GEOPHYSICAL SURVEY OF THE MT ROSE AND GALENA FANS

APRIL/JULY 1992

WASHOE COUNTY

DEPARTMENT OF PUBLIC WORKS

UTILITY DIVISION

P.O. BOX 11130 RENO, NEVADA 89520

SEAL OF WASHOE COUNTY STATE OF NEVADA

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OF THE
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1195-B CORPORATE BLVD
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Peterson and Widmer

TABLE OF CONTENTS

FIGURES AND TABLES

INTRODUCTION

During the Spring and Summer of 1992, the Washoe County Utility Division conducted geophysical surveys on the Mt. Rose and Galena Fans. The study area encompassed 18 square miles (see Figure 1). The purpose of the program was to attempt to delineate the alluvial aquifer and to gain insight into the geologic structure of these areas. The results of the survey would be used in the ground water modeling effort and to target future exploratory drilling sites.

Geophysicist, Ron Peterson, was contracted by the Utility Division to conduct the geophysical survey. His primary resonsibility was to collect and analyze the data and report the results to the Utility Division. The Utility Division supplied manpower and vehicles. Additional equipment and support was contracted from Great Basin Geophysical, Inc.

GEOPHYSICAL TECHNIQUE

The Transient Electromagnetic methodology was applied in this survey. The data were collected with a Zonge Engineering GDP-16 receiver and a GGT-25 transmitter. Sites were occupied at locations specified by county personnel and easily locatable on topographic maps. Transmitter loops of a single wire of either 500 feet or 1000 feet on a side were laid out at each location. A receiver coil, which measures the time rate of change of the vertical magnetic field over several frequencies, was located at the exact center of the transmitter loop, where (at least in theory) all horizontal magnetic fields cancel. The time rate of change of the vertical magnetic field as a function of frequency is reflective of changes in resistivity at depth. The raw data were inverted with the public domain program EINVRT4 from the New Jersey Geological Survey to yield the one-dimensional layered models which are plotted on the profile for each site.

In general, the larger 1000 foot loops provide greater depth penetration, but at the sacrifice of shallower resolution, than do the 500 foot loops. The sites to the north of the highway were originally occupied with 1000 foot loops. ~~As discussed above,~~ problems with the inversion fits led to the decision to use 500 foot loops for Phase II of the survey, primarily south of the highway. The results seemed to justify the change, and subsequently the well sites north of the highway were reoccupied with 500 foot loops, since it had become obvioius that resolution of the andesite ic ~~at about~~ BEDROCK LAYER NEAR 600 feet was critical. Furthermore, the 500 foot loops are significantly easier to deploy than are 1000 foot loops.

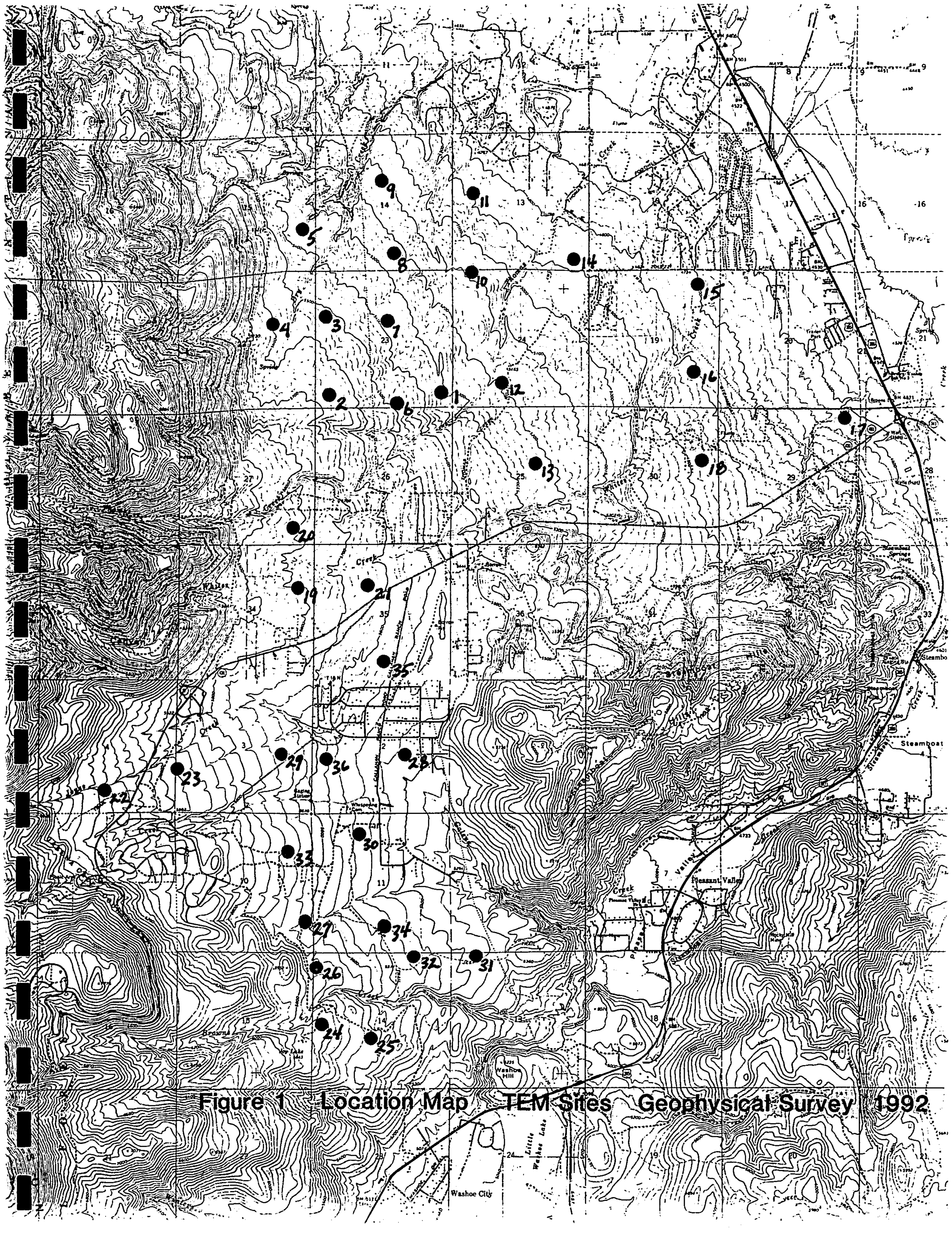


Figure 1 Location Map TEM Sites Geophysical Survey 1992

RESULTS AND DISCUSSION

Summary

Several important features were detected by the TEM survey of the Mt. Rose fan area. The most important is interpreted to be a coarse-grained saturated alluvial unit or units (see Figure 2). It seems to be fairly well defined south of the Mt. Rose highway, where at least the east, west, and south sides appear to terminate abruptly against the volcanics. The northern termination, in the vicinity of the Mt. Rose Highway, is less certain. Its width, thickness, and general north south trend yield the impression of a buried graben-like structure. To the north, what is interpreted to be the alluvial unit is probably more widespread, but less distinct. Resistivities appear to be more gradational through a somewhat greater range. ~~Boundaries, both vertical and lateral,~~ are also less distinct. VERTICAL AND LATERAL BOUNDARIES

A key question remaining unanswered is whether the alluvial units north and south of the highway connect and/or are related. It appears that an east-west trending bedrock high runs between the two units approximately along the highway, but this cannot be stated with certainty due to low station density in this vicinity. There are enough other indications of the presence of this cross-cutting trend to indicate that it likely does exist; however, neither its extent nor its significance is well understood.

The Kate Peak andesite is interpreted to represent hydrologic basement, at least north of the highway. South of the highway, the Kate Peak seems to be shallower and thicker. Where soundings were coincident with drill holes, agreement between the resistive unit in the TEM inversion models and the actual depth of the andesite in the drill holes was quite good. This provided confidence to extrapolate the presence of the andesite beneath other sites in the survey area.

Ambiguities in the Data:

Ambiguity is an inherent and unavoidable aspect of TEM interpretation. In brief, it will always be possible to fit the data curve of any particular sounding with more than one layered model. It is particularly important to remain cognizant of this fact when interpreting this data set. As discussed in more detail below, most sites, at least north of the highway, were fit with a four layer model which included a resistive unit at depth. However, most of these models can be fit equally well with a three layer model which does not include this deep resistor. This can probably best be illustrated by ~~noting~~ the general similarity of curves for TEM-2 and TEM-3 (see appendix for data curves), and noting that ~~1.)~~ the inversion for TEM-3 shows a resistor at depth, whereas the inversion for TEM-2 does not~~,~~ ~~and 2.)~~ ~~that~~ Kate Peak

THE DATA CURVES ARE VALID SINCE THE

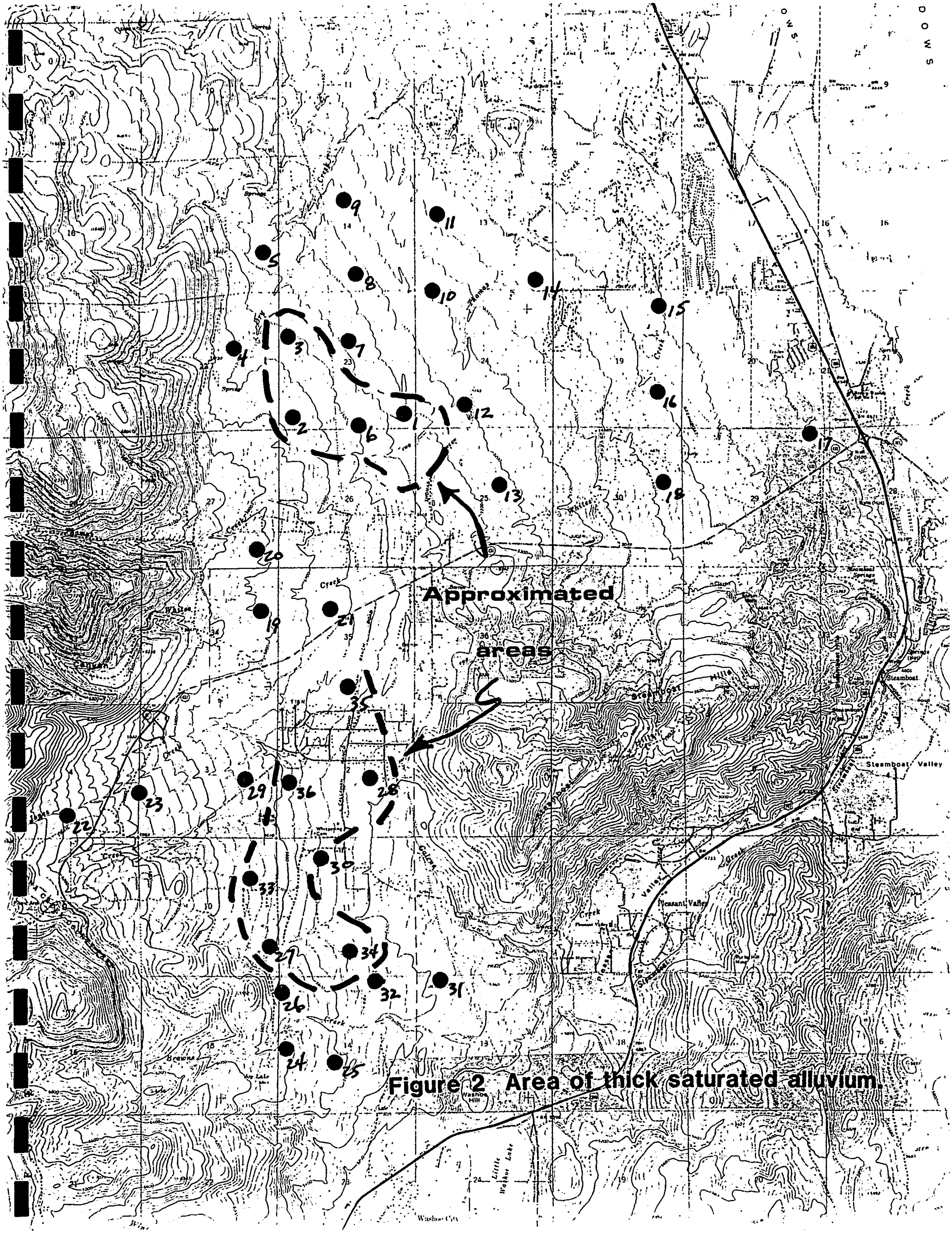


Figure 2 Area of thick saturated alluvium.

andesite was detected at about the same depth in the Laura well(at TEM-3), but was not detected in the Robin Well(at TEM-2) ~~and~~ WHICH WAS drilled to 1100 ft). It has also been shown theoretically that deep resistors are the most difficult to identify in TEM data.

These sites were originally run with deeper-looking 1000 foot loops and inverted to three layer models. It soon became apparent that these models (without the resistive layer) were in poor agreement with the well information. At this point, the drill sites were reoccupied with shallower-looking 500 foot loops and the data were reinverted with the four layer model which included the deep resistor. Significant improvement in overall resolution resulted.

The Geoelectric Section

The following discussion of resistivities of lithologic units is based primarily upon correlation of the TEM soundings with the available well logs. Table 1 lists the apparent resistivities of the top three layers for each site.

1.) The resistivity of the upper unit is 1000 to 1500 ohm-meters at most site; thickness is on the order of 100-200 feet, although it appears to be somewhat thicker at a few sites. This generally correlates with unsaturated alluvium in the drill holes, although the TEM inversions of many sites appears to yield an estimated thickness somewhat greater than the actual unsaturated thickness.

2.) Immediately below this unit at many sites, there is a unit with resistivity in the range of 20-40 ohm-meters. Thicknesses vary from less than 100 feet beneath some sites to over 600 feet beneath others. This is interpreted to represent saturated, relatively coarse-grained alluvium. This unit is generally assumed to be the best potential aquifer.

3.) At a few sites, a unit with resistivities in the range of 10-20 ohm-meters is present. Such resistivities are typical finer grained alluvial materials, and are tentatively correlated with the Hunter Creek Member of the Truckee Formation. If both this unit and the 20-40 ohm-meter unit are present at a site, this unit is deeper. Thickness of this unit is also quite variable within the 100 to 600 foot range. It should be kept in mind that for this unit, as well as for all the others, the stated resistivities are coarse averages for the particular unit; it is possible, even probable, that several units of different resistivities make up the formation. This means that even though this unit is interpreted to be primarily fine-grained, locally coarse-grained units may be abundant.

TABLE 1
APPARENT RESISTIVITIES
(in feet and ohm-m)

TEM	LAYER 1	RES	LAYER 2	RES	LAYER 3	RES
1	0 - 236	1020	236-636	38	636-888	92
2	0 - 164	970	164-826	27	826-950	20
3	0 - 170	1465	170-773	13	773-842	79
4	0 - 177	1053	177-393	11	393-760	72
5	0 - 75	1674	75-412	16	412-745	80
6	0 - 331	1005	331-652	27	652-999	89
7	0 - 197	1002	197-345	15	345-561	78
8	0 - 167	1004	167-636	17	636-895	65
9	0 - 105	970	105-360	30	360-670	15
10	0 - 330	980	330-530	15	530-850	128
11	0 - 200	998	200-350	16	350-750	82
12	0 - 290	770	290-360	26	360-620	74
13	0 - 400	1030	400-510	30	510-840	75
14	0 - 390	1020	390-595	12	595-867	65
15	0 - 260	1001	260-390	15	390-520	61
16	0 - 203	1153	203-330	20	330-690	87
17	0 - 20	967	20- 46	47	46- 82	6
18	0 - 213	998	213-470	7		
19	0 - 574	1018	574-728	23	728-1354	56
20	0 - 400	1020	400-544	21	544-909	68
21	0 - 390	1020	390-505	29	505-1046	80
22	0 - 2	884	2-380	18	380-577	27
23	0 - 170	985	170-734	50	734-858	17
24	0 - 100	1100	100-460	122	460-686	8
25	0 - 66	970	66-999+	78		
26	0 - 165	992	165-516	54	516-644	116
27	0 - 275	BIG	275-1400	28		
28	0 - 82	840	82-367	34	367-460	20
29	0 - 99	496	99-646	93	646-790	58
30	0 - 305	1422	305-400	15	400-470	49
31	0 - 440	2433	440-760	12	760-900	13
32	0 - 315	1256	315-446	69	446-BIG	43
33	0 - 285	1040	285-737	32	737-890	21
34	0 - 275	952	275-1170	55		
35	0 - 270	1063	270-650	35	650-830	4
36	0 - 250	2253	250-738	27	738-925	5

4.) Resistivities in the 50-120 ohm-meter range appear to be reflecting the presence of the Kate Peak andesite at depth, usually 600 feet or more. Where TEM soundings are located at drill holes, correlation of the resistive unit in the model with depth at which the andesite is intersected is generally good. It is probable that the lower the resistivity within this range, the greater the degree of alteration of the andesite.

5.) Lower resistivities at depth, in the 5-10 ohm-meter range are likely reflecting a deeper conductor. While its nature is not clear from the data, it is generally at a depth which is of minor concern with respect to the water resources of the area. However, at TEM-17 and TEM-18 to the east, this unit appears to both be extremely shallow and have slightly lower resistivities in the 1-5 ohm-meter range. These are tentatively interpreted to be due to hot brines from the Steamboat geothermal area.

Profile interpretations

Figure 3 shows the locations of the geoelectric cross sections discussed below. The actual cross sections are located in the appendix.

A-A′ Soundings 19, 20, and 21 on the far west end appear to overlie shallow bedrock. This is substantiated by the fact that a domestic water well drilled only a few hundred feet north of TEM-20 intersected bedrock at approximately 235 feet. While a thin alluvial section is shown in the inversions, it's actual presence is doubtful. The large gaps between soundings 21 and 13 and 13 and 18 make the continuity shown on the profile somewhat questionable. Whether or not the andesite really does continue through this gap has an important bearing on whether (or how much) continuity exists between the alluvial unit(s) identified to the north of the Mt. Rose highway and those identified to the south.

B-B′ There appears to be a relatively thick alluvial section beneath soundings TEM-2, TEM-6, and TEM-1. Based on available data, it appears to possibly thin to the east. The more abrupt boundary to the west suggests the possibility of truncation by a fault. No andesitic bedrock was encountered in the Robin well(TEM-2 & TEM-37), drilled to a depth of 1100 feet.

C-C′ Similar to Profile B-B′, TEM-4 on the far west end appears to lie over shallow bedrock. TEM-3 appears to be somewhat anomalous with respect to the sites immediately

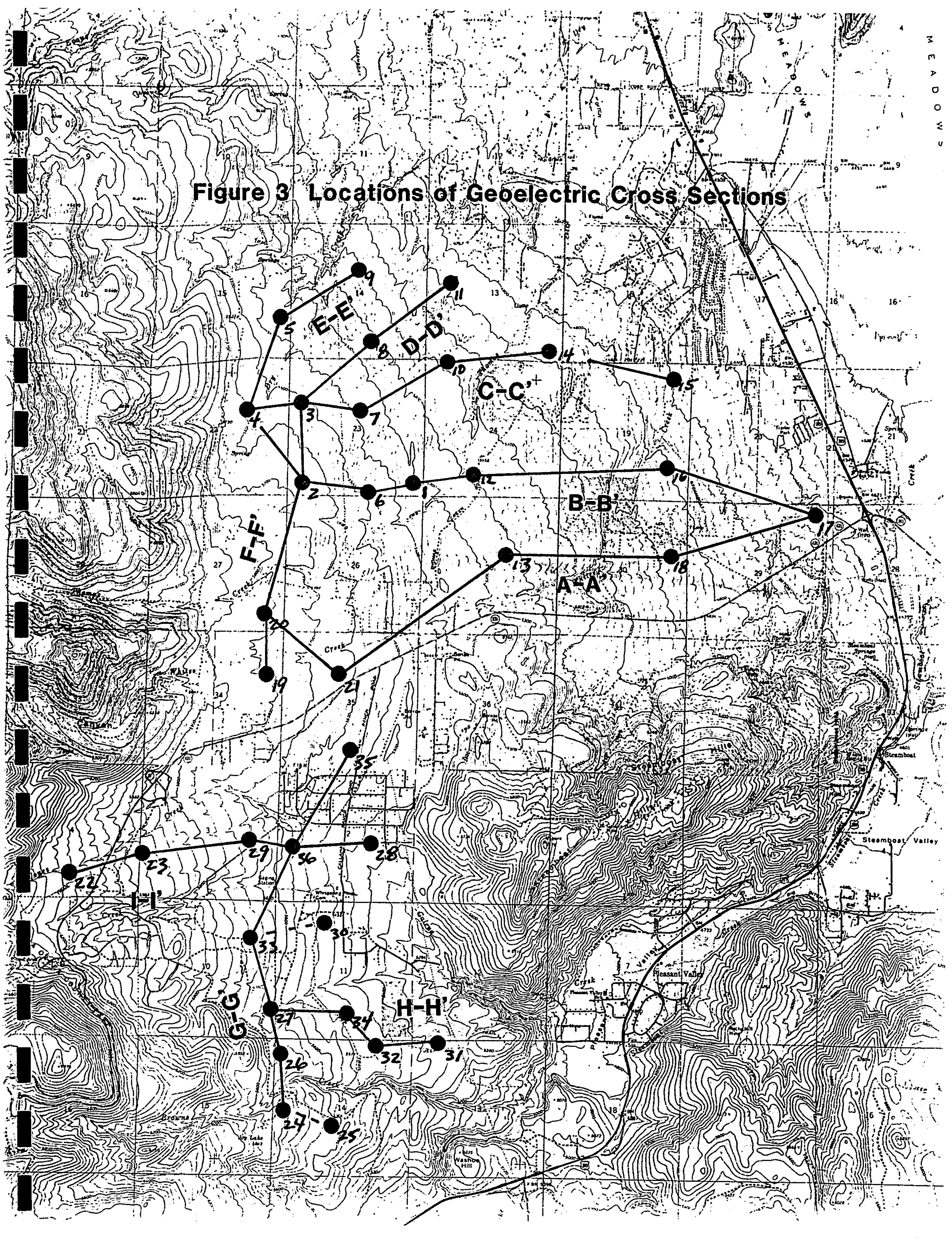


Figure 3 Locations of Geoelectric Cross Sections

adjacent to it (TEM-4 and TEM-7), as well as the rest of the line; however, it does exhibit a good correlation with depth to andesite in the Karen well. The profile from TEM-7 to TEM-15 seems to be very consistent. Overall, the ambiguities in the vicinity of soundings TEM-4, TEM-3, and TEM-7 are significant enough that a much higher density of soundings in this area would be advisable.

D-D′ The relatively low alluvial resistivities (11 to 17 ohm-meters) suggest that whatever alluvium is present here is mostly Truckee formation. The deep resistor in the both TEM-3 and TEM-8 inversions correlates well with depth to andesite in the Laura and Kathy wells respectively.

E-E′ Resistivities of this section suggest that much of the shallow alluvium is Truckee formation, with possibly some coarser-grained shallow material beneath TEM-9. A unit of Hunter Creek sandstone is known to to be present in this area. The depth to the resistor in TEM-5 does not correlate well with the depth to andesite in the Kaye well. This discrepancy may be due to structural complexity. The site lies very near Dry creek, which has tentatively been interpreted to be a fault zone.

F-F′ As noted previously, inversions of both TEM-3 and TEM-8 show good agreement with depth to andesite in their respective wells, and TEM-2 also agrees with the fact that no andesite was detected in the Robin well (drilled to a depth of 1100 feet). The alluvial unit beneath the middle of this line appears to be relatively thick, over 600 feet at its maximum. TEM-2 suggests that the resistivity of the alluvial unit to the west is in the 20-30 ohm-meter range, while to the east it is generally less than 20 ohm-meters. If this difference is real, it suggests that the alluvium to the west is more coarse-grained. It also tentatively suggests the possiblity of a structural or stratigraphic break between TEM-2 and TEM-3.

South of the Mt. Rose highway, sites either show a clear indication of the existence of an alluvial section, as defined by the 20-40 ohm-meter material, or they do not. Inversions for sites which do not show the clear-cut alluvial section generally exhibit higher overall resistivities as well as greater complexity. This is typical of higher resistivity sections; thus these sites are lumped together as primarily bedrock sites. Many of these sites (eg. TEM-24 and TEM-25) are locationed where surface andesite is indicated on the geologic map. Furthermore, one well near TEM-29 intersected mostly saturated detrital andesitic and basaltic fragments. This observation is important because it suggests that significant volumes of water may exist in areas of high resistivity indicated in the TEM soundings. However, the overall geometry of the volcanic units is much less well defined in the TEM data than that of the alluvial units.

G-G′ From TEM-27 north, a significant alluvial section appears to be present. Its thickness seems to be somewhat anomalous beneath TEM-27. TEM-24 and TEM-26 to the south exhibit the pattern of high and complex resistivities typical of bedrock sites. These can be seen to lie very near outcrops of andesite, and are likely reflecting the apparent structural complexity of the area. TEM-33 and TEM-30 are plotted together to the right of this profile, but are not given a letter designation. Comparison of these two sites suggests a rather abrupt eastward termination of the alluvium in this vicinity. Likewise the significant differences between the TEM-26 and TEM-27 inversions suggest a relatively abrupt termination of the alluvium here also.

H-H′ This section suggests a rapid thinning of the alluvial eastward beneath TEM-34 and TEM-32, with an abrupt termination beneath TEM-32 and TEM-31. TEM-24 and TEM-25 are plotted together without letter designation. Both of these sites are located on mapped andesite, which is consistent with their high and complex resistivity inversions. It should be noted that they represent a relatively abrupt southward termination of the alluvium.

I-I′ Resistivities in the 30 ohm-meter range beneath TEM-28 and TEM-36 suggest that the alluvial unit is present, although perhaps slightly thinner beneath these two sites. High and complex resistivity patterns beneath TEM-23 and TEM-29 suggest that they overlie volcanics. As discussed earlier, this is confirmed by the Cinder well near TEM-29. Similarly, it is noted that the differences between the inversions of TEM-29 and TEM-36 suggest an abrupt westward termination of the basin. However, the fact that copious water was detected in a well which apparently lies very near the alluvial unit should be noted for possible further investigation. The inversion for TEM-22 on the far west end of the profile is also complex as well as somewhat different than the others in that the shallow, high resistivity unit does not appear to be present here. The TEM data suggest the presence of a unit of 27 ohm-meters which is about 200 feet thick and lies at a depth of about 400 feet. Perhaps this is a small sub-aquifer. The overlying resistivity of average 18 ohm-meters from surface to about 400 feet depth suggests that significant thicknesses of coarser-grained units may lie within.

When viewed in plan, there is a strong suggestion in the data of a north-south trending graben. It is relatively distinct south of the Mt. Rose Highway, but becomes less distinct to the north. Its interpretative boundaries are shown in figure 2.

Correlations with Well Logs

For the most part, the TEM data is in good correlation with the lithologic logs of the wells. Resistivities in the shallow portions of the models are in good agreement with those seen in the later logs, and depths to andesite are also consistent with increased resistivities at similar depth in the models at most sites. The few wells that encountered andesite suggest its resistivity to be in the 70-120 ohm-meter range, which is consistent with those obtained from the models.

CONCLUSIONS

Generally there is a good correlation of the geophysical model with the lithology. Two areas were identified that appear to contain relative thick sequences of saturated, coarse grained alluvium. These areas should be targeted for exploratory drilling for production wells.

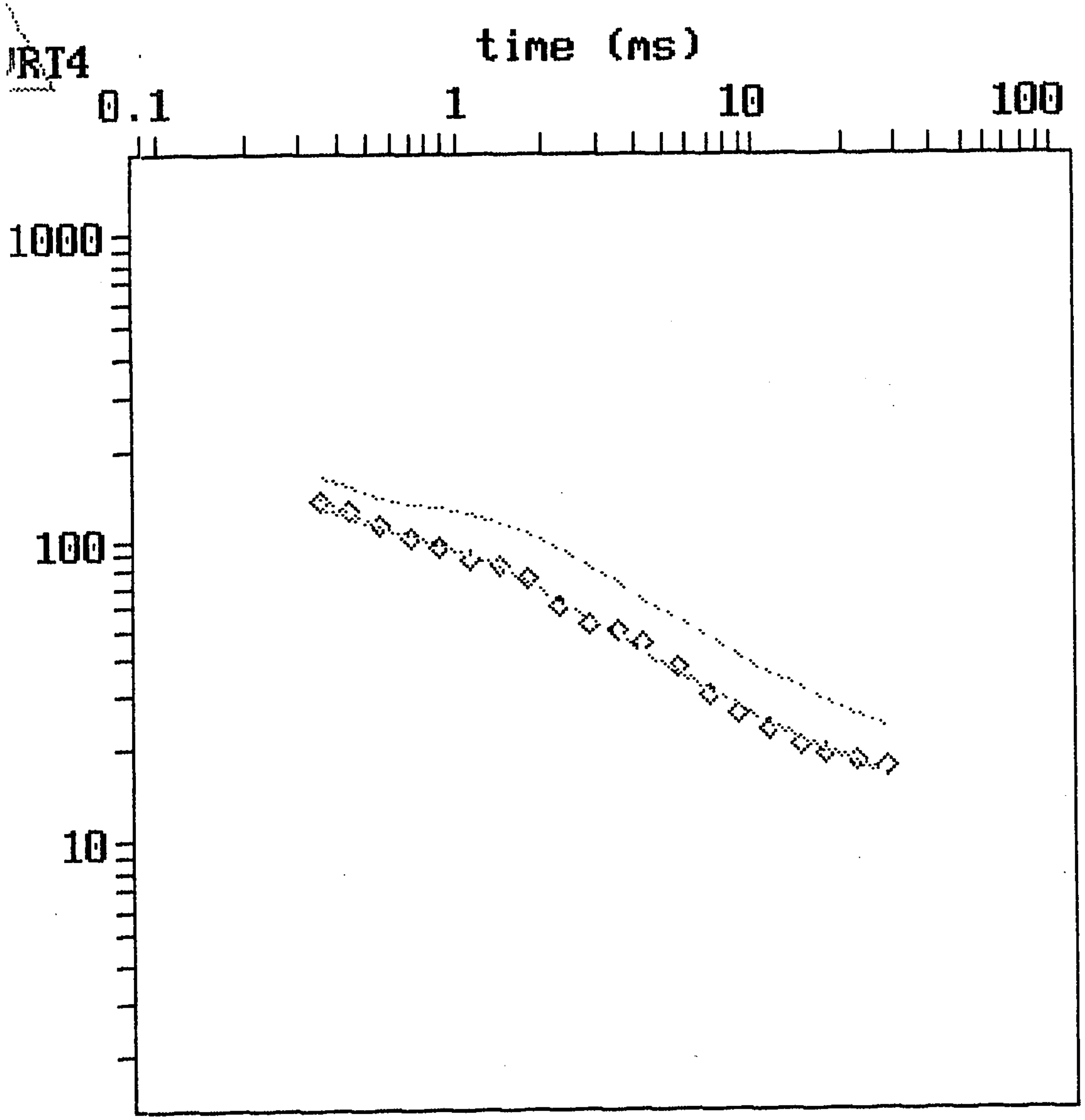
The geophysical model in somewhat confusing in the areas of near surface volcanics. Exploratory drilling could provide the necessary data for better correlation. This would lead to a better understanding of the geology in the southern section of the study area.

More geophysical work is warranted along Whites Creek in order to determine any structural changes between the Mt. Rose and Galena Fans. Also, more work is warranted in the area of TEM 7 in order to more exactly determine the lateral extent of the thick alluvial sequence as seen in Figure 2.

APPENDIX

Geophysical Data

Geoelectric Cross Sections



◇ TEM data

TEM calculated

iteration= 2/ 5
RCSQ=0.00052 l1=0.0154

layer		rho		thk(m)
1	*	1018.53	*	72.3
2	*	37.75	*	122.7
3	*	91.52	*	76.6
4	*	7.32		

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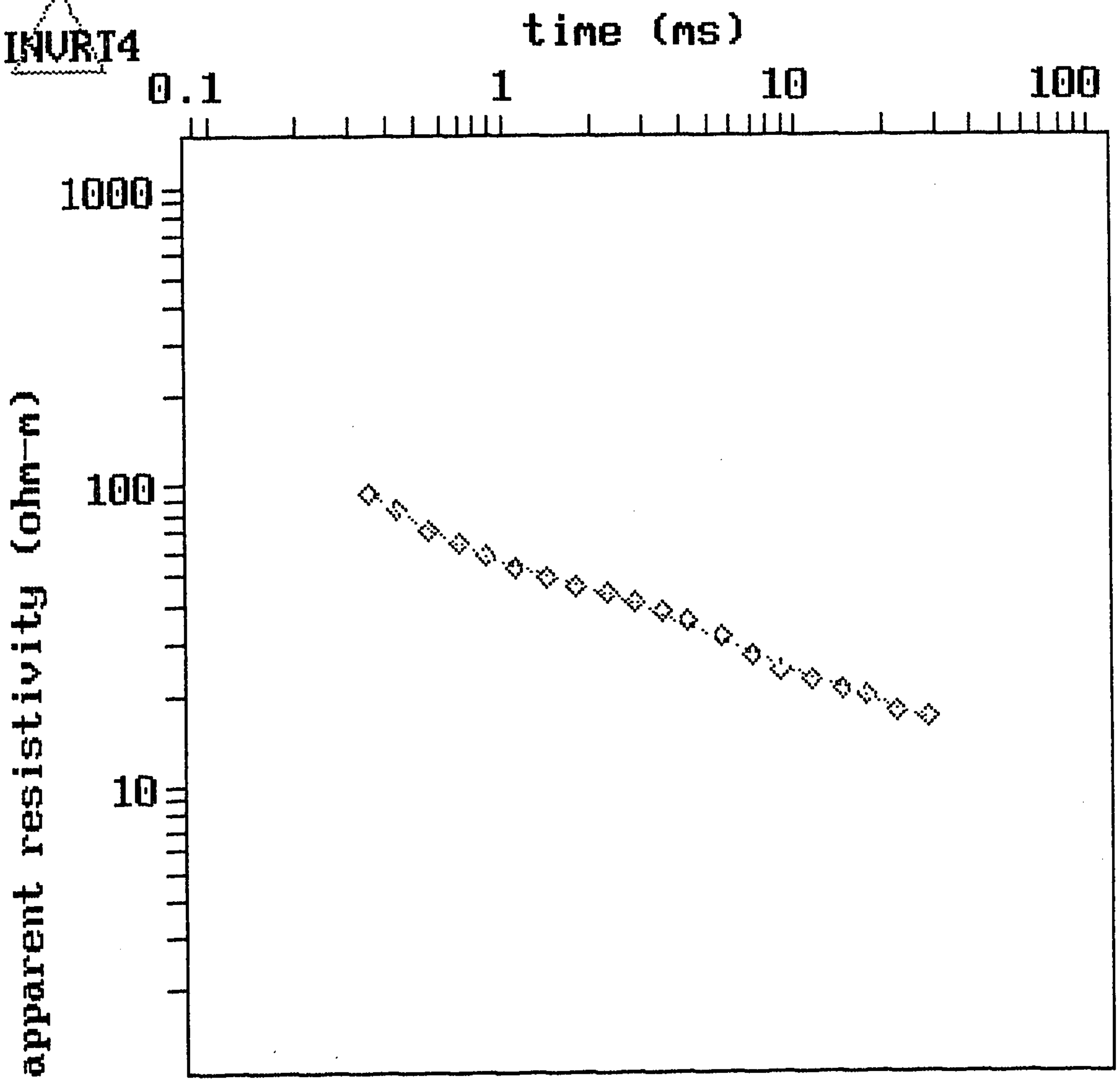
EINVRT4



◇ TEM data

TEM calculated

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layer		rho		thk(m)
1	*	970.00	*	50.0
2	*	27.00	*	202.0
3	*	20.00	*	38.0
4	*	9.00		

m
s

tr02.mod
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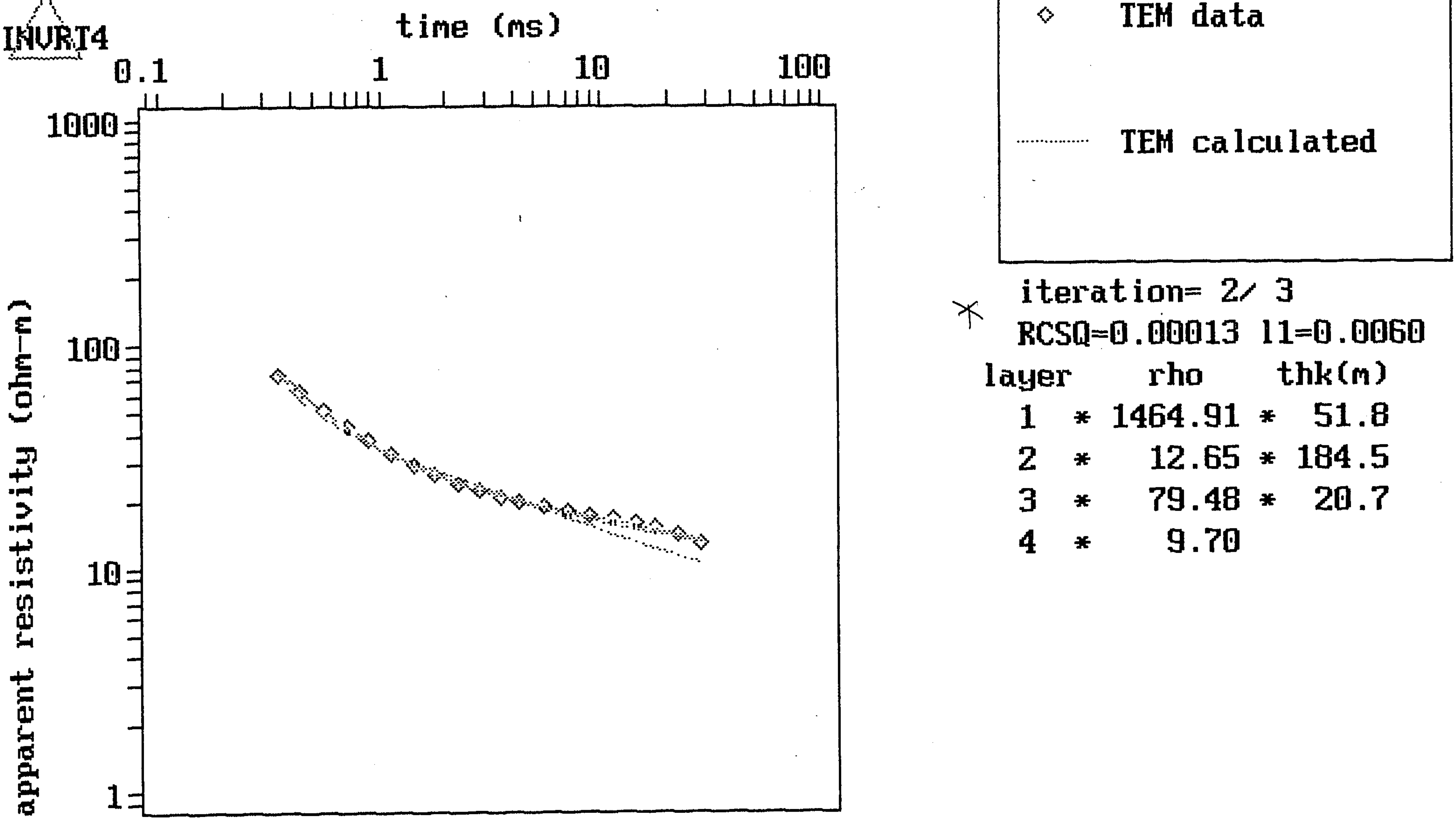
EINVRT4



iteration= 2/ 3
RCSQ=0.00013 l1=0.0060

layer		rho		thk(m)
1	*	1464.91	*	51.8
2	*	12.65	*	184.5
3	*	79.48	*	20.7
4	*	9.70		

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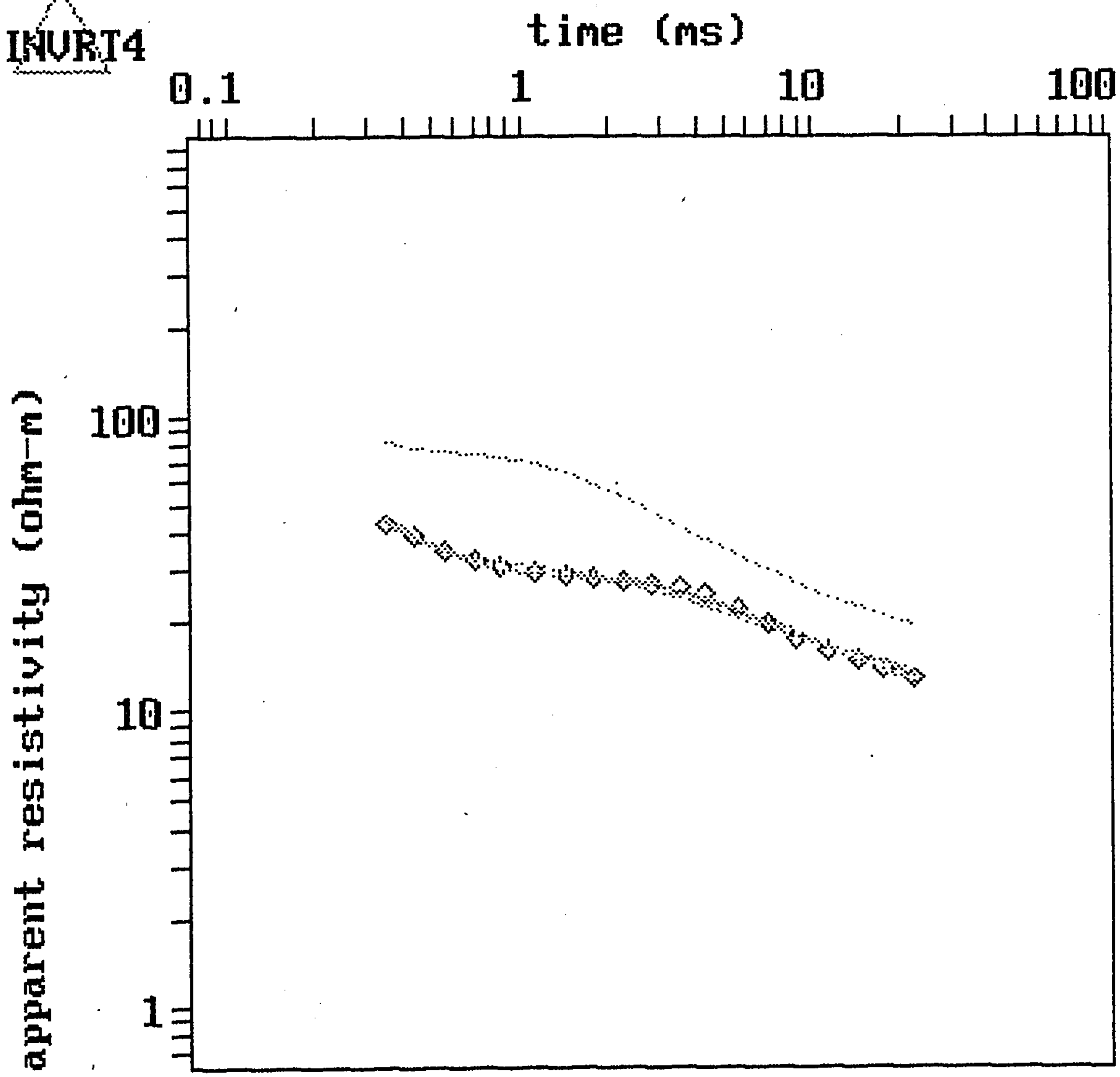

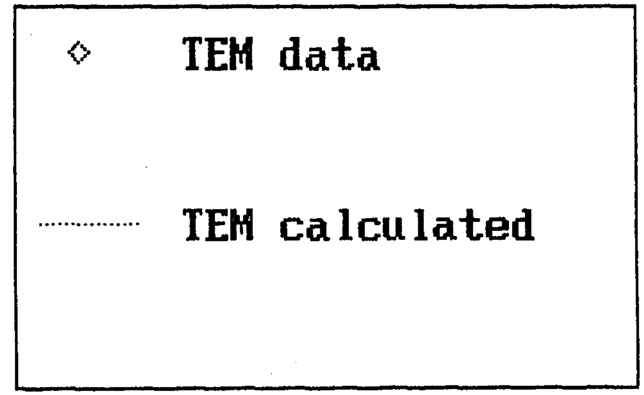

iteration= 3/ 5
RCSQ=0.00008 l1=0.0059

layer		rho		thk(m)
1	*	1053.38	*	54.2
2	*	11.14	*	66.1
3	*	72.10	*	112.0
4	*	5.72		

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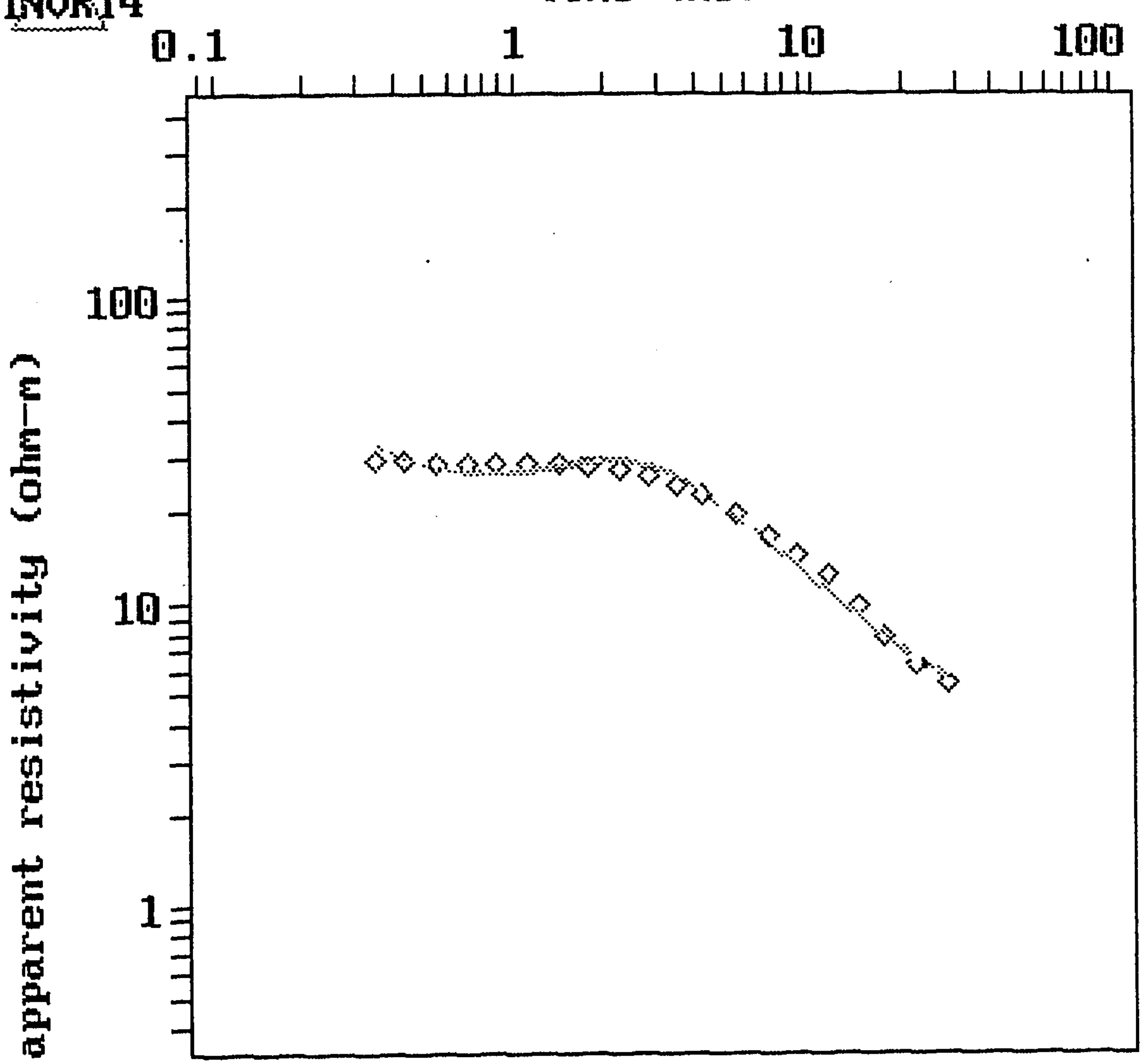
EINVRT4



TEM data

TEM calculated

iteration= 2/ 5
RCSQ=0.00126 11=0.0258

layer		rho		thk(m)
1	*	1674.50	*	22.9
2	*	15.99	*	103.2
3	*	79.96	*	102.2
4	*	1.18		

upper resistor

MTR-5
mtr39.mod
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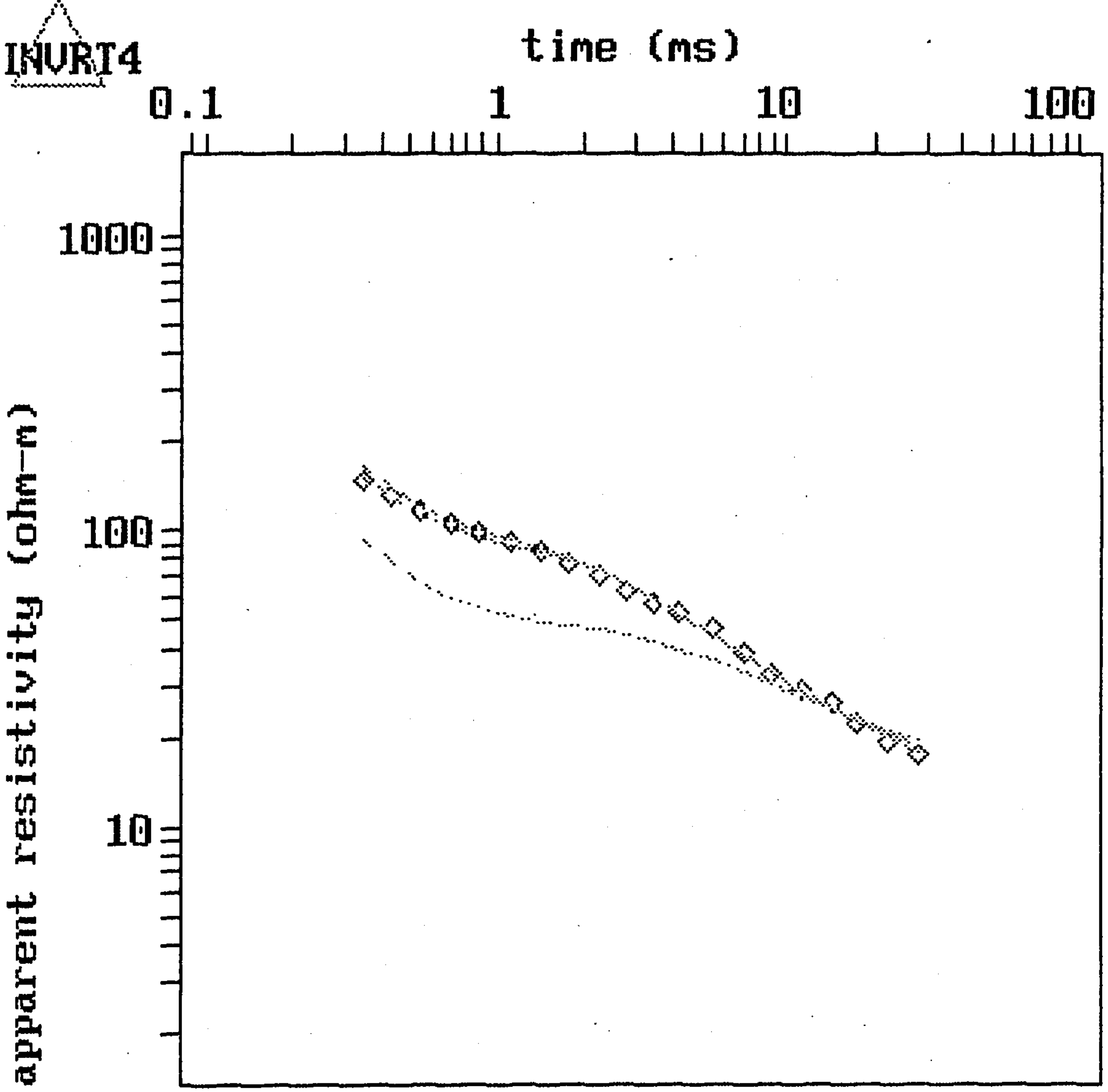
INVRT4



TEM data

TEM calculated

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RCSQ=0.00028 l1=0.0116

layer		rho		thk(m)
1	*	1004.80	*	101.1
2	*	27.46	*	98.4
3	*	88.62	*	129.0
4	*	6.73		

MTR-6

tr61.mod

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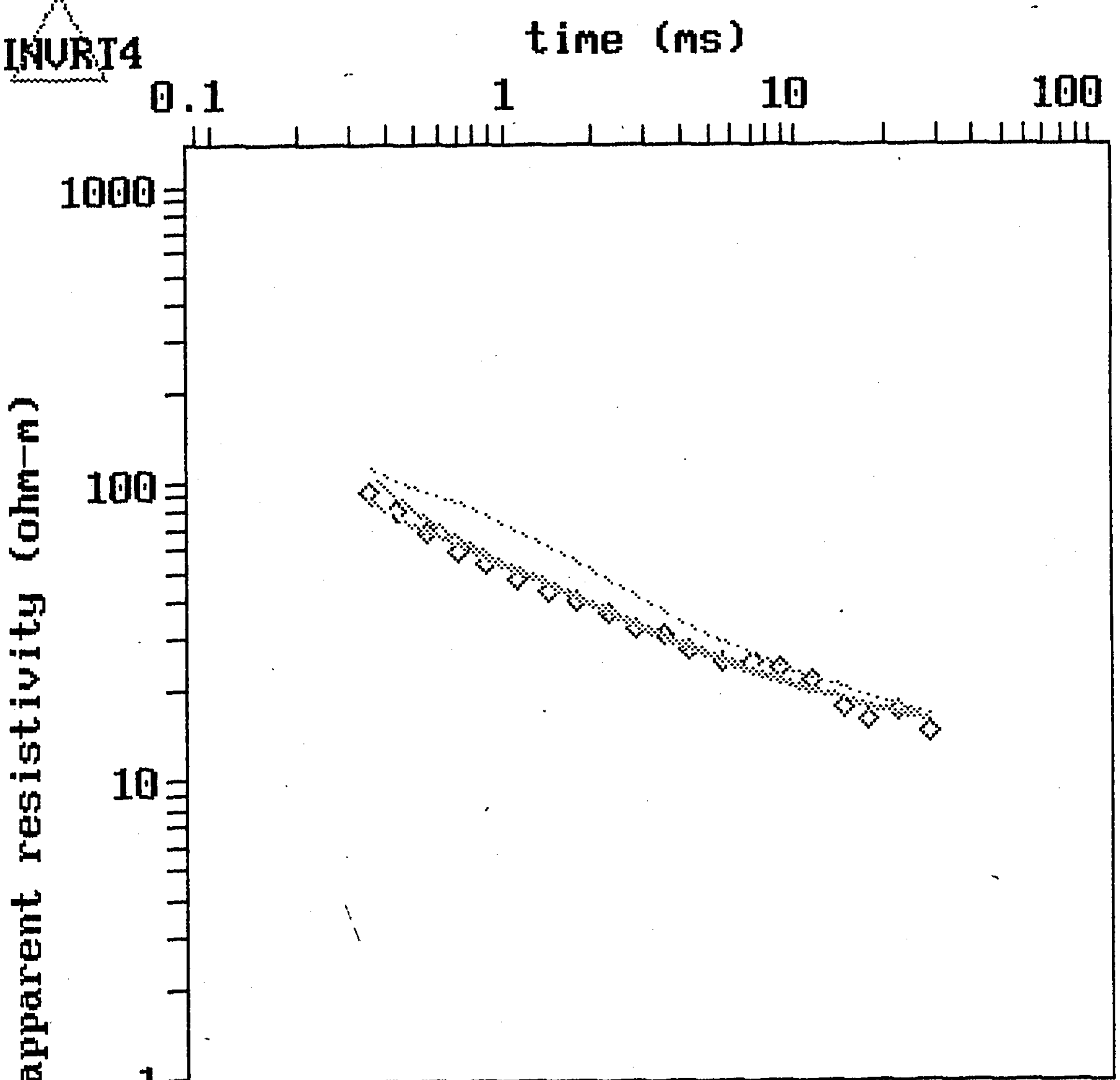
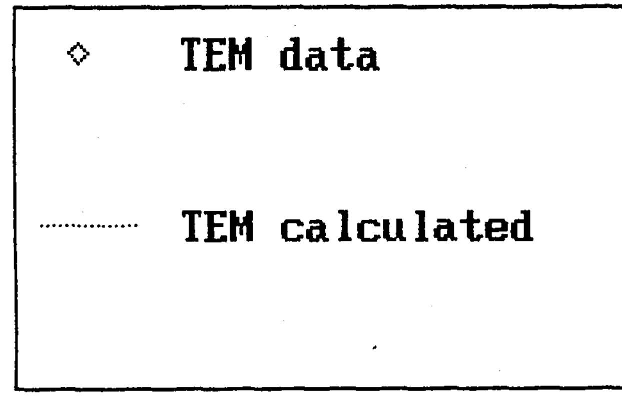
EINVRT4





iteration= 3/ 5

RCSQ=0.00100 11=0.0203

	layer		rho		thk(m)	
110'	1	*	1001.69	*	59.8	197'
280'	2	*	15.09	*	45.1	148'
230'	3	*	78.41	*	65.5	215
620	4	*	10.97			560'

Sat = 363'

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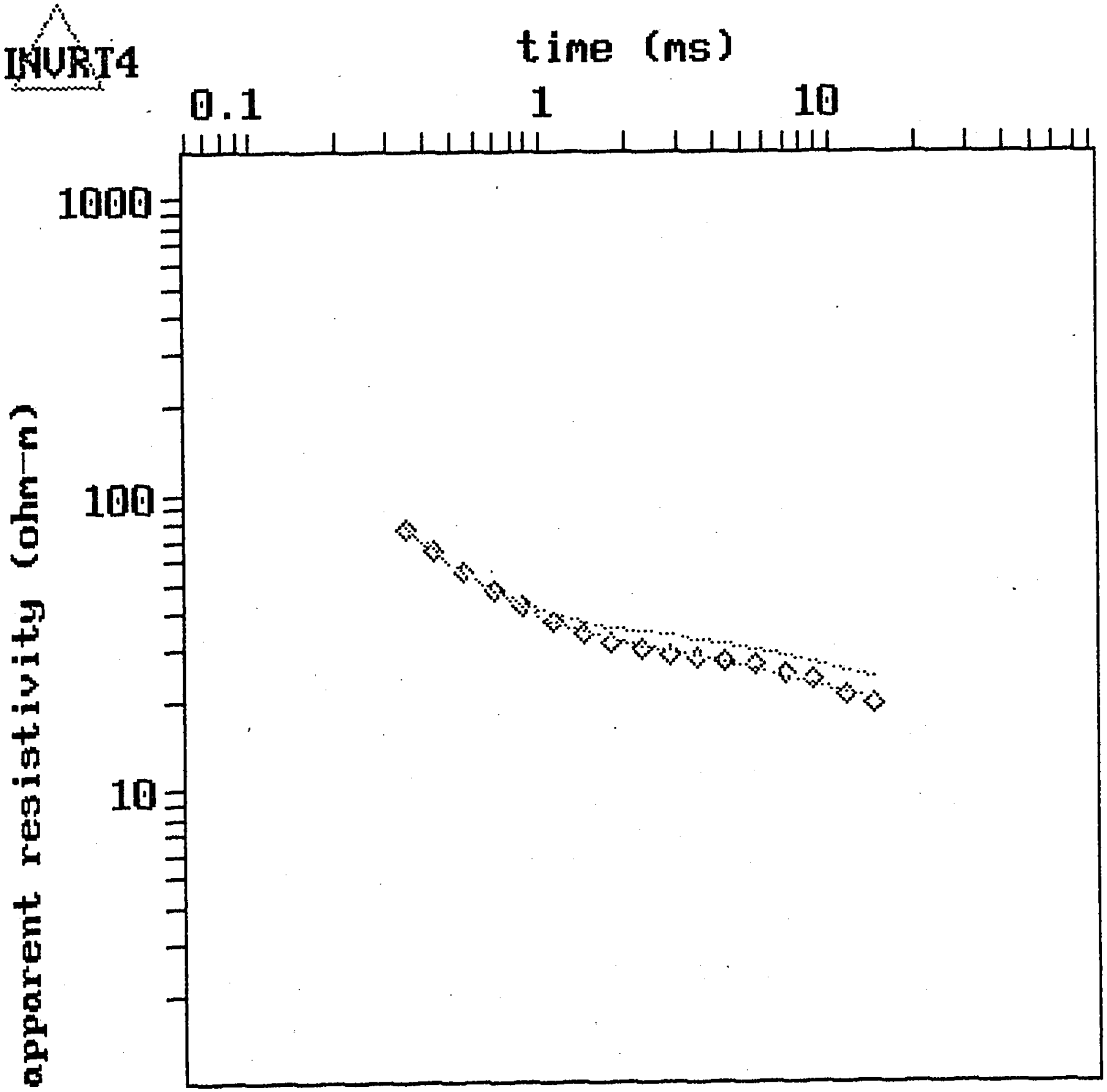
EINVRT4



TEM data

TEM calculated

iteration= 1/ 5
RCSQ=0.00017 l1=0.0080

layer		rho		thk(m)
1	*	1003.82	*	51.2
2	*	16.88	*	143.3
3	*	64.63	*	79.3
4	*	10.73		

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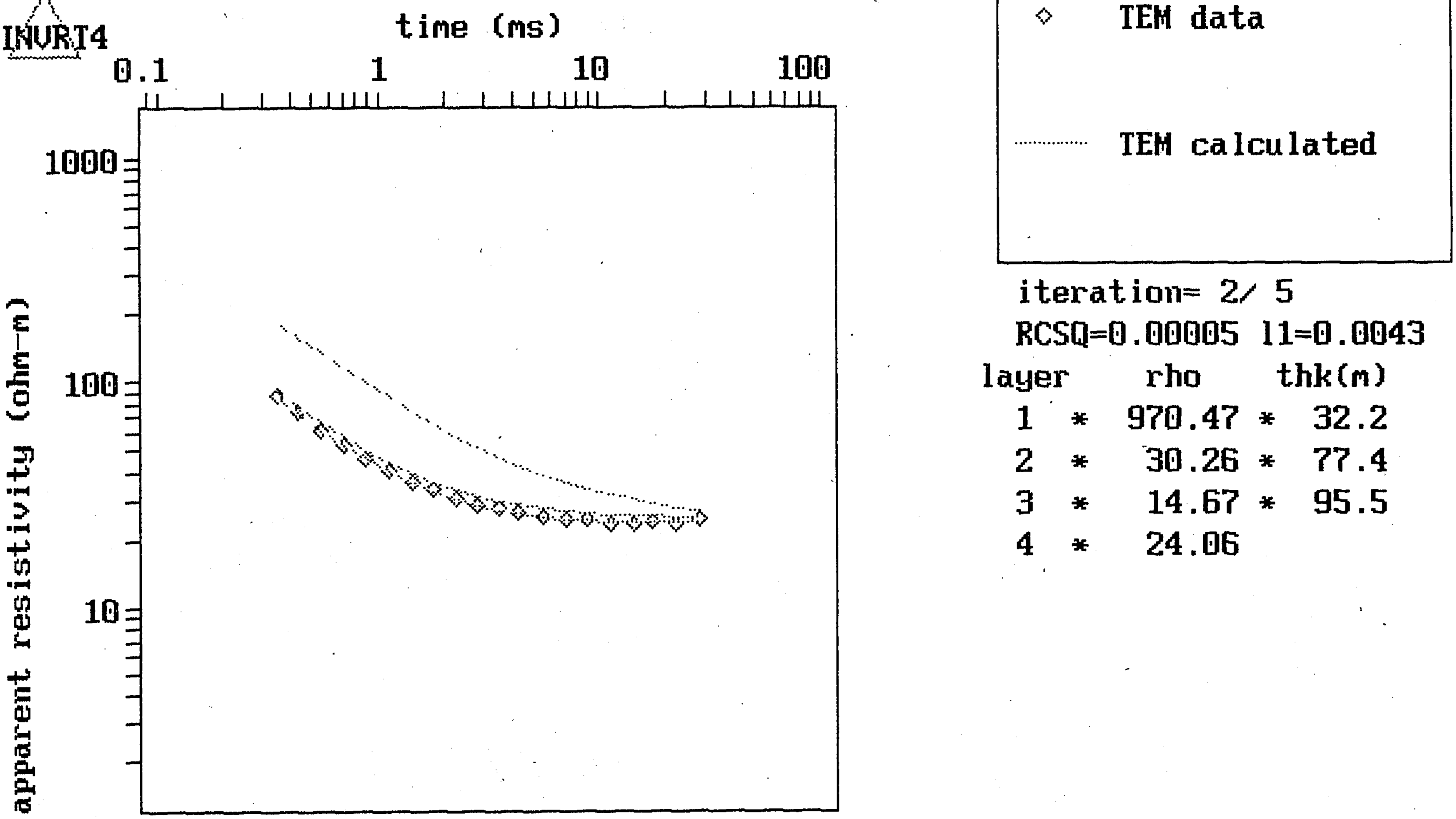
EINVRT4



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1	*	970.47	*	32.2
2	*	30.26	*	77.4
3	*	14.67	*	95.5
4	*	24.06		

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h m s

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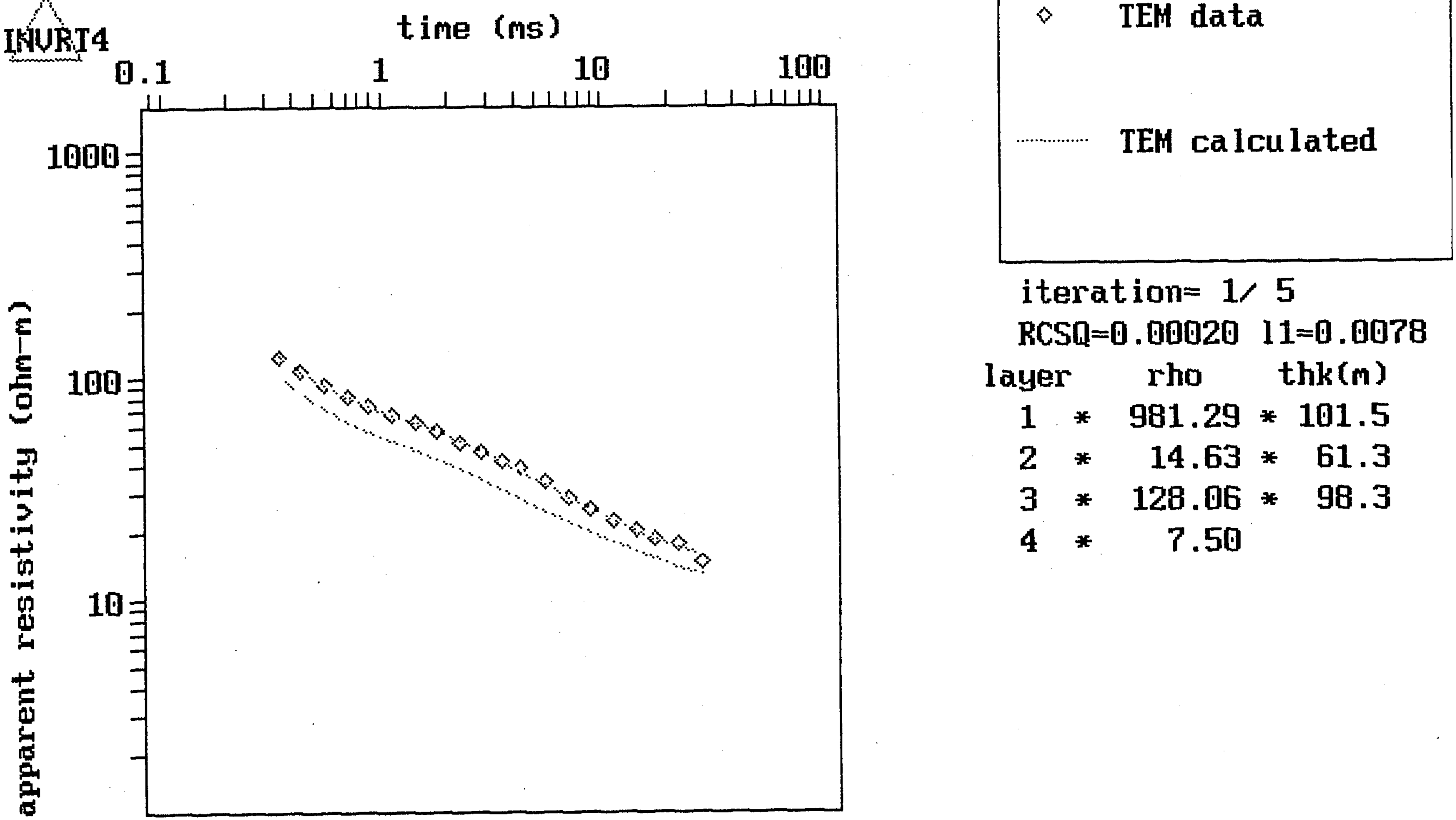
EINVRT4

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layer      rho      thk(m)
  1  *   981.29 *  101.5
  2  *    14.63 *   61.3
  3  *   128.06 *   98.3
  4  *     7.50
```

```
mtr10.mod                                            h  m  s
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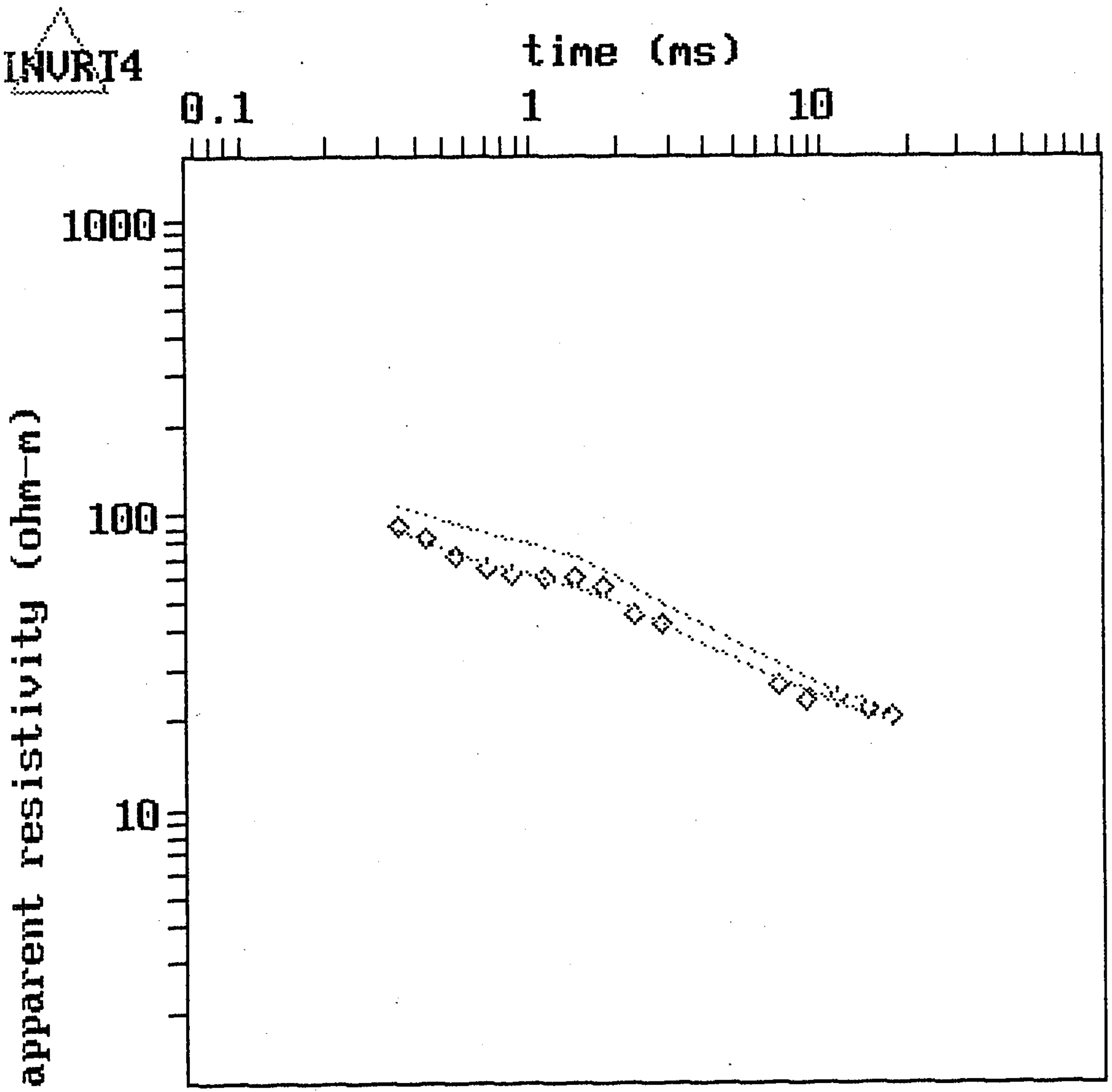

iteration= 2/ 5
RCSQ=0.00074 l1=0.0168

layer		rho		thk(m)
1	*	997.59	*	61.8
2	*	16.50	*	45.6
3	*	81.69	*	120.5
4	*	9.94		

r11.mod

			h	m	s	
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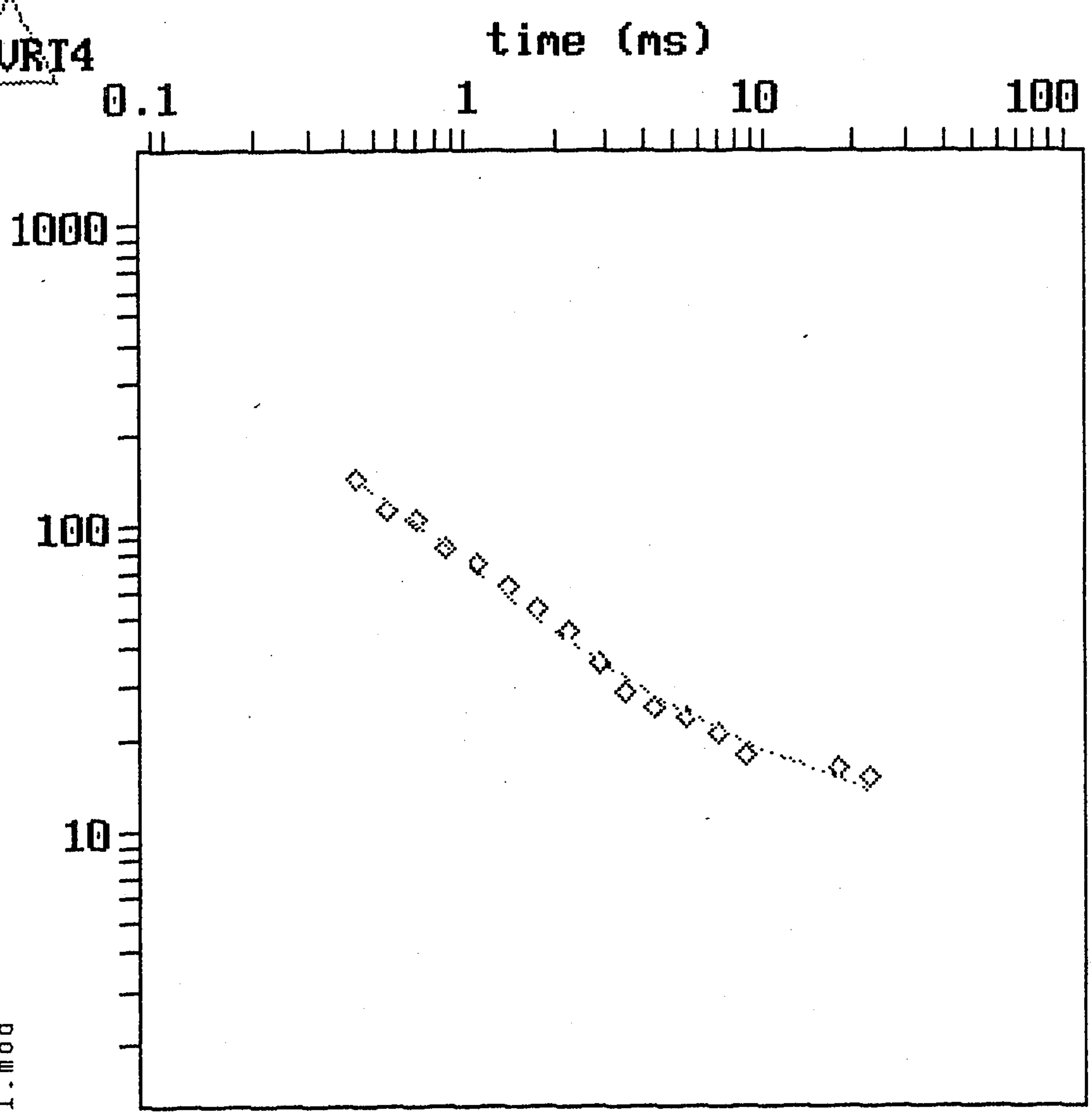
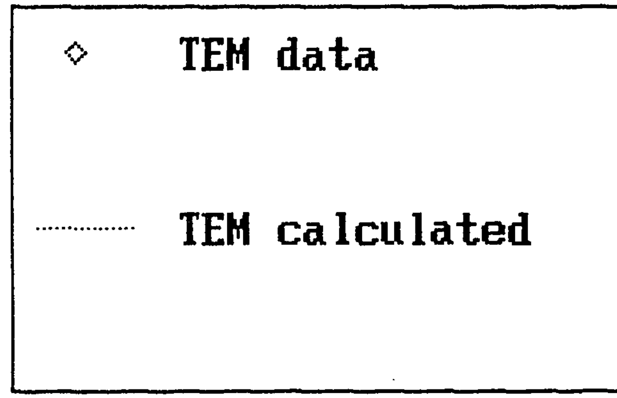
EINVRT4





iteration= 0/ 5

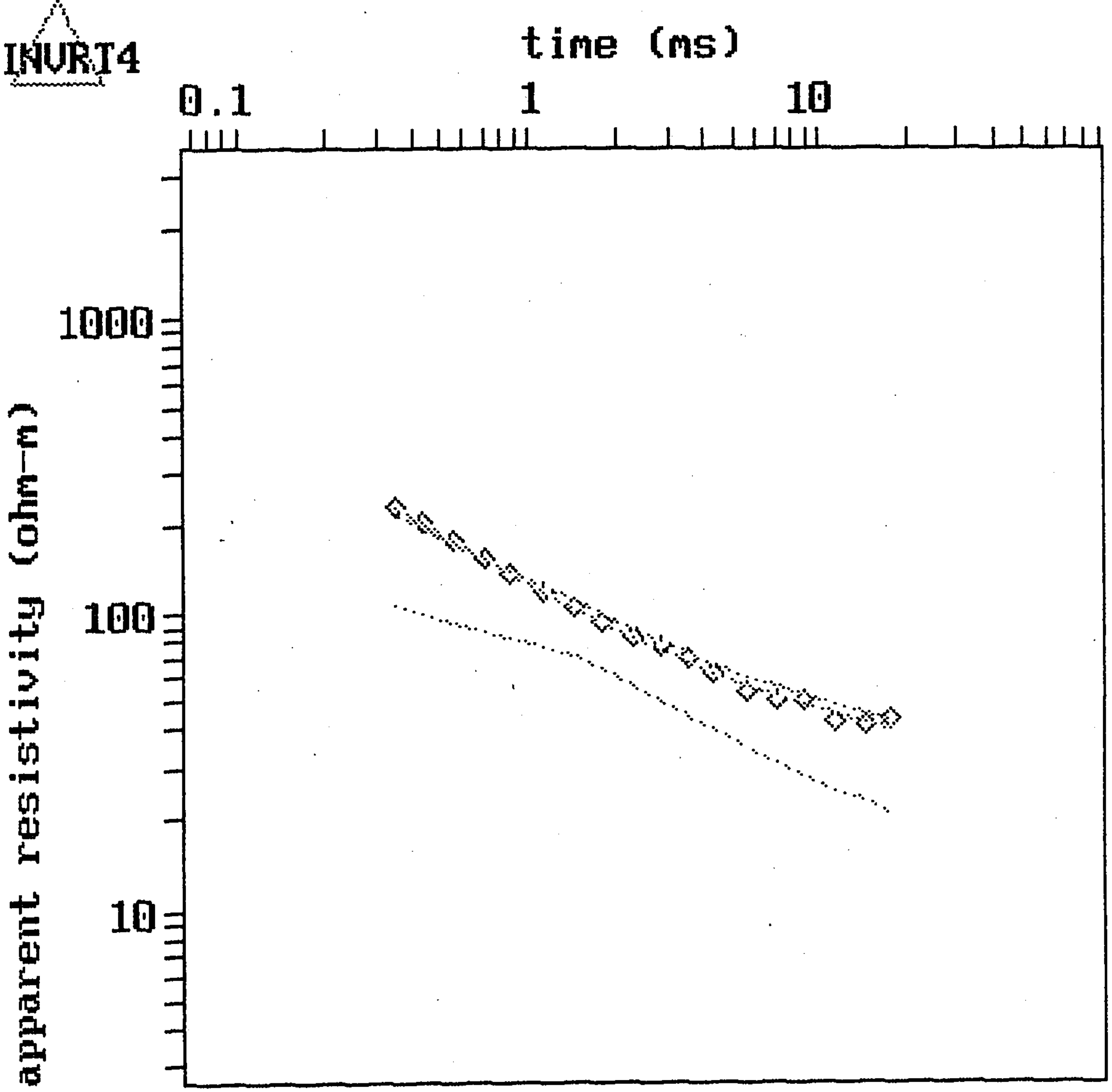
RCSQ=0.00131 l1=0.0241

layer		rho		thk(m)	ft
1	*	769.00	*	88.0	290
2	*	26.00	*	22.0	72
3	*	74.00	*	79.0	260
4	*	7.00			620

t121.mod

tatus**>sys matrix 16 estim. completion: h m s 0 6 53 mu= 0.10

EINVRT4



iteration= 3/ 5

RCSQ=0.00029 11=0.0087

layer		rho		thk(m)	
1	*	1032.41	*	123.9	400
2	*	30.60	*	32.6	110
3	*	75.21	*	101.4	330
4	*	25.35			840

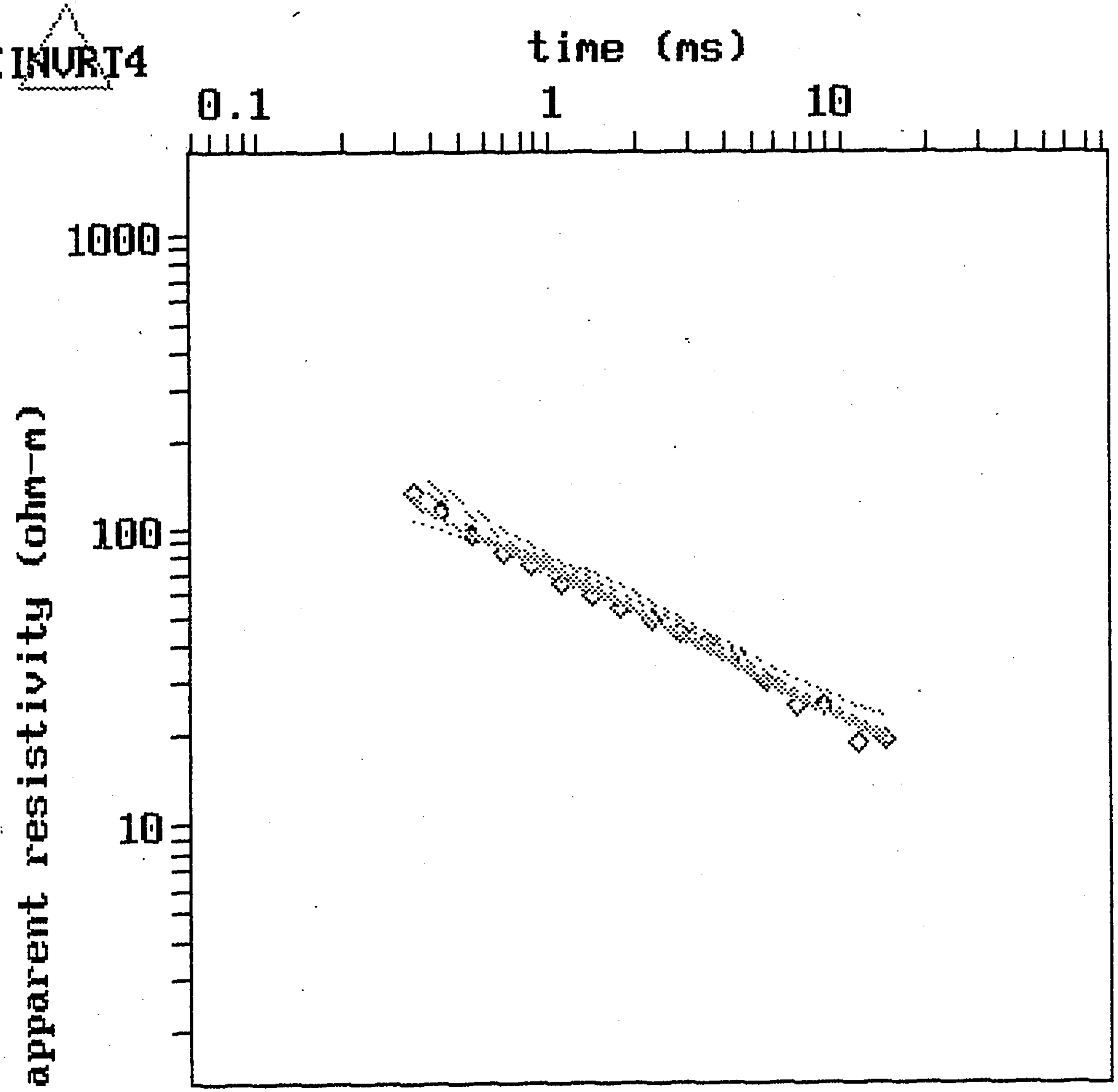
MTR-13

mt133.mod

h m s

status**>sys matrix r 1/ 18 estim. completion: 0 5 29 mu= 0.01

EINVRT4



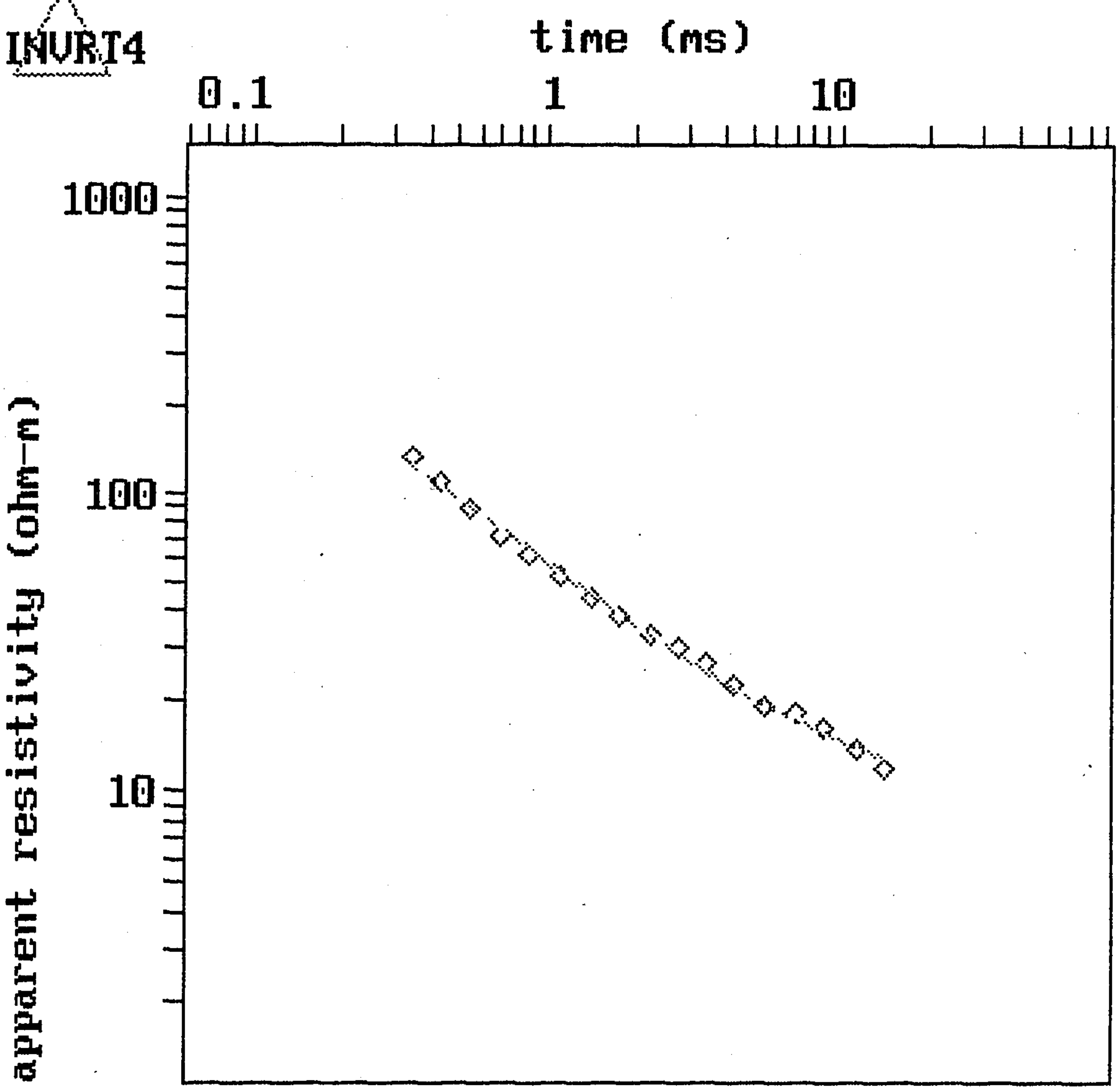
iteration= 4/ 5
RCSQ=0.00075 l1=0.0162

layer		rho		thk(m)
1	*	1020.08	*	118.5
2	*	12.18	*	62.5
3	*	64.98	*	83.4
4	*	6.58		

MTR-14
mt142.mod

status**>sys matrix r 7/ 17 estim. completion: h m s 0 5 22 mu= 0.03

EINVRT4



TEM data

TEM calculated

iteration= 1/ 5

RCSQ=0.00076 l1=0.0183

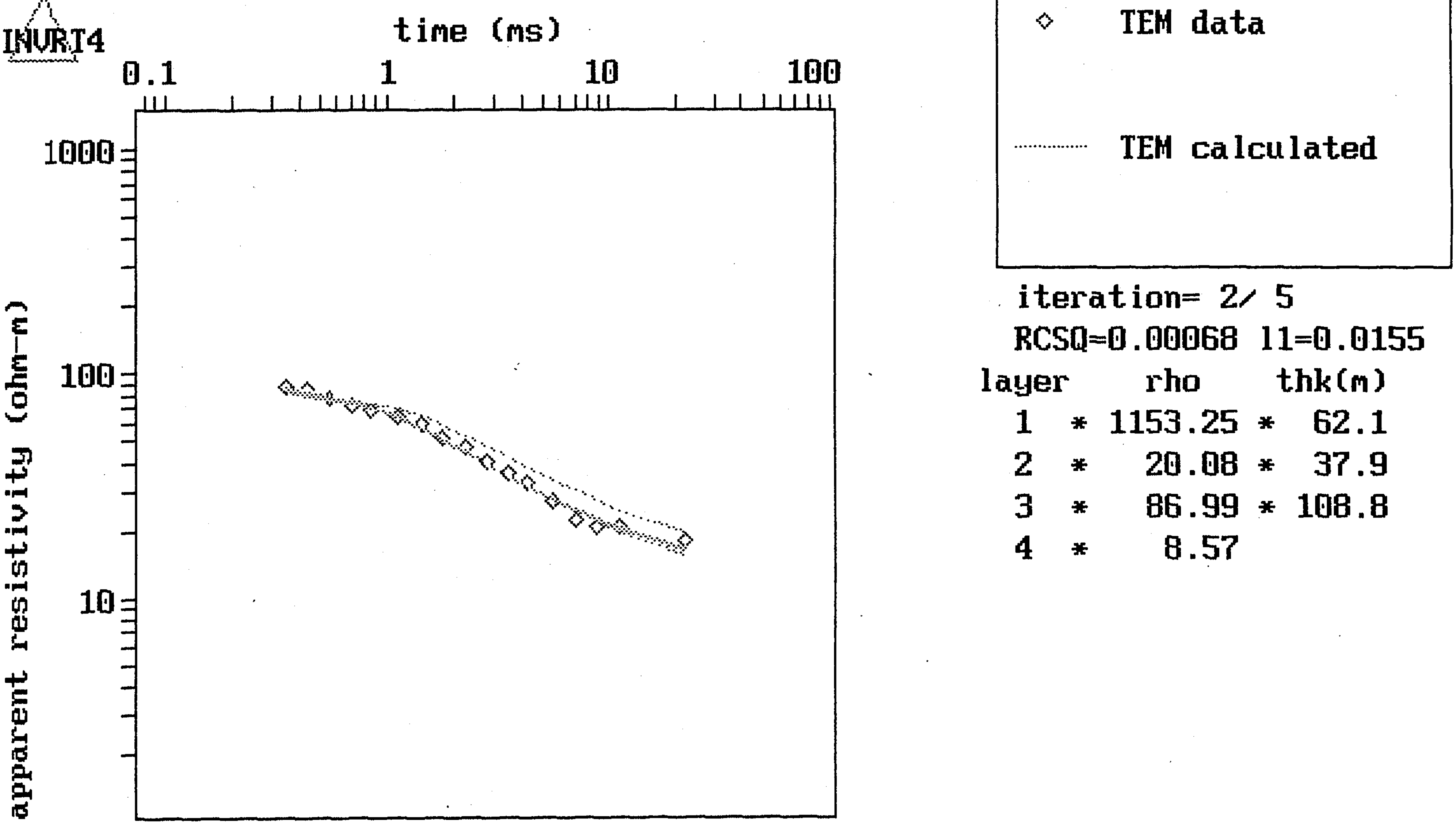
layer		rho		thk(m)
1	*	1001.25	*	80.0
2	*	15.10	*	38.9
3	*	60.77	*	38.6
4	*	6.31		

MTR-15

mt151.mod

status**>sys matrix r 10/ 17 estim. completion: h m s 0 2 1 mu= 0.05

EINVRT4

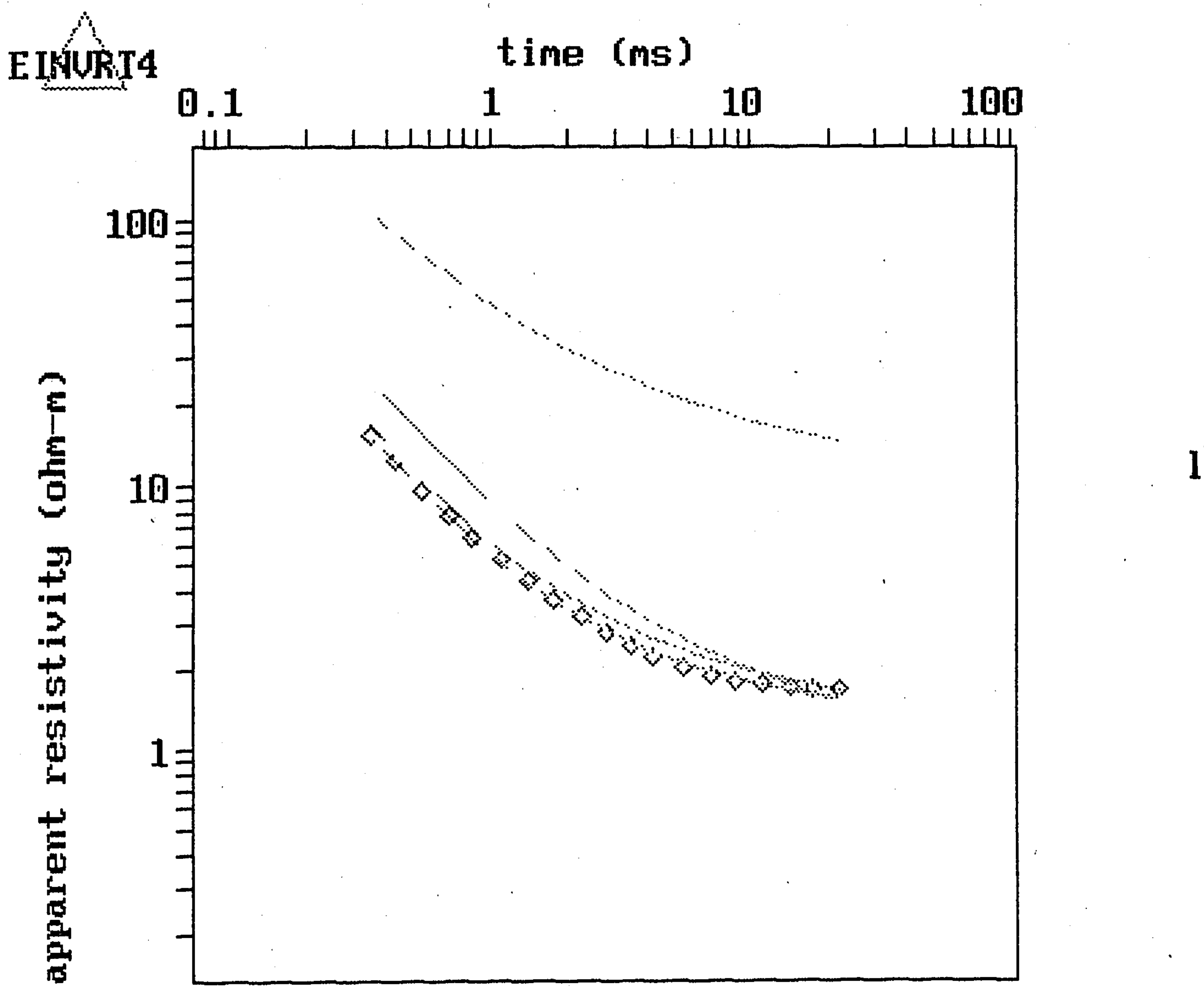


iteration= 2/ 5
RCSQ=0.00068 l1=0.0155

layer		rho		thk(m)
1	*	1153.25	*	62.1
2	*	20.08	*	37.9
3	*	86.99	*	108.8
4	*	8.57		

MTR-16
mt162.mod

h m s
status**>sys matrix r 3/ 17 estim. completion: 0 5 56 mu= 0.05

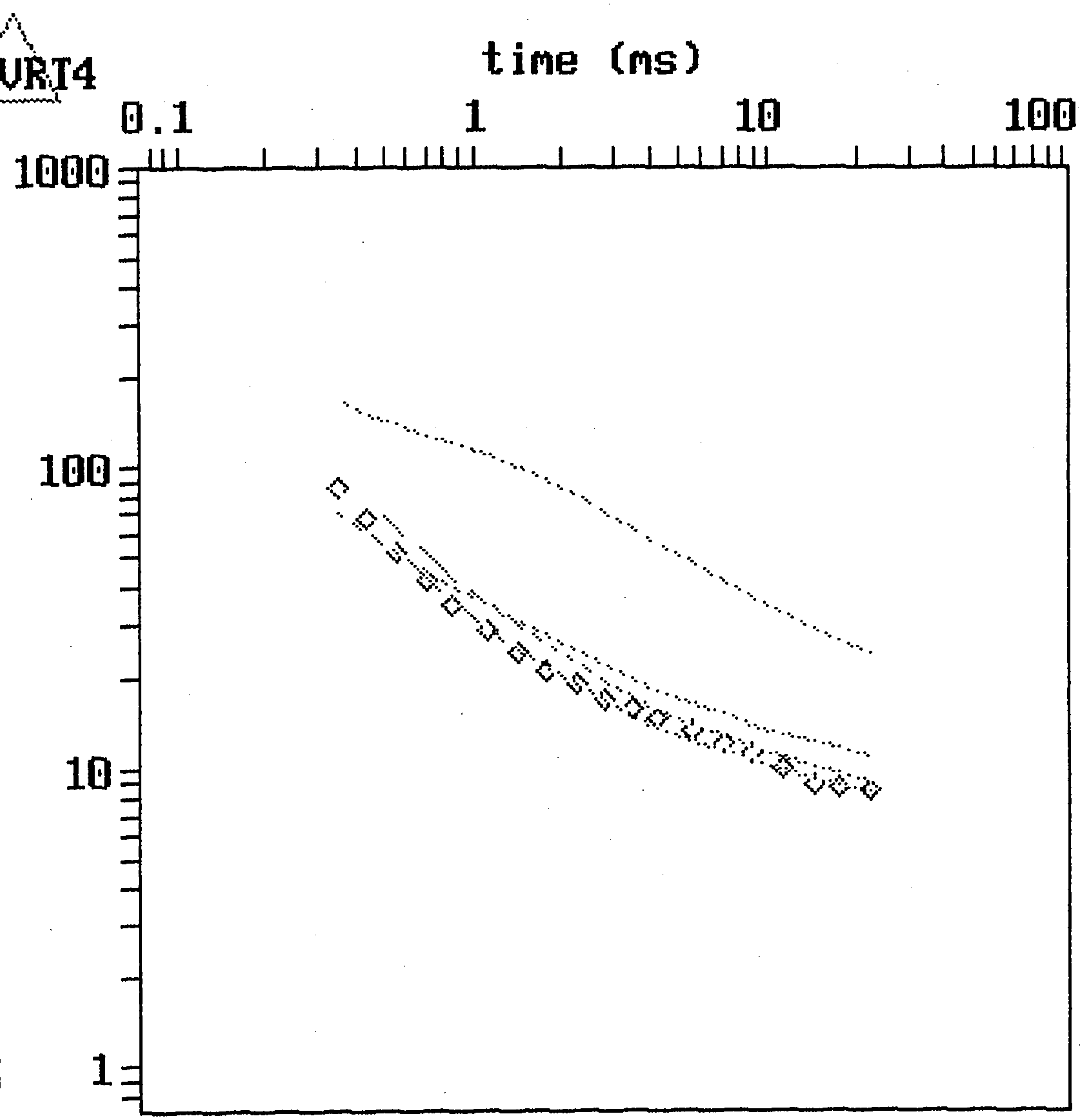


iteration= 3/ 5
RCSQ=0.00035 11=0.0119

layer		rho		thk(m)
1	*	967.31	*	6.0
2	*	47.25	*	8.2
3	*	6.30	*	11.0
4	*	1.19		

mtr17.mod h m s
status**>sys matrix r 7/ 19 estim. completion: 0 5 56 mu= 0.01

EINVRT4



iteration= 3/ 5

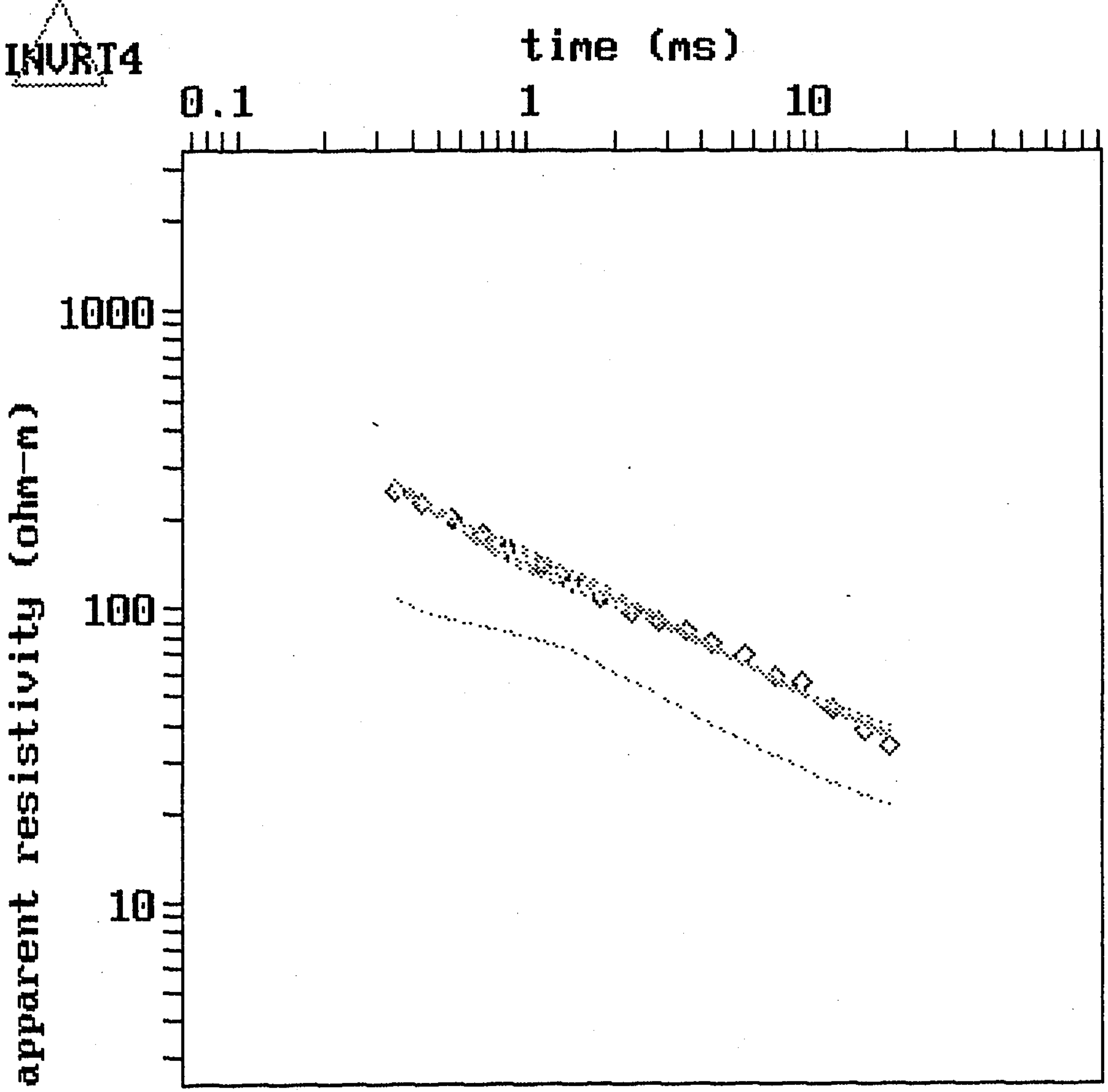
RCSQ=0.00041 l1=0.0140

layer		rho		thk(m)
1	*	997.83	*	65.2
2	*	6.82	*	38.8
3	*	6.77	*	39.3
4	*	5.93		

mtr18.mod h m s mt

status**>sys matrix r 1/ 19 estim. completion: 0 6 12 mu= 0.01 st

EINVRT4

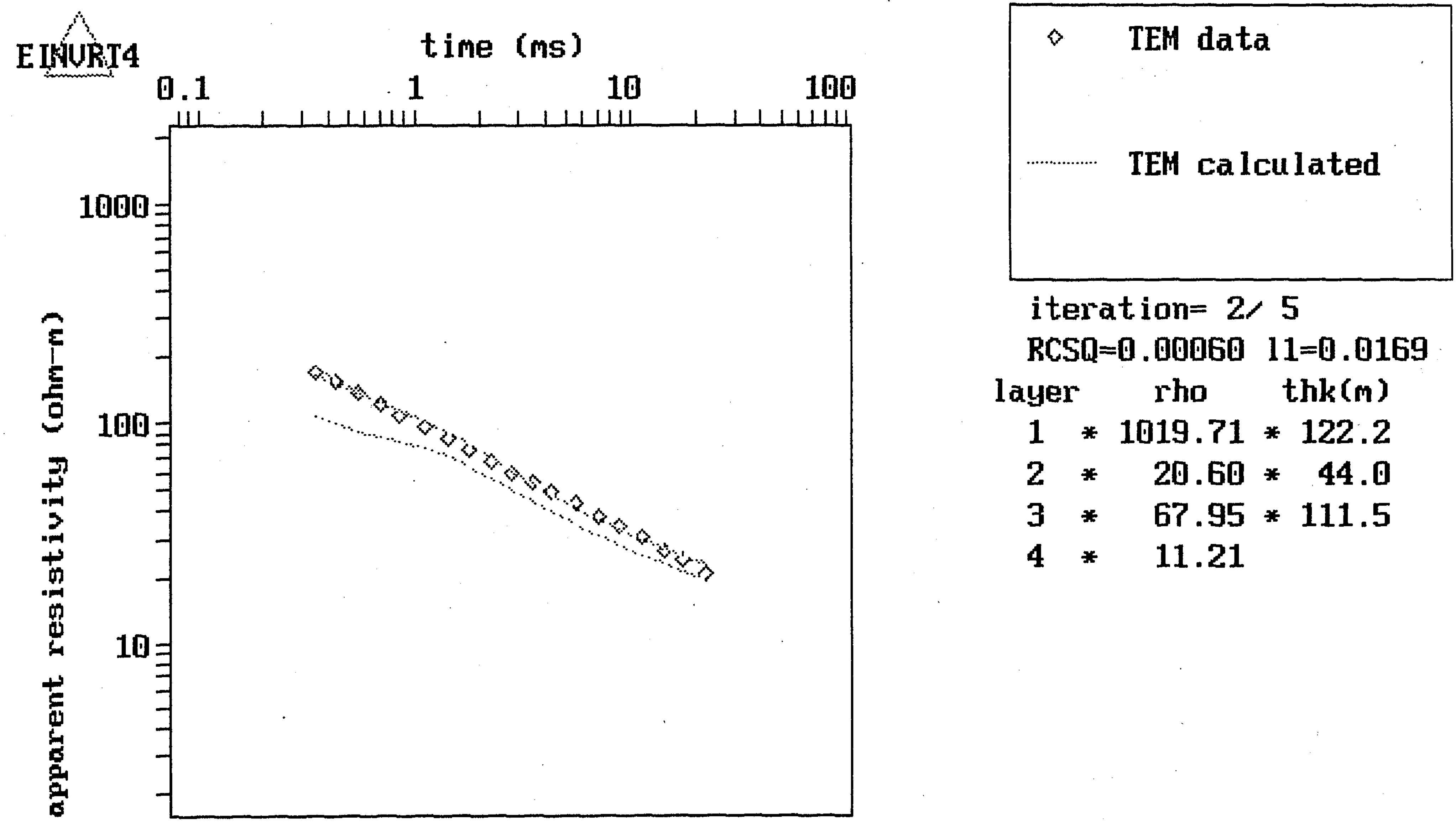


E

iteration= 4/ 5
RCSQ=0.00069 l1=0.0173

layer		rho		thk(m)
1	*	1018.17	*	175.0
2	*	22.80	*	46.8
3	*	56.27	*	191.2
4	*	12.99		

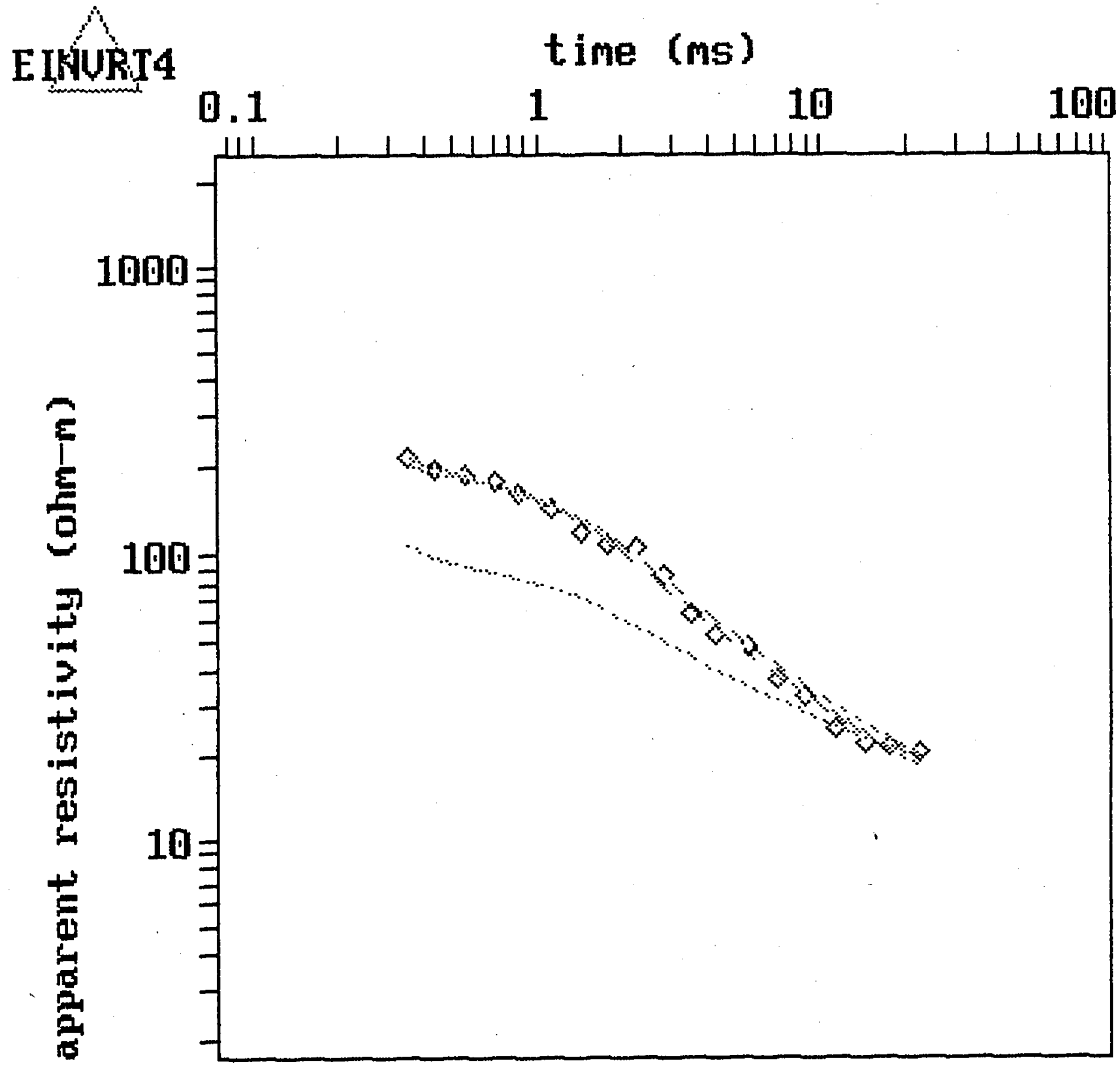
MTR-19
mt192.mod h m s mt
status**>sys matrix 18 estim. completion: 0 5 54 mu= 0.01 st



iteration= 2/ 5
RCSQ=0.00060 11=0.0169

layer		rho		thk(m)
1	*	1019.71	*	122.2
2	*	20.60	*	44.0
3	*	67.95	*	111.5
4	*	11.21		

mt201.mod h m s
status**>sys matrix r 5/ 19 estim. completion: 0 4 59 mu= 0.03



◇ TEM data

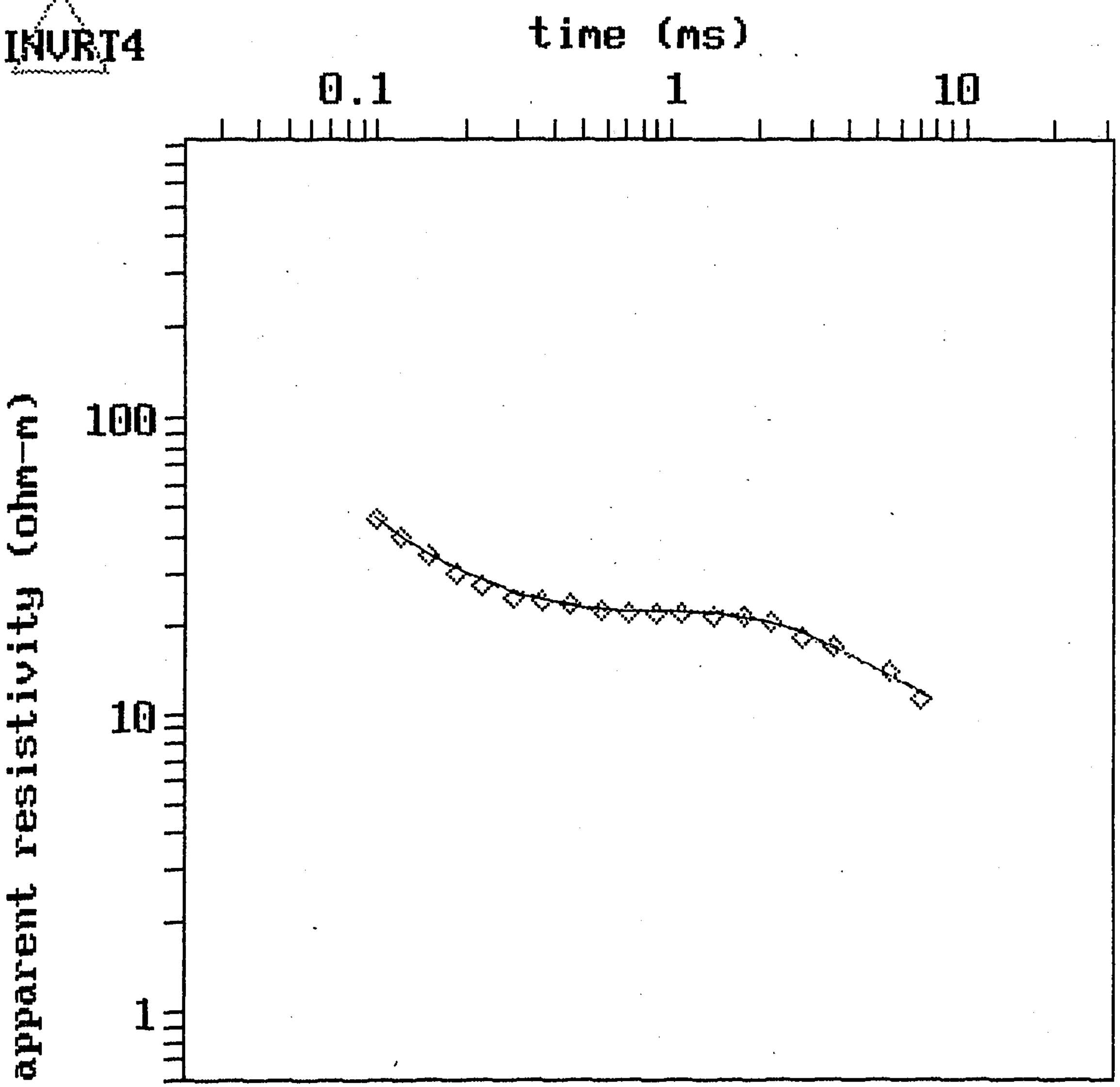
TEM calculated

iteration= 3/ 5
RCSQ=0.00114 l1=0.0211

layer		rho		thk(m)
1	*	1021.58	*	118.6
2	*	28.64	*	35.2
3	*	80.34	*	165.2
4	*	5.19		

mt211.mod
status**>sys matrix r 5/ 19 estim. completion: h m s 0 4 38 mu= 0.01

EINVRT4

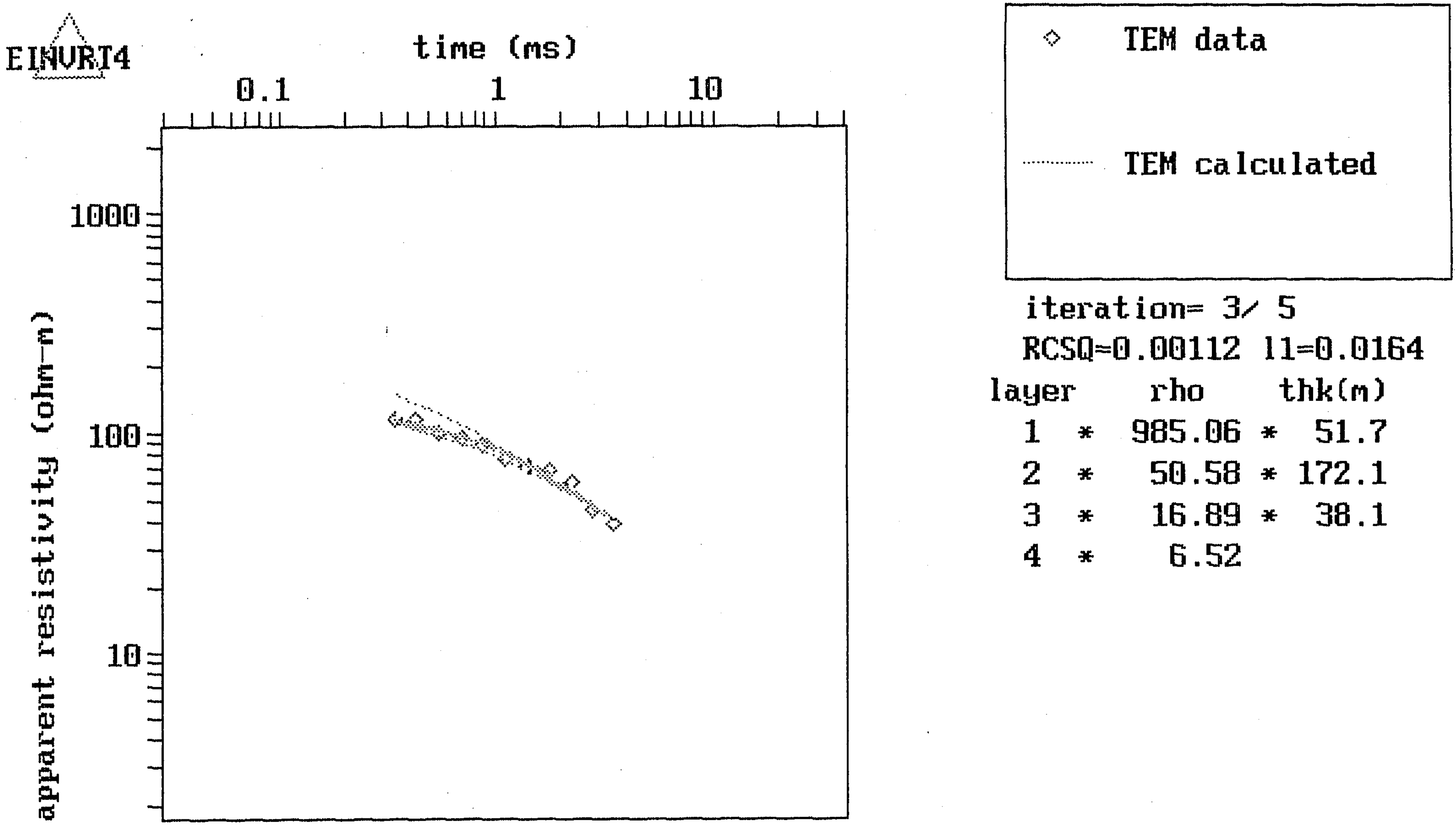


iteration= 0/ 5
RCSQ=0.00034 l1=0.0114

layer		rho		thk(m)
1	*	884.00	*	0.5
2	*	18.00	*	116.0
3	*	27.00	*	60.0
4	*	3.00		

mtr22.pro

			h	m	s	
status**>sys matrix	19	estim. completion:	11	54	3	mu= 0.10

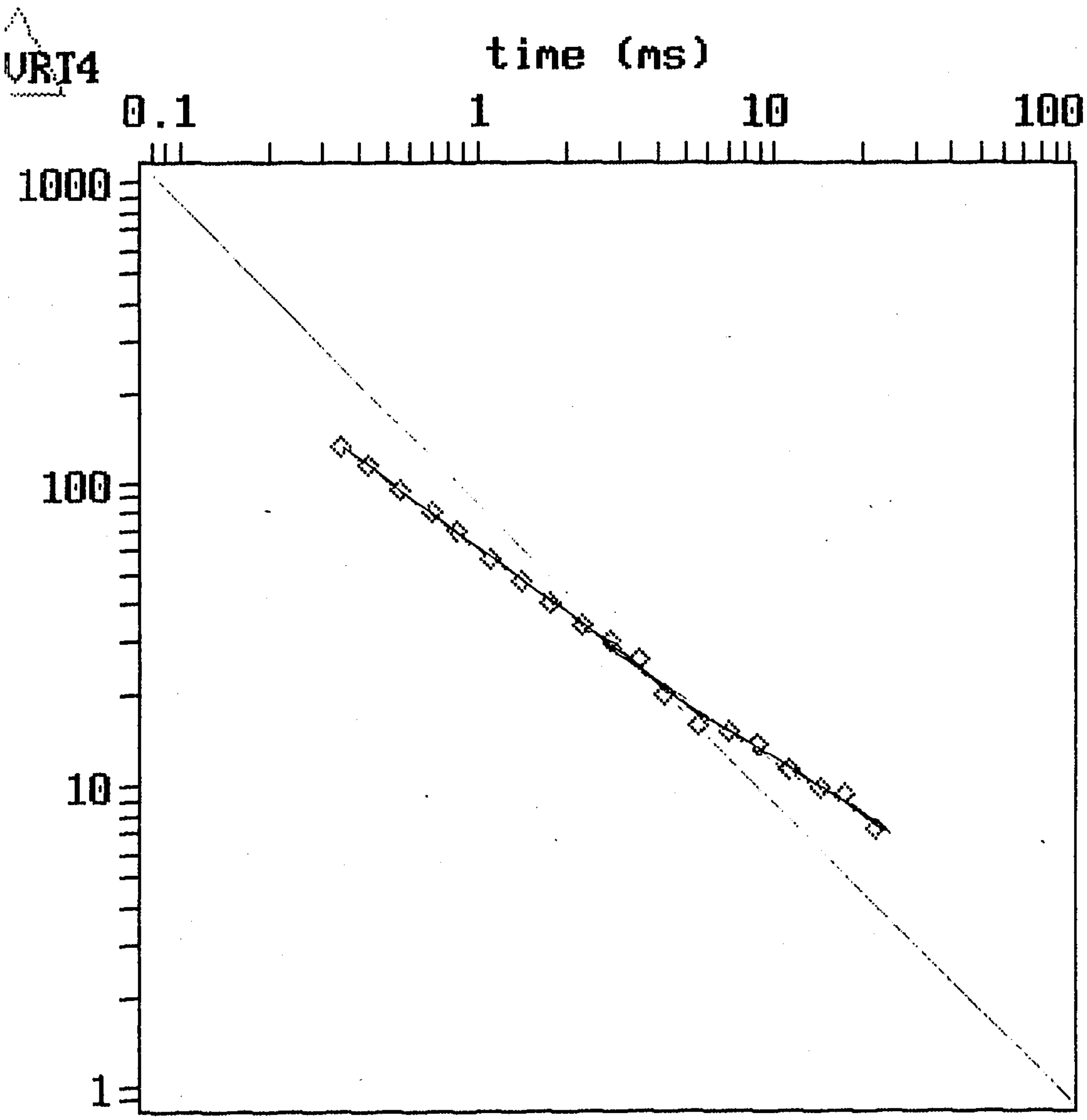


iteration= 3/ 5
RCSQ=0.00112 l1=0.0164

layer		rho		thk(m)
1	*	985.06	*	51.7
2	*	50.58	*	172.1
3	*	16.89	*	38.1
4	*	6.52		

mtr23.mod

			h m s	
status**>sys matrix	11	estim. completion:	0 3 43	mu= 0.03



◇	TEM data			
········	TEM calculated			

iteration= 0/ 5
RCSQ=0.00041 l1=0.0123

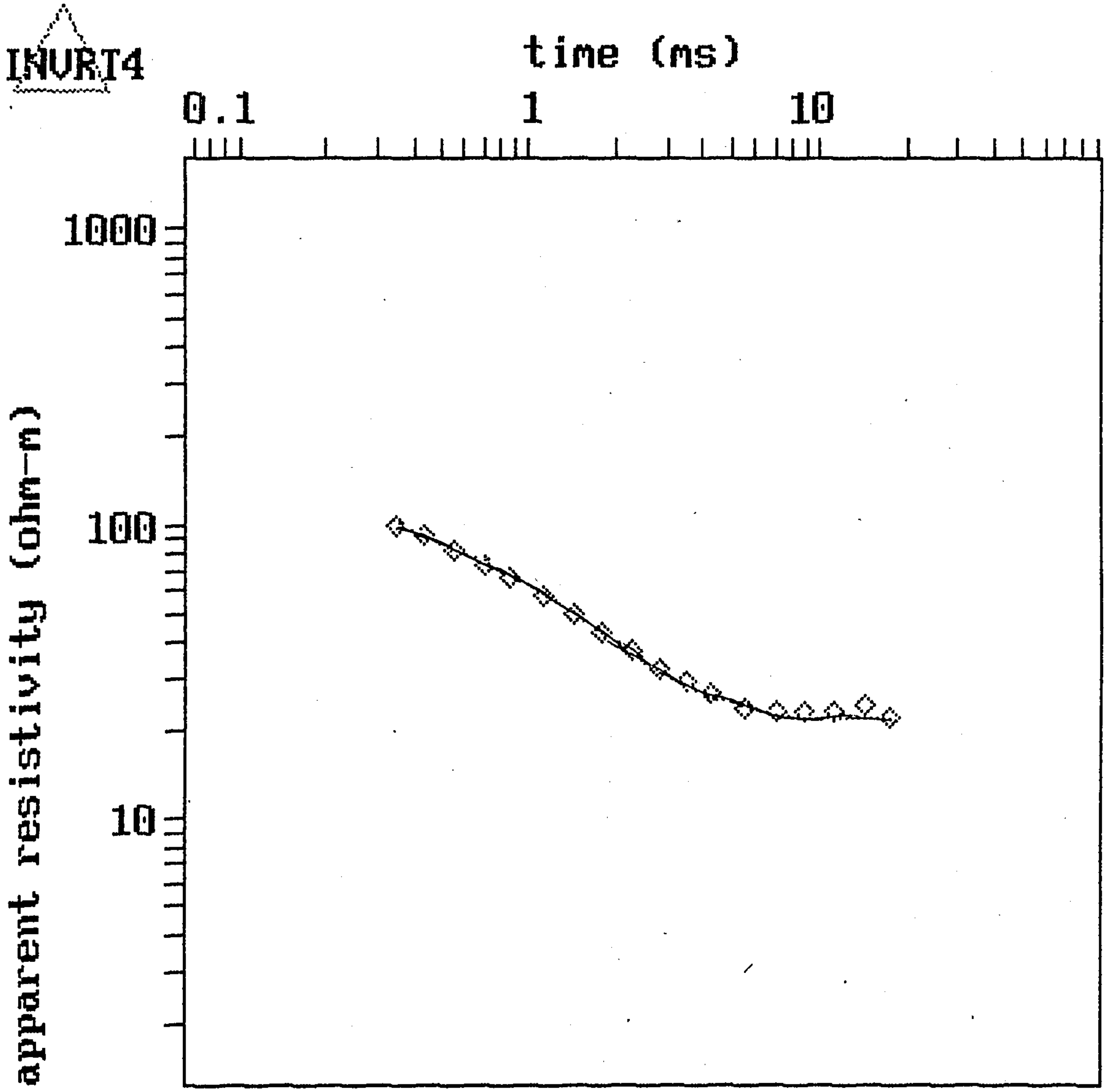
layer		rho		thk(m)
1	*	1103.00		30.0
2	*	122.00	*	110.0
3	*	7.50	*	69.0
4	*	2.60		

EINV

apparent resistivity (ohm-m)

4.pro h m s mtr34
us**>sys matrix 19 estim. completion: 0 5 45 mu= 0.10 statu

EINVRT4



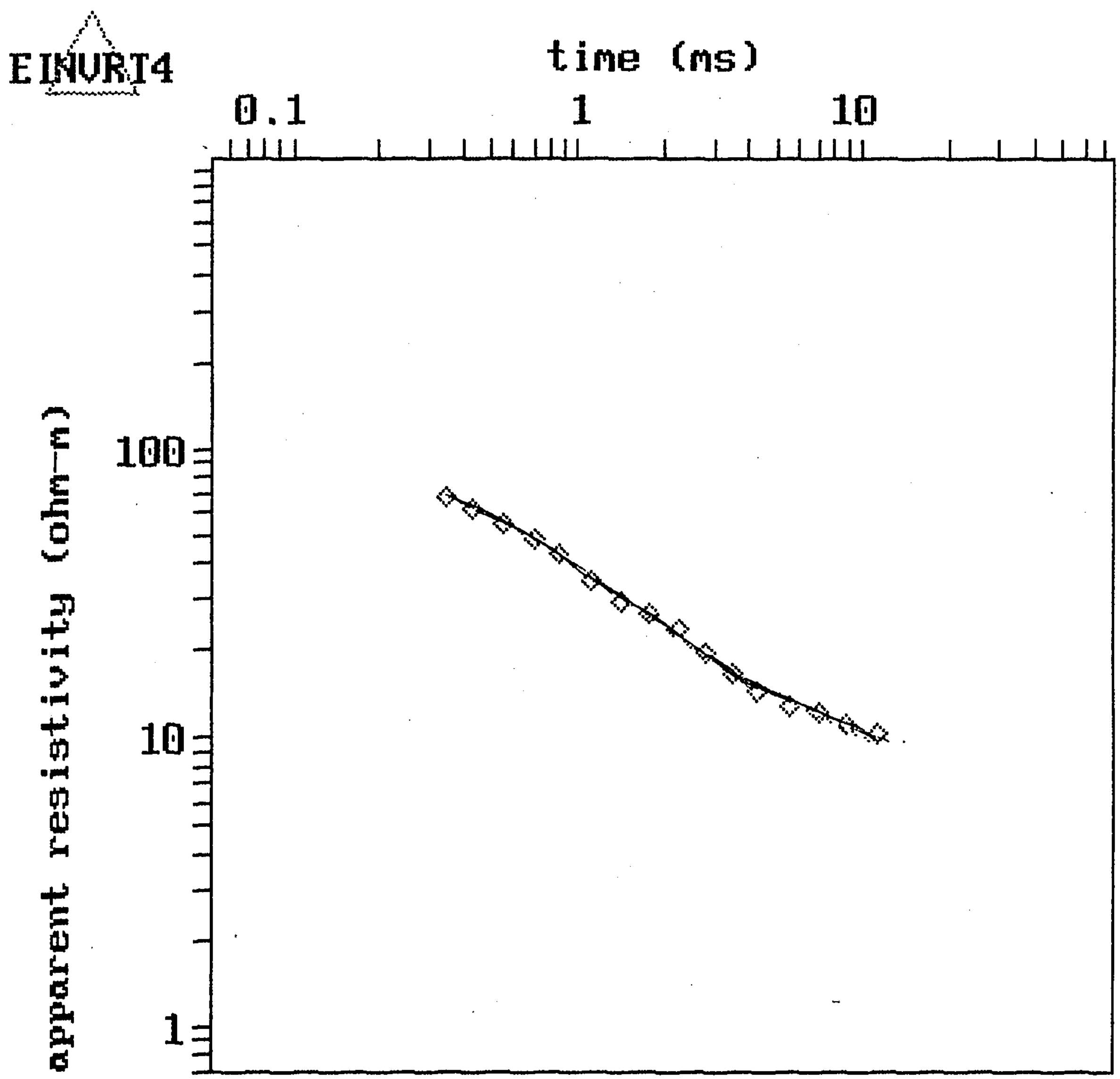
◇ TEM data

TEM calculated

iteration= 0/ 5
RCSQ=0.00040 11=0.0117

layer		rho		thk(m)
1	*	2253.00	*	76.0
2	*	27.00	*	149.0
3	*	5.00	*	57.0
4	*	43.00		

mtr36.pro h m s
status**>sys matrix 18 estim. completion: 0 8 13 mu= 0.10

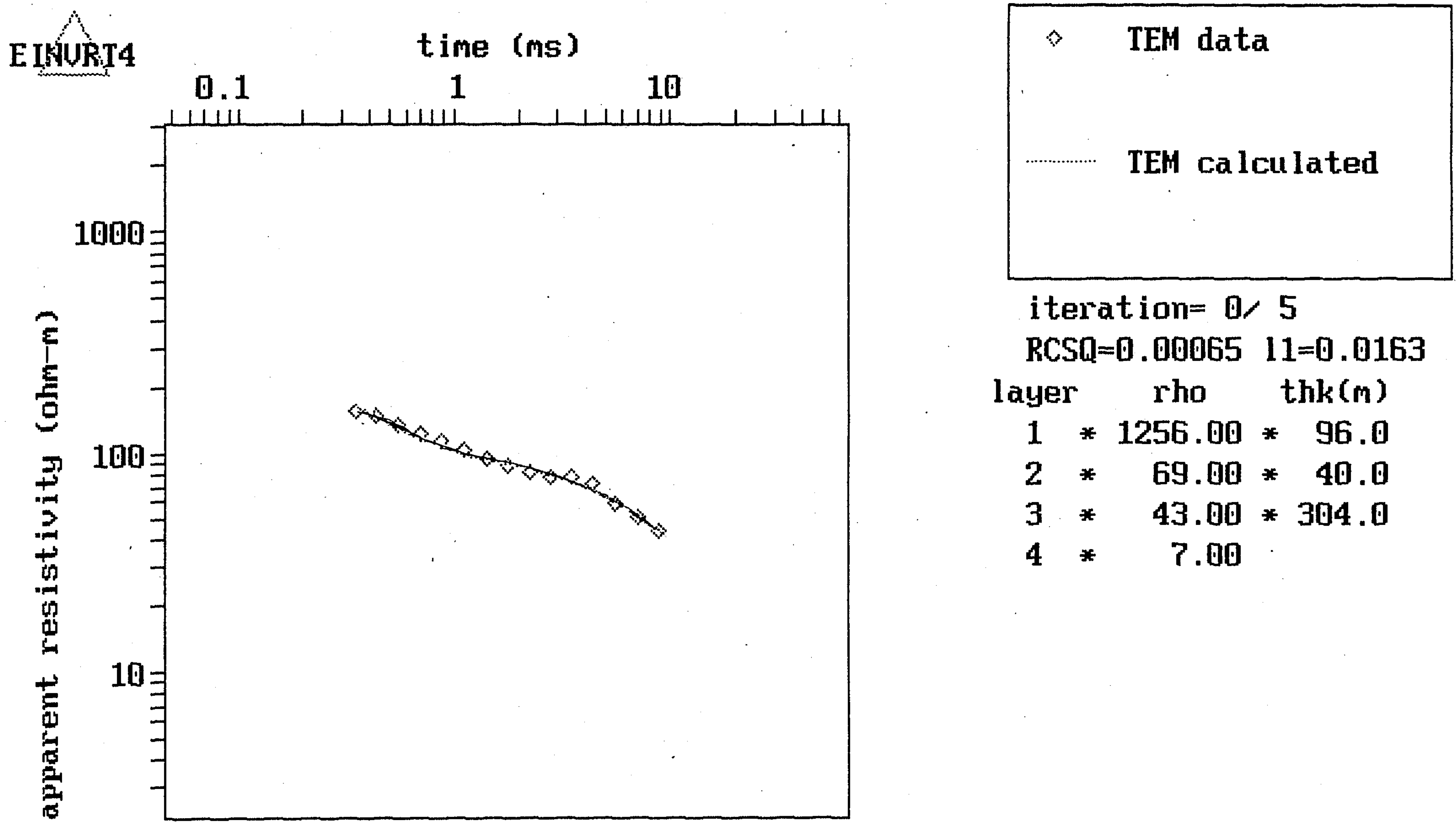


TEM data

TEM calculated

```
iteration= 0/ 5
RCSQ=0.00040 11=0.0123
layer    rho      thk(m)
 1  *  839.00 *  25.0
 2  *   34.00 *  87.0
 3  *   20.00 *  28.0
 4  *    4.00
```

```
mtr28.pro                                      h  m  s
status**>sys matrix      16    estim. completion:  0  5 17      mu= 0.10
```

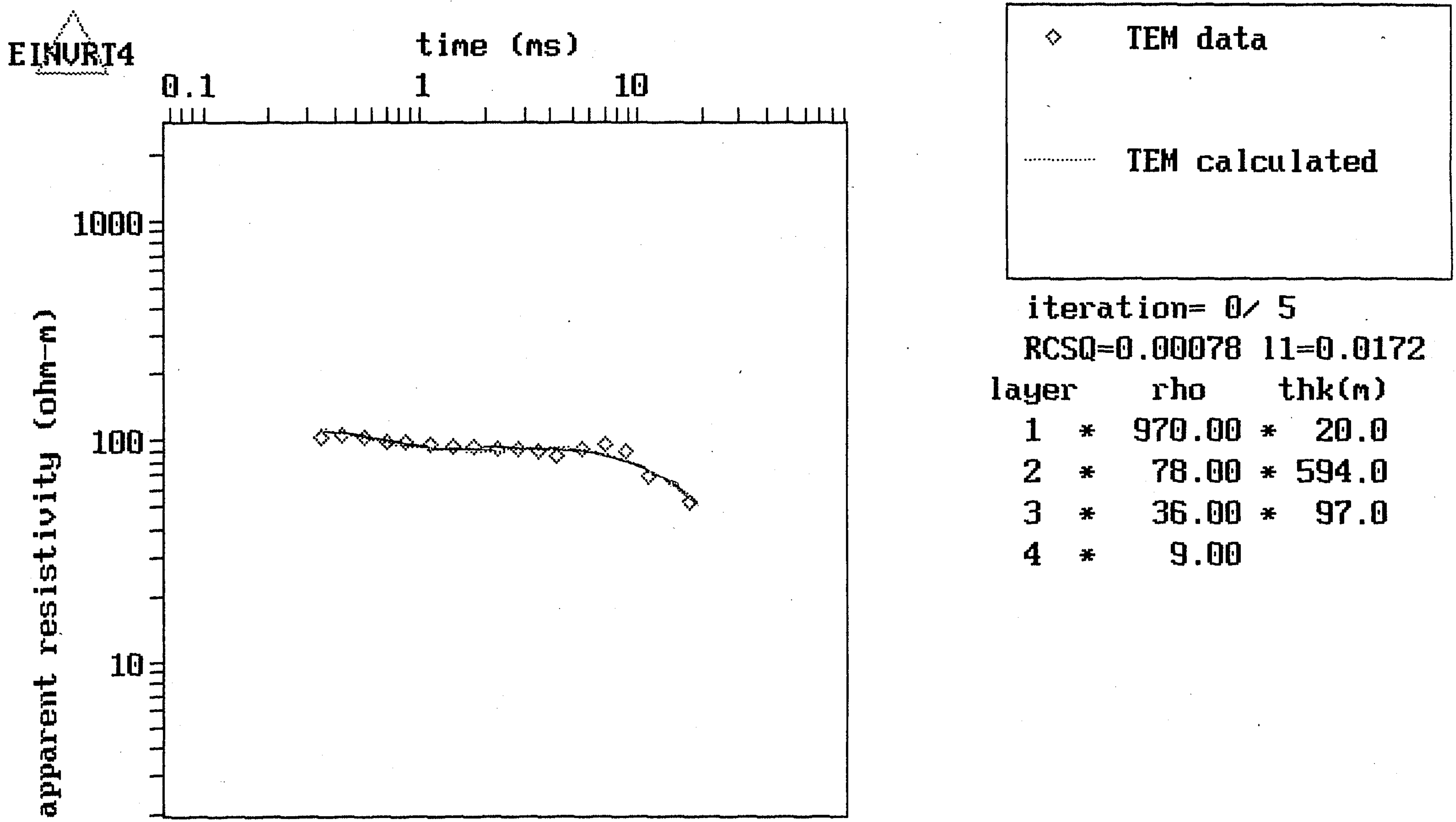


iteration= 0/ 5
RCSQ=0.00065 l1=0.0163

layer		rho		thk(m)
1	*	1256.00	*	96.0
2	*	69.00	*	40.0
3	*	43.00	*	304.0
4	*	7.00		

mtr32.pro

			h	m	s	
status**>sys matrix	15	estim. completion:	0	6	25	mu= 0.10

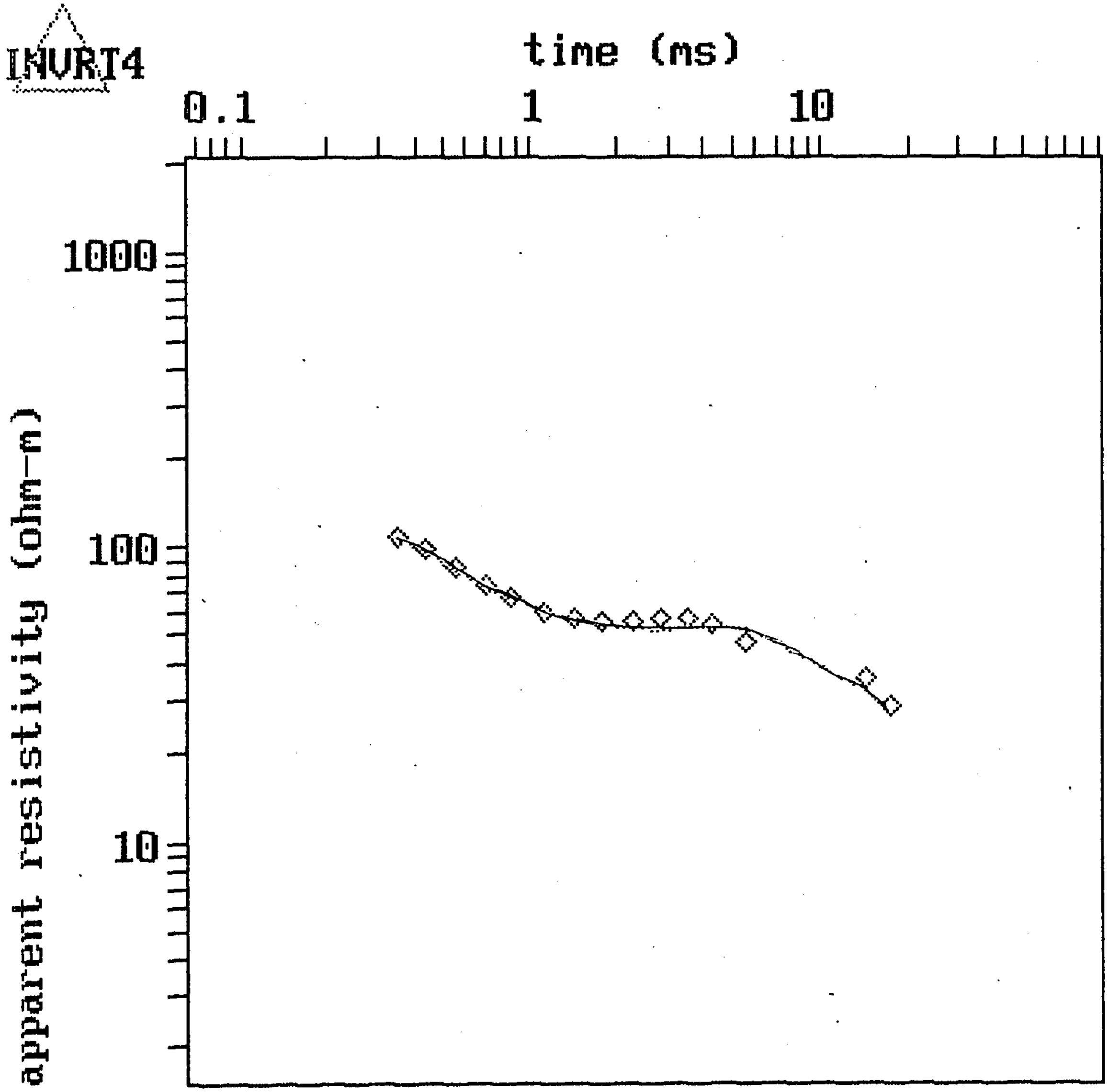


iteration= 0/ 5
RCSQ=0.00078 11=0.0172

layer		rho		thk(m)
1	*	970.00	*	20.0
2	*	78.00	*	594.0
3	*	36.00	*	97.0
4	*	9.00		

mtr25.pro h m s
status**>sys matrix 17 estim. completion: 0 7 46 mu= 0.10

INVRT4



◇ TEM data

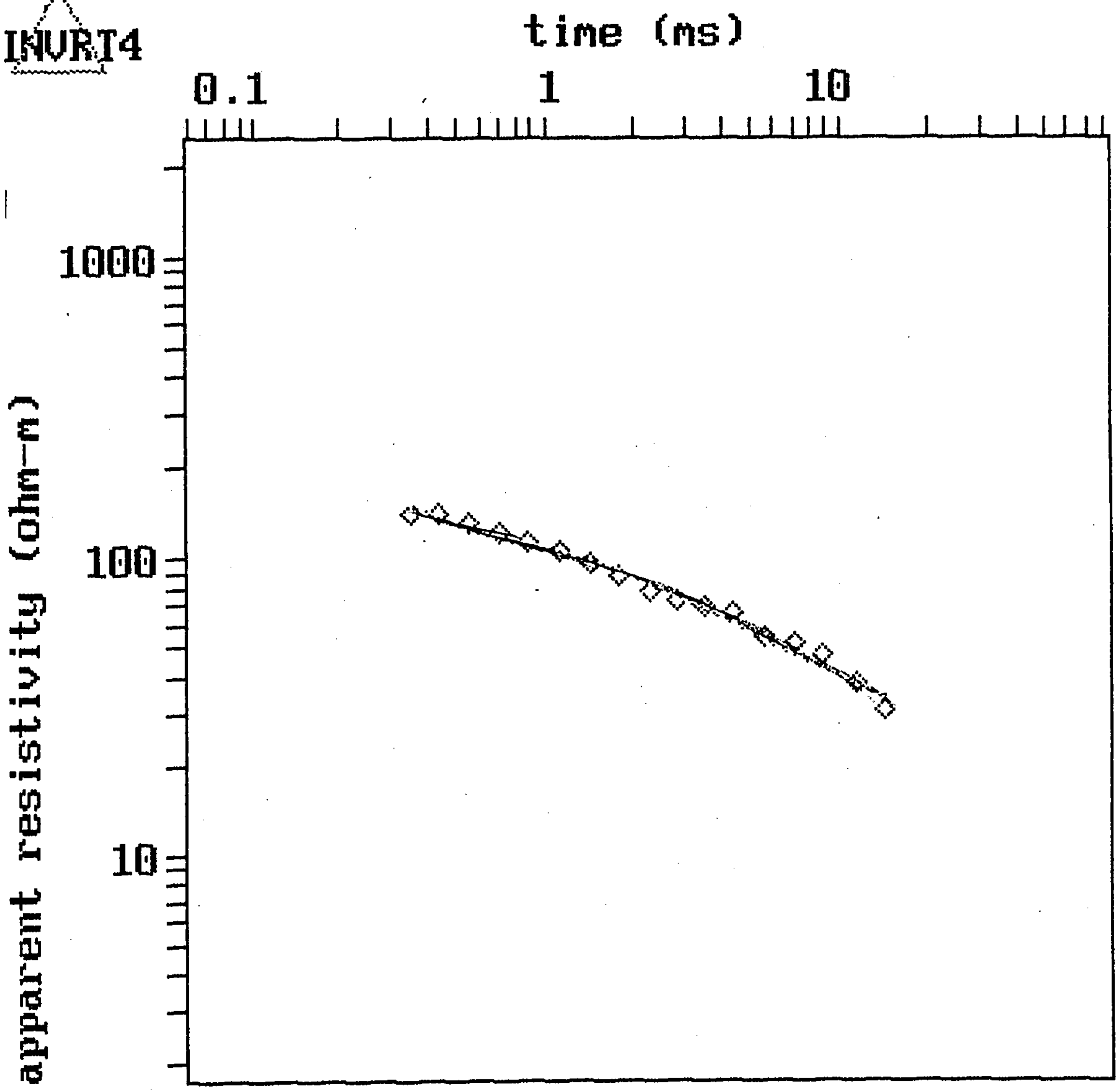
TEM calculated

iteration= 0/ 5
RCSQ=0.00111 11=0.0184

layer		rho		thk(m)
1	*	8215.00	*	84.0
2	*	28.00	*	345.0
3	*	25.00	*	47.0
4	*	1.00		

r27.pro h m s mtr
atus**>sys matrix 15 estim. completion: 0 5 44 mu= 0.10 sta

EINVRT4

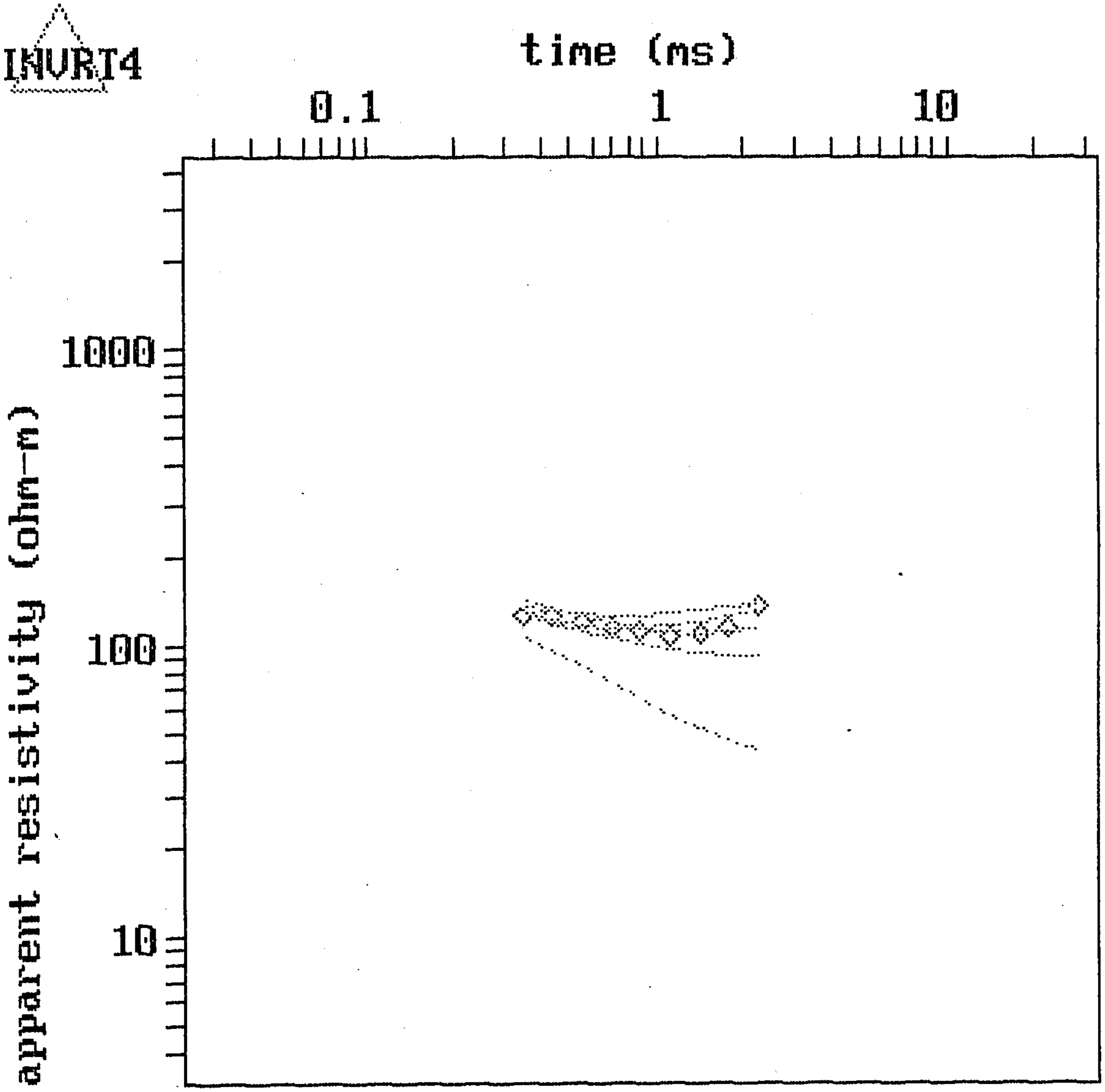


iteration= 0/ 5
RCSQ=0.00083 11=0.0202

layer		rho		thk(m)
1	*	952.00	*	84.0
2	*	55.00	*	273.0
3	*	13.00		

mtr34.pro
status**>sys matrix r 2/ 17 estim. completion: h m s 0 2 54 mu= 0.10

EINVRT4



◇ TEM data

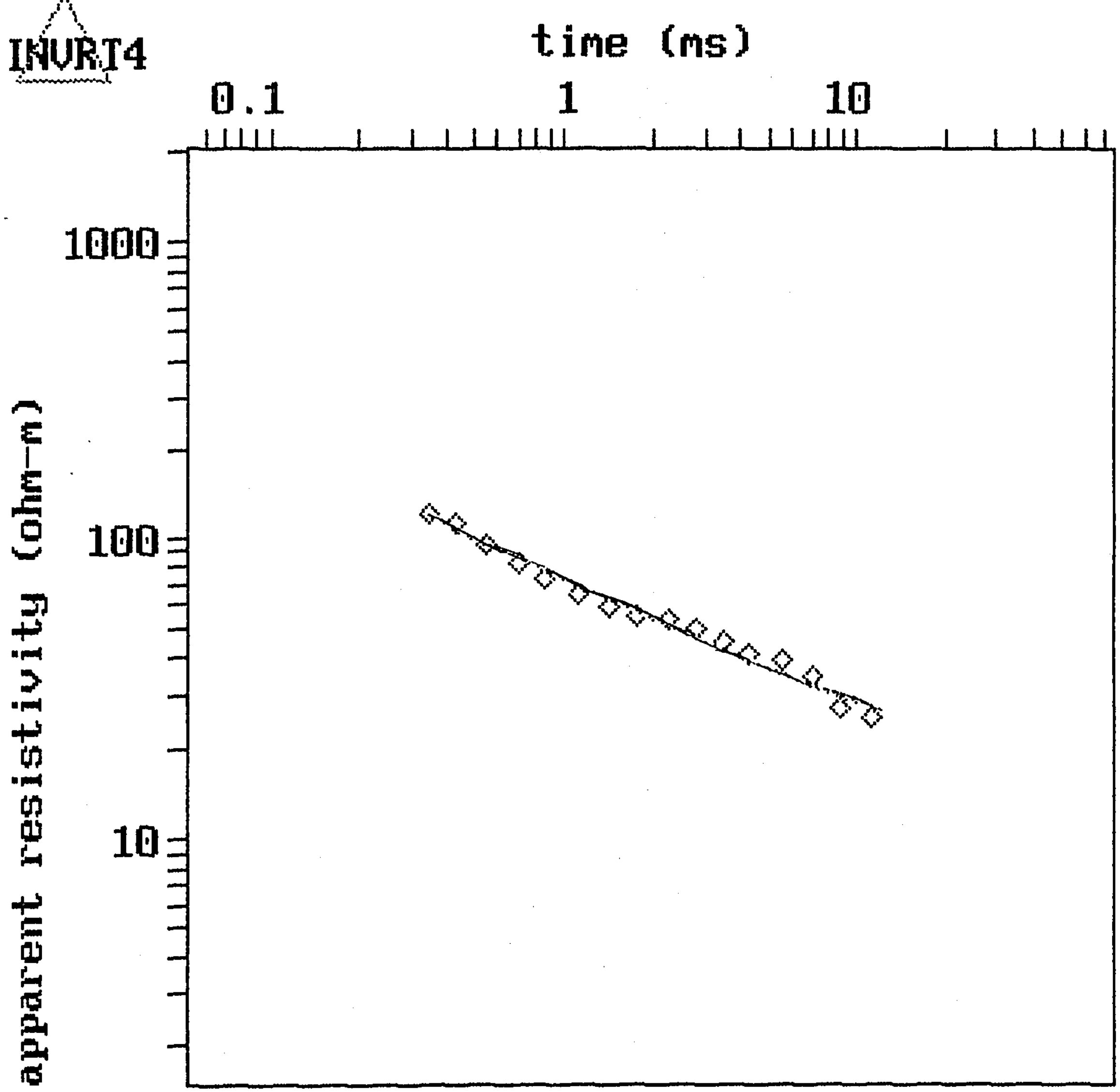
TEM calculated

iteration= 4/ 5
RCSQ=0.00276 11=0.0202

layer		rho		thk(m)
1	*	495.67	*	27.8
2	*	93.21	*	168.8
3	*	58.27	*	43.8
4	*	475.54		

mtr29.mod h m s
status**>sys matrix r 6/ 9 estim. completion: 0 0 35 mu= 0.01

EINVRT4

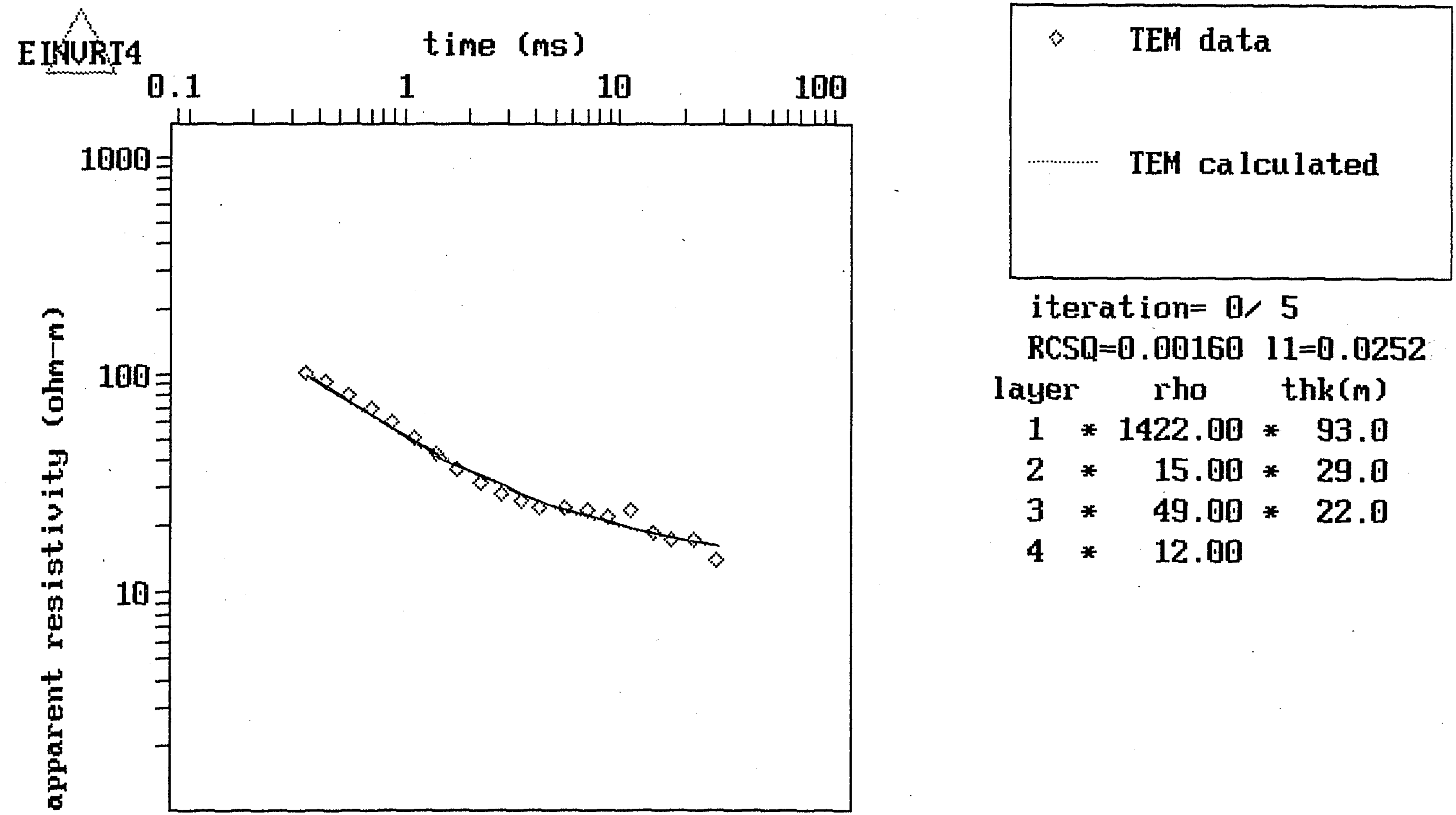


iteration= 0/ 5
RCSQ=0.00125 11=0.0239

layer		rho		thk(m)
1	*	1040.00	*	87.0
2	*	32.00	*	138.0
3	*	21.00	*	48.0
4	*	14.00		

mtr33.pro h m s

status**>sys matrix 16 estim. completion: 0 7 0 mu= 0.10



iteration= 0/ 5

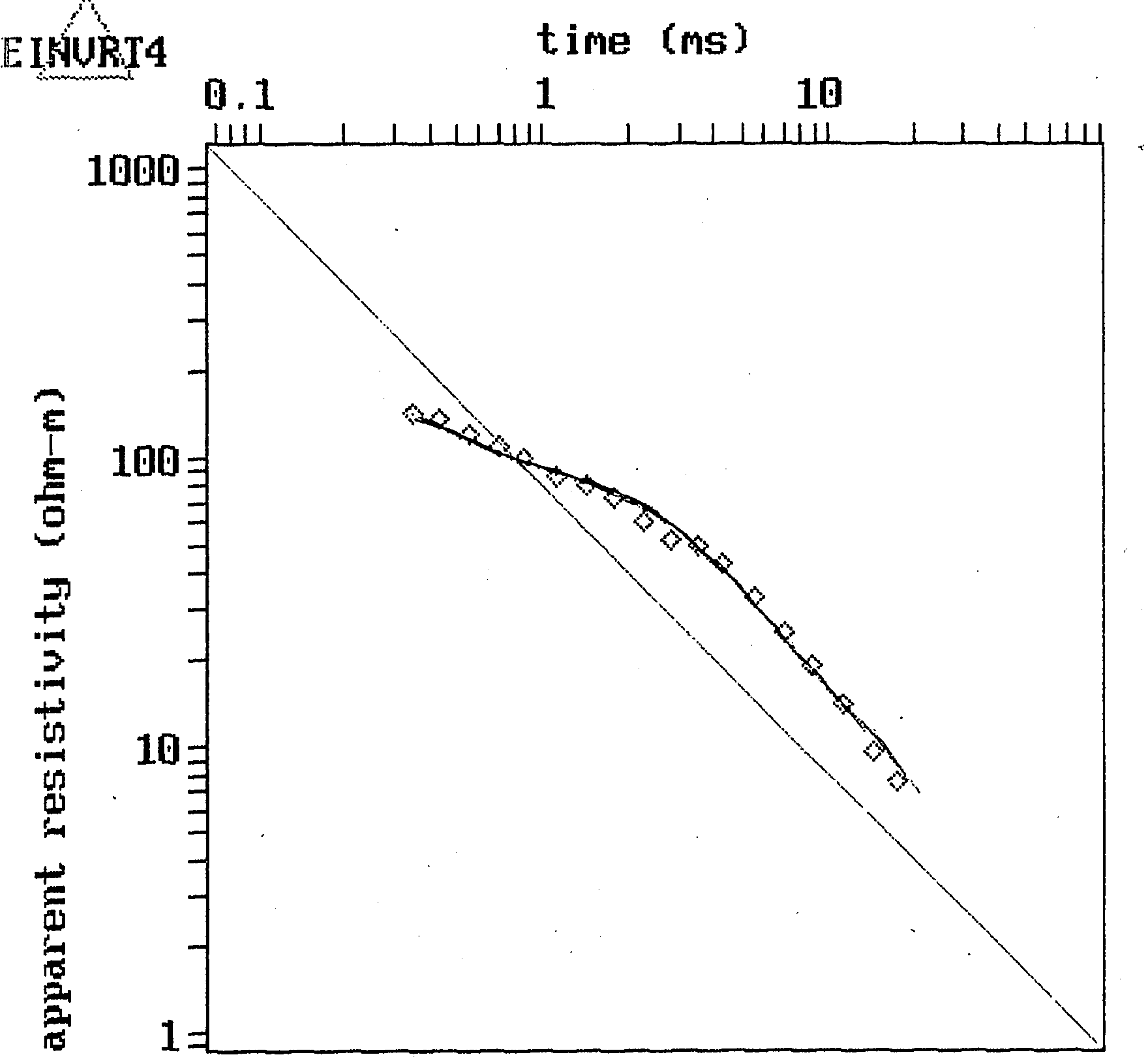
RCSQ=0.00160 11=0.0252

layer		rho		thk(m)
1	*	1422.00	*	93.0
2	*	15.00	*	29.0
3	*	49.00	*	22.0
4	*	12.00		

mtr30.pro h m s

status**>sys matrix 20 estim. completion: 0 9 42 mu= 0.10

EINVRT4



◇	TEM data	
······	TEM calculated	

iteration= 0/ 5

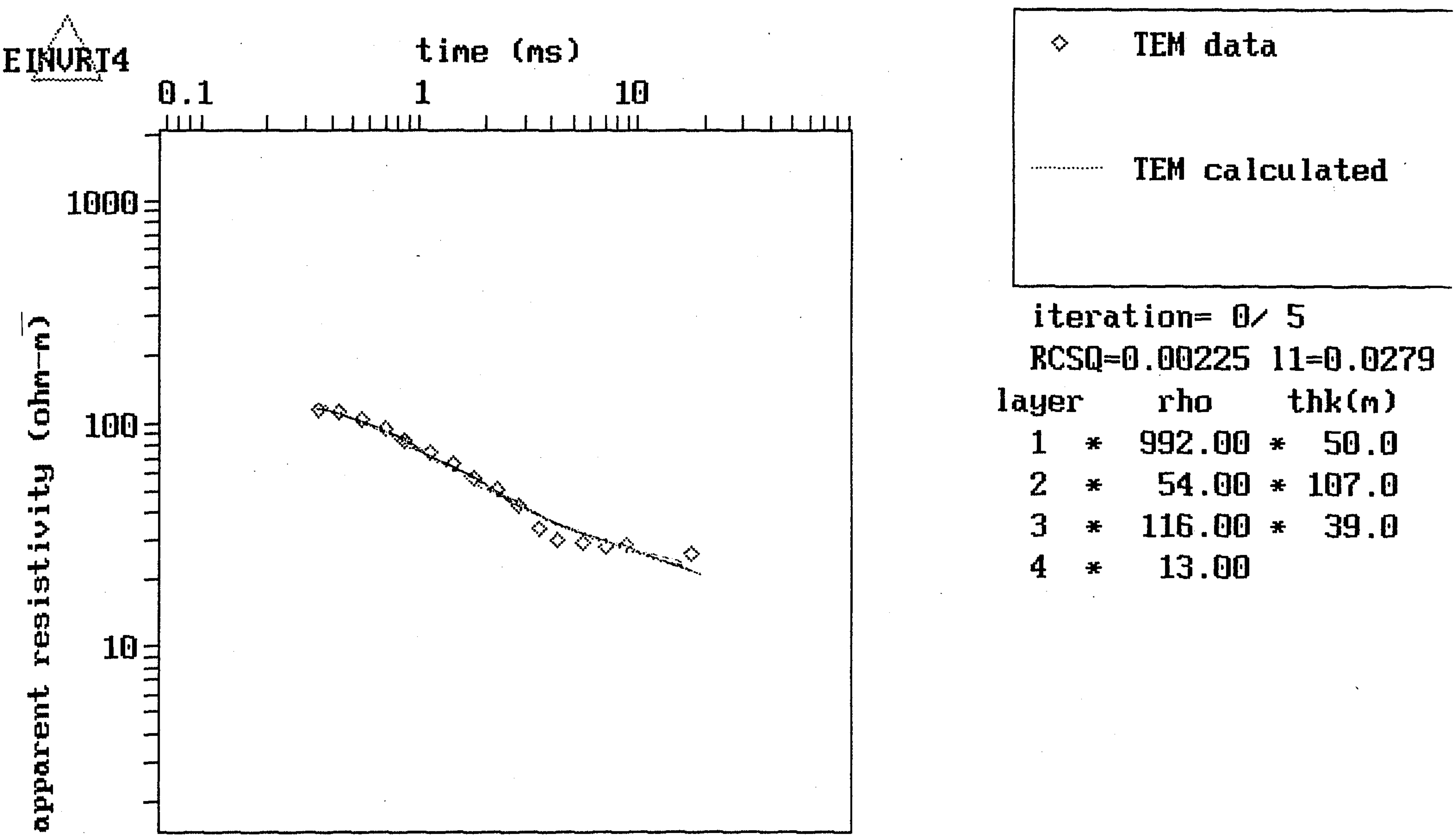
RCSQ=0.00180 l1=0.0264

layer		rho		thk(m)
1	*	1063.00	*	82.0
2	*	35.00	*	116.0
3	*	4.00	*	55.0
4	*	0.20		

tr35.pro

			h	m	s		
tatus**>sys matrix	18	estim. completion:	0	6	8	mu= 0.10	

EINVRT4

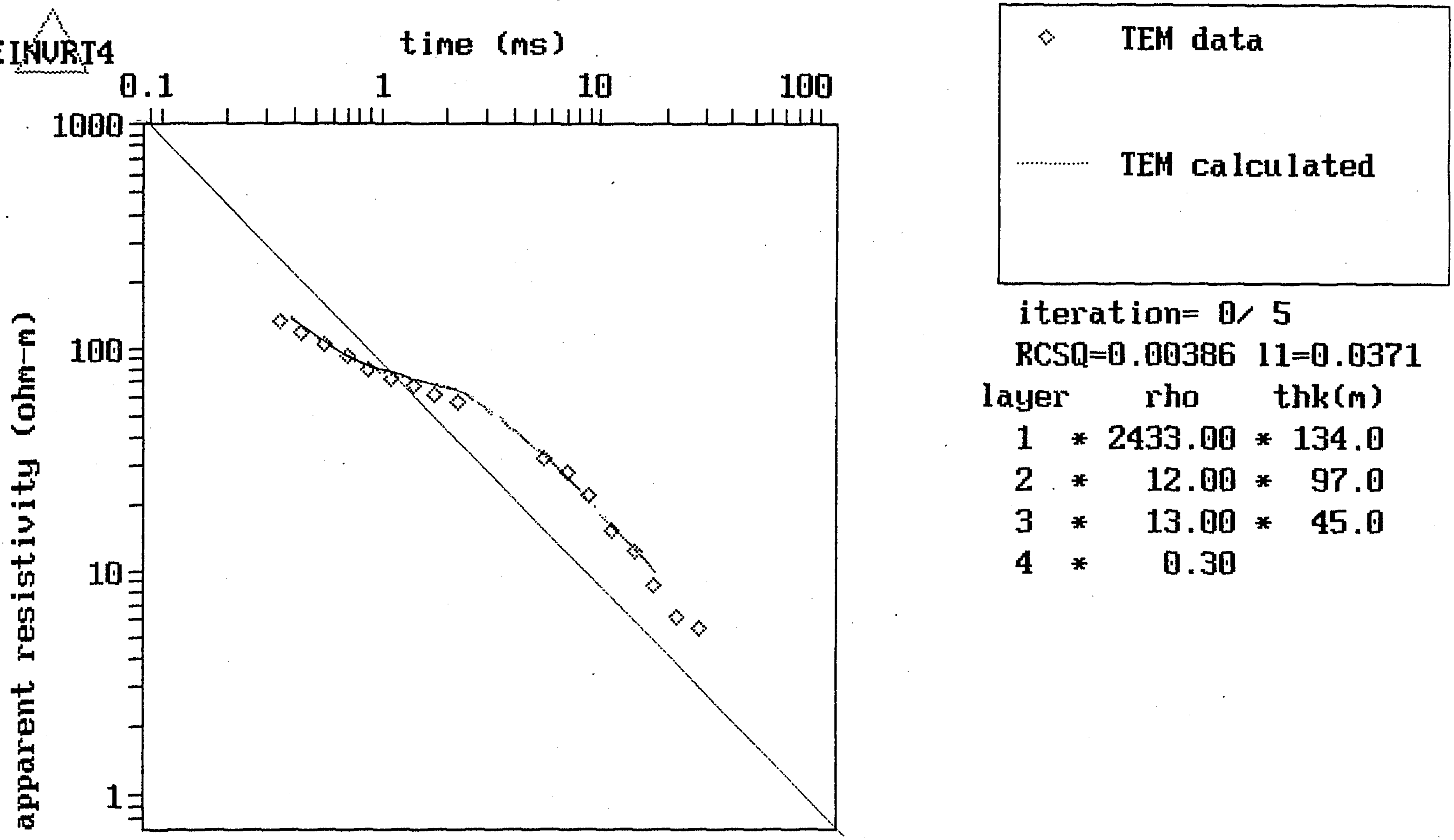


iteration= 0/ 5
RCSQ=0.00225 11=0.0279

layer		rho		thk(m)
1	*	992.00	*	50.0
2	*	54.00	*	107.0
3	*	116.00	*	39.0
4	*	13.00		

mtr26.mod   h m s
status**>sys matrix   16   estim. completion: 0 6 57   mu= 0.10

EINVRT4



iteration= 0/ 5

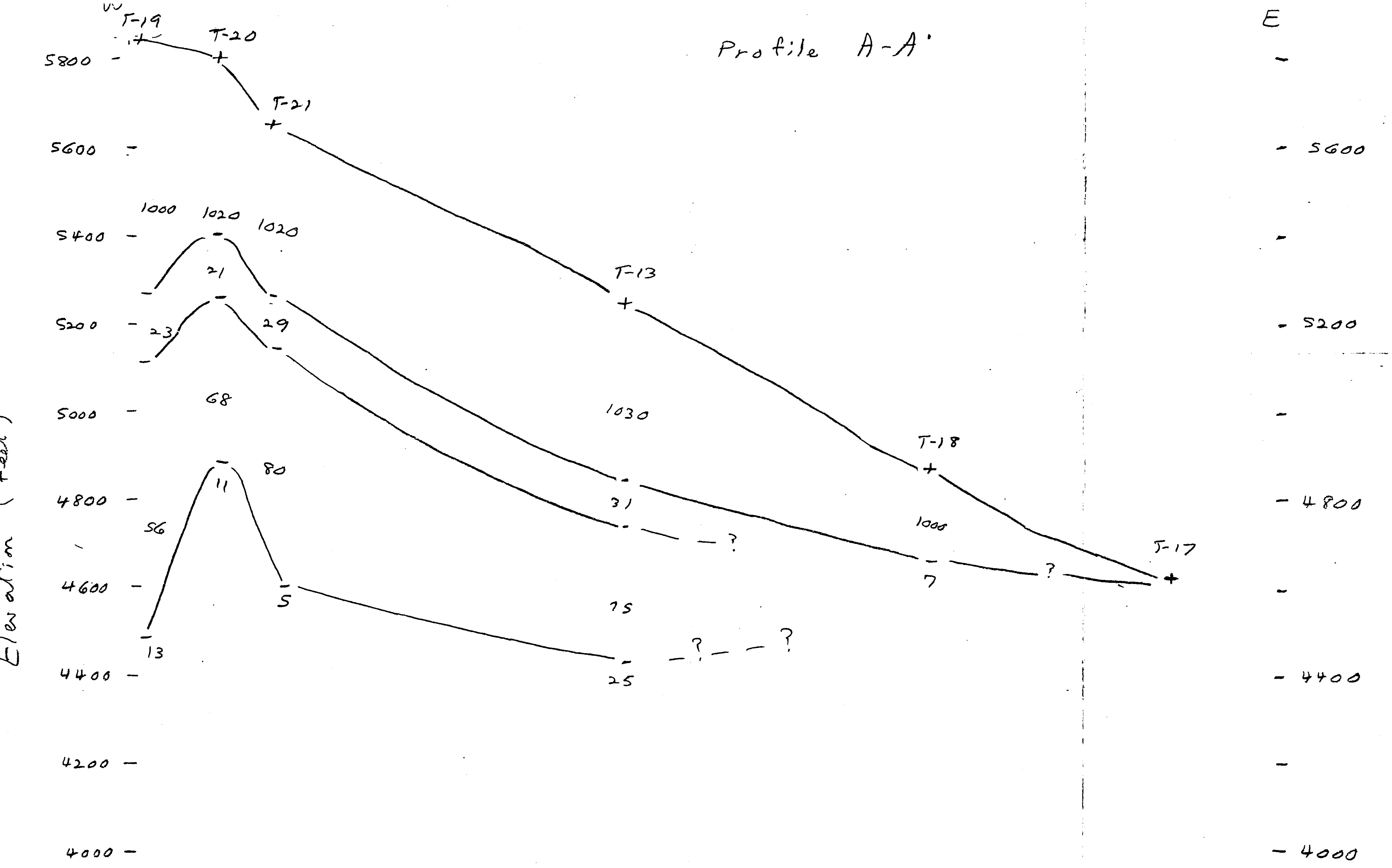
RCSQ=0.00386 11=0.0371

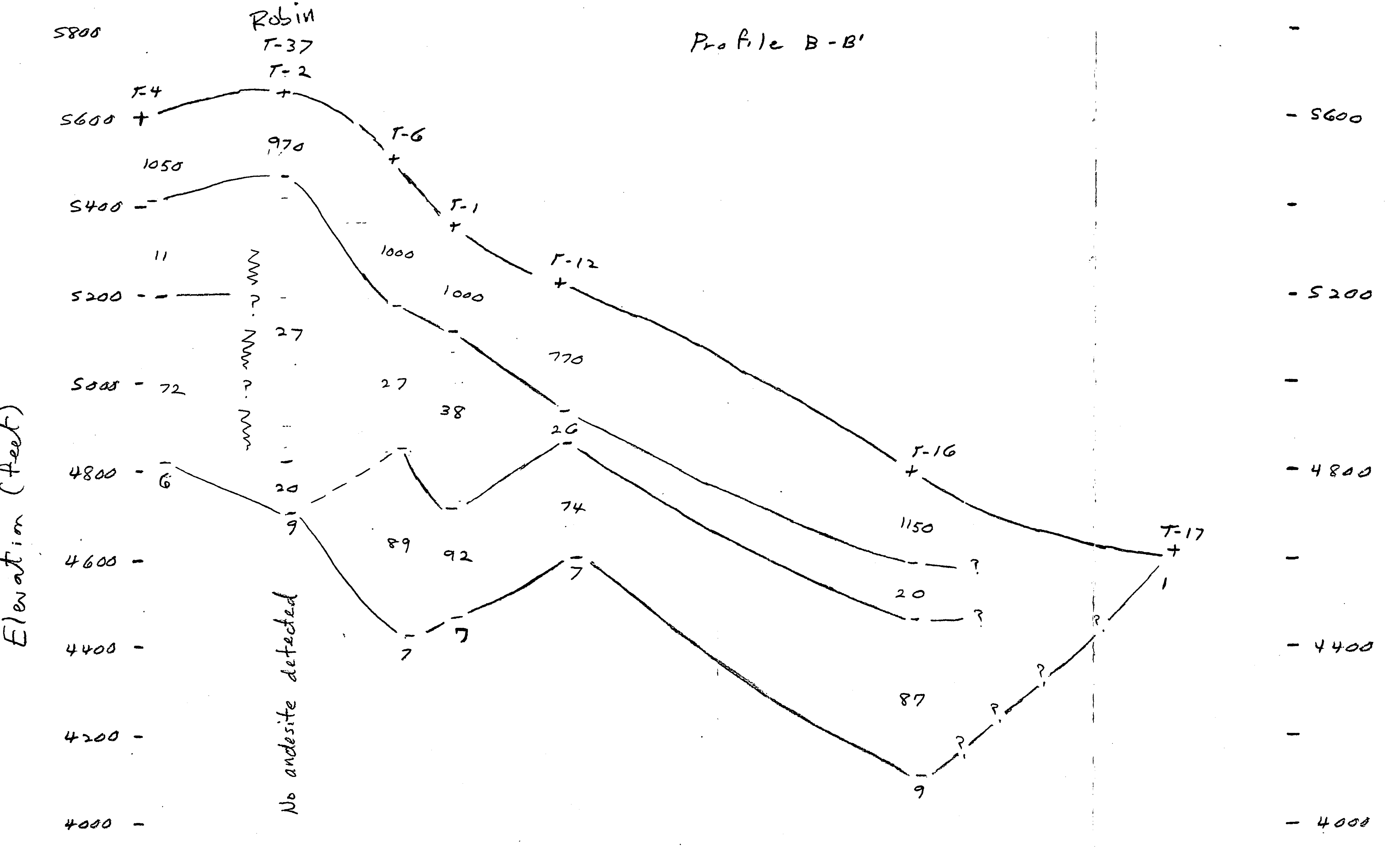
layer		rho		thk(m)
1	*	2433.00	*	134.0
2	*	12.00	*	97.0
3	*	13.00	*	45.0
4	*	0.30		

mtr31.pro

			h	m	s	
status**>sys matrix	17	estim. completion:	0	5	54	mu= 0.10

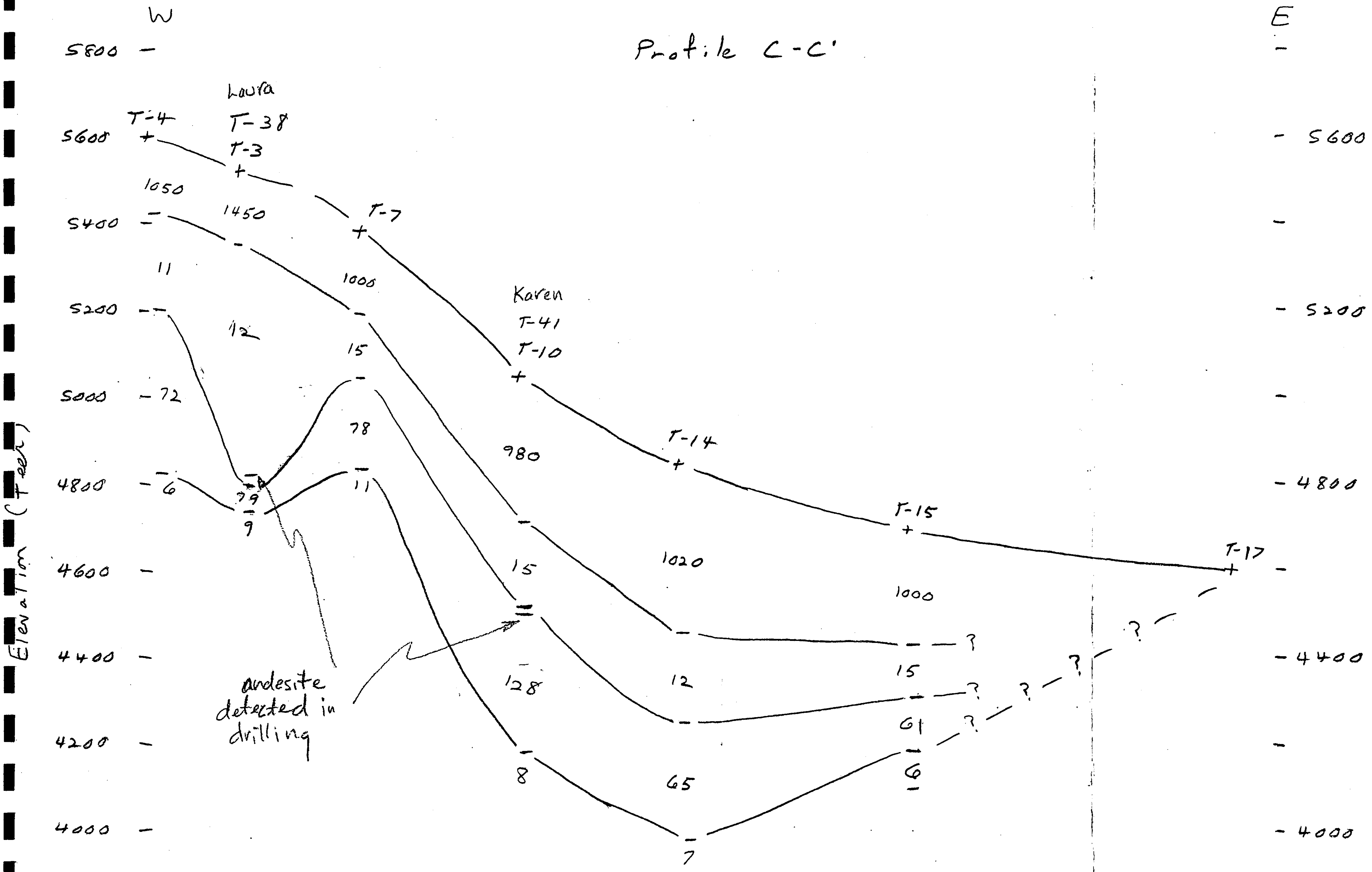
Profile A-A'


W
E
T-19
T-20
T-21
T-13
T-18
T-17
Elevation (feet)
5800
5600
5400
5200
5000
4800
4600
4400
4200
4000
1000
1020
1020
1030
1000
21
23
29
68
31
7
80
11
56
5
75
13
25
?
?
?
?

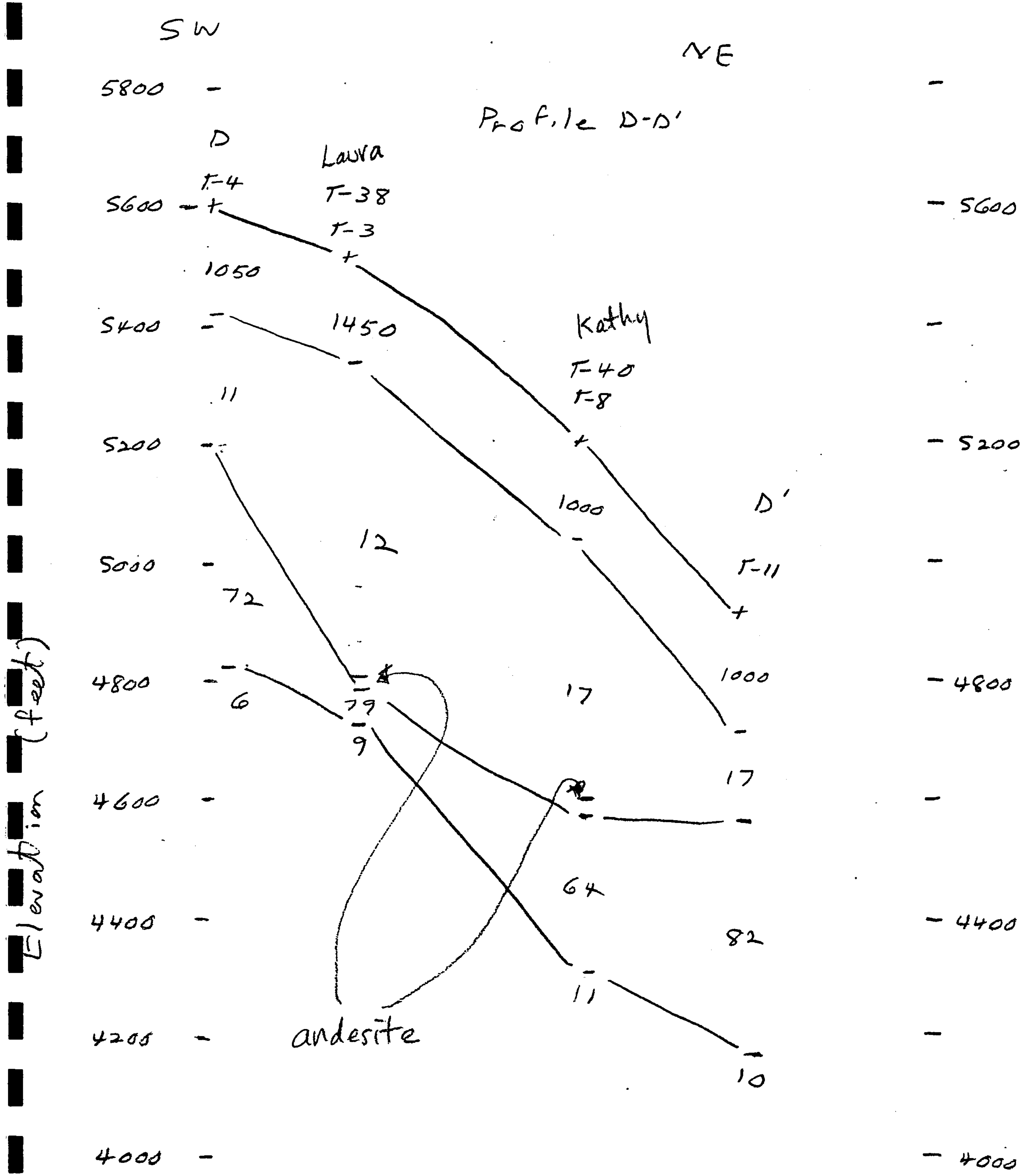


Profile B-B'
Elevation (Feet)
Robin
T-37
T-2
T-4
T-6
T-1
T-12
T-16
T-17
5800
5600
5400
5200
5000
4800
4600
4400
4200
4000
1050
970
1000
1000
770
1150
11
27
72
27
38
26
20
6
20
9
89
92
74
7
7
7
87
9
1
No andesite detected

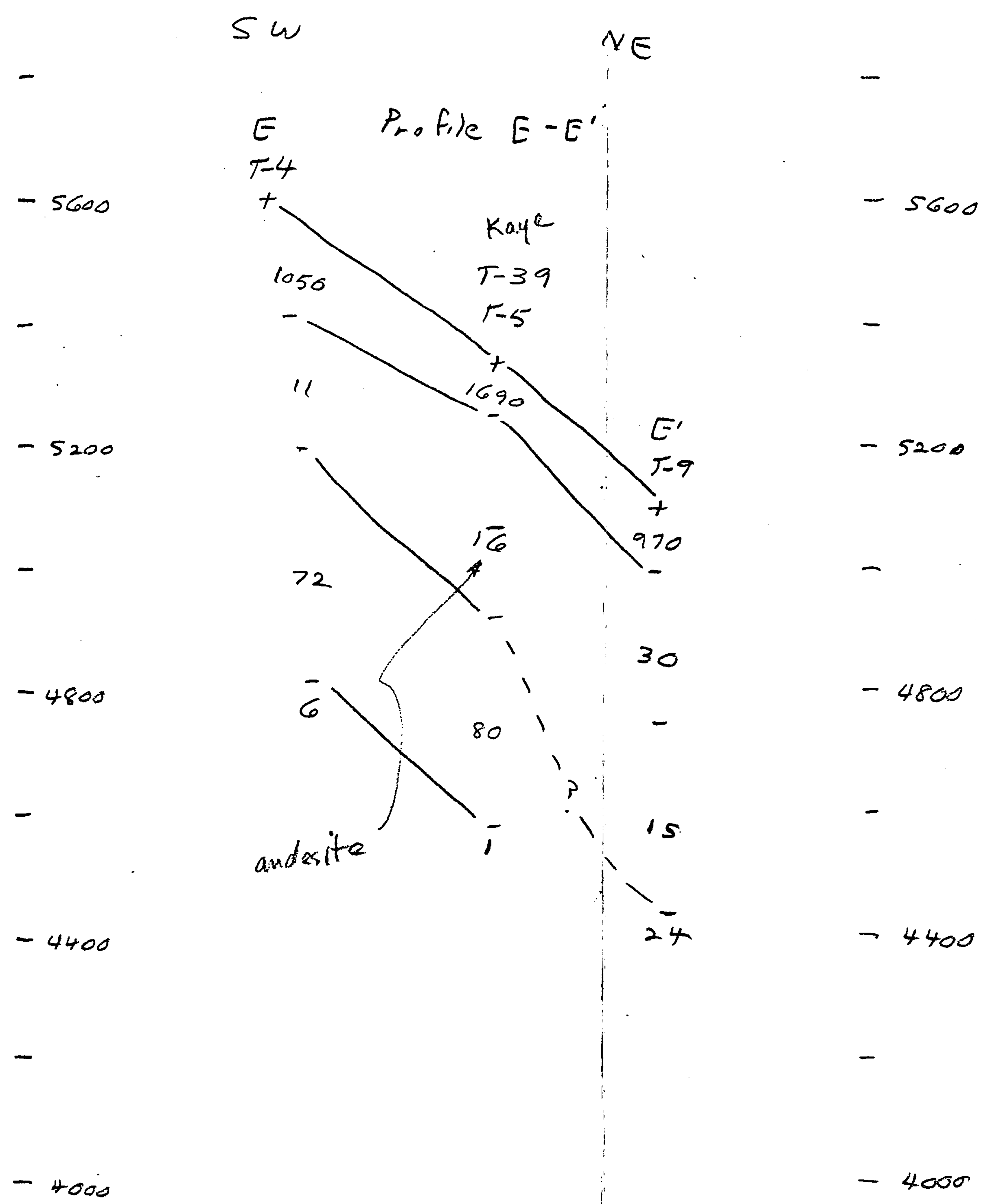
Profile C-C'



W
E
Elevation (feet)
5800
5600
5400
5200
5000
4800
4600
4400
4200
4000
T-4
Laura
T-38
T-3
T-7
Karen
T-41
T-10
T-14
T-15
T-17
1050
1450
1000
980
1020
1000
11
12
15
15
12
15
72
78
128
65
61
6
79
9
11
8
7
6
?
andesite detected in drilling

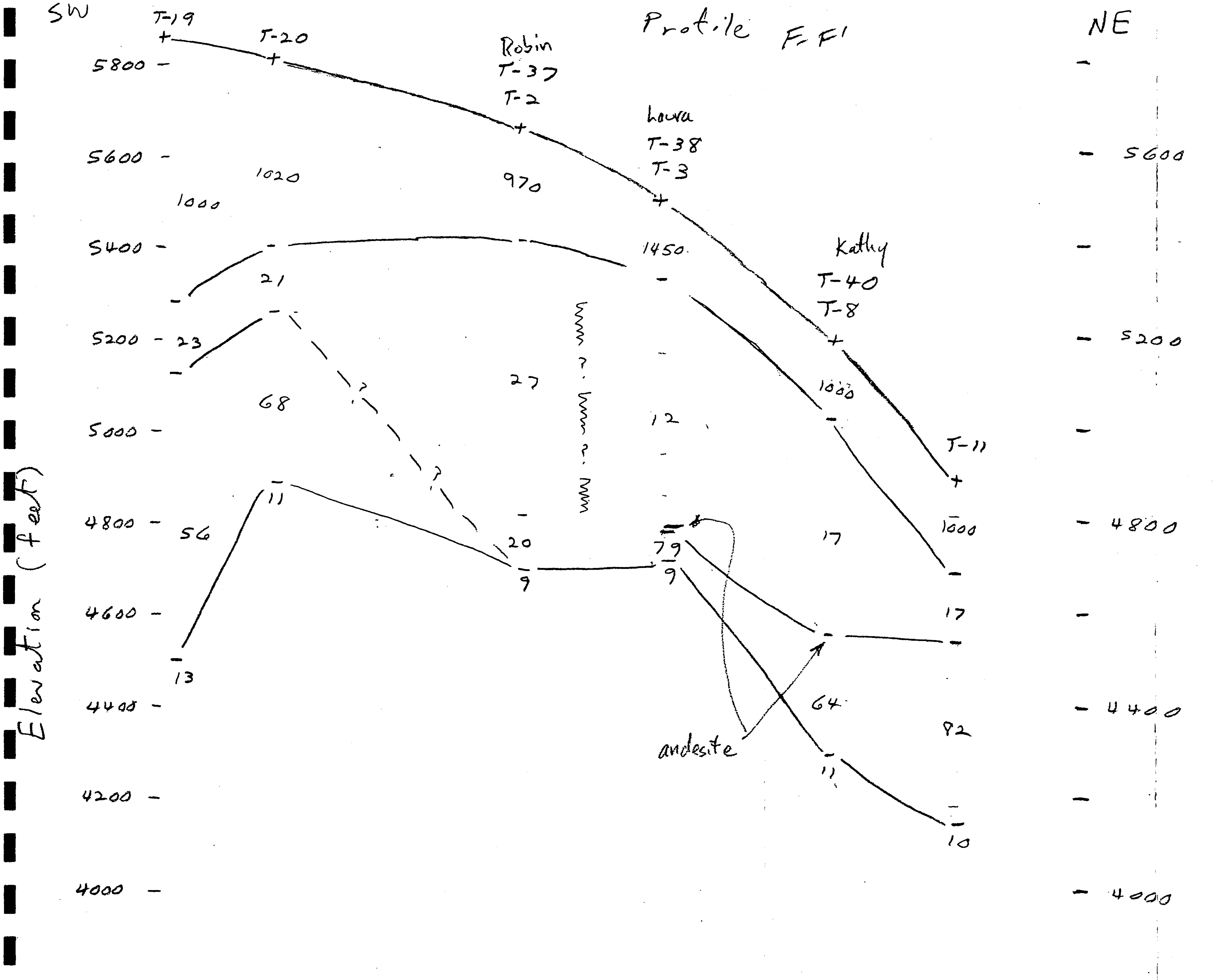


Elevation (feet)
SW
NE
Profile D-D'
D
T-4
Laura
T-38
T-3
Kathy
T-40
T-8
D'
T-11
5800
5600
5400
5200
5000
4800
4600
4400
4200
4000
1050
1450
1000
1000
11
12
72
6
79
9
17
17
64
82
11
10
andesite

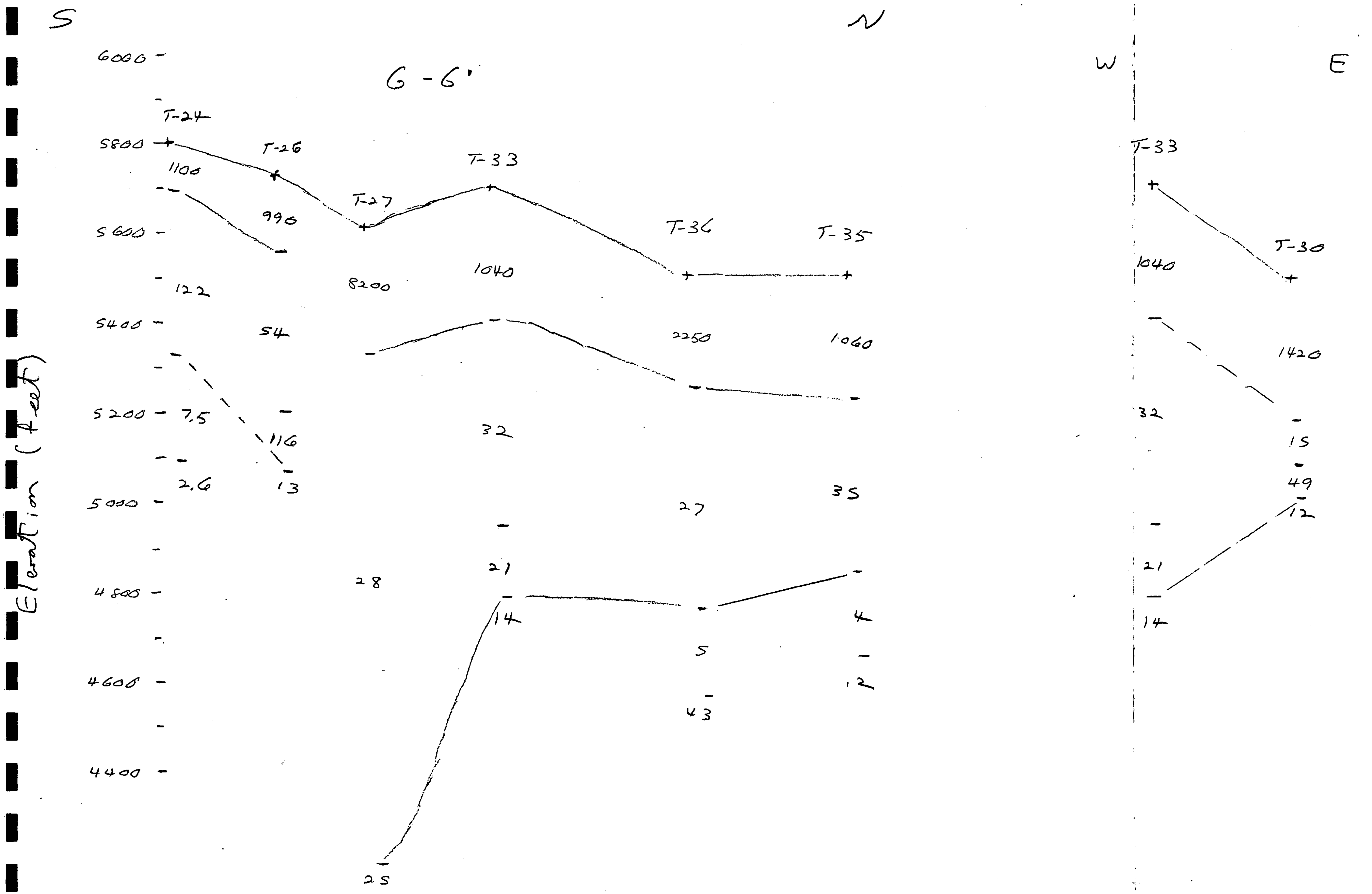


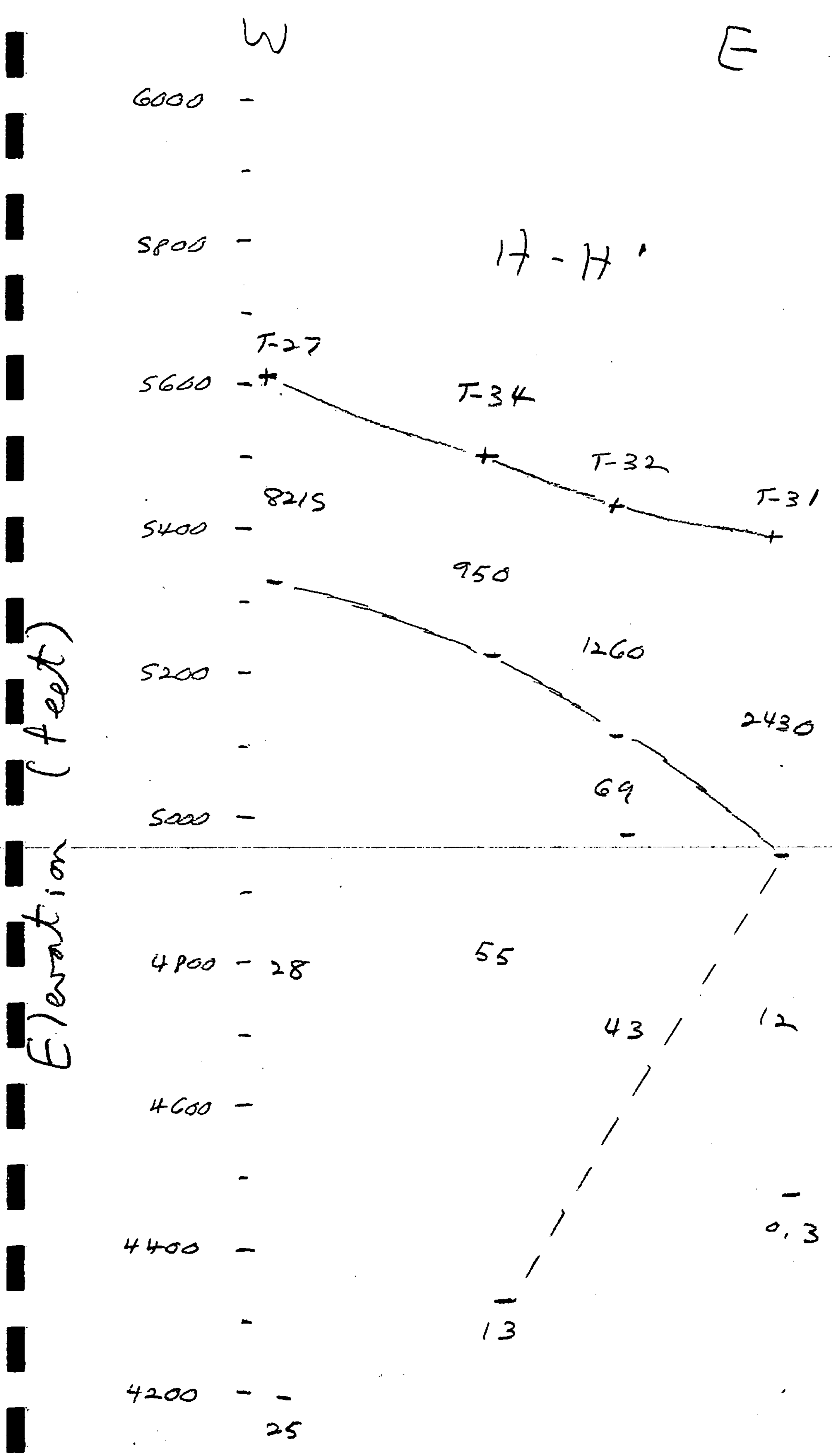
SW
NE
Profile E-E'
E
T-4
Kaye
T-39
T-5
E'
T-9
5600
5200
4800
4400
4000
1050
1690
970
11
16
72
6
80
30
15
24
?
andesite

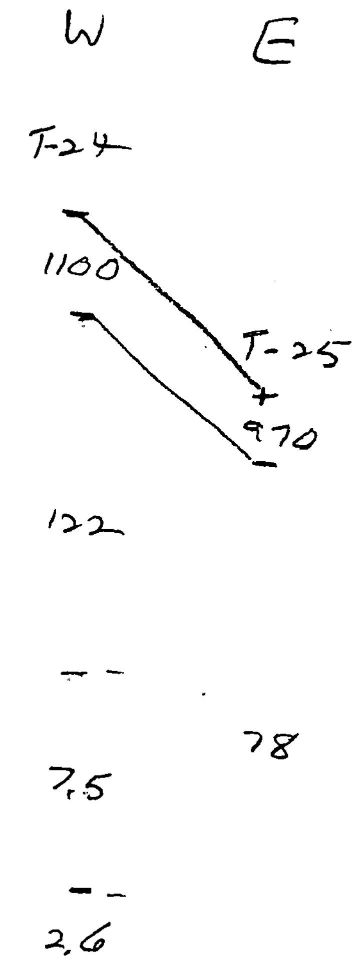
Profile F-F'

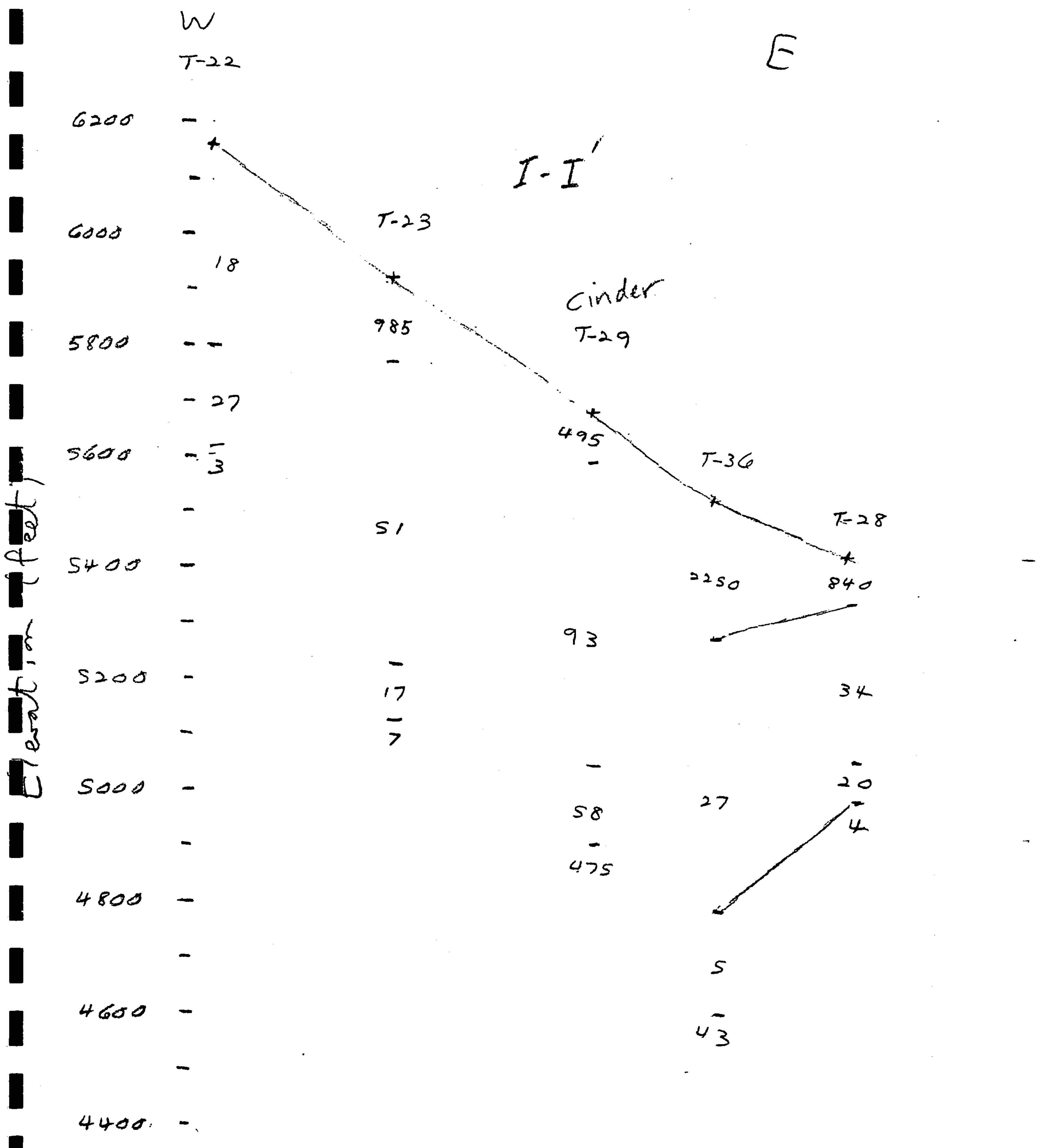


SW
NE
T-19
T-20
Robin
T-37
T-2
Laura
T-38
T-3
Kathy
T-40
T-8
T-11
Elevation (feet)
5800
5600
5400
5200
5000
4800
4600
4400
4200
4000
1000
1020
970
1450
1000
1000
21
23
68
27
12
11
56
20
79
9
9
17
17
13
64
92
11
10
andesite


G - G'
S
N
W
E
Elevation (Feet)
6000
5800
5600
5400
5200
5000
4800
4600
4400
T-24
T-26
T-27
T-33
T-36
T-35
T-30
1100
990
8200
1040
2250
1060
1420
122
54
32
27
35
7,5
116
2,6
13
15
49
12
28
21
14
5
4
43
.2
25


W
E
H - H'
Elevation (feet)
6000
5800
5600
5400
5200
5000
4800
4600
4400
4200
T-27
T-34
T-32
T-31
8215
950
1260
2430
69
28
55
43
12
13
0,3
25


W
E
T-24
T-25
1100
970
122
7,5
78
2,6



W
E
I-I'
T-22
T-23
Cinder
T-29
T-36
T-28
Elevation (feet)
6200
6000
5800
5600
5400
5200
5000
4800
4600
4400
18
27
3
985
51
17
7
495
93
58
475
2250
27
5
43
840
34
20
4