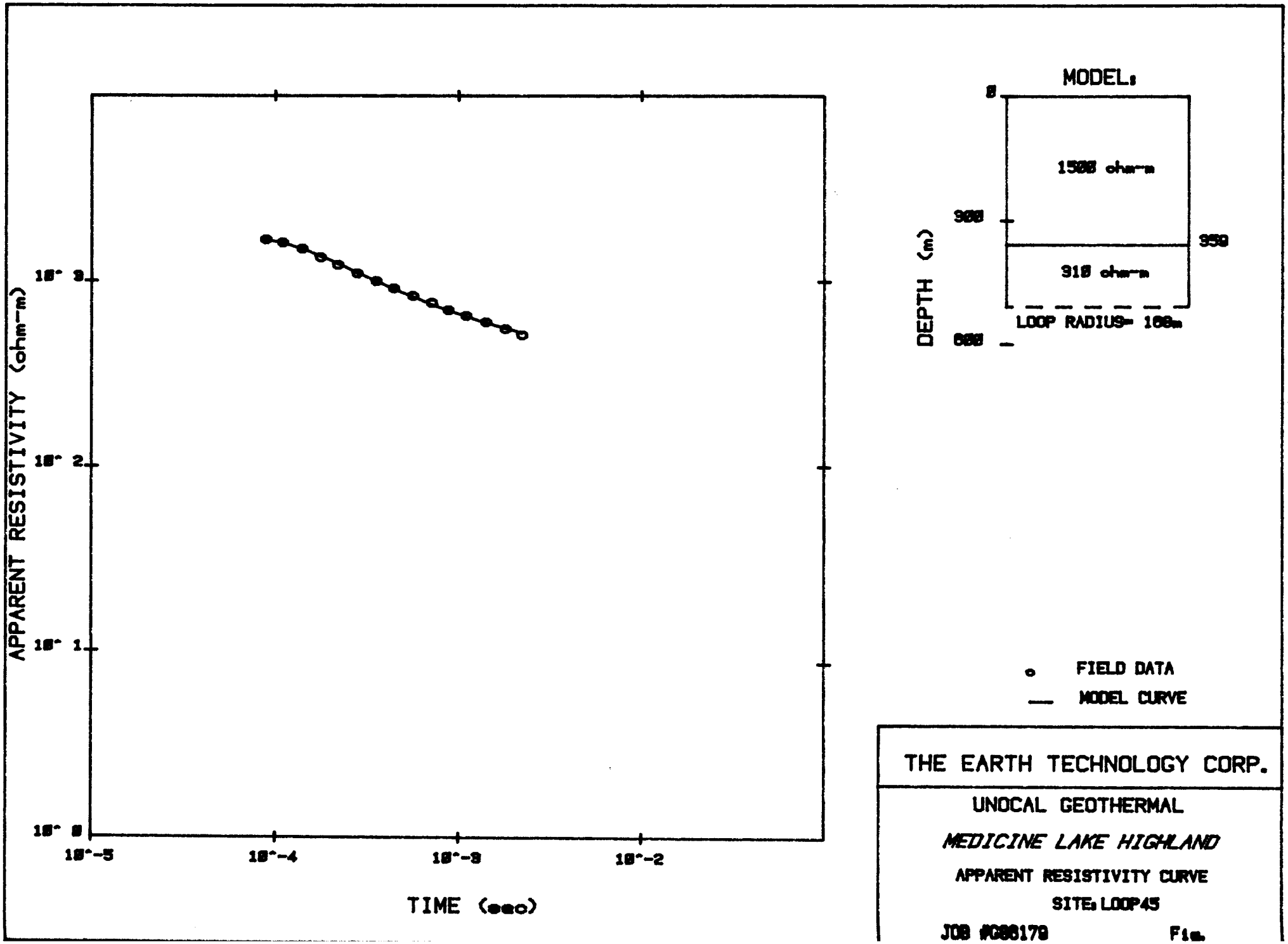
LINE: 0044
STA.: 0000

FREQUENCY = 30 hz
LOOP SIZE = 300 x 300 m
CURRENT = 19 amps
SPACING = 168 m

CH.	TIME(msec)	V(Volts/A-m^2)	RHOA-LATE	RHOA-EARLY
1	0.0890	6.1828E-07	976.31	9.8102E-01
2	0.1100	3.5917E-07	985.15	5.6977E-01
3	0.1400	2.0842E-07	947.37	3.3069E-01
4	0.1770	1.2775E-07	888.17	2.0274E-01
5	0.2200	8.1435E-08	834.54	1.2928E-01
6	0.2800	5.0459E-08	768.19	8.0119E-02
7	0.3550	3.1373E-08	710.02	4.9828E-02
8	0.4430	2.0411E-08	653.80	3.2421E-02
9	0.5640	1.2816E-08	596.20	2.0361E-02
10	0.7130	8.1944E-09	543.50	1.3022E-02
11	0.8810	5.5748E-09	493.84	8.8613E-03
12	1.0960	3.6056E-09	458.87	5.7326E-03
13	1.4110	2.1839E-09	420.72	3.4729E-03
14	1.7950	1.3677E-09	384.83	2.1756E-03
15	2.2240	8.9723E-10	356.61	1.4275E-03
16	2.8500	5.7396E-10	317.71	9.1344E-04
17	3.6000	3.7100E-10	287.92	5.9034E-04
18	4.4900	2.5090E-10	258.59	3.9932E-04
19	5.7000	1.6197E-10	232.60	2.5781E-04
20	7.1900	1.0127E-10	216.01	1.6127E-04

THE EARTH TECHNOLOGY CORP.

Job #:G86179
Client:UNOCAL
Location:MEDICINE LAKE HIGHLAND
File:MLHIGH7.DAT


APPARENT RESISTIVITY (ohm-m)
10^3
10^2
10^1
10^0
10^-5
10^-4
10^-3
10^-2
TIME (sec)
MODEL:
0
1500 ohm-m
300
350
910 ohm-m
DEPTH (m)
600
LOOP RADIUS= 100m
FIELD DATA
MODEL CURVE
THE EARTH TECHNOLOGY CORP.
UNOCAL GEOTHERMAL
MEDICINE LAKE HIGHLAND
APPARENT RESISTIVITY CURVE
SITE: LOOP45
JOB #C88179
Fig.

LOOP45

MODEL: 2 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		.0	.0		
1525.27	358.7	-358.7	-1176.8	.2	.2
308.00					

TIMES	DATA LATE	CALC LATE	% ERROR	DATA EARLY
8.90E-05	1.67E+03	1.67E+03	+0.396	4.37E-01
1.10E-04	1.61E+03	1.60E+03	+0.654	2.72E-01
1.40E-04	1.49E+03	1.49E+03	-0.159	1.67E-01
1.77E-04	1.34E+03	1.36E+03	-1.335	1.09E-01
2.20E-04	1.22E+03	1.24E+03	-1.540	7.28E-02
2.80E-04	1.10E+03	1.11E+03	-1.484	4.66E-02
3.55E-04	1.00E+03	9.99E+02	+0.182	2.97E-02
4.43E-04	9.16E+02	9.06E+02	+1.101	1.95E-02
5.64E-04	8.34E+02	8.25E+02	+1.144	1.22E-02
7.13E-04	7.66E+02	7.48E+02	+2.421	7.74E-03
8.81E-04	6.99E+02	6.94E+02	+0.656	5.23E-03
1.10E-03	6.51E+02	6.47E+02	+0.626	3.34E-03
1.41E-03	6.02E+02	5.94E+02	+1.336	2.02E-03
1.80E-03	5.53E+02	5.59E+02	-1.068	1.25E-03
2.22E-03	5.11E+02	5.27E+02	-2.963	8.31E-04

R: 168. X: 0. Y: 0. DL: 0. REQ: 0. CF: 1.0000
TDHZ ARRAY, 15 DATA POINTS, SYSTEM: NONE DATA: LOOP45
MEDICINE LAKE HIGHLAND
UNOCAL GEOTHERMAL 8-19-86
RMS LOG ERROR: 8.91E-03, ANTILOG YIELDS 2.0736 %
LATE TIME PARAMETERS

IGS: ARRTI

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	T 1	F 0
P 1	.82			
P 2	-.08	.73		
T 1	.11	.15	.86	
F 0	.00	.00	.00	.00

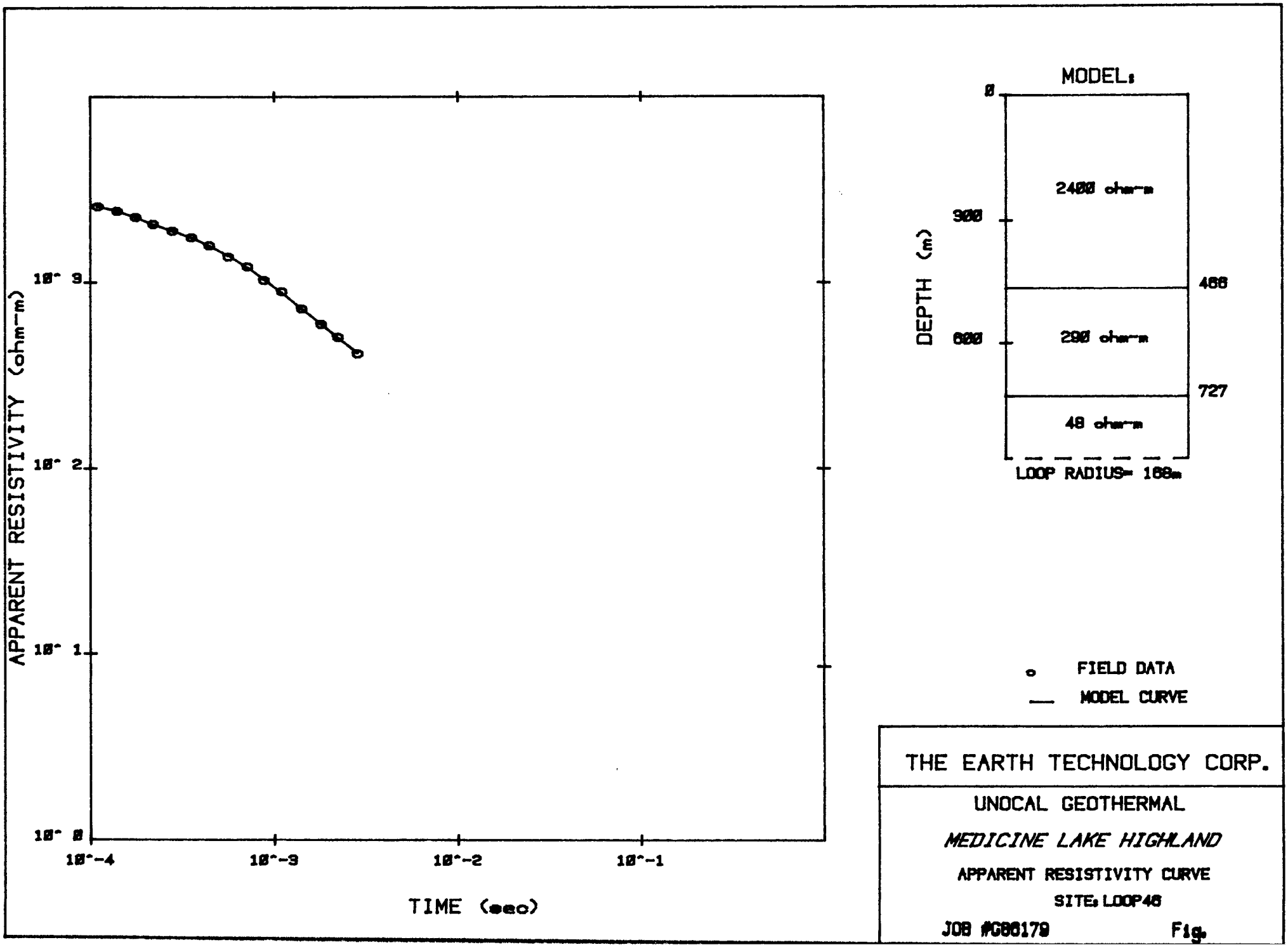
LINE: 0045
STA.: 0000

FREQUENCY = 30 hz
LOOP SIZE = 300 x 300 m
CURRENT = 21 amps
SPACING = 168 m

CH.	TIME(msec)	V(Volts/A-m^2)	RHOA-LATE	RHOA-EARLY
1	0.0890	2.7404E-07	1679.46	4.3523E-01
2	0.1100	1.7142E-07	1613.09	2.7200E-01
3	0.1400	1.0519E-07	1494.50	1.6695E-01
4	0.1770	6.8733E-08	1342.64	1.0906E-01
5	0.2200	4.6013E-08	1221.05	7.3028E-02
6	0.2800	2.9423E-08	1100.63	4.6707E-02
7	0.3550	1.8667E-08	1003.69	2.9639E-02
8	0.4430	1.2257E-08	918.53	1.9466E-02
9	0.5640	7.7076E-09	836.78	1.2244E-02
10	0.7130	4.8677E-09	769.12	7.7341E-03
11	0.8810	3.2936E-09	701.38	5.2341E-03
12	1.0960	2.1208E-09	653.64	3.3712E-03
13	1.4110	1.2676E-09	604.65	2.0155E-03
14	1.7950	7.8894E-10	555.34	1.2547E-03
15	2.2240	5.1973E-10	513.19	8.2676E-04
16	2.8500	3.3331E-10	456.44	5.3031E-04
17	3.6000	2.1788E-10	410.56	3.4680E-04
18	4.4900	1.4810E-10	367.48	2.3579E-04
19	5.7000	9.3573E-11	335.32	1.4900E-04
20	7.1900	5.8252E-11	312.32	9.2832E-05

THE EARTH TECHNOLOGY CORP.

Job #:G86179
Client:UNOCAL
Location:MEDICINE LAKE HIGHLAND
File:MLHIGH7.DAT


APPARENT RESISTIVITY (ohm-m)
10^ 3
10^ 2
10^ 1
10^ 0
10^-4
10^-3
10^-2
10^-1
TIME (sec)
MODEL:
0
300
600
DEPTH (m)
2400 ohm-m
290 ohm-m
48 ohm-m
466
727
LOOP RADIUS= 168m
FIELD DATA
MODEL CURVE
THE EARTH TECHNOLOGY CORP.
UNOCAL GEOTHERMAL
MEDICINE LAKE HIGHLAND
APPARENT RESISTIVITY CURVE
SITE: LOOP48
JOB #C88179
Fig.

LOOP46

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANC LAYER
		.0	.0	
2367.50	466.5	-466.5	-1530.6	.2
290.38	260.2	-726.8	-2384.4	.9
48.30				

TIMES	DATA LATE	CALC LATE	% ERROR	DATA EARLY
1.10E-04	2.57E+03	2.58E+03	-0.408	1.35E-01
1.40E-04	2.43E+03	2.43E+03	-0.105	8.02E-02
1.77E-04	2.25E+03	2.25E+03	-0.121	5.01E-02
2.20E-04	2.07E+03	2.06E+03	+0.134	3.30E-02
2.80E-04	1.90E+03	1.90E+03	-0.180	2.05E-02
3.55E-04	1.75E+03	1.75E+03	-0.356	1.28E-02
4.43E-04	1.59E+03	1.58E+03	+0.480	8.51E-03
5.64E-04	1.38E+03	1.40E+03	-0.919	5.75E-03
7.13E-04	1.22E+03	1.21E+03	+0.644	3.85E-03
8.81E-04	1.03E+03	1.04E+03	-0.923	2.93E-03
1.10E-03	8.94E+02	8.81E+02	+1.561	2.08E-03
1.41E-03	7.21E+02	7.20E+02	+0.200	1.54E-03
1.80E-03	5.94E+02	5.95E+02	-0.223	1.12E-03
2.22E-03	5.05E+02	5.02E+02	+0.576	8.46E-04
2.85E-03	4.12E+02	4.15E+02	-0.773	6.15E-04

R: 168. X: 0. Y: 0. DL: 0. REQ: 0. CF: 1.00000
TDHZ ARRAY, 15 DATA POINTS, SYSTEM: NONE DATA: LOOP4
MEDICINE LAKE HIGHLAND
UNOCAL GEOTHERMAL 8-21-86
RMS LOG ERROR: 4.17E-03, ANTILOG YIELDS .9646 %
LATE TIME PARAMETERS

IGS: ARRT1

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	.96					
P 2	-.11	.56				
P 3	-.01	-.13	.78			
T 1	.04	.13	.02	.96		
T 2	-.05	-.16	-.01	.06	.92	
F 0	.00	.00	.00	.00	.00	.00

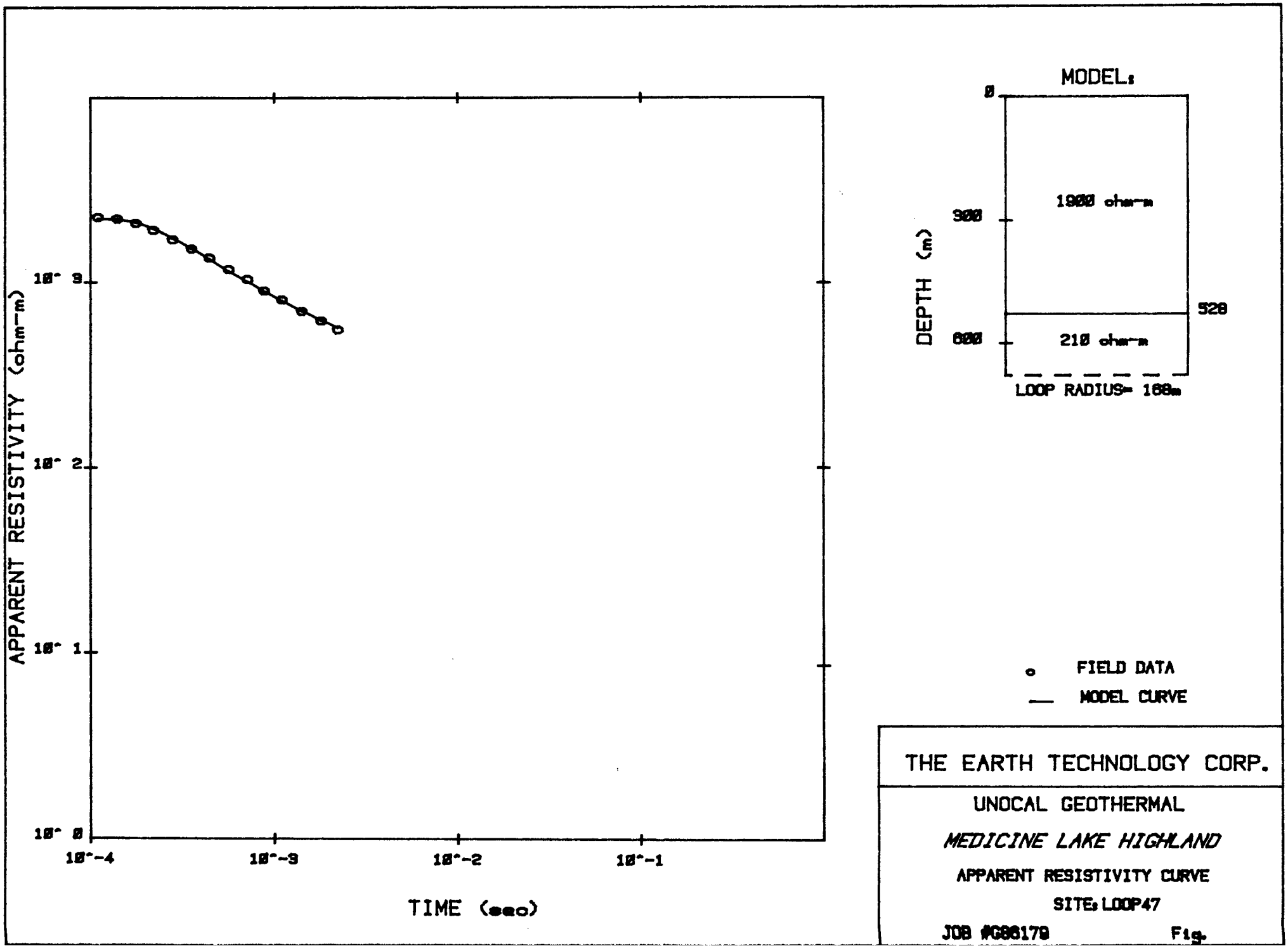
LINE: 0046
STA.: 0000

FREQUENCY = 30 hz
LOOP SIZE = 300 x 300 m
CURRENT = 21 amps
SPACING = 168 m

CH.	TIME(msec)	V(Volts/A-m^2)	RHOA-LATE	RHOA-EARLY
1	0.0890	1.4448E-07	2573.37	2.2918E-01
2	0.1100	8.4732E-08	2580.32	1.3444E-01
3	0.1400	5.0452E-08	2439.08	8.0071E-02
4	0.1770	3.1575E-08	2255.15	5.0122E-02
5	0.2200	2.0821E-08	2071.67	3.3062E-02
6	0.2800	1.2900E-08	1907.13	2.0486E-02
7	0.3550	8.0940E-09	1752.00	1.2857E-02
8	0.4430	5.3417E-09	1597.97	8.4868E-03
9	0.5640	3.6045E-09	1388.87	5.7284E-03
10	0.7130	2.4172E-09	1226.50	3.8422E-03
11	0.8810	1.8402E-09	1033.92	2.9261E-03
12	1.0960	1.3173E-09	897.88	2.0945E-03
13	1.4110	9.6663E-10	724.39	1.5371E-03
14	1.7950	7.0860E-10	596.55	1.1274E-03
15	2.2240	5.2817E-10	507.71	8.4059E-04
16	2.8500	3.8586E-10	414.00	6.1399E-04
17	3.6000	2.7585E-10	350.81	4.3903E-04
18	4.4900	2.0091E-10	299.88	3.1990E-04
19	5.7000	1.3502E-10	262.60	2.1497E-04

THE EARTH TECHNOLOGY CORP.

Job #:686179
Client:UNOCAL
Location:MEDICINE LAKE HIGHLAND
File:MLHIGH9.DAT


APPARENT RESISTIVITY (ohm-m)
10^3
10^2
10^1
10^0
10^-4
10^-3
10^-2
10^-1
TIME (sec)
MODEL:
0
300
600
1900 ohm-m
210 ohm-m
520
DEPTH (m)
LOOP RADIUS= 168m
FIELD DATA
MODEL CURVE
THE EARTH TECHNOLOGY CORP.
UNOCAL GEOTHERMAL
MEDICINE LAKE HIGHLAND
APPARENT RESISTIVITY CURVE
SITE: LOOP47
JOB #C88179
Fig.

LOOP47

MODEL: 2 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		.0	.0		
1919.34	528.3	-528.3	-1733.2	.3	.3
210.56					

TIMES	DATA LATE	CALC LATE	% ERROR	DATA EARLY
1.10E-04	2.24E+03	2.20E+03	+1.761	1.66E-01
1.40E-04	2.20E+03	2.19E+03	+0.771	9.31E-02
1.77E-04	2.08E+03	2.11E+03	-1.399	5.64E-02
2.20E-04	1.91E+03	1.95E+03	-2.198	3.72E-02
2.80E-04	1.70E+03	1.73E+03	-2.184	2.42E-02
3.55E-04	1.52E+03	1.53E+03	-0.968	1.58E-02
4.43E-04	1.36E+03	1.34E+03	+1.380	1.08E-02
5.64E-04	1.18E+03	1.15E+03	+1.859	7.28E-03
7.13E-04	1.04E+03	1.01E+03	+2.733	4.89E-03
8.81E-04	8.98E+02	8.95E+02	+0.329	3.59E-03
1.10E-03	8.04E+02	7.92E+02	+1.512	2.44E-03
1.41E-03	6.96E+02	7.01E+02	-0.693	1.63E-03
1.80E-03	6.18E+02	6.22E+02	-0.633	1.06E-03
2.22E-03	5.53E+02	5.67E+02	-2.549	7.38E-04

R: 168. X: 0. Y: 0. DL: 0. REQ: 0. CF: 1.0000
TDHZ ARRAY, 14 DATA POINTS, SYSTEM: NONE DATA: LOOP47
MEDICINE LAKE HIGHLAND
UNOCAL GEOTHERMAL 8-21-86
RMS LOG ERROR: 1.09E-02, ANTILOG YIELDS 2.5299 %
LATE TIME PARAMETERS

IGS: ARRTI

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	T 1	F 0
P 1	.89			
P 2	-.07	.47		
T 1	.04	.12	.94	
F 0	.00	.00	.00	.00

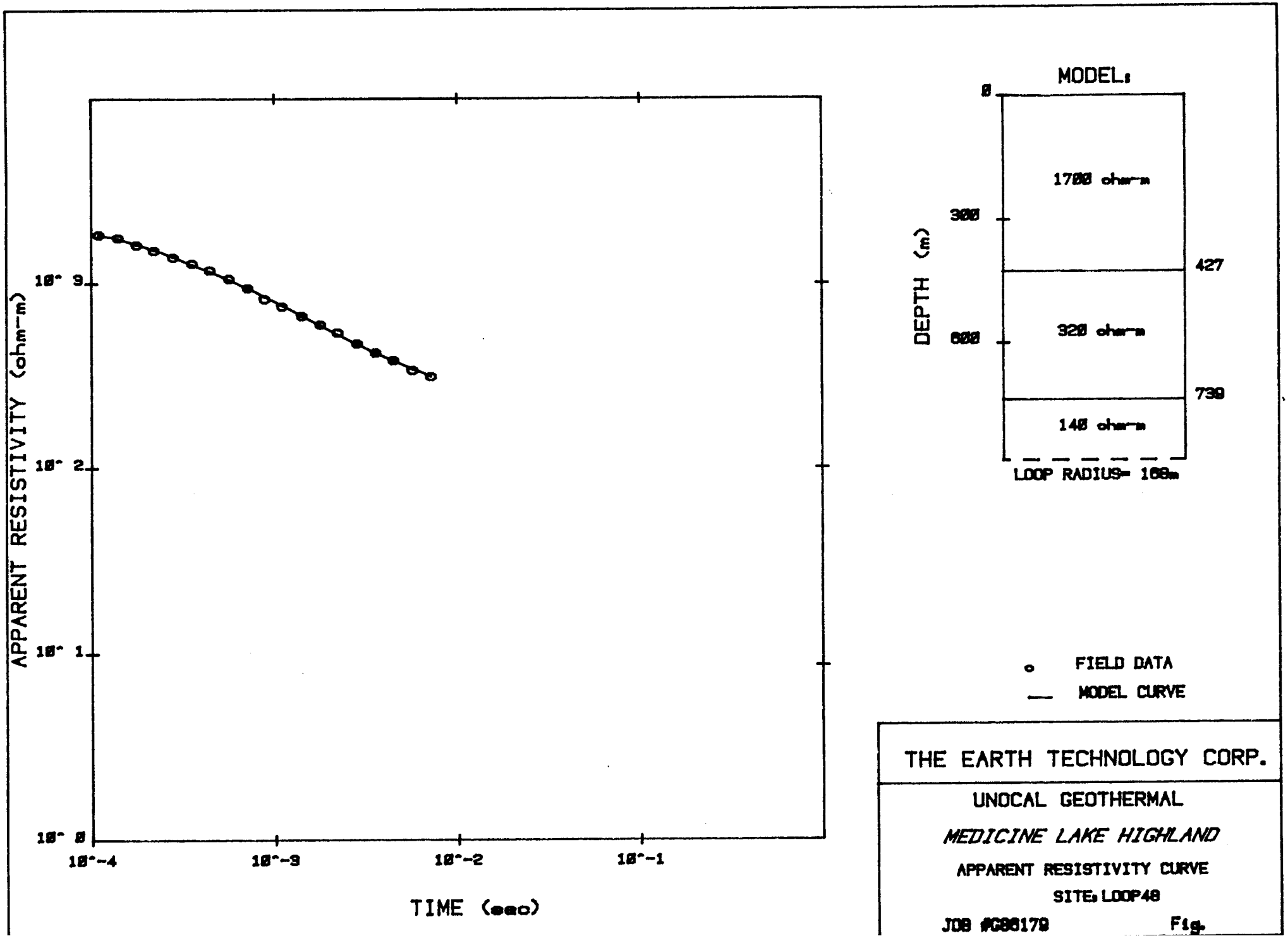
LINE: 0047
STA.: 0000

FREQUENCY = 30 hz
LOOP SIZE = 300 x 300 m
CURRENT = 20 amps
SPACING = 168 m

CH.	TIME(msec)	V(Volts/A-m^2)	RHOA-LATE	RHOA-EARLY
1	0.0890	2.0954E-07	2008.50	3.3272E-01
2	0.1100	1.0424E-07	2247.47	1.6557E-01
3	0.1400	5.8501E-08	2209.89	9.2952E-02
4	0.1770	3.5537E-08	2084.26	5.6435E-02
5	0.2200	2.3446E-08	1914.01	3.7243E-02
6	0.2800	1.5297E-08	1702.27	2.4301E-02
7	0.3550	9.9950E-09	1522.15	1.5881E-02
8	0.4430	6.7999E-09	1360.45	1.0806E-02
9	0.5640	4.5997E-09	1180.52	7.3109E-03
10	0.7130	3.0907E-09	1041.12	4.9143E-03
11	0.8810	2.2594E-09	901.72	3.5931E-03
12	1.0960	1.5447E-09	807.43	2.4573E-03
13	1.4110	1.0190E-09	699.38	1.6209E-03
14	1.7950	6.6810E-10	620.43	1.0625E-03
15	2.2240	4.6148E-10	555.52	7.3444E-04
16	2.8500	3.0353E-10	485.83	4.8309E-04
17	3.6000	2.0182E-10	432.06	3.2121E-04
18	4.4900	1.3593E-10	389.10	2.1646E-04
19	5.7000	9.1865E-11	339.47	1.4641E-04
20	7.1900	5.8845E-11	310.22	9.3977E-05

THE EARTH TECHNOLOGY CORP.

Job #:G86179
Client:UNOCAL
Location:MEDICINE LAKE HIGHLAND
File:MLHIGH9.DAT


APPARENT RESISTIVITY (ohm-m)
10^ 3
10^ 2
10^ 1
10^ 0
10^-4
10^-3
10^-2
10^-1
TIME (sec)
MODEL:
0
1700 ohm-m
300
427
DEPTH (m)
320 ohm-m
600
739
140 ohm-m
LOOP RADIUS= 168m
FIELD DATA
MODEL CURVE
THE EARTH TECHNOLOGY CORP.
UNOCAL GEOTHERMAL
MEDICINE LAKE HIGHLAND
APPARENT RESISTIVITY CURVE
SITE: LOOP48
JOB #C86179
Fig.

LOOP48

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		.0	.0		
1655.75	426.8	-426.8	-1400.1	.3	.3
319.78	311.8	-738.6	-2423.2	1.0	1.2
135.76					

TIMES	DATA LATE	CALC LATE	% ERROR	DATA EARLY
1.10E-04	1.82E+03	1.82E+03	-0.007	2.26E-01
1.40E-04	1.75E+03	1.74E+03	+0.699	1.31E-01
1.77E-04	1.61E+03	1.62E+03	-0.686	8.28E-02
2.20E-04	1.50E+03	1.52E+03	-0.980	5.34E-02
2.80E-04	1.38E+03	1.39E+03	-0.275	3.31E-02
3.55E-04	1.28E+03	1.26E+03	+1.405	2.05E-02
4.43E-04	1.18E+03	1.16E+03	+1.382	1.33E-02
5.64E-04	1.06E+03	1.05E+03	+0.324	8.55E-03
7.13E-04	9.46E+02	9.43E+02	+0.331	5.64E-03
8.85E-04	8.26E+02	8.53E+02	-3.173	4.03E-03
1.10E-03	7.53E+02	7.64E+02	-1.501	2.69E-03
1.41E-03	6.69E+02	6.72E+02	-0.479	1.73E-03
1.78E-03	6.00E+02	5.95E+02	+0.918	1.13E-03
2.21E-03	5.44E+02	5.31E+02	+2.408	7.65E-04
2.83E-03	4.75E+02	4.73E+02	+0.547	5.05E-04
3.57E-03	4.24E+02	4.22E+02	+0.365	3.35E-04
4.46E-03	3.86E+02	3.83E+02	+0.742	2.21E-04
5.67E-03	3.41E+02	3.48E+02	-1.944	1.46E-04
7.16E-03	3.15E+02	3.17E+02	-0.463	9.19E-05

R: 168. X: 0. Y: 0. DL: 0. REQ: 0. CF: 1.0000
TDHZ ARRAY, 19 DATA POINTS, SYSTEM: NONE DATA: LOOP48
MEDICINE LAKE HIGHLAND
UNOCAL GEOTHERMAL 8-21-86
RMS LOG ERROR: 8.30E-03, ANTILOG YIELDS 1.9289 %
LATE TIME PARAMETERS

IGS: ARRTI

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	1.00					
P 2	.00	1.00				
P 3	.00	.00	1.00			
T 1	.00	.00	.00	1.00		
T 2	.00	.00	.00	.00	1.00	
F 0	.00	.00	.00	.00	.00	.00

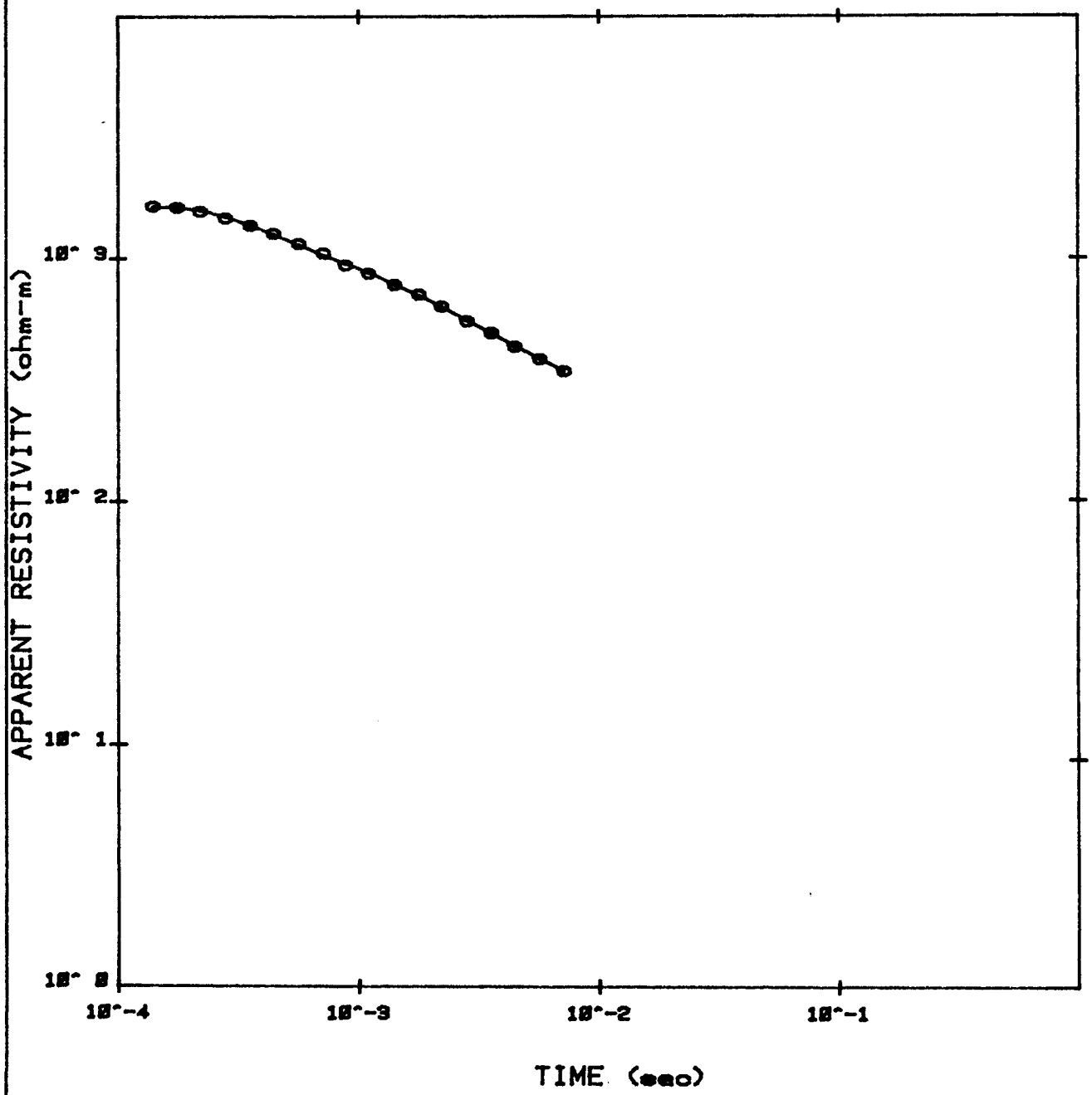
LINE: 0048
STA.: 0000

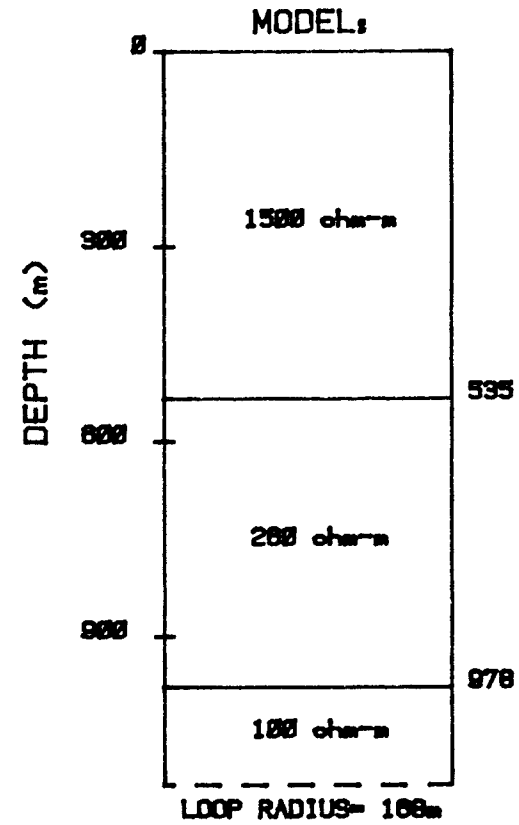
FREQUENCY = 30 hz
LOOP SIZE = 300 x 300 m
CURRENT = 20 amps
SPACING = 168 m

CH.	TIME(msec)	V(Volts/A-m^2)	RHOA-LATE	RHOA-EARLY
2	0.1100	1.4297E-07	1820.60	2.2675E-01
3	0.1400	8.2598E-08	1755.90	1.3104E-01
4	0.1770	5.2079E-08	1615.45	8.2642E-02
5	0.2200	3.3543E-08	1507.49	5.3239E-02
6	0.2800	2.0810E-08	1386.46	3.3039E-02
7	0.3550	1.2885E-08	1285.08	2.0461E-02
8	0.4430	8.3973E-09	1181.93	1.3337E-02
9	0.5640	5.4016E-09	1060.59	8.5813E-03
10	0.7130	3.5510E-09	949.10	5.6425E-03
11	0.8810	2.5296E-09	836.31	4.0207E-03
12	1.0960	1.6981E-09	758.05	2.6994E-03
13	1.4110	1.0943E-09	666.89	1.7402E-03
14	1.7950	7.1006E-10	595.74	1.1292E-03
15	2.2240	4.7976E-10	541.31	7.6318E-04
16	2.8500	3.1858E-10	470.40	5.0697E-04
17	3.6000	2.1016E-10	420.56	3.3444E-04
18	4.4900	1.3885E-10	383.64	2.2117E-04
19	5.7000	9.1841E-11	339.53	1.4621E-04
20	7.1900	5.7612E-11	314.63	9.1733E-05

THE EARTH TECHNOLOGY CORP.

Job #:686179
Client:UNOCAL
Location:MEDICINE LAKE HIGHLAND
File:MLHIGH9.DAT





o FIELD DATA

— MODEL CURVE

THE EARTH TECHNOLOGY CORP.

UNOCAL GEOTHERMAL

MEDICINE LAKE HIGHLAND

APPARENT RESISTIVITY CURVE

SITE: LOOP49

JOB #G86179 Fig.

LOOP49

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		.0	.0		
1481.18	534.8	-534.8	-1754.7	.4	.4
258.36	443.3	-978.1	-3209.1	1.7	2.1
101.25					

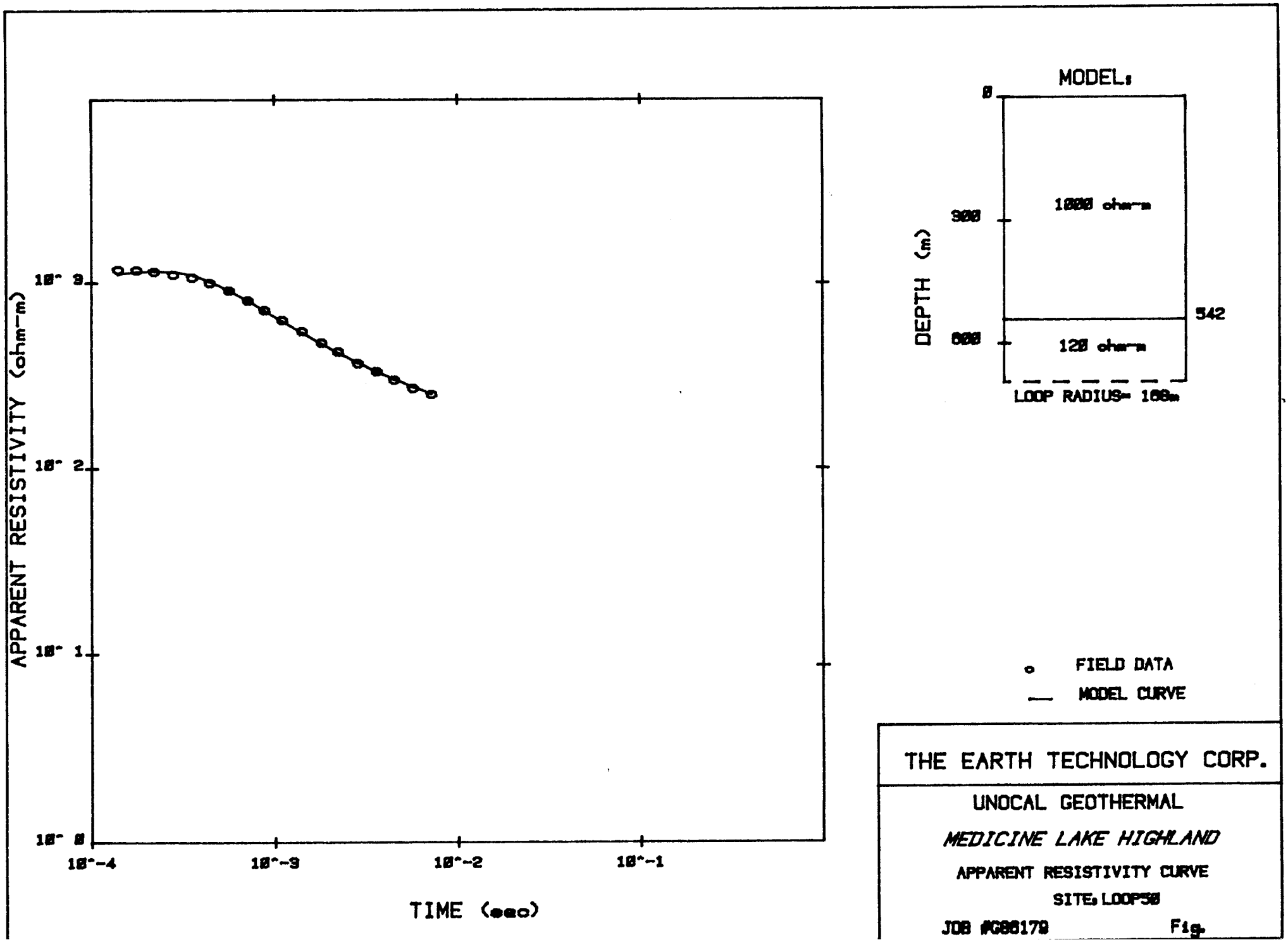
TIMES	DATA LATE	CALC LATE	% ERROR	DATA EARLY
1.40E-04	1.65E+03	1.64E+03	+0.631	1.43E-01
1.77E-04	1.63E+03	1.63E+03	+0.431	8.12E-02
2.20E-04	1.57E+03	1.59E+03	-0.969	4.99E-02
2.80E-04	1.47E+03	1.49E+03	-1.537	3.01E-02
3.55E-04	1.37E+03	1.37E+03	+0.590	1.85E-02
4.43E-04	1.27E+03	1.26E+03	+0.663	1.19E-02
5.64E-04	1.15E+03	1.14E+03	+0.635	7.56E-03
7.13E-04	1.05E+03	1.03E+03	+1.339	4.83E-03
8.85E-04	9.36E+02	9.51E+02	-1.541	3.34E-03
1.10E-03	8.66E+02	8.74E+02	-0.937	2.18E-03
1.41E-03	7.78E+02	7.80E+02	-0.238	1.38E-03
1.78E-03	7.10E+02	7.03E+02	+0.872	8.81E-04
2.21E-03	6.34E+02	6.31E+02	+0.531	6.06E-04
2.83E-03	5.52E+02	5.55E+02	-0.599	4.03E-04
3.57E-03	4.94E+02	4.91E+02	+0.699	2.67E-04
4.46E-03	4.34E+02	4.36E+02	-0.410	1.86E-04
5.67E-03	3.66E+02	3.87E+02	-0.208	1.21E-04
7.16E-03	3.44E+02	3.44E+02	+0.005	8.05E-05

R: 168. X: 0. Y: 0. DL: 0. REQ: 0. CF: 1.0000
TDHZ ARRAY, 18 DATA POINTS, SYSTEM: NONE DATA: LOOP49
MEDICINE LAKE HIGHLAND
UNOCAL GEOTHERMAL 8-21-86
RMS LOG ERROR: 5.39E-03, ANTILOG YIELDS 1.2491 %
LATE TIME PARAMETERS

IGS: ARRTI

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	.89					
P 2	-.08	.34				
P 3	-.01	-.07	.17			
T 1	.06	.24	.00	.86		
T 2	-.03	.06	.18	.03	.48	
F 0	.00	.00	.00	.00	.00	.00


APPARENT RESISTIVITY (ohm-m)
10^ 3
10^ 2
10^ 1
10^ 0
10^-4
10^-3
10^-2
10^-1
TIME (sec)
MODEL:
0
300
600
542
DEPTH (m)
1000 ohm-m
120 ohm-m
LOOP RADIUS= 168m
FIELD DATA
MODEL CURVE
THE EARTH TECHNOLOGY CORP.
UNOCAL GEOTHERMAL
MEDICINE LAKE HIGHLAND
APPARENT RESISTIVITY CURVE
SITE: LOOP50
JOB #G86179
Fig.

LOOP50

MODEL: 2 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		.0	.0		
1016.31	542.4	-542.4	-1779.5	.5	.5
117.46					

TIMES	DATA LATE	CALC LATE	% ERROR	DATA EARLY
1.40E-04	1.18E+03	1.12E+03	+5.721	2.37E-01
1.77E-04	1.17E+03	1.15E+03	+1.678	1.34E-01
2.20E-04	1.15E+03	1.16E+03	-1.078	7.96E-02
2.80E-04	1.11E+03	1.15E+03	-3.994	4.59E-02
3.55E-04	1.07E+03	1.11E+03	-3.679	2.68E-02
4.43E-04	1.00E+03	1.02E+03	-1.656	1.71E-02
5.64E-04	9.13E+02	9.13E+02	+0.003	1.07E-02
7.13E-04	8.09E+02	8.07E+02	+0.133	7.13E-03
8.81E-04	7.16E+02	7.11E+02	+0.836	5.05E-03
1.10E-03	6.35E+02	6.24E+02	+1.676	3.47E-03
1.41E-03	5.51E+02	5.42E+02	+1.640	2.31E-03
1.80E-03	4.79E+02	4.73E+02	+1.344	1.55E-03
2.22E-03	4.29E+02	4.22E+02	+1.536	1.08E-03
2.85E-03	3.71E+02	3.76E+02	-1.244	7.19E-04
3.60E-03	3.37E+02	3.35E+02	+0.513	4.63E-04
4.49E-03	3.04E+02	3.07E+02	-1.065	3.11E-04
5.70E-03	2.73E+02	2.78E+02	-1.831	2.01E-04
7.19E-03	2.54E+02	2.56E+02	-0.794	1.26E-04

R: 168. X: 0. Y: 0. DL: 0. REQ: 0. CF: 1.0000
TDHZ ARRAY, 18 DATA POINTS, SYSTEM: NONE DATA: LOOP50
MEDICINE LAKE HIGHLAND
UNOCAL GEOTHERMAL 8-21-86
RMS LOG ERROR: 1.42E-02, ANTILOG YIELDS 3.3252 %
LATE TIME PARAMETERS

IGS: ARRTI

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	T 1	F 0
P 1	.24			
P 2	.00	.05		
T 1	.06	.09	.37	
F 0	.00	.00	.00	.00

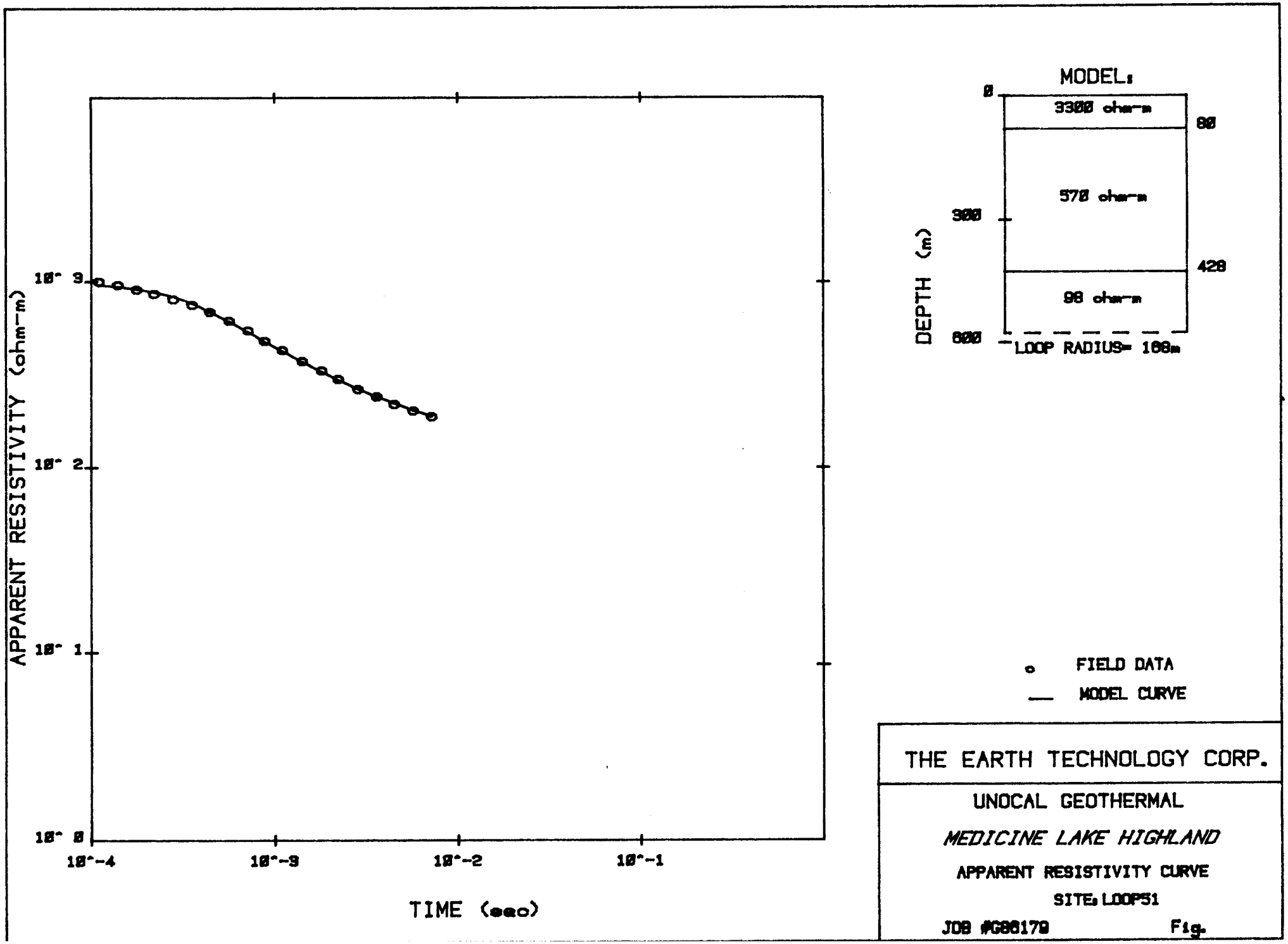
LINE: 0050
STA.: 0000

FREQUENCY = 30 hz
LOOP SIZE = 300 x 300 m
CURRENT = 20 amps
SPACING = 168 m

CH.	TIME(msec)	V(Volts/A-m^2)	RHOA-LATE	RHOA-EARLY
1	0.0890	6.6090E-07	933.87	1.0478E+00
2	0.1100	2.8767E-07	1142.29	4.5617E-01
3	0.1400	1.4852E-07	1167.46	2.3558E-01
4	0.1770	8.4638E-08	1168.67	1.3429E-01
5	0.2200	5.0397E-08	1149.17	7.9981E-02
6	0.2800	2.9119E-08	1108.28	4.6224E-02
7	0.3550	1.6973E-08	1069.40	2.6951E-02
8	0.4430	1.0678E-08	1006.97	1.6960E-02
9	0.5640	6.7264E-09	916.30	1.0686E-02
10	0.7130	4.4922E-09	811.41	7.1378E-03
11	0.8810	3.1727E-09	719.09	5.0420E-03
12	1.0960	2.2028E-09	637.32	3.5013E-03
13	1.4110	1.4476E-09	553.42	2.3014E-03
14	1.7950	9.7763E-10	481.36	1.5546E-03
15	2.2240	6.7613E-10	430.64	1.0753E-03
16	2.8500	4.5184E-10	372.65	7.1876E-04
17	3.6000	2.9120E-10	338.37	4.6334E-04
18	4.4900	1.9592E-10	304.95	3.1181E-04
19	5.7000	1.2628E-10	274.59	2.0104E-04
20	7.1900	7.8978E-11	254.96	1.2577E-04

THE EARTH TECHNOLOGY CORP.

Job #:686179
Client:UNOCAL
Location:MEDICINE LAKE HIGHLAND
File:MLHIGH9.DAT


APPARENT RESISTIVITY (ohm-m)
10^3
10^2
10^1
10^0
10^-4
10^-3
10^-2
10^-1
TIME (sec)
MODEL:
0
3300 ohm-m
80
570 ohm-m
300
428
98 ohm-m
600
DEPTH (m)
LOOP RADIUS= 100m
FIELD DATA
MODEL CURVE
THE EARTH TECHNOLOGY CORP.
UNOCAL GEOTHERMAL
MEDICINE LAKE HIGHLAND
APPARENT RESISTIVITY CURVE
SITE: LOOP51
JOB #G88179
Fig.

LOOP51

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		.0	.0		
3288.92	80.4	-80.4	-263.8	.0	.0
568.31	347.2	-427.6	-1402.9	.6	.6
98.39					

TIMES	DATA LATE	CALC LATE	% ERROR	DATA EARLY
1.10E-04	1.00E+03	9.59E+02	+4.430	5.55E-01
1.40E-04	9.59E+02	9.39E+02	+2.198	3.24E-01
1.77E-04	9.05E+02	9.14E+02	-0.984	1.96E-01
2.20E-04	8.59E+02	8.78E+02	-2.184	1.23E-01
2.80E-04	8.00E+02	8.31E+02	-3.627	7.51E-02
3.55E-04	7.47E+02	7.66E+02	-2.386	4.60E-02
4.43E-04	6.86E+02	6.88E+02	-0.381	3.00E-02
5.64E-04	6.15E+02	6.10E+02	+0.844	1.93E-02
7.13E-04	5.45E+02	5.37E+02	+1.409	1.29E-02
8.81E-04	4.78E+02	4.75E+02	+0.533	9.26E-03
1.10E-03	4.27E+02	4.23E+02	+1.083	6.29E-03
1.41E-03	3.74E+02	3.70E+02	+0.862	4.13E-03
1.80E-03	3.32E+02	3.28E+02	+1.241	2.68E-03
2.22E-03	2.99E+02	2.96E+02	+0.994	1.86E-03
2.85E-03	2.64E+02	2.66E+02	-1.011	1.20E-03
3.60E-03	2.41E+02	2.41E+02	-0.090	7.66E-04
4.49E-03	2.20E+02	2.23E+02	-1.312	5.06E-04
5.70E-03	2.03E+02	2.05E+02	-0.967	3.14E-04
7.19E-03	1.89E+02	1.90E+02	-0.505	1.96E-04

R: 168. X: 0. Y: 0. DL: 0. REQ: 0. CF: 1.0000
TDHZ ARRAY, 19 DATA POINTS, SYSTEM: NONE DATA: LOOP51
MEDICINE LAKE HIGHLAND
UNOCAL GEOTHERMAL 8-20-86
RMS LOG ERROR: 1.16E-02, ANTILOG YIELDS 2.7088 %
LATE TIME PARAMETERS

IGS: ARRTI

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	.04					
P 2	.06	.79				
P 3	.01	-.04	.72			
T 1	.03	.33	.02	.18		
T 2	-.02	-.02	.11	.13	.88	
F 0	.00	.00	.00	.00	.00	.00

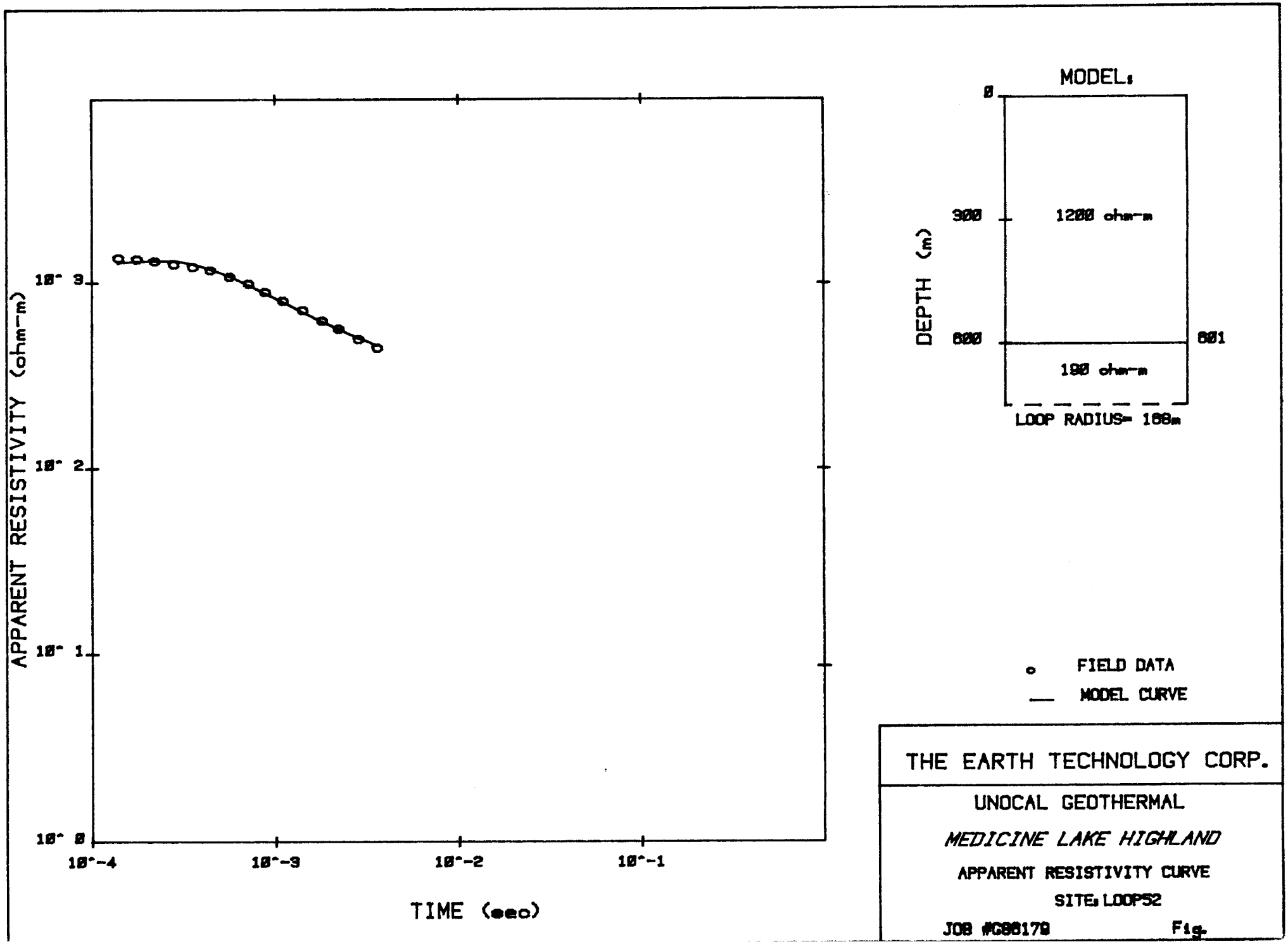
LINE: 0051
STA.: 0000

FREQUENCY = 30 hz
LOOP SIZE = 300 x 300 m
CURRENT = 20 amps
SPACING = 168 m

CH.	TIME(msec)	V(Volts/A-m^2)	RHOA-LATE	RHOA-EARLY
2	0.1100	3.4913E-07	1003.94	5.5374E-01
3	0.1400	2.0385E-07	961.49	3.2330E-01
4	0.1770	1.2382E-07	906.87	1.9642E-01
5	0.2200	7.7723E-08	860.91	1.2332E-01
6	0.2800	4.7239E-08	802.72	7.4974E-02
7	0.3550	2.8930E-08	749.46	4.5926E-02
8	0.4430	1.8922E-08	687.66	3.0045E-02
9	0.5640	1.2181E-08	616.74	1.9346E-02
10	0.7130	8.1210E-09	546.77	1.2900E-02
11	0.8810	5.8249E-09	479.60	9.2541E-03
12	1.0960	3.9935E-09	428.65	6.3458E-03
13	1.4110	2.5957E-09	374.96	4.1256E-03
14	1.7950	1.6990E-09	333.01	2.7009E-03
15	2.2240	1.1598E-09	300.53	1.8441E-03
16	2.8500	7.5407E-10	264.86	1.1992E-03
17	3.6000	4.8080E-10	242.22	7.6501E-04
18	4.4900	3.1718E-10	221.18	5.0487E-04
19	5.7000	1.9735E-10	203.90	3.1430E-04
20	7.1900	1.2227E-10	190.52	1.9488E-04

THE EARTH TECHNOLOGY CORP.

Job #:G86179
Client:UNOCAL
Location:MEDICINE LAKE HIGHLAND
File:MLHIGH8.DAT


APPARENT RESISTIVITY (ohm-m)
10^3
10^2
10^1
10^0
10^-4
10^-3
10^-2
10^-1
TIME (sec)
MODEL:
0
300
600
DEPTH (m)
1200 ohm-m
100 ohm-m
601
LOOP RADIUS= 100m
FIELD DATA
MODEL CURVE
THE EARTH TECHNOLOGY CORP.
UNOCAL GEOTHERMAL
MEDICINE LAKE HIGHLAND
APPARENT RESISTIVITY CURVE
SITE: LOOP52
JOB #G80170
Fig.

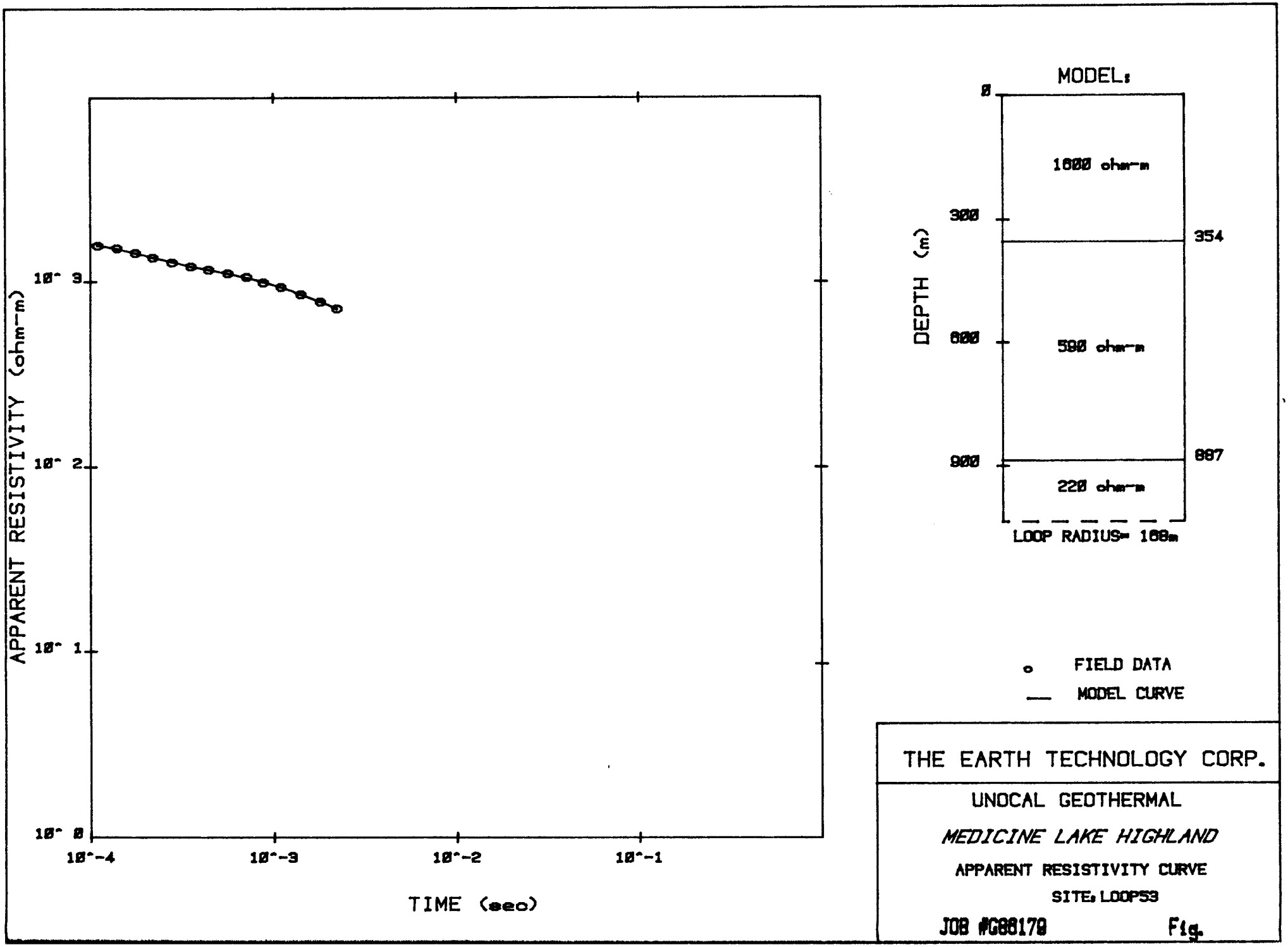
LINE: 0052
STA.: 0000

FREQUENCY = 30 hz
LOOP SIZE = 300 x 300 m
CURRENT = 20 amps
SPACING = 168 m

CH.	TIME(msec)	V(Volts/A-m^2)	RHOA-LATE	RHOA-EARLY
2	0.1100	2.2573E-07	1342.70	3.5799E-01
3	0.1400	1.2024E-07	1367.02	1.9075E-01
4	0.1770	6.9029E-08	1338.80	1.0953E-01
5	0.2200	4.1200E-08	1314.39	6.5392E-02
6	0.2800	2.3808E-08	1267.51	3.7798E-02
7	0.3550	1.3851E-08	1224.61	2.1995E-02
8	0.4430	8.4886E-09	1173.44	1.3484E-02
9	0.5640	5.2057E-09	1087.03	8.2709E-03
10	0.7130	3.3040E-09	995.82	5.2509E-03
11	0.8810	2.2678E-09	899.49	3.6048E-03
12	1.0960	1.5474E-09	806.49	2.4609E-03
13	1.4110	9.8339E-10	716.14	1.5640E-03
14	1.7950	6.5139E-10	630.99	1.0362E-03
15	2.2240	4.4406E-10	569.96	7.0653E-04
16	2.8500	2.9008E-10	500.74	4.6165E-04
17	3.6000	1.8992E-10	449.92	3.0233E-04
18	4.4900	1.2458E-10	412.41	1.9830E-04
19	5.7000	7.3960E-11	392.26	1.1806E-04
20	7.1900	4.4872E-11	371.68	7.1540E-05

THE EARTH TECHNOLOGY CORP.

Job #:G86179
Client:UNOCAL
Location:MEDICINE LAKE HIGHLAND
File:MLHIGH8.DAT


APPARENT RESISTIVITY (ohm-m)
10^ 3
10^ 2
10^ 1
10^ 0
10^-4
10^-3
10^-2
10^-1
TIME (sec)
MODEL:
0
1000 ohm-m
300
354
DEPTH (m)
600
590 ohm-m
900
887
220 ohm-m
LOOP RADIUS= 100m
FIELD DATA
MODEL CURVE
THE EARTH TECHNOLOGY CORP.
UNOCAL GEOTHERMAL
MEDICINE LAKE HIGHLAND
APPARENT RESISTIVITY CURVE
SITE: LOOP53
JOB #C88170
Fig.

LOOP53

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		.0	.0		
1550.34	354.4	-354.4	-1162.8	.2	.2
594.43	532.4	-886.8	-2909.4	.9	1.1
215.91					

TIMES	DATA LATE	CALC LATE	% ERROR	DATA EARLY
1.10E-04	1.57E+03	1.58E+03	-0.559	2.82E-01
1.40E-04	1.52E+03	1.51E+03	+0.610	1.62E-01
1.77E-04	1.43E+03	1.43E+03	+0.292	9.89E-02
2.20E-04	1.35E+03	1.35E+03	-0.203	6.26E-02
2.80E-04	1.27E+03	1.28E+03	-1.088	3.75E-02
3.55E-04	1.21E+03	1.21E+03	-0.014	2.23E-02
4.43E-04	1.16E+03	1.16E+03	+0.350	1.37E-02
5.64E-04	1.11E+03	1.11E+03	-0.229	7.98E-03
7.13E-04	1.06E+03	1.05E+03	+0.926	4.76E-03
8.81E-04	9.89E+02	9.96E+02	-0.739	3.11E-03
1.10E-03	9.35E+02	9.36E+02	-0.116	1.94E-03
1.41E-03	8.55E+02	8.55E+02	-0.038	1.19E-03
1.80E-03	7.79E+02	7.80E+02	-0.195	7.46E-04
2.22E-03	7.16E+02	7.16E+02	+0.069	5.01E-04

R: 168. X: 0. Y: 0. DL: 0. REQ: 0. CF: 1.0000
TDHZ ARRAY, 14 DATA POINTS, SYSTEM: NONE DATA: LOOP53
MEDICINE LAKE HIGHLAND
UNOCAL GEOTHERMAL 8-20-86
RMS LOG ERROR: 3.32E-03, ANTILOG YIELDS .7678 %
LATE TIME PARAMETERS

IGS: ARRTI

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	1.00					
P 2	.00	1.00				
P 3	.00	.00	.99			
T 1	.00	.00	.00	1.00		
T 2	.00	.00	.00	.00	1.00	
F 0	.00	.00	.00	.00	.00	.00

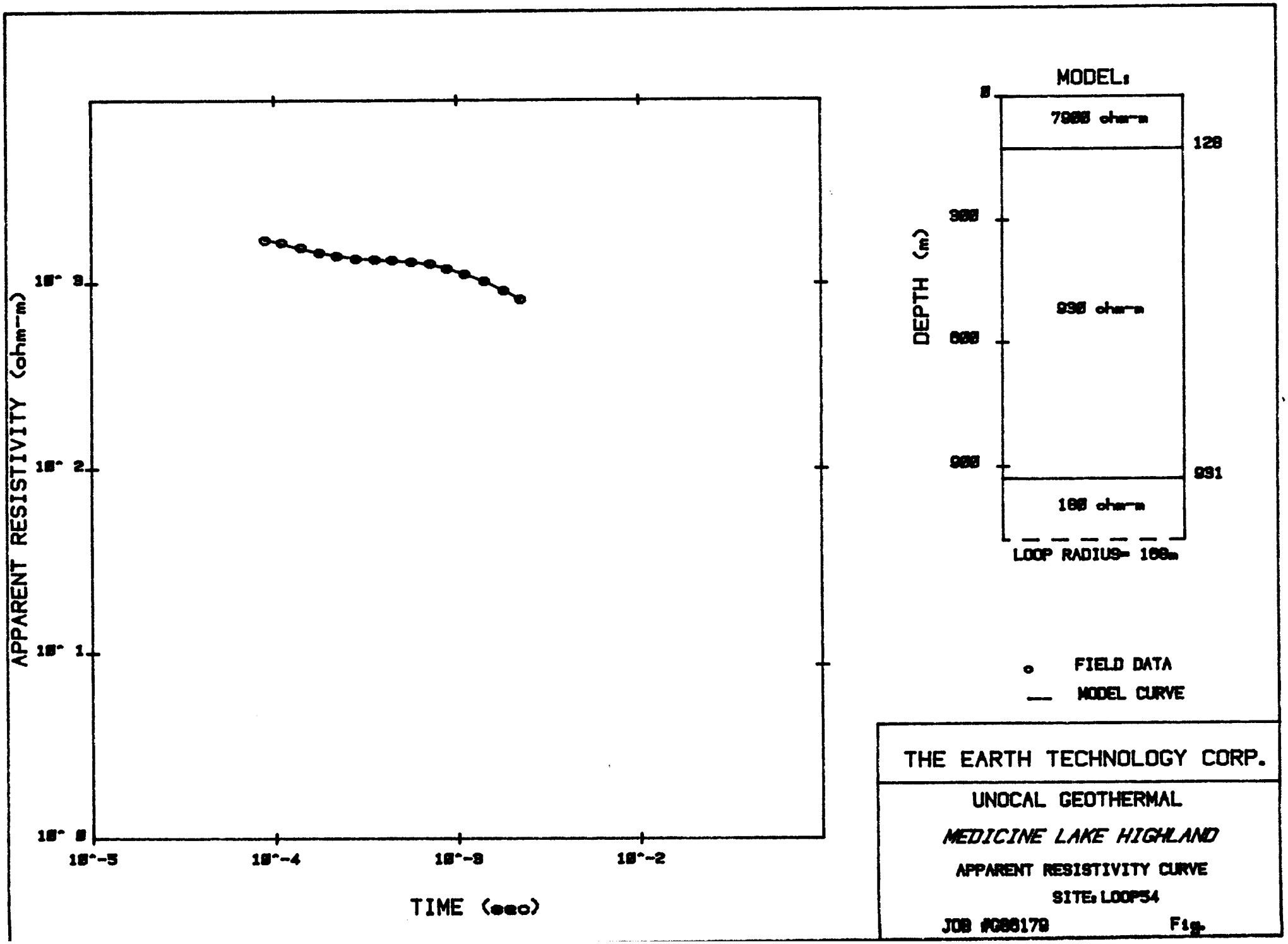
LINE: 0053
STA.: 0000

FREQUENCY = 30 hz
LOOP SIZE = 300 x 300 m
CURRENT = 20 amps
SPACING = 165 m

CH.	TIME(msec)	V(Volts/A-m^2)	RHOA-LATE	RHOA-EARLY
1	0.0890	3.0116E-07	1577.06	4.7828E-01
2	0.1100	1.7766E-07	1575.14	2.8189E-01
3	0.1400	1.0219E-07	1523.56	1.6213E-01
4	0.1770	6.2292E-08	1433.67	9.8847E-02
5	0.2200	3.9423E-08	1353.60	6.2573E-02
6	0.2800	2.3702E-08	1271.27	3.7630E-02
7	0.3550	1.3962E-08	1218.12	2.2171E-02
8	0.4430	8.5501E-09	1167.81	1.3581E-02
9	0.5640	5.0050E-09	1115.90	7.9521E-03
10	0.7130	2.9843E-09	1065.74	4.7430E-03
11	0.8810	1.9557E-09	992.81	3.1088E-03
12	1.0960	1.2317E-09	939.04	1.9583E-03
13	1.4110	7.4948E-10	858.31	1.1921E-03
14	1.7950	4.7215E-10	781.98	7.5107E-04
15	2.2240	3.1307E-10	719.52	4.9824E-04
16	2.8500	2.0848E-10	624.09	3.3188E-04
17	3.6000	1.3231E-10	572.53	2.1073E-04
18	4.4900	8.2992E-11	540.66	1.3211E-04
19	5.7000	4.9261E-11	514.32	7.8446E-05
20	7.1900	2.8505E-11	502.96	4.5386E-05

THE EARTH TECHNOLOGY CORP.

Job #:G86179
Client:UNOCAL
Location:MEDICINE LAKE HIGHLAND
File:MLHIGH8.DAT


APPARENT RESISTIVITY (ohm-m)
10^3
10^2
10^1
10^0
10^-5
10^-4
10^-3
10^-2
TIME (sec)
MODEL:
0
7000 ohm-m
128
300
930 ohm-m
600
900
931
100 ohm-m
DEPTH (m)
LOOP RADIUS= 100m
FIELD DATA
MODEL CURVE
THE EARTH TECHNOLOGY CORP.
UNOCAL GEOTHERMAL
MEDICINE LAKE HIGHLAND
APPARENT RESISTIVITY CURVE
SITE: LOOP54
JOB #G88179
Fig.

LOOP54

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		.0	.0		
7908.73	128.0	-128.0	-420.0	.0	.0
925.50	802.7	-930.7	-3053.5	.9	.9
161.23					

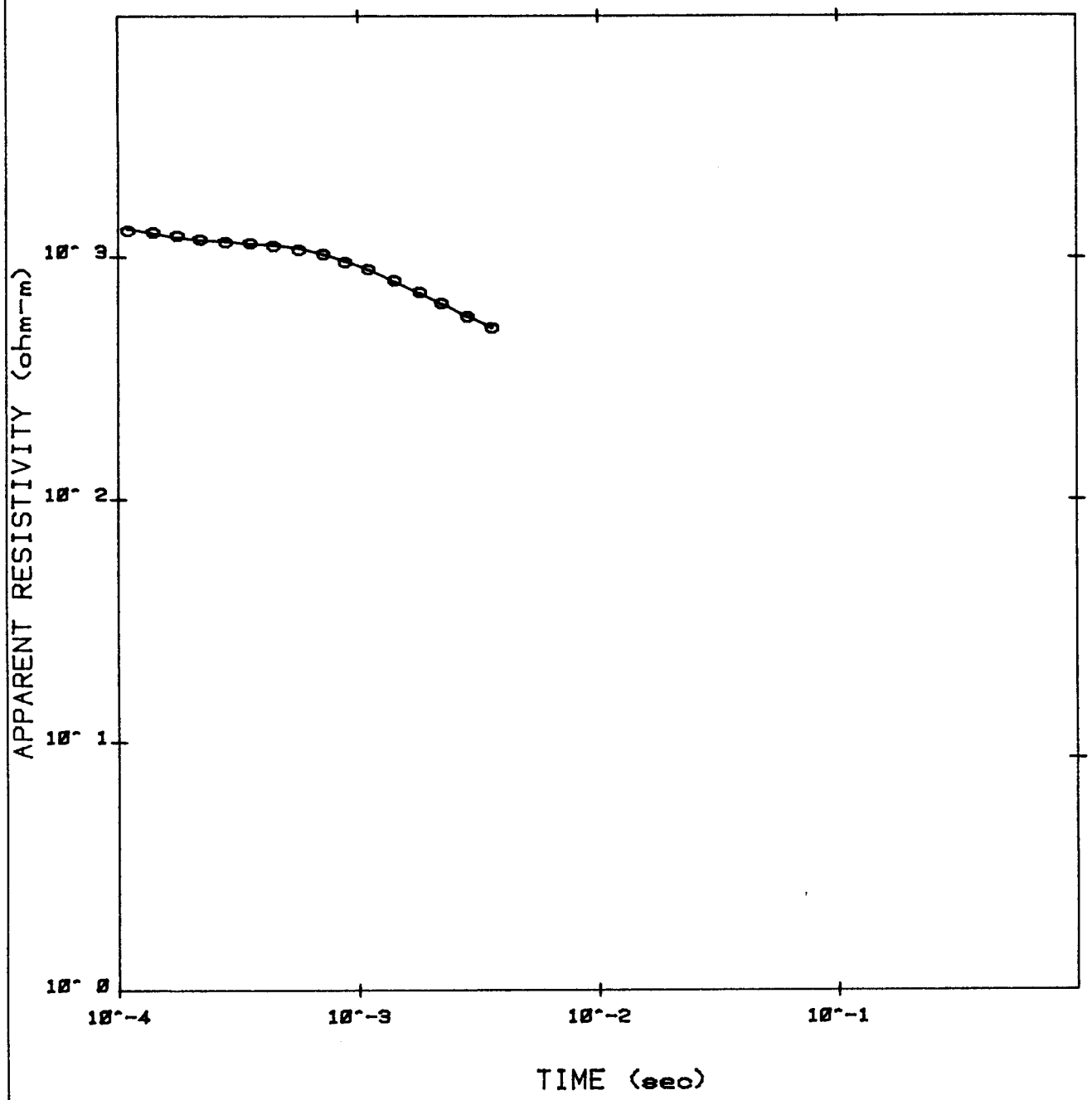
TIMES	DATA LATE	CALC LATE	% ERROR	DATA EARLY
8.90E-05	1.72E+03	1.75E+03	-1.630	4.18E-01
1.10E-04	1.67E+03	1.65E+03	+0.993	2.57E-01
1.40E-04	1.57E+03	1.55E+03	+1.573	1.54E-01
1.77E-04	1.47E+03	1.47E+03	-0.075	9.49E-02
2.20E-04	1.41E+03	1.42E+03	-0.589	5.86E-02
2.80E-04	1.36E+03	1.37E+03	-0.826	3.39E-02
3.55E-04	1.35E+03	1.35E+03	-0.308	1.89E-02
4.43E-04	1.34E+03	1.33E+03	+0.656	1.10E-02
5.64E-04	1.31E+03	1.31E+03	+0.434	6.22E-03
7.13E-04	1.28E+03	1.27E+03	+0.463	3.58E-03
8.81E-04	1.20E+03	1.21E+03	-1.310	2.33E-03
1.10E-03	1.12E+03	1.12E+03	-0.093	1.48E-03
1.41E-03	1.03E+03	1.03E+03	+0.598	9.03E-04
1.80E-03	9.10E+02	9.12E+02	-0.172	5.91E-04
2.22E-03	8.18E+02	8.19E+02	-0.101	4.10E-04

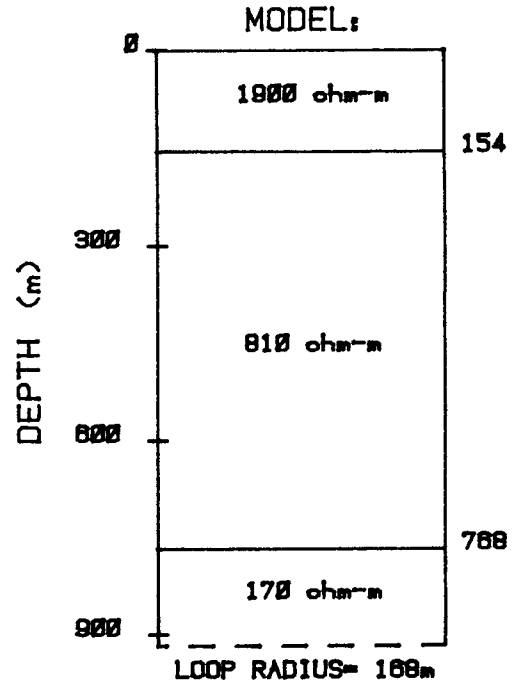
R: 168. X: 0. Y: 0. DL: 0. REQ: 0. CF: 1.0000
TDHZ ARRAY. 15 DATA POINTS, SYSTEM: NONE DATA: LOOP54
MEDICINE LAKE HIGHLAND
UNOCAL GEOTHERMAL 8-20-86
RMS LOG ERROR: 5.38E-03, ANTILOG YIELDS 1.2460 %
LATE TIME PARAMETERS

IGS: ARRTI

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	.99					
P 2	.00	1.00				
P 3	.00	.00	.99			
T 1	.00	.00	.00	1.00		
T 2	.00	.00	.00	.00	1.00	
F 0	.00	.00	.00	.00	.00	.00





o FIELD DATA

— MODEL CURVE

THE EARTH TECHNOLOGY CORP.

UNOCAL GEOTHERMAL

MEDICINE LAKE HIGHLAND

APPARENT RESISTIVITY CURVE

SITE: LOOP55

JOB #G88179 Fig.

LOOP55

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		.0	.0		
1872.87	154.2	-154.2	-506.0	.1	.1
805.74	613.6	-767.9	-2519.2	.8	.8
174.12					

TIMES	DATA LATE	CALC LATE	% ERROR	DATA EARLY
1.10E-04	1.28E+03	1.31E+03	-1.783	3.83E-01
1.40E-04	1.26E+03	1.25E+03	+0.930	2.15E-01
1.77E-04	1.22E+03	1.20E+03	+1.486	1.25E-01
2.20E-04	1.18E+03	1.17E+03	+1.122	7.66E-02
2.80E-04	1.15E+03	1.16E+03	-0.517	4.36E-02
3.55E-04	1.14E+03	1.13E+03	+0.188	2.44E-02
4.43E-04	1.11E+03	1.12E+03	-0.478	1.46E-02
5.64E-04	1.07E+03	1.09E+03	-1.011	8.43E-03
7.13E-04	1.03E+03	1.03E+03	+0.578	4.97E-03
8.81E-04	9.52E+02	9.63E+02	-1.114	3.29E-03
1.10E-03	8.90E+02	8.91E+02	-0.150	2.09E-03
1.41E-03	8.00E+02	7.94E+02	+0.793	1.32E-03
1.80E-03	7.18E+02	7.10E+02	+1.123	8.43E-04
2.22E-03	6.47E+02	6.43E+02	+0.605	5.83E-04
2.85E-03	5.69E+02	5.72E+02	-0.607	3.79E-04
3.60E-03	5.12E+02	5.16E+02	-0.719	2.47E-04

R: 168. X: 0. Y: 0. DL: 0. REQ: 0. CF: 1.0000
TDHZ ARRAY, 16 DATA POINTS, SYSTEM: NONE DATA: LOOP55
MEDICINE LAKE HIGHLAND
UNOCAL GEOTHERMAL 8-20-86
RMS LOG ERROR: 6.05E-03, ANTILOG YIELDS 1.4035 %
LATE TIME PARAMETERS

IGS: ARRTI

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	.99					
P 2	.00	1.00				
P 3	.00	.00	1.00			
T 1	.01	.00	.00	.99		
T 2	.00	.00	.00	.00	1.00	
F 0	.00	.00	.00	.00	.00	.00

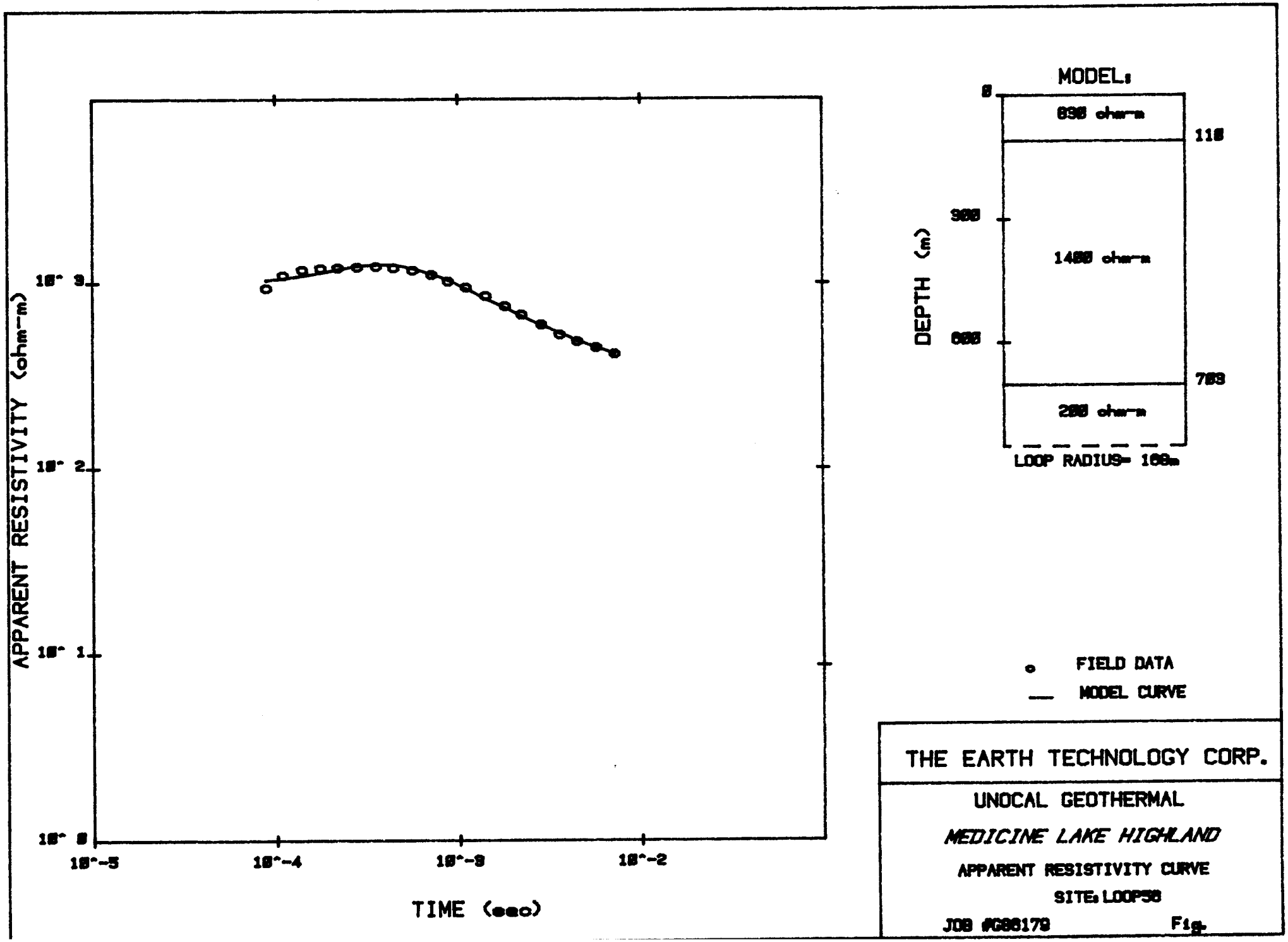
LINE: 0055
STA.: 0000

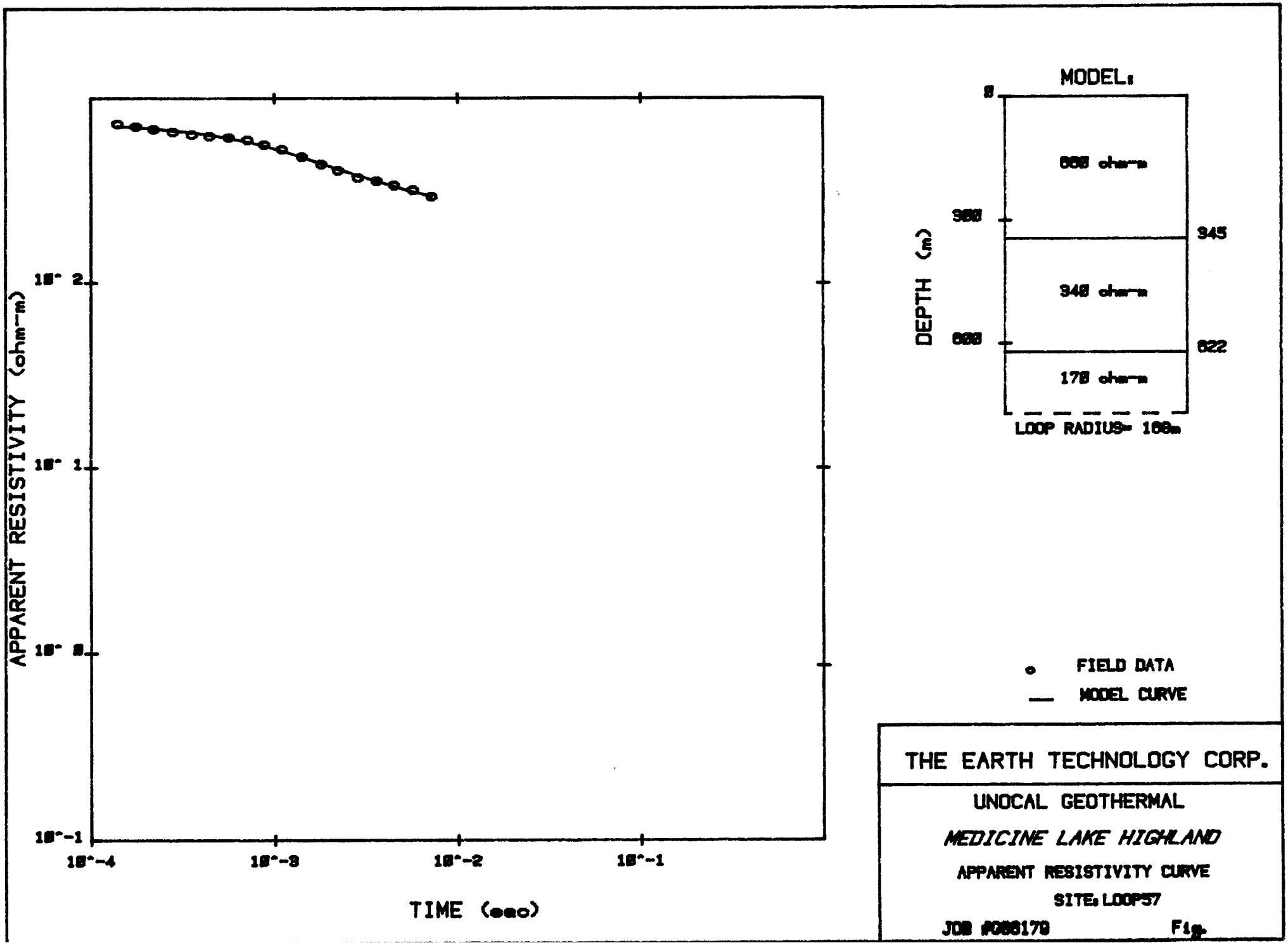
FREQUENCY = 30 hz
LOOP SIZE = 300 x 300 m
CURRENT = 20 amps
SPACING = 168 m

CH.	TIME(msec)	V(Volts/A-m^2)	RHOA-LATE	RHOA-EARLY
1	0.0890	4.3940E-07	1225.94	6.9676E-01
2	0.1100	2.4077E-07	1286.19	3.6189E-01
3	0.1400	1.3489E-07	1266.14	2.1398E-01
4	0.1770	7.9072E-08	1222.89	1.2546E-01
5	0.2200	4.7933E-08	1188.23	7.6073E-02
6	0.2800	2.7419E-08	1153.61	4.3529E-02
7	0.3550	1.5446E-08	1138.77	2.4528E-02
8	0.4430	9.1373E-09	1117.23	1.4514E-02
9	0.5640	5.2662E-09	1078.69	8.3672E-03
10	0.7130	3.1057E-09	1037.77	4.9358E-03
11	0.8810	2.0696E-09	956.04	3.2897E-03
12	1.0960	1.3275E-09	893.26	2.1107E-03
13	1.4110	8.2763E-10	803.38	1.3163E-03
14	1.7950	5.3335E-10	720.96	8.4859E-04
15	2.2240	3.6441E-10	650.24	5.7989E-04
16	2.8500	2.3796E-10	571.41	3.7875E-04
17	3.6000	1.5532E-10	514.49	2.4729E-04
18	4.4900	1.0372E-10	466.00	1.6527E-04
19	5.7000	6.2408E-11	439.28	9.9417E-05
20	7.1900	4.0390E-11	398.69	6.4617E-05

THE EARTH TECHNOLOGY CORP.

Job #:G86179
Client:UNOCAL
Location:MEDICINE LAKE HIGHLAND
File:MLHIGH8.DAT


APPARENT RESISTIVITY (ohm-m)
10^3
10^2
10^1
10^0
10^-5
10^-4
10^-3
10^-2
TIME (sec)
MODEL:
0
890 ohm-m
110
300
1400 ohm-m
DEPTH (m)
600
700
200 ohm-m
LOOP RADIUS= 100m
FIELD DATA
MODEL CURVE
THE EARTH TECHNOLOGY CORP.
UNOCAL GEOTHERMAL
MEDICINE LAKE HIGHLAND
APPARENT RESISTIVITY CURVE
SITE: LOOP58
JOB #C88179
Fig.


APPARENT RESISTIVITY (ohm-m)
10^2
10^1
10^0
10^-1
10^-4
10^-3
10^-2
10^-1
TIME (sec)
MODEL:
0
300
600
945
622
DEPTH (m)
340 ohm-m
170 ohm-m
LOOP RADIUS= 100m
FIELD DATA
MODEL CURVE
THE EARTH TECHNOLOGY CORP.
UNOCAL GEOTHERMAL
MEDICINE LAKE HIGHLAND
APPARENT RESISTIVITY CURVE
SITE: LOOP57
JOB #088170
Fig.

LOOP57

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		.0	.0		
655.23	345.0	-345.0	-1131.8	.5	.5
342.56	276.8	-621.8	-2040.1	.8	1.3
170.43					

TIMES	DATA LATE	CALC LATE	% ERROR	DATA EARLY
1.40E-04	7.22E+02	7.03E+02	+2.677	4.95E-01
1.77E-04	6.99E+02	6.93E+02	+0.877	2.89E-01
2.20E-04	6.75E+02	6.81E+02	-0.888	1.77E-01
2.80E-04	6.54E+02	6.66E+02	-1.758	1.02E-01
3.55E-04	6.32E+02	6.50E+02	-2.672	5.91E-02
4.43E-04	6.20E+02	6.30E+02	-1.597	3.49E-02
5.64E-04	6.09E+02	6.05E+02	+0.628	1.96E-02
7.13E-04	5.91E+02	5.77E+02	+2.458	1.14E-02
8.81E-04	5.55E+02	5.48E+02	+1.336	7.40E-03
1.10E-03	5.24E+02	5.15E+02	+1.856	4.63E-03
1.41E-03	4.78E+02	4.77E+02	+0.213	2.86E-03
1.80E-03	4.36E+02	4.40E+02	-0.990	1.78E-03
2.22E-03	4.04E+02	4.12E+02	-1.877	1.18E-03
2.85E-03	3.69E+02	3.79E+02	-2.740	7.25E-04
3.60E-03	3.54E+02	3.54E+02	+0.095	4.30E-04
4.49E-03	3.36E+02	3.32E+02	+0.928	2.68E-04
5.70E-03	3.17E+02	3.10E+02	+2.173	1.61E-04
7.19E-03	2.93E+02	2.94E+02	-0.410	1.01E-04

R: 168. X: 0. Y: 0. DL: 0. REQ: 0. CF: 1.0000
TDHZ ARRAY, 16 DATA POINTS, SYSTEM: NONE DATA: LOOP57
MEDICINE LAKE HIGHLAND
UNOCAL GEOTHERMAL 8-20-86
RMS LOG ERROR: 1.10E-02, ANTILOG YIELDS 2.5579 %
LATE TIME PARAMETERS

IGS: ARRT1

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	.95					
P 2	.00	.28				
P 3	-.02	-.03	.62			
T 1	.06	.38	.10	.58		
T 2	-.04	.07	.19	.17	.19	
F 0	.00	.00	.00	.00	.00	.00

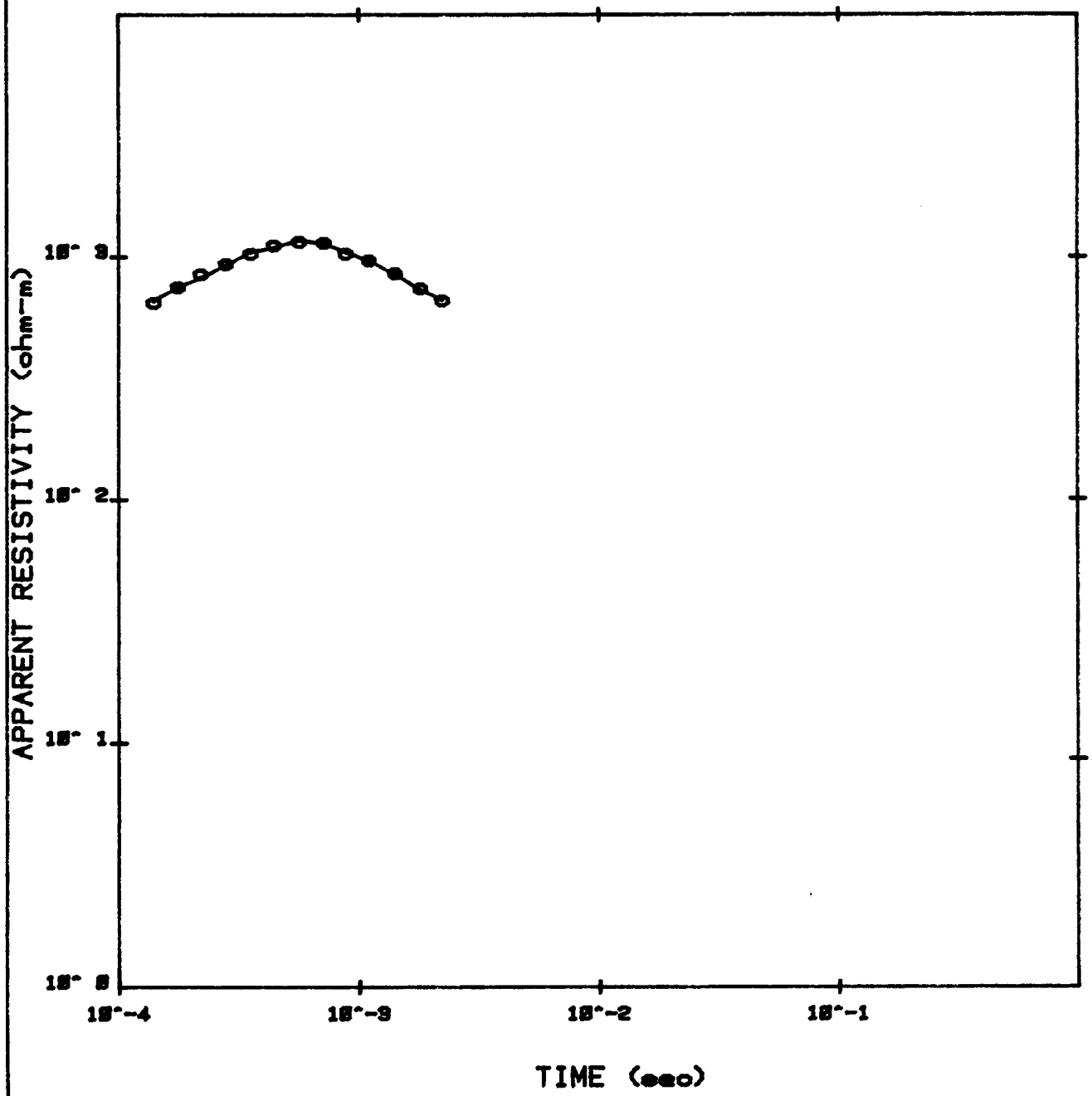
LINE: 0057
STA.: 0000

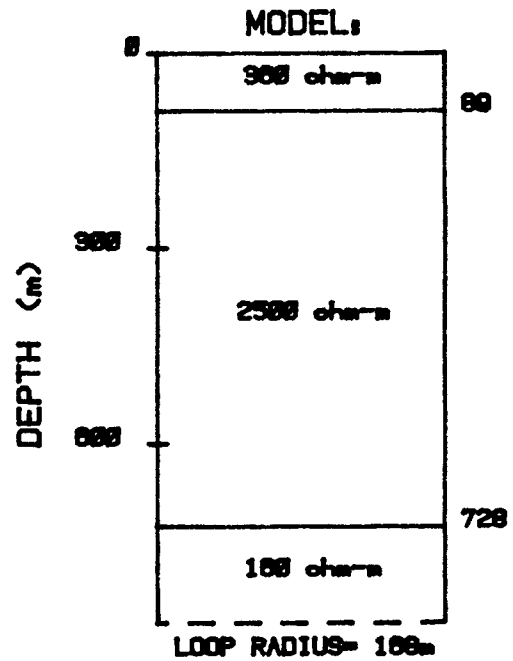
FREQUENCY = 30 hz
LOOP SIZE = 300 x 300 m
CURRENT = 21 amps
SPACING = 168 m

CH.	TIME(msec)	V(Volts/A-m^2)	RHOA-LATE	RHOA-EARLY
1	0.0890	1.1794E-06	634.74	1.8692E+00
2	0.1100	5.9245E-07	705.68	9.3916E-01
3	0.1400	3.1247E-07	723.23	4.9547E-01
4	0.1770	1.8221E-07	700.97	2.8894E-01
5	0.2200	1.1163E-07	676.30	1.7707E-01
6	0.2600	6.3922E-08	656.14	1.0148E-01
7	0.3550	3.7168E-08	634.16	5.8988E-02
8	0.4430	2.2029E-08	621.38	3.4971E-02
9	0.5640	1.2358E-08	610.83	1.9625E-02
10	0.7130	7.1855E-09	593.25	1.1413E-02
11	0.8810	4.6565E-09	556.79	7.3979E-03
12	1.0960	2.9364E-09	526.17	4.6663E-03
13	1.4110	1.7956E-09	479.37	2.8541E-03
14	1.7950	1.1277E-09	437.64	1.7930E-03
15	2.2240	7.3920E-10	405.78	1.1755E-03
16	2.8500	4.5549E-10	370.65	7.2448E-04
17	3.6000	2.7021E-10	355.68	4.3001E-04
18	4.4900	1.6860E-10	337.07	2.6833E-04
19	5.7000	1.0110E-10	318.47	1.6098E-04
20	7.1900	6.3528E-11	294.78	1.0127E-04

THE EARTH TECHNOLOGY CORP.

Job #:G86179
Client:UNOCAL
Location:MEDICINE LAKE HIGHLAND
File:MLHIGH8.DAT





o FIELD DATA

— MODEL CURVE

THE EARTH TECHNOLOGY CORP.

UNOCAL GEOTHERMAL

MEDICINE LAKE HIGHLAND

APPARENT RESISTIVITY CURVE

SITE: LOOP58

JOB #088179 Fig.

LOOP58

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		.0	.0		
361.66	88.7	-88.7	-291.2	.2	.2
2543.69	639.0	-727.7	-2387.5	.3	.5
163.31					

TIMES	DATA LATE	CALC LATE	% ERROR	DATA EARLY
1.40E-04	6.48E+02	6.64E+02	-2.330	5.83E-01
1.77E-04	7.52E+02	7.55E+02	-0.439	2.59E-01
2.20E-04	8.48E+02	8.25E+02	+2.821	1.26E-01
2.80E-04	9.34E+02	9.24E+02	+1.067	5.95E-02
3.55E-04	1.03E+03	1.05E+03	-1.908	2.84E-02
4.43E-04	1.11E+03	1.09E+03	+1.843	1.46E-02
5.64E-04	1.15E+03	1.17E+03	-1.589	7.56E-03
7.13E-04	1.14E+03	1.13E+03	+1.081	4.27E-03
8.81E-04	1.03E+03	1.05E+03	-1.332	2.93E-03
1.10E-03	9.68E+02	9.63E+02	+0.520	1.84E-03
1.41E-03	8.59E+02	8.54E+02	+0.588	1.19E-03
1.80E-03	7.44E+02	7.33E+02	+1.395	7.99E-04
2.22E-03	6.63E+02	6.71E+02	-1.308	5.62E-04

R: 168. X: 0. Y: 0. DL: 0. REQ: 0. CF: 1.0000
TDHZ ARRAY, 13 DATA POINTS, SYSTEM: NONE DATA: LOOP58
MEDICINE LAKE HIGHLAND
UNOCAL GEOTHERMAL
RMS LOG ERROR: 1.01E-02, ANTILOG YIELDS 2.3604 %
LATE TIME PARAMETERS

IGS: ARRTI

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	.97					
P 2	-.03	.62				
P 3	.01	-.13	.79			
T 1	-.05	-.15	-.02	.88		
T 2	.01	.07	.04	.03	.98	
F 0	.00	.00	.00	.00	.00	.00

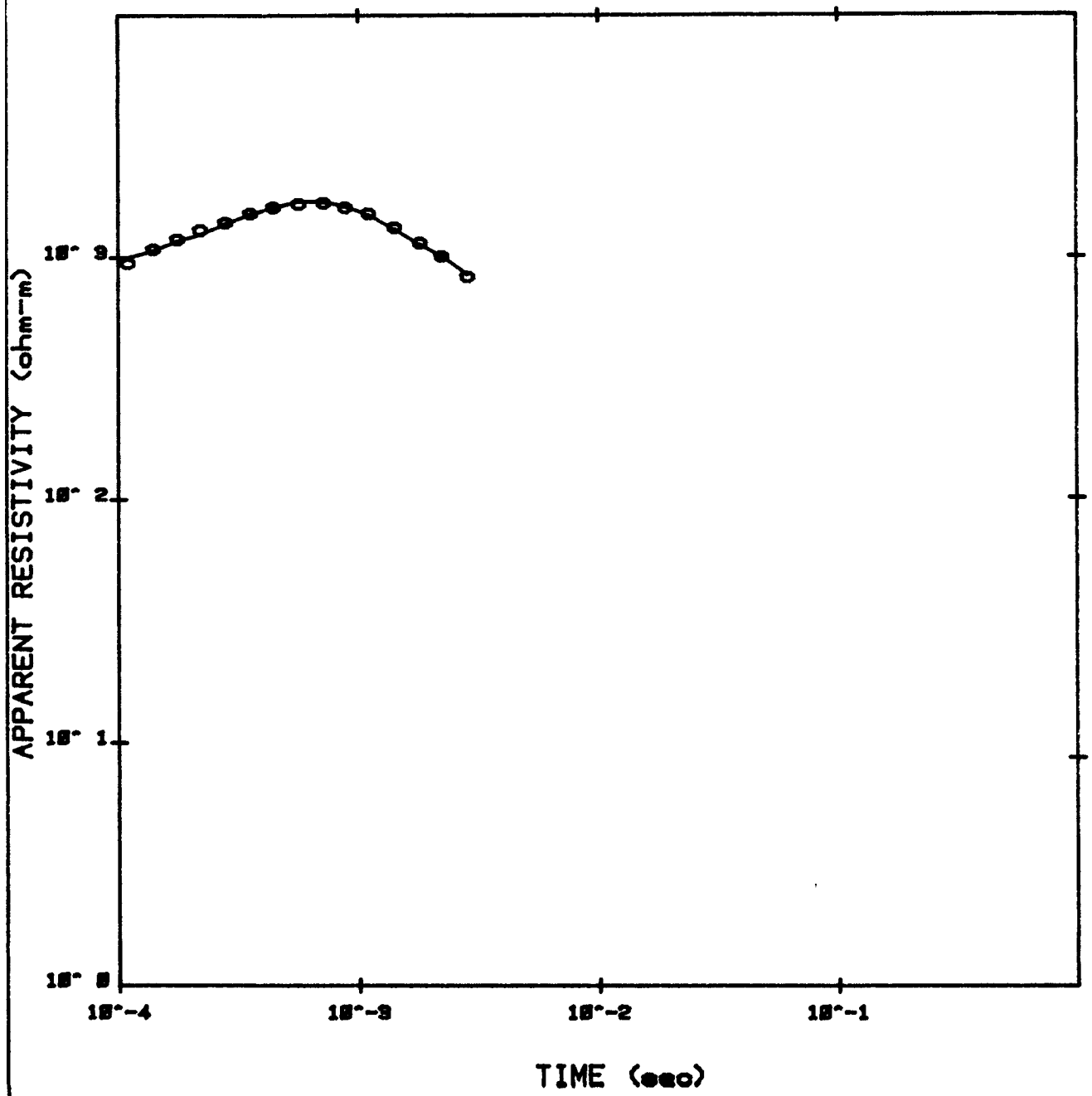
LINE: 0058
STA.: 0000

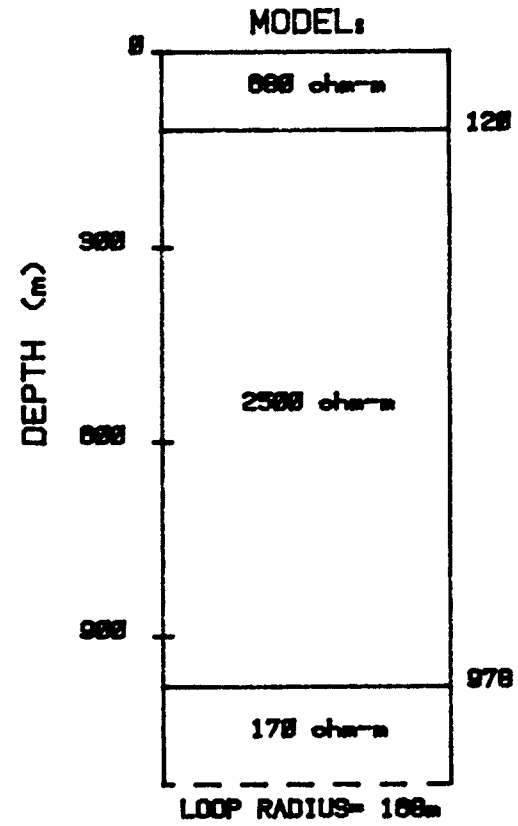
FREQUENCY = 30 hz
LOOP SIZE = 300 x 300 m
CURRENT = 20 amps
SPACING = 168 m

CH.	TIME(msec)	V(Volts/A-m^2)	RHOA-LATE	RHOA-EARLY
1	0.0890	1.9816E-06	449.12	3.1473E+00
2	0.1100	8.7259E-07	545.13	1.3850E+00
3	0.1400	3.6654E-07	650.23	5.8189E-01
4	0.1770	1.6323E-07	754.27	2.5923E-01
5	0.2200	7.9120E-08	850.74	1.2570E-01
6	0.2800	3.7452E-08	937.08	5.9515E-02
7	0.3550	1.7779E-08	1036.81	2.8262E-02
8	0.4430	9.2163E-09	1110.83	1.4658E-02
9	0.5640	4.7718E-09	1151.96	7.5945E-03
10	0.7130	2.6766E-09	1145.91	4.2641E-03
11	0.8810	1.8288E-09	1038.20	2.9096E-03
12	1.0960	1.1692E-09	972.17	1.8606E-03
13	1.4110	7.4206E-10	864.01	1.1822E-03
14	1.7950	5.0488E-10	747.82	8.0479E-04
15	2.2240	3.5113E-10	666.53	5.5989E-04
16	2.8500	2.5036E-10	552.38	3.9907E-04
17	3.6000	1.7952E-10	467.14	2.8638E-04
18	4.4900	1.2462E-10	412.30	1.9896E-04
19	5.7000	8.0036E-11	372.14	1.2757E-04
20	7.1900	5.5192E-11	323.76	8.7951E-05

THE EARTH TECHNOLOGY CORP.

Job #:G86179
Client:UNOCAL
Location:MEDICINE LAKE HIGHLAND
File:MLHIGH5.DAT





o FIELD DATA

— MODEL CURVE

THE EARTH TECHNOLOGY CORP.

UNOCAL GEOTHERMAL

MEDICINE LAKE HIGHLAND

APPARENT RESISTIVITY CURVE

SITE: LOOP50

JOB #G00170 Fig.

LOOP59

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		.0	.0		
676.87	120.4	-120.4	-395.0	.2	.2
2490.61	857.6	-978.0	-3208.8	.3	.5
166.82					

TIMES	DATA LATE	CALC LATE	% ERROR	DATA EARLY
1.10E-04	9.48E+02	1.00E+03	-5.321	6.02E-01
1.40E-04	1.08E+03	1.07E+03	+1.379	2.71E-01
1.77E-04	1.19E+03	1.17E+03	+1.762	1.30E-01
2.20E-04	1.30E+03	1.25E+03	+4.013	6.62E-02
2.80E-04	1.39E+03	1.38E+03	+0.972	3.28E-02
3.55E-04	1.52E+03	1.51E+03	+0.184	1.58E-02
4.43E-04	1.61E+03	1.61E+03	+0.064	8.35E-03
5.64E-04	1.66E+03	1.71E+03	-2.901	4.36E-03
7.13E-04	1.68E+03	1.70E+03	-0.887	2.38E-03
8.81E-04	1.61E+03	1.63E+03	-1.121	1.50E-03
1.10E-03	1.52E+03	1.50E+03	+1.277	9.37E-04
1.41E-03	1.33E+03	1.31E+03	+1.390	6.15E-04
1.80E-03	1.15E+03	1.13E+03	+1.786	4.16E-04
2.22E-03	1.01E+03	1.01E+03	+0.207	2.99E-04
2.85E-03	8.31E+02	8.52E+02	-2.417	2.15E-04

R: 168. X: 0. Y: 0. DL: 0. REQ: 0. CF: 1.0000
TDHZ ARRAY, 15 DATA POINTS, SYSTEM: NONE DATA: LOOP59
MEDICINE LAKE HIGHLAND
UNOCAL GEOTHERMAL 8-17-86
RMS LOG ERROR: 1.45E-02, ANTILOG YIELDS 3.4037 %
LATE TIME PARAMETERS

IGS: ARRTI

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	.93					
P 2	-.04	.90				
P 3	-.02	-.07	.81			
T 1	-.14	-.13	-.06	.71		
T 2	.02	.03	.03	.06	.98	
F 0	.00	.00	.00	.00	.00	.00

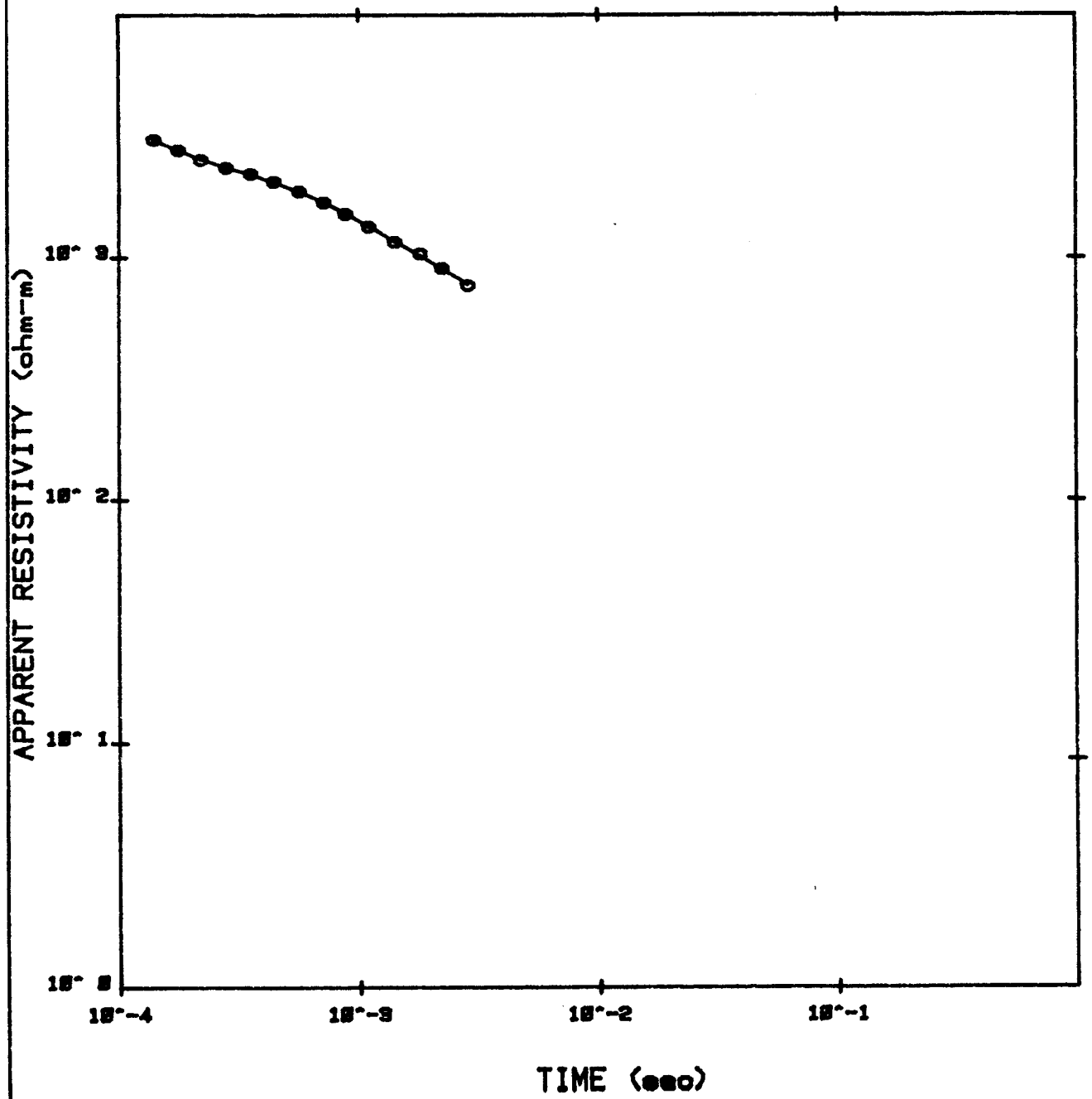
LINE: 0059
STA.: 0000

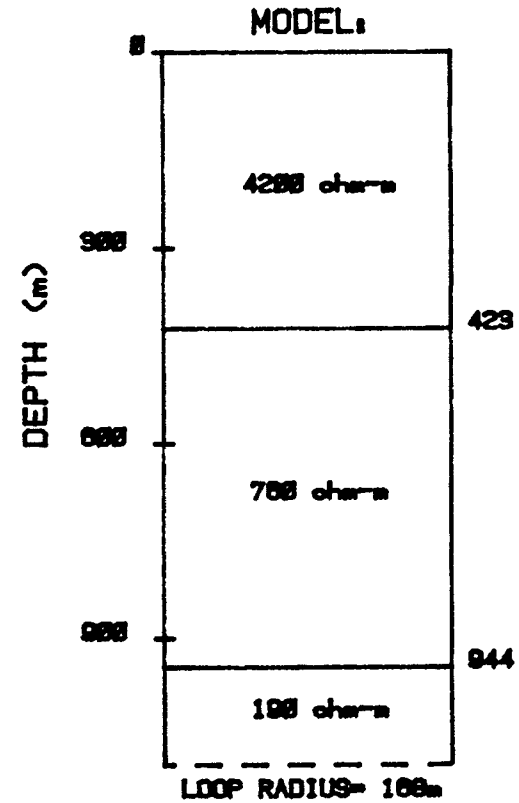
FREQUENCY = 30 hz
LOOP SIZE = 300 x 300 m
CURRENT = 21 amps
SPACING = 168 m

CH.	TIME(msec)	V(Volts/A-m^2)	RHOA-LATE	RHOA-EARLY
1	0.0890	7.9931E-07	822.68	1.2694E+00
2	0.1100	3.7894E-07	950.58	6.0141E-01
3	0.1400	1.6952E-07	1087.24	2.6906E-01
4	0.1770	8.1542E-08	1198.07	1.2946E-01
5	0.2200	4.1818E-08	1301.40	6.6421E-02
6	0.2800	2.0608E-08	1395.55	3.2736E-02
7	0.3550	1.0006E-08	1521.01	1.5901E-02
8	0.4430	5.2418E-09	1618.21	8.3345E-03
9	0.5640	2.7310E-09	1671.14	4.3420E-03
10	0.7130	1.4928E-09	1691.25	2.3746E-03
11	0.8810	9.4243E-10	1615.23	1.4997E-03
12	1.0960	5.9397E-10	1526.97	9.4541E-04
13	1.4110	3.8518E-10	1337.73	6.1367E-04
14	1.7950	2.6258E-10	1156.31	4.1805E-04
15	2.2240	1.8717E-10	1013.87	2.9827E-04
16	2.8500	1.3444E-10	836.11	2.1431E-04
17	3.6000	9.7627E-11	701.15	1.5568E-04
18	4.4900	7.0801E-11	601.07	1.1358E-04
19	5.7000	4.9292E-11	514.10	7.9501E-05
20	7.1900	3.1497E-11	470.58	5.0819E-05

THE EARTH TECHNOLOGY CORP.

Job #:G86179
Client:UNOCAL
Location:MEDICINE LAKE HIGHLAND
File:MLHIGH5.DAT





o FIELD DATA

— MODEL CURVE

THE EARTH TECHNOLOGY CORP.

UNOCAL GEOTHERMAL

MEDICINE LAKE HIGHLAND

APPARENT RESISTIVITY CURVE

SITE: LOOP00

JOB #000170 Fig.

LOOP60

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		.0	.0		
4220.42	422.7	-422.7	-1386.9	.1	.1
759.77	521.6	-944.3	-3098.1	.7	.8
185.23					

TIMES	DATA LATE	CALC LATE	% ERROR	DATA EARLY
1.40E-04	3.03E+03	3.02E+03	+0.344	5.76E-02
1.77E-04	2.75E+03	2.75E+03	-0.119	3.71E-02
2.20E-04	2.51E+03	2.53E+03	-0.810	2.47E-02
2.80E-04	2.33E+03	2.33E+03	-0.018	1.51E-02
3.55E-04	2.20E+03	2.19E+03	+0.479	9.09E-03
4.43E-04	2.04E+03	2.03E+03	+0.527	5.86E-03
5.64E-04	1.86E+03	1.86E+03	+0.195	3.68E-03
7.13E-04	1.68E+03	1.69E+03	-0.649	2.38E-03
8.81E-04	1.51E+03	1.52E+03	-0.785	1.65E-03
1.10E-03	1.34E+03	1.35E+03	-0.559	1.13E-03
1.41E-03	1.16E+03	1.17E+03	-0.505	7.56E-04
1.80E-03	1.04E+03	1.02E+03	+2.317	4.83E-04
2.22E-03	9.04E+02	8.98E+02	+0.659	3.53E-04
2.85E-03	7.70E+02	7.83E+02	-1.558	2.41E-04

R: 168. X: 0. Y: 0. DL: 0. REQ: 0. CF: 1.0000
TDHZ ARRAY, 14 DATA POINTS, SYSTEM: NONE DATA: LOOP60
MEDICINE LAKE HIGHLAND
UNOCAL GEOTHERMAL 8-16-86
RMS LOG ERROR: 5.80E-03, ANTILOG YIELDS 1.3442 %
LATE TIME PARAMETERS

IGS: ARRTI

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	.99					
P 2	.00	1.00				
P 3	.00	.00	1.00			
T 1	.01	.00	.00	1.00		
T 2	.00	.00	.00	.00	1.00	
F 0	.00	.00	.00	.00	.00	.00

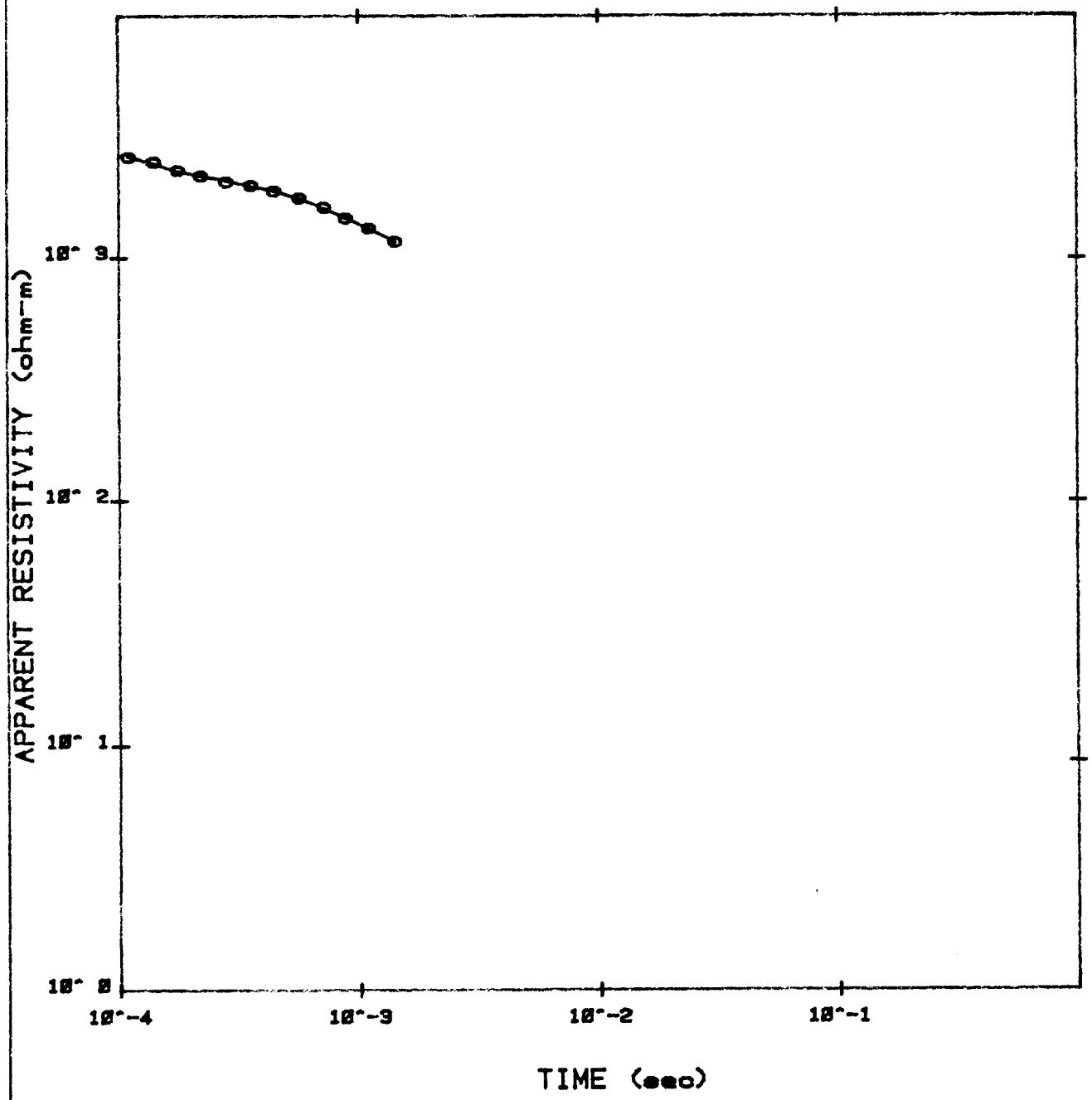
LINE: 0060
STA.: 0000

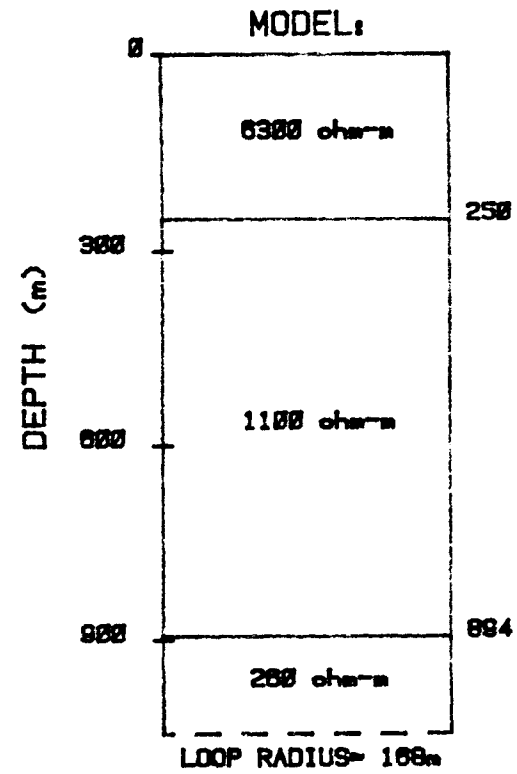
FREQUENCY = 30 hz
LOOP SIZE = 300 x 300 m
CURRENT = 20.5 amps
SPACING = 168 m

CH.	TIME(msec)	V(Volts/A-m^2)	RHOA-LATE	RHOA-EARLY
2	0.1100	6.4376E-08	3098.99	1.0225E-01
3	0.1400	3.6180E-08	3044.37	5.7488E-02
4	0.1770	2.3388E-08	2754.68	3.7147E-02
5	0.2200	1.5512E-08	2520.77	2.4642E-02
6	0.2800	9.5139E-09	2336.27	1.5123E-02
7	0.3550	5.7343E-09	2204.57	9.1168E-03
8	0.4430	3.6861E-09	2046.32	5.8647E-03
9	0.5640	2.3118E-09	1867.51	3.6775E-03
10	0.7130	1.4973E-09	1687.88	2.3817E-03
11	0.8810	1.0396E-09	1512.94	1.6549E-03
12	1.0960	7.1595E-10	1348.19	1.1390E-03
13	1.4110	4.7209E-10	1168.06	7.5111E-04
14	1.7950	3.0526E-10	1045.85	4.8572E-04
15	2.2240	2.2059E-10	908.68	3.5115E-04
16	2.8500	1.5093E-10	774.03	2.4026E-04
17	3.6000	9.7785E-11	700.39	1.5565E-04
18	4.4900	6.7466E-11	620.72	1.0741E-04
19	5.7000	4.3771E-11	556.47	6.9713E-05
20	7.1900	3.0617E-11	479.55	4.8782E-05

THE EARTH TECHNOLOGY CORP.

Job #:686179
Client:UNOCAL
Location:MEDICINE LAKE HIGHLAND
File:MLHIGH4.DAT





o FIELD DATA

— MODEL CURVE

THE EARTH TECHNOLOGY CORP.

UNOCAL GEOTHERMAL

MEDICINE LAKE HIGHLAND

APPARENT RESISTIVITY CURVE

SITE: LOOP 61

JOB #G88179 Fig.

LOOP61

MODEL: 3 LAYERS

RESISTIVITY (OHM-M)	THICKNESS (M)	ELEVATION (M)	ELEVATION (FEET)	CONDUCTANCE (S) LAYER	CONDUCTANCE (S) TOTAL
		.0	.0		
6275.26	249.9	-249.9	-820.0	.0	.0
1080.02	644.3	-894.3	-2934.0	.6	.6
260.29					

TIMES	DATA LATE	CALC LATE	% ERROR	DATA EARLY
1.10E-04	2.61E+03	2.64E+03	-1.308	1.32E-01
1.40E-04	2.49E+03	2.45E+03	+1.605	7.73E-02
1.77E-04	2.30E+03	2.28E+03	+0.735	4.85E-02
2.20E-04	2.18E+03	2.19E+03	-0.225	3.05E-02
2.80E-04	2.06E+03	2.09E+03	-1.261	1.82E-02
3.55E-04	1.99E+03	1.98E+03	+0.609	1.06E-02
4.43E-04	1.89E+03	1.90E+03	-0.499	6.57E-03
5.64E-04	1.77E+03	1.76E+03	+0.290	3.96E-03
7.13E-04	1.62E+03	1.61E+03	+0.824	2.52E-03
8.81E-04	1.46E+03	1.47E+03	-0.671	1.73E-03
1.10E-03	1.33E+03	1.33E+03	-0.018	1.14E-03
1.41E-03	1.17E+03	1.17E+03	-0.060	7.46E-04

R: 168. X: 0. Y: 0. DL: 0. REQ: 0. CF: 1.0000
TDHZ ARRAY, 12 DATA POINTS, SYSTEM: NONE DATA: LOOP61
MEDICINE LAKE HIGHLAND
UNOCAL GEOTHERMAL 8-16-86
RMS LOG ERROR: 5.42E-03, ANTILOG YIELDS 1.2552 %
LATE TIME PARAMETERS

IGS: ARRTI

PARAMETER RESOLUTION MATRIX:
"F" MEANS FIXED PARAMETER

	P 1	P 2	P 3	T 1	T 2	F 0
P 1	.99					
P 2	.00	1.00				
P 3	.00	.00	.99			
T 1	.00	.00	.00	1.00		
T 2	.00	.00	.00	.00	1.00	
F 0	.00	.00	.00	.00	.00	.00

LINE: 0061
STA.: 0000

FREQUENCY = 30 hz
LOOP SIZE = 300 x 300 m
CURRENT = 21 amps
SPACING = 168 m

CH.	TIME(msec)	V(Volts/A-m^2)	RHOA-LATE	RHOA-EARLY
2	0.1100	8.3063E-08	2614.76	1.3191E-01
3	0.1400	4.8655E-08	2498.76	7.7261E-02
4	0.1770	3.0487E-08	2308.50	4.8412E-02
5	0.2200	1.9176E-08	2188.51	3.0462E-02
6	0.2800	1.1421E-08	2068.33	1.8148E-02
7	0.3550	6.6268E-09	2001.89	1.0534E-02
8	0.4430	4.1371E-09	1894.76	6.5744E-03
9	0.5640	2.4931E-09	1775.82	3.9629E-03
10	0.7130	1.5766E-09	1630.78	2.5066E-03
11	0.8810	1.0880E-09	1467.75	1.7301E-03
12	1.0960	7.2584E-10	1335.92	1.1545E-03
13	1.4110	4.6966E-10	1172.08	7.4730E-04
14	1.7950	3.2968E-10	993.56	5.2461E-04
15	2.2240	2.2639E-10	893.10	3.6048E-04
16	2.8500	1.6113E-10	741.02	2.5648E-04
17	3.6000	1.0643E-10	661.94	1.6959E-04
18	4.4900	7.5301E-11	576.87	1.2015E-04
19	5.7000	4.5046E-11	545.92	7.1903E-05
20	7.1900	2.5328E-11	544.18	4.0362E-05

THE EARTH TECHNOLOGY CORP.

Job #:G86179
Client:UNOCAL
Location:MEDICINE LAKE HIGHLAND
File:MLHIGH4.DAT

1986 Data
"M" series

TABLE 3-1

SUMMARY OF SOLUTIONS

Site #	# Layers	Resistivities (ohm-m)				Thicknesses (m)		
		ρ_1	ρ_2	ρ_3	ρ_4	h_1	h_2	h_3
1	1	602						
2	2	1149	257			630		
3	3	384	1045	79		96	976	
4	4	329	2017	371	77	89	300	491
5	4	7013	150	573	46	273	210	31
6	3	3354	259	56		290	517	
7	4	413	33	[redacted]	[redacted]	190	116	174
8	4	1446	130	[redacted]	[redacted]	124	123	105
9	3	412	32	[redacted]		149	52	
A 10	3	1192	83	[redacted]		173	129	
11	3	321	[redacted]	[redacted]		211	389	
12	3	423	[redacted]	[redacted]		196	409	
13	4	866	149	807	46	125	234	217
14	4	807	339	791	51	173	212	215
15	3	506	39	[redacted]		218	167	
16	3	1695	790	141		433	321	
17	3	1588	696	114		518	340	
18	3	1751	467	205		332	239	
19	3	4472	966	54		138	483	
20	3	3434	1250	52		84	587	
21	3	542	48	[redacted]		261	143	
22	3	595	[redacted]	[redacted]		298	101	
A 23	3	650	54	[redacted]		210	59	
24	3	936	[redacted]	[redacted]		334	83	
25	3	799	[redacted]	[redacted]		369	157	
26	4	315	421	112	[redacted]	119	135	136
27	3	541	55	[redacted]		202	179	
28	3	1418	231	67		373	236	
29	3	5864	414	95		198	396	
30	2	816	97			626		
31	3	654	1700	226		122	669	
32	3	680	217	42		417	263	
33	3	293	6377	326		75	636	
34	3	870	71	[redacted]		393	245	
35	2	2033	91			517		
36	2	1970	149			469		
37	2	1287	115			412		
38	3	4904	277	44		259	228	

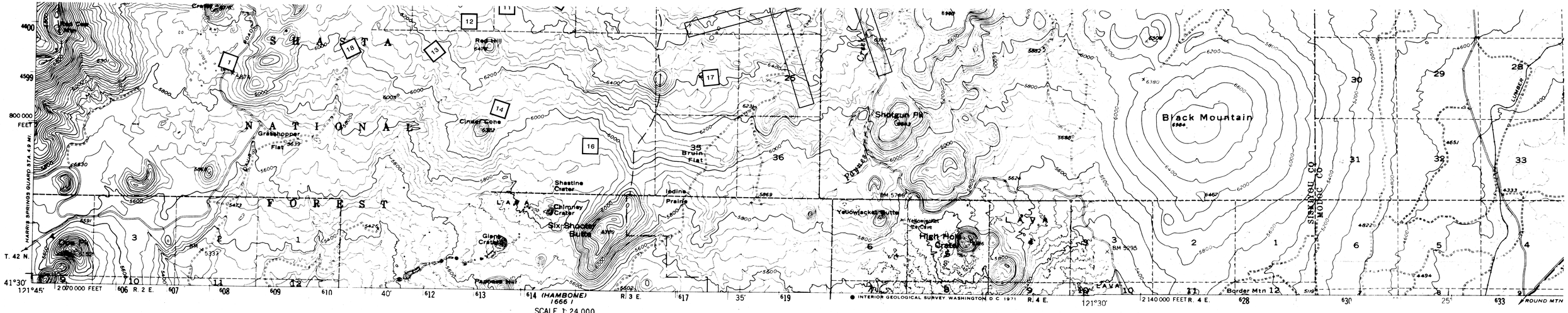
TABLE 3-1

SUMMARY OF SOLUTIONS

(Continued)

Site #	# Layers	Resistivities (ohm-m)				Thicknesses (m)		
		ρ_1	ρ_2	ρ_3	ρ_4	h_1	h_2	h_3
39	3	2405	253	51		533	214	
40	3	1931	516	155		373	141	
41	3	1100	41	[redacted]		244	85	
42	3	727	42	[redacted]		355	168	
43	3	1367	269	72		406	255	
44	3	874	201	111		328	333	
45	2	1525	308			359		
46	3	2368	290	48		467	260	
47	2	1919	210			528		
48	3	1656	320	136		427	312	
49	3	1481	258	101		535	443	
50	2	1016	117			524		
51	3	3289	568	98		80	347	
52	2	1193	190			601		
53	3	1550	594	216		354	532	
54	3	7909	926	181		128	803	
55	3	1873	806	174		154	614	
56	3	829	1377	203		110	593	
57	3	655	343	170		345	277	
58	3	362	2544	163		89	639	
59	3	277	2491	167		120	858	
60	3	4220	760	185		423	522	
61	3	6275	1080	260		250	644	

Little Sand Butte
BM 4359
Cougar Butte
Lookout Butte
Fourmile Hill
Indian Butte
Gravel Pits
Mt Hoffman
Glass Mtn
Glass Mountain
Glass Flow
Hot Spot
Pumice Mine
Red Shale Butte
Medicine Lake Glass Flow
Arnica Sink
Badger Pk
Grouse Hill
Schonchin Spring
Little Medicine Lake
Guard Sta
Medicine Lake
Bromwell Meadow
Crystal Spr
Medicine Mtn
Mt Hoffman
Little Glass Mountain
Pumice Stone Well
Pumice Stone Mtn
Paint Pot Crater
Telephone Flat
Bullseye Lake
Payne Springs
Undertakers Camp
LINE 1 (1985)
LINE 2 (1985)
LINE 3 (1985)
LINE 4 (1985)
LINE 5 (1985)
LINE 6 (1985)
Red Hill
Cinder Cone
Grasshopper Flat
Shotgun Pk
Bruin Flat
Iodine Prairie
Shastine Crater
Chimney Crater
Six-Shooter Butte
Glass Crater
Yellowjacket Butte
Yellowjacket Ice Cave
High Hole Crater
Black Mountain
Old Camp One
VABM 4712
Water Tank
NATIONAL FOREST BOUNDARY
SISKIYOU CO
MODOC CO
SHASTA NATIONAL FOREST
KLAMATH NATIONAL
MODOC
LAVA
Duck Well
T. 44 N.
T. 43 N.
800 000 FEET
TENNANT 14 MI.
1667 III (BRAY)
HARRIS SPRINGS GUARD STA 4.9 MI.



SCALE 1: 24,000

1 ½ 0 1 2 3 4 MILES

3000 0 3000 6000 9000 12000 15000 18000 21000 FEET

1 .5 0 1 2 3 4 5 KILOMETERS

CONTOUR INTERVAL 40 FEET
DATUM IS MEAN SEA LEVEL

LINE 00 — 1985 TEM Survey Lines

00 — 1986 TEM Loop Survey Locations

N

The Earth Technology Corporation

PROJECT NO.: G86179
UNOCAL GEOTHERMAL DIV.

TEM SOUNDING LOCATION MAP

Medicine Lake Highland TEM Survey

FIGURE 1-1

APPENDIX H:
Transient electromagnetic depth sounding test survey at Glass Mountain - Medicine Lake, Northern California; Report #8246 Prepared for: Occidental Geothermal, Inc. Bakersfield, CA

Attachment VII

CEC-500-2007-XXX-ATVII

Transient electromagnetic depth sounding test survey at Glass Mountain - Medicine Lake, Northern California; Report #8246 Prepared for: Occidental Geothermal, Inc. Bakersfield, CA.

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GM 38.01

B.2.d.2

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GEOTHERMAL
EXPLORATION

TRANSIENT ELECTROMAGNETIC DEPTH SOUNDING TEST SURVEY AT GLASS MOUNTAIN - MEDICINE LAKE NORTHERN CALIFORNIA, 1982

Report #8246

Prepared for:

Occidental Geothermal, Inc.
Bakersfield, Calfiornia

August 1982

ELECTROMAGNETIC SURVEYS, INC.
2161 Shattuck Avenue, Suite 303
Berkeley, California 94704
(415) 845-8745

TRANSIENT ELECTROMAGNETIC DEPTH SOUNDING
TEST SURVEY AT GLASS MOUNTAIN - MEDICINE LAKE
NORTHERN CALIFORNIA, 1982

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SUMMARY

A transient electromagnetic (TEM) depth sounding demonstration survey was carried out over the Glass Mountain volcanic glass flow near Medicine Lake in Northern California, for Occidental Geothermal, Inc. Because access to this area is impossible in the summer months, the survey was conducted during the winter when equipment and personnel could be transported by snowmobiles.

The TEM equipment used was the Geonics EM37, capable of transmitting 20A into loop sizes up to 500 m square. Three transmitter locations were set up and measurements made both inside and outside the loop. In-loop soundings, and others located close enough to the transmitter to be classed as near-zone, were interpreted using two-layer master curves.

The most favorable geothermal target was interpreted to be located under loop position 2 northwest of Red Shale Butte where a conductor of one ohm-m resistivity was detected at a depth of 130 m.

It is recommended that in-loop soundings be used in preference to separated-loop soundings in future surveys for ease of interpretation and optimum lateral resolution.

INTRODUCTION

A transient electromagnetic (TEM) depth sounding test survey was carried out in the Glass Mountain - Medicine Lake area of Northern California, 50 miles south of Klamath Falls, Oregon for Occidental Geothermal, Inc.

The objective of the survey was to investigate the application of the TEM method for depth sounding in this environment, and, in particular, to evaluate the use of the Geonics EM37 system. In theory, central TEM sounding (also known as in-loop and near-zone sounding) is superior to all other electrical and electromagnetic sounding techniques in that it is relatively insensitive to lateral changes in resistivity away from the loop.

The Medicine Lake - Glass Mountain geothermal field is characterized by a surface layer of highly resistive volcanic glass up to 500 m thick which overlies the deeper conductive potential geothermal reservoir. Much of the area is impassable most of the year because of sharp volcanic glass outcrops and scree slopes. For this reason it was decided to conduct the survey during the winter months when the area would be deeply covered by snow and accessible by snowmobiles.

The survey was conducted from April 29 to May 7, 1982. Three transmitter loops were laid out and 51 receiver stations, measuring two components each, were occupied during seven working days.

EMSurveys personnel involved in the survey were R. H. MacLeod (Crew Chief), and H. Patsch and J. Law (Field Operators). The crew was assisted by J. Arestad and D. Goodwin of Occidental Geothermal, Inc.

EQUIPMENT AND FIELD PROCEDURE

A standard Geonics EM37 system was used for this survey. Detailed specifications of the system can be found in Appendix 1. This system can be operated in either high frequency mode, enabling sample times from 0.09 ms to 7.2 ms to be measured, or in low frequency mode in which the sample times are a factor of ten greater. Because of very high surface resistivities, measurements were normally taken using the high frequency mode. At two sites these were supplemented with additional low frequency measurements.

The equipment was loaded onto sleds and snowmobiles at the snow line each morning and towed to the survey sites. This was often a slow, difficult task as continually melting snow required frequent detours over gravel, logs and stumps.

The transmitter loop consisted of a single turn of wire, 400 m square. The transmitted current was on the order of 15 to 20 amps, and the turnoff ramp-time was 290 μs. Due to time considerations, the number of transmitter sites was limited to three.

Up to eighteen receiver sites were occupied with each transmitter loop (Figure 1). These sites were located on convenient trails at various distances up to several kilometers from the transmit loop. Both vertical and radial components were measured at each site. The vertical component results are used

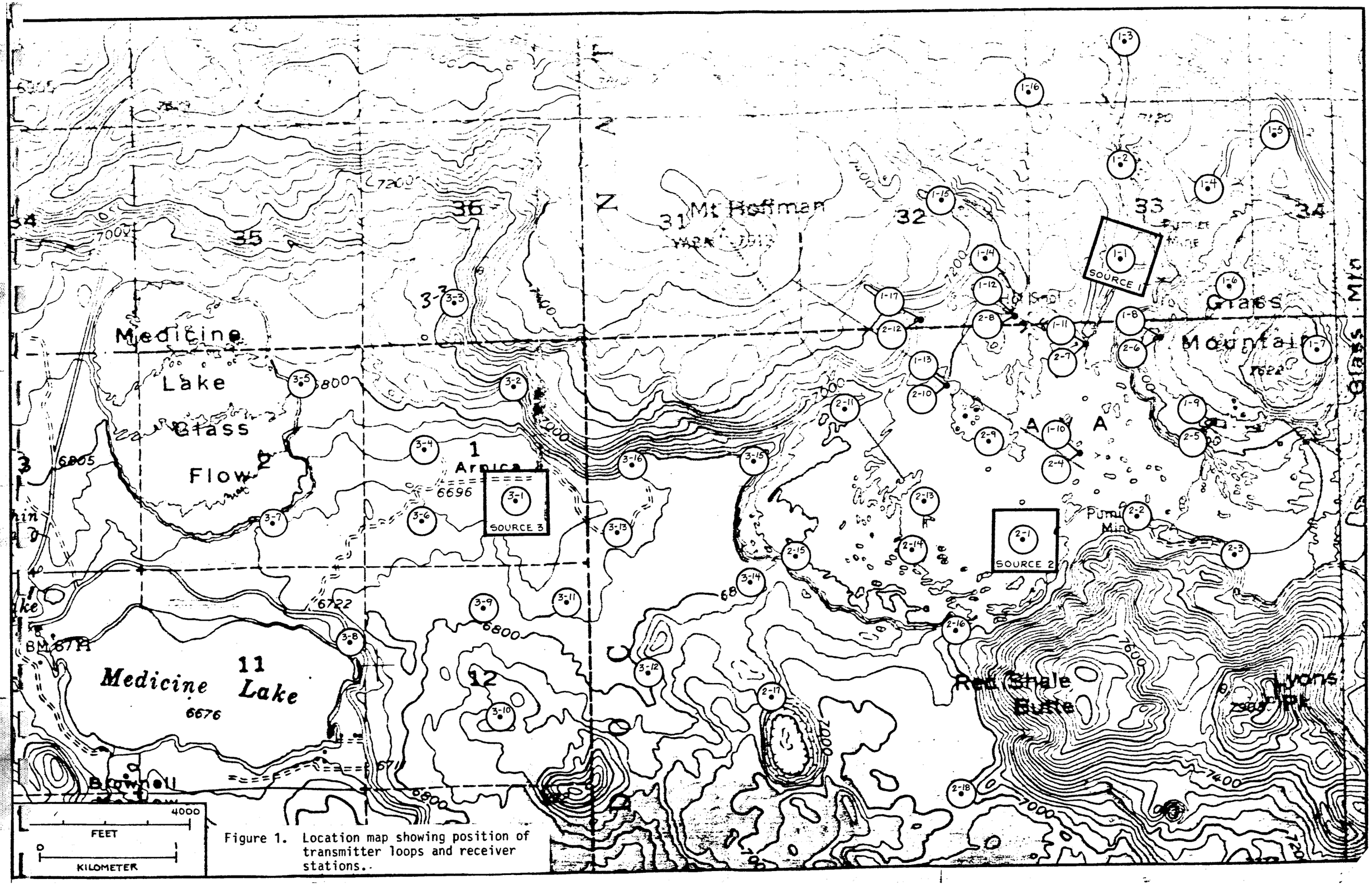


Figure 1. Location map showing position of transmitter loops and receiver stations.

for interpretation in this report, as relevant interpretation techniques were readily available. The soundings are designated by the code Sounding X-YY, where X is the transmitter loop number, and YY is the receiver position number.

DATA REDUCTION AND APPARENT RESISTIVITY FORMULATION

The data were normalized for transmitter current, receiver gain and dipole moment, yielding values of received voltage in units of $\mu V/Am^2$.

Where appropriate, these data were converted to late time apparent resistivity values, using the expression

$$\rho_a^L = \frac{6.29 \times 10^{-12}}{t^{5/3}} \frac{A^{2/3}}{V_z^{2/3}}$$

where A = transmitter loop area (m^2),

t = sample time (s), and

V_z = emf induced in vertical axis receiver coil of unit dipole moment (V).

The late time formulation was used purely as a convenient normalization factor. This is the conventional formula used in much of the literature for "near-zone" soundings, for it avoids ambiguities in two-loop systems (see Appendix III). In many situations this formula is a close approximation of the true apparent resistivity.

In Appendix II the basic theory of the TEM method is described. Appendix III discusses the coincident-loop and separated-loop responses of a homogeneous halfspace. At the late stage, which corresponds to near-zone sounding, changes in loop separation (L) have little effect. The late stage is characterized by values of normalized time, $T = t/\sigma\mu L^2$ greater

than about unity. For a two-loop system this corresponds to loop separations which are less than the depth of investigation so that both source and receiver can, to a first approximation, be treated as coincident dipoles.

For the TEM survey described in this report, sites with TEM decay curves of conventional positive sign (usually for separations less than 1 km) were interpreted using the coincident-loop two-layer master curves of Raiche and Spies (Geophysics, v. 46, p. 53-64, 1981) which are described in Appendix IV. For this purpose the loop configuration was assumed to be a coincident 12 m radius transmitter-receiver loop with a dipole moment equivalent to that in the configuration used in the survey. It should be noted that any dipolar loop size would have resulted in the same interpretation.

The master curves assume true values of apparent conductivity (or resistivity). Over the time range measured in this survey, the late stage asymptotic approximation is valid since we are in the late stage, or dipolar field, region. Typically, values of normalized time T range from 0.6 at early times to greater than 2.0 at late times.

For separations greater than the depth of investigation (far-zone sounding) the transient is of negative sign. From the discussion of the two-loop halfspace response given in Appendix III it can be seen that this situation occurs when the equivalent current filament is still moving towards the receiver loop from the transmitter. At these times the "early time" asymptotic formula for apparent resistivity is often used:

$$\rho_a^E = 4.4 \times 10^{-6} \; V_z \; L^5 ,$$

where the symbols are as described earlier. Note that in the early stage the apparent resistivity is independent of time and is directly proportional to voltage.

RESULTS

Noise Levels

Measurements were made from the earliest EM37 time channel (0.09 ms) to between 6 and 10 ms, where the signal disappeared into noise. The noise level was usually very low, on the order of 8×10^{-4} $\mu V/Am^2$ (equivalent to an accuracy of 0.5 mV on the EM37 using a gain of 7).

This value effectively defines the late time limit of measurement as shown by the graph of detection limits in Figure 2; the lower the resistivity, the later in time it is possible to measure.

Field Results

The field data are presented as graphs of normalized voltage versus time in Figures 3 to 52. Positive voltage curves are solid; dashed lines denote negative values. The curves can be subdivided into four categories, which can be understood by the "smoke ring" concept explained in Appendix III.

(i) Positive sign, monotonically decreasing with time. This is standard "near-zone" or late time behavior. The equivalent current filament has passed under the receiver.

(ii) Negative sign, monotonically decreasing in amplitude with time. This is "far-zone", early time behavior. The equivalent current filament has not yet reached the receiver location.

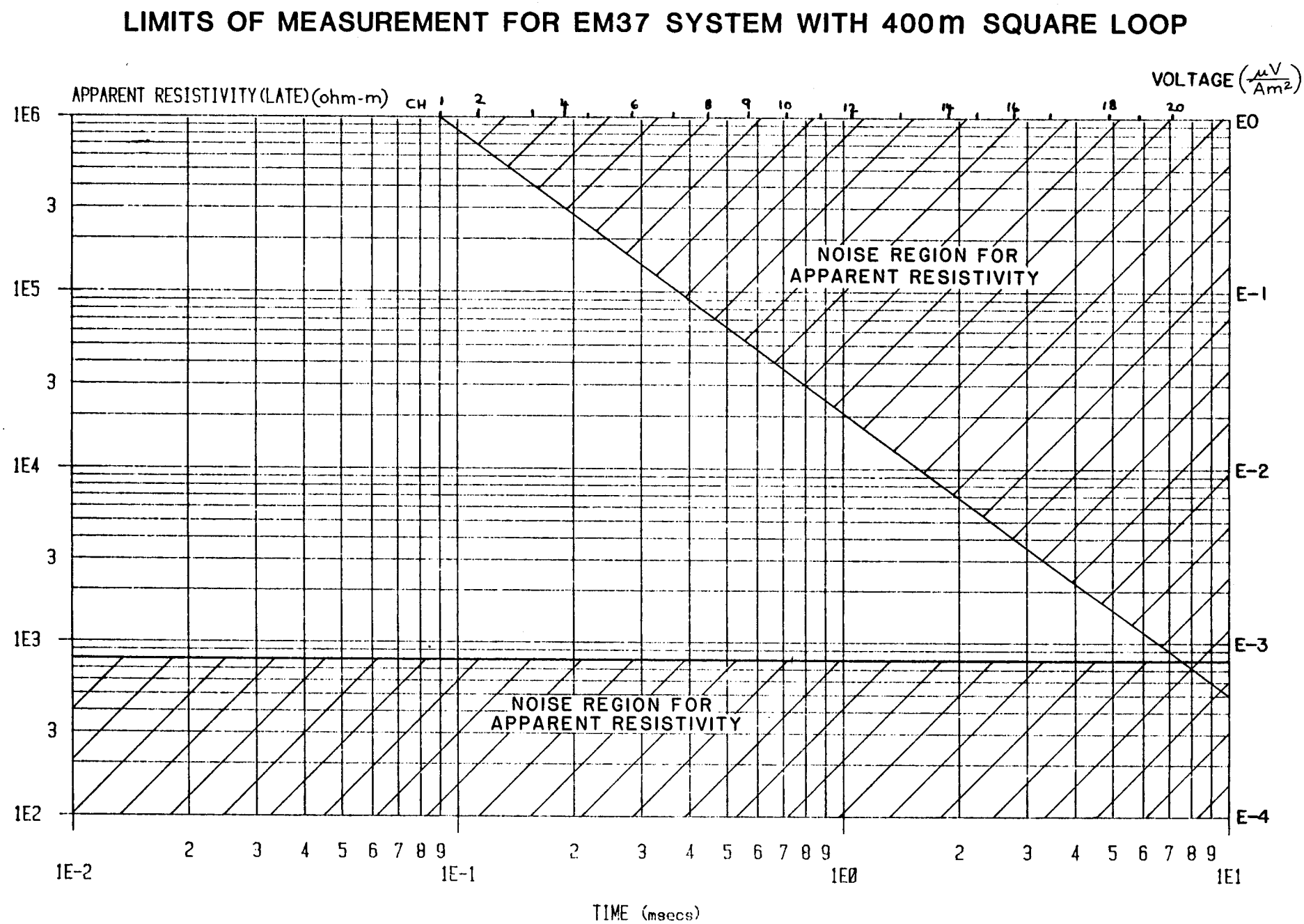


Figure 2. Graph showing measurement and noise ranges for Geonics EM37 system using 400 m square transmitter loop.

TEM SOUNDING

Station 1-1 Z Component

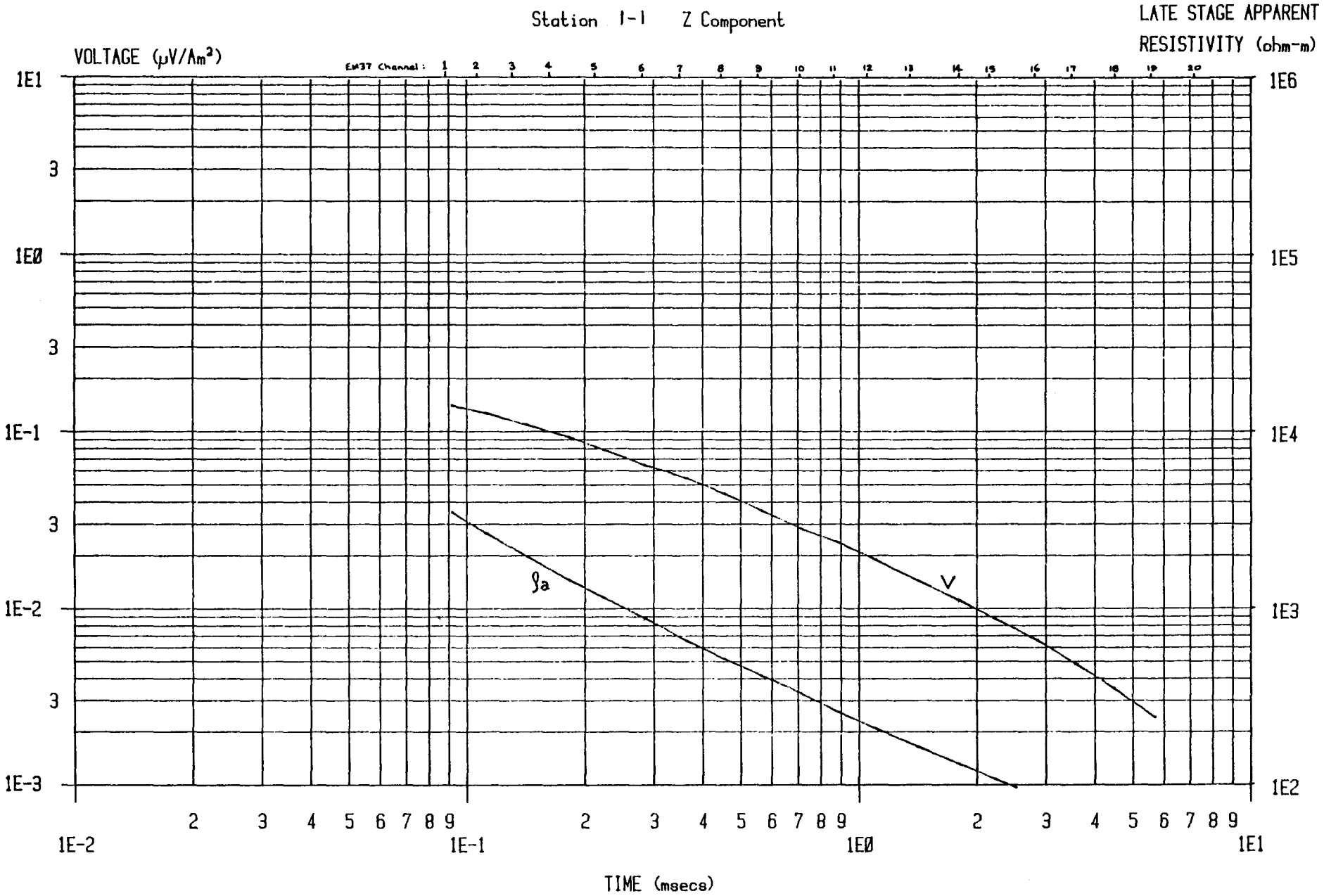


Figure 3

TEM SOUNDING

Station 1-2 Z Component

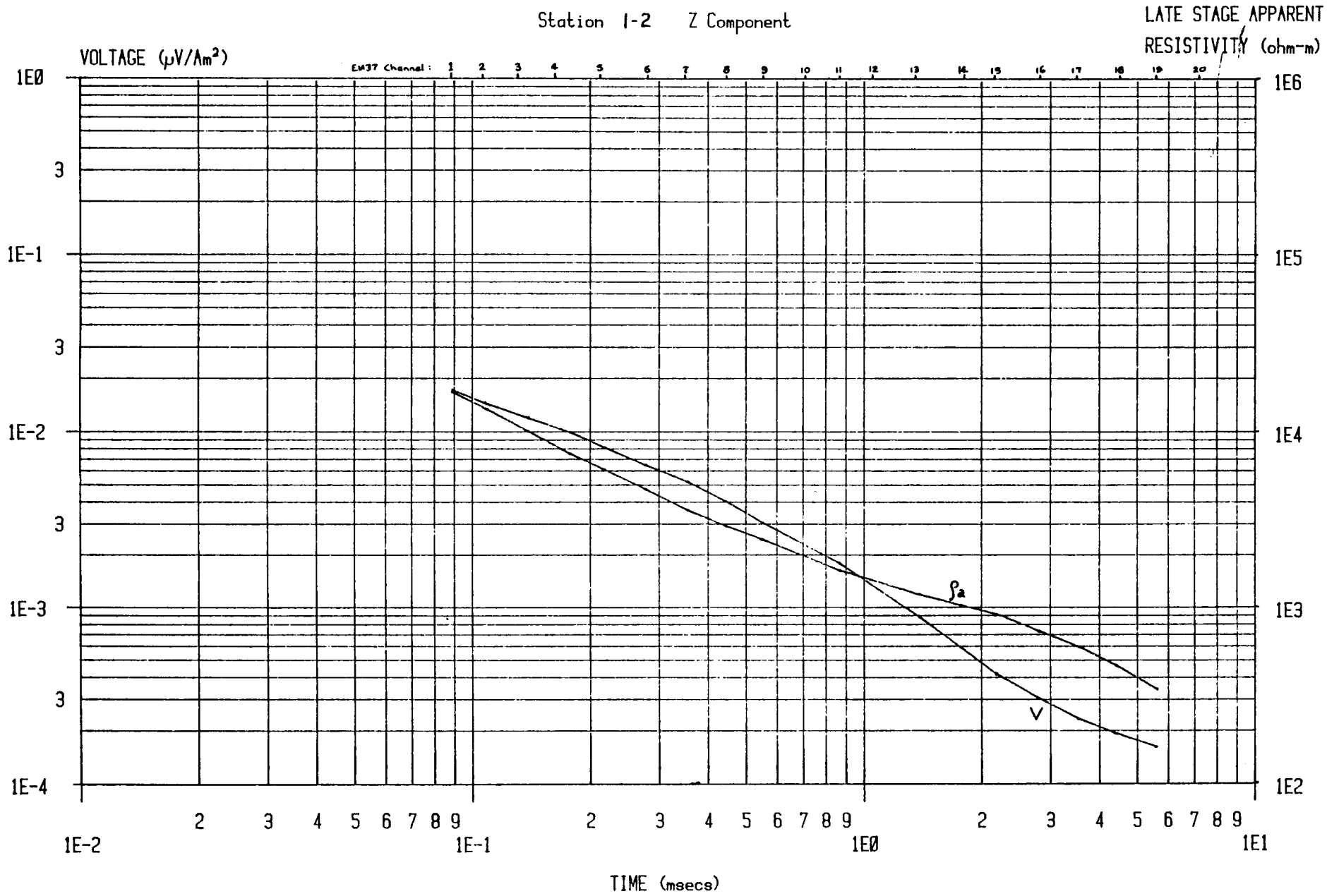


Figure 4

TEM SOUNDING

Station 1-3 Z Component

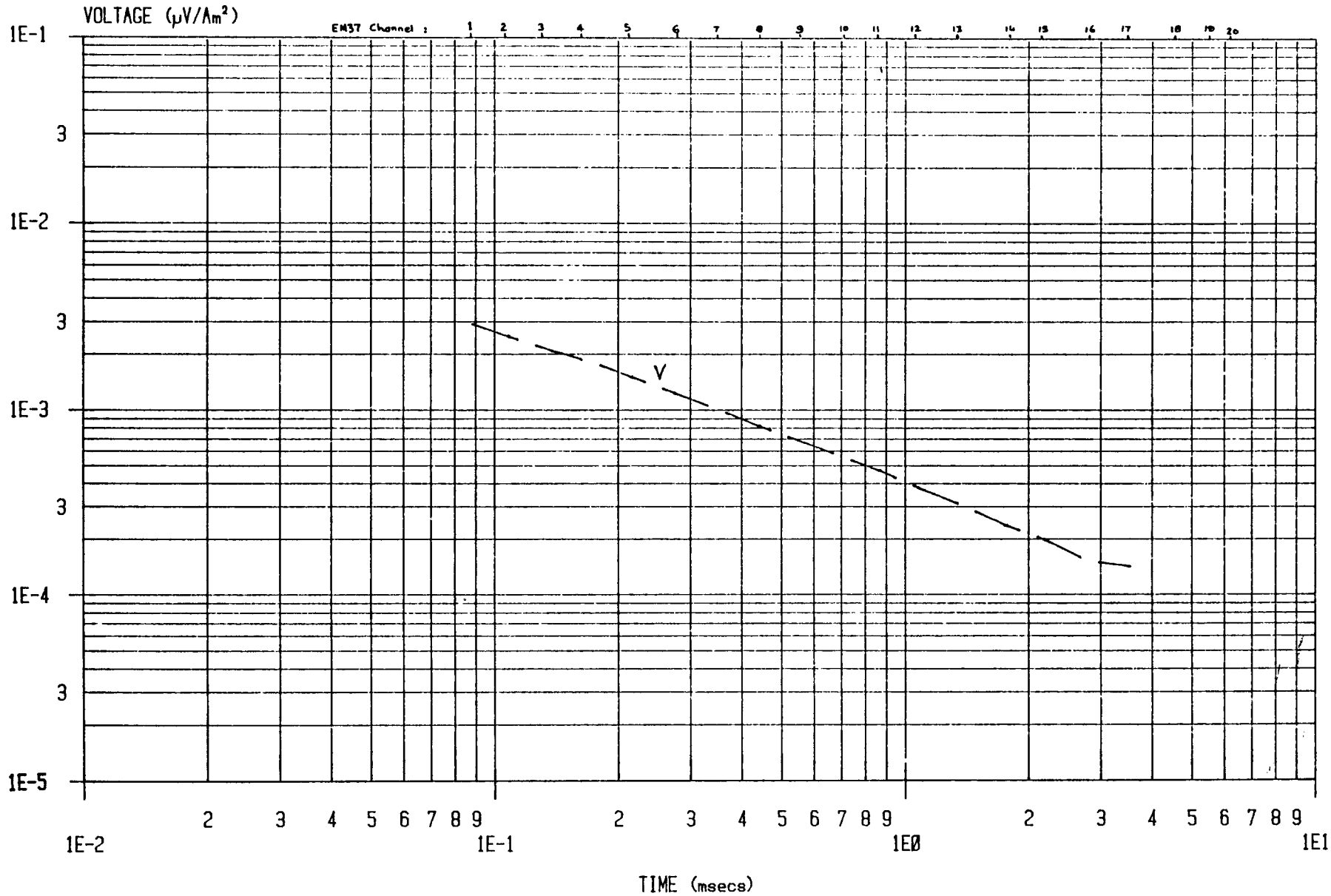


Figure 5

TEM SOUNDING

Station 1-4 Z Component

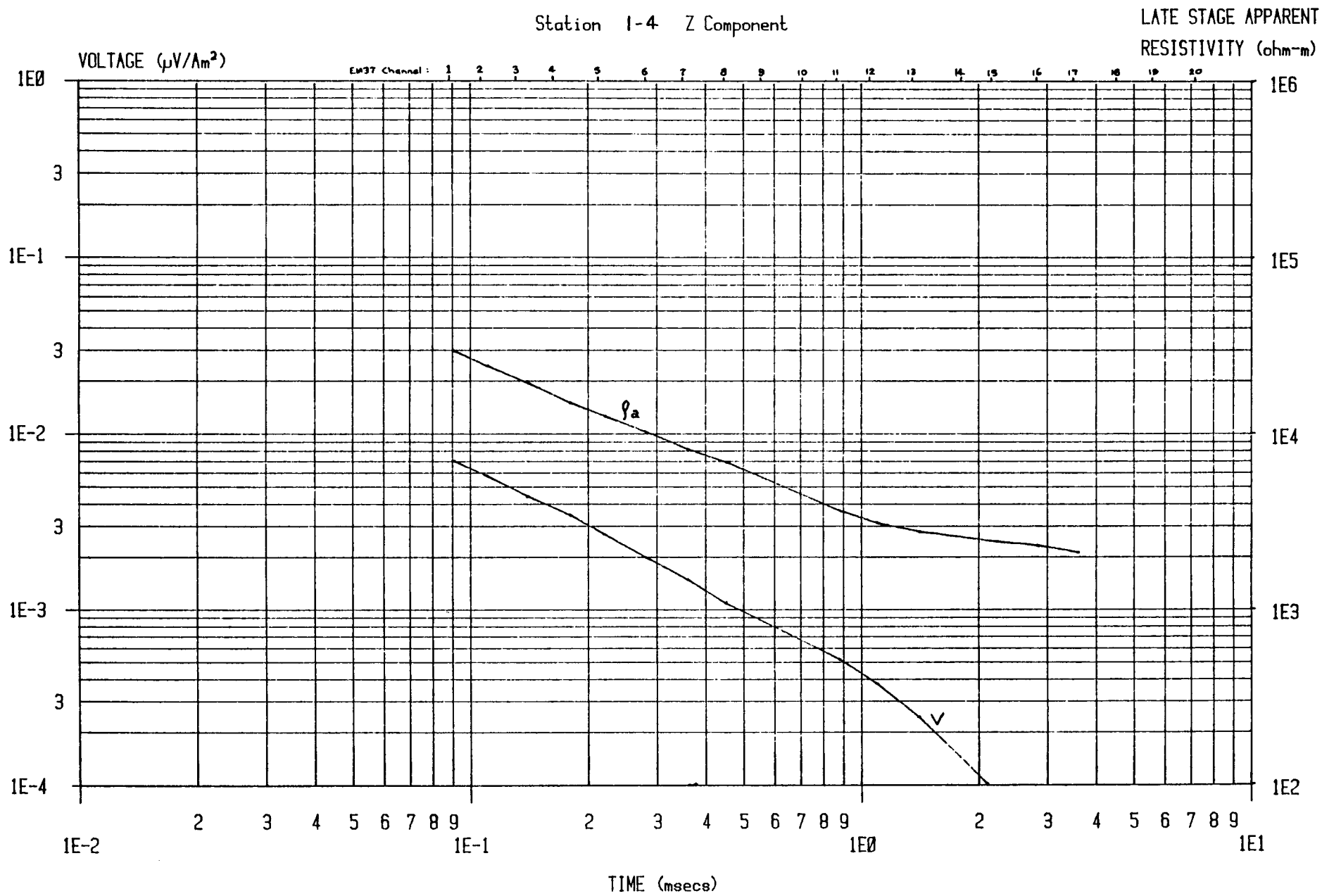


Figure 6

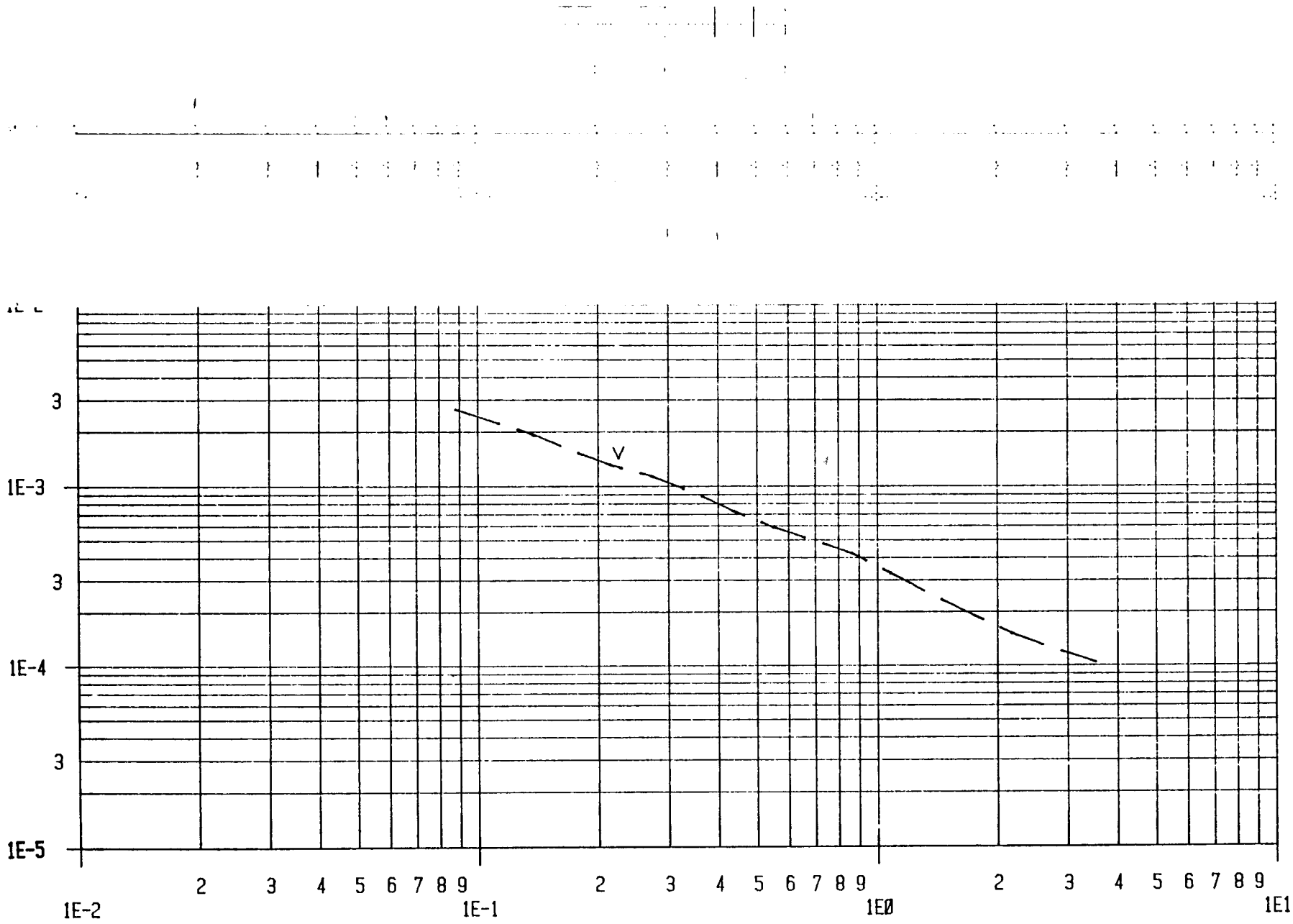

3
1E-3
3
1E-4
3
1E-5
V
1E-2
2 3 4 5 6 7 8 9
1E-1
2 3 4 5 6 7 8 9
1E0
2 3 4 5 6 7 8 9
1E1
TIME (msecs)

Figure 7

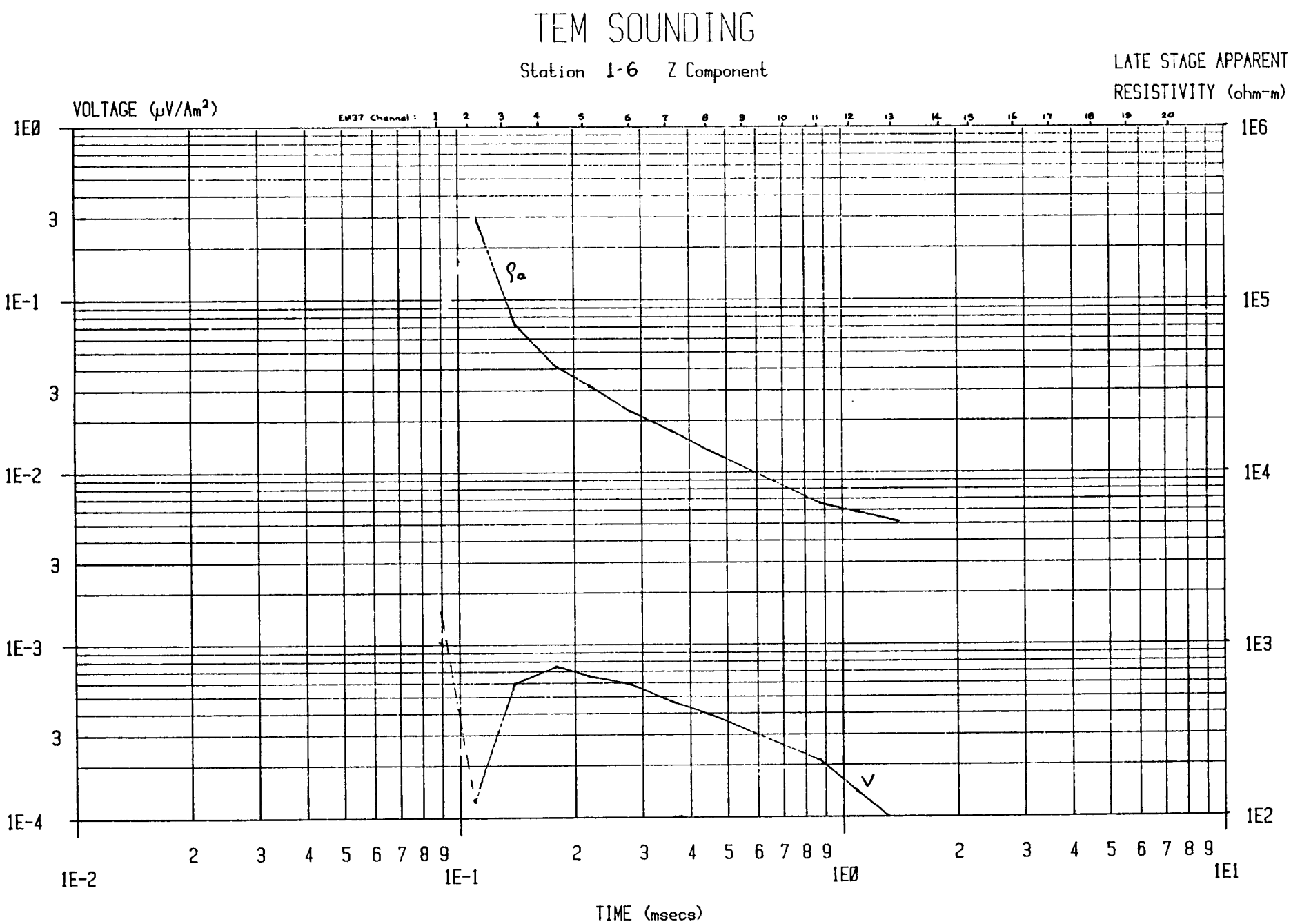

TEM SOUNDING
Station 1-6 Z Component
LATE STAGE APPARENT RESISTIVITY (ohm-m)
VOLTAGE (μV/Am²)
EM37 Channel: 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
1E0
3
1E-1
3
1E-2
3
1E-3
3
1E-4
1E6
1E5
1E4
1E3
1E2
ρa
V
1E-2
2 3 4 5 6 7 8 9
1E-1
2 3 4 5 6 7 8 9
1E0
2 3 4 5 6 7 8 9
1E1
TIME (msecs)

Figure 8

TEM SOUNDING

Station 1-7 Z Component

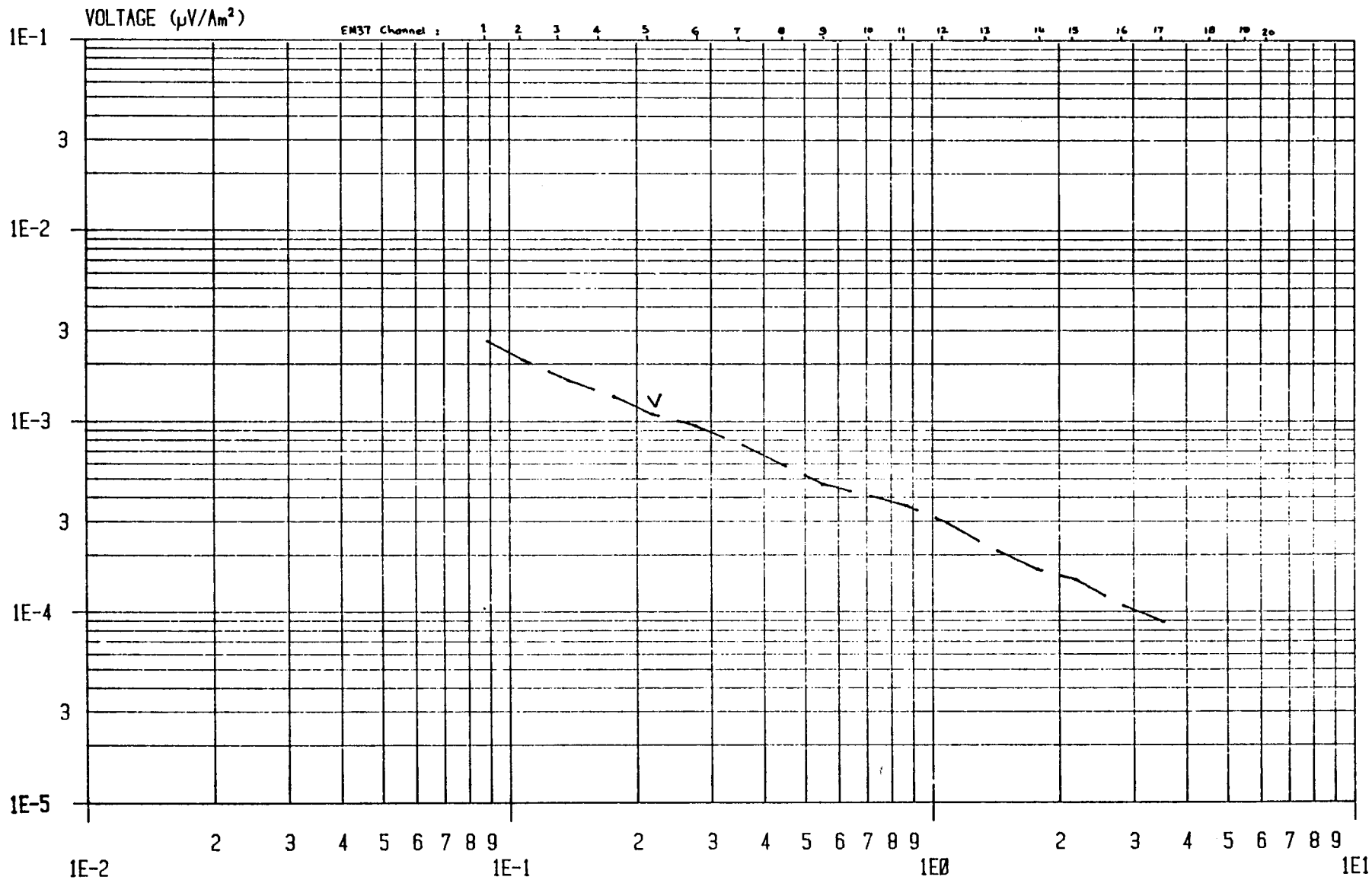


Figure 9

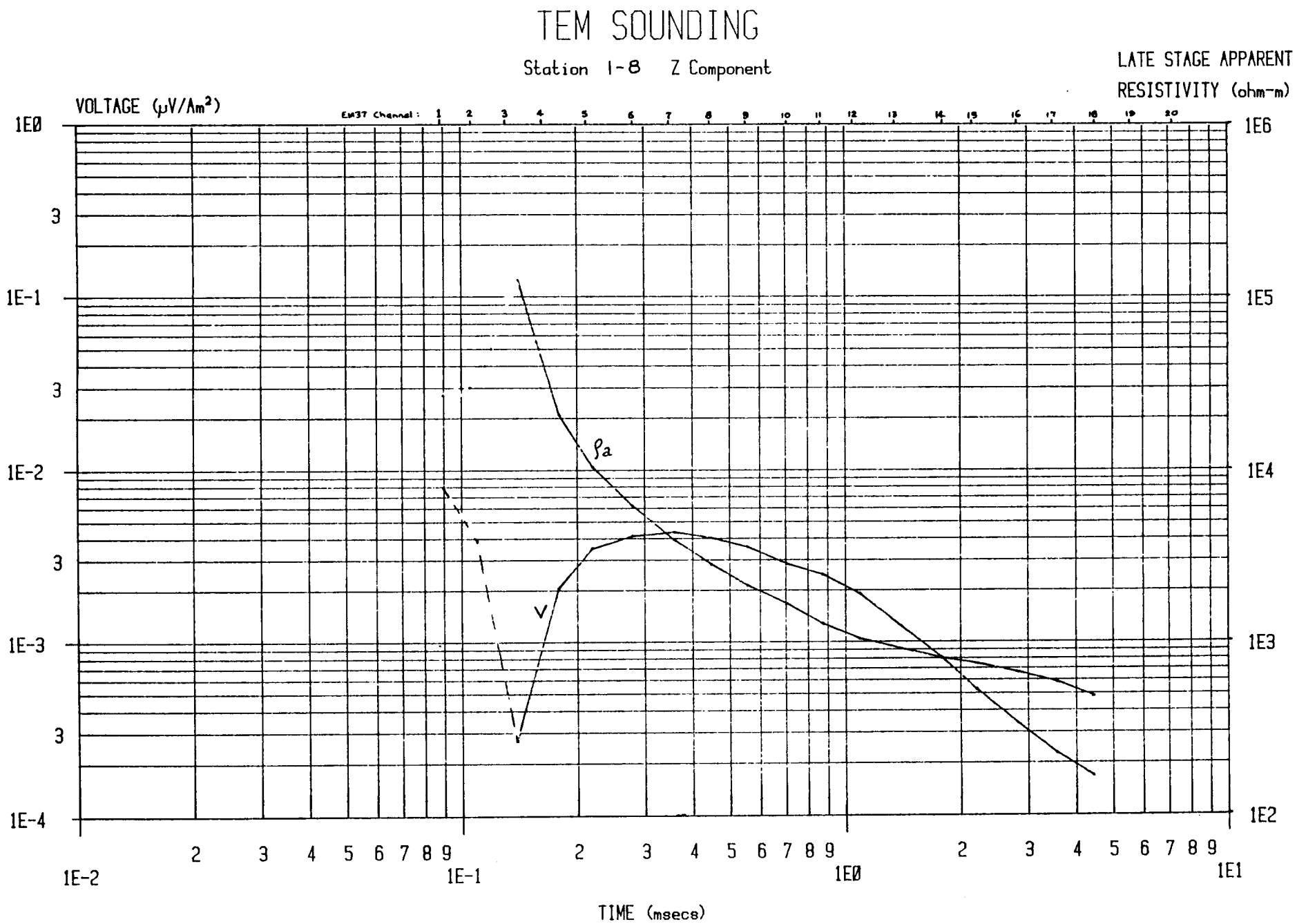

TEM SOUNDING
Station 1-8 Z Component
LATE STAGE APPARENT RESISTIVITY (ohm-m)
VOLTAGE (μV/Am²)
EM37 Channel: 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
1E0
3
1E-1
3
1E-2
3
1E-3
3
1E-4
1E6
1E5
1E4
1E3
1E2
ρa
V
1E-2
1E-1
1E0
1E1
TIME (msecs)

Figure 10

TEM SOUNDING

Station 1-9 Z Component

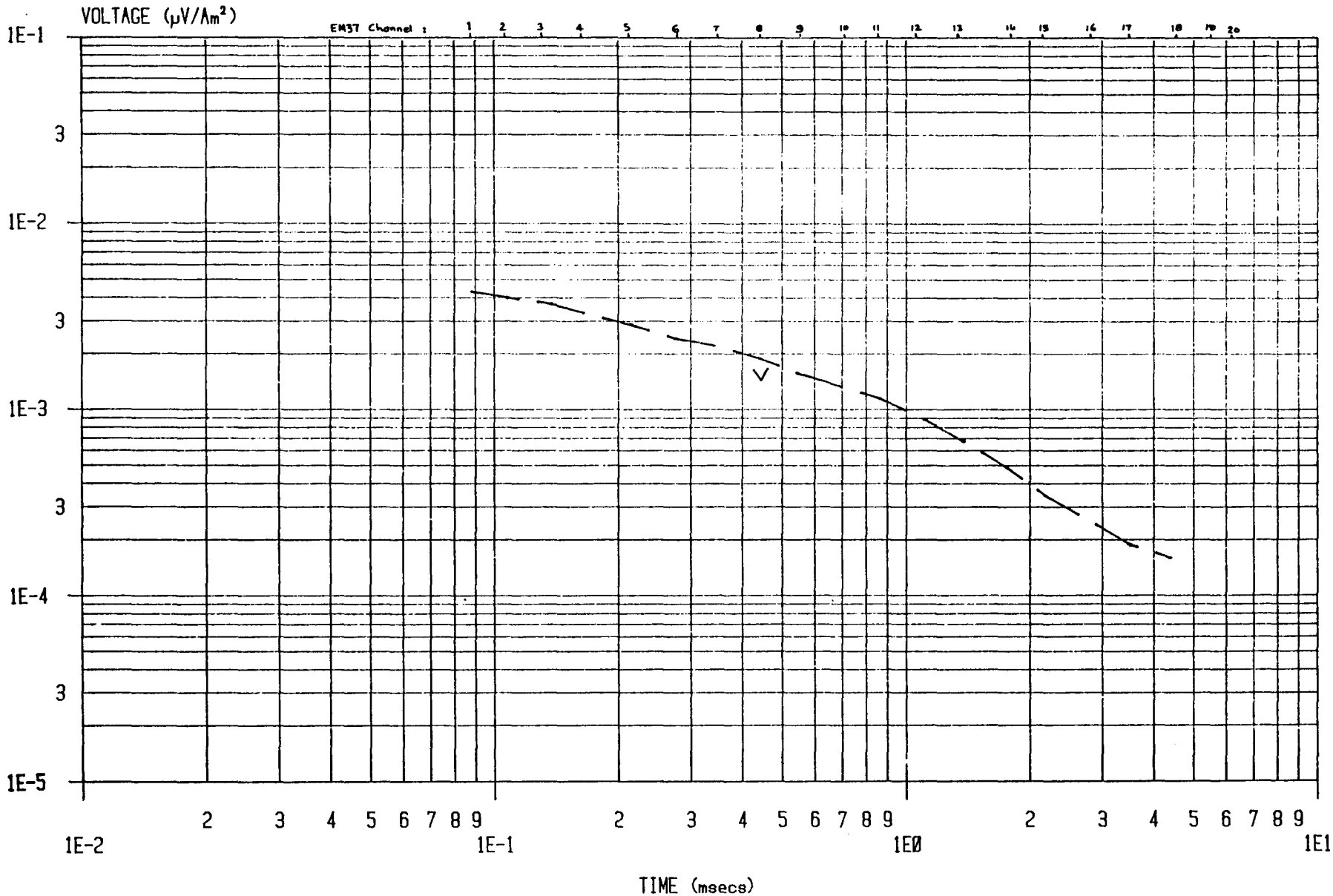


Figure 11

TEM SOUNDING

Station 1-10 Z Component

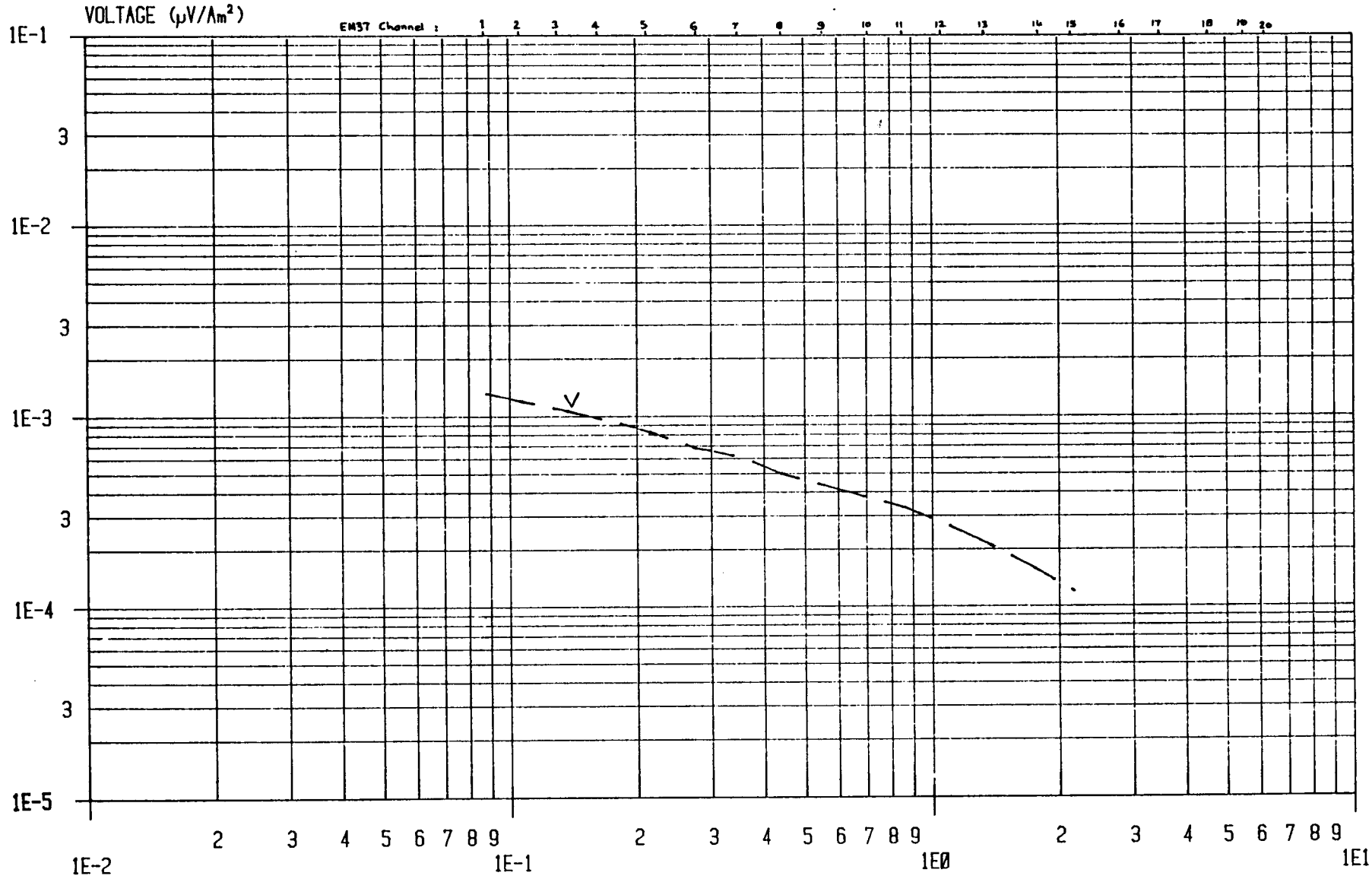


Figure 12

TEM SOUNDING

Station 1-11 Z Component

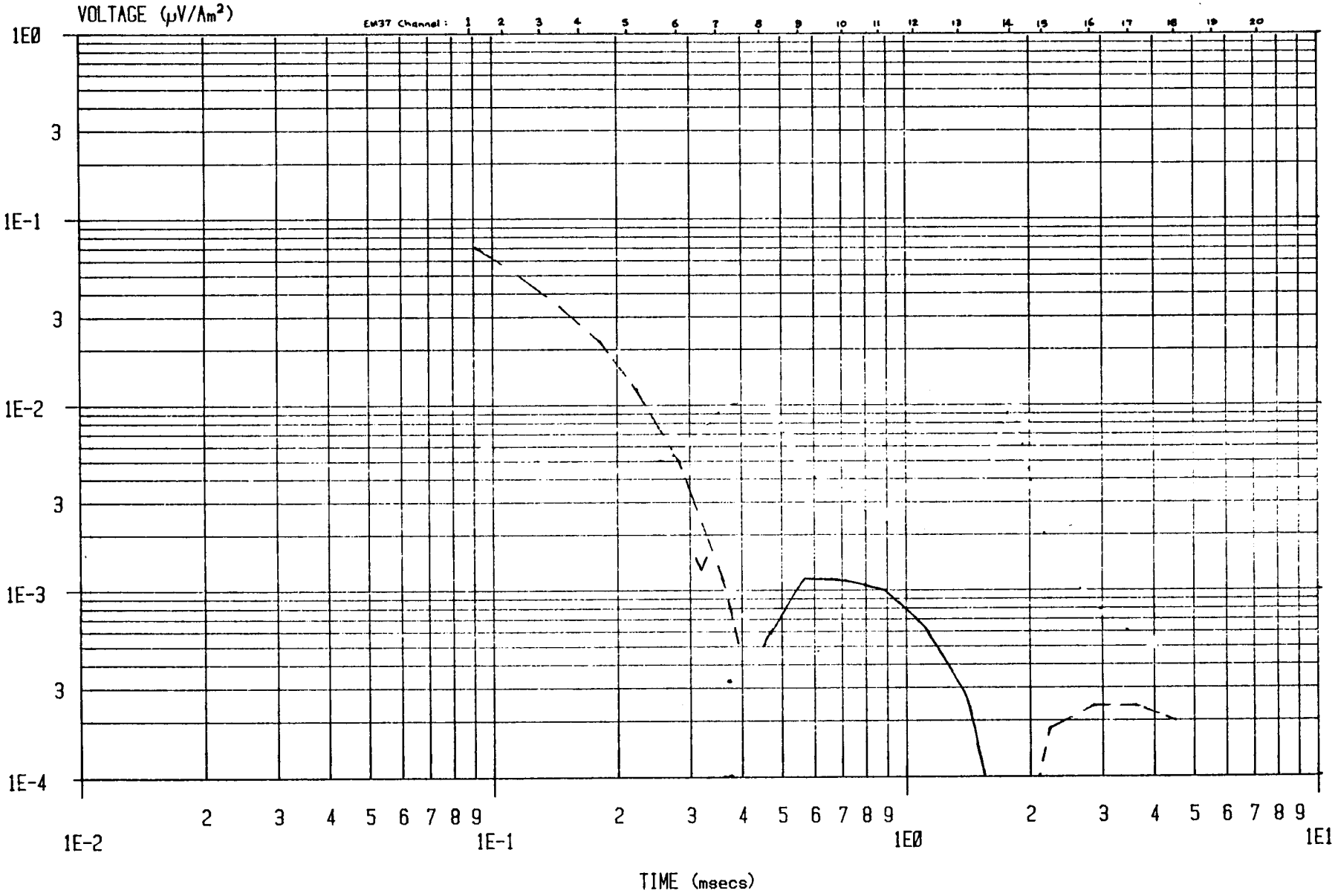


Figure 13

TEM SOUNDING

Station 1-12 Z Component

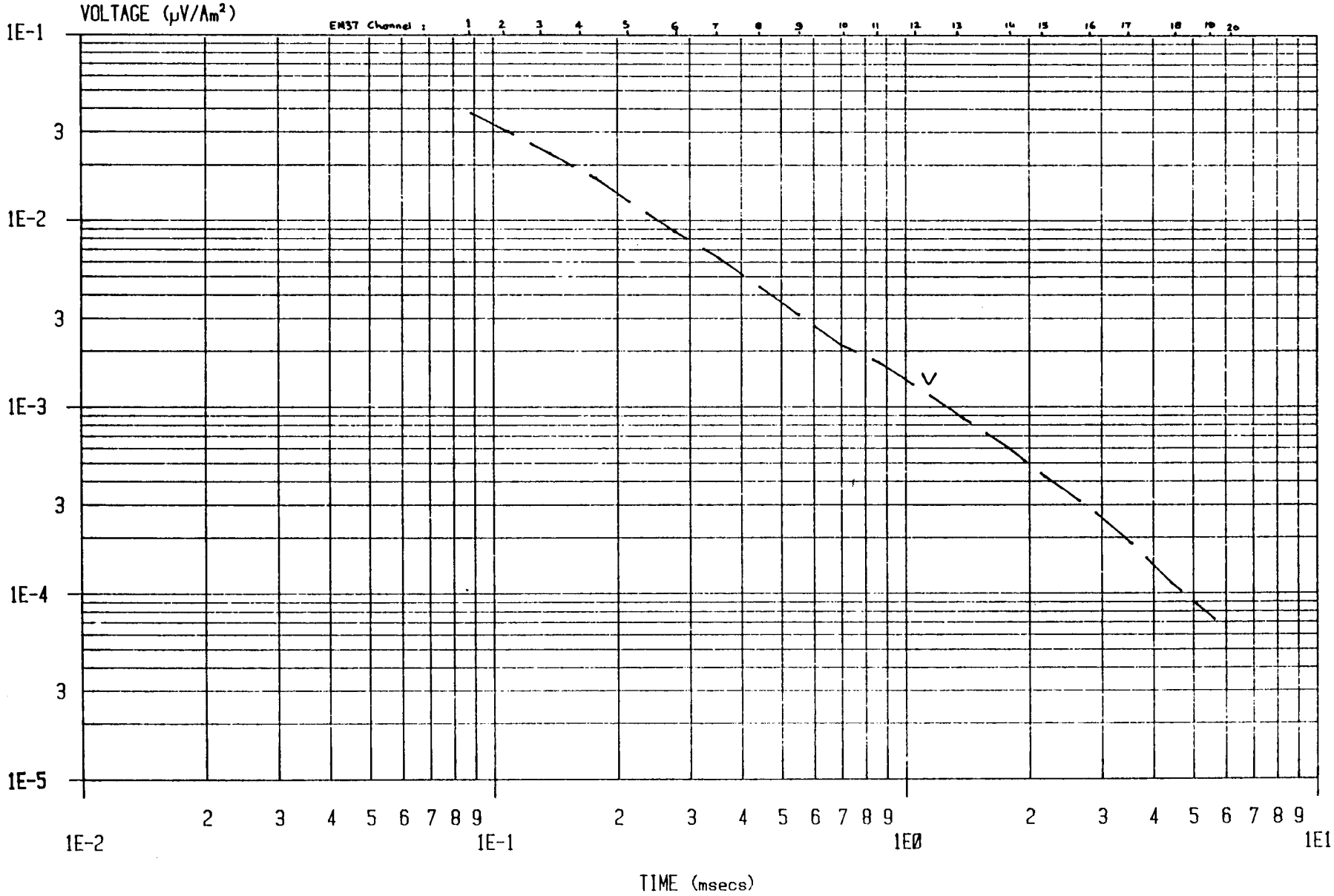


Figure 14

TEM SOUNDING

Station 1-13 Z Component

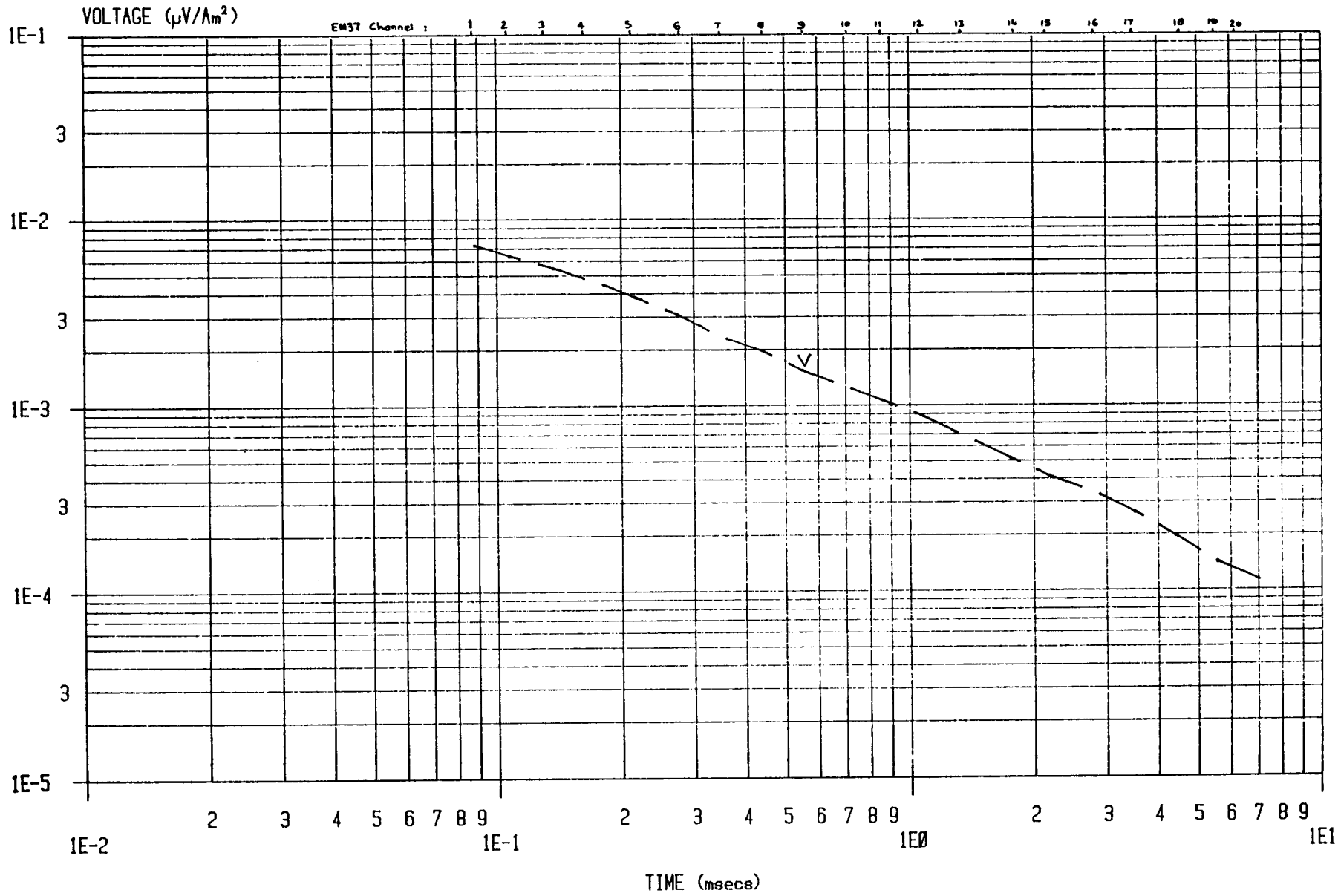


Figure 15

TEM SOUNDING

Station 1-14 Z Component

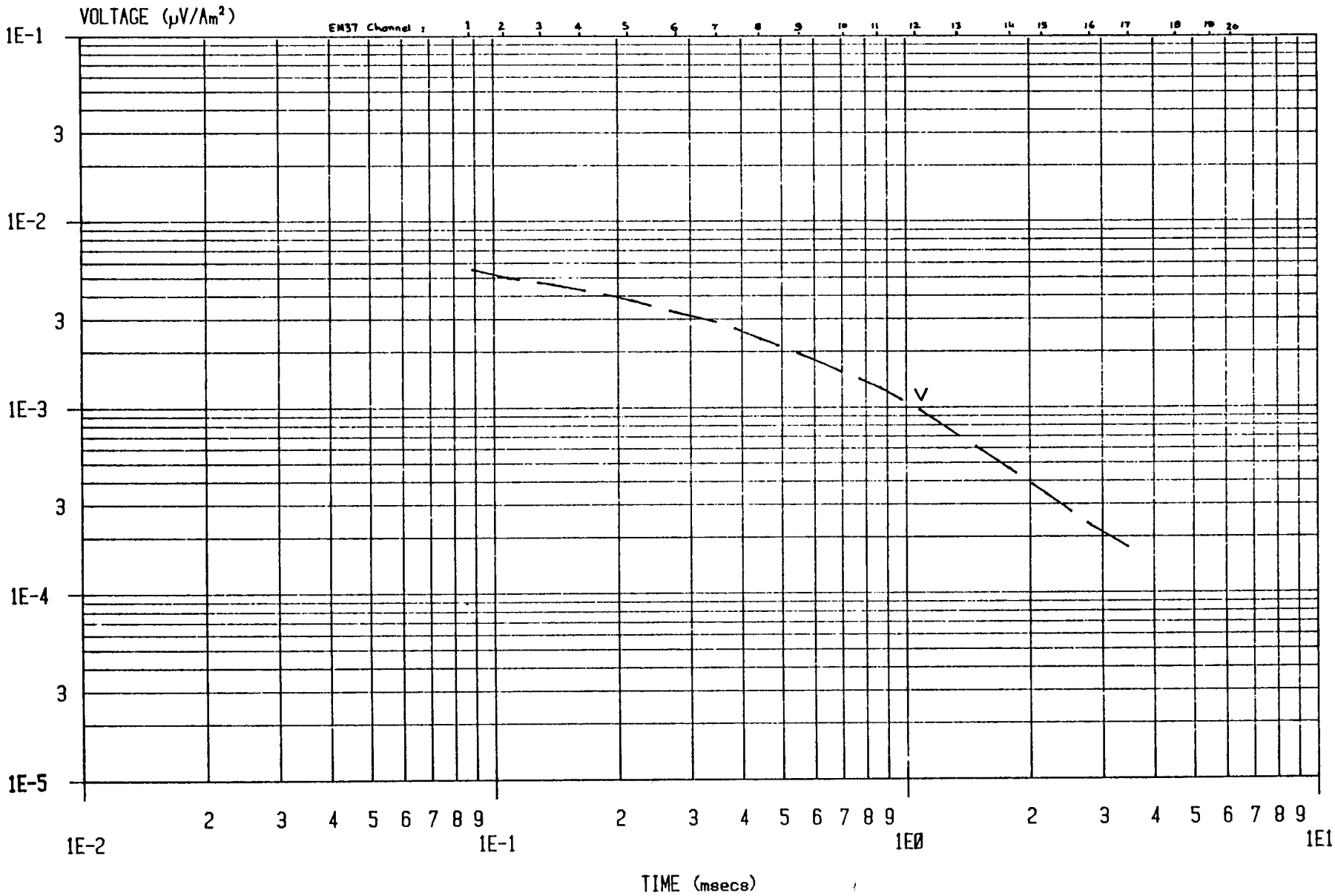


Figure 16

TEM SOUNDING

Station 1-15 Z Component

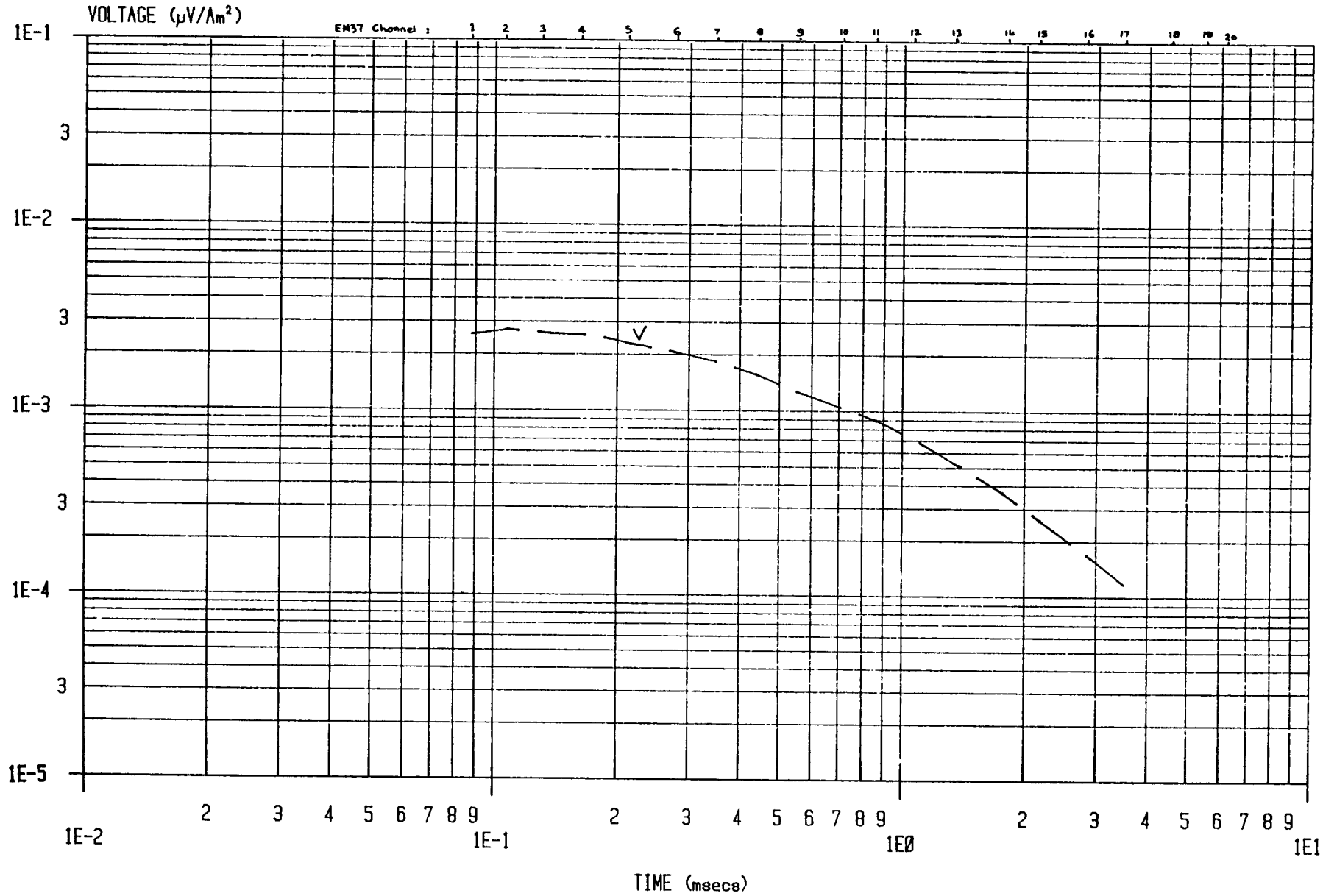


Figure 17

TEM SOUNDING

Station 1-16 Z Component

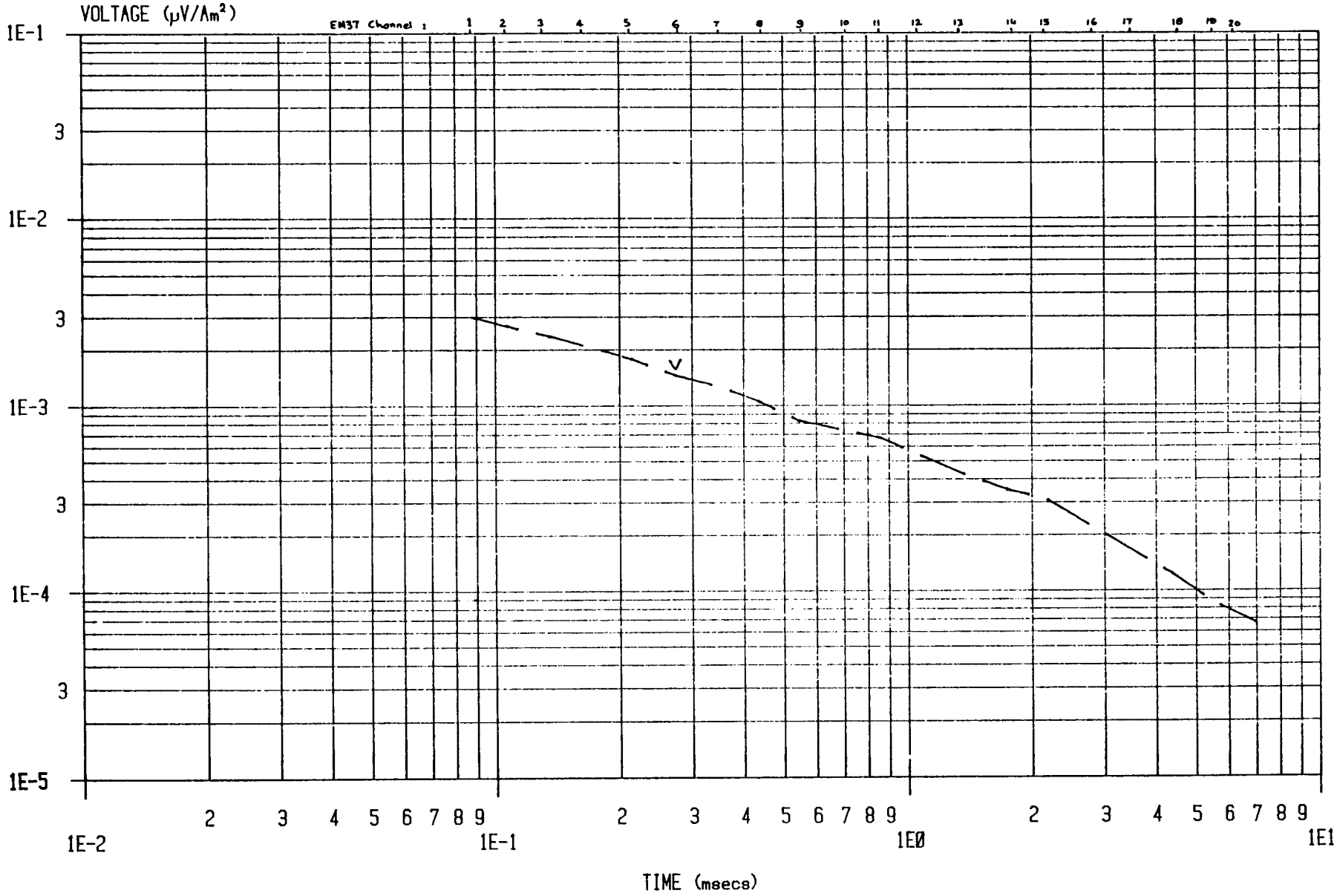


Figure 18

TEM SOUNDING

Station 1-17 Z Component

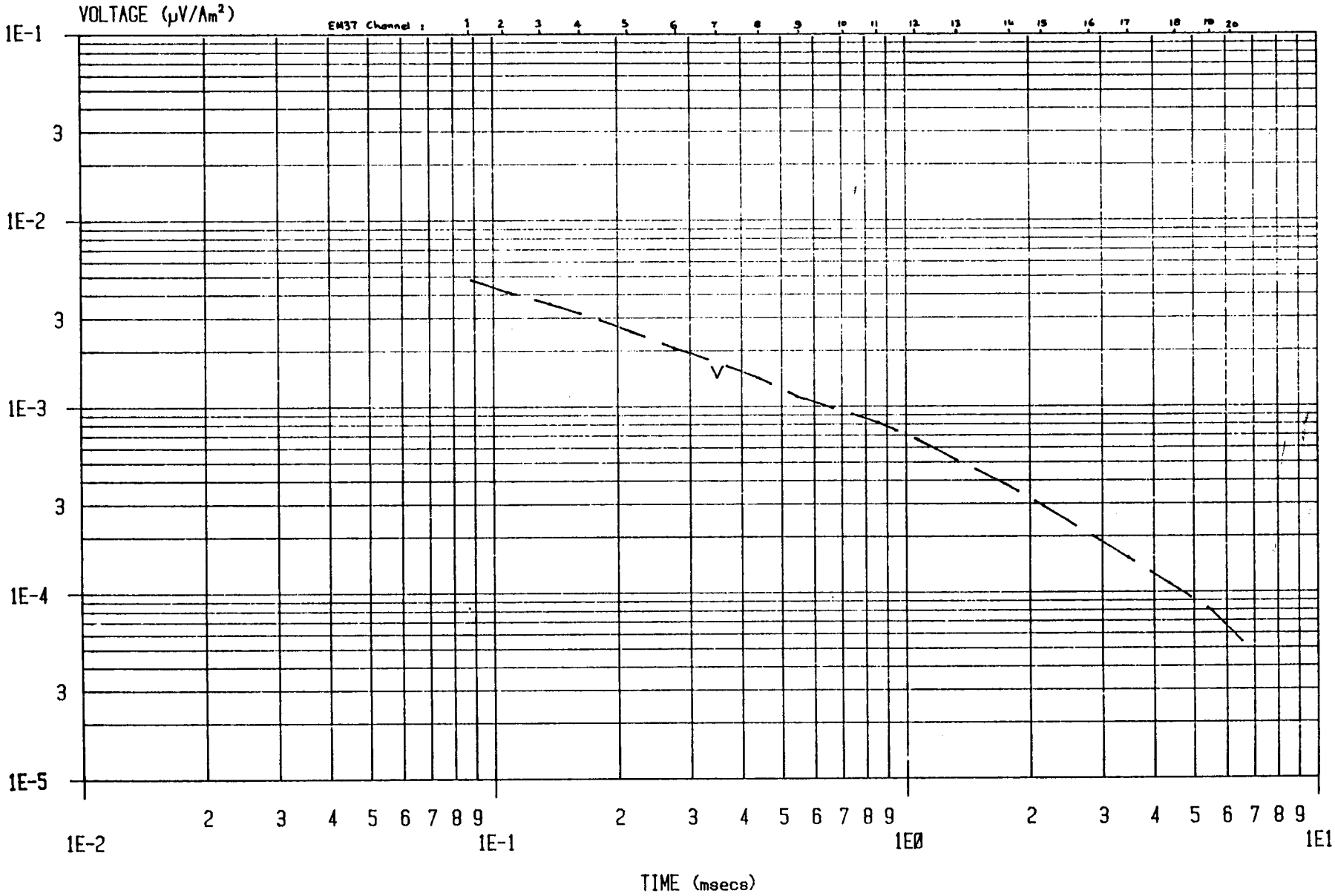


Figure 19

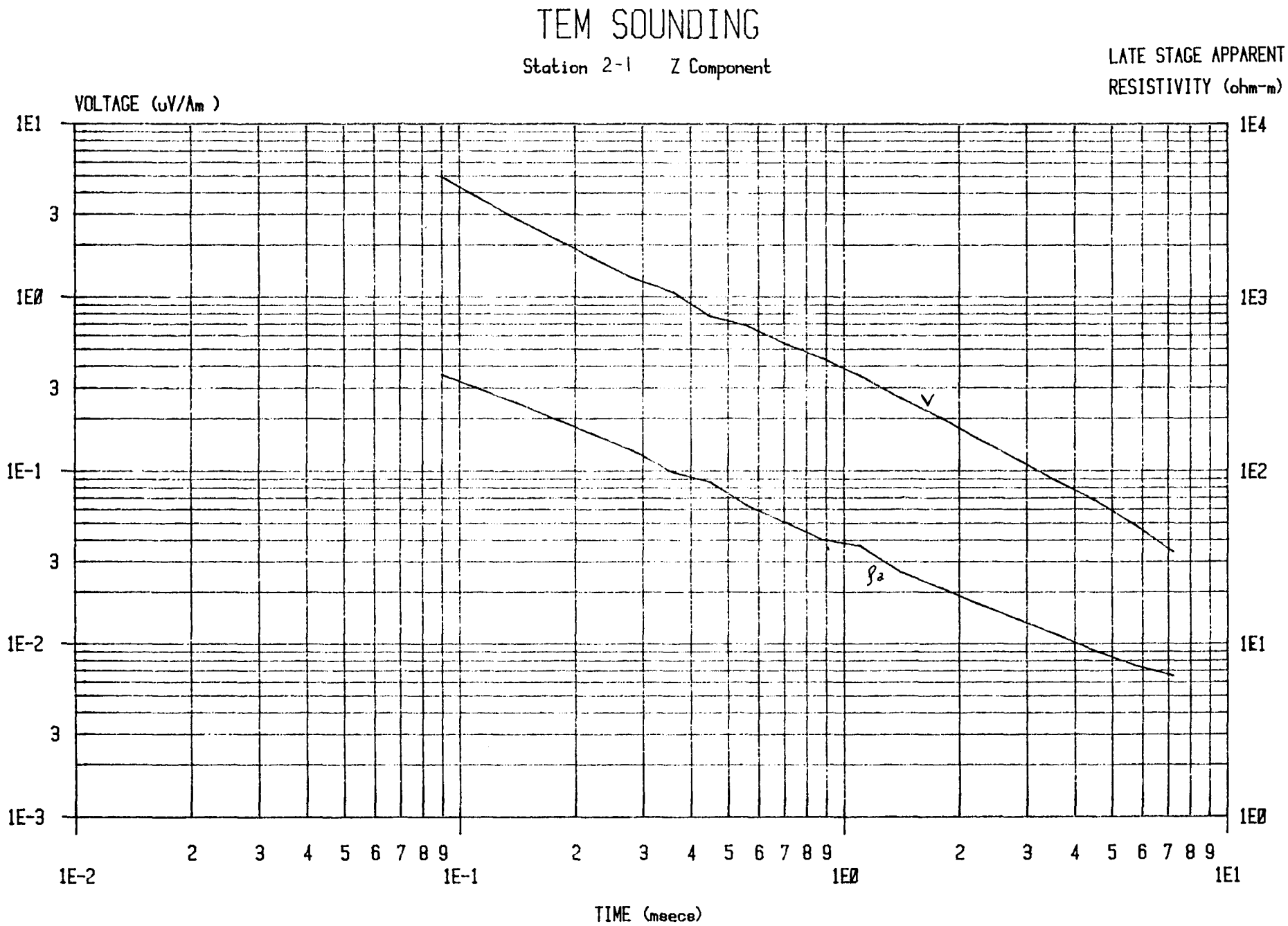

TEM SOUNDING
Station 2-1 Z Component
LATE STAGE APPARENT RESISTIVITY (ohm-m)
VOLTAGE (uV/Am)
1E1
3
1E0
3
1E-1
3
1E-2
3
1E-3
1E4
1E3
1E2
1E1
1E0
V
ρa
1E-2
2 3 4 5 6 7 8 9
1E-1
2 3 4 5 6 7 8 9
1E0
2 3 4 5 6 7 8 9
1E1
TIME (msecs)

Figure 20

TEM SOUNDING

Station 2-2 Z Component

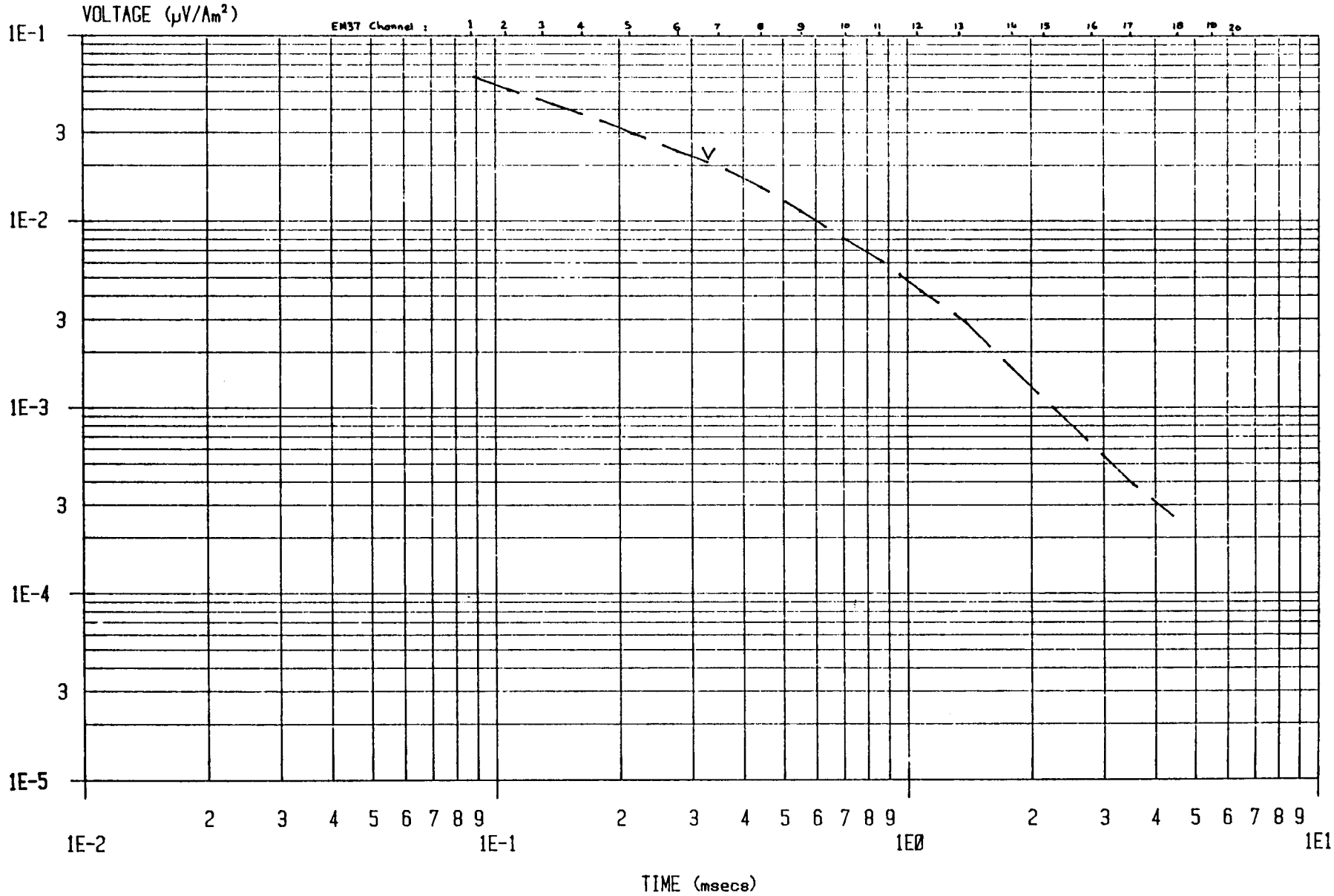


Figure 21

TEM SOUNDING

Station 2-3 Z Component

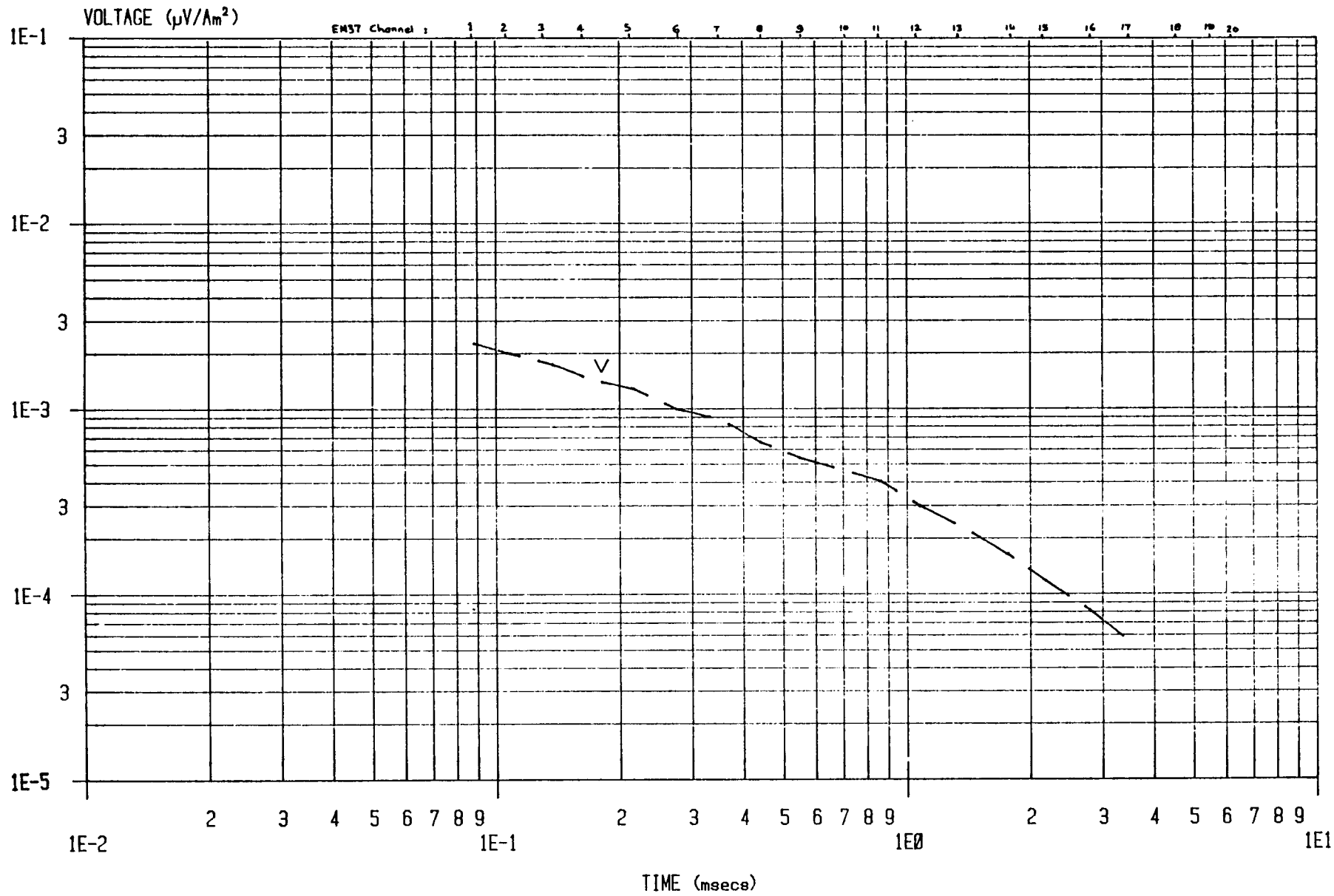


Figure 22

TEM SOUNDING

Station 2-4 Z Component

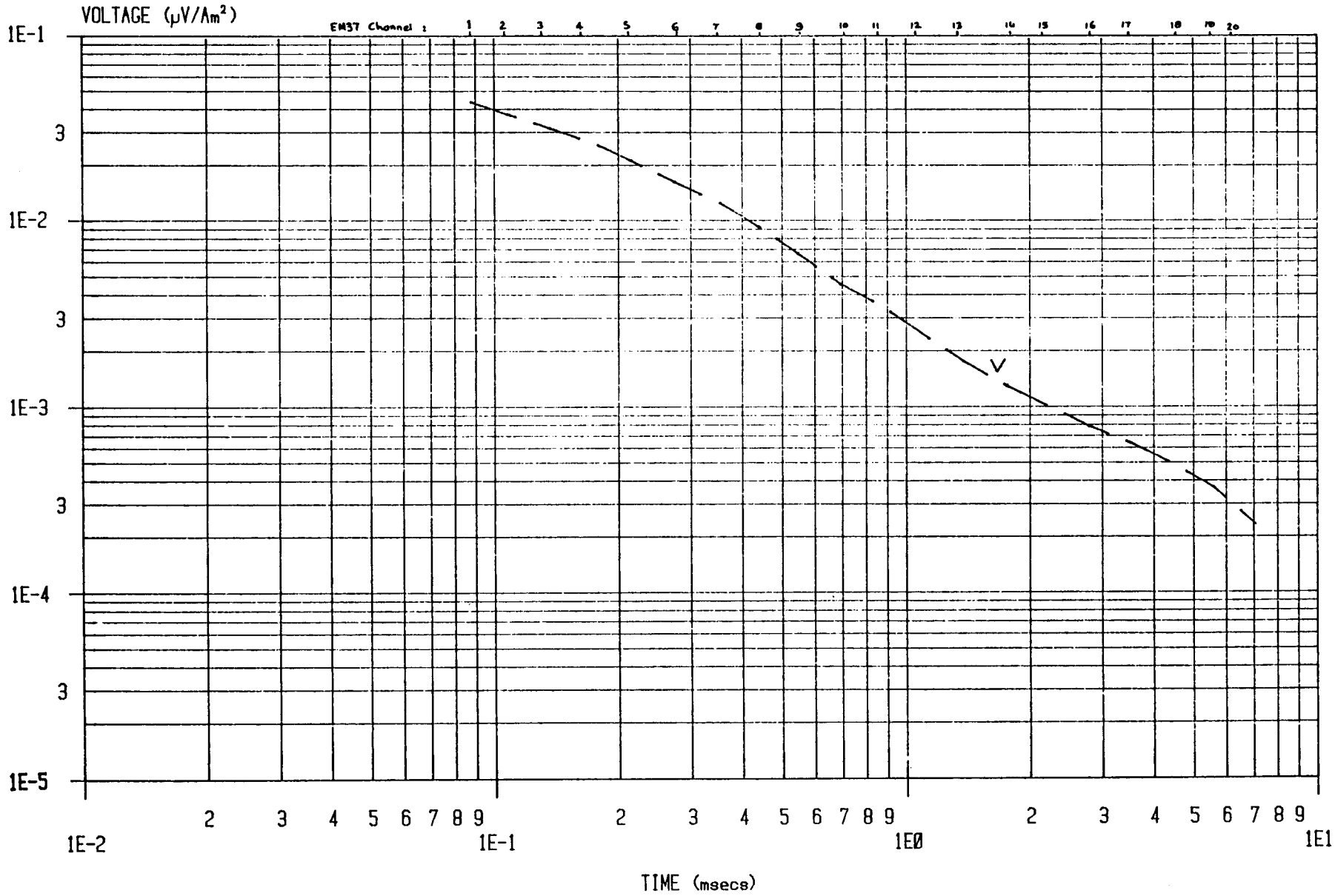


Figure 23

TEM SOUNDING

Station 2-5 Z Component

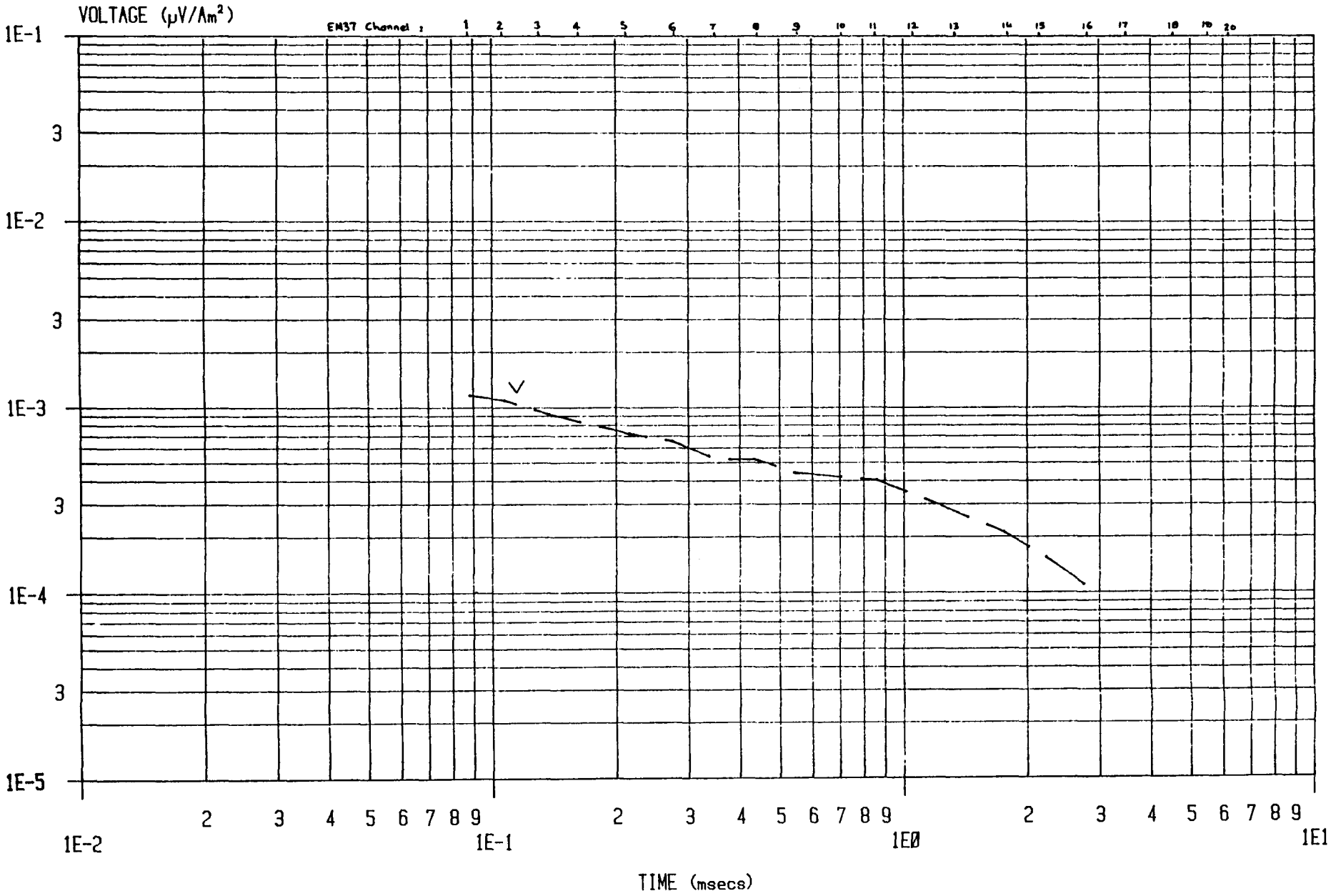


Figure 24

TEM SOUNDING

Station 2-6 Z Component

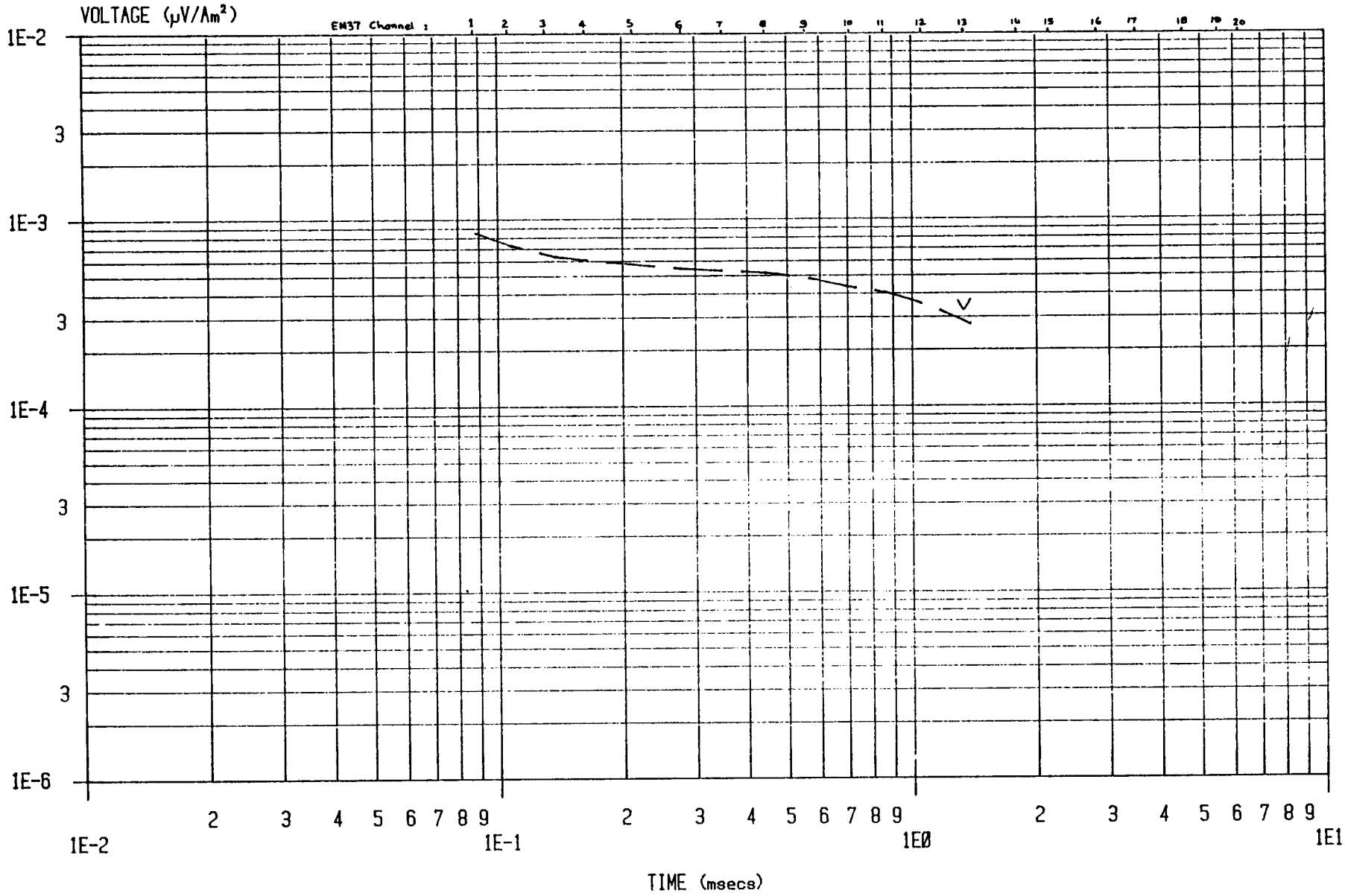


Figure 25

TEM SOUNDING

Station 2-7 Z Component

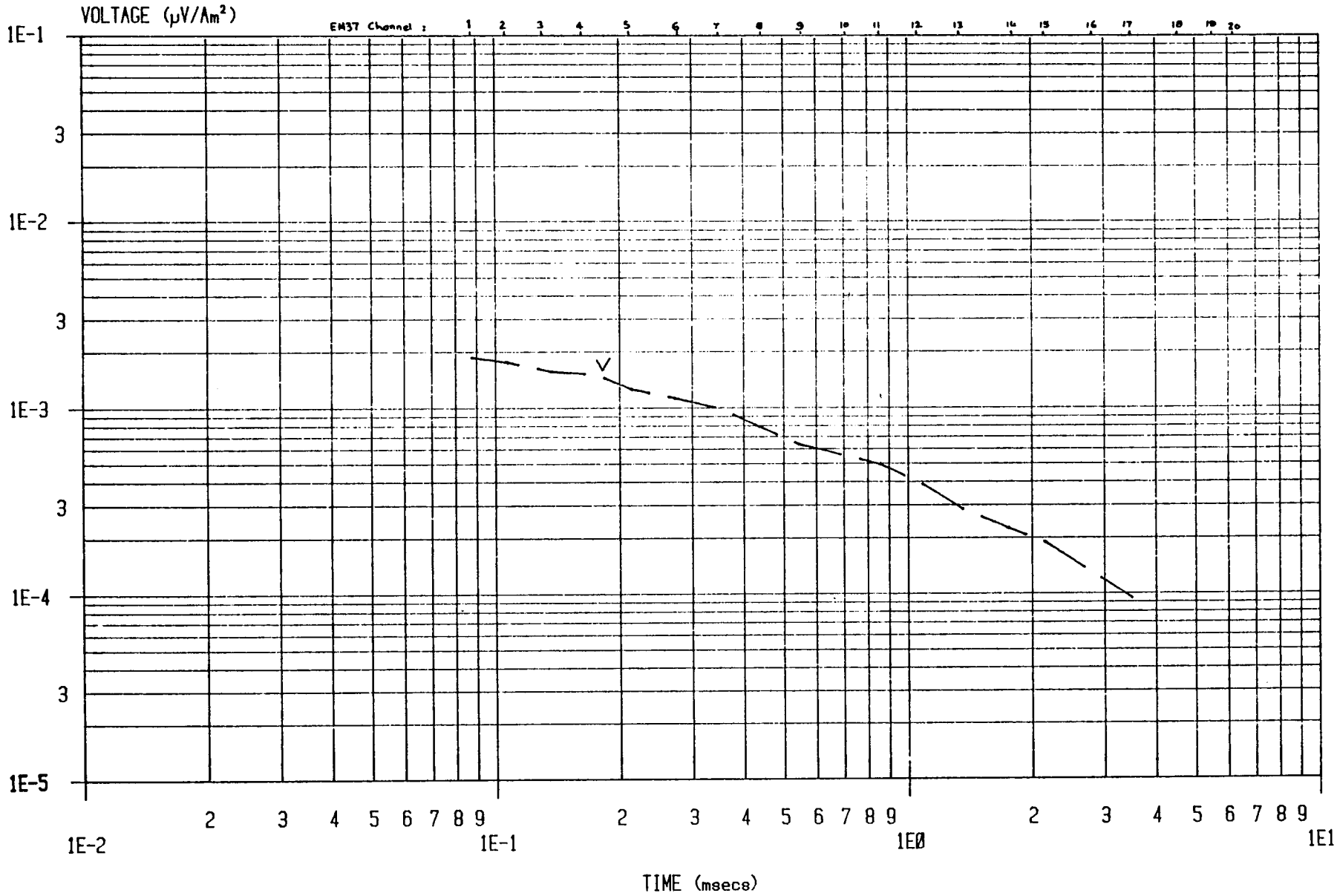


Figure 26

TEM SOUNDING

Station 2-8 Z Component

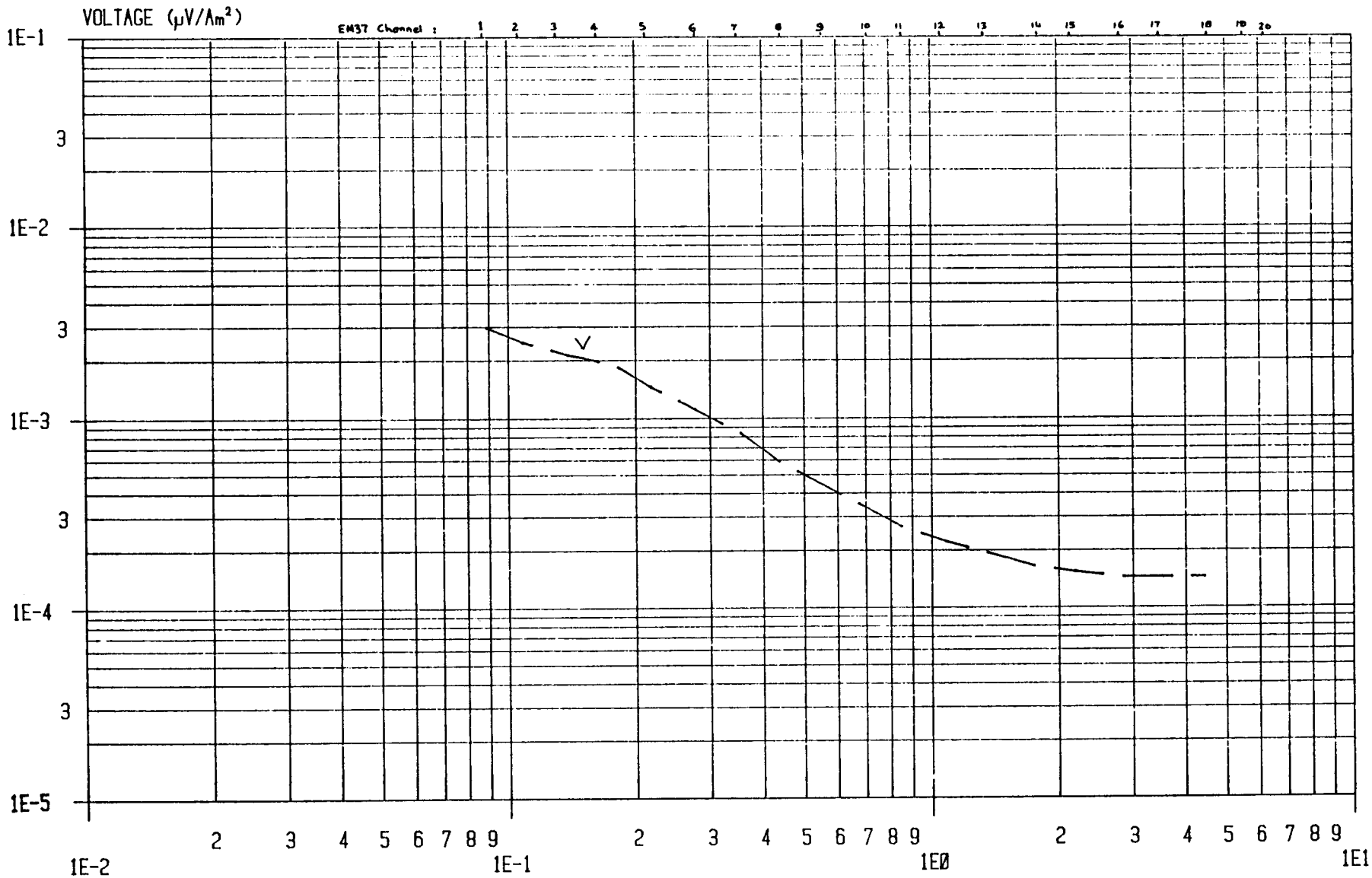


Figure 27

TEM SOUNDING

Station 2-9 Z Component

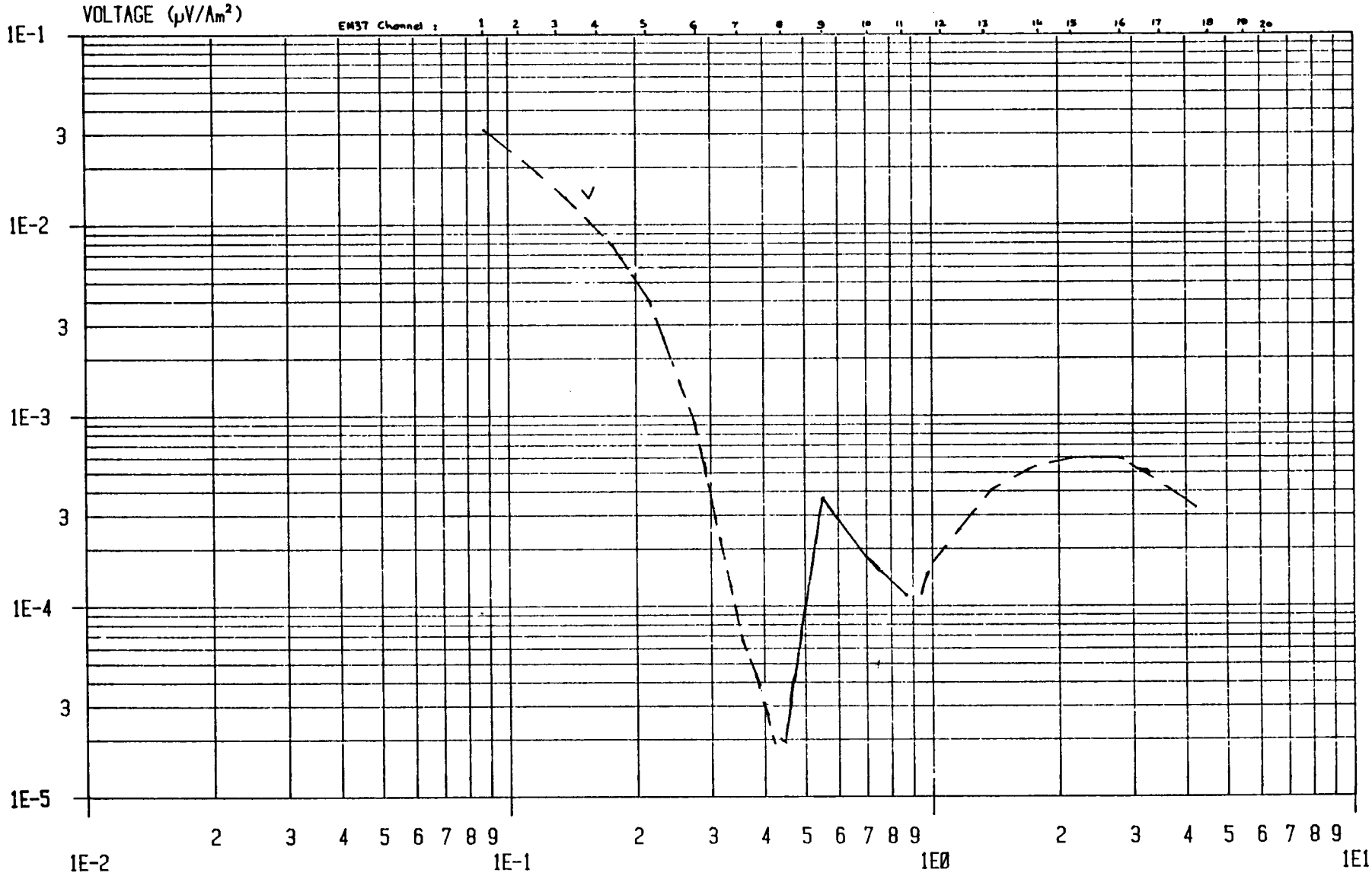


Figure 28

TEM SOUNDING

Station 2-10 Z Component

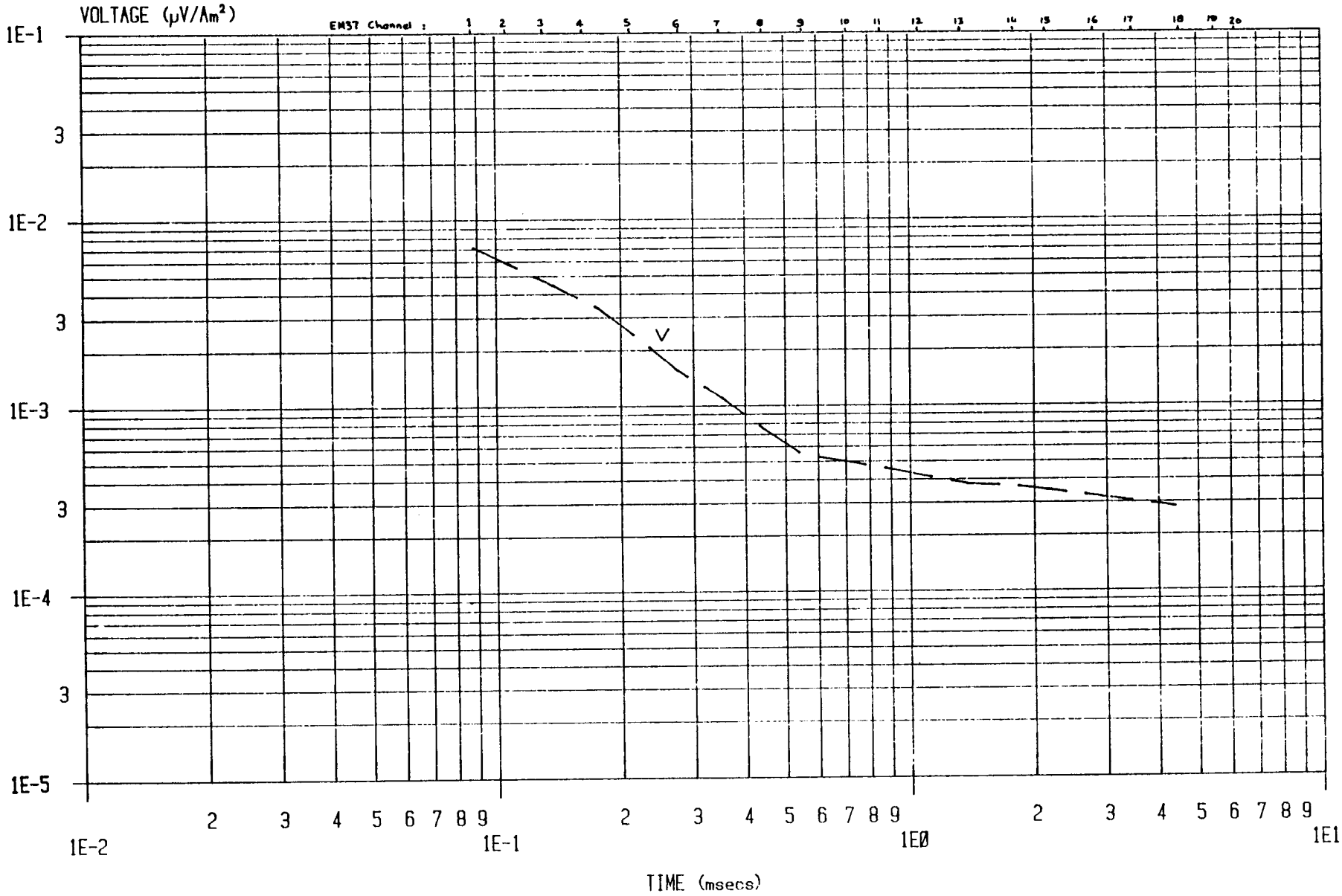


Figure 29

TEM SOUNDING

Station 2-11 Z Component

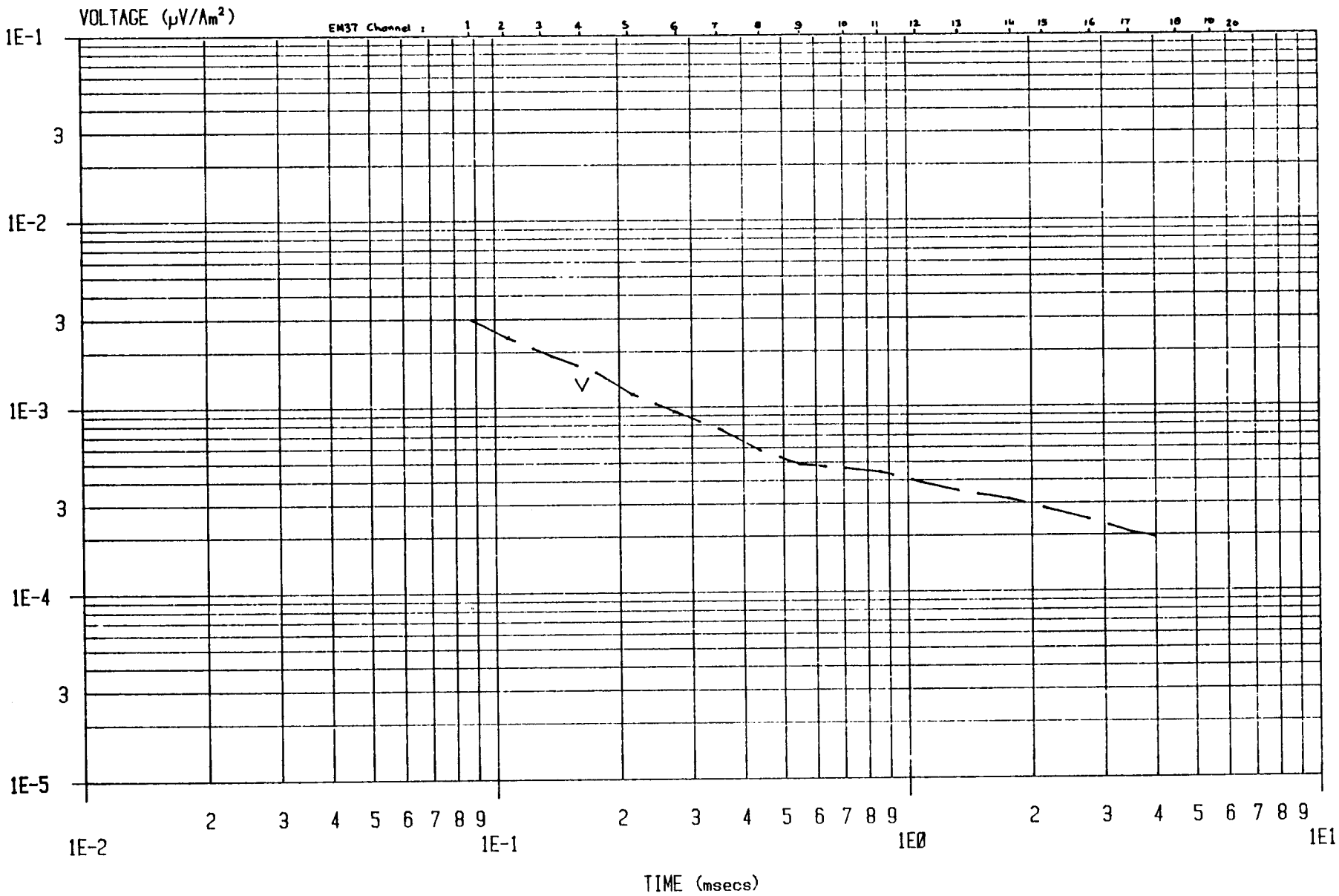


Figure 30

TEM SOUNDING

Station 2-13 Z Component

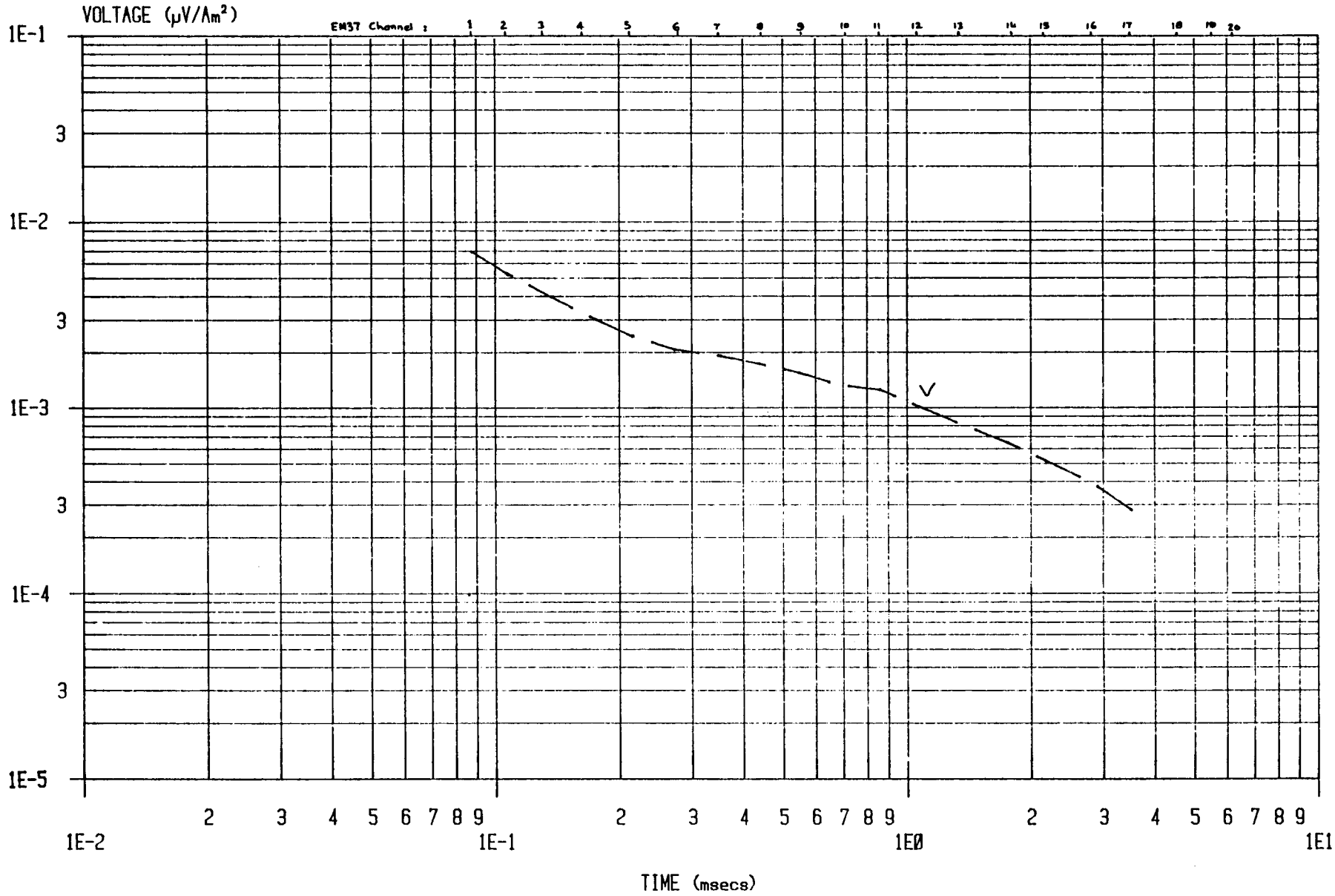


Figure 31

TEM SOUNDING

Station 2-14 Z Component

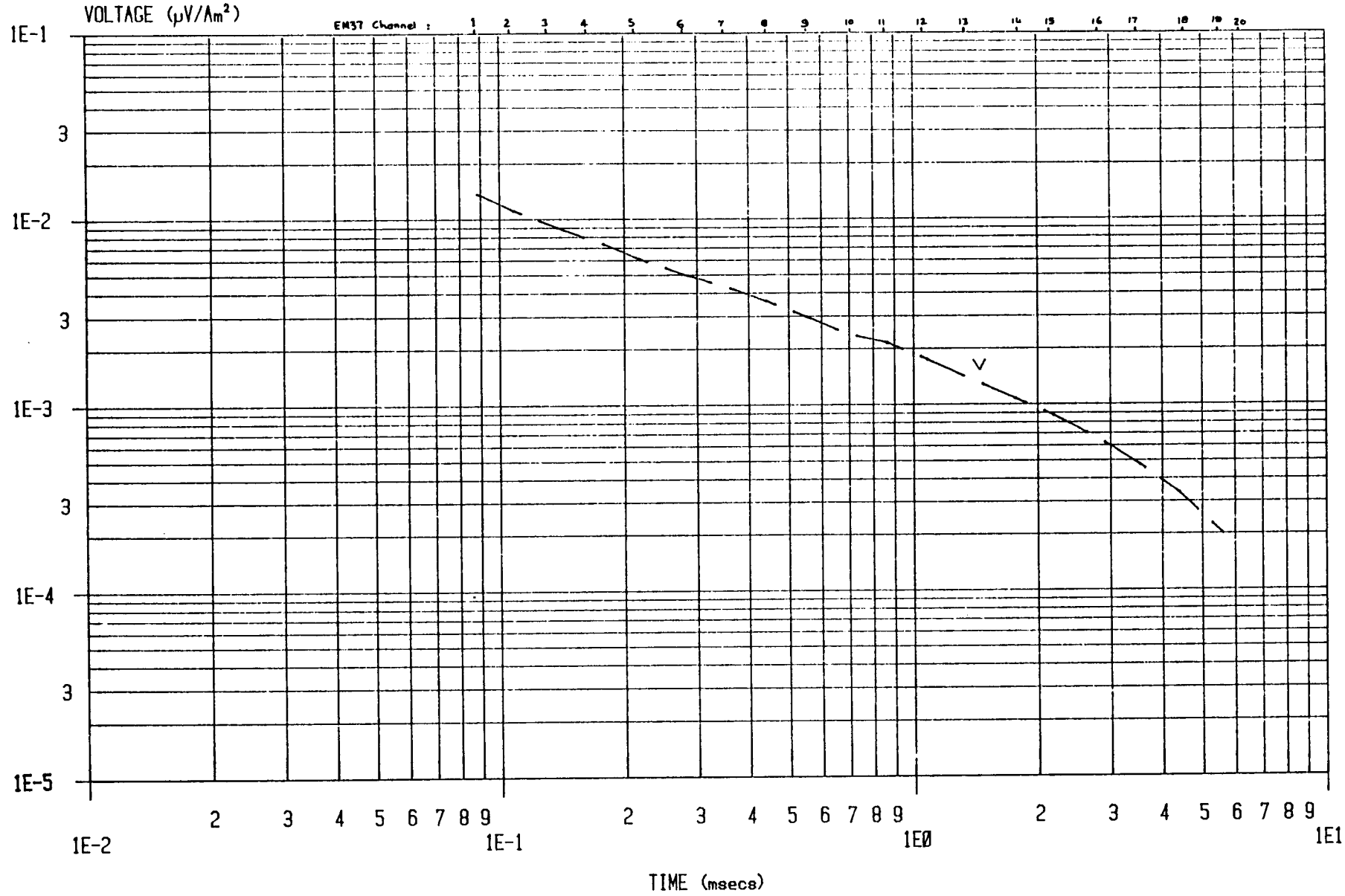


Figure 32

TEM SOUNDING

Station 2-15 Z Component

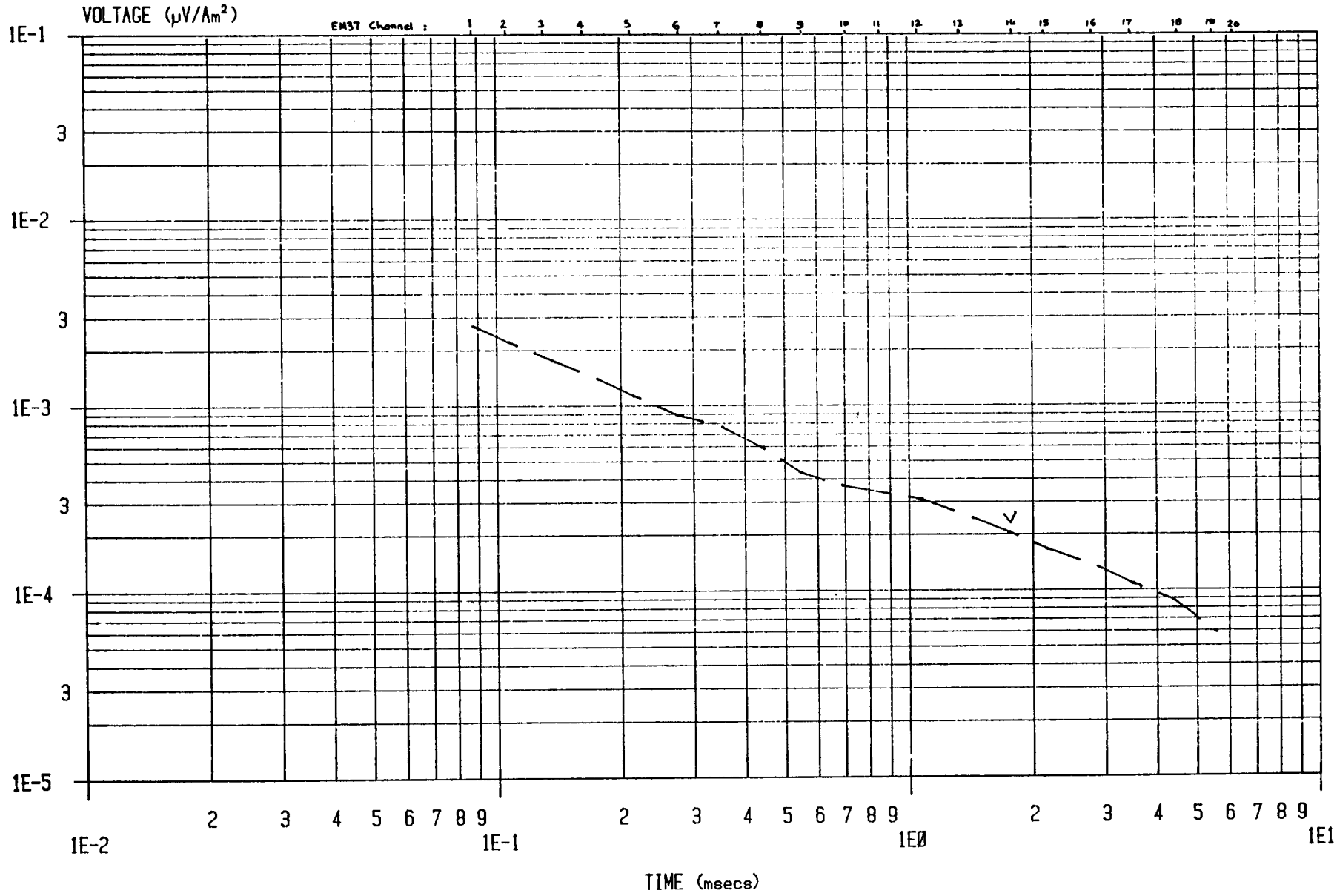


Figure 33

TEM SOUNDING

Station 2-16 Z Component

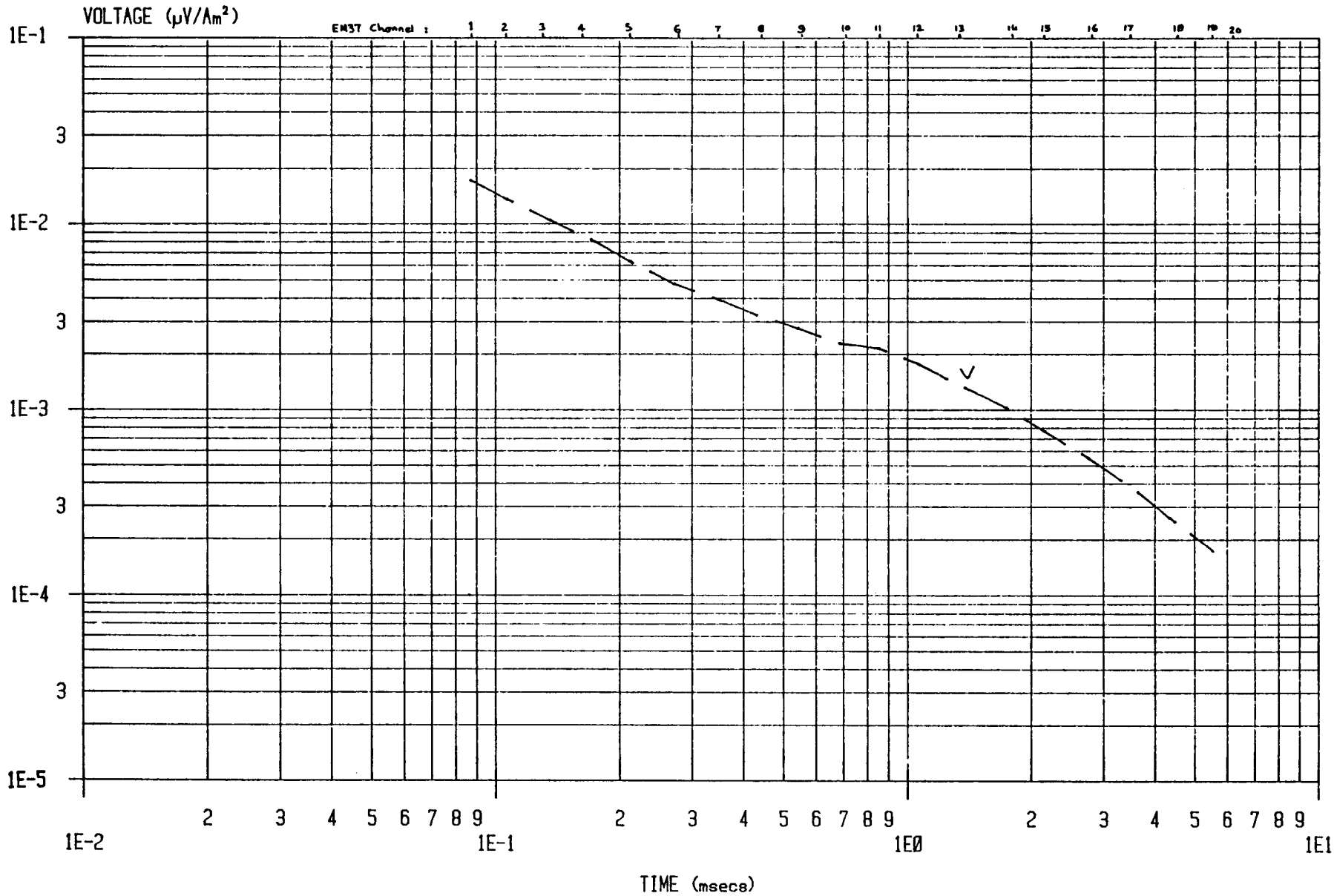


Figure 34

TEM SOUNDING

Station 2-17 Z Component

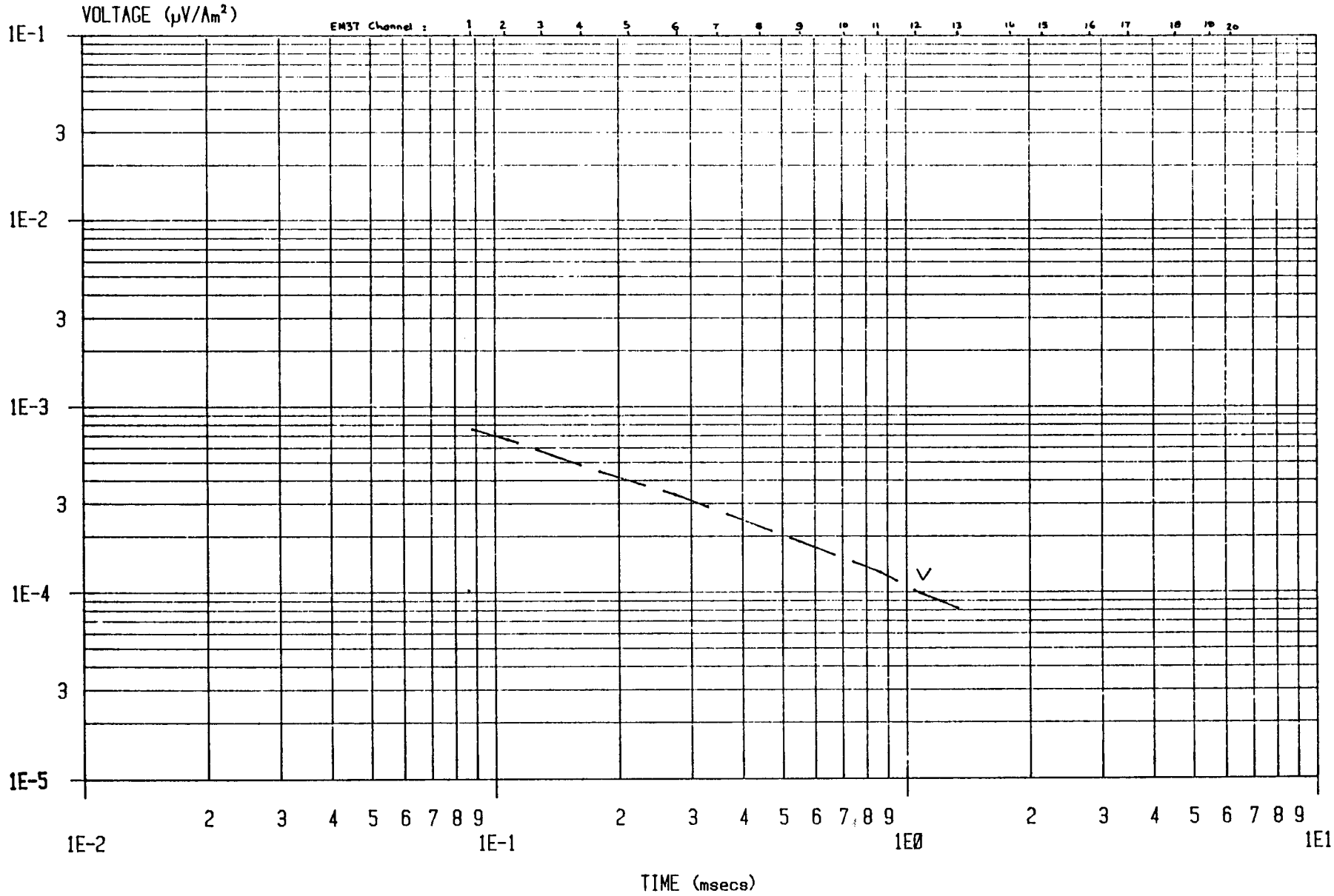


Figure 35

TEM SOUNDING

Station 2-18 Z Component

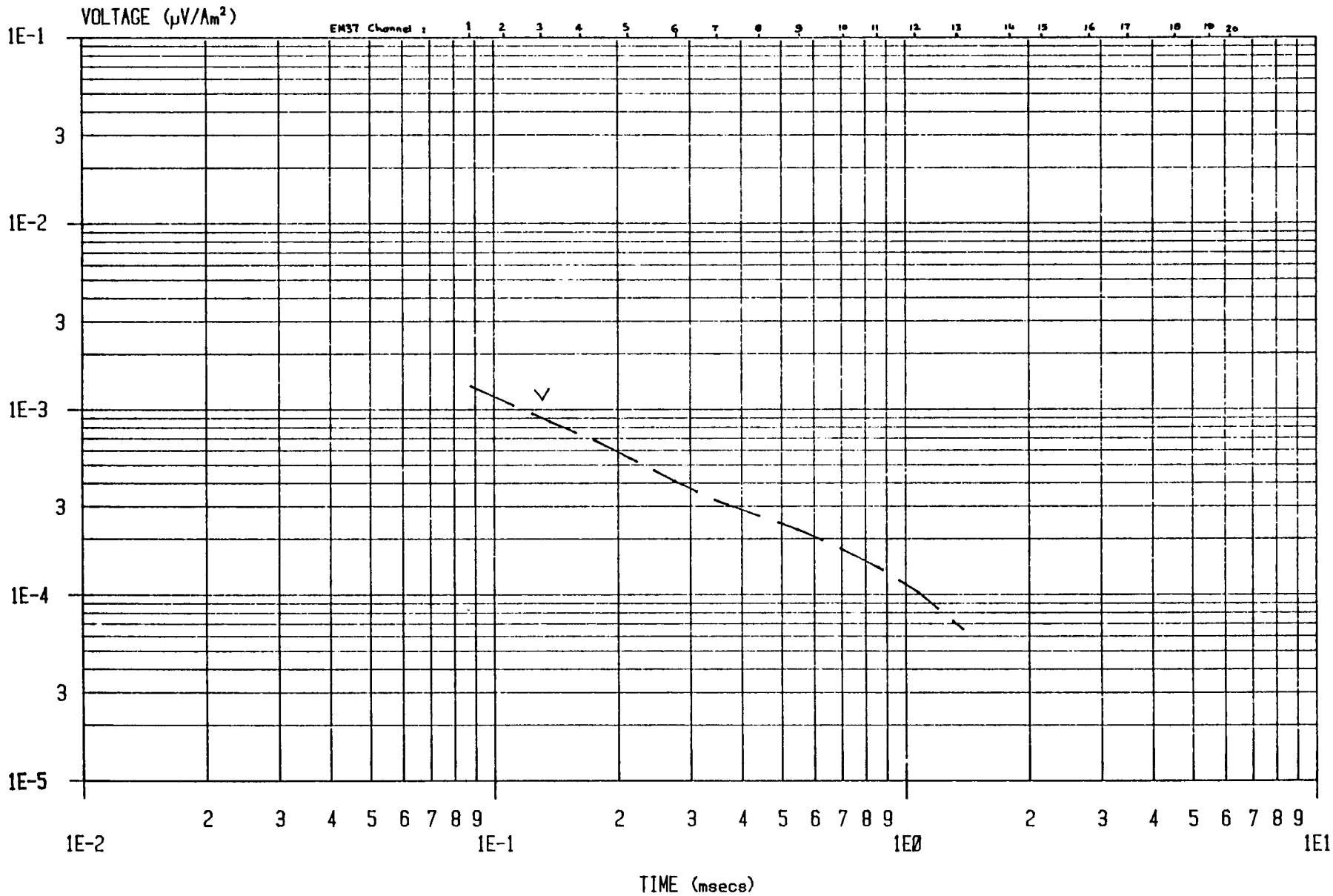


Figure 36

TEM SOUNDING

Station 3-1 Z Component

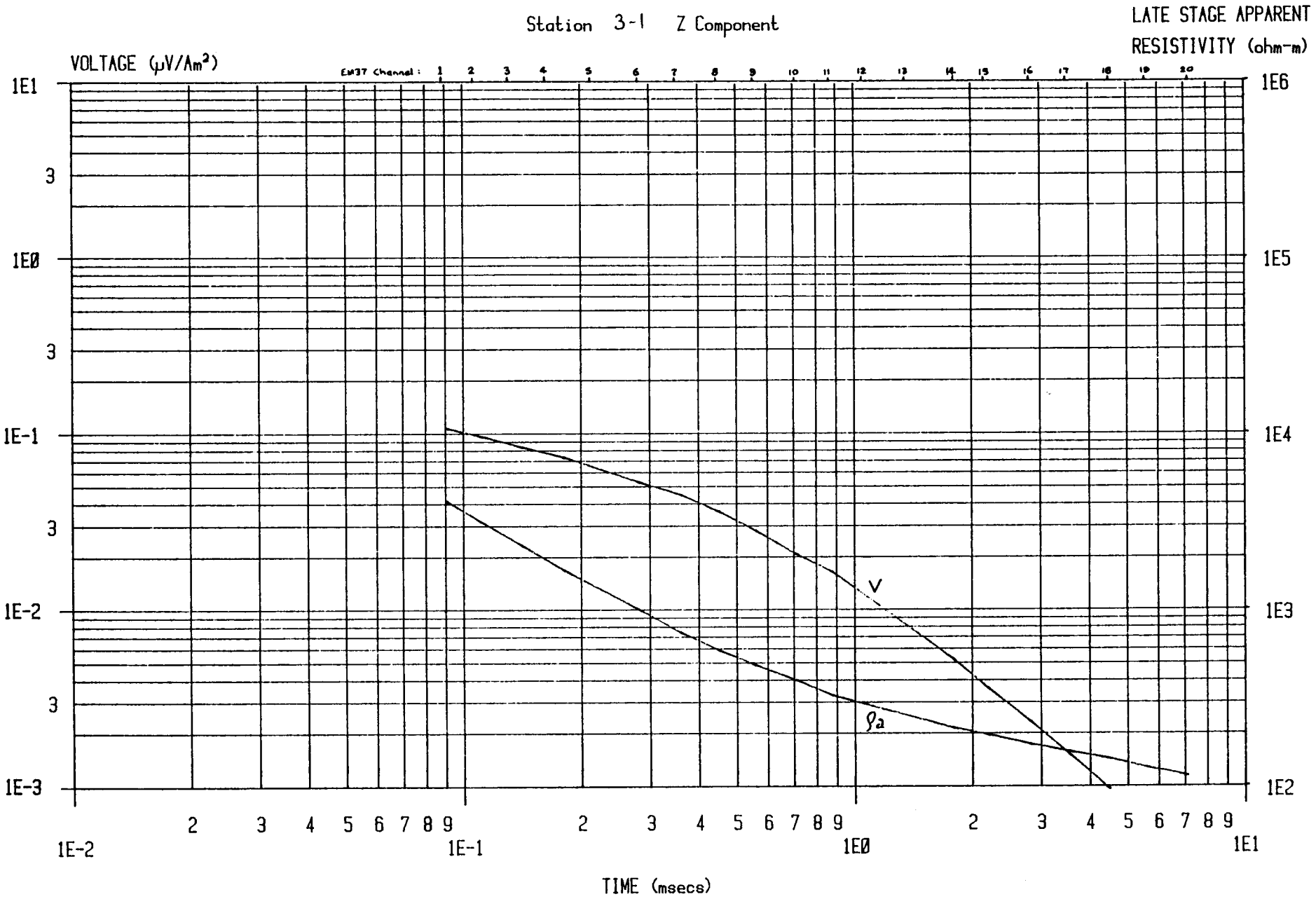


Figure 37

TEM SOUNDING

Station 3-2 Z Component

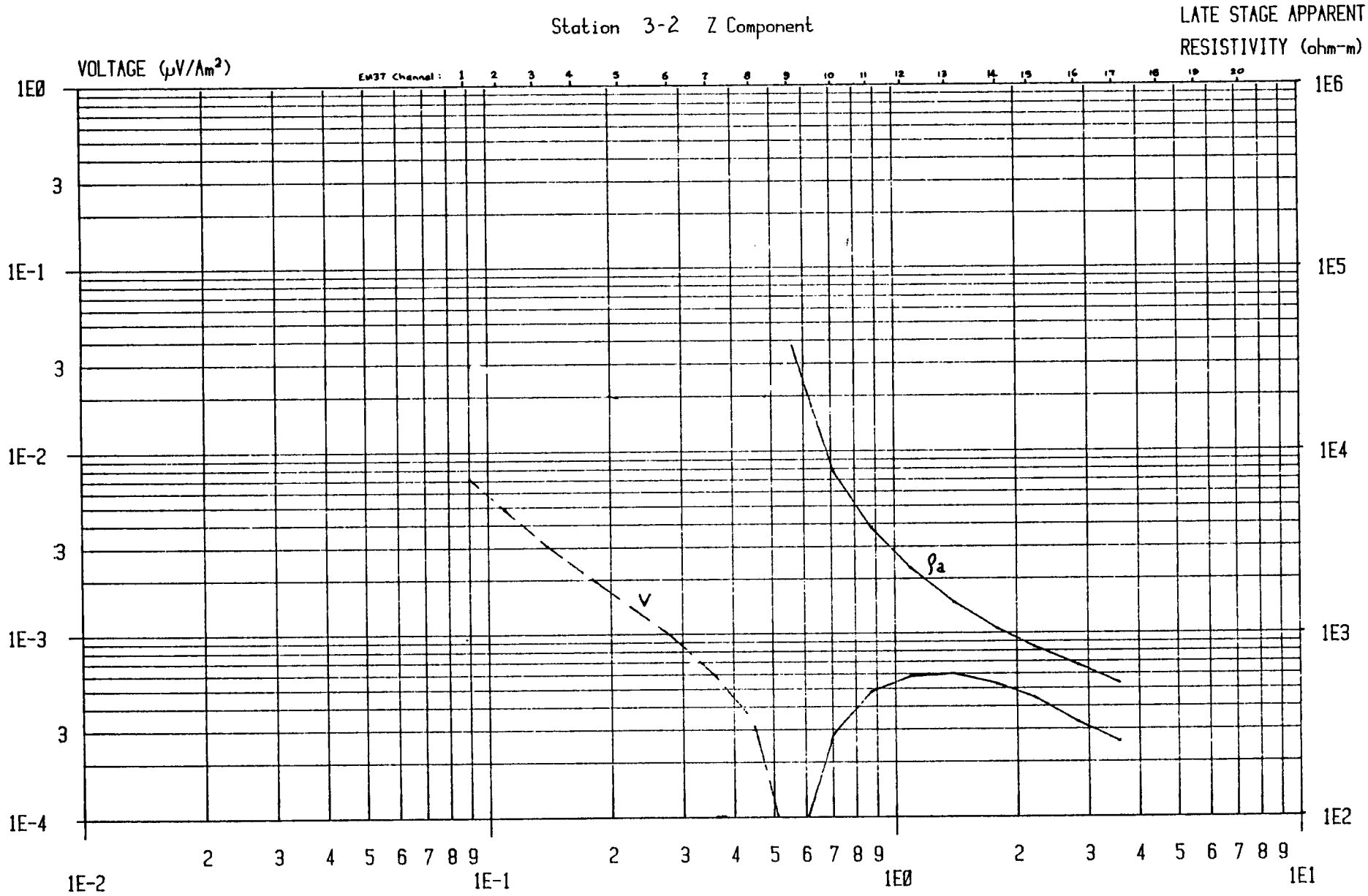


Figure 38

TEM SOUNDING

Station 3-3 Z Component

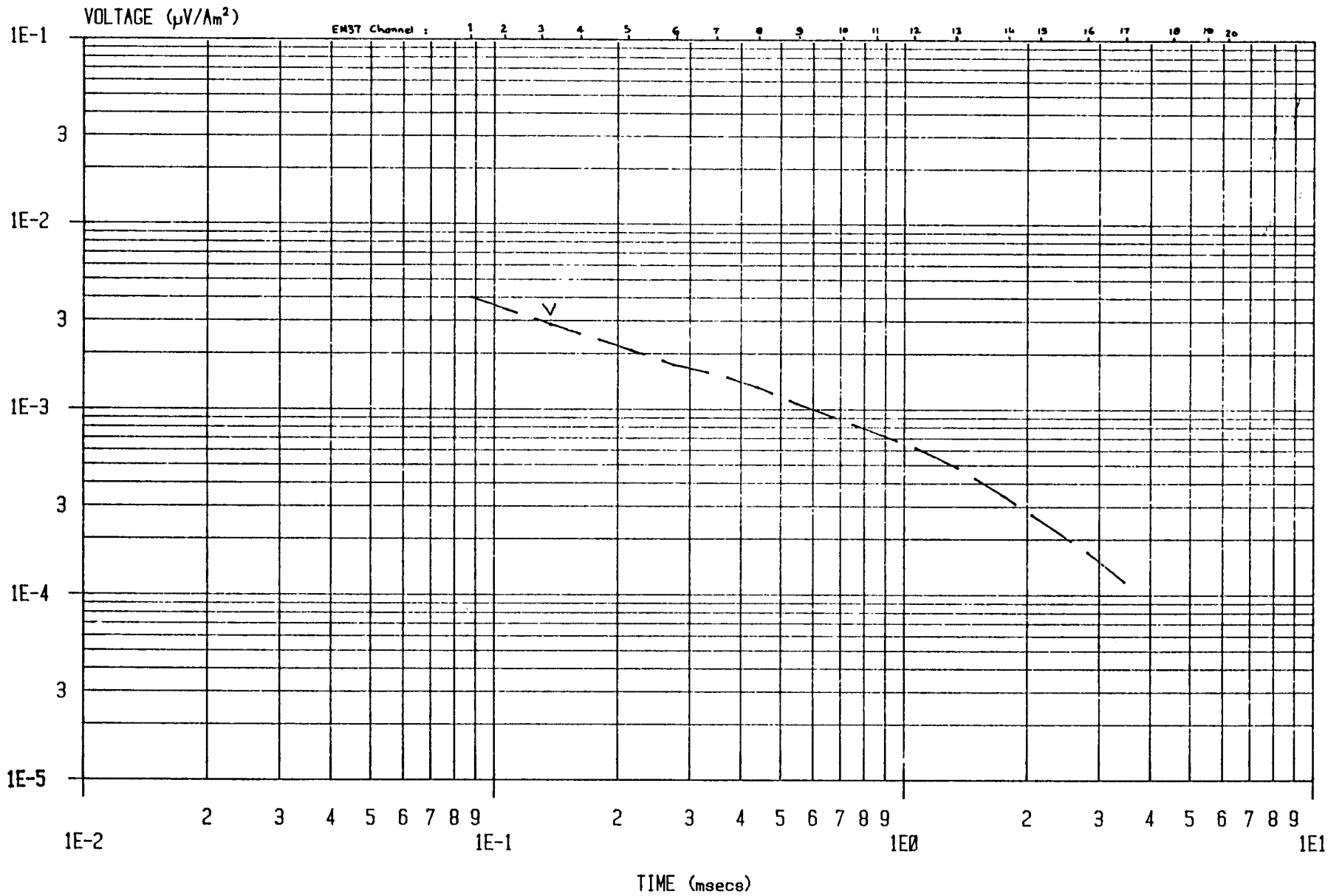


Figure 39

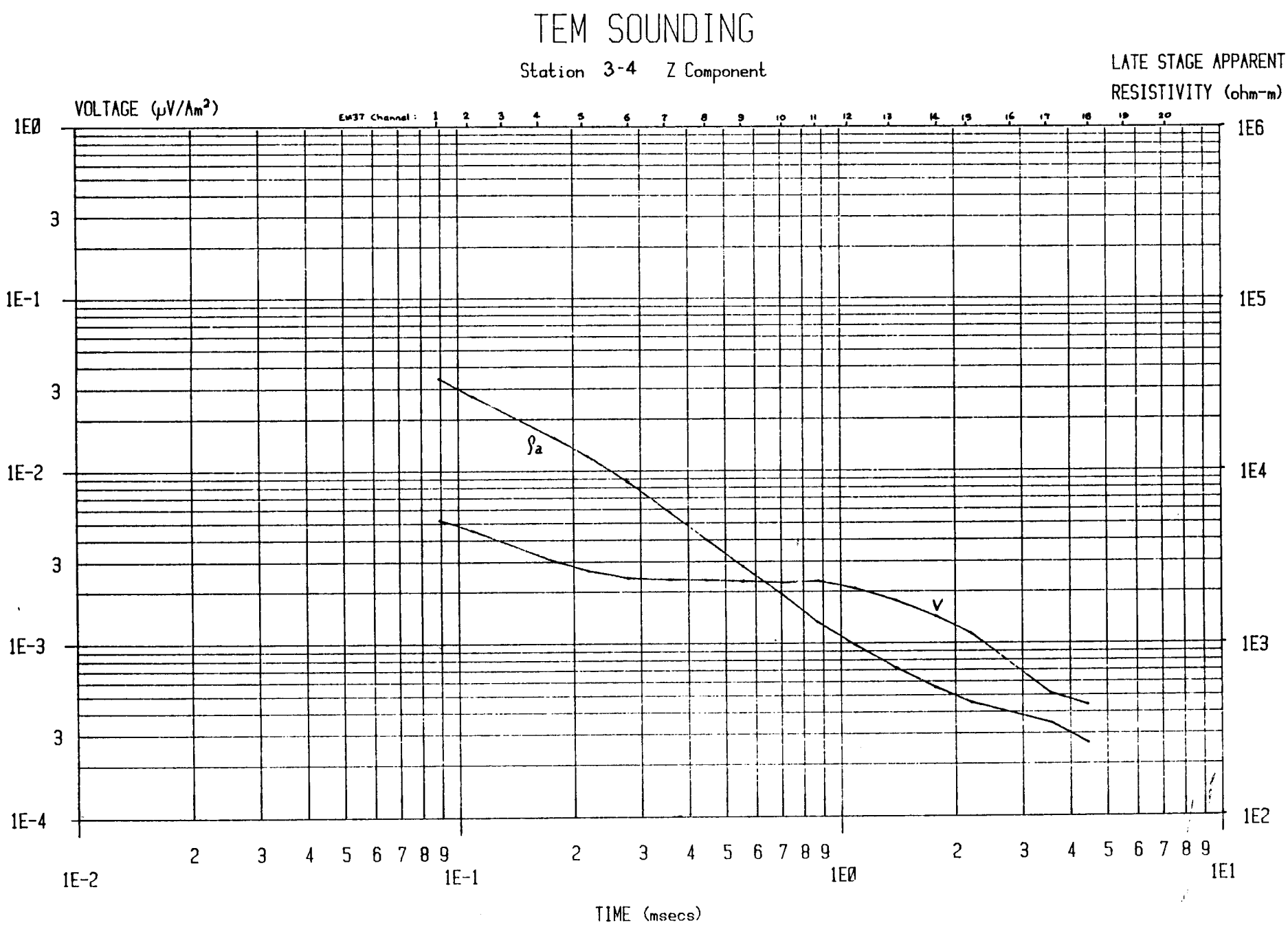

TEM SOUNDING
Station 3-4 Z Component
LATE STAGE APPARENT RESISTIVITY (ohm-m)
VOLTAGE (μV/Am²)
EM37 Channel: 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
1E0
3
1E-1
3
1E-2
3
1E-3
3
1E-4
1E6
1E5
1E4
1E3
1E2
ρa
V
1E-2
2 3 4 5 6 7 8 9
1E-1
2 3 4 5 6 7 8 9
1E0
2 3 4 5 6 7 8 9
1E1
TIME (msecs)

Figure 40

TEM SOUNDING

Station 3-5 Z Component

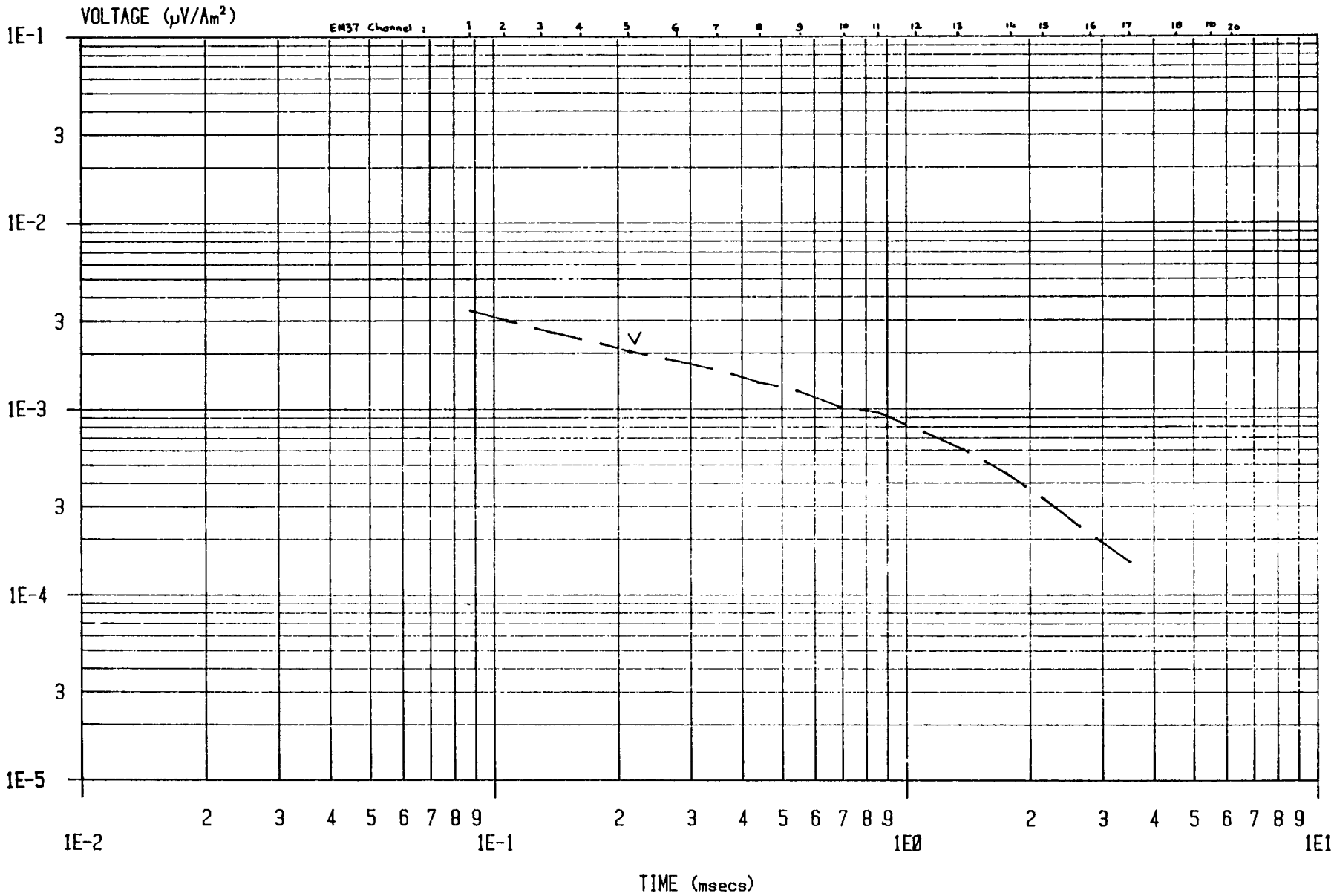


Figure 41

TEM SOUNDING

Station 3-6 Z Component

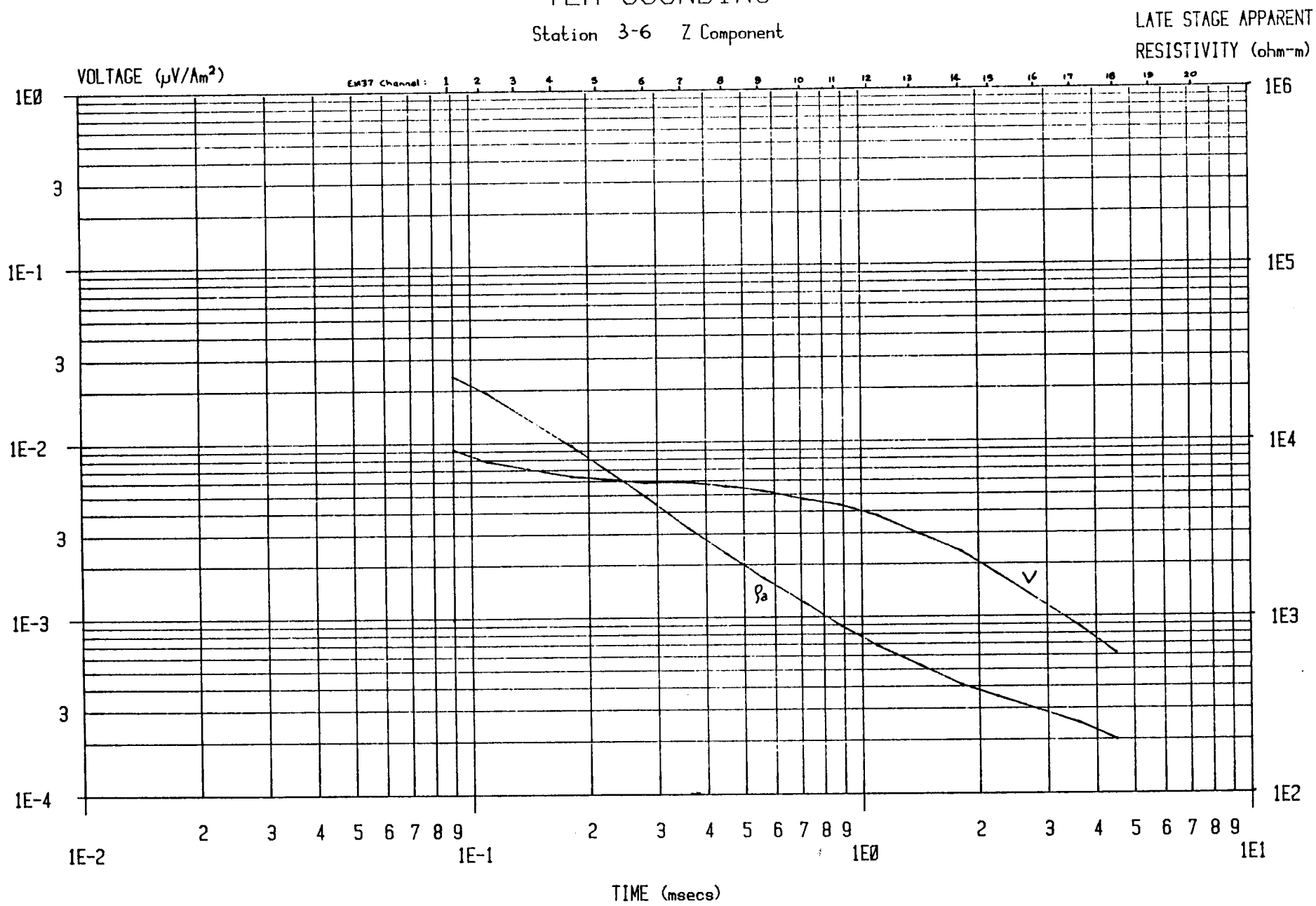


Figure 42

TEM SOUNDING

Station 3-7 Z Component

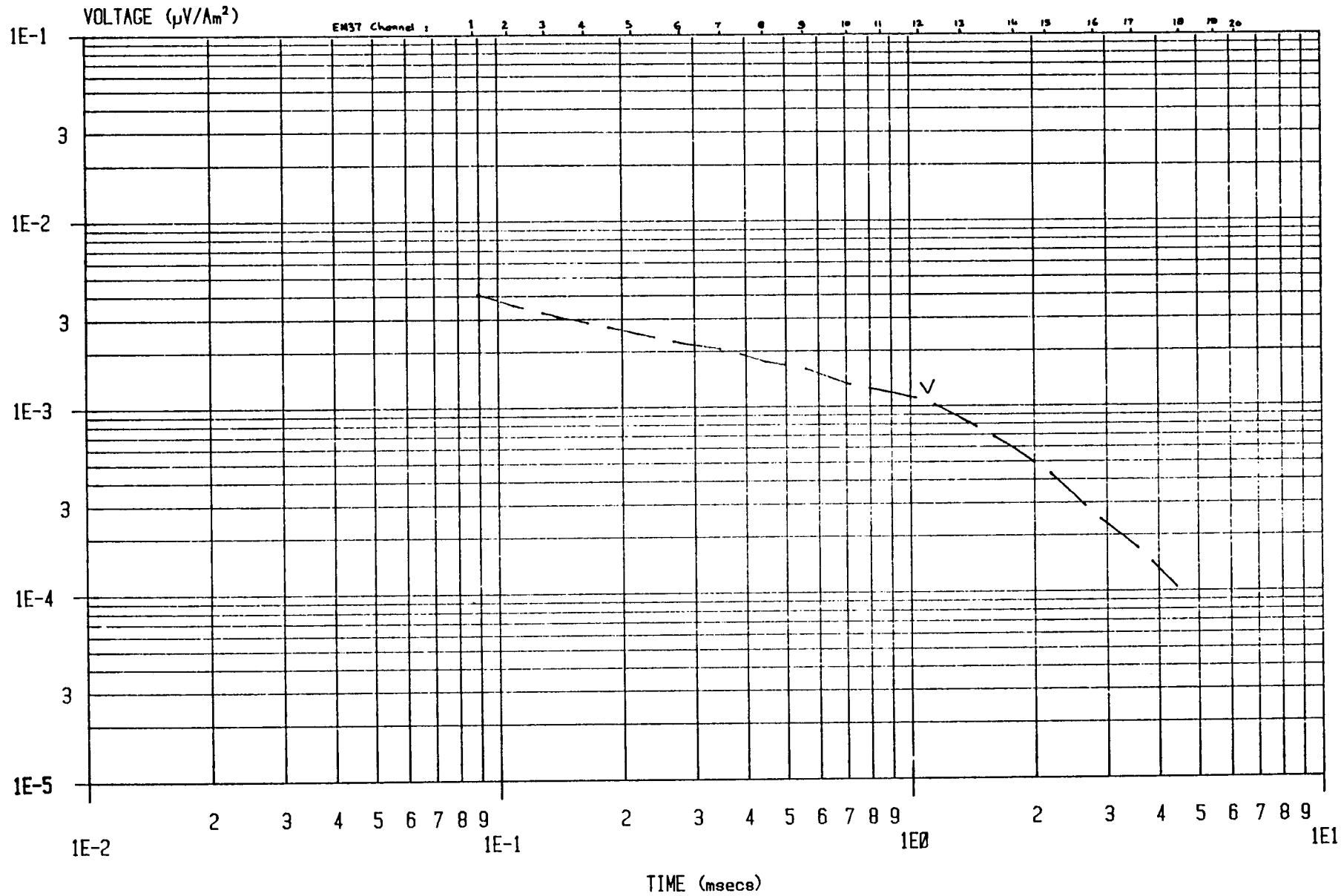


Figure 43

TEM SOUNDING

Station 3-8 Z Component

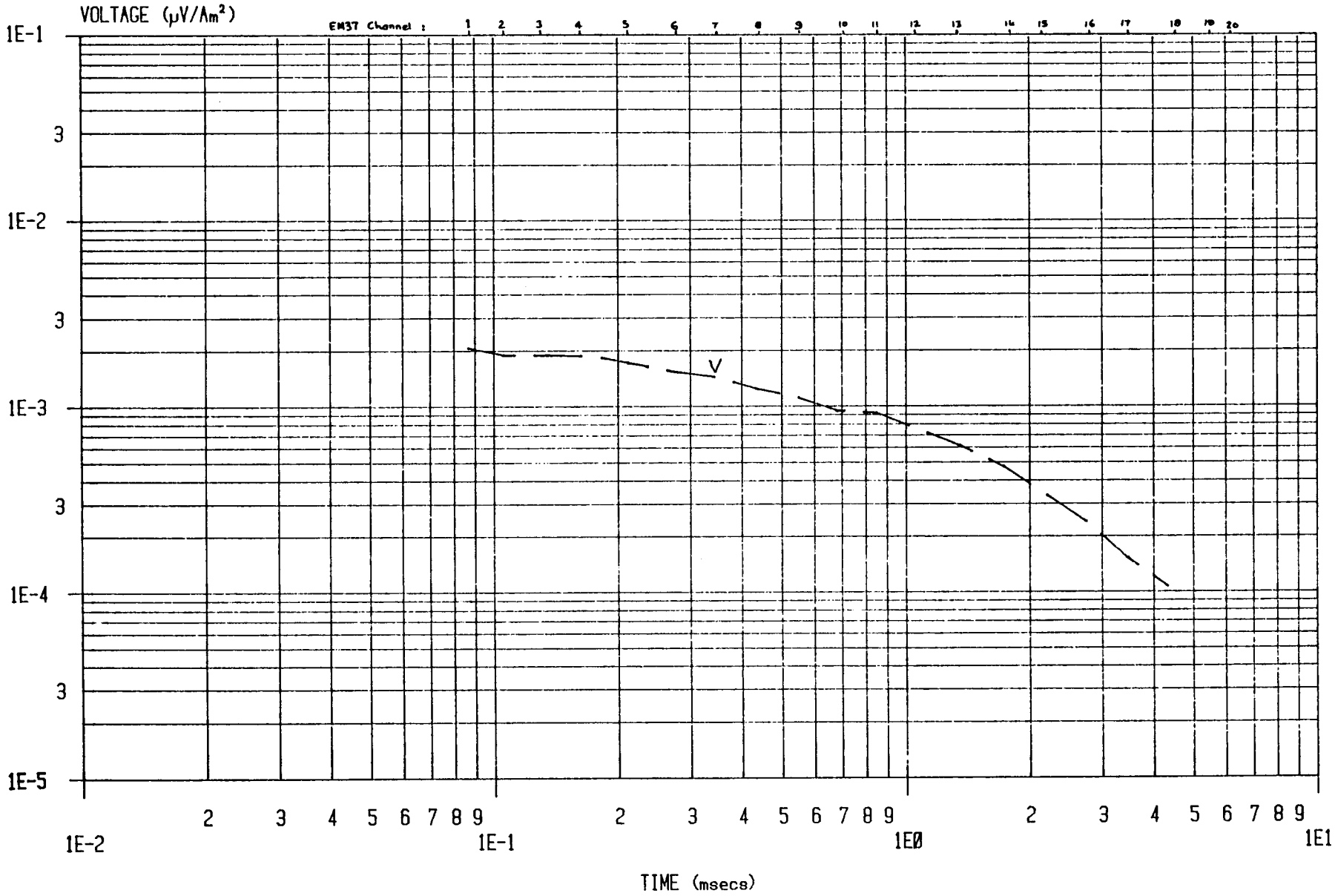


Figure 44

TEM SOUNDING

Station 3-9 Z Component

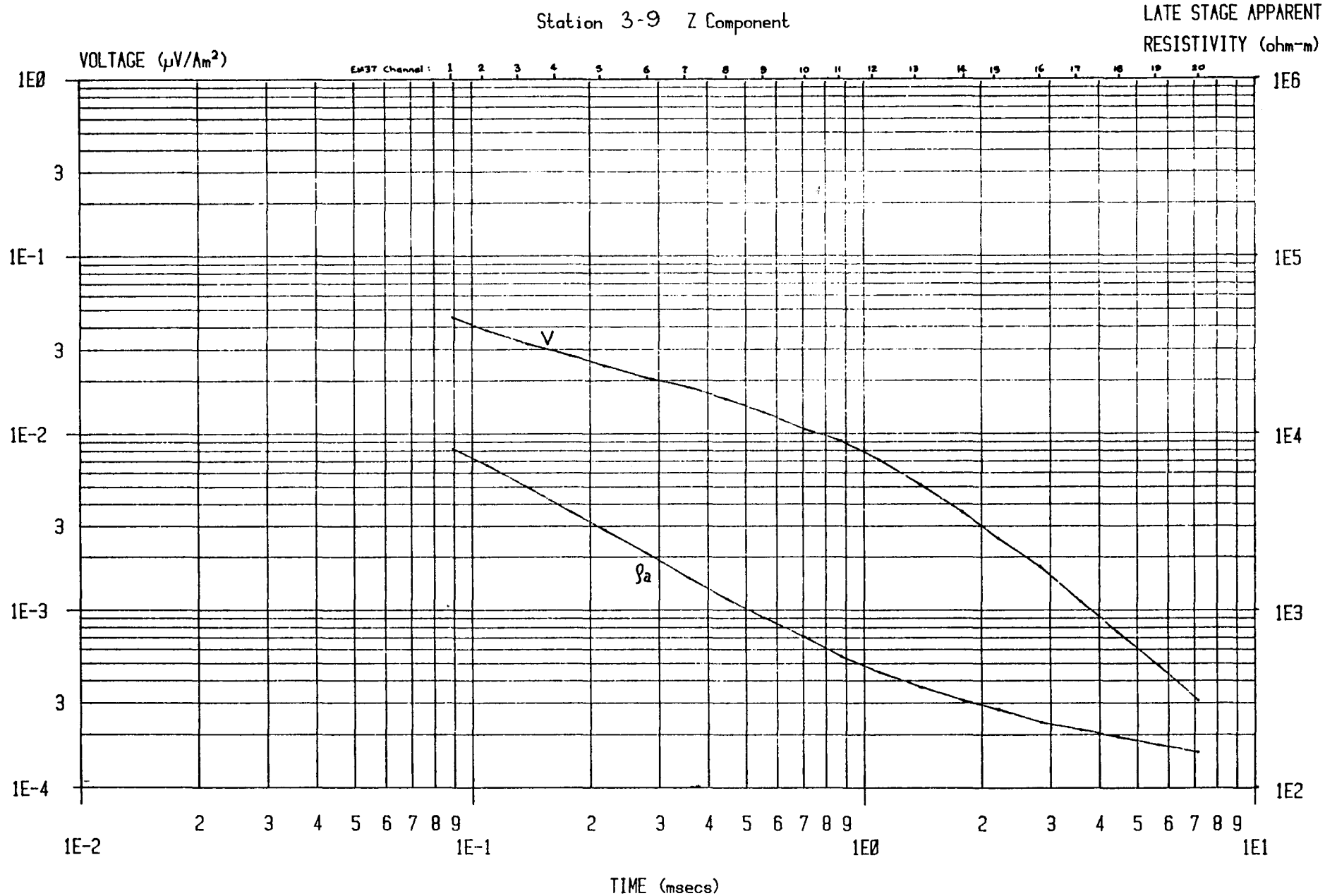


Figure 45

TEM SOUNDING

Station 3-10 Z Component

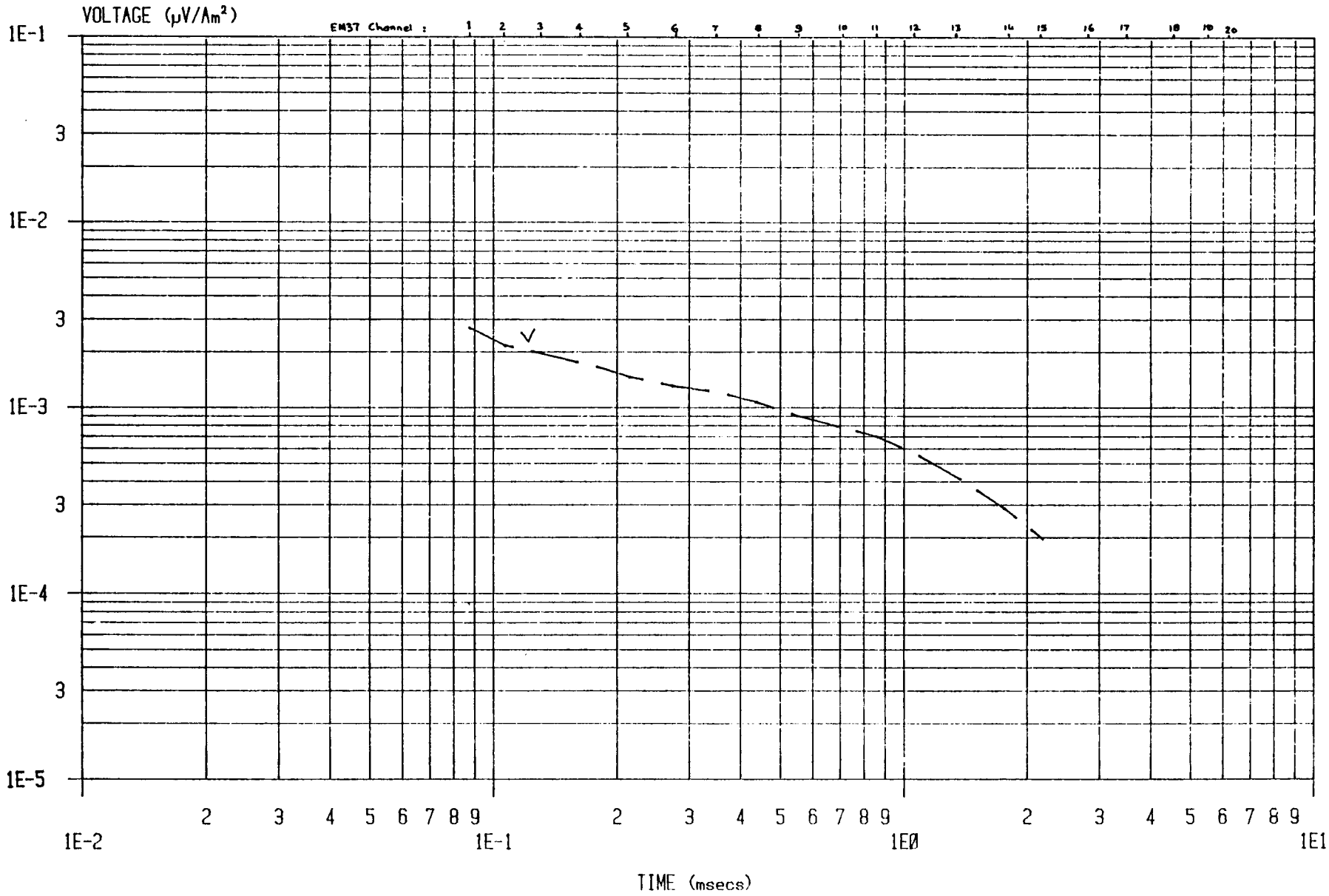


Figure 46

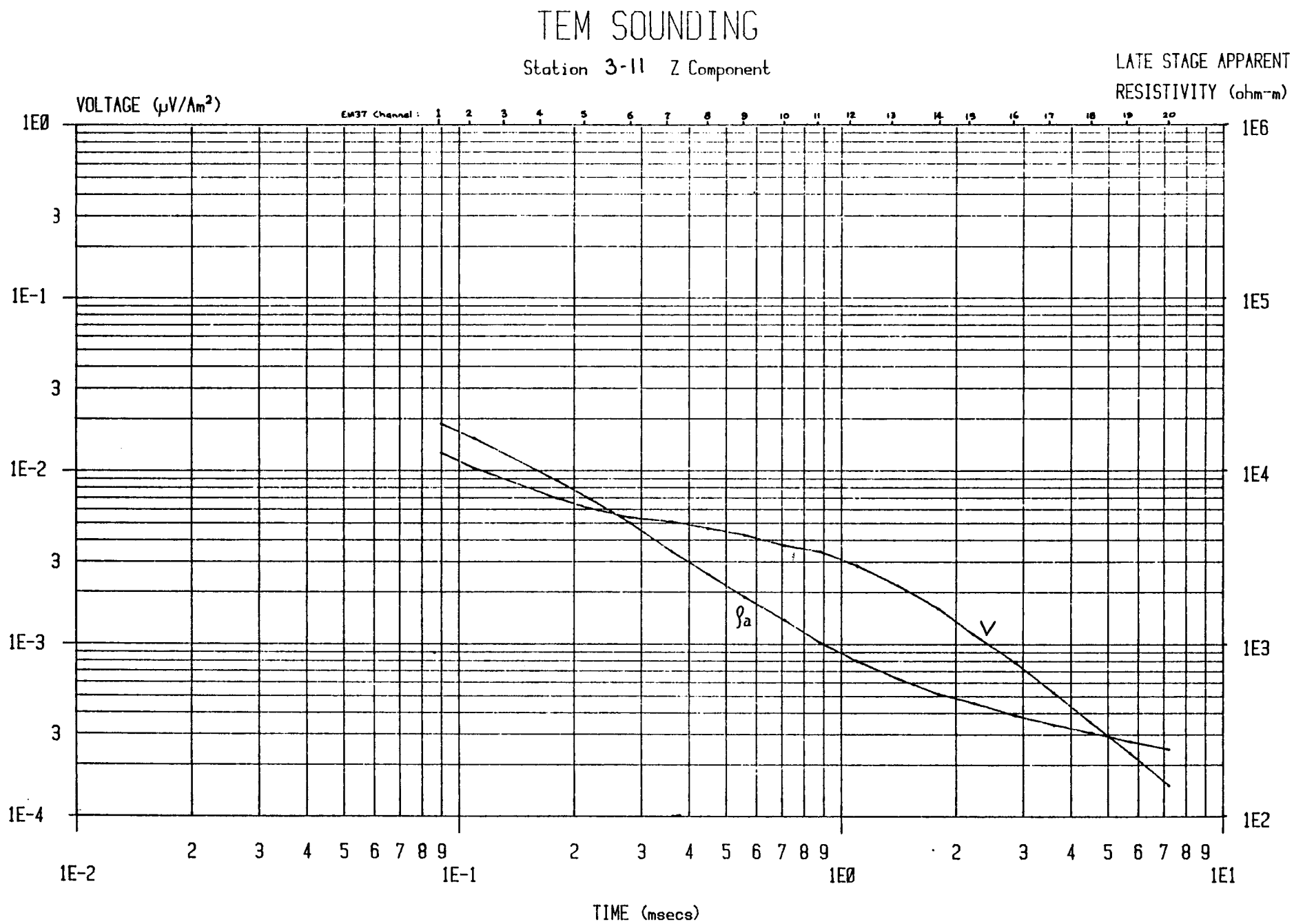

TEM SOUNDING
Station 3-11 Z Component
LATE STAGE APPARENT RESISTIVITY (ohm-m)
VOLTAGE (μV/Am²)
EM37 Channel: 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
1E0
3
1E-1
3
1E-2
3
1E-3
3
1E-4
1E6
1E5
1E4
1E3
1E2
ρa
V
1E-2
1E-1
1E0
1E1
TIME (msecs)

Figure 47

TEM SOUNDING

Station 3-12 Z Component

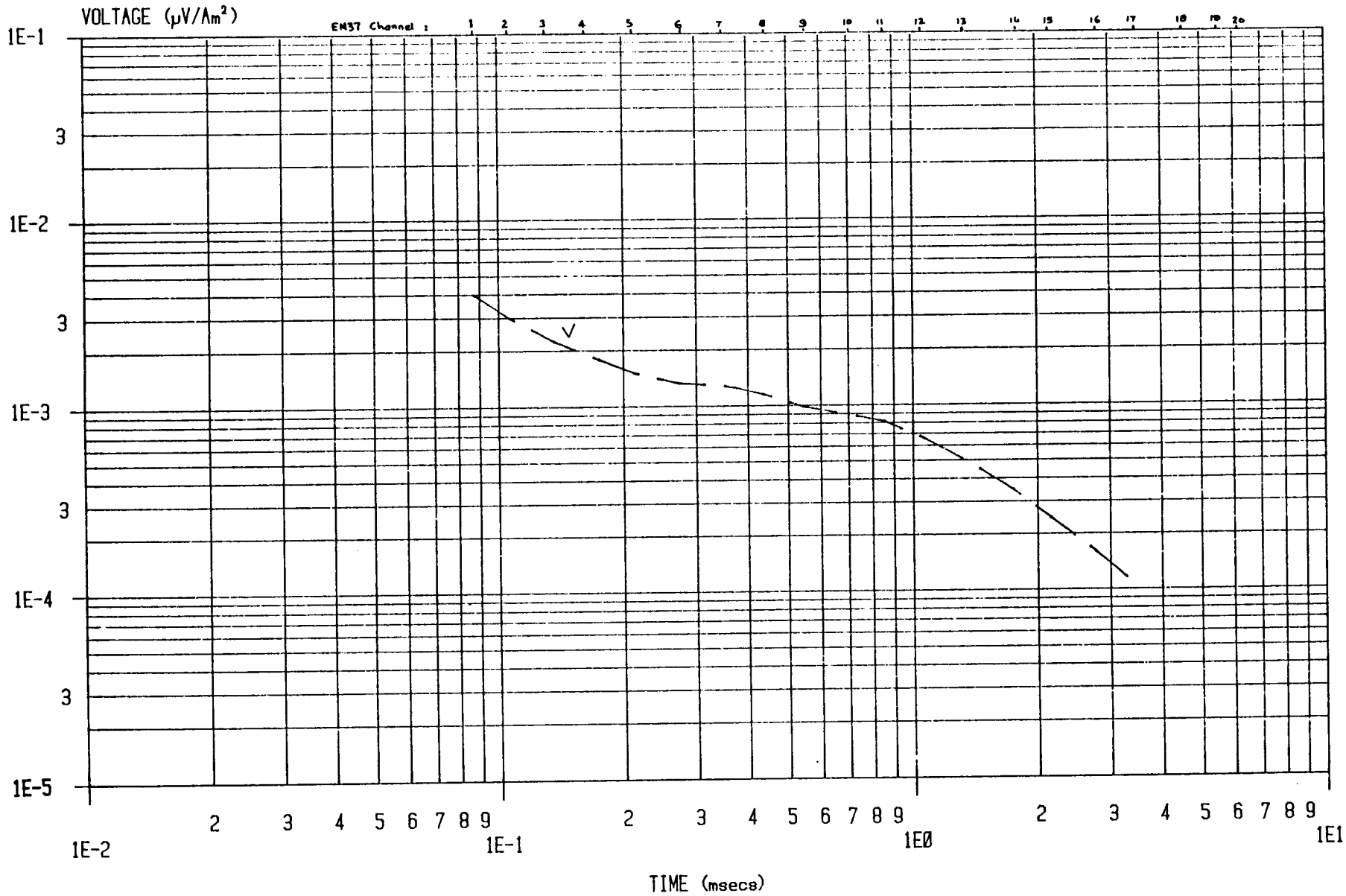


Figure 48

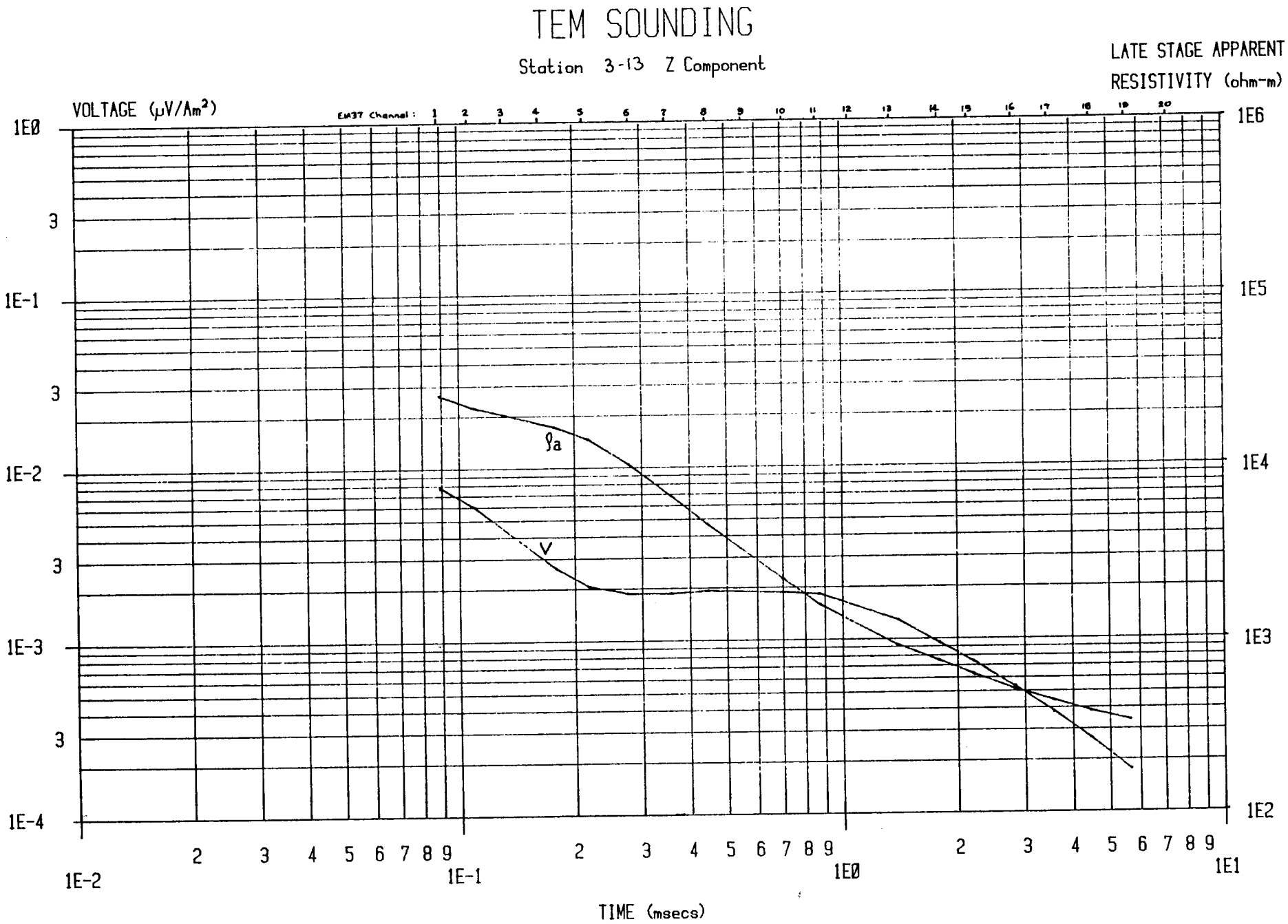

TEM SOUNDING
Station 3-13 Z Component
LATE STAGE APPARENT
RESISTIVITY (ohm-m)
VOLTAGE (μV/Am²)
EM37 Channel: 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
1E0
3
1E-1
3
1E-2
3
1E-3
3
1E-4
1E6
1E5
1E4
1E3
1E2
ρa
V
1E-2
2 3 4 5 6 7 8 9
1E-1
2 3 4 5 6 7 8 9
1E0
2 3 4 5 6 7 8 9
1E1
TIME (msecs)

Figure 49

TEM SOUNDING

Station 3-14 Z Component

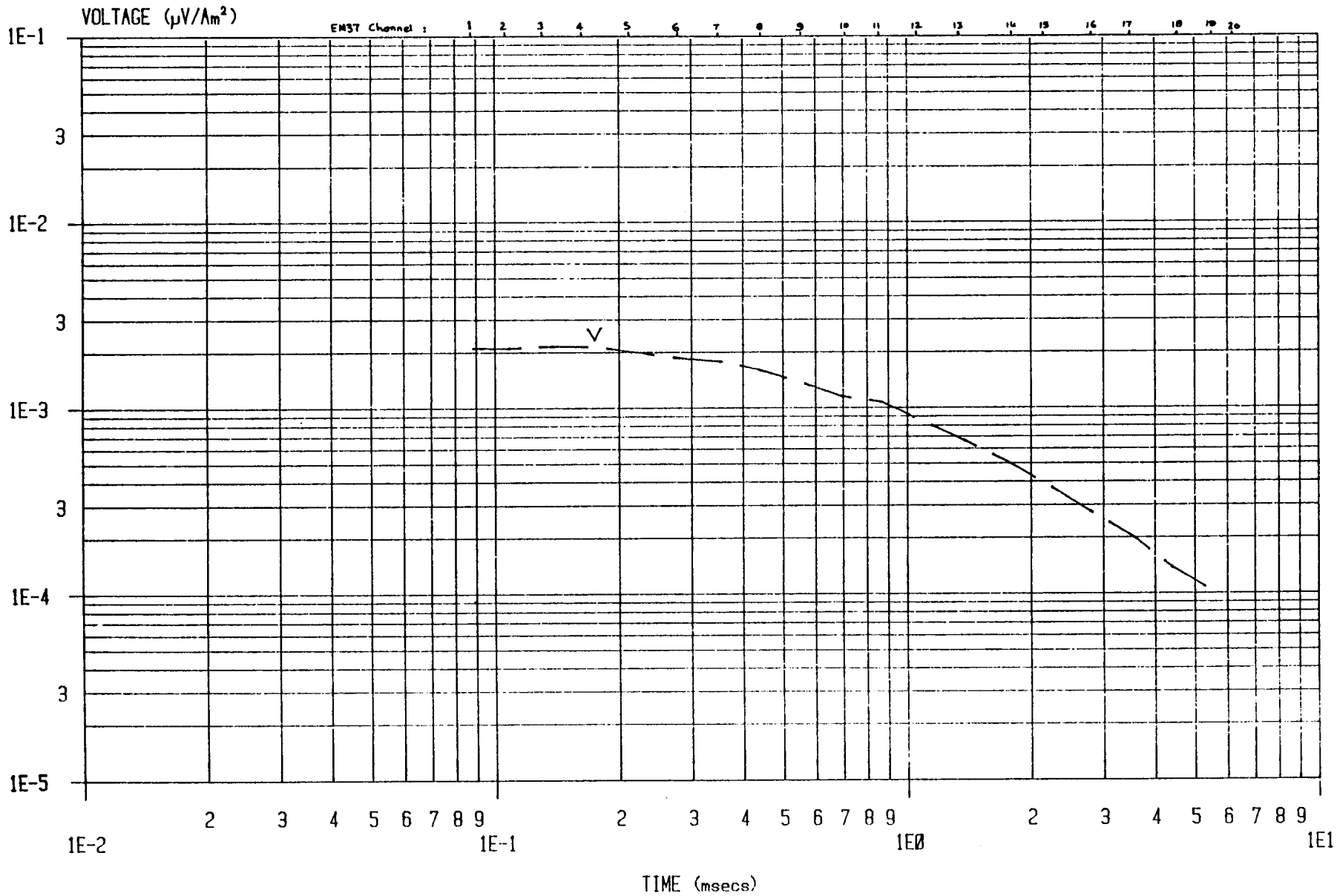
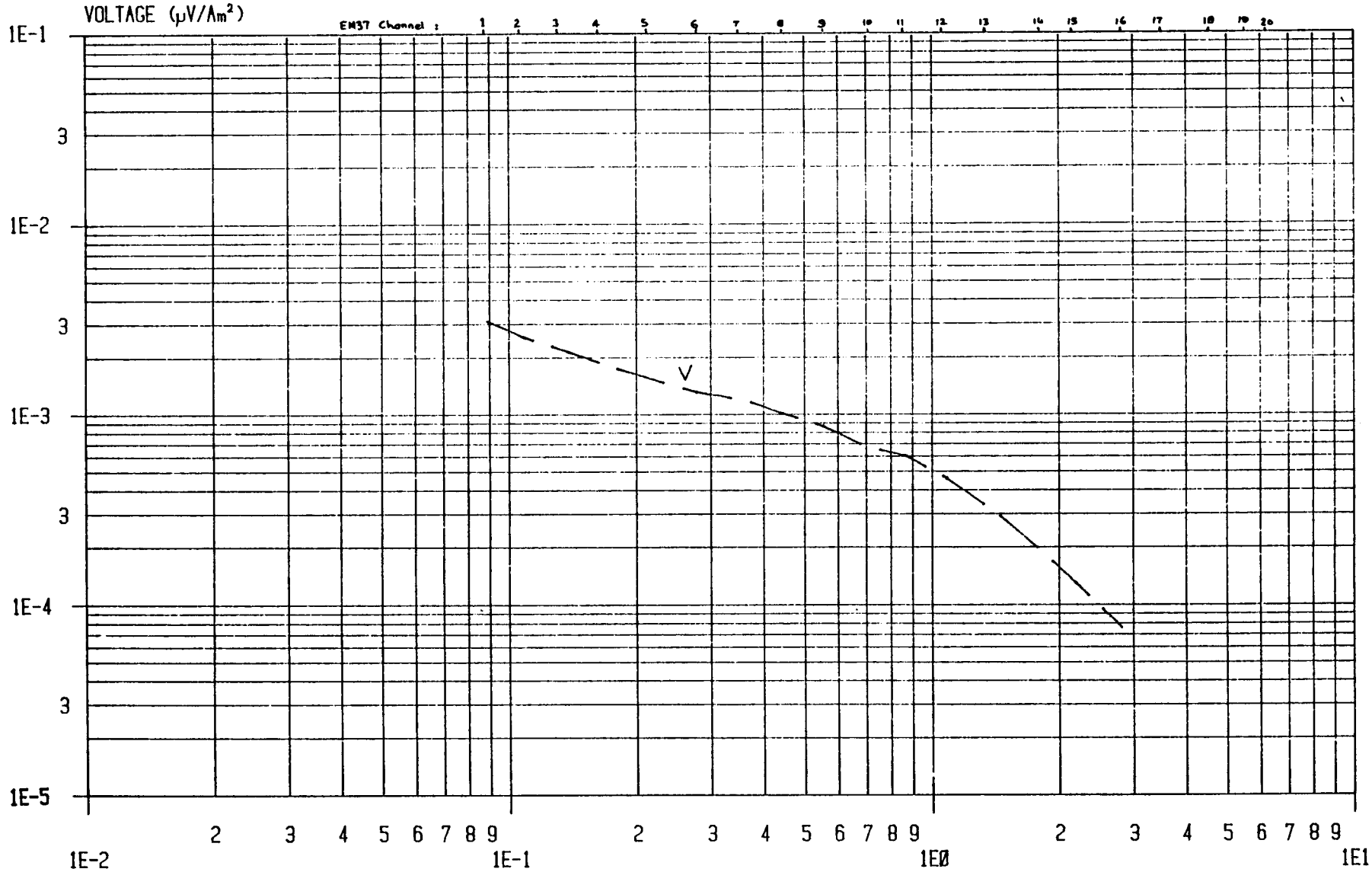


Figure 50

TEM SOUNDING

Station 3-15 Z Component



TIME (msecs)

Figure 51

TEM SOUNDING

Station 3-16 Z Component

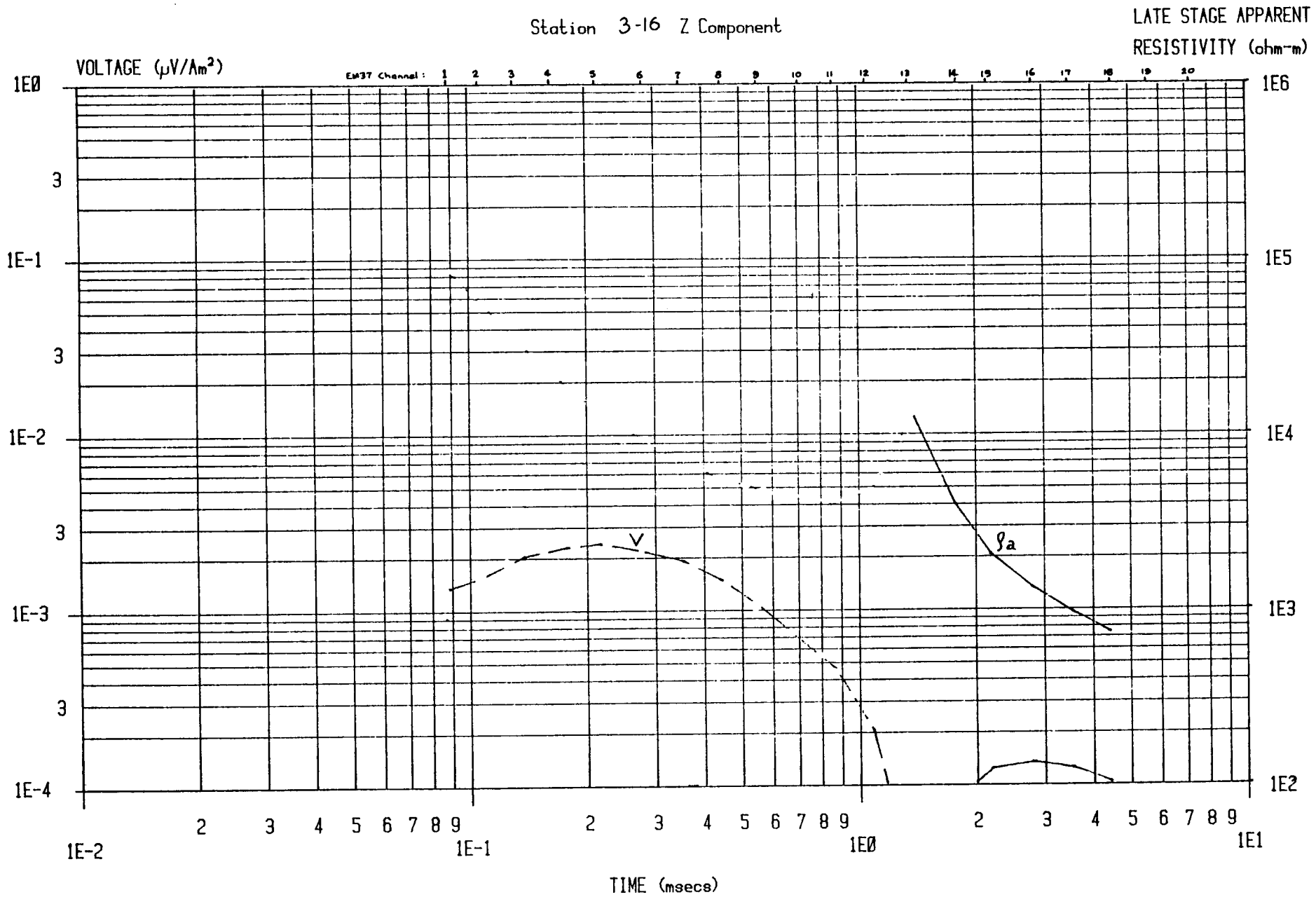


Figure 52

(iii) A transition between (i) and (ii). The curve has a negative sign which changes to positive, increases and then monotonically decreases with time. At the time of the sign change the equivalent current filament is located approximately underneath the receiver.

(iv) More complex behavior which is not attributable to a layered earth response.

For field results with near-zone behavior, late time apparent resistivity curves are also plotted on the graphs of field results. In most cases, the apparent resistivity curves decrease with time from initial values of several thousand ohm-m. The lowest values of apparent resistivity are recorded from Loop 2. None of the sounding locations surrounding Loop 2 are near-zone in character.

Numerical Model Example

The two-loop response of a two-layered model with thick resistive overburden is given in Figure 53 for loop separations of 1 and 2 km. The parameters of the model are:

depth to basement - 300 m;

top layer resistivity - 10,000 ohm-m; and

basement resistivity - 10 or 100 ohm-m.

The three categories described above can be clearly seen in these curves. For the loop separation of 2 km, early time behavior (far-zone) is evident over the entire time range measured. For the smaller separation of 1 km the time of the sign change occurs at about 0.7 ms in the case of the 100 ohm-m basement, and at

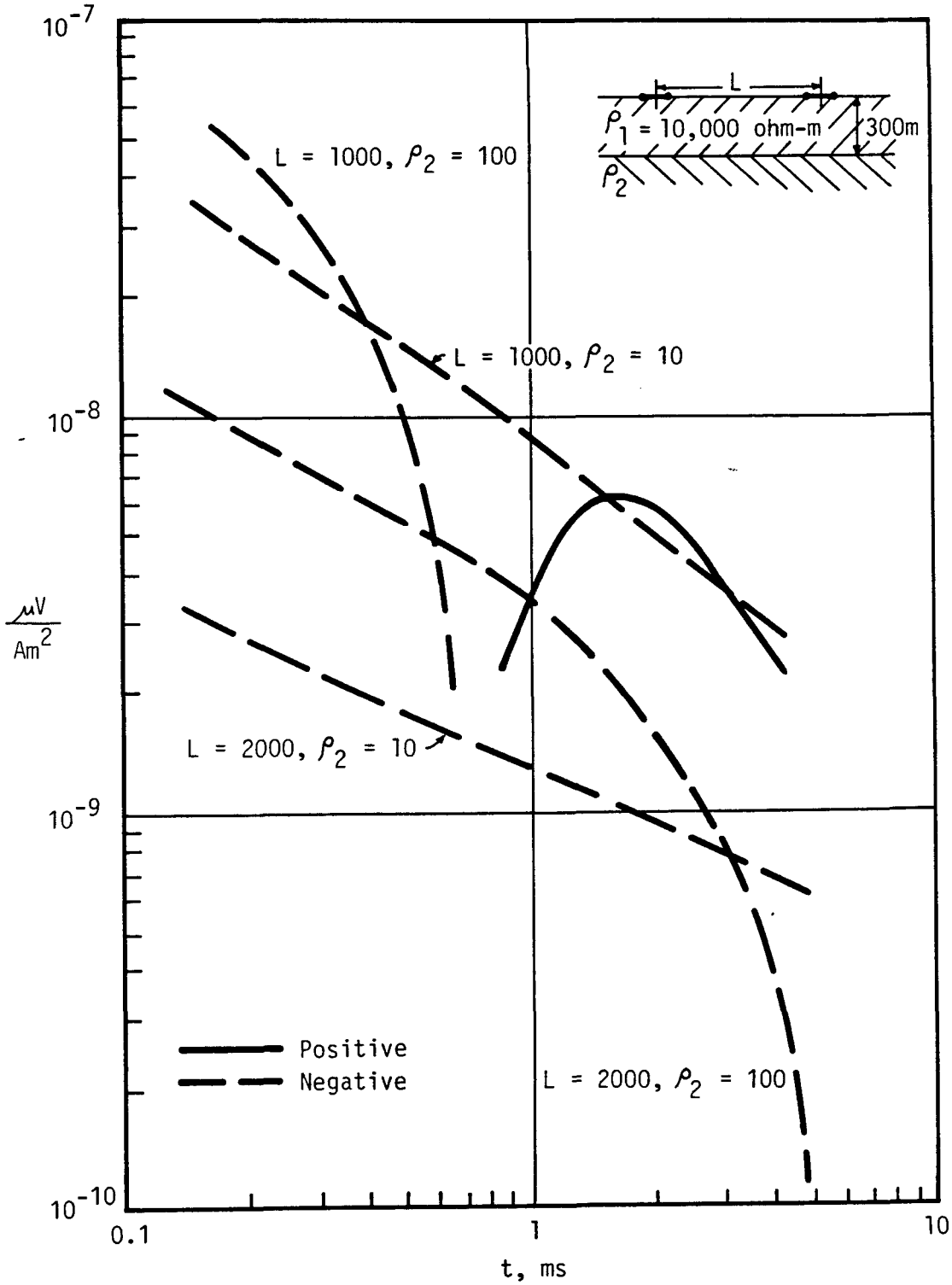


Figure 53. Separated loop forward computer model of a two-layered earth with conductive basement.

much later times for the 10 ohm-m basement. This behavior can be easily understood by considering that the velocity of the equivalent current filament increases as resistivity increases.

Varying the top layer resistivity between 5,000 and 20,000 ohm-m does not appreciably change the curves over the time range shown. Much earlier times would have to be measured to define this parameter.

INTERPRETATION

As mentioned in the previous section, all near zone apparent resistivity curves exhibit a decrease in apparent resistivity values with time. This behavior is consistent with a model of a highly resistive upper layer overlying a conductive basement. Previous Schlumberger resistivity surveys in adjacent areas have provided evidence that the near-surface volcanics in adjacent areas typically have resistivities in the range of 10,000 to 100,000 ohm-m, and may extend to depths of up to 1 km (A Zohdy, U.S.G.S., pers. comm., 1982).

Near-Zone Soundings

Data from field sites exhibiting near-zone behavior (positive voltage over the time range measured) were interpreted using two-layer master curves. These locations were limited to sites 1-1, 1-2, and 1-4 from Loop 1; site 2-1 (only in-loop) from Loop 2; and sites 3-1, 3-4, 3-6, 3-9, 3-11 and 3-13 from Loop 3.

Because measurements were not made in the "early stage" of the sounding curve the field curves can be fitted to a number of resistivity contrasts. In the following evaluation, results are given for resistivity contrasts of 200, 500 and 1000. It was found that this procedure merely changed ρ_1 (the resistivity of the first layer), and that varying the contrast had very little effect on ρ_2 (second layer) or d (the depth of the interface).

A summary of interpretation is presented in Table 1. As expected, ρ_1 is not well defined because measurements were not

TABLE 1. Two-layer interpretation of near-zone soundings

Loop	Sounding Number (Tx/Rx Separation in meters)	ρ_1/ρ_2 = 1/200				ρ_1/ρ_2 = 1/500				ρ_1/ρ_2 = 1/1000			Goodness of fit
		ρ_1	ρ_2	d	Goodness of fit	ρ_1	ρ_2	d	Goodness of fit	ρ_1	ρ_2	d	
1	1-1	2,500	12	300	A	5,000	10	340	A	10,000	10	330	A
	1-2(650)	20,000	100	730	A	50,000	100	730	A	85,000	85	730	A
	1-4(750)	100,000	500	1200	A	380,000	760	1200	A	700,000	700	1200	A
2	2-1	400	2	120	E	1,220	2.4	110	E	2,300	2.3	120	E
						Fitting only first half:				10,000	10	120	D
						Fitting only second half:				550	0.5	140	B
3	3-1	5,500	28	360	A	12,500	25	360	A	24,000	24	360	A
	3-4(720)				P				P	20,800	21	670	B(P)
	3-6(680)				P				P	18,800	19	590	B
	3-9(760)				P	7,700	15	440	E	21,000	21	500	E
	3-11(780)				P				P	20,800	21	670	B
	3-13(720)				P				P	50,000	50	700	E(P)

Notes

Goodness of Fit:
A = good fit on whole curve
B = fits best on second half
C = fits best in middle
D = fits best on first half
E = moderate fit, whole curve
P = poor fit

Resistivities given in ohm-m, depths in m

made early enough in time to define the early time asymptote. However, d and ρ_2 are relatively stable parameters.

Interpretation of the in-loop soundings is considered accurate. The separation between receiver and transmitter with many of the other soundings is considered too large for a true near-zone interpretation. Values of all parameters are biased in a positive sense to varying degrees. However, parameters at sounding locations at a constant value of separation can accurately be used for comparative purposes. Each of the transmitter loop locations will be described in turn.

One method for comparing the results at various sites around the loop is to plot the location of the equivalent current filament at a fixed time. In areas with lower resistivity, the filament will move more slowly with time, and thus will be located closer to the transmitter loop position. This procedure is used for the data presented in Figure 54 for a sample time of 150 μs.

Loop 1

Interpretation of the in-loop soundings for Loop 1 gives a basement resistivity of 10 ohm-m at a depth of 330 m which is indicative of a geothermal reservoir. Only sites 1-2 and 1-4 can be considered to be in the near-zone, and, of these, site 1-2 gives the most favorable interpretation.

The contour is closest to Loop 1 on the southwest side (south of the "hot spot" marked on the map), inferring that, in this direction, the resistivity is lower than on the other sides.

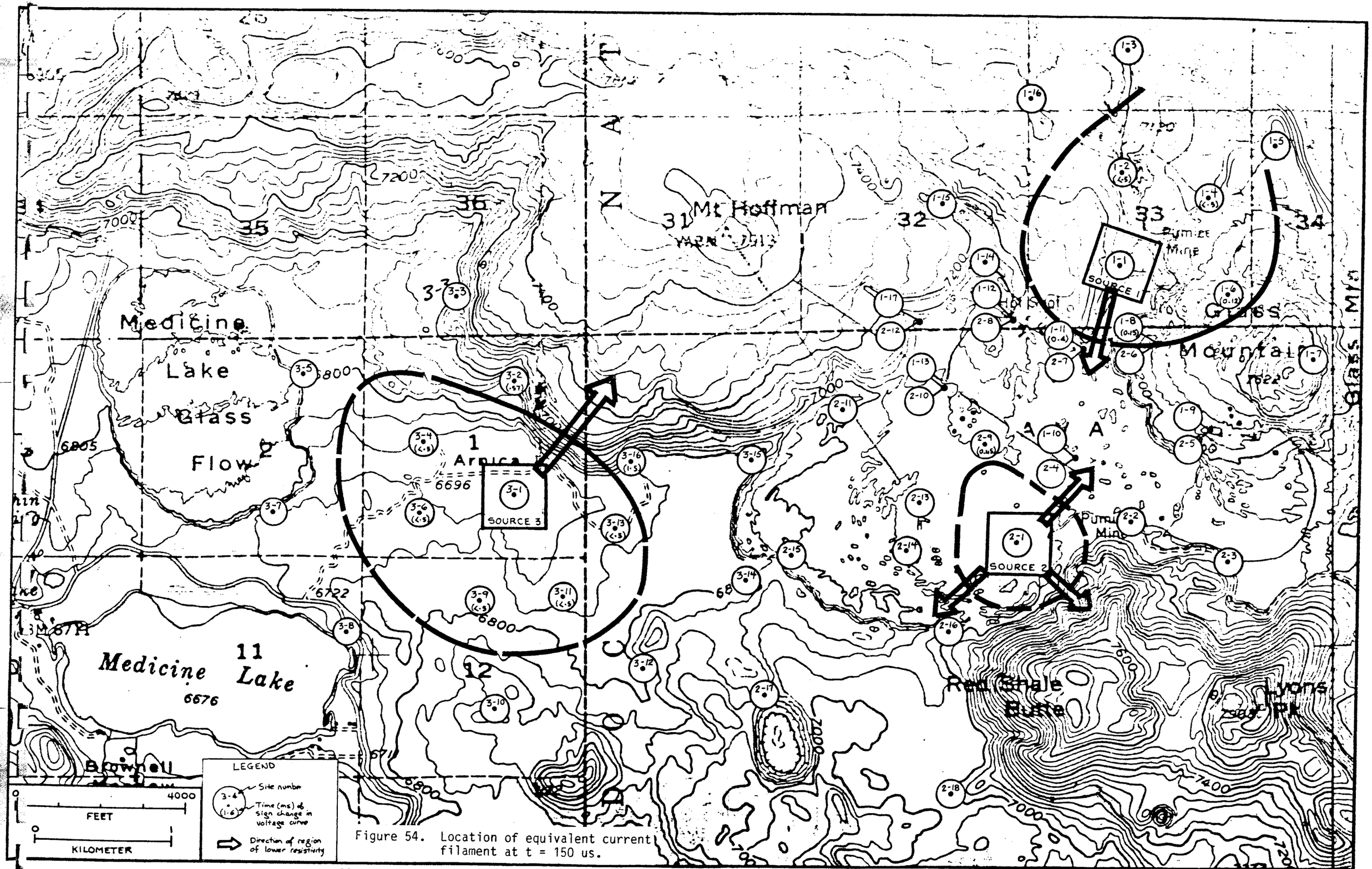


Figure 54. Location of equivalent current filament at t = 150 us.

Sites 1-1, 1-2 and 1-4 are all within the current filament, and thus can be interpreted as near-zone data.

Loop 2

Interpretation of the in-loop sounding (site 2-1) resulted in much lower values of basement resistivity and depth than at site 1. The fit to a two-layer curve was not excellent; there is evidence that a third layer may be present. However, the two-layer interpretation gives accurate first-order values of the geo-electric parameters.

Curve-matching results for this site are given in Table 1 for an interpretation of the whole curve (which has moderate fit) and also for the first half, and then the second half, of the curve. This procedure is really an "equivalent layer" technique. The combined interpretation at this site results in a basement resistivity on the order of 1 ohm-m at a depth of between 120 and 140 m.

No other sites surrounding Loop 2 are classed as near-zone. This is because the equivalent current filament moves slowly in the conductive earth underlying this loop location.

However, from Figure 54 it can be seen that the filament contour at 150 μs extends close to site 2-9. This is interpreted as indicating a region of higher basement resistivity.

Loop 3

Site 3-1, in the center of the loop, gave a good curve fit to the two-layer curves, and was interpreted as having a basement resistivity of 25 ohm-m at a depth of about 360 m,

similar to the central sounding at Loop 1 but with a slightly higher value of resistivity.

Many sites surrounding Loop 3 could be regarded as being in the near-zone region. However, they generally had a poor fit with a layered earth model, although reasonably low basement resistivities were encountered. The poor fit is attributed to the limited depth of the conductive layer which is less than the loop separation and thus not a true near-zone condition.

The contour plot in Figure 54 indicates that the region northeast of the loop, towards Mount Hoffman, is more conductive than elsewhere due to close proximity of the 150 μs contour in this directon.

Far-Zone Data

Far-zone loop-loop data is more difficult to interpret in a quantitative fashion than near-zone data because master curves or computer inversion schemes have not yet been developed. However, use can be made of the data by plotting values of early time apparent resistivity for a certain value of transmitter-receiver separation.

Figure 55 shows the 1500 ohm-m contour locations for the three loops. This data was calculated for all sites with separations between 2.5 and 3 km, at a sample time of 0.09 ms. In most cases the early time asymptote has not been reached, but the data can be used to give a qualitative estimate of conductivity patterns.

The data do not, by themselves, indicate absolute resistivities, but their deviation from a perfectly circular pattern is indicative of structural changes.

The main feature shown in Figure 55 is the elongated zone between Loops 1 and 2 which may indicate a region of lower resistivity basement. A northeast-southwest trend is evident from Loop 3, but data points are too sparsely scattered to define a reliable pattern.

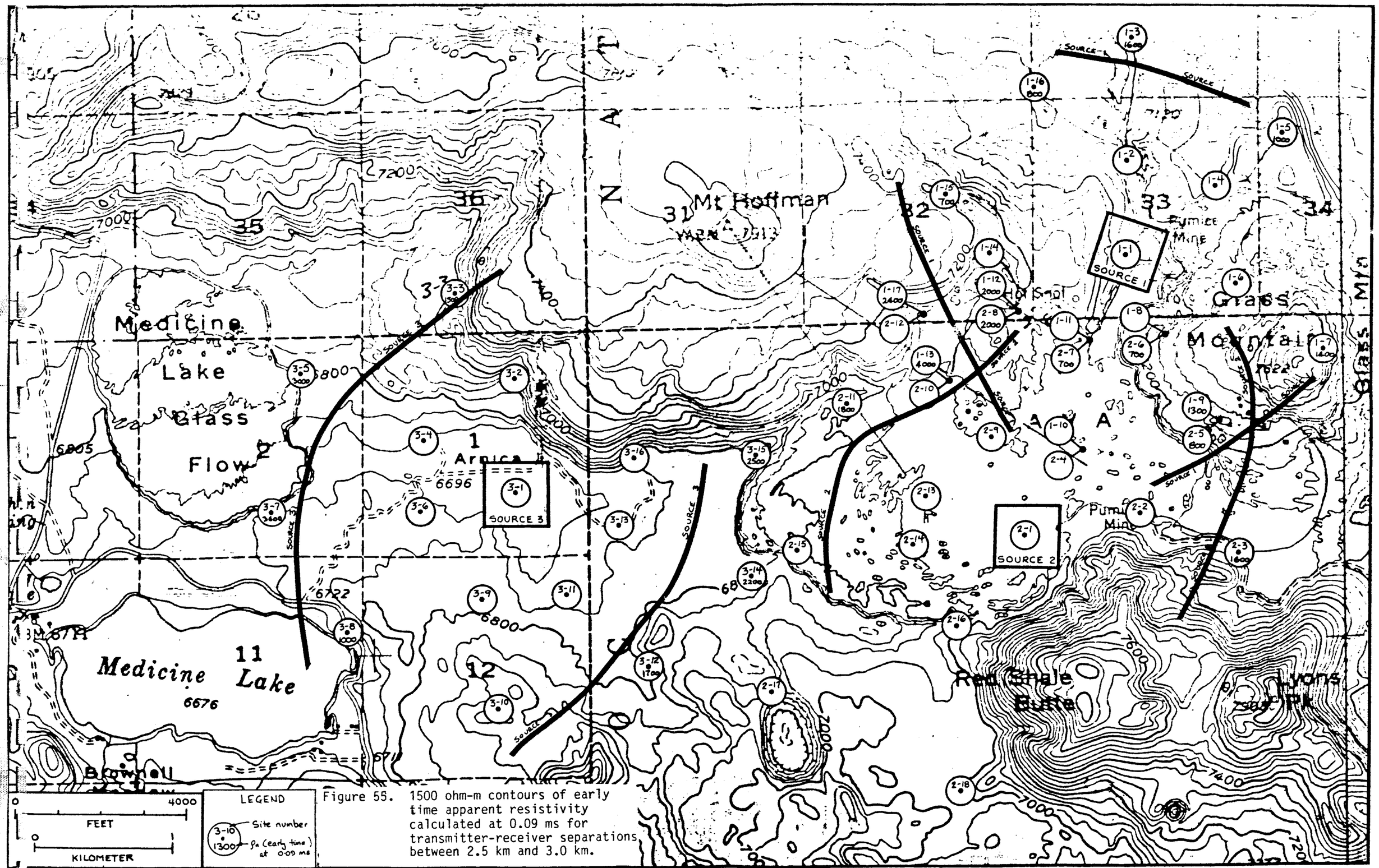


Figure 55. 1500 ohm-m contours of early time apparent resistivity calculated at 0.09 ms for transmitter-receiver separations between 2.5 km and 3.0 km.

CONCLUSIONS

The TEM survey was successful as a sounding tool in the very difficult conditions on the Glass Mountain lava flow. The survey detected a basement conductor at all three transmitter loop positions. The most favorable site is loop position 2 to the northwest of Red Shale Butte where a conductor with 1 ohm-m resistivity was detected at a depth of about 130 m.

The geological section in the area contains a very high resistivity surface layer composed mainly of volcanic glass with resistivities of at least several thousand ohm-m. The resistivity of this layer, which is up to 500 m thick in places, is not well defined by the TEM system. In fact, it would be necessary to measure in the 1-10 μs range (or MHz range in the frequency domain) to accurately define this layer.

In-loop measurements (soundings in the near-zone) were the most easily interpreted. This configuration offers the advantage that soundings are subject to smaller lateral effects than separated-loop configurations.

Since the survey was mainly for demonstration purposes, only three loop positions could be occupied in the limited time available. Due to the poor data coverage, it is recommended that further in-loop soundings be made at a grid spacing of approximately 2 km to accurately map the conductivity structure of the geothermal field.

APPENDIX I.

GEONICS EM37 SPECIFICATIONS

GEONICS LIMITED

EM37 Ground Transient Electromagnetic System
Technical Specifications

Transmitter

Current Waveform	-	See Fig. 1
Repetition rate	-	3Hz or 30Hz in countries using 60Hz power line frequency; 2.5Hz or 25Hz in countries using 50Hz power line frequency; all four base frequencies are switch selectable.
Turn-off time (Δt)	-	fast linear turn-off of maximum 300 μsec. at 20 amps into 300x600m loop. Decreases proportionally with current and (loop area)$^{\frac{1}{2}}$ to minimum of 20 μsec. Actual value of Δt read on front panel meter.
Transmitter loop	-	any dimensions from 40x40m to 300x600m maximum at 20 amps. Larger dimensions at reduced current. Transmitter output voltage switch adjustable for smaller loops. Value of loop resistance read from front panel meter; resistance must be greater than 1 ohm on lowest voltage setting to prevent overload.
Transmitter protection	-	circuit breaker protection against input overvoltage; instantaneous solid state protection against output short circuit; automatically resets on removal of short circuit. Input voltage, output voltage and current indicated on front panel meter.
Transmitter output voltage	-	150 volts (zero to peak) maximum; 20 volts (zero to peak) minimum
Transmitter output power	-	2.8 kw maximum
Transmitter wire supplied	-	1800m. #10 copper wire PVC insulated with nylon jacket; transmitter wire contained on 6 reels (supplied); 2 reel winders supplied.
Transmitter motor generator	-	5 HP Honda gasoline engine coupled to 120 volt, 3 phase, 400Hz alternator. Approximately 8 hours continuous operation from full (built-in) fuel tank.

Receiver

Measured quantity	-	time rate of decay of magnetic flux along 3 axes.
Sensor	-	air-cored coil of bandwidth 40 kHz; 100cm dia. by 7x5cm cross-section. Coil holder supplied to facilitate measurement along 3 axes.
Time channels	-	20 time channels with locations and widths as shown in Fig. 2. Successive operation at 30Hz, then 3Hz, effectively gives 30 channels covering range from 80 μsec. to 80 msec.
Output display	-	4 digit plus sign LED display; display also shows channel number and gain.
Integration time	-	2^n cycles at 30Hz; n=4,6,8,10,12,14 (switch selectable); similar integration times at other base frequencies.
Receiver output noise referred to input	-	typically 1.5×10^{-10} volt/m^2 at last gate at 30Hz with integration time of 34 seconds. Noise will be higher during intense local spherics activity.
Output connector	-	all 20 channels in analogue format and house-keeping functions in digital format available from output connector.
Synchronization to Tx	-	any of the following (switch selectable) (1) reference cable (2) primary pulse (3) 27 MHz radio link (40 channels) (4) high stability (oven controlled) quartz crystals.
Noise rejection circuitry	-	Selective clipping of atmospheric noise pulses at all times. Audio output of Rx coil (transmitter pulse blanked out) is available on built-in loud speaker for ready identification of interference.
Receiver batteries	-	12 volt rechargeable Gel-cell; 9 hours continuous operating time at 17°C. Two batteries and a battery charger supplied to permit charging of second battery from transmitter motor-generator during survey.

Component Dimensions

Transmitter console	25x42x36 cm
GPU	35x74x48 cm
Wirewinder	42x38x35 cm each (2 off)
Wire reels (20 amp)	33x31(dia.)cm each (6 off)
Receiver console	38x37x27 cm
Receiver coil	100 cm dia. 7x5 cm cross-section

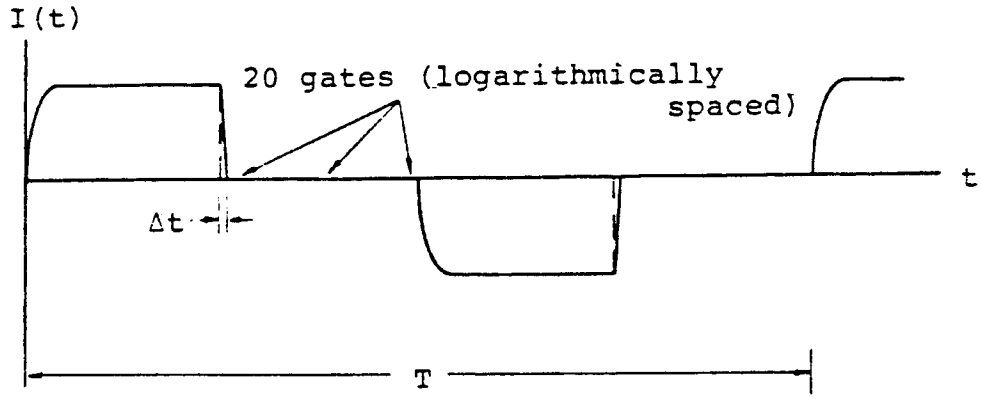
Component Weights

Transmitter console	20 kg
GPU	60 kg
Wirewinders and loaded reels (20 amp)	120 kg (total)
Receiver console (incl.20 amp-hour battery)	21.8 kg
Receiver coil	8.0 kg

Shipping Information

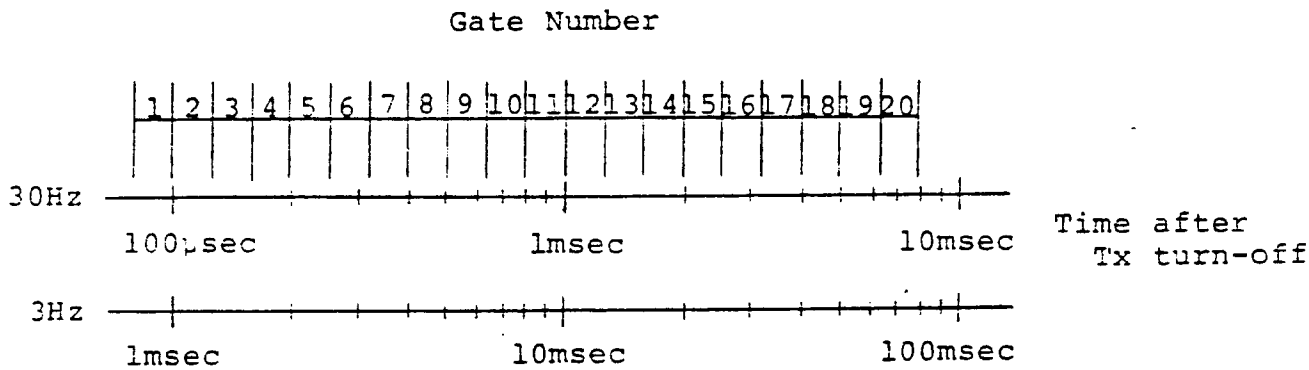
Shipment consists of 5 boxes

Two wire boxes	116x62x48 cm @ 186 kg (total)
GPU box	96x61x73 cm @ 90 kg
Receiver/transmitter box	96x75x73 cm @ 86 kg
Receiver coil/coil-holder box	110x110x20 cm @ 34 kg
Total shipping volume	1.90 cubic metres
Total shipping weight	390 kg



Transmitter Current Waveform

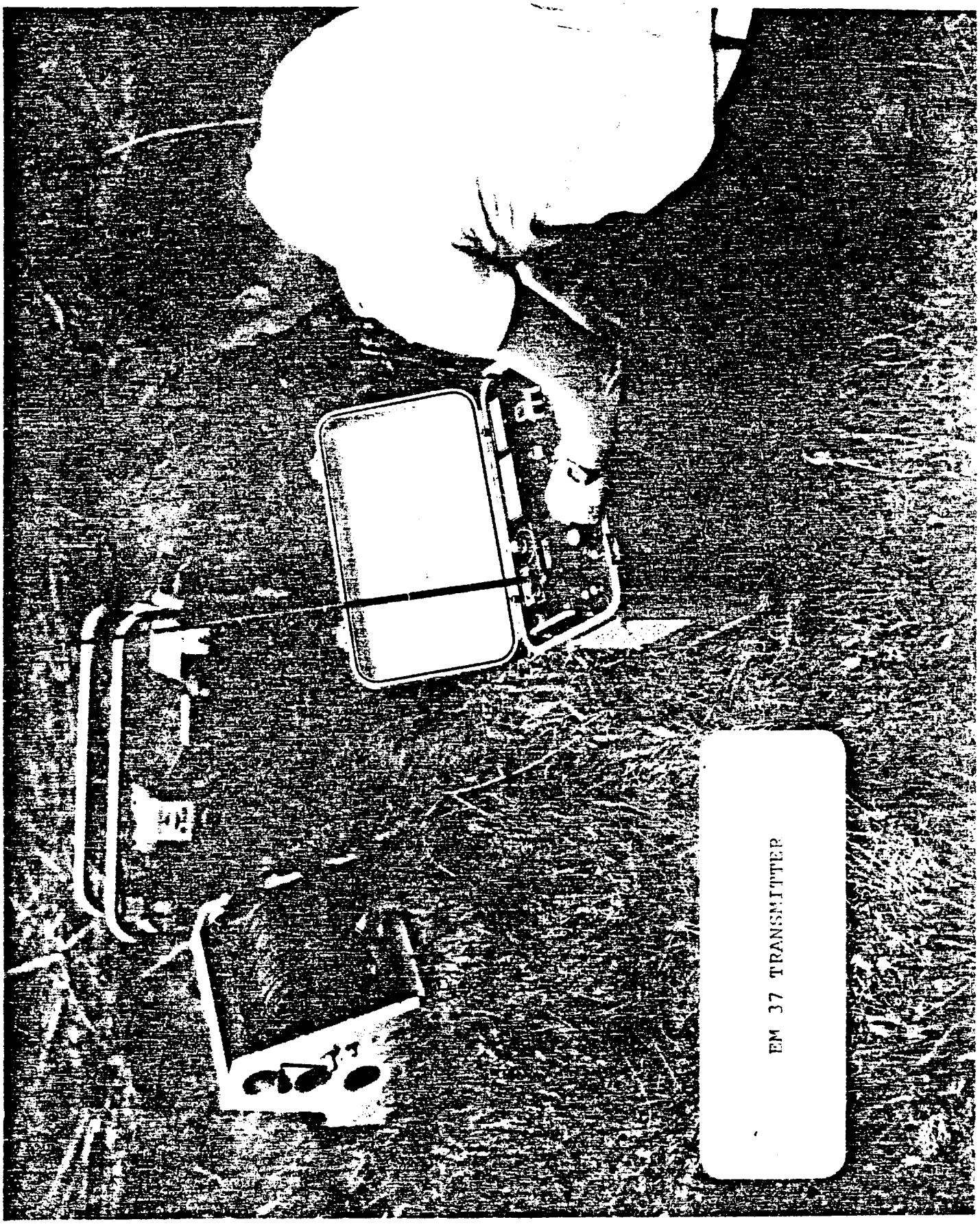
FIG. I-1



Gate Location and Widths (30 and 3Hz)

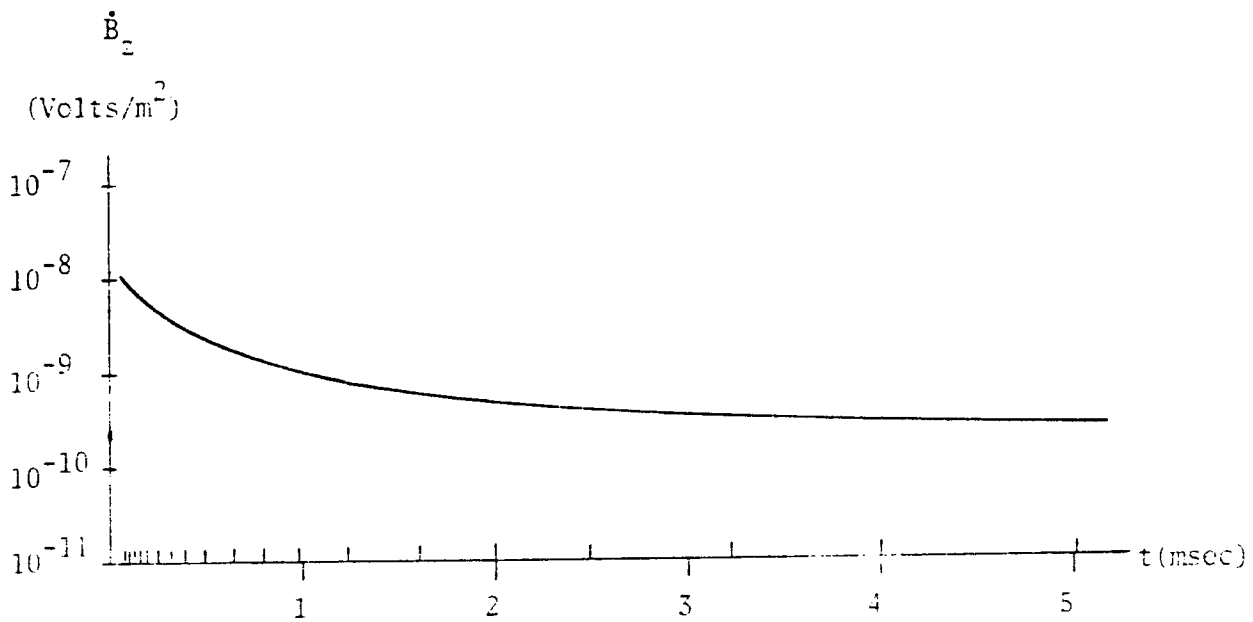
FIG. I-2

FIG 37 RECEIVER



EM 37 TRANSMITTER

EM 37 TRANSMITTER
WIRE CARRIER



Average System Noise
(30Hz)

EM37 System Noise Graph for 300 m x 600 m Transmitter Loop

FIG. I-3

APPENDIX II.

BASIC THEORY OF TRANSIENT ELECTROMAGNETICS

APPENDIX II: BASIC THEORY OF TRANSIENT ELECTROMAGNETICS

The transient (or time domain) electromagnetic method obtains information on subsurface conductors by inducing eddy currents in the ground and analyzing their decay. A steady current flowing through the transmitting loop is sharply terminated, thus producing a change in the primary magnetic field. In accordance with Faraday's Law, this changing magnetic field induces eddy currents in nearby conductors.

The decaying eddy currents have an associated secondary magnetic field which is detected by a receiving coil. The voltage induced in this coil is proportional to the time derivative (rate of decay) of the component of the secondary magnetic field threading the coil. In practical systems, resistivities of rocks and minerals found in the field produce transient decays which can be measured from 100 microseconds to tens of milliseconds.

In theory, the complete transient waveform is mathematically equivalent to a measurement of the response at all frequencies for a harmonically varying (or frequency domain) source. Although the transient curve has a broad frequency spectrum, the response measured at different times contains differing proportions of high and low frequency components. At early times the response is due to both low and high frequency components, whereas at later times, the low frequency response dominates.

Time domain methods, however, offer theoretical advantages over frequency domain methods when exploring for deeply buried conductors (eg., Kaufman, 1978).

The character of the induced eddy currents depends on the type of conductor present. In a confined conductor (such as a sulphide or graphite zone), the induced currents are determined by the conductivity, shape and size of the conductor, as well as its position in relation to the loop. After the eddy currents have been established in the conductor, they diffuse inwards towards the center of the body and are gradually dissipated by resistive heat loss. In a highly conductive body, the currents tend to circulate along the margin of the body and decay slowly. At late times the decay takes the form of a simple exponential with time constant τ, which is related to the conductivity (σ), magnetic permeability (μ), and effective cross-sectional area of the body (Q) by the relation:

$$\tau = \mu \sigma Q \text{ seconds.}$$

For a non-confined conductor, such as a layered earth or uniform ground, the eddy currents diffuse outward with time at a velocity determined by the conductivity of the ground. To an observer on the surface of the earth, the received fields are similar to what a simple current filament produces as it increases in radius and depth. This phenomenon is referred to as a "smoke ring" (Nabighian, 1979, and Boyd, 1980b). Using the smoke ring concept, it is easy to explain the sign reversals observed in the vertical component measured in the field.

Unlike confined conductors, the transient decay curve over an infinite conductor obeys a power law. For example, over a uniform halfspace, the late time response is proportional to time to the power -5/2.

The behavior of the early and late time response is often used for depth sounding applications. At early times the response is controlled only by near-surface effects, whereas at later times, the eddy currents diffuse deeper into the ground. Raiche and Spies (1981) describe TEM depth sounding using co-incident transmitter-receiver loops. A similar study for a loop-loop Crone PEM system is reported by Verma and Rai (1982).

A useful rule to remember for interpreting TEM data as a depth sounding is that the earliest time a response can be recorded from a conductor (or resistor) at a depth d is given by the relation

$$t = 10^{-7} \sigma \ d^2 ,$$

where σ is the conductivity of the medium overlying the conductor (Spies, 1980a).

Methods of interpretation are often different for large-loop and coincident-loop surveys, and depend largely upon the background resistivity of the area. Two general guides to interpretation of TEM data are presented by Spies (1980a) and Crone (1976). Comparison of coincident-loop, in-loop and loop-loop systems are given by Spies (1980c and 1980d).

In areas of low to moderate resistivity, interpretation can become quite complex. An excellent set of papers has been

published on the use of several systems over the Elura orebody (covered by 100 m of 10 to 20 ohm-m material) in Australia: Boyd (1980a) describes the results of a large-loop Newmont EMP survey; Crone (1980) describes the results of loop-loop, in-loop and borehole PEM surveys; and Spies (1980c and 1980d) reports on coincident-loop and loop-loop studies.

Difficulties can arise when the signal from a target conductor becomes buried in a halfspace response (Spies, 1980b). Because of the difference in transient decay characteristics (exponential versus power-law), there is an optimum time window for detecting the response of the confined conductor above the geological noise. When a steeply dipping conductor is located outside the loop, the standard anomaly shape is a crossover in the vertical component(Z) and a maximum in the horizontal component(X). When a conductive host is present the anomaly migrates away from the loop. It is often difficult to determine whether a crossover is caused by finite conductors or by sharp changes in bedrock conductivity.

Current channeling (or current gathering) is another important consideration. This phenomenon occurs when currents induced in a conductive medium (for example the smoke rings in a halfspace) are galvanically channeled into a more conductive zone, producing a transient decay which is unlike simple induction. Current channeling is most evident in areas of conductive overburden when measuring the response of a conductive zone that has a long strike-length and is located outside of the loop. It is usually not present for in-loop or coincident-loop surveys.

REFERENCES

Boyd, G. W., 1980a, Newmont EMP surveys over Elura: Bull. Aust. Soc. Expl. Geophys., v. 11, no. 4, p. 295-302.

_____ 1980b, Smoke rings: Bull. Aust. Soc. Expl. Geophys., v. 11, no. 4, p. 303-304.

Crone, D., 1976, Ground pulse EM - Examples of survey results in the search for massive sulphides and developments with the Crone PEM equipment: Paper presented at the 25th Intern. Geol. Congress, Sydney, August 1975.

_____ 1980, Pulse EM tests at the Elura massive sulphide body using several methods with the Crone PEM equipment: Bull. Aust. Soc. Expl. Geophys., v. 11, no. 4, p. 305-311.

Kaufman, A. A., 1978, Resolving capabilities of the inductive methods of propsecting: Geophysics, v. 43, no. 7, p. 1392-1398.

Nabighian, M. N., 1979, Quasi-static transient response of a conducting halfspace: An approximate representation: Geophysics, v. 44, no. 10, p. 1700-1705.

Raiche, A. P., and Spies, B. R., 1981, Coincident loop TEM master curves for interpretation of two-layer earths: Geophysics, v. 46, p. 53-64.

Spies, B. R., 1980a, The application of the transient electromagnetic method in Australian conditions - field examples and model studies: Ph.D. Thesis, Macquarie University, Sydney.

_____ 1980b, Interpretation and design of time domain EM surveys in areas of conductive overburden: Bull. Aust. Soc. Expl. Geophys., v. 11, no. 4, p. 272-288.

_____ 1980c, One-loop and two-loop TEM responses of the Elura deposit, Cobar, N.S.W.: Bull. Aust. Soc. Geophys., v. 11, no. 4, p. 282-283.

_____ 1980d, Results of experimental and test TEM surveys, Elura deposit, Cobar, N.S.W.: Bull. Aust. Soc. Expl. Geophys., v. 11, no. 4, p.289-294.

Verma, S. K., and Rai, S. S., 1982, Response of a layered earth to the Crone pulse electromagnetic system: Geophysics, v. 47, p. 63-70.

APPENDIX III.

THE SMOKE RING CONCEPT AND HALFSPACE RESPONSE

APPENDIX III. THE SMOKE RING CONCEPT AND HALFSPACE RESPONSE

Time domain electromagnetic theory lends itself to physical understanding by considering the distribution of electric fields, or eddy currents, in the ground. The behavior of these eddy currents has long been known for finite conductors contained within an infinitely resistive medium. For example, Wait (1951) has studied the transient response of a sphere, and Velikin and Bulgakov (1967) describe the transient response of other conductors, such as a cylinder and plate. All these finite conductors decay exponentially at late times.

For large-loop surveys, it is often necessary to analyze the homogeneous halfspace response to aid in interpretation of field results. Consider a transmitter loop carrying a constant current which is abruptly shut off at time t = 0. By Lenz's Law, an identical current is induced in the ground directly under the transmit loop immediately following the current turnoff in order to preserve the primary magnetic field which had previously existed. Nabighian (1979) has studied the behavior of the currents at later times. He showed that the electric fields induced in a conducting halfspace can be approximately represented by a system of "smoke rings" which move downward and outward with time, as shown at the top of Figure III-1. Lewis and Lee (1978) calculated that the maximum electric field (smoke ring) moves along a cone dipping at 30 degrees away from the loop, and occurs beneath a point on the surface a distance L from

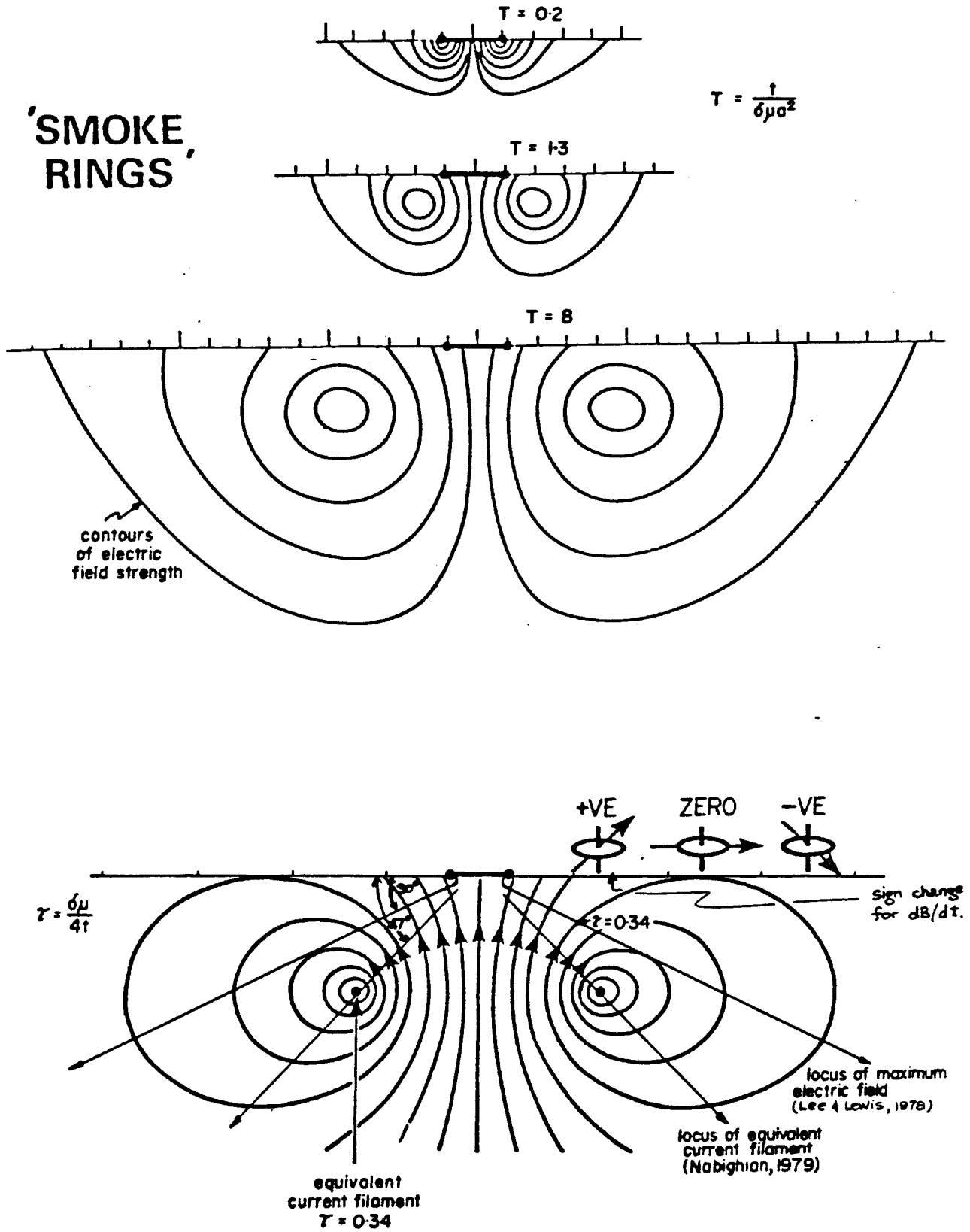


Figure III-1. Movement of "smoke rings" and equivalent current filament.

the center of the loop at a time of 0.39 $\sigma\mu L^2$ seconds. Nabighian (1979) has commented that an approximate representation of the electric field behavior is obtained by considering the integrated effect of all current lines. This yields an equivalent current filament which moves out from the loop at an angle of 47 degrees and is located beneath a point on the surface at a time of 0.23 $\sigma\mu L^2$ seconds. A diagram of the equivalent current filament and its associated secondary magnetic field is shown at the bottom of Figure III-1.

If a vertical axis magnetometer was used as a receiver, then a sign change would be recorded when the magnetic field from the equivalent current filament was horizontal at the ground surface, as shown in Figure III-1. The sign change occurs when the maximum E field and equivalent current filament are located between the transmit loop and the receiver. At late times the eddy currents diffuse deeper into the halfspace and the vertical magnetic fields are positive in sign.

For most field systems, including the Geonics EM37, the measured quantity is not the magnetic field, but rather its time derivative. The sign change for dB/dt will not occur at the same time as for B. In fact, dB/dt changes sign later in time by a factor of 2.6. In spatial terms, the sign change in dB/dt at a fixed sample time will be located at a distance equal to 60% of the distance from the loop where it occurs when measuring B. The sign change of the vertical component of dB/dt measured on the surface is located approximately at the position of the equivalent current filament under the receiver.

Dipole Approximation of Loop-Loop TEM Response

The TEM response of dipole transmitter and receiver loops separated by a distance, L, on the surface of a homogeneous halfspace is given by the expression:

$$\frac{e(t)}{I} = \frac{A_1 A_2}{2\pi \sigma L^5} P(t)\, u(t), \qquad (1)$$

where

$$P(t) = 9 \operatorname{erf}(\beta) + (9\beta + 6\beta^3 + 4\beta^5) \operatorname{erf}'\beta ,$$
$$\beta = \alpha / 2 t^{1/2},$$
$$\alpha = (\sigma \mu_0)^{1/2} L,$$

u(t) is the unit step function and A_1, A_2 the dipole moments of the transmitting and receiving loops. In this derivation displacement currents are neglected, which imposes the restriction

$$t \gg \frac{4\varepsilon^2}{\sigma^2} + \varepsilon \mu L^2 , \qquad (2)$$

(Wait, 1960). The error in assuming a dipole source is less than 1% if the loop separation is greater than about 10 loop radii (Wait, 1954).

The separated dipole expression given in equation (1) is displayed using normalized dimensionless parameters in Figure III-2. The sign change occurs at a time given by

$$t' = 0.16 \ \sigma\mu L^2 \text{ seconds.} \qquad (3)$$

It can be seen from the graph that a sign change can be caused by a change in t, σ, or L. The sign reversals for a moving loop-loop system present a particular difficulty in interpretation. For instance, a profile across a geological model of varying conductivity could cause a change in sign. A similar effect would be obtained over a uniform ground with two surveys using different loop separations.

The graph represents a transient decay curve if σ and L are kept constant.

Relation between Coincident-Loop and Loop-Loop Response

Figure III-3 shows the results of a scale model study from Spies (1980) in which the relationship between coincident-loop and separated-loop responses was investigated. L, a, and σ refer to the loop separation, loop radii and conductivity, respectively.

The curve for L = 0 is simply the coincident-loop response which is identical to the in-loop response over this time range. For L/a = 1.1, the initial transient decays quickly, changes sign, and asymptotically approaches the coincident-loop

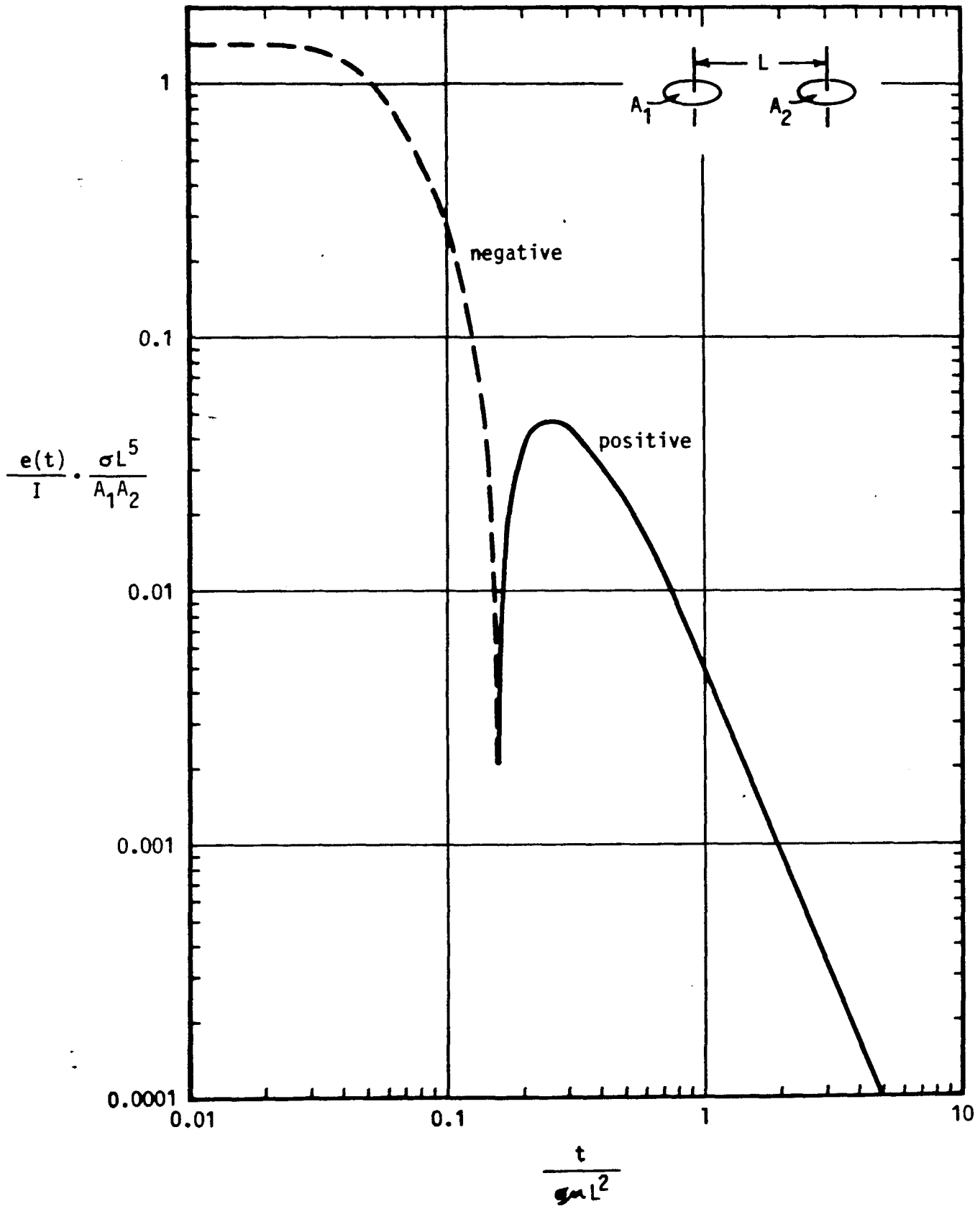


Figure III-2. Two-loop TEM voltage response of a homogeneous halfspace.

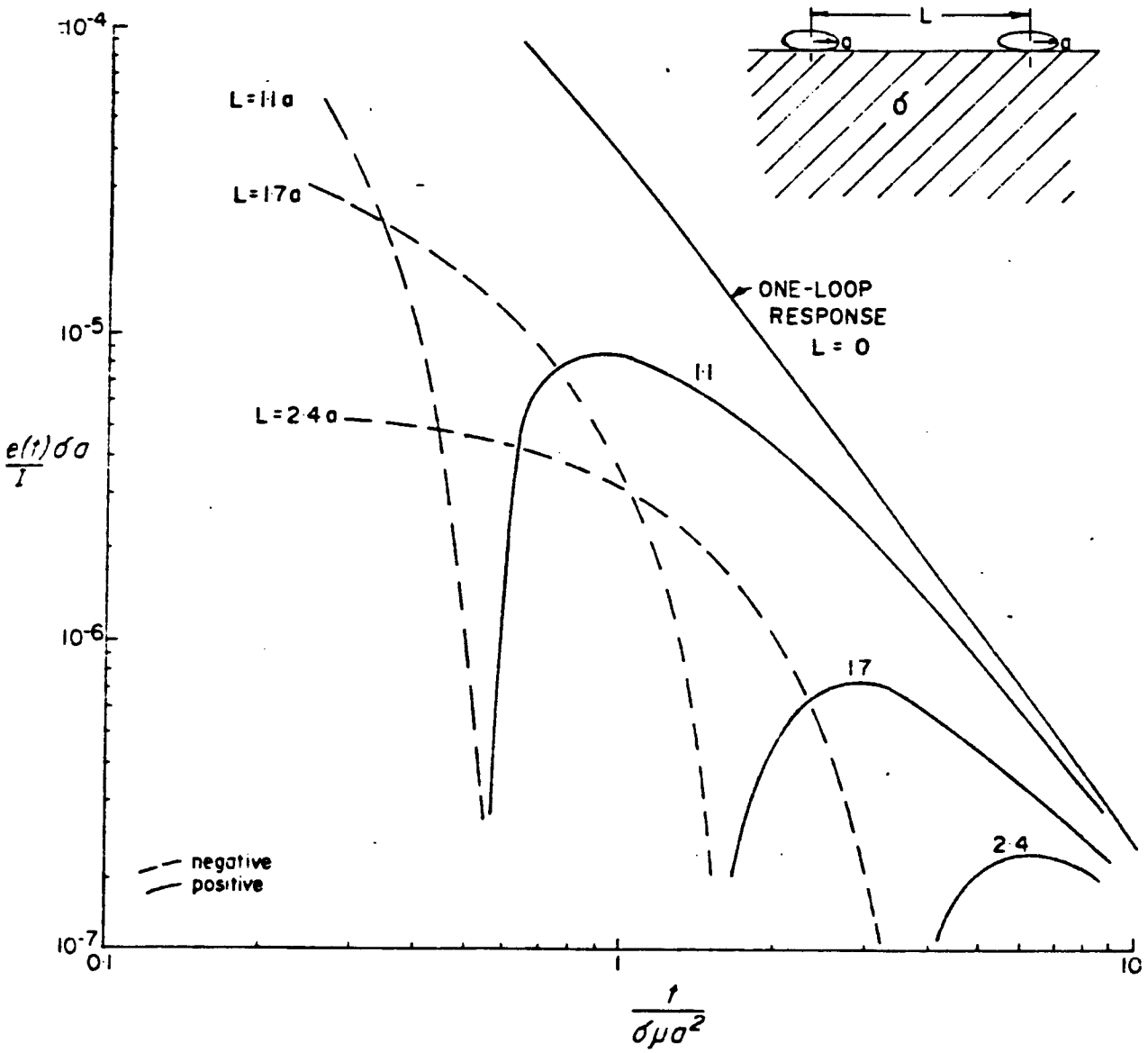


Figure III-3. One-loop and two-loop TEM decay curves of a homogeneous halfspace for various values of L.

response at late times. For increasing loop separation, the sign change occurs later in time, as does the asymptotic approach to the coincident-loop response.

Thus we can see that the coincident-loop response is consistent with the loop-loop response as the loop separation goes to zero. This is an example of what is commonly referred to as the "late stage". For the range of parameters $t/\sigma\mu L^2 > 1$, the transient field decays as time to the power -5/2, and changes in loop size or separation are unimportant. This is known as the "late-time approximation".

TEM Profiles of Homogeneous Halfspace

The TEM response of a 100 ohm-m homogeneous halfspace obtained with a 1500 x 1000 ft loop and plotted on an HP-85 in the standard EMSurveys profile format is shown in Figure III-4. The loop center is at ON. The profiles are symmetrical on the left of the loop, but the X component is of a negative sign.

The X component profile consists of a zero crossing in the center of the loop and a maximum which moves out along the profile with time. The Z component profile consists of values which decrease monotonically with distance from the loop until a reversal in sign occurs. The position of the sign reversal moves out with time.

The apparent resistivity of any field case can be simply calculated using a graph such as that presented in Figure III-5. The homogeneous halfspace transient decay curves are for resistivities ranging from 10 ohm-m to 10,000 ohm-m.

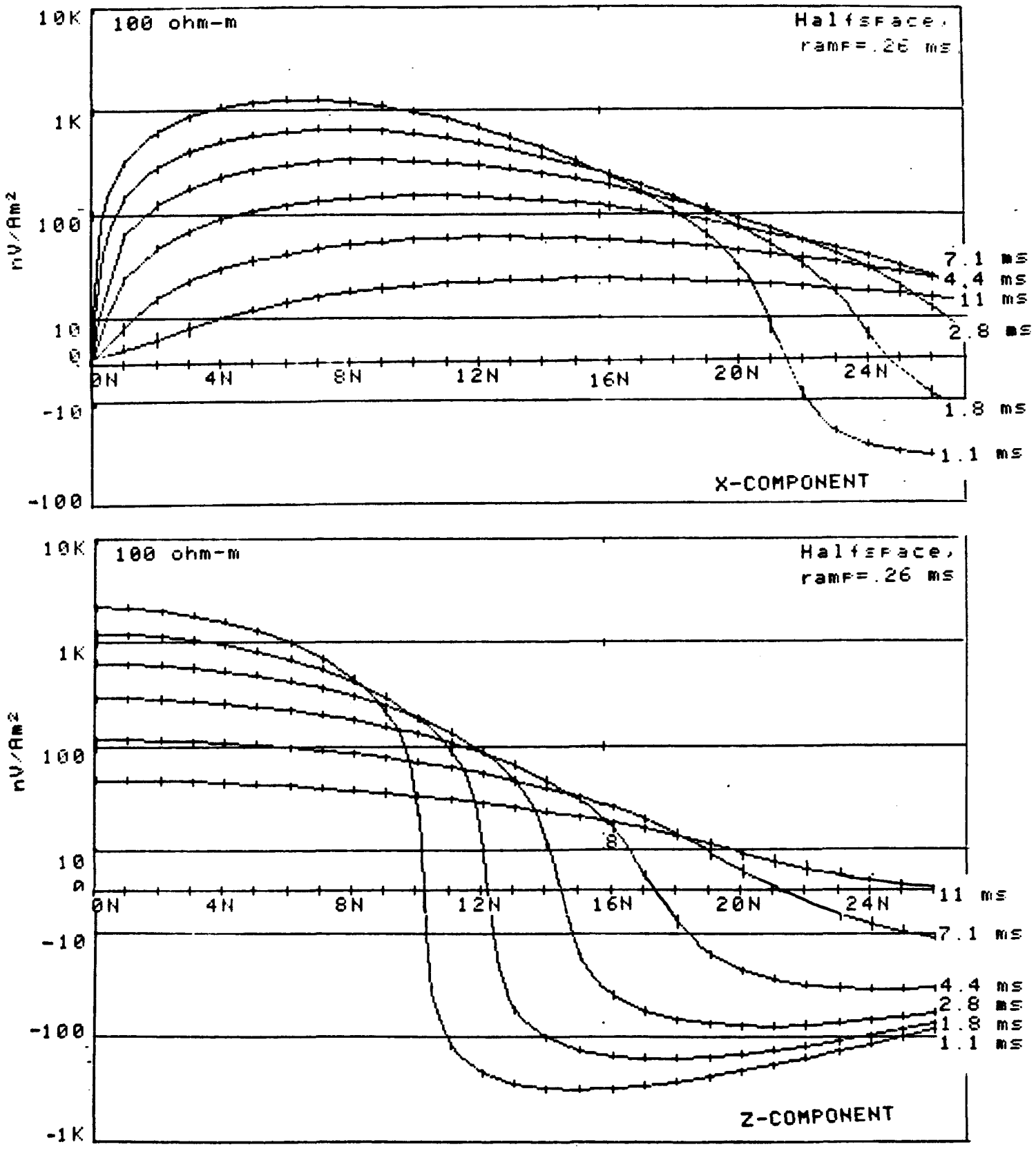


Figure III-4. TEM profiles of a 100 ohm-m homogeneous halfspace. The profiles for both components are symmetric about the loop axis (0N), but the X component is reversed in sign.

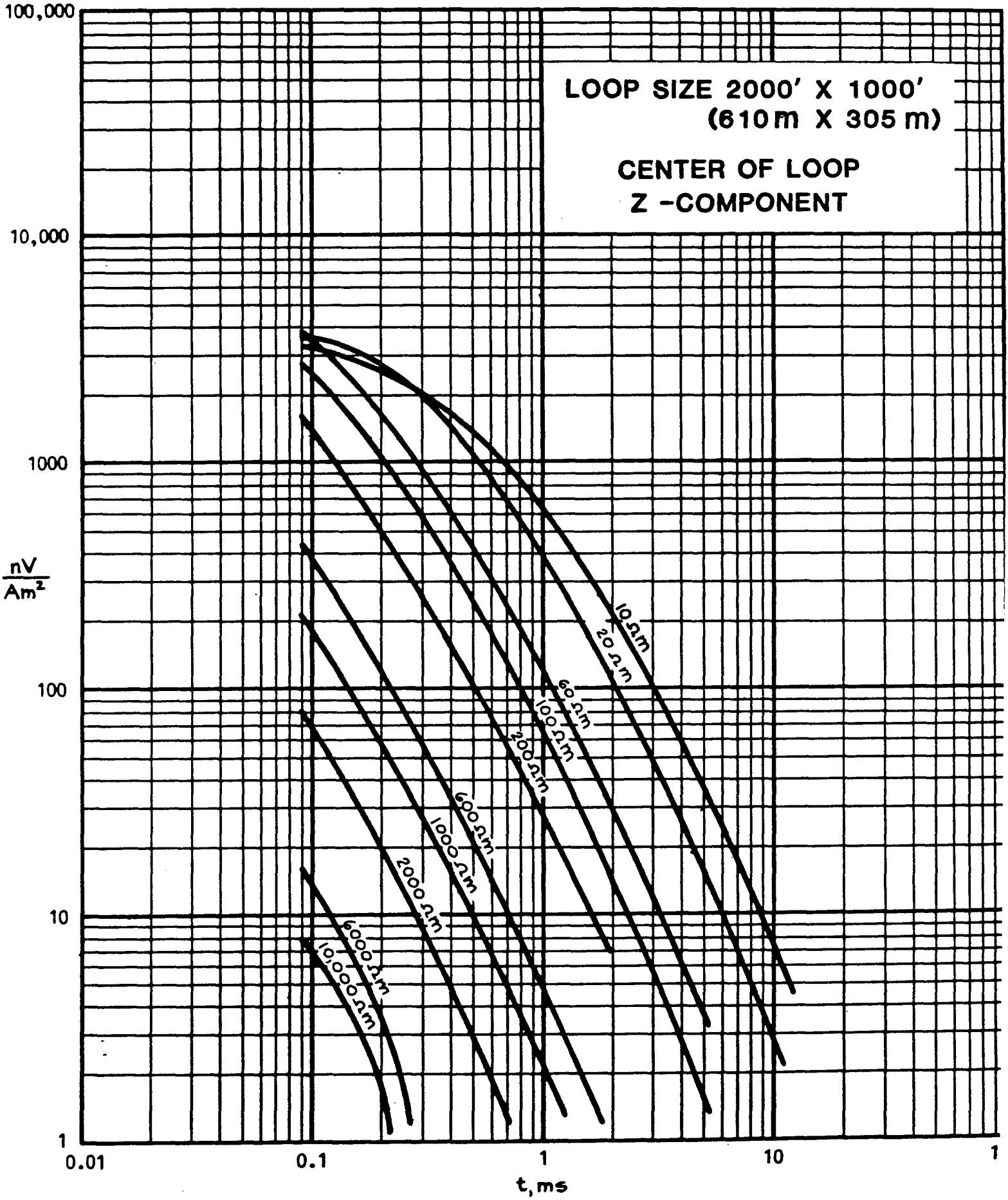


Figure III-5. Homogeneous halfspace curves for a 2000 by 1000 ft rectangular loop.

Smoke Rings in a Layered Halfspace

From the previous discussion we know that the electric field maximum, or smoke ring, moves down and away from the loop at an angle of 30 degrees at a velocity which increases with decreasing conductivity or increasing resistivity.

In a stratified earth the smoke ring will tend to slow down in, and be confined to, more conductive layers. An example of this (from Hoversten and Morrison, 1982) is shown in Figure III-6. The geological model is a 50 m thick layer with a 1 ohm-m resistivity buried at a depth of 50 m in a 50 ohm-m halfspace. Contours of the electric field strength are plotted at times from 1 ms to 30 ms. The maximum electric field, or smoke ring, is confined to the conductive layer, and moves at a velocity which is between that in a 1 ohm-m and that in a 50 ohm-m earth.

In the case of a resistive middle layer the smoke ring is confined to the surface conductor at early times, but is "pulled down" into the lower halfspace conductor as time progresses.

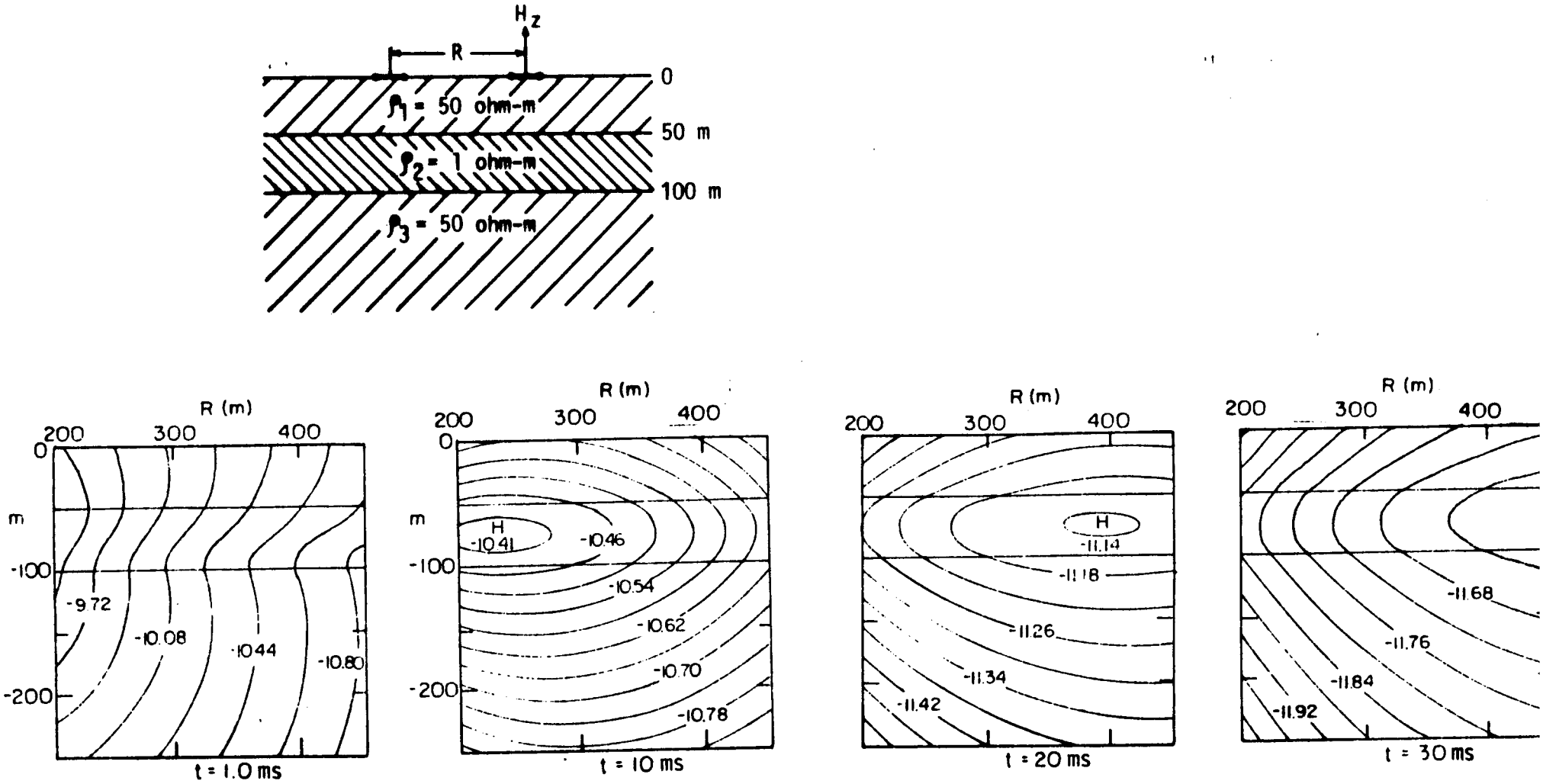


Figure III-6. Induced electric fields (V/m) in an earth with conductive middle layer (after Hoversten and Morrison, 1982).

REFERENCES

Hoversten, G.M., and Morrison, H. F., 1982, Transient fields of a current source above a layered earth: Geophysics, v. 47, no. 7, p. 1068-1077.

Lewis, R., and Lee, T., 1978, The transient electric fields about a loop on a halfspace: Bull. Aust. Soc. Explor. Geophys., v. 9, p.173-177.

Nabighian, M. N., 1979, Quasi-static transient response of a conducting halfspace: An approximate representation: Geophysics, v. 44, no. 10, p. 1700-1705.

Spies, B. R., 1980, The application of the transient electromagnetic method in Australian conditions - field examples and model studies: Ph.D. Thesis, Macquarie University, Sydney.

Velikin, A. B., and Bulgakov, Y. I., 1967, Transient method of electrical prospecting (one loop version): Seminar on geophysical methods of prospecting for ore minerals, UNO. Moscow, July 1967.

Wait, J. R., 1951, A conducting sphere in a time-varying magnetic field: Geophysics, v. 16, no. 4, p. 666-672.

_____, 1954, Mutual coupling of loops lying on the ground: Geophysics, v. 19, no. 2, p. 290-296.

_____, 1960, Propogation of electromagnetic pulses in a homogeneous conducting earth: Appl. Sci., Res., Sect. B., v. 8, p. 213-253.

GEOPHYSICS, VOL. 46, NO. 1 (JANUARY 1981); P. 53–64, 14 FIGS.

APPENDIX IV

Coincident loop transient electromagnetic master curves for interpretation of two-layer earths

A. P. Raiche* and B. R. Spies‡

A set of apparent conductivity master curves has been calculated for the coincident loop transient electromagnetic (TEM) method used over a two-layer earth. Conductivity contrasts range from 0.001 to 1000. Loop radius/layer depth ratios range from 0.01 to 100. The time range is sufficient to see the entire shape of the curves from the early to the late time asymptotes. These curves allow the determination of the parameters of a two-layer earth for accurate data over a sufficient time range. Examples using the curves to interpret multilayered earths are given. The curves are also used to show the limitations placed on interpretation by existing TEM equipment.

INTRODUCTION

The transient electromagnetic (TEM) method is being increasingly used for mineral exploration and geologic mapping (Velikin and Bulgakov, 1967; Kamenetskii, 1976; Spies, 1976; Buselli, 1977; Braham et al, 1978). It has been used with a single transmitter-receiver (Tx-Rx) loop, coincident Tx and Rx loops, and separated loops. Source excitation forms have included step function (Sirotem and the Russian MPP series), half sine wave (Input*), and sawtooth (Utem).

Although a number of theoretical papers dealing with the TEM response of layered media have appeared in the literature in the last few years (e.g., Wait, 1960; Morrison et al, 1969; Lee and Lewis, 1974; Mallick and Verma, 1978), none has been in the nature of a model suite with extended times, conductivity contrasts, and layer depths. (Extensive interpretive work has been done in the Soviet Union but the results have not been published in the open literature.) Our purpose, therefore, is to present the results of a two-layer model study for use as a basis for interpretation of single loop TEM surveys. The terms single loop and coincident loop will be used interchangeably since the theoretical analysis for one applies to the other.

The models investigated had conductivity contrasts ranging from 0.001 to 1000 with three models per decade of contrast. For each contrast, calculations were done for four decades of loop radius/layer depth ratios (0.01 to 100) with three models per decade. The results are presented in the form of apparent conductivity versus normalized time curves. The time range is sufficient to show the early and late time asymptotes.

In the following sections we describe the method of calculation starting from frequency domain expressions, examine the features of the apparent conductivity curves, and then show how these curves can be used to interpret field data. Three field examples are given. Finally, we give an example of the limitations for interpretation imposed by the time range and sensitivity of existing equipment (MPP series and Sirotem).

METHOD OF CALCULATION

As shown in Figure 1, the model used for these calculations consists of a two-layer earth excited by a circular coincident transmitter-receiver loop. Four assumptions are made: (1) The displacement current can be neglected; (2) the exciting voltage is a step function, i.e., it can be turned off in zero time; (3) the response of square and near-square loops will be the same as that of a circular loop of the same area; and (4) the loop wire is filamentary.

The development of the equations to calculate voltage is essentially similar to that of Lee and Lewis (1974).

HALF-SPACE MODEL

From Morrison et al (1969), the "frequency domain" electric field $E(p, h)$ induced in a coincident Tx-Rx loop configuration (of radius a), h meters above a uniform half-space of conductivity

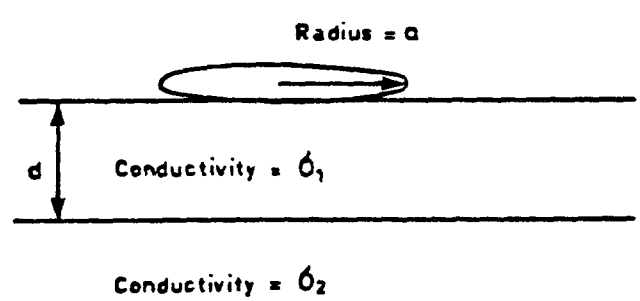


FIG. 1. Loop on layered half-space.

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σ, can be expressed as

$$E(p, h) = \frac{p\mu a I}{2} \int_0^\infty \left[\frac{\lambda - s}{\lambda + s} e^{-2\lambda h} + 1\right] J_1^2(\lambda a)\, d\lambda, \quad (1)$$

where

p = Laplace transform variable corresponding to $(-i\omega)$ for $\exp(-i\omega t)$ time variation,
I = transmitter current,
$\mu = 4\pi * 10^{-7}$,
$J_1(\lambda a)$ = Bessel function of the first kind,
$s = \sqrt{\lambda^2 + \mu\sigma p}$, and
λ = transform variable.

To obtain the voltage response per ampere $V_E(p, h)$, we divide by the current I and integrate the field around the loop which gives a factor $2\pi a$. The transform of the voltage response of the earth is the product of $V_E(p, h)$ with the Laplace transform of the source function (p^{-1} in the case of step function excitation).

Finally, we want the voltage on the ground so $h = 0$.

$$V(p) = 2\pi\mu a^2 \int_0^\infty \left[\frac{1}{\lambda + s}\right] J_1^2(\lambda a)\lambda\, d\lambda. \quad (2)$$

To get the voltage in the time domain, we take the inverse Laplace transform of the term in brackets (Churchill, 1958, p. 326, eq. no. 37)

$$\mathcal{L}^{-1}\left[\frac{1}{\lambda + s}\right] = \frac{1}{\sqrt{\sigma\mu}} \mathcal{L}^{-1}\left\{\frac{1}{\left(\frac{\lambda^2}{\sigma\mu} + p\right)^{1/2} + \frac{\lambda}{\sqrt{\sigma\mu}}}\right\}$$

$$= \frac{1}{\sqrt{\sigma\mu}} e^{-\frac{\lambda^2 t}{\sigma\mu}} \left[\frac{1}{\sqrt{\pi t}} - \frac{\lambda}{\sqrt{\sigma\mu}} e^{+\frac{\lambda^2 t}{\sigma\mu}} \operatorname{erfc}\left(\lambda\sqrt{t/\sigma\mu}\right)\right]. \quad (3)$$

Defining normalized time $\tau = t/\sigma\mu a^2$ and changing the variable of integration to $\xi = \lambda a$, equation (2) can be expressed as

$$\frac{V(t)}{I} = \frac{2a\mu\sqrt{\pi}}{t} S(\tau), \quad (4)$$

and

$$S(\tau) = \int_0^\infty \{e^{-\tau\xi^2} - \sqrt{\pi t}\, \xi \operatorname{erfc}(\sqrt{\tau}\xi)\}\sqrt{\tau}\, \xi\, J_1^2(\xi)\, d\xi. \quad (5)$$

Expanding the Bessel function,

$$J_1^2(\xi) = (\xi/2)^2 \sum_{k=0}^{\infty} \frac{(-)^k (2k + 2)!(\xi/2)^{2k}}{k!(k + 1)!(k + 1)!(k + 2)!}$$

(Abramowitz and Stegun, 1964, p. 360, eq. no. 9.1.14) and integrating term by term (Gradshteyn and Ryzhik, 1965, p. 317, 3.381.4, and p. 648, 6.2.81), $S(\tau)$ can be expressed in a series for large τ.

$$S(\tau) = X^{3/2} \sum_{k=0}^{\infty} \frac{(-)^k (2k + 2)! X^k}{k!(k + 1)!(k + 2)!(2k + 5)}, \quad (6)$$

where

$$X = 1/4\tau = \sigma\mu a^2/4t.$$

The convergence of the series depends upon the word length of the calculator used to evaluate it; e.g., for a CDC 7600 (60-bit word), the series will converge for $X \leq 7$. For $X > 7$, $S(\tau)$ can be calculated efficiently using Patterson's method for Gaussian quadrature (Patterson, 1973). For $X < 0.03$, the zero-order term can be used with less than 5 percent error. Figure 2 shows a plot of $S(\tau)$ versus τ.

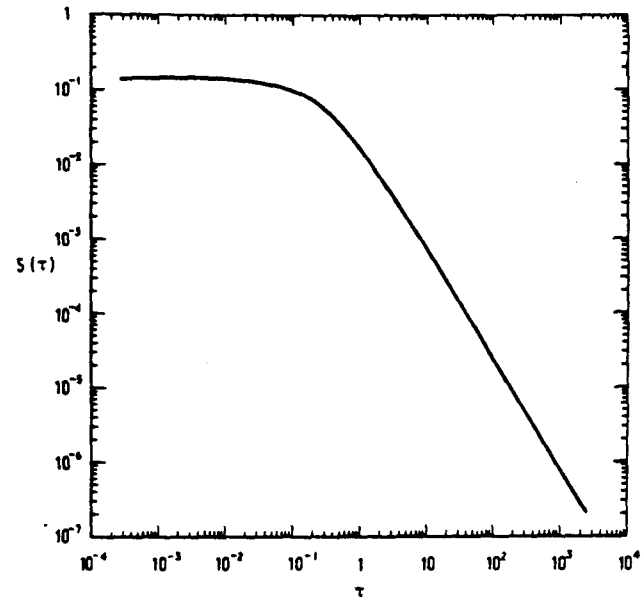

FIG. 2. $S(\tau)$ versus τ for a half-space.

APPARENT CONDUCTIVITY

Equation (4) can be inverted to give an apparent conductivity from either field or model data. As with electrical resistivity data, apparent conductivity is defined as the conductivity of a uniform half-space that will give the same voltage at a given time. If the data come from other than a half-space, the apparent conductivity will vary as a function of time. For the curves in this paper, an iterative method to determine X from $V(t)/I$ was used as follows.

From equation (4), we define

$$S_0 = \frac{t}{2a\mu\sqrt{\pi}} \frac{V(t)}{I}. \quad (7)$$

An estimate for X comes from the late time asymptote $X_0 = (5S_0)^{2/3}$. Then equation (5) or (6) is used to calculate S_1. A new estimate for X, X_1 is obtained from

$$X_1 = X_0\left[1 + 0.8\left(\frac{S_0 - S_1}{S_0}\right)\right].$$

From this, a new value S_2 is calculated. The procedure is continued until $(S_i/S_0 - 1)$ is less than a prespecified error. If the last X is, say, X_N, then the apparent conductivity σ_a is

$$\sigma_a = \frac{4tX_N}{\mu a^2}. \quad (8)$$

Another method for obtaining apparent conductivity is the subject of another paper (Spies and Raiche, 1980). After obtaining S_0 from equation (7), the series of equation (6) is inverted as

$$X_1 = y(a_0 + a_1 y + a_2 y^2 + \ldots, a_9 y^9)^2, \quad (9)$$

where

$$y = S_0^{2/3}$$
$$a_0 = 1.71,$$

$$a_1 = 2.381,$$
$$a_2 = 6.492,$$
$$a_3 = 20.88,$$
$$a_4 = 71.9,$$
$$a_5 = 255.9,$$
$$a_6 = 955.9,$$
$$a_7 = 3378,$$
$$a_8 = 12{,}361,$$

and

$$a_9 = 110{,}000.$$

For $S_0 < 0.08$ ($X_1 < 1.4$), setting $X = X_1$ will result in an error of less than one percent. For ($1.4 < X_1 < 2.8$),

$$X = X_1 + 0.001635\, X_1^{4.892}. \tag{10}$$

For ($2.8 < X_1 < 5.69$),

$$X = X_1 + 0.004018\, X_1^{4.01364}. \tag{11}$$

Equation (8) is used to calculate σ_a from X. This method should cover almost all field situations.

LAYERED MODEL

Returning to the model of Figure 1, if the loop is $-h$ above the earth, the field at $-h < z < 0$ can be expressed in the form

$$E_0 = \frac{Ip\mu a}{2} \int_0^\infty [A_0 e^{\lambda(z+h)} + e^{-\lambda(z-h)}]\, J_1^2(\lambda a)\, d\lambda, \tag{12}$$

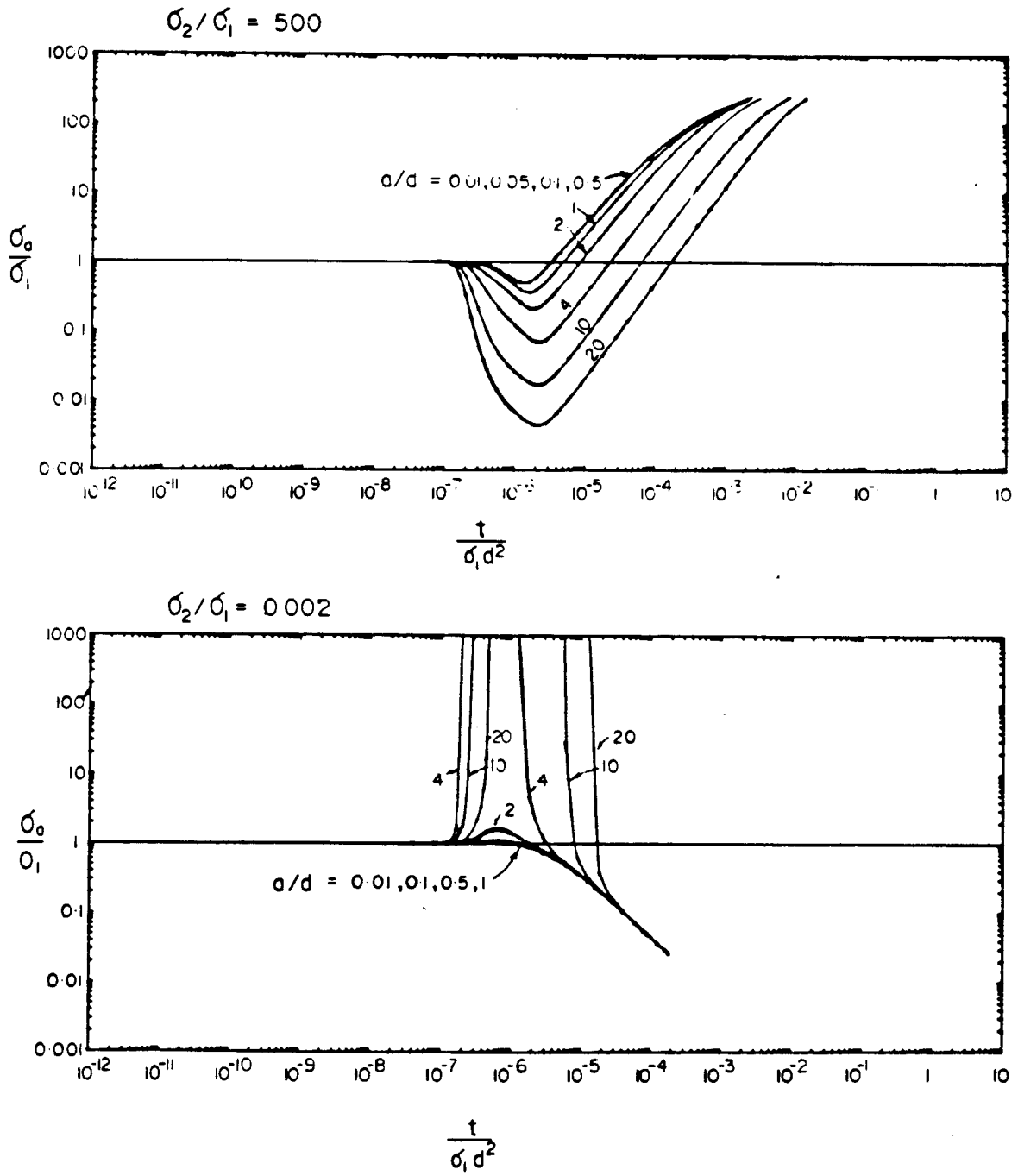

FIG. 3. Apparent conductivity varying a/d; $K = 500$ and 0.002. Time is normalized with respect to depth squared.

and in each layer i as

$$E_i = \frac{Ip\mu a}{2}\int_0^\infty [A_i e^{s_i z} + B_i e^{-s_i z}] J_1^2(\lambda a)\, d\lambda, \tag{13}$$

where $s_i = \sqrt{\lambda^2 + \mu\sigma_i p}$.

Obviously, $A_2 = 0$ for a two-layer earth, and the other coefficients are found by continuity of E and $\partial E/\partial z$ at the boundaries $z = 0$ and $z = d$.

Letting $h \to 0$ and evaluating E_0 at $z = 0$,

$$E_0 = Ip\mu a \int_0^\infty \frac{\lambda[s_1 + s_2 + (s_1 - s_2)e^{-2s_1 d}]}{(\lambda + s_1)(s_1 + s_2) + (\lambda - s_1)(s_1 - s_2)e^{-2s_1 d}} J_1^2(\lambda a)\, d\lambda. \tag{14}$$

Because of the difficulty in obtaining the inverse Laplace transform of this expression, Lee and Lewis (1974) subtract a term E_p corresponding to a half-space of conductivity σ_1 from the total field E_0,

$$E_p = \frac{Ip\mu a}{2}\int_0^\infty \frac{2\lambda}{\lambda + s_1} J_1^2(\lambda a)\, d\lambda, \tag{15}$$

which can be calculated analytically as above. Defining reflection coefficients R_1 and R_2 as

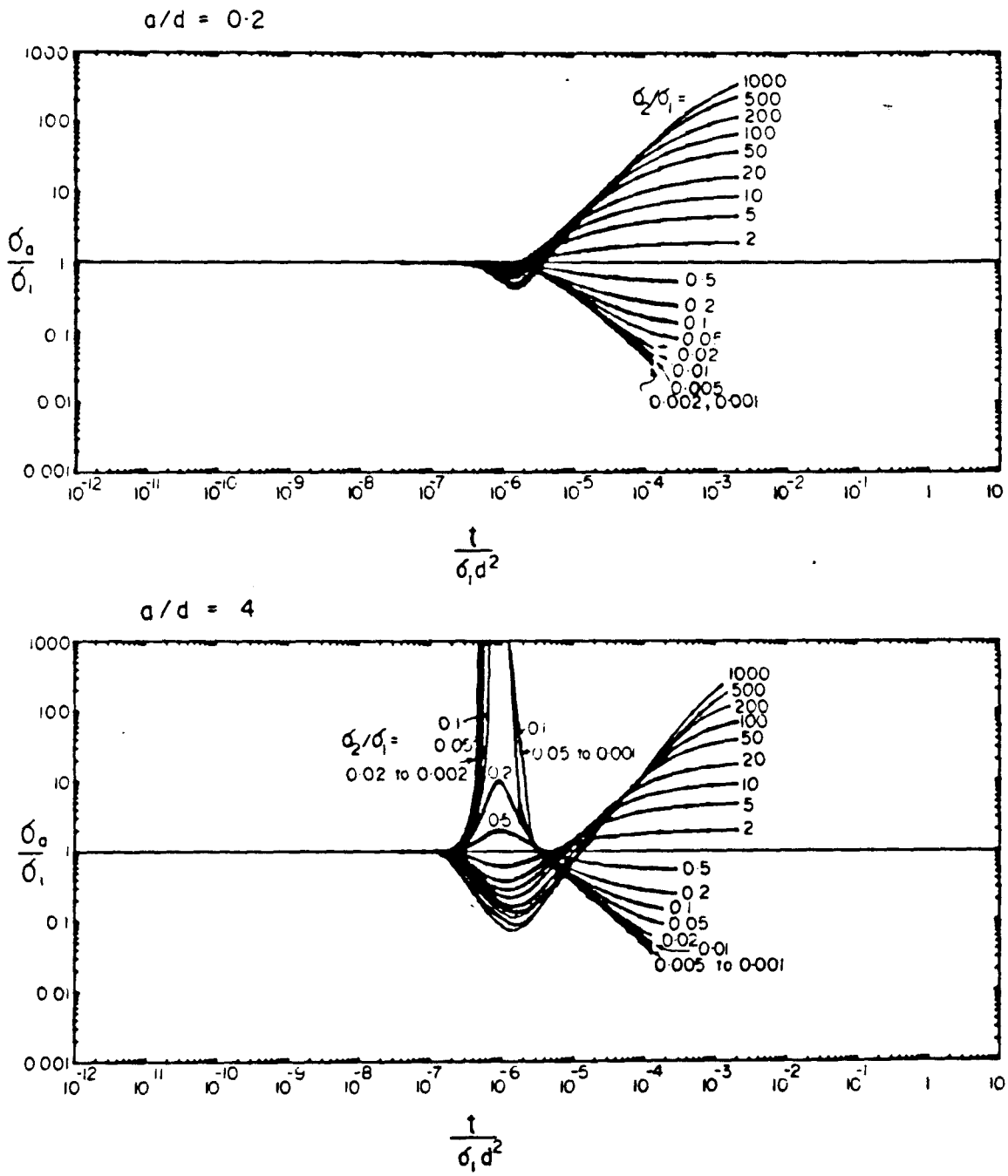

FIG. 4. Apparent conductivity varying K; $a/d = 0.2$ and 4. Time is normalized with respect to depth squared.

$$R_1 = \frac{s_1 - \lambda}{s_1 + \lambda};\ R_2 = \frac{s_2 - s_1}{s_2 + s_1},$$

the remaining interactive term $E_I = E_0 - E_p$ can be expressed as

$$E_I = \frac{p\mu a I}{2} \int_0^\infty \frac{R_2(R_1^2 - 1) J_1^2(\lambda a) d\lambda}{e^{2s_1 d} + R_1 R_2}. \tag{16}$$

To get the voltage $V_I(p)$ as before, we multiply by the transform of the step function and integrate the field around the loop. This corresponds to multiplying $E_I(p)$ by $2\pi a/p$. The inverse Laplace transform is defined as

$$V_I(t) = \frac{1}{2\pi i} \lim_{\beta \to \infty} \int_{\alpha - i\beta}^{\alpha + i\beta} e^{pt} V(p) dp.$$

Because $V(p)$ is analytic for $\mathrm{Re}(p) > 0$, α can be set to zero. Then, letting $\omega = ip$, the result looks like a Fourier integral. To put the equation in final form, we normalize some of the variables as follows:

B = normalized loop radius = a/d,
K = conductivity contrast = σ_2/σ_1,
W = normalized frequency = $\mu\sigma_1 d^2\omega$,
T = normalized time = $t/\sigma_1\mu d^2$,
$x = \lambda d$,
$\gamma_1 = s_1 d = \sqrt{\lambda^2 d^2 - i\omega\mu\sigma_1 d^2} = \sqrt{x^2 - iW}$,
$\gamma_2 = s_2 d = \sqrt{x^2 - iKW}$,

$$R_1 = \frac{\gamma_1 - x}{\gamma_1 + x}, \text{ and } R_2 = \frac{\gamma_2 - \gamma_1}{\gamma_2 + \gamma_1}.$$

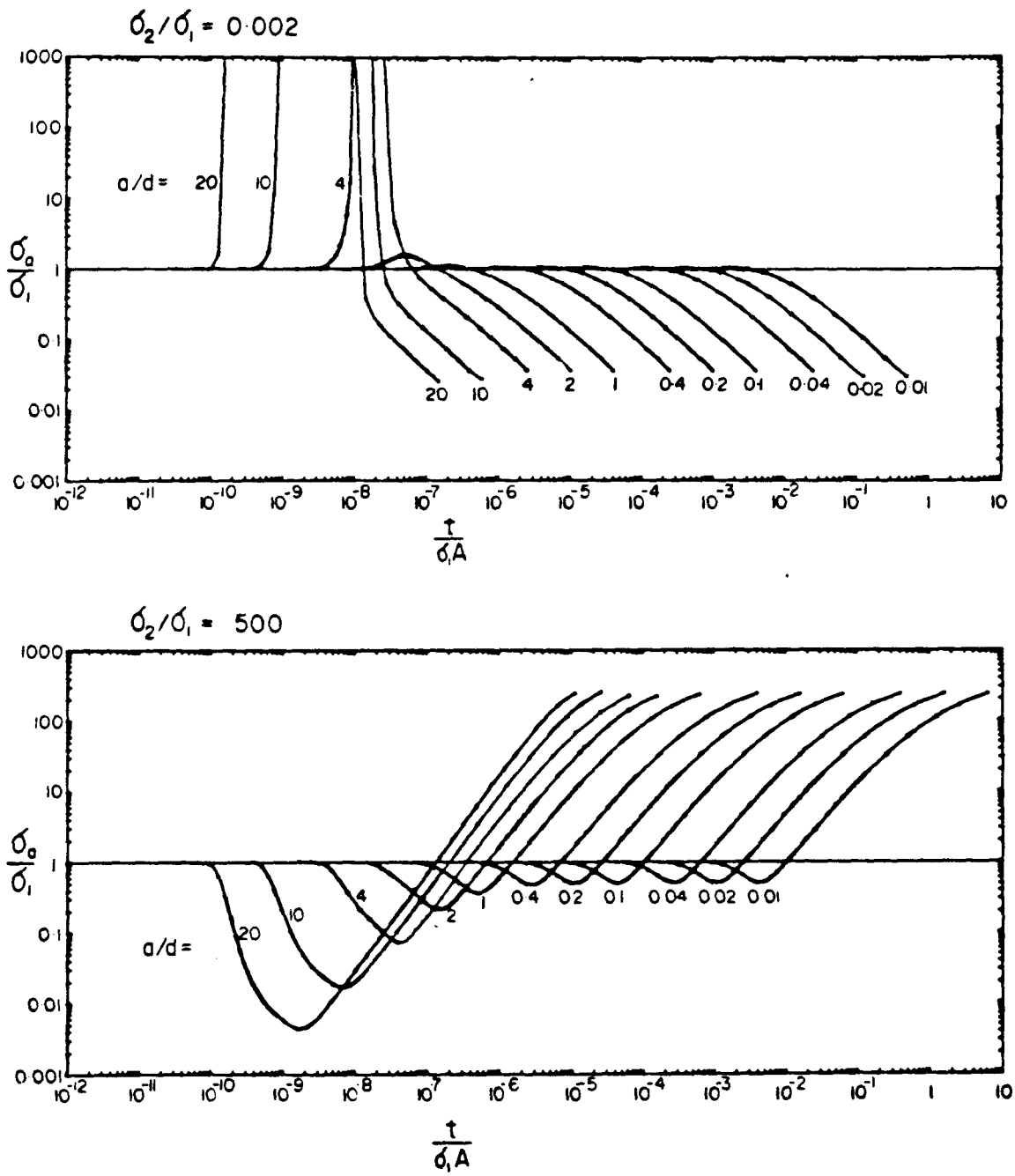

FIG. 5. Apparent conductivity varying a/d; K = 500 and 0.002. Time is normalized with respect to loop area.

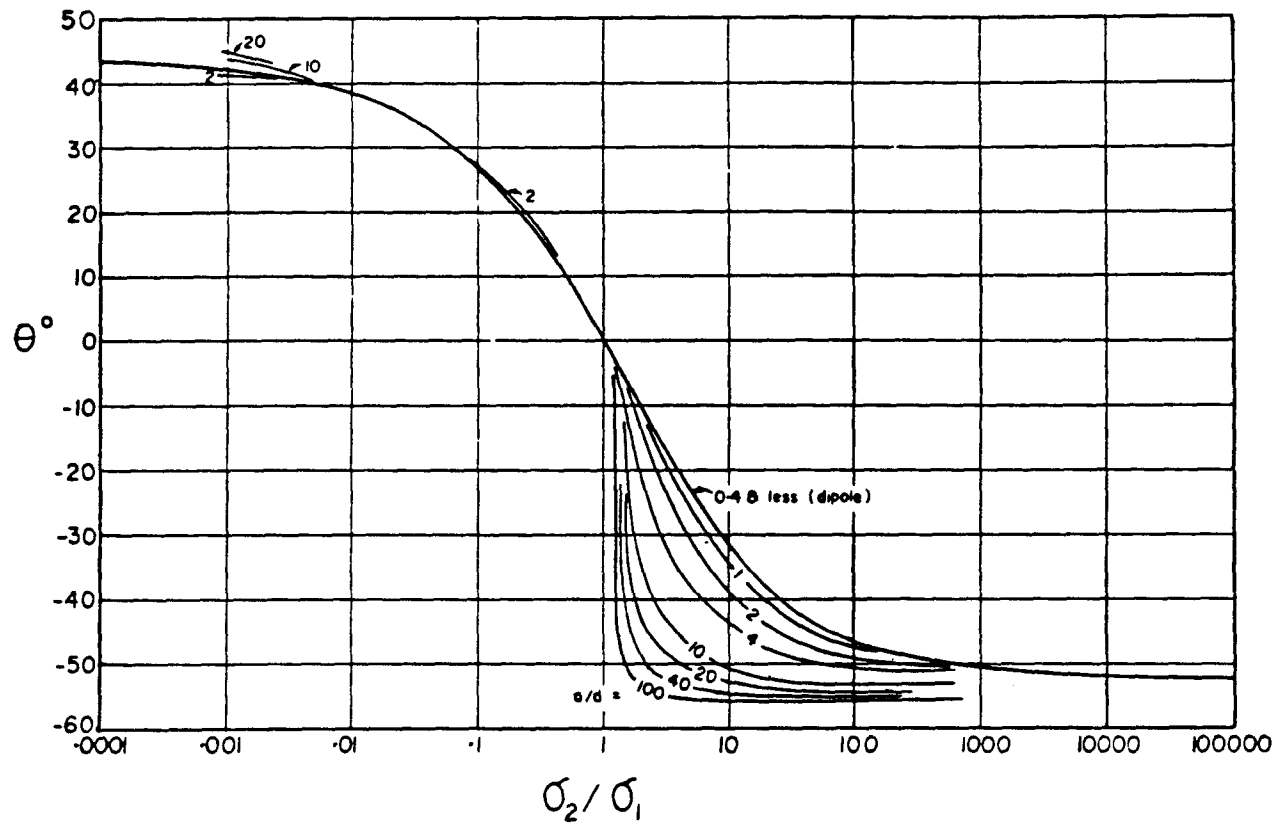

FIG. 6. Slope of middle time regime of apparent conductivity curves as a function of K.

Thus the "interactive" voltage per unit source current can be expressed as

$$\frac{V_I(t)}{I} = \frac{B^2}{\sigma_1 d} \operatorname{Re} \int_0^\infty e^{-iWT} \int_0^\infty \frac{R_2(R_1^2 - 1) J_1^2(xB)}{e^{2\gamma_1} + R_1 R_2} \, dx \, dW. \tag{17}$$

The total voltage is calculated using equations (17) and (4). Using the method previously explained, the voltage is transformed into apparent conductivity.

Calculating the voltage or σ_a at late times when $\sigma_1 \gg \sigma_2$ can be difficult. At late times, the apparent conductivity should approach the true conductivity of the half-space underlying the overburden. Since at late times voltage is proportional to $\sigma^{3/2}$, if $\sigma_1 = 100\ \sigma_2$, then $V_p - V_I = 1000\ V_{\text{total}}$. Since a small error in V_I can mean a very large error in V_{total}, it is important to calculate V_I carefully. The error criteria used in calculating V_I (as discussed below) were chosen so as to give a relative error of less than 0.1 percent.

The integral, with respect to x,

$$I_1 = \int_0^\infty f(B, K, W, x) \, dx$$

is calculated using Patterson's (1973) method for Gaussian integration, i.e., an automatic routine which increases the number of points in an interval until the desired convergence is achieved without recalculating any old points (internal criterion). For small values of the frequency-conductivity product, the integrals can be made to converge faster by transforming the interval $0 \to \infty$ to $0 \to 1$ using $y = \exp(-x)$. For large frequency-conductivity products, it is better to keep the semiinfinite interval. An initial interval is chosen (e.g., $0 \le x \le 1$); when the integral converges, the next interval is taken to be twice as big as the previous one. This process is continued until the integral over the last interval is less than a given percentage of the total integral (external criterion). The internal and external criteria were set to 0.05 percent relative error.

The integral $I_1(B, K, W)$ is calculated for 400–500 values of W. A cubic is fitted between each adjacent four points for generating function values between the two interior points. The points are irregularly spaced such that the relative error of the cubic approximation at the midpoint is less than 10^{-4}.

$I_1(W)$ is zero at $W = 0$, rises to a maximum in the region $0.1 < W < 1$, and then decays for large W. In order to achieve consistent results in the inverse Fourier transform, especially at late times, it was necessary to calculate I_1 for W sufficiently large that the value of I_1 was eight to ten orders of magnitude below peak value. For the model suite reported here, the integrals went out to $W = 200$ or 400. Once again, the integral over W was calculated using Patterson's algorithm, and

$$\begin{aligned} \int_0^\infty f(W) \sin(WT) \, dW &= \frac{1}{T} \int_0^\infty f(y/T) \sin y \, dy \\ &= \frac{1}{T} \int_0^{2\pi} \sin y \left\{ \sum_{n=0}^{N} f\left(\frac{y + 2n\pi}{T}\right) \right\} dy. \end{aligned} \tag{18}$$

In the literature, a half-cycle version of the above is commonly used, but for these calculations, the full cycle version proved to be

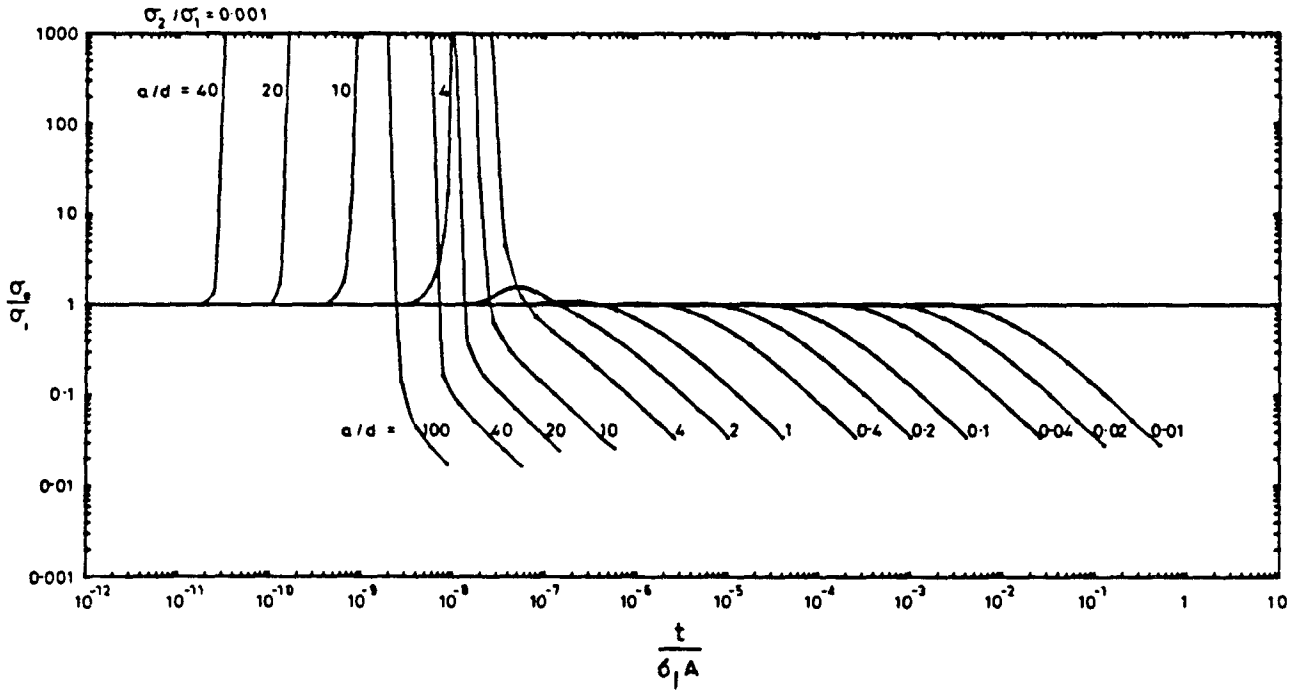

FIG. 7. Normalized apparent conductivity versus normalized time for various a/d. $K = 0.001$.

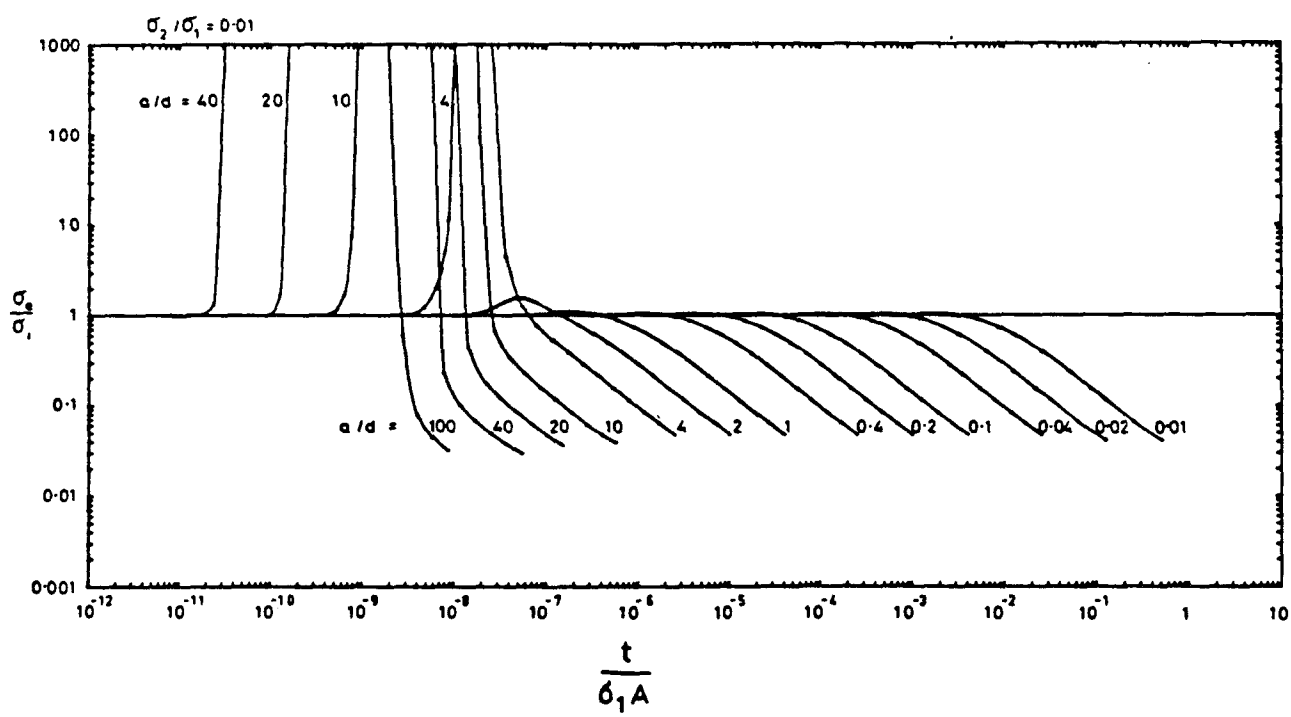

FIG. 8. Same as Figure 7 except $K = 0.01$.

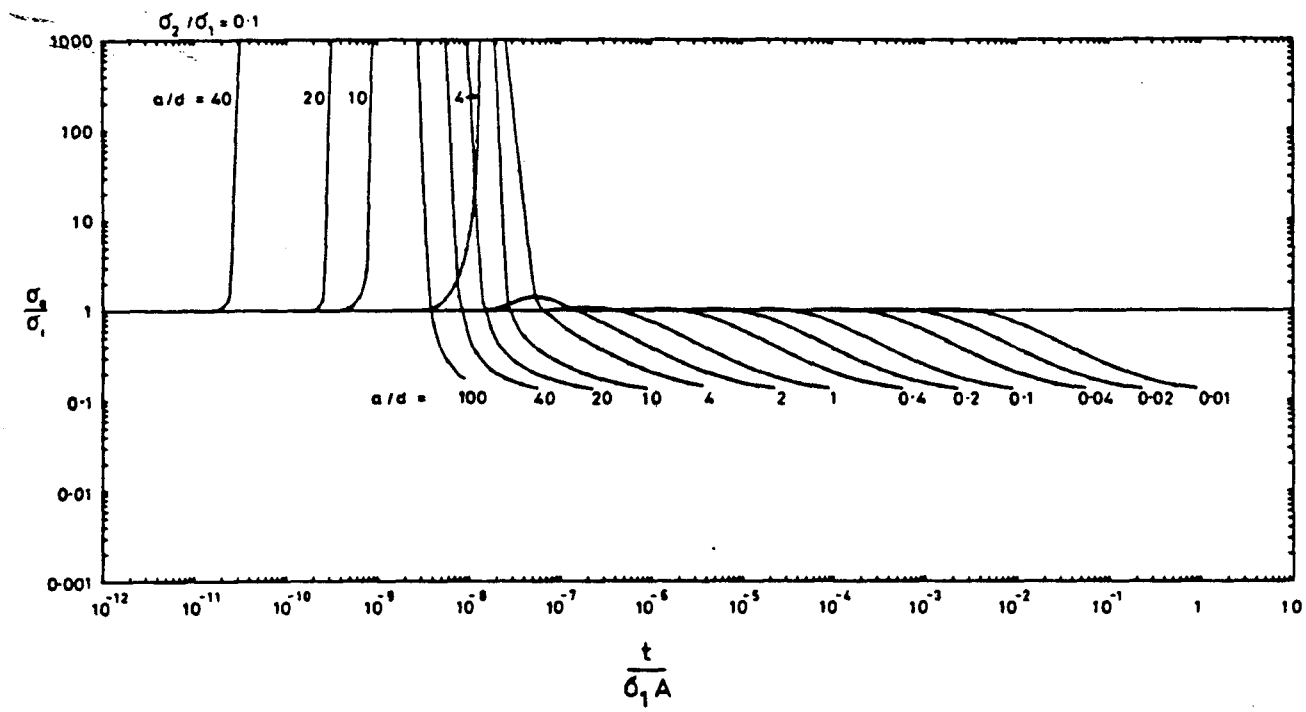

FIG. 9. Same as Figure 7 except $K = 0.1$.

more efficient. Computation time can vary by orders of magnitude depending upon the parameters of the model.

CHARACTERISTICS OF σ_a/σ_1 PLOTS

Our basic data presentation consists of plots of σ_a/σ_1, the apparent conductivity normalized to the conductivity of the top layer (see Figures 3, 4, and 5). Two different normalized times are used. The first is defined as $T_{N1} = t/\sigma_1 d^2$; and the second is $T_{N2} = t/\sigma_1 A$, where A is the area of the loop (πa^2). In order to make these quantities dimensionless, μ would have to be included in the denominators. However, in order to facilitate the use of these curves for interpretation, this was not done.

(1) Normalized time $t/\sigma_1 d^2$, varying a/d

Figure 3 shows σ_a/σ_1 versus normalized time for conductivity contrasts $\sigma_2/\sigma_1 = 500$ and 0.002 for several values of a/d. The different curves can be thought of as showing the effect of keeping top layer thickness constant and changing loop radius. For $\sigma_1 < \sigma_2$, the apparent conductivity is initially that of the top layer σ_1 and then at a time t_D actually decreases (undershoot), reaching a minimum and then increasing until it asymptotically approaches σ_2, the conductivity of the underlying half-space. Similarly, for $\sigma_1 > \sigma_2$, the apparent conductivity is initially that of the top layer and then increases (overshoot), reaching a maximum before decreasing asymptotically to σ_2.

The overshoot/undershoot phenomenon is greatest for large values of a/d. In fact for $\sigma_1 > \sigma_2$ and large a/d, the overshoots are infinite, i.e., there is no equivalent half-space. For small a/d (<0.4), all the curves coincide, i.e., the loop can be regarded as a dipole.

(2) Normalized time $t/\sigma_1 d^2$, varying σ_2/σ_1

Figure 4 shows σ_a/σ_1 versus normalized time for a/d values of 0.2 and 4.0. The overshoot/undershoot phenomenon is again apparent and is seen to increase monotonically with $|\log(\sigma_2/\sigma_1)|$.

The time of departure of σ_a from σ_1 (i.e., the time at which the signal in the Rx loop first indicates the presence of a structure other than a half-space) is a function of top layer thickness and conductivity. From inspection of the graphs, we have found an approximate relation for this time:

$$t_D = 2 * 10^{-7} \sigma_1 d^2. \tag{19}$$

(3) Normalized time $t/\sigma_1 A$ varying a/d

With this type of normalization, the group of curves can be thought of as representing the effect of changing top layer thickness with constant loop size. In Figure 5, the time of departure and, in fact, the generalized curve shape, move across the normalized time axis two decades for every decade increase in d. It will be shown that this type of normalization is the most useful for interpretation.

The σ_a/σ_1 curves can be qualitatively characterized by three regimes. The early time regime starts at $\sigma_a = \sigma_1$ and includes the peak of the overshoot/undershoot. The medium time regime is the straight portion of the curve where σ_a is going smoothly toward σ_2. The late time regime starts where σ_a turns to approach σ_2 asymptotically. Regime 2 is of interest because the conductivity contrast can be determined from the slope of the curve. Figure 6 is a plot of the slope (in degrees) of the medium time regime as a function of σ_2/σ_1 for different values of a/d.

There has been some question as to whether interpretation is best accomplished using plots of apparent conductivity or the decay function S_0 defined in equation (7). We have chosen to plot apparent conductivity because of the structure of the curves. For example, for a homogeneous half-space, the plot of σ_a versus time is constant as opposed to the plot of S_0 in Figure 2. For layered half-spaces, σ_a is initially the conductivity of the topmost layer and for late times, σ_a approaches the conductivity of the basement. Even for three or more layers, the middle portions of the curves

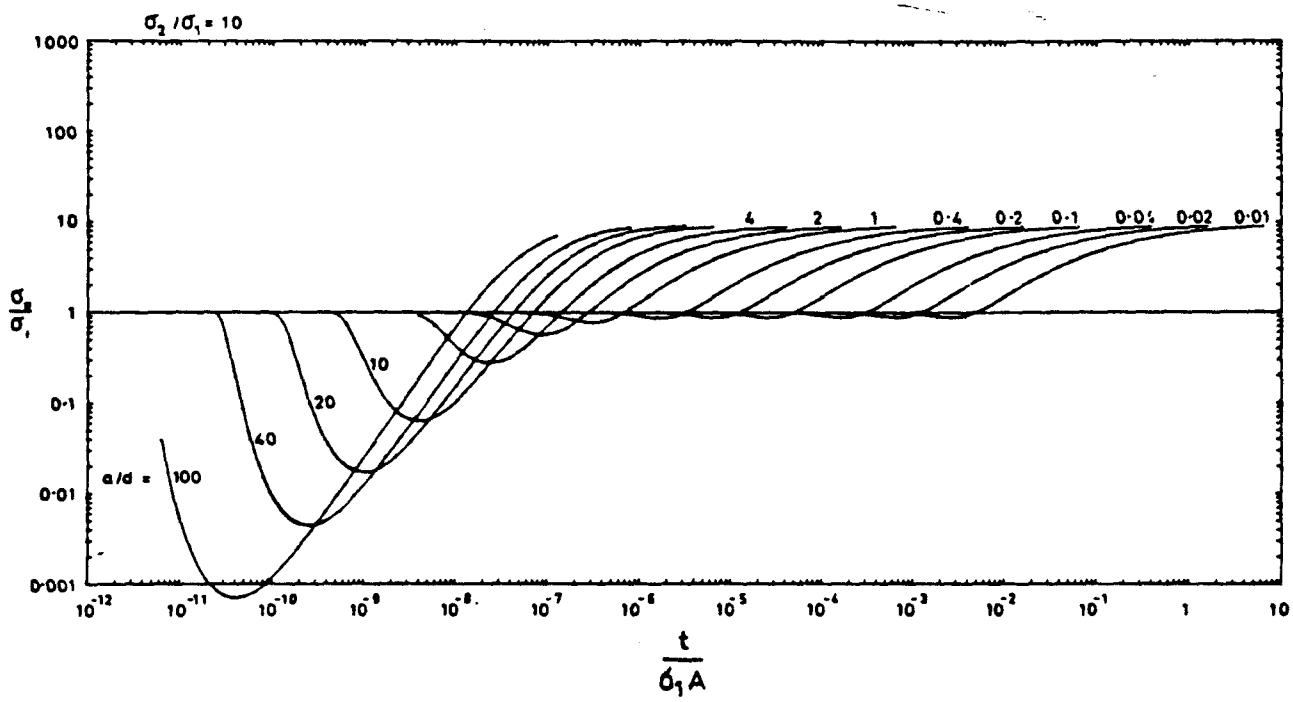

FIG. 10. Same as Figure 7 except $K = 10$.

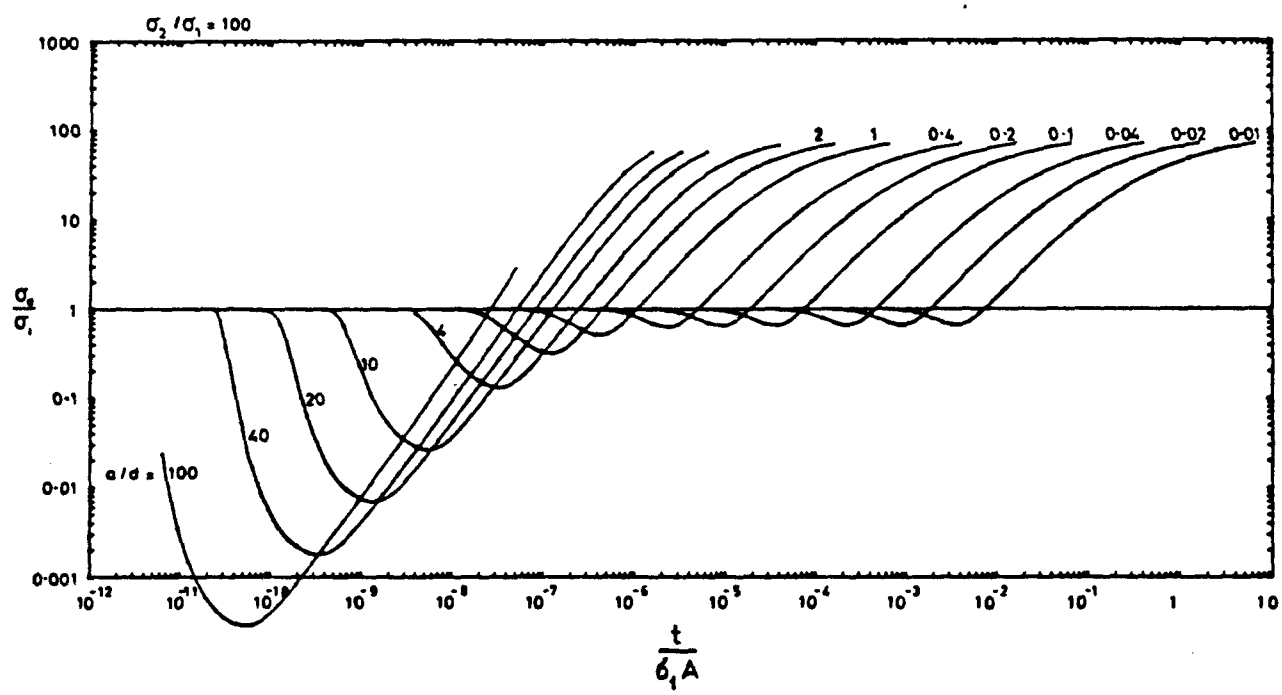

FIG. 11. Same as Figure 7 except $K = 100$.

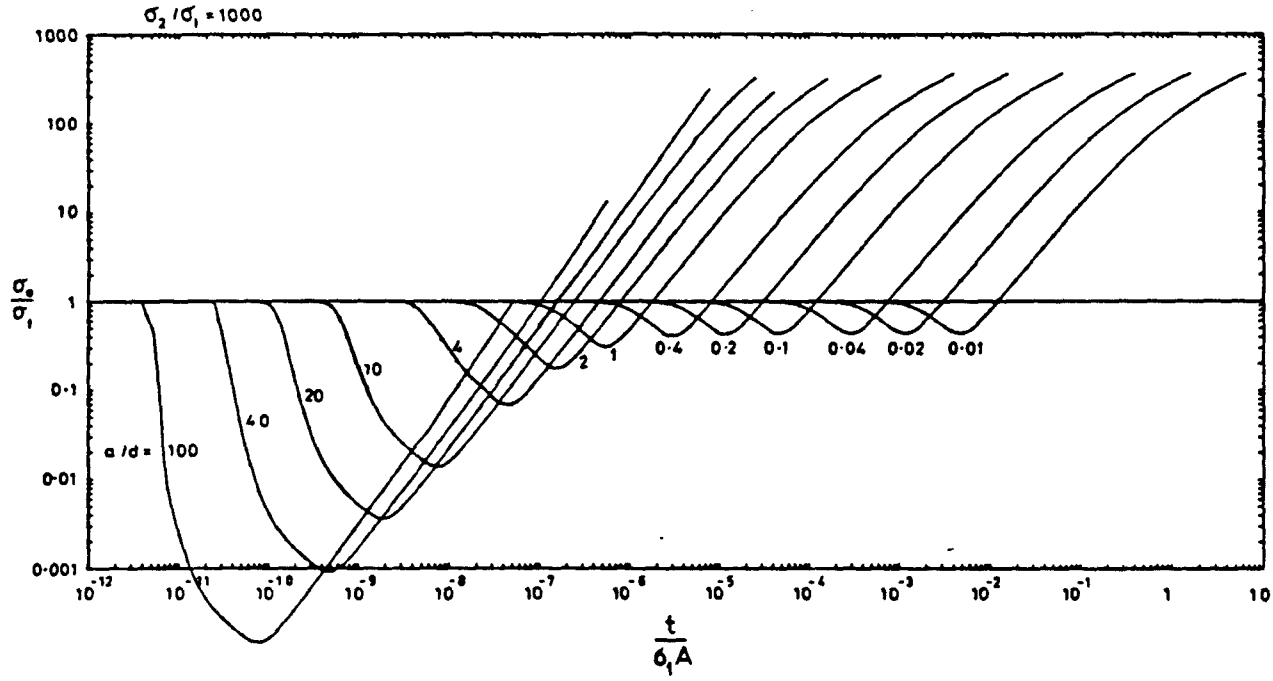

FIG. 12. Same as Figure 7 except $K = 1000$.

show considerably more "interpretable" structure than the corresponding plots of S_0.

As previously mentioned, plots of σ_a versus τ can become undefined for small values of a/d at very early times for $\sigma_1 > \sigma_2$. To date, we are not aware of any field results where this has happened, but as instruments become capable of measuring earlier times, this could be a problem. In this case, we would suggest using an apparent conductivity corresponding to the late time asymptote, e.g., from equation (9),

$$X_1 = a_0^2 y, \tag{20}$$

and

$$\bar{\sigma}_a = \frac{4tX_1}{\mu a^2}. \tag{8a}$$

Figures 7–12 are plots of σ_a/σ_1 versus $t/\sigma_1 A$ for σ_2/σ_1 values of 0.001, 0.01, 0.1, 10, 100, and 1000, respectively (K contrast master curves). Each of these figures has curves for a/d ratios of 0.01, 0.02, 0.04, 0.1, 0.2, 0.4, 1, 2, 4, 10, 20, 40, and 100. (These curves are included for purposes of illustration. Anyone wishing a more complete set on a more usable scale should write to the authors. Also available, if desired, are plots of $\bar{\sigma}_a$ for the regions where σ_a is infinite.)

USING THE CURVES FOR INTERPRETATION

Step 1—Transform to σ_a

The field data are converted to apparent conductivities [equations (7, 8)] and plotted as log σ_a versus log t.

Step 2—Estimate of K

Using Figure 6, conductivity contrast is determined from the slope of the σ_a versus t curve in the medium time region. The appropriate figure is then selected for the contrast. As can be seen from Figure 6, this procedure is not quite precise for nondipole values of a/d. Thus one may possibly look at two or three different K contrast master curves.

Step 3—Estimate of a/d

If the field curve contains the early time regime as well as the middle time, the procedure is fairly simple. The field curve is superposed on the master curve which gives the best congruence. (In this discussion, superposition of a field curve on a master curve plot will always imply that the respective time and conductivity axes are kept parallel.) Then the σ_a from the field curve ordinate is compared with the σ_a/σ_1 ordinate from the master curve, and hence σ_1 is determined. Comparison of t on the field curve abscissa with $t/\sigma_a A$ on the master curve abscissa would also yield a value of σ_1. Obviously the values of σ_1 must agree, and it is this constraint which enables one to choose among otherwise indistinguishable dipole curves if a/d is small. Once σ_1 is determined, σ_2 is determined from the known value of σ_2/σ_1, and d is known from the a/d value of the best curve.

Usually the field curve does not include the early time regime, so the procedure becomes slightly more complicated. A point F_1 is chosen on the field curve at a convenient delay time, e.g., t_F = 10 msec. σ_F is defined as the value of apparent conductivity at delay time t_F. Next, on the appropriate master curve figure, a point M_1 is chosen such that $\sigma_a/\sigma_1 = 1$ and $t_1/\sigma_1 A = t_F/\sigma_F A$.

Suppose for the moment that σ_1 were known. Letting $b = \sigma_F/\sigma_1$, a second point M_2 on the master curve plot could be defined such that $\sigma_a/\sigma_1 = b$ and $t/\sigma_1 A = bt_F/\sigma_F A$. If the field curve were superposed on the master curve plot such that F_1 coincided with M_2, the field curve would be congruent with an existing master curve or one which is an interpolation between two existing curves.

A straight line joining M_1 and M_2 makes a 45-degree angle with respect to the time axes, regardless of the value of b, i.e., regardless of the value of σ_1. Thus, the interpretation procedure consists of marking the point M_1 on the appropriate master curve plot and

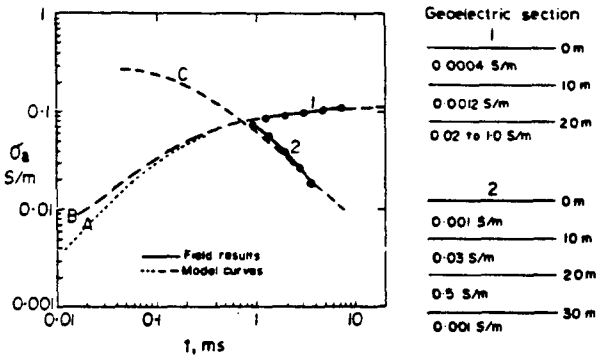

FIG. 13. Comparison of field results and model curves for Alligator River.

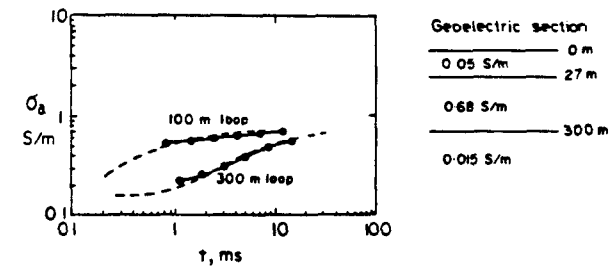

FIG. 14. Comparsion of field results and model curves for Pooncarie.

drawing a 45 degree line through it. The field curve is superposed on the plot such that F_1 lies on the 45-degree line. Restricting F_1 to lie on this line, the field curve is moved on the master curve plot until the best congruence is achieved. Thus a/d is determined, σ_1 can be read off either axis, and σ_2 and d are also determined.

FIELD EXAMPLES

(1) Alligator River

In 1975, the Bureau of Mineral Resources, Geology and Geophysics (BMR) did a regional TEM survey in the Alligator River area of the Northern Territory, Australia (Spies, 1978). The apparent conductivity curves from this survey allowed the discrimination of anomalies caused by subsurface carbonaceous shale from those caused by surficial conductors. Field results (curves 1 and 2) from two locations are shown in Figure 13, together with the model curves (A, B, and C) which fit the data and electrical sections from Schlumberger soundings.

Curve 1 was obtained with a 100-m loop over a carbonaceous shale bed overlain by 20 m of highly resistive cover. Model A curve is for $\sigma_1 = 0.0026$ S/m, $\sigma_2 = 0.13$ S/m, and $d = 20$ m. Because of the narrow time range in which measurements were made (1–15 msec), there are many other model curves which fit the data, e.g., curve B is for the case $\sigma_1 = 0.012$ S/m, $\sigma_2 = 0.12$ S/m, and $d = 20$ m. In this example, the depth to the bed and its conductivity are consistent with the Schlumberger soundings. To discriminate possible top layer conductivities, earlier readings would have been necessary as can be seen by the early time divergence of curves A and B.

Curve 2 was obtained with a 50-m loop over a thin surficial conducting layer. According to the resistivity sounding, the layer has a conductivity of 0.5 S/m, is 10 m thick, and is buried at a depth of 20 m in a resistive medium.

The TEM curve decreases sharply with time, implying a conductivity contrast of over 1000 for a two-layer interpretation with the lower layer more resistive. Fitting the field data to model curve C results in an interpretation of $d = 10$ m and $\sigma_1 = 0.34$ S/m. However, the data fit just as well to other models, such as $d = 3$ m and $\sigma_1 = 1.3$ S/m. To resolve the conductivity and thickness requires measurements over an earlier time range. In this example, the surface resistive layer does not appear in the σ_a curves.

(2) Pooncarie

At Pooncarie in western New South Wales, loosely consolidated conductive Quaternary, Tertiary, and Cretaceous sediments overlie resistive Paleozoic strata. The sediments are horizontally layered, and a geoelectric section is shown in Figure 14 (K. Vozoff, personal communication). A 300-m thick conductive layer (0.7 S/m) lies under about 22 m of more resistive sand.

Apparent conductivity curves are shown for 300-m and 100-m loops. The fact that they are markedly different implies that at least one of the loops is nondipolar, i.e., $a/d > 1$. Both field curves can be fitted to two-layer model curves as shown, where the parameters are $\sigma_1 = 0.28$ S/m, $\sigma_2 = 1$ S/m, and $d = 24$ m.

The interpreted depth and conductivity of the lower layer are in good agreement with the electrical sounding data. The difference in σ_1 could be attributed to seasonal variations in near-surface groundwater, since the two surveys were conducted several months apart.

DISCUSSION

In principle, the curves presented here should allow the interpretation of two-layer earths using coincident loop TEM systems if good data exist over a sufficient time range. However, existing TEM equipment has a time range of two decades. The earliest dependable sample time is about 1 msec, and the late time response is limited by voltage sensitivity of 0.1 $\mu V/A$.

To illustrate the effect of these limits, consider a TEM survey over a two-layer earth with a conducting overburden, $\sigma_1 = 0.1$ S/m and substrate conductivity $\sigma_2 = 0.001$ S/m using a 100 m square loop. If the earliest reading is at 1 msec, this gives a normalized time of 10^{-6} sec/Sm. As shown in Figure 8 ($K = 0.01$), the curves for $d < 80$ m all lie to the left of this time, so the thinnest layer that can be identified is $d = 80$ m. Voltage sensitivity considerations (0.1 $\mu V/A$) limit the largest detectable value of d to 300 m. In other words, if d were larger than 300 m, the received voltage would be too weak to measure for delay times sufficiently late to identify the bottom layer.

In addition to this kind of absolute limit, reliable interpretation requires data over a reasonable time range. In the previous field example it was shown how limited data allowed a multiplicity of interpretations. In these cases, the two-layer curves were still useful in limiting the number of models. The use of two different loop sizes, one in the dipolar range and one larger than the dipolar range, allowed the further narrowing of model choices. However, the use of different loop sizes does not yield a different time regime on the curves.

Single or coincident loop TEM is, in principle, an attractive depth sounding method because it inherently contains information over a wide range of frequency (depth). In comparison with electrical resistivity soundings, the TEM equipment layout requires less space. Also, the geoelectric column contributing to the response is more localized. However, to be used as a viable stratigraphic tool sensitivities must be increased, and the ability to make reliable measurements must be extended to much earlier times.

ACKNOWLEDGMENT

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REFERENCES

Abramowitz, M., and Stegun, I., 1964, Handbook of Mathematical Functions: Nat. Bur. of Stan. applied mathematics series, 1046 p.

Braham, B., Haren, R., Lappi, D., Lemaire, H., Payne, D., Raiche, A., Spies, B., and Vozoff, K., 1978, Lecture notes from the U.S.–Australia electromagnetic workshop: Austral. SEG Bull., v. 9, p. 2–33.

Buselli, G., 1977, Transient electromagnetic measurements to late delay times over the Woodlawn Orebody: Austral. SEG Bull., v. 8, p. 1–5.

Churchill, R. V., 1958, Operational mathematics: New York, McGraw-Hill Book Co., Inc., 337 p.

Gradshteyn, I. S., and Ryzhik, I. M., 1965, Tables of integrals, series and products: 4th ed. (Engl. trans.), New York, Academic Press, 1086 p.

Kamenetskii, F. H., 1976, Applications handbook for transient process methods in the geophysics of ore bodies: Leningrad, All-Union Sci. Res. Inst. of Explor. Geophys.

Lee, T., and Lewis, R., 1974, Transient response of a large loop on a layered ground: Geophys. Prosp., v. 22, p. 430–444.

Mallick, K., and Verma, R. K., 1978, Time-domain electromagnetic sounding with horizontal and vertical coplanar loops on a multilayered earth: Geoexpl., v. 16, p. 291–302.

Morrison, H. F., Phillips, R. J., and O'Brien, D. P., 1969, Quantitative interpretation of transient electromagnetic fields over a layered half-space: Geophys. Prosp., v. 17, p. 82–101.

Patterson, T. N. L., 1973, Algorithm for automatic numerical integration over a finite interval: Assoc. for Computing Mach. Comm., v. 16, p. 694–699.

Spies, B. R., 1976, The transient electromagnetic method in Australia: BMR J. Austral. Geol. Geophys., v. 1, p. 23–32.

——— 1978, Combined ground geophysical survey, Alligator River area, Northern Territory, 1975: Bur. Min. Resour. Aust. rep. 205.

Spies, B. R., and Raiche, A. P., 1980, Calculation of apparent conductivity for the TEM (coincident loop) method using an HP-67 calculator: Geophysics, v. 45, p. 1197–1204.

Velikin, A. B., and Bulgakov, Yu. I., 1967, Transient method of electrical prospecting (one loop version): Seminar on geophysical methods of prospecting for ore minerals, U.N.O., Moscow, July.

Wait, J. R., 1960, Propagation of electromagnetic pulses in a homogeneous conducting earth: Appl. Sci. Res., sect. B, v. 9, p. 213–253.

EMS

11 October 1985

Mr John F Arestad, Senior Geophysicist
Santa Fe Geothermal, Inc
5001 Commerce Center Drive
Bakersfield, CA 93309

Dear John

Enclosed are inversions of the three inloop soundings we did for Oxy in May of 1982 They are twenty channel 30Hz readings, with pretty good model fits If there is anything else I can be of assistance with, let me know

Yours Truly,
ELECTROMAGNETIC SURVEYS, INC

Ross

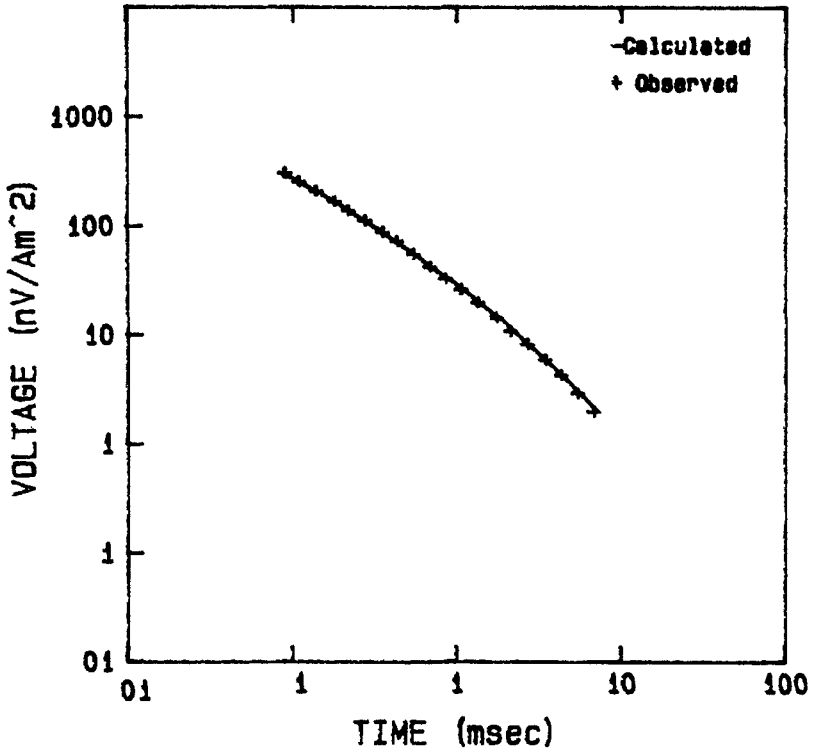
Ross H MacLeod, Geophysicist

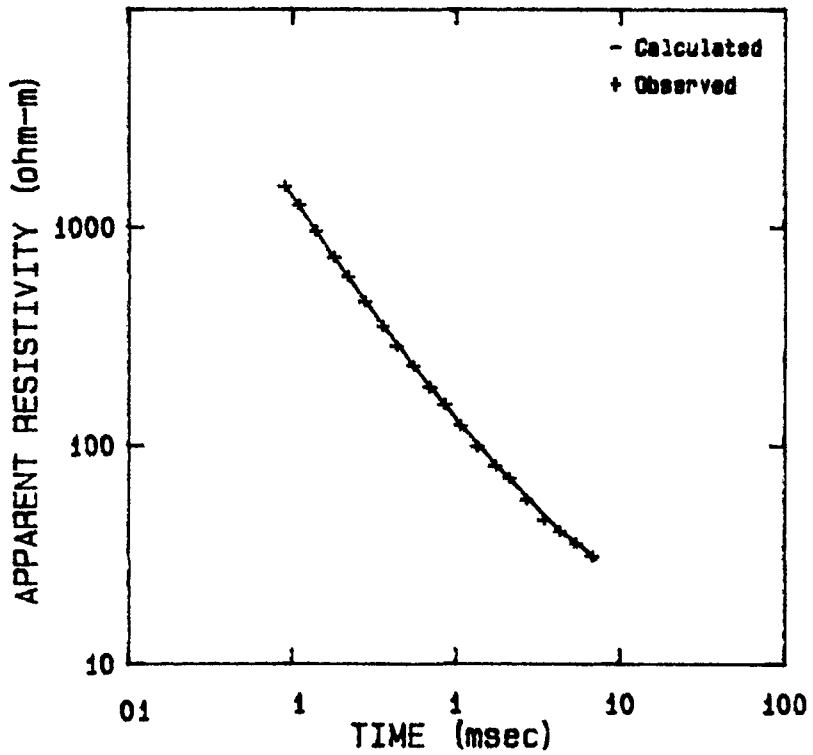
RHM/ms
enc

ElectroMagnetic Surveys Inc
2161 Shattuck Avenue Suite 317
Berkeley California 94704
(415) 845 8745

EMSURVEYS TEM INVERSION

GLASS MOUNTAIN
STATION 1-Z1





MODEL

RESISTIVITY (ohm-m)	THICKNESS (meters)
8565	209
12 3	54
8	

ELECTROMAGNETIC SURVEYS INC

GLASS MOUNTAIN 1 Z1

I	TIME (sec)	VOLTAGE (nV/Am^2)	CALC VOLT	RESIDUAL	/RES ERR
1	8900E 04	3020E+03	2985E+03	3538E+01	1185E+01
2	1100E 03	2510E+03	2524E+03	- 1401E+01	- 5549E+00
3	1400E 03	2070E+03	2064E+03	5839E+00	2829E+00
4	1770E 03	1660E+03	1679E+03	- 1877E+01	- 1118E+01
5	2200E-03	1360E+03	1376E+03	- 1594E+01	- 1159E+01
6	2800E-03	1100E+03	1093E+03	6917E+00	6328E+00
7	3550E-03	8660E+02	8646E+02	1363E+00	1577E+00
8	4430E-03	7130E+02	6911E+02	2190E+01	3168E+01
9	5540E 03	5470E+02	5475E+02	- 4669E 01	- 8529E 01
0	7130E-03	4180E+02	4184E+02	- 3948E-01	- 9437E-01
1	8810E-03	3230E+02	3317E+02	- 8669E+00	- 2614E+01
2	1090E-02	2570E+02	2606E+02	- 3632E+00	1394E+01
3	1410E-02	1950E+02	1927E+02	2343E+00	1216E+01
4	1790E-02	1415E+02	1437E+02	- 2174E+00	- 1513E+01
5	2220E-02	1060E+02	1092E+02	- 3195E+00	- 2926E+01
6	2850E-02	8080E+01	7828E+01	2523E+00	3223E+01
7	3600E-02	5810E+01	5654E+01	1564E+00	2766E+01
8	4490E-02	4220E+01	4110E+01	1098E+00	2672E+01
9	5700E 02	2850E+01	2871E+01	- 2101E-01	7319E+00
0	7190E-02	1960E+01	2007E+01	- 4703E-01	- 2343E+01

RMSERR= 1 83

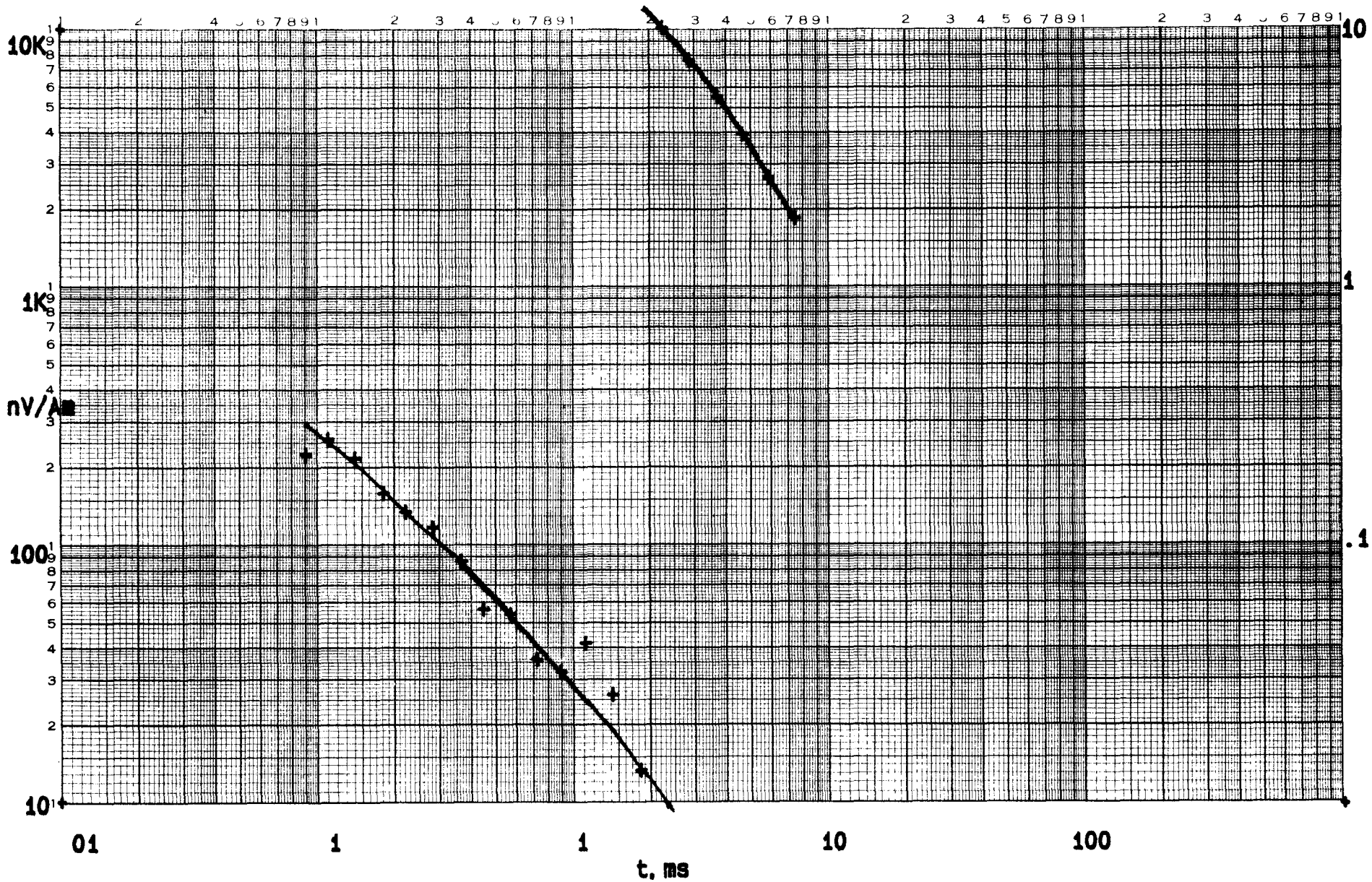
RRELATION MATRIX

1000E+01				
5659E+00	1000E+01			
- 4441E+00	- 9402E 01	1000E+01		
- 5652E+00	7122E+00	- 6414E-01	1000E+01	
- 6956E+00	3048E+00	5788E+00	3493E+00	1000E+01

**PARM_SOL	STD_ERROR	REL_ERROR	/ ERROR **
1168E-03	5861E 04	5020E+00	5020E+02
8100E-01	3384E-02	4178E 01	4178E+01
1257E+00	5399E-02	4297E-01	4297E+01
2093E+03	4074E 03	1946E 05	1946E-03
5365E+02	4238E-02	7900E-04	7900E-02

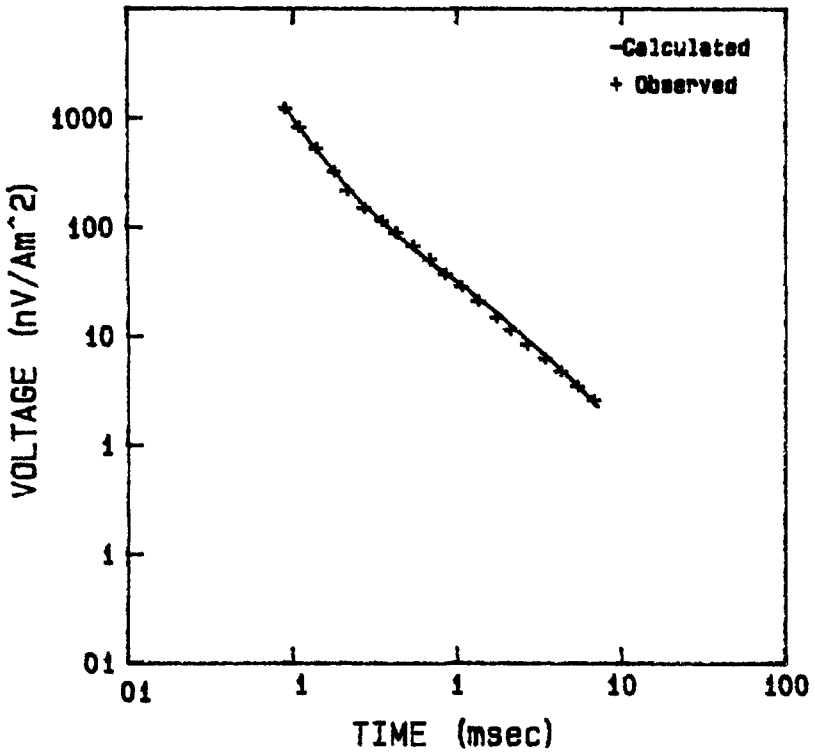
RAMETER NAME	FINAL SOLUTION	RESISTIVITY	LAYER DEPTH
1 SIGMA(1)	11676E-03	85646E+04	
2 SIGMA(2) =	81003E-01	12345E+02	
3 SIGMA(3) =	12565E+00	79584E+01	
4 THICK(1) =	20931E+03		20931E+03
5 THICK(2)	53647E+02		26295E+03
6 SHIFT =	20700E+03		

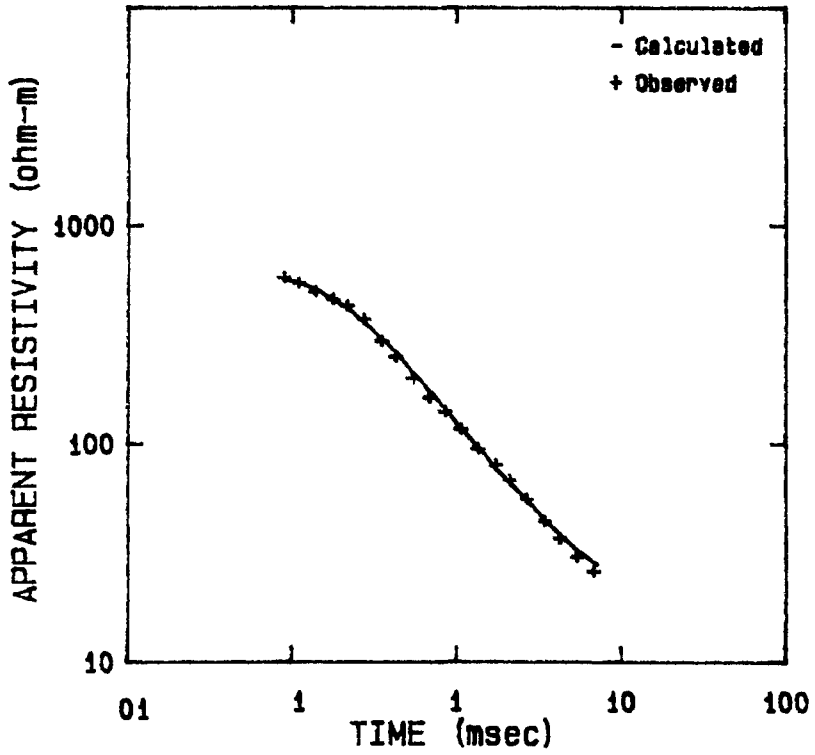
ull Logarithmic 3 x 5



EMSURVEYS TEM INVERSION

GLASS MOUNTAIN
STATION 2-Z1





MODEL

RESISTIVITY (ohm-m)	THICKNESS (meters)
1164	92
159	114
15 4	41
6 2	

ELECTROMAGNETIC SURVEYS INC

GLASS MOUNTAIN 2-Z1

TIME (sec)	VOLTAGE (nV/Am^2)	CALC VOLT	RESIDUAL	%RES ERR
8900E-04	1221E+04	1243E+04	2249E+02	- 1809E+01
1100E 03	8190E+03	8139E+03	5134E+01	6308E+00
1400E-03	5240E+03	5045E+03	1950E+02	3866E+01
1770E 03	3200E+03	3248E+03	- 4842E+01	1491E+01
2200E 03	2140E+03	2258E+03	- 1177E+02	- 5215E+01
2800E 03	1490E+03	1556E+03	- 6599E+01	- 4241E+01
3550E-03	1130E+03	1103E+03	2690E+01	2438E+01
4430E 03	8780E+02	8259E+02	5214E+01	6314E+01
5540E-03	6660E+02	6267E+02	3932E+01	6274E+01
7130E 03	5070E+02	4648E+02	4220E+01	9080E+01
8810E-03	3670E+02	3639E+02	3062E+00	8414E+00
1090E 02	2810E+02	2846E+02	- 3588E+00	- 1261E+01
1410E-02	2080E+02	2099E+02	- 1948E+00	- 9278E+00
1790E-02	1450E+02	1575E+02	- 1251E+01	- 7941E+01
2220E-02	1110E+02	1202E+02	- 9216E+00	- 7666E+01
2850E 02	8240E+01	8690E+01	- 4498E+00	- 5176E+01
3600E-02	6160E+01	6329E+01	1690E+00	- 2670E+01
4490E 02	4710E+01	4624E+01	8585E-01	1857E+01
5700E-02	3440E+01	3249E+01	1910E+00	5879E+01
7190E-02	2540E+01	2266E+01	2740E+00	1209E+02

RMSERR= 5 37

RELATION MATRIX

1000E+01						
- 2177E+00	1000E+01					
1249E+00	4621E+00	1000E+01				
4243E+00	8421E+00	- 1072E+00	1000E+01			
- 2402E+00	9856E+00	4172E+00	- 8816E+00	1000E+01		
3117E+00	8603E+00	- 5608E 01	9133E+00	9078E+00	1000E+01	
2315E+00	- 9393E+00	- 3516E+00	8391E+00	- 9232E+00	8133E+00	1000E+01

**PARM_SOL	STD_ERROR	REL_ERROR	/ ERROR **
8592E-03	3899E 03	4538E+00	4538E+02
6283E 02	9412E-02	1498E+01	1498E+03
6500E-01	2609E-01	4013E+00	4013E+02
1618E+00	4654E-01	2876E+00	2876E+02
9240E+02	1471E-01	1592E-03	1592E-01
1138E+03	8258E-02	7259E-04	7259E-02
4133E+02	1662E-01	4022E-03	4022E-01

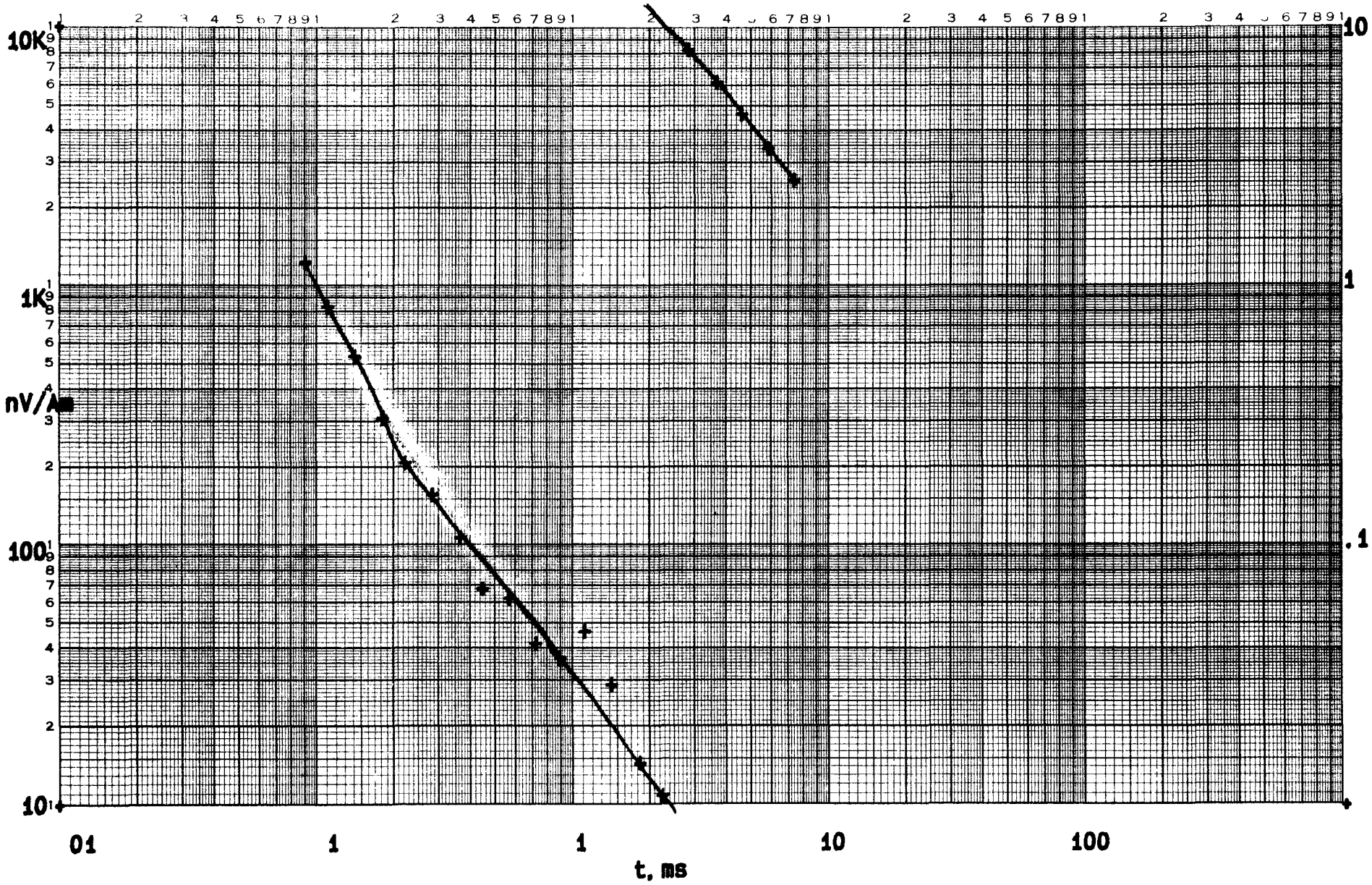
AMETER NAME	FINAL SOLUTION	RESISTIVITY	LAYER DEPTH
SIGMA(1)	85924E-03	11638E+04	
SIGMA(2) =	62835E 02	15915E+03	
SIGMA(3) =	64997E 01	15385E+02	
SIGMA(4) =	16180E+00	61804E+01	
THICK(1)	92403E+02		92403E+02
THICK(2) =	11377E+03		20617E+03
THICK(3)	41326E+02		24749E+03
SHIFT	20700E 07		

ull Logarithmic 3 × 5

2 191

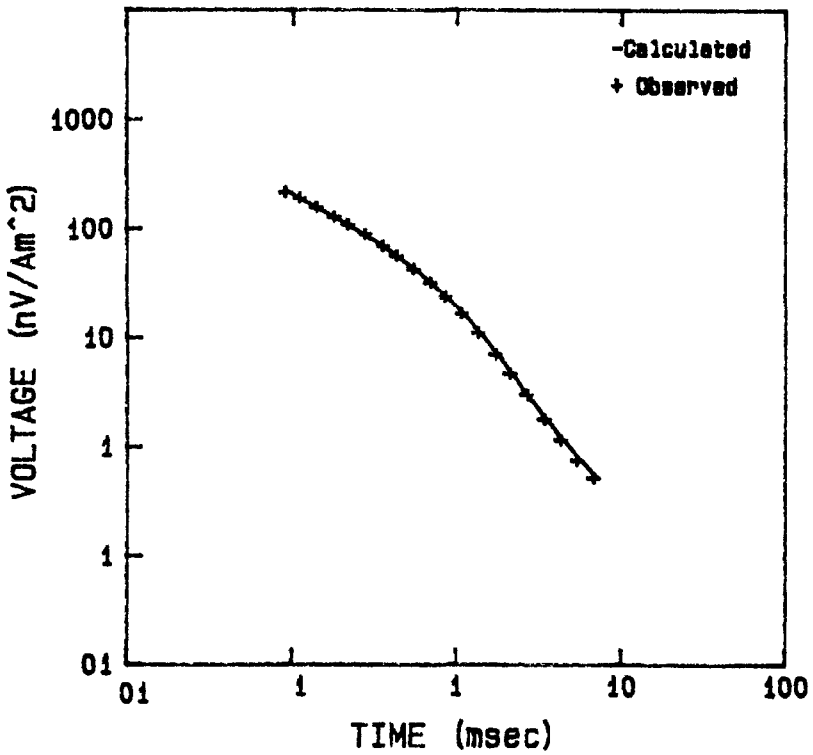
STATION: 2-Z1 + 30COILHI

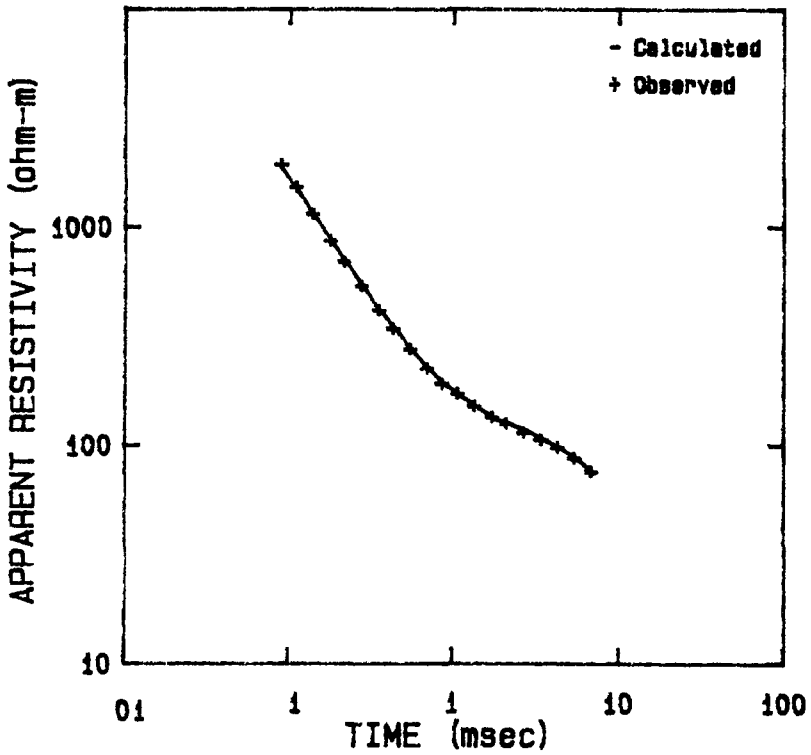
OCCIDENTAL
GLASS MOUNTAIN



EMSURVEYS TEM INVERSION

GLASS MOUNTAIN
STATION 3-Z1





MODEL

RESISTIVITY (ohm-m)	THICKNESS (meters)
2663	250
21 6	74
41 3	238
5 7	

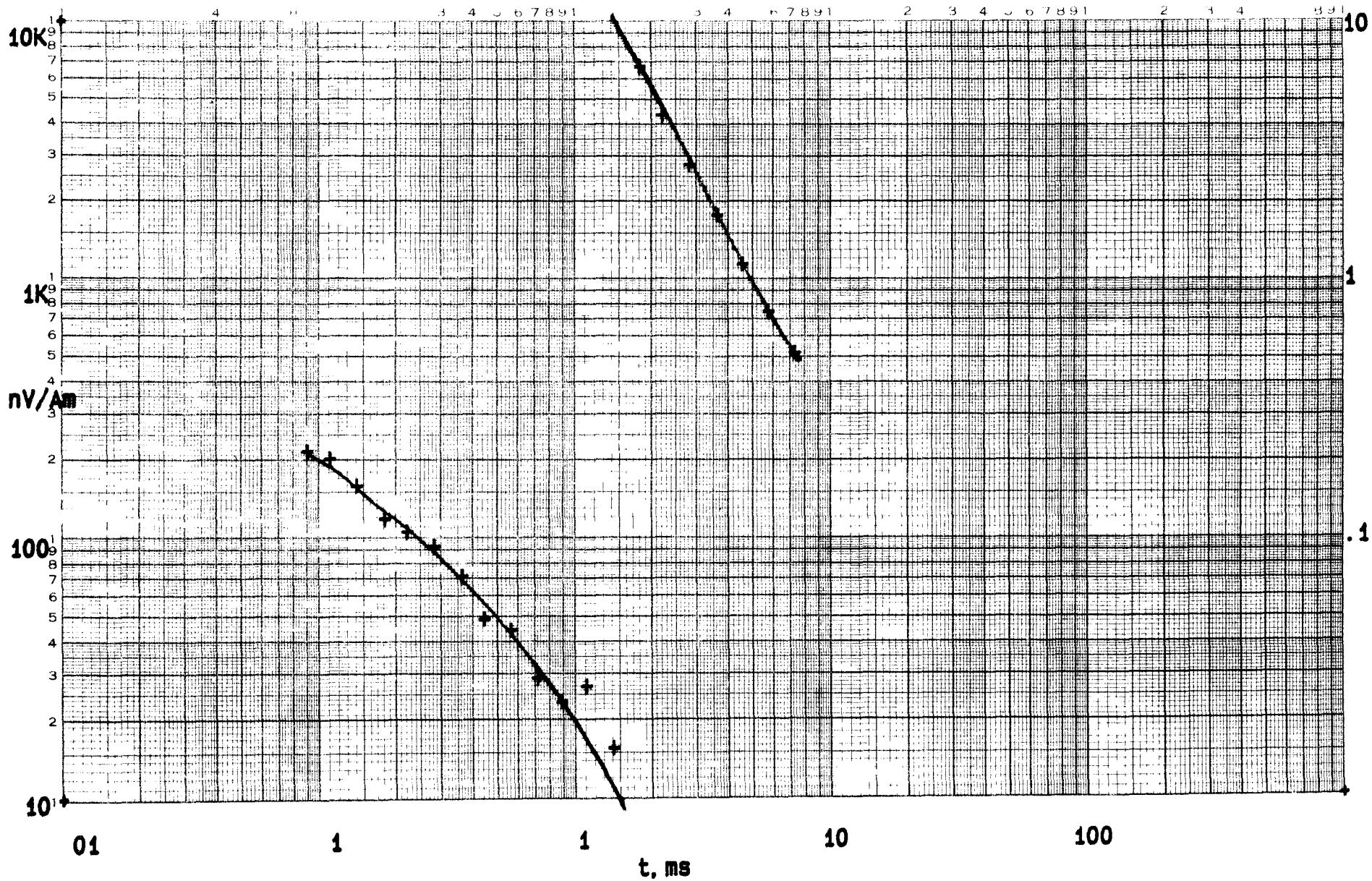
ELECTROMAGNETIC SURVEYS INC

GLASS MOUNTAIN 3-Z1

I	TIME (sec)	VOLTAGE (nV/Am^2)	CALC VOLT	RESIDUAL	%RES ERR
1	8900E-04	2140E+03	2264E+03	- 1240E+02	- 5477E+01
2	1100E-03	1910E+03	1875E+03	3468E+01	1849E+01
3	1400E-03	1550E+03	1551E+03	- 9392E-01	- 6056E-01
4	1770E-03	1270E+03	1273E+03	- 2800E+00	2200E+00
5	2200E 03	1080E+03	1058E+03	2150E+01	2031E+01
6	2800E-03	8750E+02	8559E+02	1910E+01	2232E+01
7	3550E 03	6860E+02	6829E+02	3072E+00	4498E+00
8	4430E-03	5570E+02	5441E+02	1288E+01	2367E+01
9	5540E-03	4190E+02	4230E+02	- 3959E+00	- 9360E+00
0	7130E-03	3150E+02	3094E+02	5575E+00	1802E+01
1	8810E 03	2330E+02	2312E+02	1821E+00	7879E+00
2	1090E-02	1640E+02	1674E+02	3442E+00	- 2056E+01
3	1410E 02	1090E+02	1091E+02	- 7565E-02	- 6936E-01
4	1790E-02	6870E+01	7028E+01	- 1581E+00	- 2250E+01
5	2220E-02	4630E+01	4619E+01	1121E 01	2427E+00
6	2850E-02	2920E+01	2800E+01	1196E+00	4269E+01
7	3600E-02	1760E+01	1749E+01	1125E-01	6433E+00
8	4490E-02	1130E+01	1143E+01	- 1286E 01	- 1126E+01
9	5700E 02	7370E+00	7570E+00	- 1998E 01	- 2640E+01
0	7190E-02	5090E+00	5192E+00	- 1015E-01	- 1955E+01

RMSERR= 2 16

RAMETER NAME	FINAL SOLUTION	RESISTIVITY	LAYER DEPTH
1 SIGMA(1) =	37555E-03	26628E+04	
2 SIGMA(2) =	46312E 01	21593E+02	
3 SIGMA(3) =	24196E-01	41329E+02	
4 SIGMA(4) =	17663E+00	56616E+01	
5 THICK(1) =	25054E+03		25054E+03
6 THICK(2) =	72972E+02		32351E+03
7 THICK(3) =	23881E+03		56232E+03
8 SHIFT =	20700E+03		

STATION: 3-Z1 + 30COILHI

OCCIDENTAL
GLASS MOUNTAIN