GM 38.09

U.S. DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

Interpretation of transient electromagnetic soundings at the Medicine Lake volcano, Siskiyou County, California

by

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Open-File Report 88-582

1988

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1/ Denver, Colorado.

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INTRODUCTION

In 1983, two reports were published by Anderson et al. (1983a, 1983b) that summarized the results of least-squares inversion of transient electromagnetic (TEM) soundings obtained at the Medicine Lake volcano, California. Since that time, several new interpretation aids have been developed to process TEM data; e.g., Eaton and Hohmann (1988), Newman et al. (1987).

As a sequel to the earlier Medicine Lake work, the present report uses some of these new techniques to further interpret the original Medicine Lake TEM data along several cross-sectional lines. The station location map used by Anderson et al. (1983b) is also used in this report, and is reproduced here as Figure 1. (Note: all figures are given at the end of this report.) Refer to Anderson et al. (1983a, 1983b) on the physical aspects of the loop sizes and TEM configurations used.

INTERPRETATION OF RESULTS

The profile lines studied are marked on Figure 1, and are denoted as lines AA+, BB+, and CC+, respectively. The center point of these lines is approximately located at Medicine Lake (grid square 11), with the lines spanning across the caldera rim (Donnelly-Nolan, 1988, Fig.2) in generally east-west and north-south directions. The sparsity of TEM stations and station spacing used by Anderson et al. (1983a, 1983b) makes a detailed analysis difficult at best.

It should be recognized that we previously assumed localized one-dimensional (1-D) layered earth models beneath each TEM station, as processed separately by least-squares inversion (Anderson et al., 1983a, 1983b). However, it is quite possible that nearby 2-D and/or 3-D structural effects could play a large role in distorting the assumed 1-D layered earth solutions as discussed by Newman et al. (1987). Furthermore, it is obvious that higher dimensional analysis would require many more TEM stations, possibly on a dense grid over the study area. The economy and logistics of such a venture precludes this approach. Thus, I attempted to piece together a crude interpretation of three cross-sections using just the TEM data at hand and the new interpretational aids previously mentioned.

Cross-section AA+

Line AA+ consists of the TEM station numbers as noted at the top of Figure 2. (Note that station 19 was excluded on line AA+ because a smaller loop size and configuration was

used than at the other stations.) Each 1-D layered solution obtained from Anderson et al. (1983a, 1983b) is recast as a continuous distribution of apparent resistivity -vs- depth. Then a grid of points was interpolated in the xz-plane and contoured using the resistivity scale: 10, 15, 30, 50, 70, 100, 300, 500, 1000, 3000, and 4000 ohm-m. A logarithmic transformation of the unequally-spaced data was used before interpolation to an equal-interval grid, and then an anti-logarithmic transformation was finally used prior to contouring; this approach was used for all 1-D layered solutions in this report to minimize the introduction of fictitious anomalies between the original data points at the widely-spaced station locations.

In general, Figure 2 shows highly resistive material exist near the surface, and a lower resistivity zone (denoted by hashed lines) of 10 ohm-m or less occurs at approximately 500 m depth beneath stations 13, 1, and 17. The low resistivity zone in Figure 2 may or may not represent a hydrothermal altered region. Note that the basement (near 1000 m depth) generally has increasing resistivity under stations 13, 7, and 18, but this is questionable when observing the transient responses used in Anderson et al. (1983a, 1983b); i.e., the deeper interpreted layer resistivities generally had poorer standard errors as determined by least-squares for the time-range of the observed TEM data. It should be emphasized that the term "basement" used here is not the true electrical basement, but represents the approximate maximum probing depth obtainable from the TEM survey used.

Cross-section BB+

Line BB+ stations and cross-section contours are shown in Figure 3. Two stations from line AA+ (station 14 and 7) are also used in line BB+, with station 9 substituted for station 13. All 1-D results for line BB+ were processed and contoured as described for line AA+ above. Figure 3 shows a 15 ohm-m band between 500 and 1000 m depth generally between stations 9 and 6, but is not quite as conductive as in the hashed zone for cross-section AA+ (Figure 2).

A closer look at the layered inversion fits for stations 9 and 6 given by Anderson et al. (1983a) reveals that good 1-D layered models could not be obtained at late-time. For these stations, this resulted in a very high resistivity basement that was poorly resolved from the analysis. We suspected that the late-time observed TEM data here was in error, or perhaps, the soundings indicated the presence of a lateral 2-D or 3-D boundary below or near the transmitting loop at these locations. Subsequent studies by Newman et al. (1987) showed that such an effect is possible in the vicinity of a 3-D structure beneath the transmitter loop, or

in the range of the diffusing "smoke-ring" from a single transmitter loop. They also showed that about the best one can do in this situation, using 1-D inversion, is to truncate the observed data at the minimum point, or before the TEM curve begins to rise faster than 1-D models can rise. In this way, at least the depth to the top of a 3-D structure is well estimated with 1-D inversion; however, the conductance (product conductivity and thickness) of a confined 3-D body is over-estimated. (See Newman et al., 1987, p.898-901 for more information on this 3-D/1-D effect.)

The TEM data for stations 9 and 6 were reinverted as suggested by Newman et al. (1987) by truncating the soundings at the respective minimum points. The revised 1-D results for stations 9 and 6 are plotted and listed in Figures 4 and 5, and Figures 6 and 7, respectively. These results indeed reflect a better least-squares solution for low resistivity layers at depth, however, the extent of a possible 3-D body could not be estimated by this 1-D method. The definition of column headings used in figures 5 and 7 are the same as described by Anderson et al. (1983a, Appendix).

A revised line BB2+, with replaced 1-D interpretations for stations 9 and 6 (denoted by an *), is given in Figure 8. Comparing the cross-sections in Figures 3 and 8, we see that the basement is somewhat more realistic in Figure 8 than in Figure 3, and also, a 10 ohm-m zone now is shown, somewhat like in cross-section AA+ (Figure 2). But, again, I would like to stress the fact that much more TEM data would need to be observed before either interpretation (BB+ or BB2+) is marked as "best".

Cross-section CC+

Line CC+ stations and cross-section contours are shown in Figure 9. The method described for line AA+ was used for line CC+ as well. The results from the north-south line CC+ (Figure 9) are somewhat more complex than in the east-west lines AA+ and BB2+. The basement has alternating low (10 ohm-m) and high resistivity zones under stations 3, 15, 1, and 10. Another notable feature in Figure 9 is the shallow (250 m) low resistivity zone beneath station 3. This compares approximately with the shallow low resistivity zone under station 6 in line BB2+ (Figure 8). The area on the map in Figure 1 bounded by stations 3, 15, 4, and 6 (near Bullseye Lake) may be an anomalous near surface conductor distinct from the deeper (>500 m) 10 ohm-m zone shown on the rest of the cross-sections. The significance of this is unknown at this time.

A New Inversion Technique

Eaton and Hohmann (1988) developed a new and rapid inversion technique for processing TEM soundings, which they call an "image" method. The image method uses an approximation based on the diffusion velocity (Raiche and Gallagher, 1985) of TEM waves in any host media. Using observed magnetic field data as a function of time, the approximation leads to an estimate of earth resistivity as a continuous (or discrete) function of depth. This one-to-one mapping (magnetic field to resistivity) is very fast compared to least-squares inversion of layered earth parameters. However, a disadvantage of using the image method is the fact that one usually observes voltage data instead of magnetic field directly as a function of time; an approximation given by Eaton and Hohmann (1987, Appendix) to convert voltage to magnetic field transients (i.e., impulse to step response) can be used as a pre-processing phase to overcome this drawback. Another disadvantage of the image method is that a 1-D approach is still used independently below each station, and therefore, a vertical cross-section (2-D) is at best an interpolation between stations in the xz-plane, same as described above for the least-squares 1-D inversion results and cross-sections.

Nevertheless, all the original observed voltage TEM data from the Medicine Lake area obtained by Anderson et al. (1983a, 1983b) were processed using Eaton and Hohmann's (1988) image inversion scheme. Final output from the program is listed and plotted for all stations in Figures 10-26; the column headings used in these figures define V(t) as the observed voltage, Hz(t) is the converted magnetic field, "Z" is the image depth, and "RES" is the estimated resistivity. These results were truncated and plotted at a maximum image depth of 1100 m, and then processed as cross-section contour maps, denoted as image line AA+ (Figure 27), image line BB+ (Figure 28), and image line CC+ (Figure 29). Comparison of image and least-squares line AA+, Figures 27 and 2, respectively, show a general agreement for the low resistivity (10 ohm-m or less) zones beneath stations 13, 7, and 17. However, the image method does not give the near surface resistivity nearly as high as in Figure 2. (This is also true for the rest of the image contour plots.) Image line BB+ (Figure 28) compares only approximately with the least-squares line BB2+ (Figure 8). The 10 ohm-m zone under stations 6 and 12 in image line BB+ (Figure 28) shows that this zone reaches the surface, which I believe cannot occur here, and thus it was not hashed in to the surface. Image line CC+ (Figure 29) compares somewhat better with least-squares line CC+ (Figure 9) in a few places, notably between stations 3 and 15, which is near Bullseye Lake in Figure 1.

It appears that the image results and cross-sections may be best used in practice as a first approximation to subsequent layered earth least-squares inversion. However, due to the speed of computer processing, the image approach might be useful in the field during the measurement of TEM data. Fast microcomputers could implement the image technique as a byproduct of making TEM observations, thus helping to establish possible other sites dynamically. Least-squares inversion usually requires minicomputers or main-frame systems, and much longer codes than the image method. In addition, the image method does not require any initial estimates of the parameters, such as needed by the least-squares method for a fixed number of layers.

CONCLUSIONS

The interpretation of TEM soundings at the Medicine Lake volcano generally indicate a moderate to deep 10 ohm-m or less resistivity zone starting at a depth of about 500 m, and located directly below the caldera. The vertical and lateral extent of this low resistivity zone is difficult to estimate, due to the time-range of the TEM data, station locations, and signal-to-noise ratio observed at late time.

Because of the sparsity of TEM stations, only three cross-sections were estimated across the caldera. An anomalous shallow 10 ohm-m section starting at 250 m depth and near Bullseye Lake may be a localized intrusion of hydrothermally altered rock. This is hard to interpret more precisely without many more soundings in the Bullseye Lake region.

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Newman, G.A., Anderson, W.L., and Hohmann, G.W., 1987, Interpretation of transient electromagnetic soundings over three-dimensional structures for the central-loop configuration: Geophys. J. Royal astr. Soc., v. 89, n. 3, p. 889-914.

Raiche, A.P., and Gallagher, R.G., 1985, Apparent resistivity and diffusion velocity: Geophysics, v. 50, n. 10, p. 1628-1633.

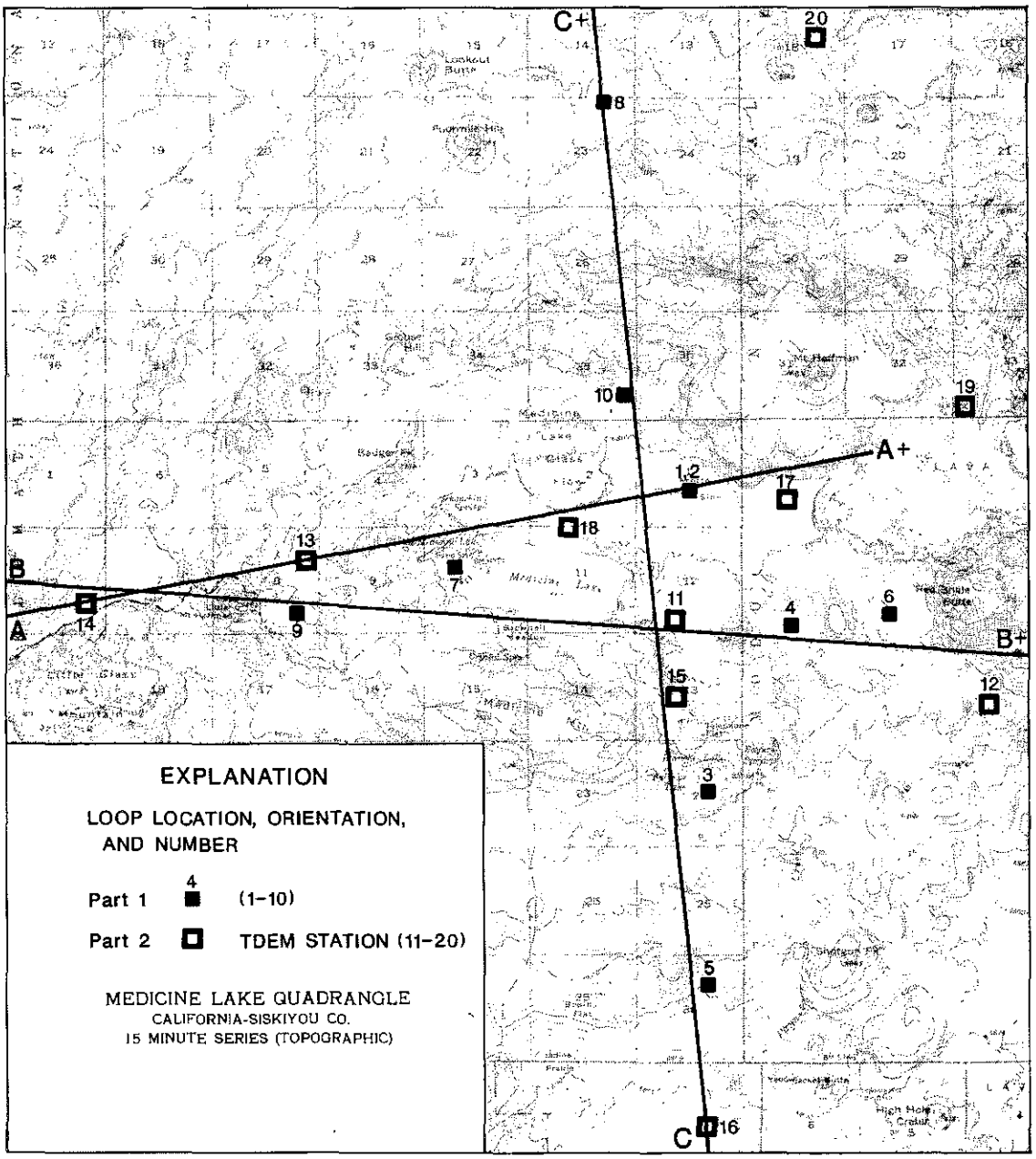

C+
20
8
10
19
A+
1,2
17
18
13
B
7
A
14
9
11
4
6
B+
15
12
3
5
C
16
EXPLANATION
LOOP LOCATION, ORIENTATION, AND NUMBER
Part 1 4 (1-10)
Part 2 TDEM STATION (11-20)
MEDICINE LAKE QUADRANGLE
CALIFORNIA-SISKIYOU CO.
15 MINUTE SERIES (TOPOGRAPHIC)
0 4 mi
0 5 km
GN
0°55'
16 MILS
19½°
347 MILS
UTM GRID AND 1952 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET
CALIF
QUADRANGLE LOCATION

Figure 1.

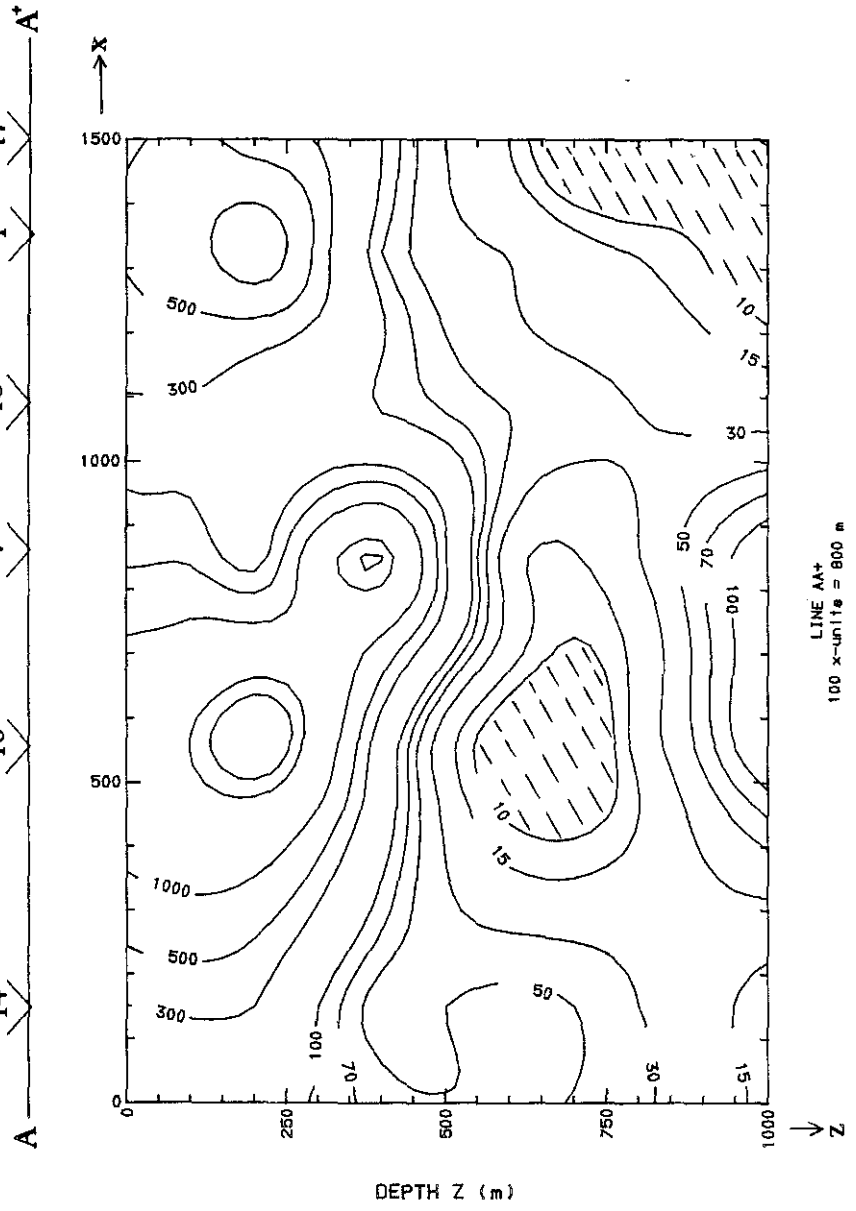

A
A+
17
1
18
7
13
14
X
Z
1500
1000
500
0
250
500
750
1000
DEPTH Z (m)
500
300
1000
500
300
100
70
50
30
15
10
15
10
15
30
50
70
100
LINE AA+
100 x-units = 800 m

Fig. 2

Fig. 2

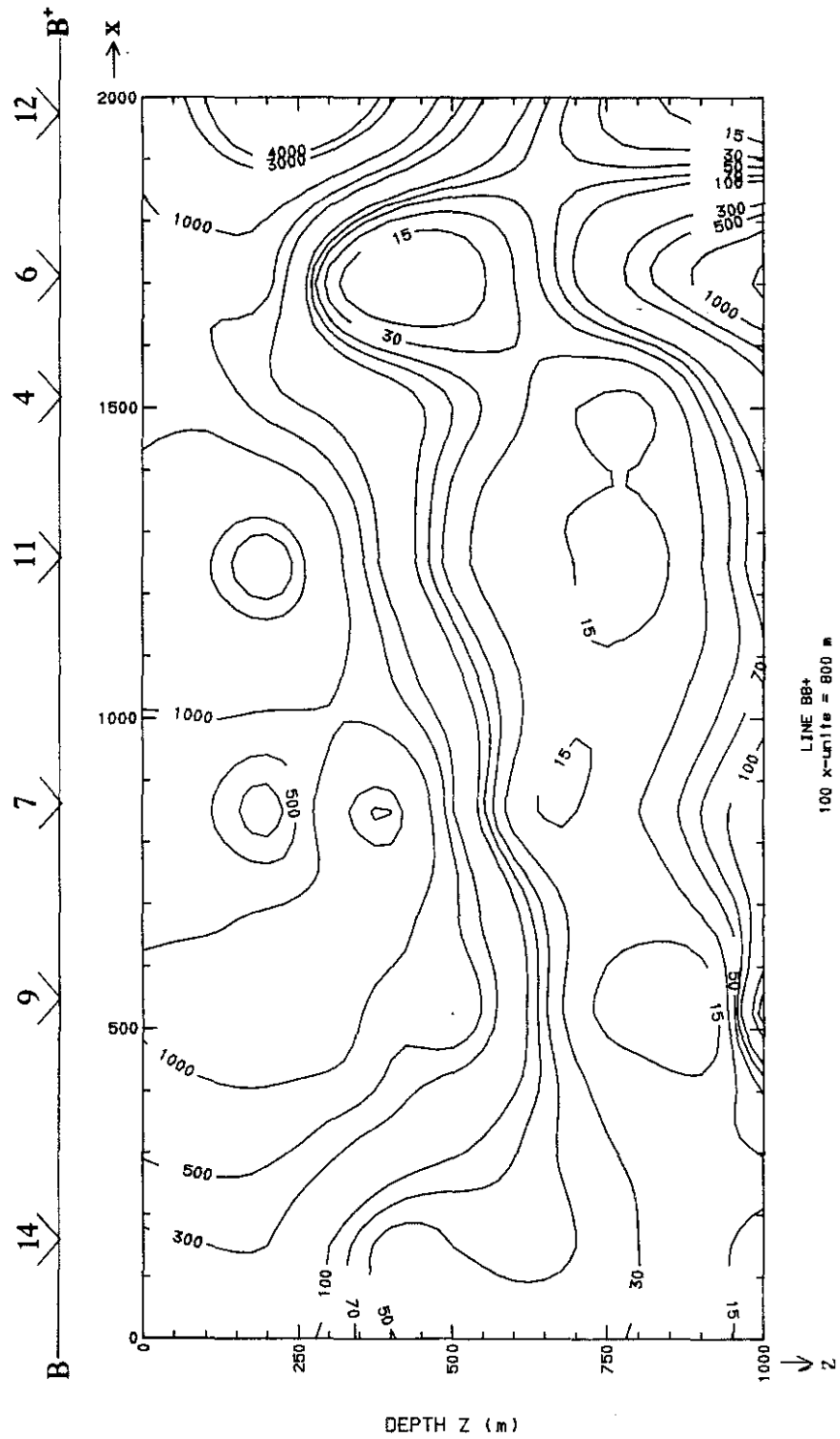
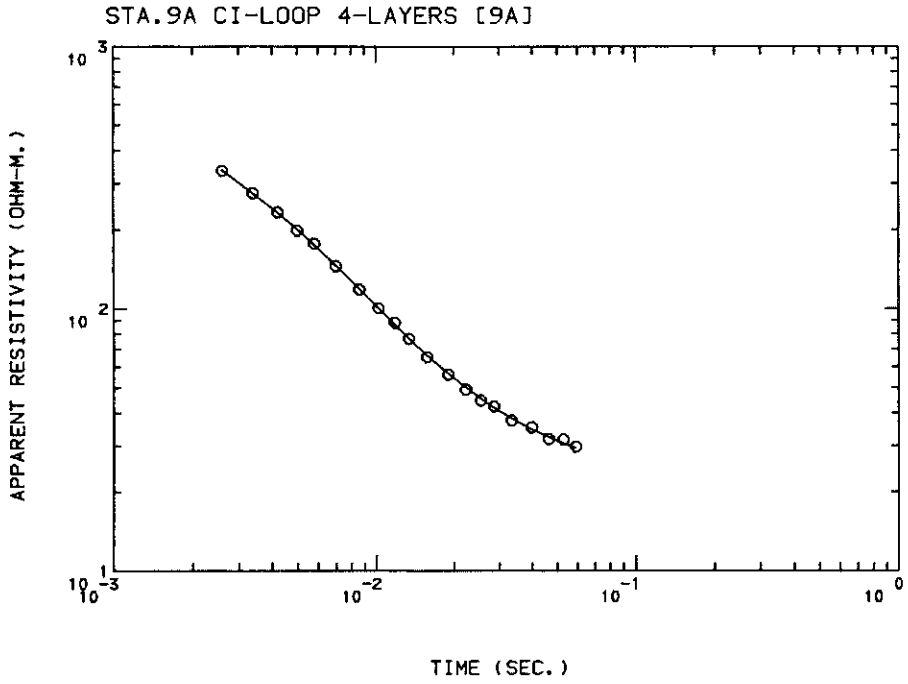

B+
B
x
z
12
6
4
11
7
9
14
2000
1500
1000
500
0
0
250
500
750
1000
4000
3000
1000
15
30
500
300
100
70
50
LINE BB+
100 x-units = 800 m
DEPTH Z (m)

Fig. 3

Fig. 3


STA.9A CI-LOOP 4-LAYERS [9A]
APPARENT RESISTIVITY (OHM-M.)
TIME (SEC.)

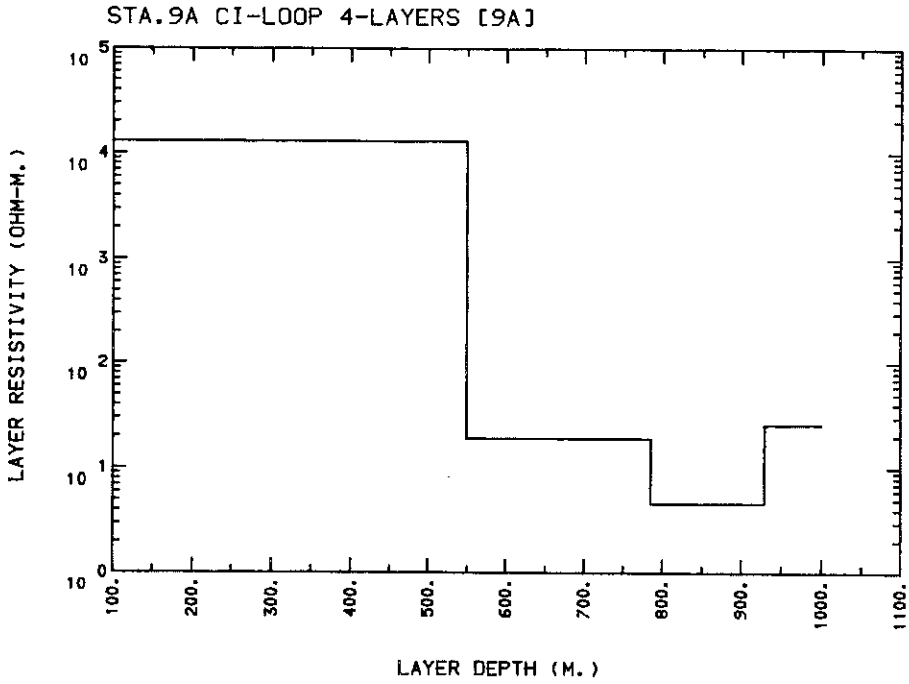

STA.9A CI-LOOP 4-LAYERS [9A]
LAYER RESISTIVITY (OHM-M.)
LAYER DEPTH (M.)

Fig. 4

```
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 A= 0.257950E+03  (equivalent loop radius)
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***** X-CONVERGENCE *****

  I     OBS.Y(I)       CAL            RES         %RES.ERR       X(I,1)
  1  0.334950E+03  0.336326E+03 -0.138E+01 -0.409111E+00  0.260000E-02
  2  0.275150E+03  0.274235E+03  0.915E+00  0.333614E+00  0.340000E-02
  3  0.232910E+03  0.232061E+03  0.849E+00  0.365904E+00  0.420000E-02
  4  0.198440E+03  0.200212E+03 -0.177E+01 -0.885003E+00  0.500000E-02
  5  0.176990E+03  0.174932E+03  0.206E+01  0.117659E+01  0.580000E-02
  6  0.145490E+03  0.145877E+03 -0.387E+00 -0.265329E+00  0.700000E-02
  7  0.118310E+03  0.118773E+03 -0.463E+00 -0.389676E+00  0.860000E-02
  8  0.100250E+03  0.100007E+03  0.243E+00  0.242490E+00  0.102000E-01
  9  0.883630E+02  0.865543E+02  0.181E+01  0.208963E+01  0.118000E-01
 10  0.765070E+02  0.766678E+02 -0.161E+00 -0.209742E+00  0.134000E-01
 11  0.652650E+02  0.660240E+02 -0.759E+00 -0.114954E+01  0.158000E-01
 12  0.559110E+02  0.564525E+02 -0.541E+00 -0.959194E+00  0.190000E-01
 13  0.489930E+02  0.499741E+02 -0.981E+00 -0.196314E+01  0.222000E-01
 14  0.447180E+02  0.453785E+02 -0.660E+00 -0.145547E+01  0.254000E-01
 15  0.424660E+02  0.419515E+02  0.514E+00  0.122630E+01  0.286000E-01
 16  0.374820E+02  0.381705E+02 -0.688E+00 -0.180375E+01  0.334000E-01
 17  0.352890E+02  0.347179E+02  0.571E+00  0.164487E+01  0.398000E-01
 18  0.318470E+02  0.323910E+02 -0.544E+00 -0.167956E+01  0.462000E-01
 19  0.317110E+02  0.307036E+02  0.101E+01  0.328100E+01  0.526000E-01
 20  0.298230E+02  0.294044E+02  0.419E+00  0.142344E+01  0.590000E-01

** RMSERR=  0.12205231E+01  AVE|%RES.ERR|=  0.114767E+01

CORRELATION MATRIX
 1  0.1000E+01
 2 -0.1966E+00  0.1000E+01
 3 -0.2344E+00 -0.1035E+00  0.1000E+01
 4 -0.3581E+00 -0.5436E+00  0.1482E+00  0.1000E+01
 5 -0.1940E+00  0.9097E+00 -0.1199E+00 -0.4258E+00  0.1000E+01
 6  0.2516E+00 -0.1029E+00 -0.1348E+00 -0.2420E+00 -0.1668E+00  0.1000E+01
 7  0.2049E+00  0.2129E+00 -0.4832E+00 -0.4680E+00 -0.2467E-01  0.4070E+00  0.1000E+01

  **PARM_SOL.    STD_ERROR    REL_ERROR     % ERROR **

 1  0.7735E-04  0.2791E-04  0.1003E-01  0.1003E+01
 2  0.5203E-01  0.9383E-03  0.1300E-01  0.1300E+01
 3  0.2160E+00  0.1368E-02  0.9273E-02  0.9273E+00
 4  0.3867E-01  0.1038E-02  0.1667E-01  0.1667E+01
 5  0.5489E+03  0.3037E-02  0.3661E-02  0.3661E+00
 6  0.2358E+03  0.3919E-02  0.7872E-02  0.7872E+00
 7  0.1445E+03  0.9293E-02  0.2462E-01  0.2462E+01

PARAMETER NAME       FINAL SOLUTION        RESISTIVITY   LAYER DEPTH

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   3   SIGMA( 3) =  0.21597953E+00   3  0.46300683E+01
   4   SIGMA( 4) =  0.38674708E-01   4  0.25856691E+02
   5   THICK( 1) =  0.54886871E+03                      1  0.54886871E+03
   6   THICK( 2) =  0.23577098E+03                      2  0.78463971E+03
   7   THICK( 3) =  0.14450076E+03                      3  0.92914050E+03
   8 * SHIFT     =  0.10000000E+01

     * FIXED
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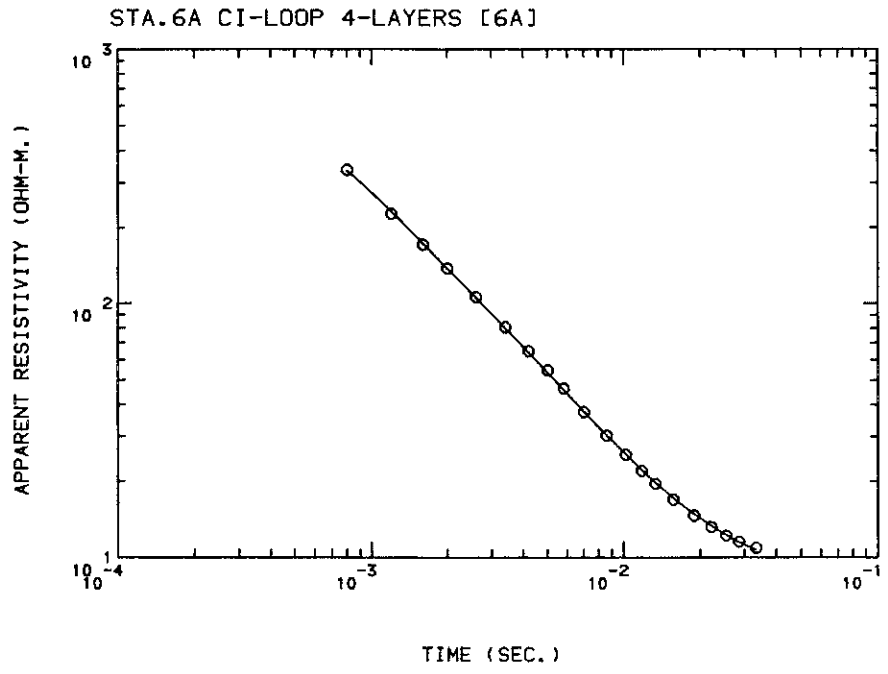
Fig. 5


STA.6A CI-LOOP 4-LAYERS [6A]
APPARENT RESISTIVITY (OHM-M.)
TIME (SEC.)

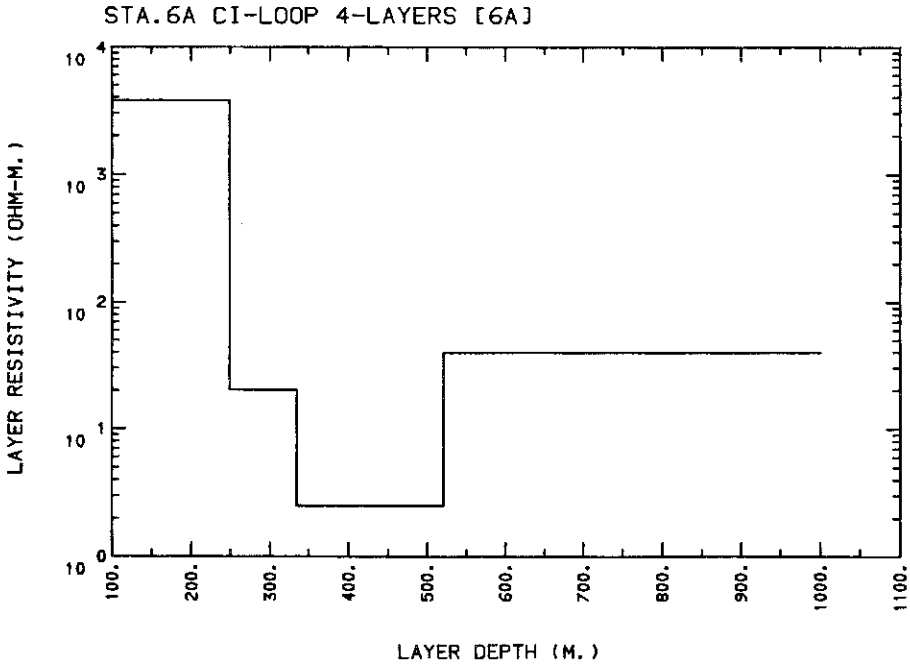

STA.6A CI-LOOP 4-LAYERS [6A]
LAYER RESISTIVITY (OHM-M.)
LAYER DEPTH (M.)

Fig. 6

```
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***** VARIABILITY CONVERGENCE *****

  I     OBS.Y(I)       CAL            RES         %RES.ERR       X(I,1)
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  2   0.226150E+03  0.230209E+03 -0.406E+01 -0.176309E+01  0.120000E-02
  3   0.171010E+03  0.172507E+03 -0.150E+01 -0.867595E+00  0.160000E-02
  4   0.137660E+03  0.137244E+03  0.416E+00  0.302887E+00  0.200000E-02
  5   0.105460E+03  0.104718E+03  0.742E+00  0.708816E+00  0.260000E-02
  6   0.803470E+02  0.794658E+02  0.881E+00  0.110895E+01  0.340000E-02
  7   0.647570E+02  0.639421E+02  0.815E+00  0.127448E+01  0.420000E-02
  8   0.545770E+02  0.533697E+02  0.121E+01  0.226209E+01  0.500000E-02
  9   0.463230E+02  0.457165E+02  0.606E+00  0.132662E+01  0.580000E-02
 10   0.374370E+02  0.375377E+02 -0.101E+00 -0.268265E+00  0.700000E-02
 11   0.302070E+02  0.302933E+02 -0.863E-01 -0.284756E+00  0.860000E-02
 12   0.254090E+02  0.255065E+02 -0.975E-01 -0.382069E+00  0.102000E-01
 13   0.219990E+02  0.221659E+02 -0.167E+00 -0.752833E+00  0.118000E-01
 14   0.195750E+02  0.197285E+02 -0.153E+00 -0.778051E+00  0.134000E-01
 15   0.169000E+02  0.171310E+02 -0.231E+00 -0.134828E+01  0.158000E-01
 16   0.146440E+02  0.148529E+02 -0.209E+00 -0.140620E+01  0.190000E-01
 17   0.132100E+02  0.133489E+02 -0.139E+00 -0.104066E+01  0.222000E-01
 18   0.122220E+02  0.122942E+02 -0.722E-01 -0.587244E+00  0.254000E-01
 19   0.115550E+02  0.115178E+02  0.372E-01  0.323103E+00  0.286000E-01
 20   0.109140E+02  0.106870E+02  0.227E+00  0.212433E+01  0.334000E-01

** RMSERR=  0.14971093E+01  AVE|%RES.ERR|=  0.982721E+00

CORRELATION MATRIX
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 2  0.4308E+00  0.1000E+01
 3 -0.1984E-01 -0.1137E+00  0.1000E+01
 4 -0.1643E+00 -0.3885E+00  0.5924E+00  0.1000E+01
 5  0.4416E+00  0.9806E+00 -0.2826E+00 -0.4984E+00  0.1000E+01
 6 -0.4407E+00 -0.9375E+00  0.3472E+00  0.6059E+00 -0.9740E+00  0.1000E+01
 7 -0.1268E+00 -0.1030E+00 -0.5344E+00 -0.5733E+00 -0.1103E-02 -0.1560E+00  0.1000E+01

  **PARM_SOL.    STD_ERROR    REL_ERROR     % ERROR **

 1  0.2654E-03  0.7003E-04  0.2355E-01  0.2355E+01
 2  0.4959E-01  0.2933E-02  0.7213E-01  0.7213E+01
 3  0.3986E+00  0.2288E-02  0.1981E-01  0.1981E+01
 4  0.2510E-01  0.4120E-02  0.1424E+00  0.1424E+02
 5  0.2492E+03  0.8499E-02  0.1631E-01  0.1631E+01
 6  0.8550E+02  0.1169E-01  0.3984E-01  0.3984E+01
 7  0.1862E+03  0.1368E-01  0.3081E-01  0.3081E+01

PARAMETER NAME       FINAL SOLUTION        RESISTIVITY   LAYER DEPTH

   1    SIGMA( 1) =  0.26538665E-03   1  0.37680869E+04
   2    SIGMA( 2) =  0.49589511E-01   2  0.20165554E+02
   3    SIGMA( 3) =  0.39857146E+00   3  0.25089605E+01
   4    SIGMA( 4) =  0.25096988E-01   4  0.39845417E+02
   5    THICK( 1) =  0.24920154E+03                      1  0.24920154E+03
   6    THICK( 2) =  0.85504211E+02                      2  0.33470575E+03
   7    THICK( 3) =  0.18620593E+03                      3  0.52091168E+03
   8 * SHIFT      =  0.10000000E+01

     * FIXED
```


Fig. 7

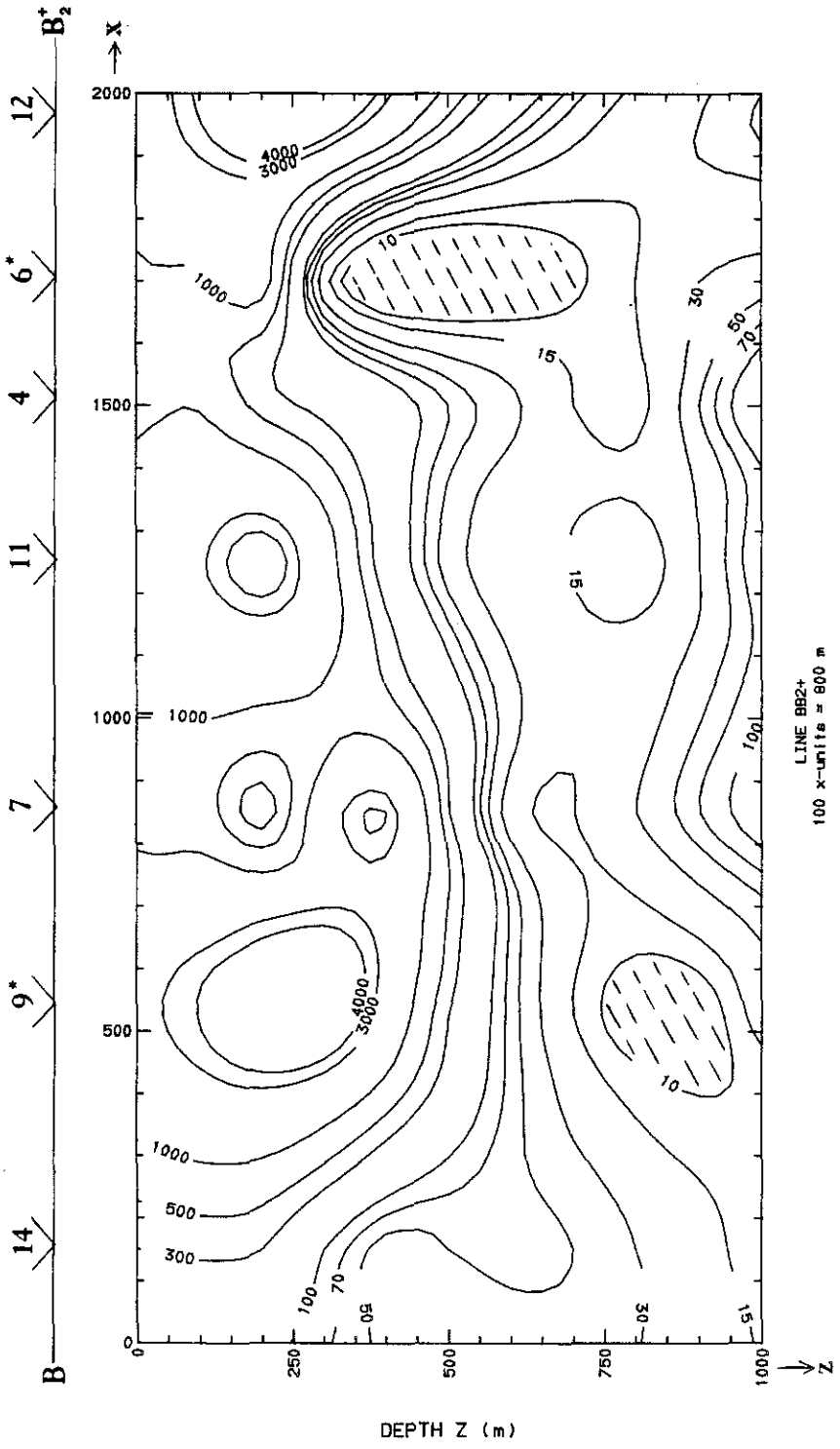
B+2
B
X
Z
12
6*
4
11
7
9*
14
2000
1500
1000
500
0
4000
3000
1000
500
300
100
70
50
30
15
10
0
250
500
750
1000
LINE BB2+
100 x-units = 900 m
DEPTH Z (m)

Fig. 8

Fig. 8

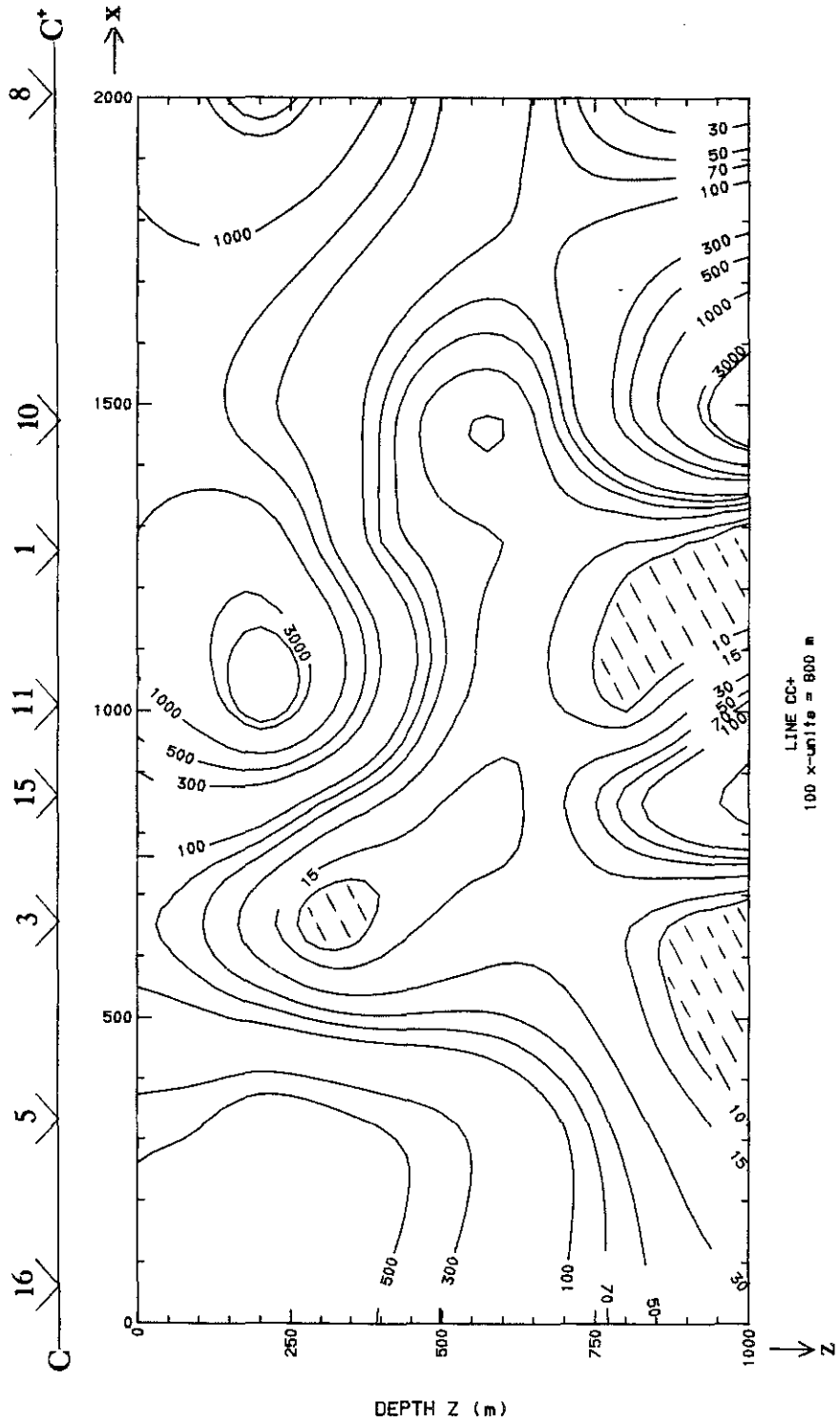
C
C'
x
z
8
10
1
11
15
3
5
16
2000
1500
1000
500
0
250
500
750
1000
DEPTH Z (m)
LINE CC+
100 x-units = 800 m

Fig. 9

Fig. 9

MED.LAKE STA.1 [F]

	TIME t (s)	V(t)	Hz(t)	Z (m)	RES.(Ohm-m)
1	0.8000000E-03	0.2814058E-07	0.2773841E-04	452.6576	146.8129
2	0.1200000E-02	0.1477383E-07	0.2091178E-04	500.0688	8.068719
3	0.1600000E-02	0.8978363E-08	0.1713339E-04	536.7825	32.51300
4	0.2000000E-02	0.5894857E-08	0.1476742E-04	565.2654	17.57367
5	0.2600000E-02	0.3801282E-08	0.1245341E-04	599.1295	17.21228
6	0.3400000E-02	0.2427498E-08	0.1047122E-04	635.9420	15.25346
7	0.4200000E-02	0.1708215E-08	0.9155114E-05	666.6247	12.10348
8	0.5000000E-02	0.1266069E-08	0.8208606E-05	690.9105	11.14064
9	0.5800000E-02	0.1033944E-08	0.7476673E-05	714.5115	12.19782
10	0.7000000E-02	0.7871049E-09	0.6607331E-05	744.9279	10.51837
11	0.8600000E-02	0.5903807E-09	0.5730506E-05	781.9646	11.72333
12	0.1020000E-01	0.4588027E-09	0.5062658E-05	816.0280	11.49324
13	0.1180000E-01	0.3646018E-09	0.4538528E-05	846.8420	11.22468
14	0.1340000E-01	0.3016311E-09	0.4114444E-05	875.5301	11.34097
15	0.1580000E-01	0.2336781E-09	0.3603304E-05	915.6295	11.66857
16	0.1900000E-01	0.1776216E-09	0.3079653E-05	965.7739	12.53461
17	0.2220000E-01	0.1421320E-09	0.2672556E-05	1013.190	13.26318
18	0.2540000E-01	0.1105312E-09	0.2350875E-05	1058.002	13.30866
19	0.2860000E-01	0.9081379E-10	0.2094531E-05	1099.880	13.58054
20	0.3340000E-01	0.7046210E-10	0.1786529E-05	1160.520	14.82171
21	0.3980000E-01	0.5075555E-10	0.1477861E-05	1237.007	15.27288
22	0.4620000E-01	0.3825048E-10	0.1251216E-05	1308.085	15.68256
23	0.5260000E-01	0.3014787E-10	0.1077046E-05	1375.784	16.38249
24	0.5900000E-01	0.2464107E-10	0.9375318E-06	1441.180	18.00448
25	0.6860000E-01	0.1963312E-10	0.7684204E-06	1540.703	21.85076

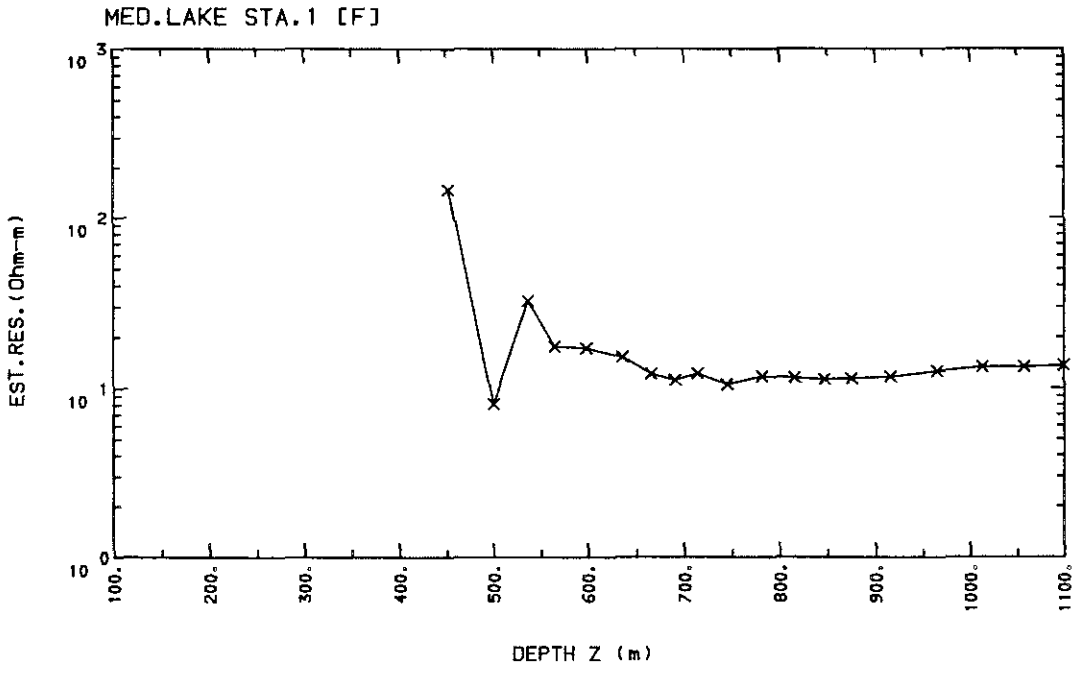

Fig. 10

MED.LAKE STA.3 [A]

	TIME t (s)	V(t)	Hz(t)	Z (m)	RES.(Ohm-m)
1	0.8000000E-03	0.4379000E-06	0.3461315E-03	165.6824	19.54085
2	0.1200000E-02	0.1955000E-06	0.2453732E-03	194.5852	4.508749
3	0.1600000E-02	0.1170000E-06	0.1956621E-03	214.4064	4.051740
4	0.2000000E-02	0.8135000E-07	0.1641095E-03	231.1697	3.490939
5	0.2600000E-02	0.5216500E-07	0.1322458E-03	252.7171	4.038093
6	0.3400000E-02	0.3401700E-07	0.1048201E-03	277.1249	5.292808
7	0.4200000E-02	0.2423700E-07	0.8628186E-04	298.8416	5.980507
8	0.5000000E-02	0.1831800E-07	0.7273957E-04	318.5060	6.917862
9	0.5800000E-02	0.1447700E-07	0.6230321E-04	337.8041	8.234689
10	0.7000000E-02	0.1055200E-07	0.5035473E-04	365.4212	9.320056
11	0.8600000E-02	0.7218500E-08	0.3904309E-04	400.9063	11.13297
12	0.1020000E-01	0.5190000E-08	0.3114458E-04	434.9654	12.04136
13	0.1180000E-01	0.3811700E-08	0.2541463E-04	467.1289	12.91474
14	0.1340000E-01	0.2902400E-08	0.2114084E-04	498.4601	14.18578
15	0.1580000E-01	0.1978700E-08	0.1648012E-04	543.8333	15.34326
16	0.1900000E-01	0.1248000E-08	0.1237202E-04	600.7255	15.82624
17	0.2220000E-01	0.8286500E-09	0.9728112E-05	652.7184	15.25277
18	0.2540000E-01	0.5676500E-09	0.7950399E-05	699.5075	13.80365
19	0.2860000E-01	0.4020000E-09	0.6715879E-05	741.0009	12.52542
20	0.3340000E-01	0.2728200E-09	0.5427122E-05	796.8333	11.58107
21	0.3980000E-01	0.1653400E-09	0.4311392E-05	861.7300	9.986535
22	0.4620000E-01	0.1188900E-09	0.3587629E-05	917.1388	8.804315
23	0.5260000E-01	0.8363500E-10	0.3071920E-05	966.5897	8.147869
24	0.5900000E-01	0.6838500E-10	0.2684816E-05	1011.503	7.927237
25	0.6860000E-01	0.4731700E-10	0.2242876E-05	1074.902	7.954424
26	0.8140000E-01	0.3286700E-10	0.1834509E-05	1150.210	7.037002
27	0.9420000E-01	0.2246700E-10	0.1552699E-05	1216.619	6.985835

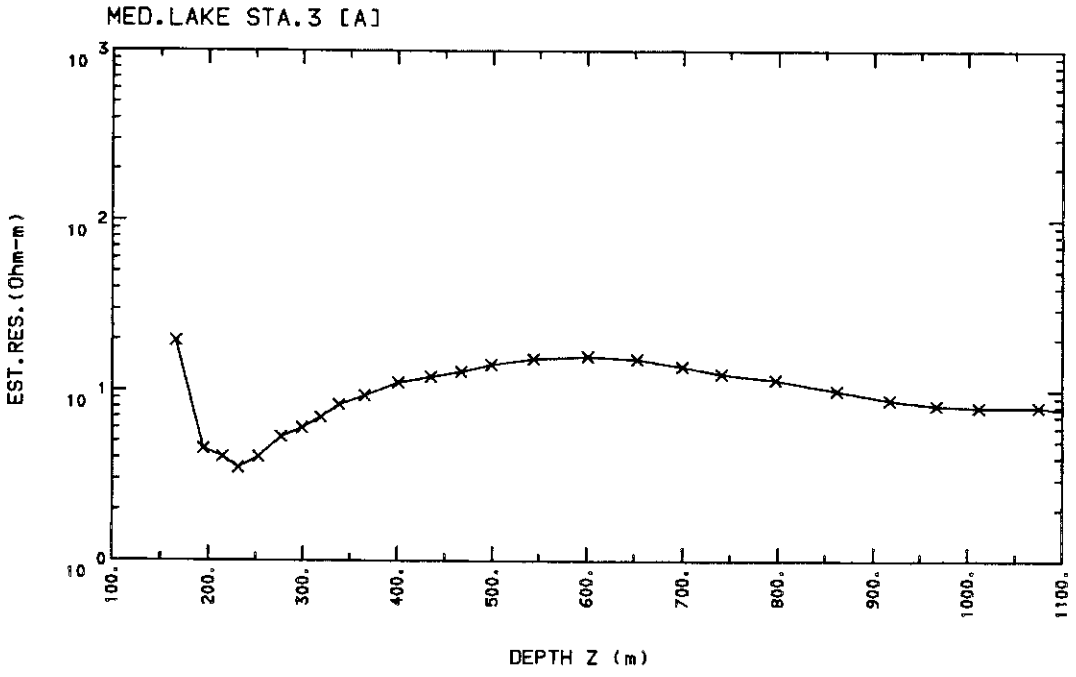

Fig. 11

MED.LAKE STA.4 [G]

	TIME t (s)	V(t)	Hz(t)	Z (m)	RES.(Ohm-m)
1	0.8000000E-03	0.1743000E-07	0.3095704E-04	435.6412	93.90369
2	0.1200000E-02	0.1095500E-07	0.2644168E-04	460.4488	2.915980
3	0.1600000E-02	0.7463000E-08	0.2351183E-04	480.0370	6.361572
4	0.2000000E-02	0.5589500E-08	0.2143550E-04	495.8814	2.922499
5	0.2600000E-02	0.4061000E-08	0.1913238E-04	516.4508	3.515581
6	0.3400000E-02	0.2821500E-08	0.1694216E-04	538.8499	2.862787
7	0.4200000E-02	0.2201000E-08	0.1534385E-04	557.7247	3.604664
8	0.5000000E-02	0.1781900E-08	0.1407637E-04	574.5369	4.241511
9	0.5800000E-02	0.1498300E-08	0.1303251E-04	590.3452	4.492689
10	0.7000000E-02	0.1213000E-08	0.1173817E-04	611.4196	4.841372
11	0.8600000E-02	0.9382500E-09	0.1036882E-04	638.7947	5.985589
12	0.1020000E-01	0.7679999E-09	0.9282719E-05	663.7301	5.779578
13	0.1180000E-01	0.6356000E-09	0.8389272E-05	686.6818	6.247862
14	0.1340000E-01	0.5415800E-09	0.7639949E-05	709.0639	6.907217
15	0.1580000E-01	0.4303300E-09	0.6711921E-05	741.2202	7.474757
16	0.1900000E-01	0.3355800E-09	0.5736795E-05	782.0075	8.166605
17	0.2220000E-01	0.2599500E-09	0.4978590E-05	820.5394	8.659180
18	0.2540000E-01	0.2146600E-09	0.4374336E-05	857.4264	9.331227
19	0.2860000E-01	0.1752600E-09	0.3877906E-05	893.2634	9.945539
20	0.3340000E-01	0.1359800E-09	0.3283506E-05	945.0372	10.85450
21	0.3980000E-01	0.9985000E-10	0.2682988E-05	1011.737	11.84653
22	0.4620000E-01	0.7235000E-10	0.2244498E-05	1074.522	12.08853
23	0.5260000E-01	0.5769000E-10	0.1913364E-05	1133.898	12.70583
24	0.5900000E-01	0.4490800E-10	0.1652109E-05	1191.371	13.30004
25	0.6860000E-01	0.3227500E-10	0.1357298E-05	1272.789	13.35875
26	0.8140000E-01	0.2087500E-10	0.1086611E-05	1371.521	12.23009
27	0.9420000E-01	0.1413300E-10	0.9052970E-06	1458.190	11.86510

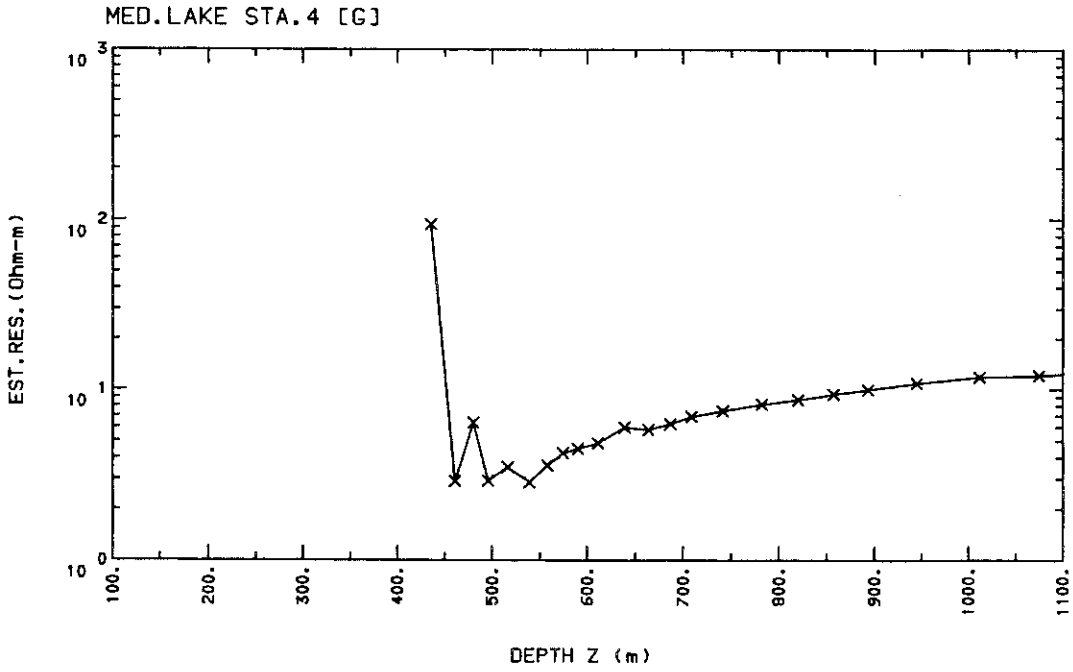

Fig. 12

MED.LAKE STA.5 [H]

	TIME t (s)	V(t)	Hz(t)	Z (m)	RES.(Ohm-m)
1	0.8000000E-03	0.1056000E-07	0.1028243E-04	640.0795	289.8165
2	0.1200000E-02	0.4343500E-08	0.7911650E-05	700.4213	8.512280
3	0.1600000E-02	0.2638500E-08	0.6800985E-05	738.0231	34.30034
4	0.2000000E-02	0.1866500E-08	0.6084350E-05	766.7859	17.46571
5	0.2600000E-02	0.1184200E-08	0.5356292E-05	800.1732	15.94729
6	0.3400000E-02	0.7818999E-09	0.4730619E-05	834.6901	11.90669
7	0.4200000E-02	0.5811800E-09	0.4296846E-05	862.2927	10.36332
8	0.5000000E-02	0.4531800E-09	0.3967682E-05	885.8192	9.616709
9	0.5800000E-02	0.3652500E-09	0.3707232E-05	906.7461	8.948213
10	0.7000000E-02	0.2811300E-09	0.3398660E-05	933.7844	7.775112
11	0.8600000E-02	0.2155600E-09	0.3082497E-05	964.8800	7.763739
12	0.1020000E-01	0.1672300E-09	0.2838835E-05	993.0589	7.158998
13	0.1180000E-01	0.1407700E-09	0.2642781E-05	1016.991	6.322391
14	0.1340000E-01	0.1153700E-09	0.2479738E-05	1039.086	6.394201
15	0.1580000E-01	0.9560800E-10	0.2278285E-05	1069.219	6.221056
16	0.1900000E-01	0.7675000E-10	0.2058846E-05	1106.274	6.542090
17	0.2220000E-01	0.6273300E-10	0.1881262E-05	1140.523	6.513466
18	0.2540000E-01	0.5326800E-10	0.1733574E-05	1172.204	6.694894
19	0.2860000E-01	0.4550000E-10	0.1607827E-05	1202.413	6.659126
20	0.3340000E-01	0.3386800E-10	0.1456251E-05	1243.173	6.173784
21	0.3980000E-01	0.2930800E-10	0.1295380E-05	1292.926	6.416599
22	0.4620000E-01	0.2042500E-10	0.1168740E-05	1338.396	5.594378
23	0.5260000E-01	0.1721700E-10	0.1072888E-05	1377.389	5.500376
24	0.5900000E-01	0.1766700E-10	0.9840596E-06	1417.920	7.428136
25	0.6860000E-01	0.1475600E-10	0.8602155E-06	1483.384	9.457768
26	0.8140000E-01	0.1165600E-10	0.7257023E-06	1570.516	10.81189
27	0.9420000E-01	0.9344300E-11	0.6187503E-06	1656.707	12.43626

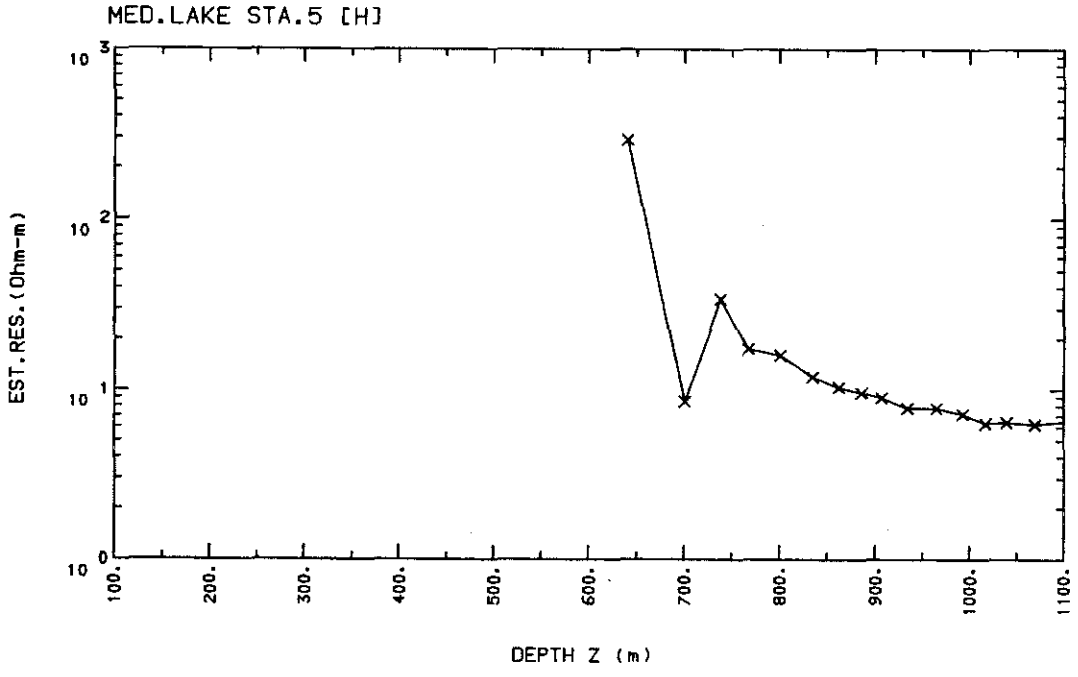

Fig. 13

MED.LAKE STA.6 [C]

	TIME t (s)	V(t)	Hz(t)	Z (m)	RES.(Ohm-m)
1	0.8000000E-03	0.3266000E-07	0.8428149E-04	301.4819	33.04400
2	0.1200000E-02	0.2153000E-07	0.7566120E-04	314.0714	1.457991
3	0.1600000E-02	0.1595700E-07	0.6969794E-04	323.9561	2.937496
4	0.2000000E-02	0.1265100E-07	0.6514711E-04	331.9305	2.058157
5	0.2600000E-02	0.9790000E-08	0.5979150E-04	343.0909	1.809834
6	0.3400000E-02	0.7526700E-08	0.5428080E-04	355.3138	1.393960
7	0.4200000E-02	0.6132000E-08	0.4993419E-04	366.2857	1.216374
8	0.5000000E-02	0.5126700E-08	0.4635132E-04	376.2859	1.083573
9	0.5800000E-02	0.4520000E-08	0.4328146E-04	385.9071	1.022182
10	0.7000000E-02	0.3882300E-08	0.3927032E-04	399.7090	1.080479
11	0.8600000E-02	0.3200000E-08	0.3476215E-04	417.9766	1.945337
12	0.1020000E-01	0.2707200E-08	0.3100198E-04	435.0872	2.512804
13	0.1180000E-01	0.2334800E-08	0.2779254E-04	452.3858	3.483060
14	0.1340000E-01	0.2025200E-08	0.2501723E-04	469.9573	4.058780
15	0.1580000E-01	0.1674000E-08	0.2148505E-04	495.6441	4.859620
16	0.1900000E-01	0.1311600E-08	0.1768390E-04	530.6248	6.398264
17	0.2220000E-01	0.1040100E-08	0.1468981E-04	566.0277	7.737610
18	0.2540000E-01	0.8370000E-09	0.1229997E-04	601.9437	9.286037
19	0.2860000E-01	0.6787700E-09	0.1037015E-04	638.5173	10.90783
20	0.3340000E-01	0.5037700E-09	0.8111757E-05	694.6319	13.62564
21	0.3980000E-01	0.3436700E-09	0.5953836E-05	772.0705	17.41360
22	0.4620000E-01	0.2392900E-09	0.4469387E-05	851.2742	20.98444
23	0.5260000E-01	0.1719900E-09	0.3422103E-05	931.9069	24.90648
24	0.5900000E-01	0.1261900E-09	0.2662818E-05	1014.398	29.44211
25	0.6860000E-01	0.8025700E-10	0.1874265E-05	1141.966	36.48862
26	0.8140000E-01	0.4659000E-10	0.1228248E-05	1316.229	44.81480
27	0.9420000E-01	0.2826700E-10	0.8470105E-06	1491.075	50.55396
28	0.1070000	0.1792200E-10	0.6117755E-06	1662.868	56.62263
29	0.1198000	0.1242200E-10	0.4572371E-06	1833.145	58.78993
30	0.1390000	0.4811300E-11	0.3255858E-06	2053.683	36.92173
31	0.1646000	0.2511100E-11	0.2510010E-06	2240.502	18.46988

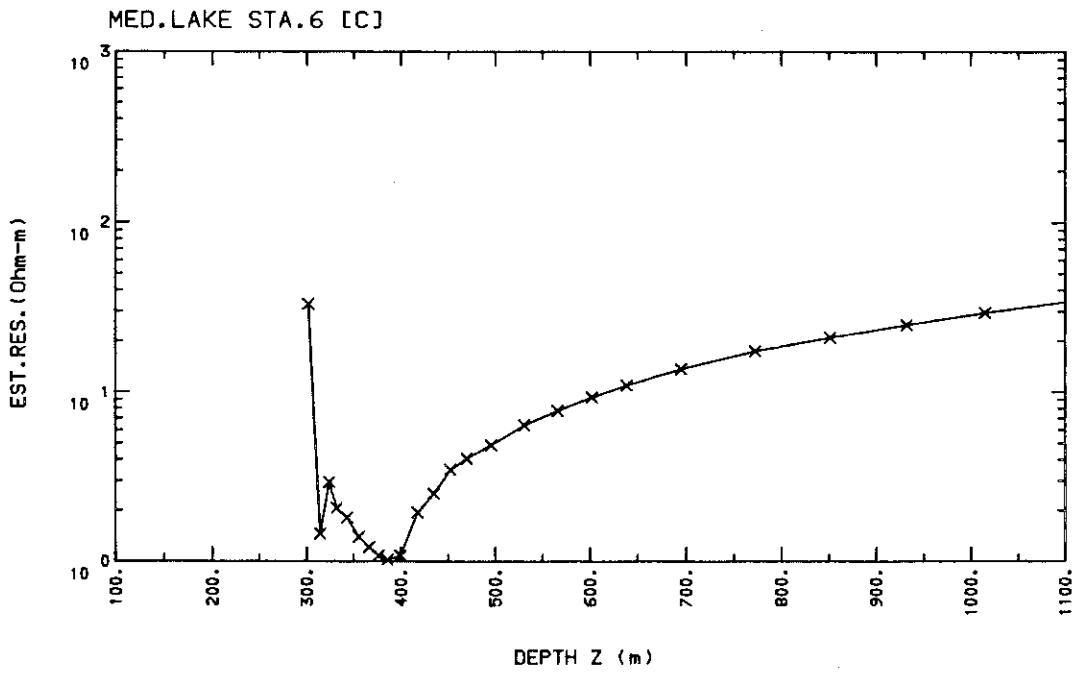

Fig. 14

MED.LAKE STA.7 [I]

	TIME t (s)	V(t)	Hz(t)	Z (m)	RES.(Ohm-m)
1	0.8000000E-03	0.5688500E-07	0.5662795E-04	349.6504	84.03047
2	0.1200000E-02	0.2506200E-07	0.4359219E-04	385.2810	4.253025
3	0.1600000E-02	0.1647300E-07	0.3698500E-04	408.4491	9.224458
4	0.2000000E-02	0.1192900E-07	0.3246694E-04	428.0888	6.183858
5	0.2600000E-02	0.8242000E-08	0.2765307E-04	453.5379	8.307341
6	0.3400000E-02	0.5536600E-08	0.2326830E-04	481.6974	7.772239
7	0.4200000E-02	0.4050600E-08	0.2021737E-04	506.0444	8.177521
8	0.5000000E-02	0.3012200E-08	0.1796977E-04	527.8040	8.181516
9	0.5800000E-02	0.2531400E-08	0.1620563E-04	547.6015	8.209576
10	0.7000000E-02	0.1951400E-08	0.1406560E-04	574.8521	8.888824
11	0.8600000E-02	0.1456500E-08	0.1189634E-04	609.2875	10.08270
12	0.1020000E-01	0.1143100E-08	0.1024159E-04	641.4771	10.67426
13	0.1180000E-01	0.9163400E-09	0.8930672E-05	672.1000	11.71851
14	0.1340000E-01	0.7497400E-09	0.7870146E-05	701.9538	12.75552
15	0.1580000E-01	0.5761200E-09	0.6604148E-05	745.1978	14.20903
16	0.1900000E-01	0.4174600E-09	0.5339161E-05	801.3456	16.16223
17	0.2220000E-01	0.3116200E-09	0.4410925E-05	855.1610	17.30731
18	0.2540000E-01	0.2394400E-09	0.3709338E-05	906.7501	18.39884
19	0.2860000E-01	0.1871300E-09	0.3166246E-05	956.6577	19.71270
20	0.3340000E-01	0.1370300E-09	0.2547172E-05	1029.638	21.80481
21	0.3980000E-01	0.8942599E-10	0.1970525E-05	1122.837	22.85961
22	0.4620000E-01	0.6431600E-10	0.1579036E-05	1209.772	23.84338
23	0.5260000E-01	0.4812200E-10	0.1292724E-05	1293.803	25.61302
24	0.5900000E-01	0.3498800E-10	0.1081092E-05	1373.995	25.03841
25	0.6860000E-01	0.2256000E-10	0.8612800E-06	1482.721	23.25562
26	0.8140000E-01	0.1516000E-10	0.6663370E-06	1615.973	24.95547

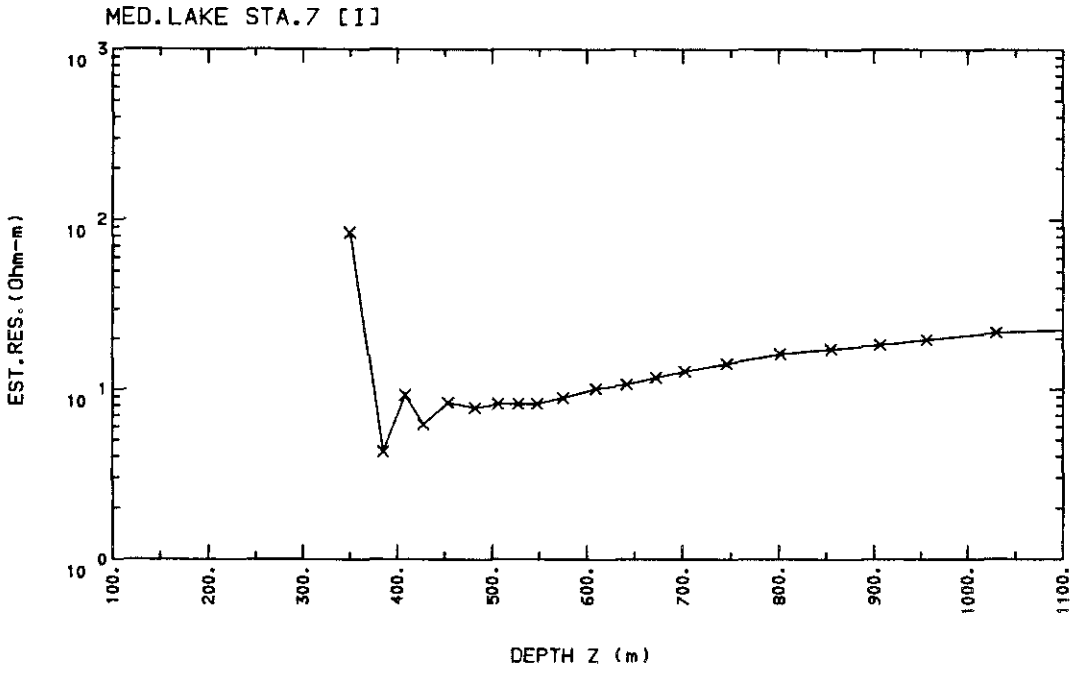

Fig. 15

MED.LAKE STA.8 [J]

	TIME t (s)	V(t)	Hz(t)	Z (m)	RES.(Ohm-m)
1	0.1200000E-02	0.3701000E-08	0.8093750E-05	695.4397	122.0949
2	0.1600000E-02	0.2272600E-08	0.7143497E-05	725.2548	3.295686
3	0.2000000E-02	0.1705600E-08	0.6510663E-05	748.7281	19.38833
4	0.2600000E-02	0.1232900E-08	0.5809381E-05	778.7456	11.02062
5	0.3400000E-02	0.8978500E-09	0.5131312E-05	812.4573	13.56792
6	0.4200000E-02	0.6911000E-09	0.4625660E-05	841.8378	11.93091
7	0.5000000E-02	0.5595000E-09	0.4227681E-05	867.1722	12.85688
8	0.5800000E-02	0.4639300E-09	0.3901995E-05	892.1710	13.97976
9	0.7000000E-02	0.3751000E-09	0.3501454E-05	925.0803	12.89084
10	0.8600000E-02	0.2872000E-09	0.3079873E-05	965.9494	14.54169
11	0.1020000E-01	0.2311600E-09	0.2749916E-05	1003.882	14.96927
12	0.1180000E-01	0.1890100E-09	0.2482461E-05	1039.191	14.76026
13	0.1340000E-01	0.1562700E-09	0.2262677E-05	1071.603	14.89848
14	0.1580000E-01	0.1271100E-09	0.1992091E-05	1118.601	16.73270
15	0.1900000E-01	0.9568000E-10	0.1708444E-05	1178.004	17.26812
16	0.2220000E-01	0.7419799E-10	0.1492162E-05	1232.891	18.00209
17	0.2540000E-01	0.6371800E-10	0.1316573E-05	1286.001	19.79504
18	0.2860000E-01	0.5099000E-10	0.1170531E-05	1337.713	20.95645
19	0.3340000E-01	0.3975800E-10	0.9972224E-06	1411.738	21.68164
20	0.3980000E-01	0.2726800E-10	0.8265475E-06	1503.510	22.12456
21	0.4620000E-01	0.2277500E-10	0.6991179E-06	1590.284	24.64568
22	0.5260000E-01	0.1750000E-10	0.5965617E-06	1676.864	27.51396
23	0.5900000E-01	0.1430000E-10	0.5155862E-06	1761.073	29.27959
24	0.6860000E-01	0.1035000E-10	0.4214321E-06	1884.030	31.11004
25	0.8140000E-01	0.6625300E-11	0.3349789E-06	2034.232	28.79049
26	0.9420000E-01	0.4808300E-11	0.2767490E-06	2168.522	29.17511
27	0.1070000	0.4000000E-11	0.2318894E-06	2300.749	33.63390

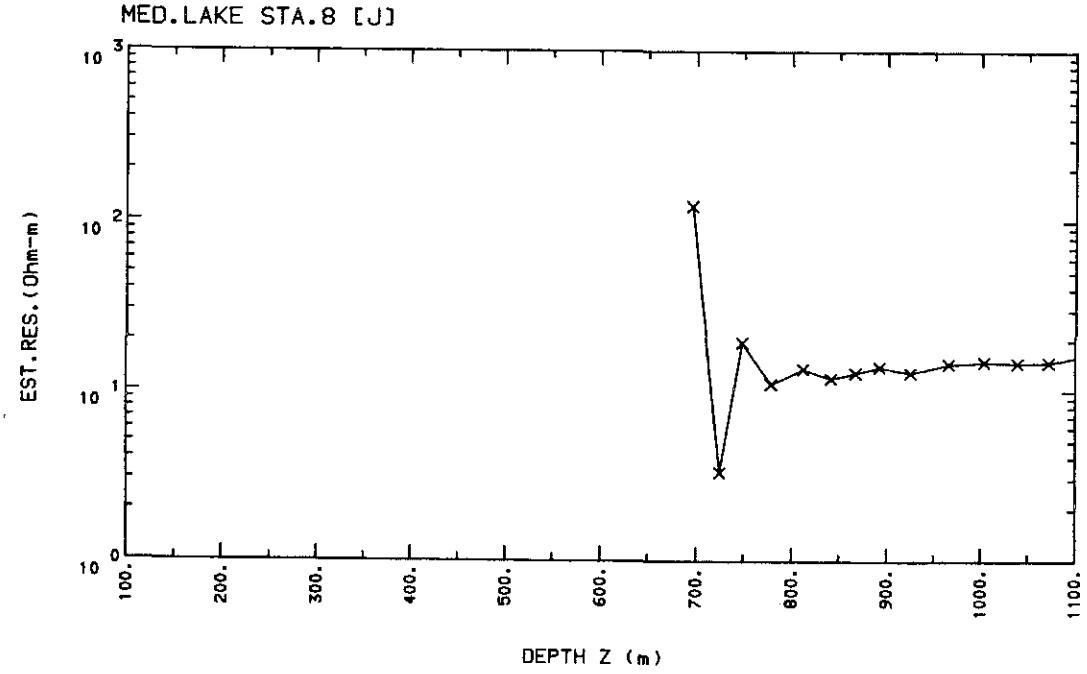

Fig. 16

MED.LAKE STA.9 [K]

	TIME t (s)	V(t)	Hz(t)	Z (m)	RES.(Ohm-m)
1	0.2600000E-02	0.1792800E-08	0.9102442E-05	667.4146	47.14936
2	0.3400000E-02	0.1232800E-08	0.8139604E-05	693.5718	1.561479
3	0.4200000E-02	0.9340000E-09	0.7450063E-05	715.0616	7.947584
4	0.5000000E-02	0.7681800E-09	0.6908377E-05	734.2010	4.954840
5	0.5800000E-02	0.6296000E-09	0.6463561E-05	750.9283	5.664255
6	0.7000000E-02	0.5278500E-09	0.5911012E-05	774.5663	6.149160
7	0.8600000E-02	0.4302500E-09	0.5301142E-05	803.3136	6.779800
8	0.1020000E-01	0.3600800E-09	0.4798065E-05	831.0433	8.155671
9	0.1180000E-01	0.3023800E-09	0.4376382E-05	857.8473	8.065095
10	0.1340000E-01	0.2730500E-09	0.4010098E-05	882.3193	8.921044
11	0.1580000E-01	0.2295800E-09	0.3530161E-05	921.7391	12.55259
12	0.1900000E-01	0.1826600E-09	0.3005314E-05	974.2173	14.00583
13	0.2220000E-01	0.1509500E-09	0.2580575E-05	1025.208	16.43308
14	0.2540000E-01	0.1237000E-09	0.2230902E-05	1076.823	18.83848
15	0.2860000E-01	0.9944300E-10	0.1946805E-05	1127.420	20.60411
16	0.3340000E-01	0.8139800E-10	0.1601439E-05	1203.938	25.47372
17	0.3980000E-01	0.5755800E-10	0.1247601E-05	1309.468	32.47443
18	0.4620000E-01	0.4626800E-10	0.9832186E-06	1418.332	41.21947
19	0.5260000E-01	0.3370800E-10	0.7795678E-06	1533.279	51.93323
20	0.5900000E-01	0.2775000E-10	0.6230711E-06	1652.879	62.87865
21	0.6860000E-01	0.1669200E-10	0.4533187E-06	1838.580	74.76079
22	0.8140000E-01	0.1061700E-10	0.3142372E-06	2078.199	78.82114
23	0.9420000E-01	0.5424800E-11	0.2325383E-06	2298.527	69.49018
24	0.1070000	0.4066700E-11	0.1841992E-06	2484.622	58.59031
25	0.1198000	0.2216700E-11	0.1521987E-06	2647.856	45.40028
26	0.1390000	0.1383400E-11	0.1246962E-06	2830.281	29.92590

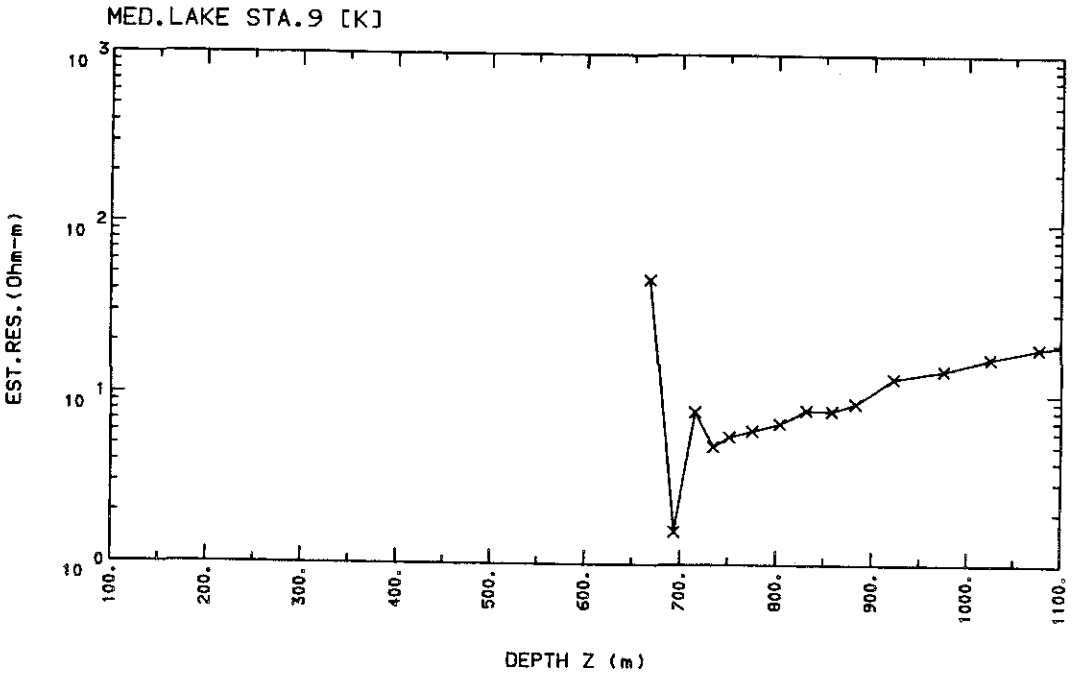

Fig. 17

MED.LAKE STA.10 [E]

	TIME t (s)	V(t)	Hz(t)	Z (m)	RES.(Ohm-m)
1	0.8000000E-03	0.2217000E-07	0.3625473E-04	412.1177	84.79508
2	0.1200000E-02	0.1278500E-07	0.3069425E-04	436.5725	2.967944
3	0.1600000E-02	0.8389500E-08	0.2732590E-04	455.4407	5.000698
4	0.2000000E-02	0.6456500E-08	0.2496427E-04	470.3653	2.734694
5	0.2600000E-02	0.4827500E-08	0.2227131E-04	489.2208	3.036407
6	0.3400000E-02	0.3931800E-08	0.1948384E-04	513.1704	5.137183
7	0.4200000E-02	0.3184800E-08	0.1721912E-04	535.0676	7.238356
8	0.5000000E-02	0.2674800E-08	0.1535442E-04	557.2070	9.233355
9	0.5800000E-02	0.2268300E-08	0.1378137E-04	578.3032	10.20778
10	0.7000000E-02	0.1842700E-08	0.1181884E-04	609.8745	13.46572
11	0.8600000E-02	0.1401300E-08	0.9753904E-05	652.3083	16.14152
12	0.1020000E-01	0.1096300E-08	0.8164081E-05	692.8621	18.36036
13	0.1180000E-01	0.8609000E-09	0.6918244E-05	733.2995	21.01258
14	0.1340000E-01	0.6861800E-09	0.5933466E-05	772.6565	22.99426
15	0.1580000E-01	0.5060000E-09	0.4795113E-05	831.1733	26.47863
16	0.1900000E-01	0.3398800E-09	0.3718172E-05	906.0117	28.23651
17	0.2220000E-01	0.2359600E-09	0.2985036E-05	975.9218	28.50092
18	0.2540000E-01	0.1691000E-09	0.2469330E-05	1040.496	27.59805
19	0.2860000E-01	0.1246400E-09	0.2095352E-05	1099.829	26.37461
20	0.3340000E-01	0.8356800E-10	0.1697721E-05	1180.510	24.43021
21	0.3980000E-01	0.5135000E-10	0.1354165E-05	1273.774	20.31388
22	0.4620000E-01	0.3343500E-10	0.1138269E-05	1350.319	15.61081
23	0.5260000E-01	0.2330900E-10	0.9937760E-06	1413.477	12.72222
24	0.5900000E-01	0.1925800E-10	0.8853833E-06	1469.114	12.13558
25	0.6860000E-01	0.1372500E-10	0.7594002E-06	1546.814	11.75114
26	0.8140000E-01	0.9316800E-11	0.6420511E-06	1636.334	9.553926
27	0.9420000E-01	0.6683500E-11	0.5605635E-06	1712.294	8.954892
28	0.1070000	0.6783500E-11	0.4919776E-06	1788.924	13.45040
29	0.1198000	0.6450000E-11	0.4245810E-06	1879.340	18.20047
30	0.1390000	0.4600000E-11	0.3401661E-06	2024.012	29.73638
31	0.1646000	0.5433500E-11	0.2379665E-06	2280.802	56.10327

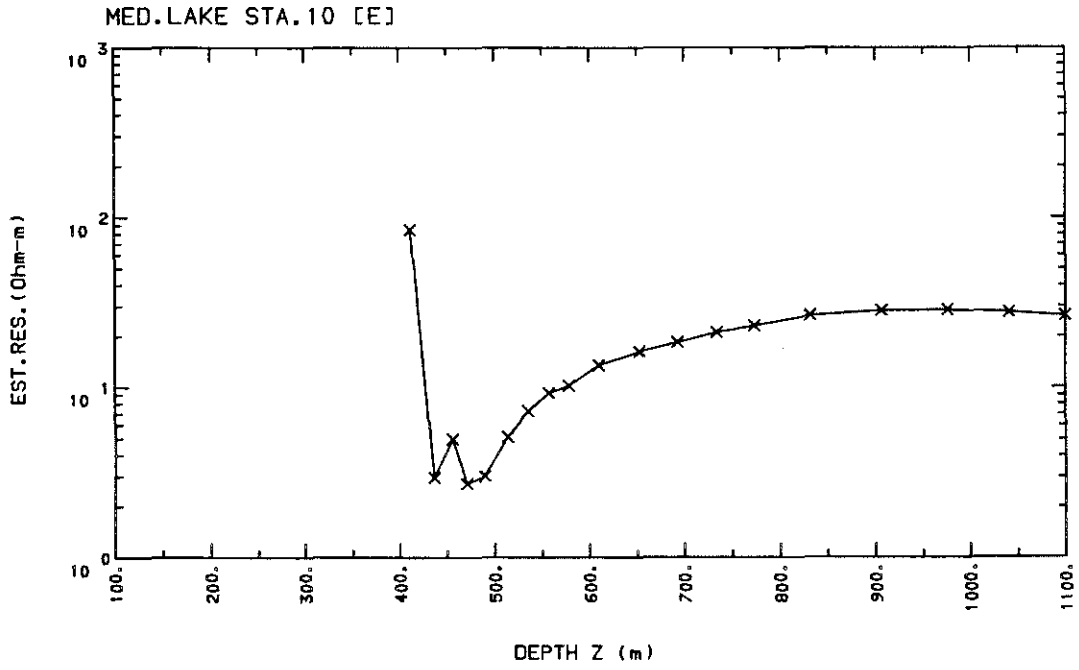

Fig. 18

MED.LAKE STA.11 [M]

	TIME t (s)	V(t)	Hz(t)	Z (m)	RES.(Ohm-m)
1	0.1200000E-02	0.1326000E-07	0.2492942E-04	470.1828	62.93102
2	0.1600000E-02	0.9103000E-08	0.2137202E-04	496.4091	3.646523
3	0.2000000E-02	0.6601000E-08	0.1887390E-04	519.0353	15.71813
4	0.2600000E-02	0.4538000E-08	0.1621554E-04	547.1472	9.158103
5	0.3400000E-02	0.3033000E-08	0.1380622E-04	578.1883	10.80714
6	0.4200000E-02	0.2238000E-08	0.1212883E-04	605.1194	9.983321
7	0.5000000E-02	0.1699000E-08	0.1087596E-04	628.4448	9.685381
8	0.5800000E-02	0.1398000E-08	0.9890397E-05	649.6826	9.423116
9	0.7000000E-02	0.1069000E-08	0.8712687E-05	677.8988	9.400166
10	0.8600000E-02	0.7937000E-09	0.7527004E-05	712.9489	9.946545
11	0.1020000E-01	0.6201999E-09	0.6627000E-05	744.2358	10.01993
12	0.1180000E-01	0.5055000E-09	0.5910447E-05	774.0724	10.72984
13	0.1340000E-01	0.4164000E-09	0.5323620E-05	802.0643	10.89475
14	0.1580000E-01	0.3280000E-09	0.4612830E-05	842.1027	11.91586
15	0.1900000E-01	0.2506000E-09	0.3876180E-05	893.2580	13.41230
16	0.2220000E-01	0.1957000E-09	0.3307968E-05	942.6722	14.45324
17	0.2540000E-01	0.1530000E-09	0.2864017E-05	989.6296	15.19909
18	0.2860000E-01	0.1265000E-09	0.2508169E-05	1035.011	15.96704
19	0.3340000E-01	0.9200000E-10	0.2090882E-05	1100.618	18.29398
20	0.3980000E-01	0.7960000E-10	0.1653920E-05	1190.916	23.96295
21	0.4620000E-01	0.4450000E-10	0.1337912E-05	1278.946	20.59425
22	0.5260000E-01	0.3360000E-10	0.1139038E-05	1350.126	17.86405
23	0.5900000E-01	0.2880000E-10	0.9801430E-06	1419.812	18.97100
24	0.6860000E-01	0.1620000E-10	0.8118005E-06	1512.131	16.87043

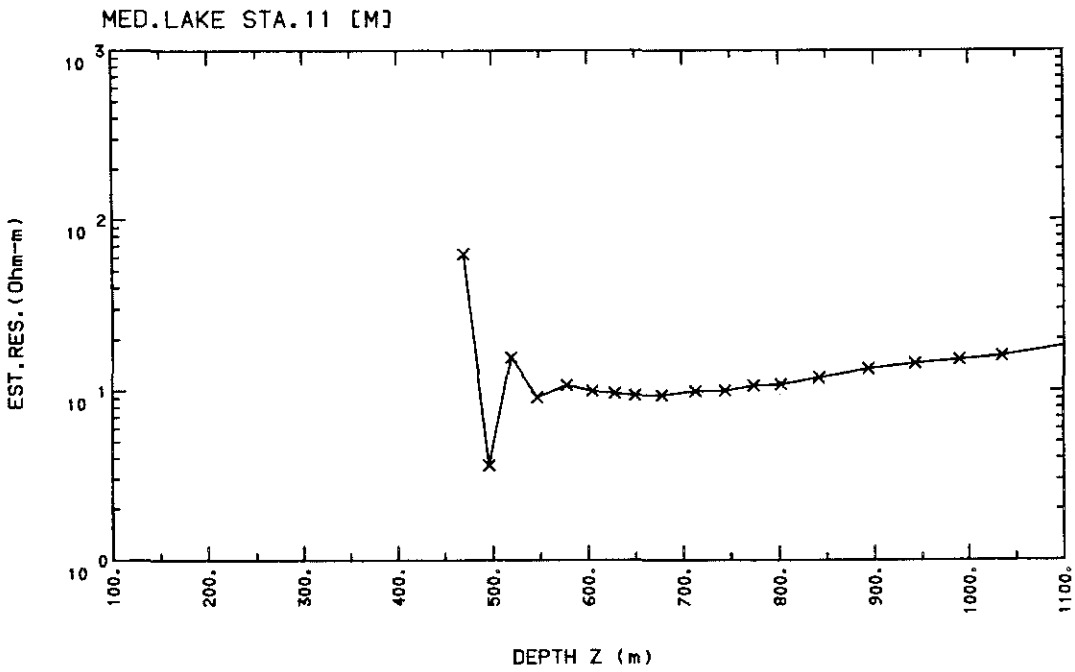

Fig. 19

MED.LAKE STA.12 [N]

	TIME t (s)	V(t)	Hz(t)	Z (m)	RES.(Ohm-m)
1	0.1600000E-02	0.3738000E-08	0.9972368E-05	647.3475	66.56281
2	0.2000000E-02	0.2525000E-08	0.8976080E-05	670.7229	3.001070
3	0.2600000E-02	0.1771000E-08	0.7950826E-05	699.5140	15.34151
4	0.3400000E-02	0.1186000E-08	0.7009819E-05	730.5680	8.058324
5	0.4200000E-02	0.8907000E-09	0.6348951E-05	755.1064	8.247600
6	0.5000000E-02	0.7202000E-09	0.5836313E-05	777.0686	8.717978
7	0.5800000E-02	0.5735000E-09	0.5424619E-05	797.3741	8.082579
8	0.7000000E-02	0.4503000E-09	0.4935872E-05	822.7005	6.993291
9	0.8600000E-02	0.3367000E-09	0.4434915E-05	853.7026	7.567904
10	0.1020000E-01	0.2843000E-09	0.4039623E-05	881.0212	7.126008
11	0.1180000E-01	0.2207000E-09	0.3718170E-05	906.0894	7.192736
12	0.1340000E-01	0.2004000E-09	0.3450123E-05	929.4061	7.540681
13	0.1580000E-01	0.1646000E-09	0.3101603E-05	963.4788	8.464409
14	0.1900000E-01	0.1280000E-09	0.2729076E-05	1005.935	8.628725
15	0.2220000E-01	0.1007000E-09	0.2437905E-05	1045.000	8.616103
16	0.2540000E-01	0.8530000E-10	0.2201097E-05	1081.639	9.423646
17	0.2860000E-01	0.7589999E-10	0.1995864E-05	1117.997	10.07024
18	0.3340000E-01	0.5190000E-10	0.1751794E-05	1168.118	9.412989
19	0.3980000E-01	0.4830000E-10	0.1496645E-05	1231.743	12.90780
20	0.4620000E-01	0.4530000E-10	0.1258302E-05	1305.597	20.07988
21	0.5260000E-01	0.3460000E-10	0.1054844E-05	1385.366	24.35511

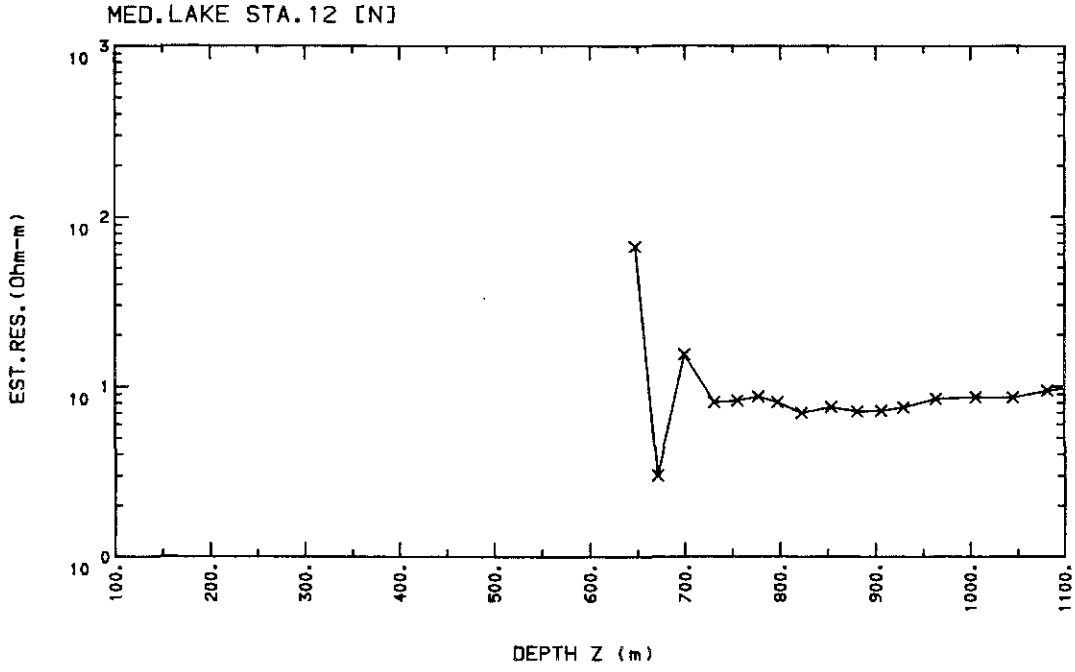

Fig. 20

MED.LAKE STA.13 [0]

	TIME t (s)	V(t)	Hz(t)	Z (m)	RES.(Ohm-m)
1	0.1200000E-02	0.1184000E-07	0.2761642E-04	453.1788	50.29772
2	0.1600000E-02	0.7810000E-08	0.2449059E-04	473.5800	2.726856
3	0.2000000E-02	0.5657000E-08	0.2234832E-04	488.4460	3.716872
4	0.2600000E-02	0.3759000E-08	0.2010116E-04	507.5777	2.341481
5	0.3400000E-02	0.2586000E-08	0.1808199E-04	526.8693	1.800733
6	0.4200000E-02	0.1981000E-08	0.1662863E-04	541.7841	1.628212
7	0.5000000E-02	0.1707000E-08	0.1545500E-04	556.3795	1.885540
8	0.5800000E-02	0.1398000E-08	0.1446689E-04	568.6870	1.781996
9	0.7000000E-02	0.1138000E-08	0.1325624E-04	586.6232	2.930171
10	0.8600000E-02	0.9327999E-09	0.1193809E-04	607.9420	3.108516
11	0.1020000E-01	0.7827000E-09	0.1084611E-04	628.3320	4.012757
12	0.1180000E-01	0.6635000E-09	0.9925545E-05	648.2504	4.398248
13	0.1340000E-01	0.5823000E-09	0.9132543E-05	667.0388	4.641901
14	0.1580000E-01	0.4726000E-09	0.8125271E-05	694.2614	5.256629
15	0.1900000E-01	0.3731000E-09	0.7048560E-05	728.8694	5.833419
16	0.2220000E-01	0.3056000E-09	0.6184467E-05	762.1322	6.526545
17	0.2540000E-01	0.2522000E-09	0.5474298E-05	794.5570	7.161190
18	0.2860000E-01	0.2136000E-09	0.4881260E-05	826.1470	7.786629
19	0.3340000E-01	0.1660000E-09	0.4156308E-05	872.5728	8.692839
20	0.3980000E-01	0.1241000E-09	0.3417597E-05	932.3332	9.667625
21	0.4620000E-01	0.9360000E-10	0.2863246E-05	989.8410	10.16130
22	0.5260000E-01	0.7120000E-10	0.2443599E-05	1044.159	10.65831
23	0.5900000E-01	0.6060000E-10	0.2107983E-05	1097.506	11.84706
24	0.6860000E-01	0.4140000E-10	0.1718380E-05	1175.818	12.44564
25	0.8140000E-01	0.2870000E-10	0.1361369E-05	1271.618	12.21307
26	0.9420000E-01	0.1920000E-10	0.1117420E-05	1358.729	10.84194
27	0.1070000	0.1370000E-10	0.9529070E-06	1433.334	9.794569

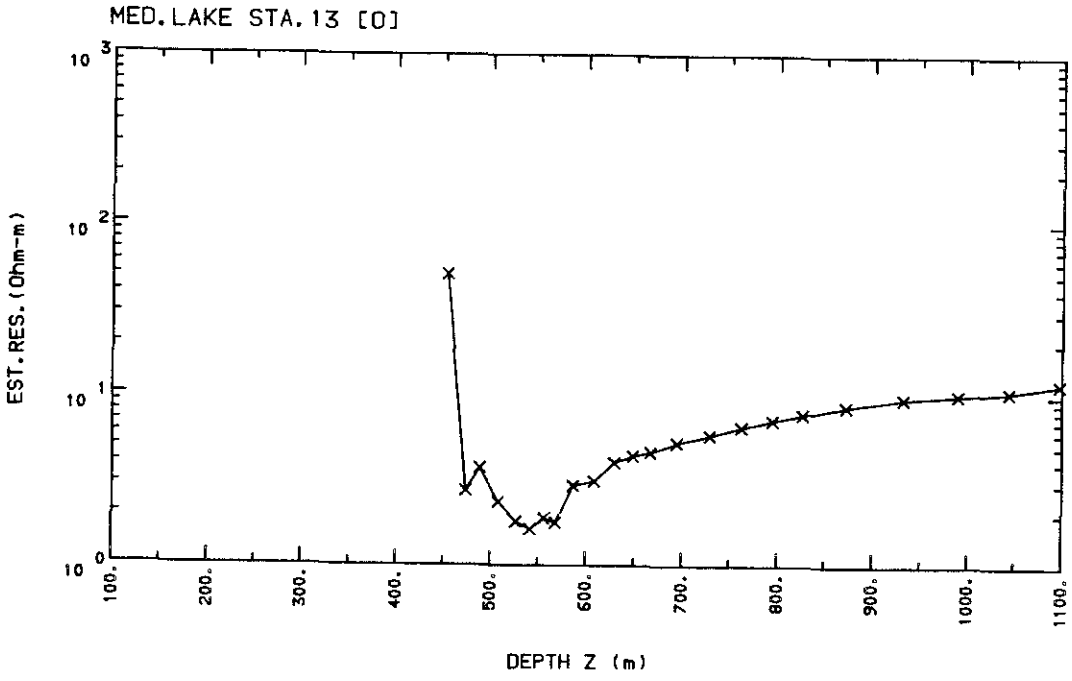

Fig. 21

MED.LAKE STA.14 [P]

	TIME t (s)	V(t)	Hz(t)	Z (m)	RES.(Ohm-m)
1	0.8000000E-03	0.7353000E-07	0.5422081E-04	355.3916	114.3291
2	0.1200000E-02	0.3264000E-07	0.3733177E-04	406.9770	20.31812
3	0.1600000E-02	0.2095000E-07	0.2880692E-04	446.3636	40.03031
4	0.2000000E-02	0.1454000E-07	0.2316133E-04	482.3890	39.47138
5	0.2600000E-02	0.9019000E-08	0.1753891E-04	532.3307	44.82250
6	0.3400000E-02	0.5258000E-08	0.1299554E-04	590.3471	42.91560
7	0.4200000E-02	0.3351000E-08	0.1025589E-04	640.6571	40.22478
8	0.5000000E-02	0.2289000E-08	0.8461075E-05	684.2325	37.42860
9	0.5800000E-02	0.1619000E-08	0.7217431E-05	723.2643	34.05320
10	0.7000000E-02	0.1078000E-08	0.5929922E-05	772.8266	29.51373
11	0.8600000E-02	0.6836000E-09	0.4808594E-05	830.6588	26.70973
12	0.1020000E-01	0.4799000E-09	0.4067979E-05	878.8156	22.91643
13	0.1180000E-01	0.3598000E-09	0.3533476E-05	921.7826	21.92099
14	0.1340000E-01	0.2762000E-09	0.3128636E-05	960.5124	20.43431
15	0.1580000E-01	0.2004000E-09	0.2673555E-05	1012.941	19.54669
16	0.1900000E-01	0.1427000E-09	0.2236734E-05	1075.799	18.96334
17	0.2220000E-01	0.1051000E-09	0.1921244E-05	1132.444	18.10579
18	0.2540000E-01	0.8070000E-10	0.1684691E-05	1183.669	17.11152
19	0.2860000E-01	0.6500000E-10	0.1499192E-05	1230.920	17.25474
20	0.3340000E-01	0.5080000E-10	0.1278039E-05	1298.903	18.65279
21	0.3980000E-01	0.3590000E-10	0.1057267E-05	1384.192	18.58925
22	0.4620000E-01	0.2680000E-10	0.8976073E-06	1462.378	19.61906
23	0.5260000E-01	0.2420000E-10	0.7677409E-06	1541.183	24.53730
24	0.5900000E-01	0.1930000E-10	0.6569726E-06	1623.764	29.32733

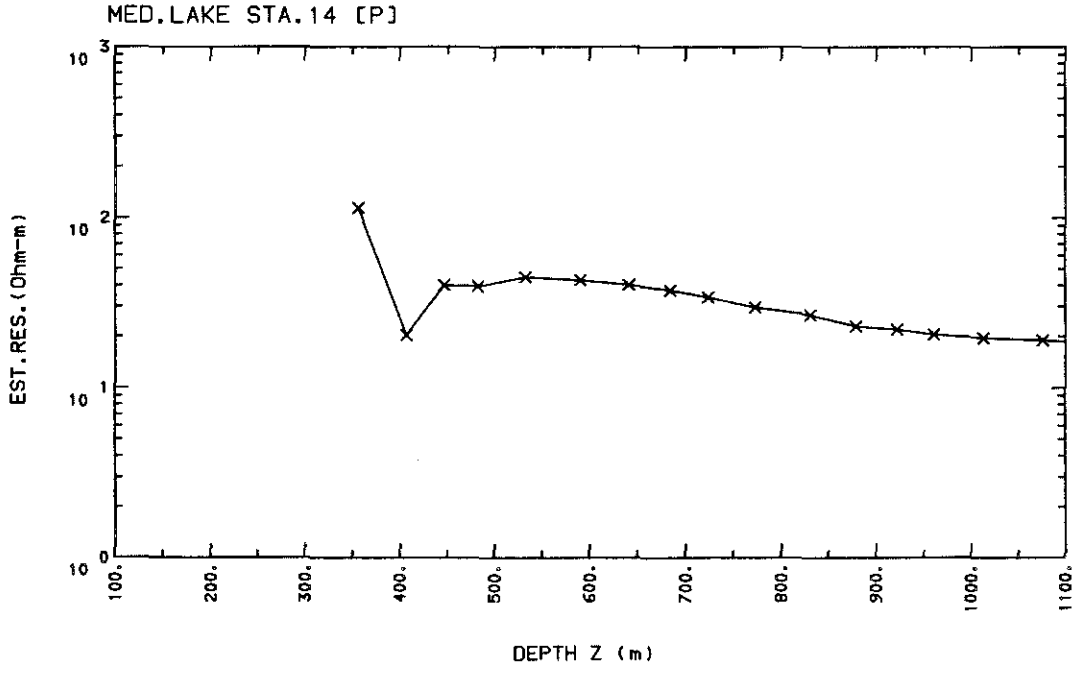

Fig. 22

MED.LAKE STA.15 [Q]

	TIME t (s)	V(t)	Hz(t)	Z (m)	RES.(Ohm-m)
1	0.8000000E-03	0.7663000E-07	0.8128244E-04	305.6345	57.96859
2	0.1200000E-02	0.3369000E-07	0.6373324E-04	334.6840	3.810002
3	0.1600000E-02	0.2216000E-07	0.5484888E-04	354.1918	4.307415
4	0.2000000E-02	0.1615000E-07	0.4875470E-04	369.7424	2.955305
5	0.2600000E-02	0.1146000E-07	0.4216550E-04	389.5465	3.138431
6	0.3400000E-02	0.8092000E-08	0.3594346E-04	413.0502	4.490049
7	0.4200000E-02	0.6079000E-08	0.3143381E-04	433.3825	4.479114
8	0.5000000E-02	0.4767000E-08	0.2798229E-04	451.2231	5.531036
9	0.5800000E-02	0.3928000E-08	0.2521527E-04	468.9983	6.201785
10	0.7000000E-02	0.3022000E-08	0.2189745E-04	492.1467	5.977061
11	0.8600000E-02	0.2250000E-08	0.1854161E-04	522.1412	7.475430
12	0.1020000E-01	0.1752000E-08	0.1599417E-04	549.7739	7.471781
13	0.1180000E-01	0.1396000E-08	0.1399034E-04	575.6820	8.120035
14	0.1340000E-01	0.1141000E-08	0.1237544E-04	600.7249	8.745637
15	0.1580000E-01	0.8709000E-09	0.1045438E-04	636.6808	9.494335
16	0.1900000E-01	0.6302000E-09	0.8543237E-05	682.4169	10.43434
17	0.2220000E-01	0.4746999E-09	0.7136523E-05	725.8395	11.09817
18	0.2540000E-01	0.3650000E-09	0.6067449E-05	767.1927	11.56401
19	0.2860000E-01	0.2855000E-09	0.5239258E-05	806.5406	11.85043
20	0.3340000E-01	0.2069000E-09	0.4298883E-05	862.5043	12.50692
21	0.3980000E-01	0.1434000E-09	0.3406879E-05	933.3175	13.15909
22	0.4620000E-01	0.1018000E-09	0.2782502E-05	999.3574	13.49853
23	0.5260000E-01	0.7680000E-10	0.2327715E-05	1061.526	13.20830
24	0.5900000E-01	0.5370000E-10	0.1995410E-05	1117.997	12.13576
25	0.6860000E-01	0.3970000E-10	0.1638656E-05	1194.762	11.88619
26	0.8140000E-01	0.2530000E-10	0.1307619E-05	1288.827	11.04989
27	0.9420000E-01	0.1850000E-10	0.1089427E-05	1370.352	10.35706

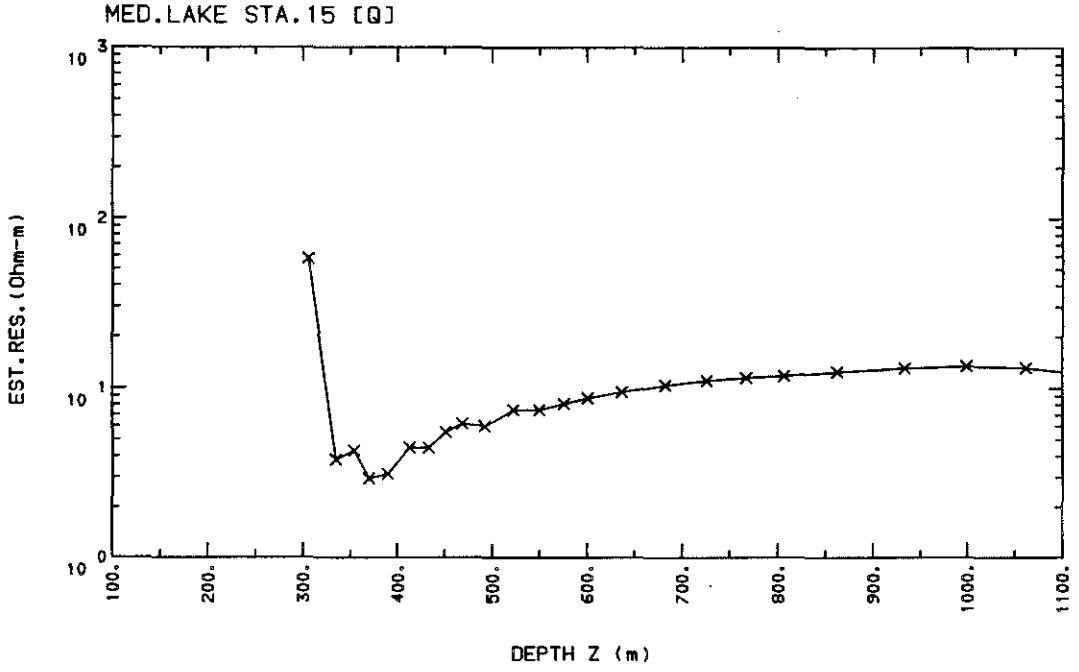

Fig. 23

MED.LAKE STA.16 [R]

	TIME t (s)	V(t)	Hz(t)	Z (m)	RES.(Ohm-m)
1	0.8000000E-03	0.2309000E-07	0.1187015E-04	609.7198	431.5401
2	0.1200000E-02	0.3691000E-08	0.7609956E-05	709.6235	53.13816
3	0.1600000E-02	0.2936000E-08	0.6555763E-05	747.5214	25.17977
4	0.2000000E-02	0.2062000E-08	0.5760704E-05	780.5359	34.32156
5	0.2600000E-02	0.1430000E-08	0.4927328E-05	823.9598	29.29994
6	0.3400000E-02	0.9327000E-09	0.4175445E-05	870.6129	26.58674
7	0.4200000E-02	0.7201000E-09	0.3649474E-05	911.7487	28.26350
8	0.5000000E-02	0.5860000E-09	0.3233834E-05	949.9130	29.95273
9	0.5800000E-02	0.4558000E-09	0.2902302E-05	985.6667	29.90892
10	0.7000000E-02	0.3570000E-09	0.2514283E-05	1034.246	30.61142
11	0.8600000E-02	0.2638000E-09	0.2119118E-05	1095.655	33.64217
12	0.1020000E-01	0.1969000E-09	0.1825864E-05	1152.022	33.49497
13	0.1180000E-01	0.1591000E-09	0.1599256E-05	1204.483	34.75941
14	0.1340000E-01	0.1271000E-09	0.1417078E-05	1254.479	36.18158
15	0.1580000E-01	0.9696999E-10	0.1203125E-05	1325.401	37.60460
16	0.1900000E-01	0.6863000E-10	0.9922893E-06	1413.983	39.93478
17	0.2220000E-01	0.5476000E-10	0.8351941E-06	1498.128	43.01152
18	0.2540000E-01	0.3940000E-10	0.7153133E-06	1578.211	42.61615
19	0.2860000E-01	0.3280000E-10	0.6233911E-06	1652.624	44.83836
20	0.3340000E-01	0.2490000E-10	0.5131969E-06	1763.832	48.78032
21	0.3980000E-01	0.1630000E-10	0.4124433E-06	1897.469	47.27974

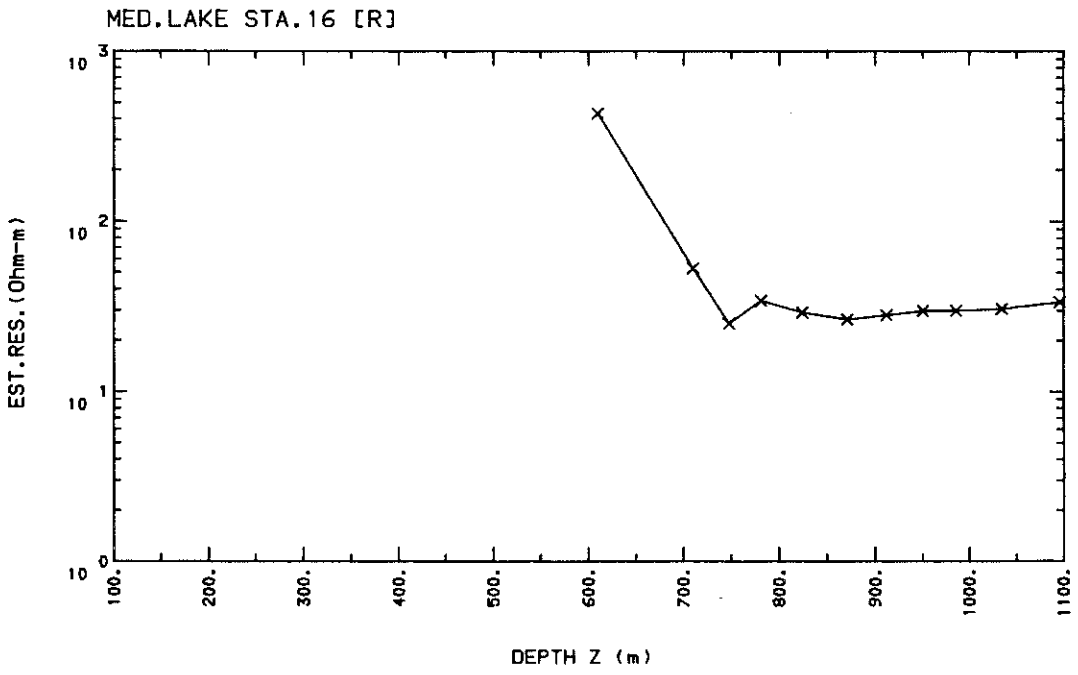

Fig. 24

MED.LAKE STA.17 [S]

	TIME t (s)	V(t)	Hz(t)	Z (m)	RES.(Ohm-m)
1	0.8000000E-03	0.3577000E-07	0.2966160E-04	442.6546	150.0000
2	0.1200000E-02	0.1080000E-07	0.2225345E-04	489.8908	4.662457
3	0.1600000E-02	0.6839000E-08	0.1944753E-04	513.0786	7.728620
4	0.2000000E-02	0.5031000E-08	0.1755930E-04	532.2805	4.856769
5	0.2600000E-02	0.3331000E-08	0.1556368E-04	555.0223	4.160043
6	0.3400000E-02	0.2235000E-08	0.1379241E-04	578.1606	3.379519
7	0.4200000E-02	0.1669000E-08	0.1255004E-04	597.5426	4.130858
8	0.5000000E-02	0.1363000E-08	0.1158517E-04	614.8353	4.165435
9	0.5800000E-02	0.1112000E-08	0.1079755E-04	630.0598	4.014498
10	0.7000000E-02	0.9180999E-09	0.9828406E-05	650.6724	4.298924
11	0.8600000E-02	0.7214000E-09	0.8784799E-05	675.7064	4.780992
12	0.1020000E-01	0.5934000E-09	0.7947876E-05	699.2219	5.444242
13	0.1180000E-01	0.4981000E-09	0.7253092E-05	721.7729	5.845246
14	0.1340000E-01	0.4267000E-09	0.6664420E-05	743.0385	6.047518
15	0.1580000E-01	0.3481000E-09	0.5924602E-05	773.3890	6.621394
16	0.1900000E-01	0.2704000E-09	0.5137153E-05	811.8563	7.173029
17	0.2220000E-01	0.2156000E-09	0.4518397E-05	847.9855	7.558714
18	0.2540000E-01	0.1753000E-09	0.4020719E-05	882.3853	7.908171
19	0.2860000E-01	0.1492000E-09	0.3607579E-05	915.3165	8.486211
20	0.3340000E-01	0.1181000E-09	0.3097095E-05	963.8412	9.417371
21	0.3980000E-01	0.8290000E-10	0.2585268E-05	1024.578	9.403595
22	0.4620000E-01	0.6610000E-10	0.2205855E-05	1080.799	10.10153
23	0.5260000E-01	0.5250000E-10	0.1903852E-05	1135.930	10.68315
24	0.5900000E-01	0.3990000E-10	0.1668564E-05	1187.416	10.44348
25	0.6860000E-01	0.3160000E-10	0.1395460E-05	1260.980	11.50834
26	0.8140000E-01	0.2180000E-10	0.1123500E-05	1356.369	12.20879
27	0.9420000E-01	0.1600000E-10	0.9309893E-06	1444.568	12.52999

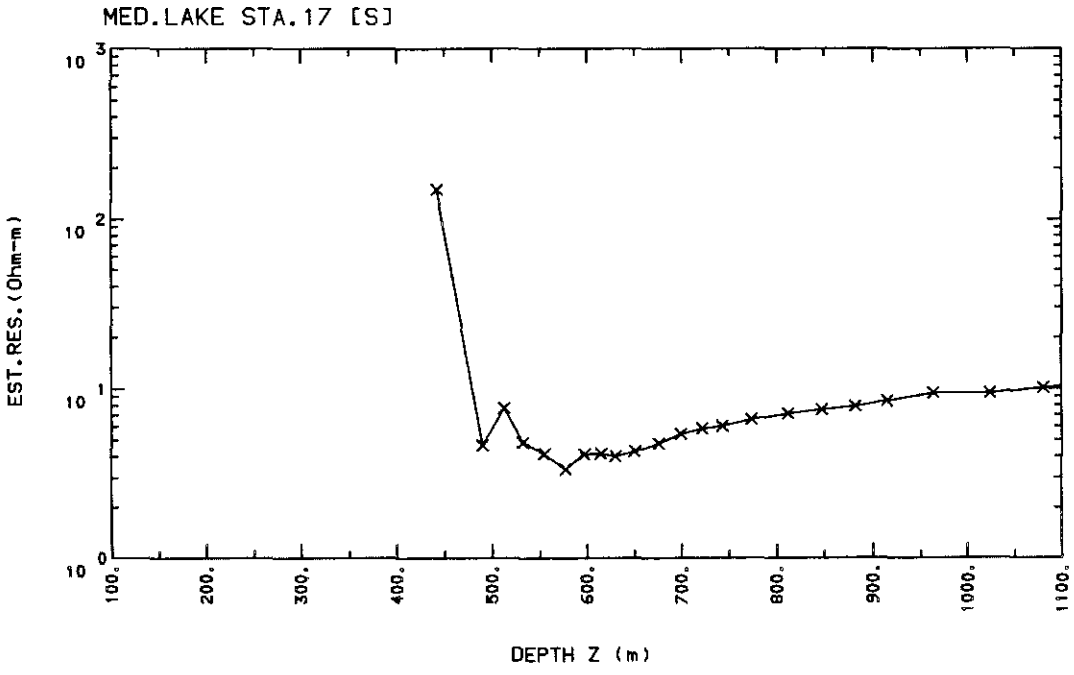

Fig. 25

MED.LAKE STA.18 [T]

	TIME t (s)	V(t)	Hz(t)	Z (m)	RES.(Ohm-m)
1	0.8000000E-03	0.3901000E-07	0.2821352E-04	449.7647	186.3023
2	0.1200000E-02	0.1608000E-07	0.1945006E-04	513.1085	30.70061
3	0.1600000E-02	0.1013000E-07	0.1528069E-04	557.8776	51.26362
4	0.2000000E-02	0.6866000E-08	0.1257704E-04	597.1714	44.20542
5	0.2600000E-02	0.4358000E-08	0.9898406E-05	648.0451	46.84744
6	0.3400000E-02	0.2690000E-08	0.7655517E-05	708.8748	47.10042
7	0.4200000E-02	0.1802000E-08	0.6226027E-05	760.7565	44.14721
8	0.5000000E-02	0.1335000E-08	0.5227739E-05	807.6205	44.73700
9	0.5800000E-02	0.9934000E-09	0.4486772E-05	850.6473	44.32577
10	0.7000000E-02	0.7038000E-09	0.3676553E-05	909.8961	45.09646
11	0.8600000E-02	0.4708000E-09	0.2928873E-05	982.1893	46.01771
12	0.1020000E-01	0.3323000E-09	0.2417667E-05	1048.010	45.63887
13	0.1180000E-01	0.2506000E-09	0.2046628E-05	1108.496	45.35099
14	0.1340000E-01	0.1915000E-09	0.1765213E-05	1164.927	45.59588
15	0.1580000E-01	0.1364000E-09	0.1452118E-05	1244.113	46.77203
16	0.1900000E-01	0.9317000E-10	0.1159839E-05	1341.826	46.84064
17	0.2220000E-01	0.6475000E-10	0.9587814E-06	1430.480	45.48583
18	0.2540000E-01	0.5104000E-10	0.8113622E-06	1512.674	46.65914
19	0.2860000E-01	0.3850000E-10	0.6973634E-06	1591.441	48.37150
20	0.3340000E-01	0.2800000E-10	0.5703631E-06	1702.383	48.06639
21	0.3980000E-01	0.1710000E-10	0.4555205E-06	1835.484	43.00566
22	0.4620000E-01	0.1260000E-10	0.3798924E-06	1950.405	39.94357
23	0.5260000E-01	0.9600000E-11	0.3230211E-06	2059.290	44.11131

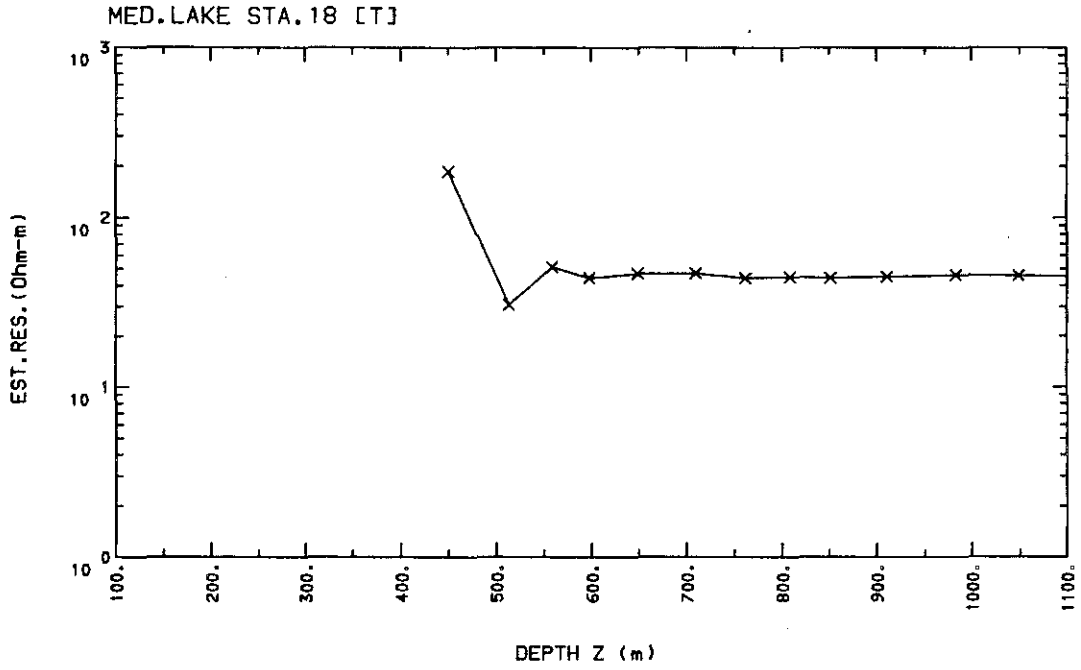

Fig. 26

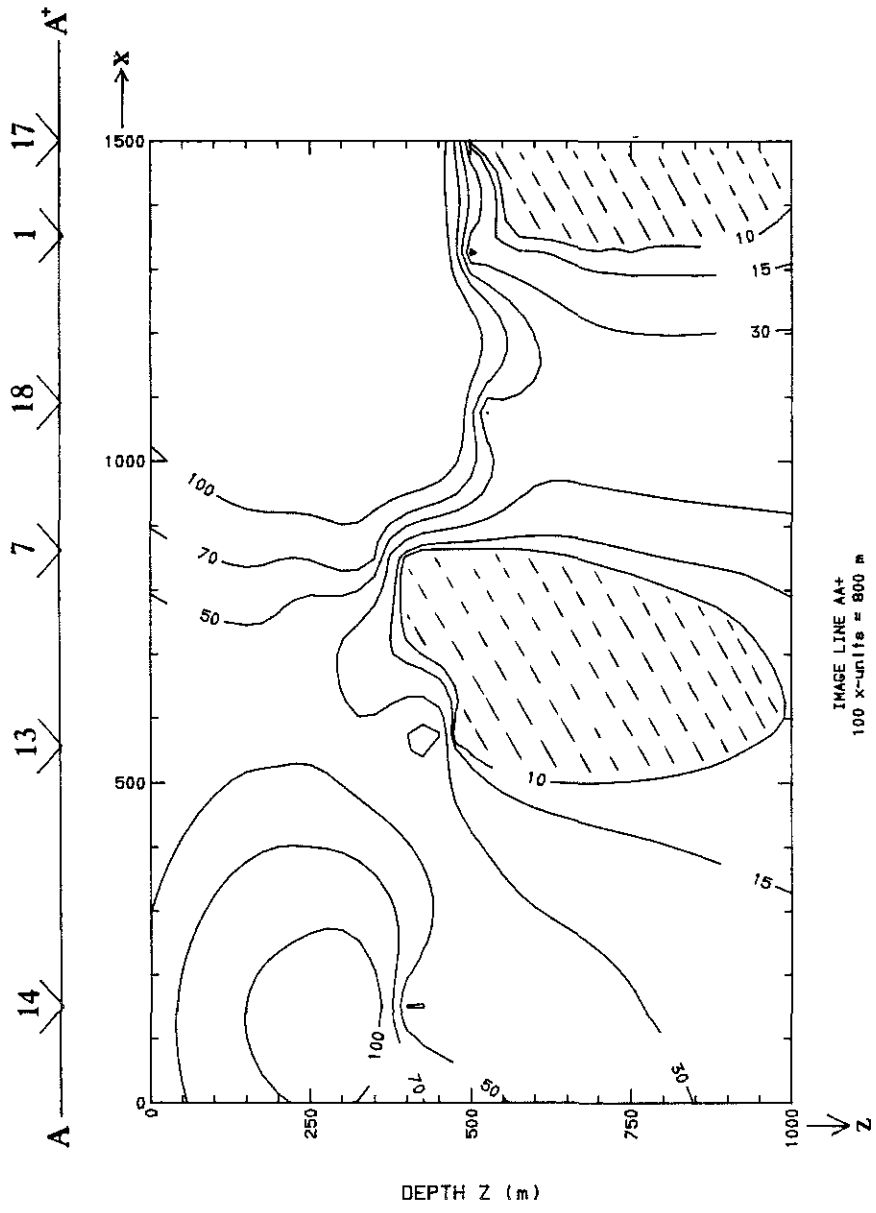
A
A'
17
1
18
7
13
14
X
Z
1500
1000
500
0
0
250
500
750
1000
10
15
30
100
70
50
10
15
100
70
50
30
IMAGE LINE AA+
100 x-units = 800 m
DEPTH Z (m)

Fig. 27

Fig. 27

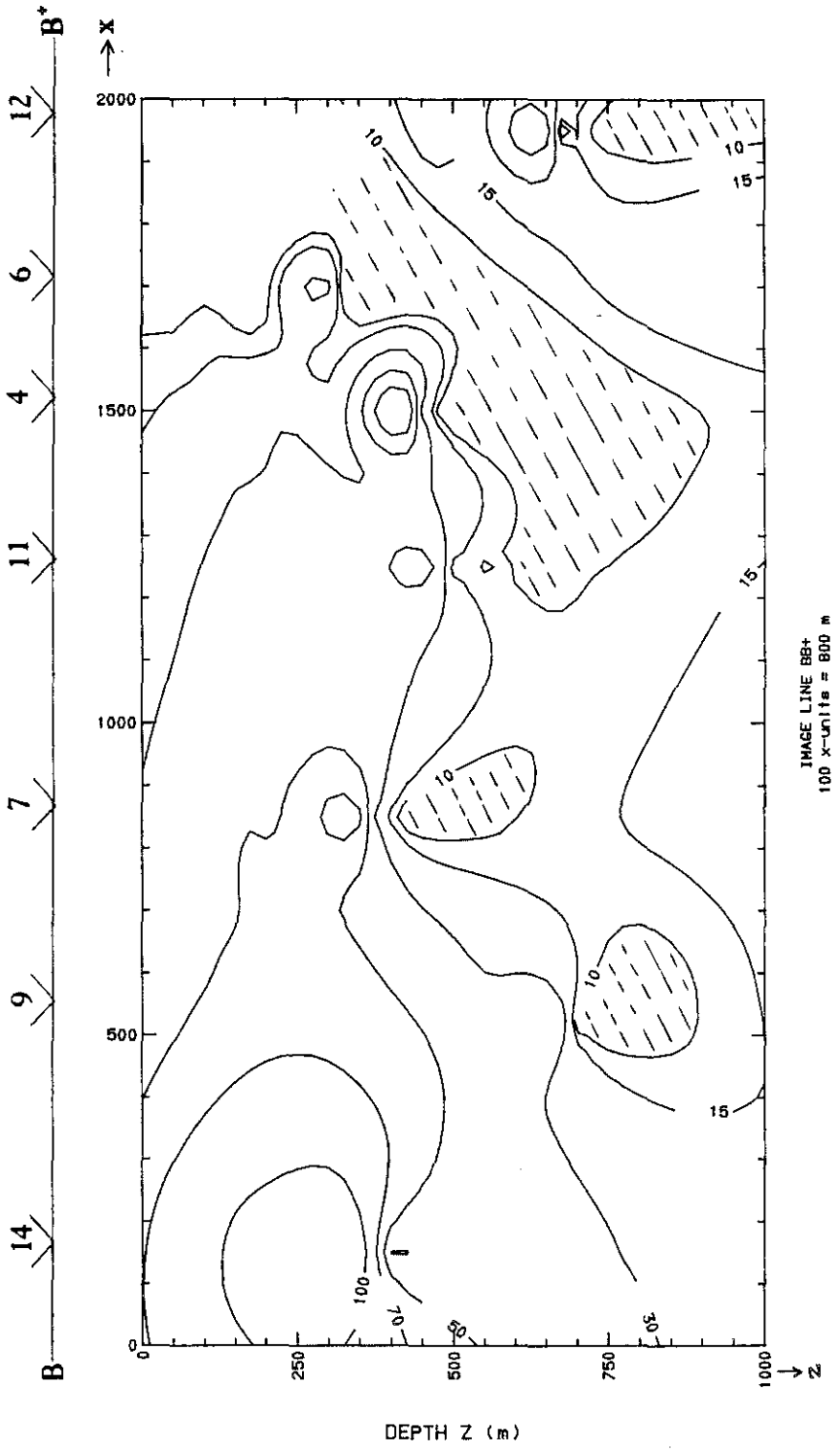
B*
B
x
z
2000
1500
1000
500
0
0
250
500
750
1000
12
6
4
11
7
9
14
10
15
100
70
50
30
IMAGE LINE BB+
100 x-units = 800 m
DEPTH Z (m)

Fig. 28

Fig. 28

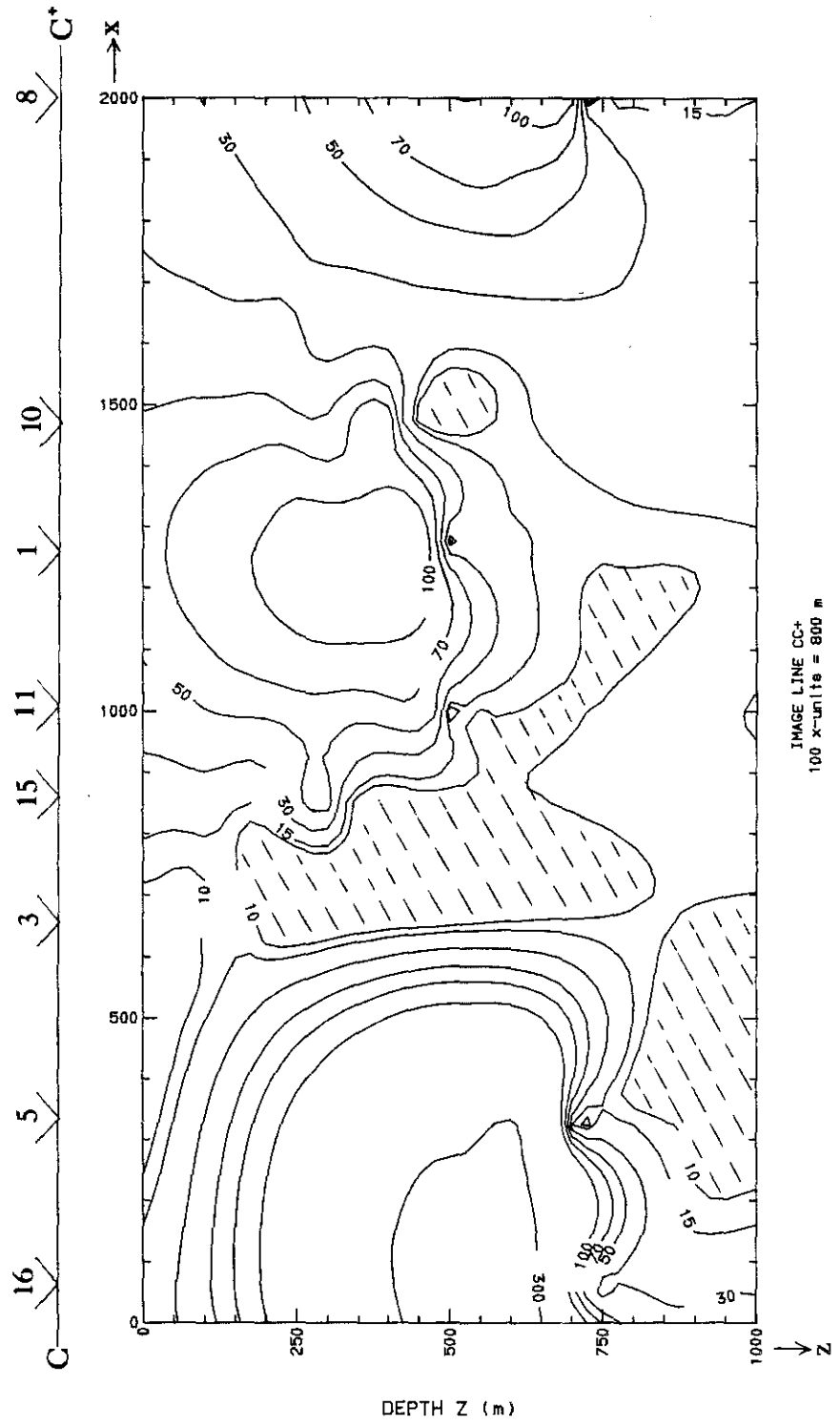
C
C'
X
Z
8
10
1
11
15
3
5
16
2000
1500
1000
500
0
0
250
500
750
1000
DEPTH Z (m)
IMAGE LINE CC+
100 x-units = 800 m

Fig. 29

Fig. 29