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Investigation of brine contamination using time-domain electromagnetic soundings

by

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INTRODUCTION

The contamination of fresh-water aquifers and land resources by saltwater or other pollutants is a serious health and economic problem in many parts of the United States (Pye and Kelley, 1984). Typically, the magnitude and extent of such pollution must first be determined in order to outline possible corrective action. Drilling test wells (Faulkner and Pascale, 1975; Goolsby, 1971) is a relatively expensive and time-consuming means of monitoring the movement of pollutants through the earth. Consequently, other methods are needed to help monitor changing ground water conditions. This report describes the testing of a geophysical time-dmain electromagnetic (TDEM) method for mapping brine contamination of ground water resources and surface soils. The study area is in an oil field west of Pawhuska, Oklahoma, in Osage County, where brines being pumped underground via injection wells have escaped to the surface. The Environmental Monitoring Systems Laboratory of the Environmental Protection Agency (EPA) funded this study as part of a research program on exploration methods for detecting and mapping fluids leaking from injection wells.

In some oil fields, large quantities of brine are produced along with oil. Generally, the brine is pumped back into the producing horizon or into other horizons through injection wells. This disposes of the brine and helps maintain pressure in the formation thereby enhancing oil recovery. However, injection of brine sometimes leads to contamination of fresh-water aquifers or even to contamination at the surface (Fryberger, 1975, 1976). The movement of brine to areas other than the producing horizon can occur as a result of leaks in the injection well or because of the presence of conduits, such as improperly plugged abandoned wells, which connect the injection horizon with fresh-water aquifers or the surface. In the Pawhuska study area it appears that the earth was fractured as a result of overpressures and that the brine flows along these fractures to the surface.

The electrical resistivity of oil field brines is typically very low. Hence, introduction of these brines into a rock will usually lower its bulk resistivity (Worthington, 1976). If the resulting resistivity contrast between the surrounding fresh-water aquifer or uncontaminated rock strata and the polluted region is large enough, then geophysical surveys using electrical methods may be useful in mapping the polluted area. The DC resistivity or vertical electric sounding (VES) method is a commonly employed geophysical technique for this purpose (Gilkeson and Cartwright, 1983; Oteri, 1981; Stollar and Roux, 1975; Urish, 1983; Warner, 1969). However, the ratio of the linear dimensions of the VES array to its effective depth of penetration is relatively large compared with other geophysical sounding methods. Consequently, application of the VES technique is limited to areas of either shallow pollution or to areas where lateral changes in uncontaminated earth resistivities are small and the distribution of conductive cultural features is sparse. Otherwise, variations in the background resistivity or the presence of noise due to cultural features will have a tendency to mask the response from the contaminated zone (Klefstad and others, 1975). While TDEM methods are also affected by natural and man-made noise, the size of the TDEM array can be much smaller than that used for other electrical methods, thus minimizing the possibility of crossing a lateral boundary, and yet detect earth layers at similar or greater depths. Hence, the TDEM method is particularly useful for depth soundings in geologic environments where lateral

variations in resistivity are common (Frischknecht and Raab, 1984). Furthermore, TDEM methods are more sensitive to the presence of low resistivity layers than other electromagnetic or DC-resistivity methods (Kaufman and Keller, 1983).

GEOLOGICAL SETTING OF THE STUDY AREA

The study area is located in a geologic setting comprised of cyclic sequences of Upper Pennsylvanian marine and non-marine sediments gently dipping to the west. Considerable geologic mapping has been done in and around this region of Oklahoma (Beckwith, 1930; Bellis and Rowland; 1976; Tanner, 1956) because of the extensive oil exploration and production here. In the study area, the lowermost units of the Upper Pennsylvanian Council Grove Group, namely the Foraker - Red Eagle limestone sequence, outcrop at the surface. Underlying this sequence are other units of the Upper Pennsylvanian stratigraphic section including the Admire Group, the Wabaunsee Group, and the Douglas-Shawnee Group. Each of these groups contain variable lithologies differentiated primarily by changing percentages of limestones, shales, and sandstones. The inferred land mass in Upper Pennsylvanian time was to the south and the main depositional basin was to the north. The sequence from the Douglas-Shawnee Group to the Council Grove Group, while alternating somewhat back and forth, appears to be primarily a transgressive sequence from near-shore continental, deltaic, and shallow marine clastics in the Vamoosa Formation of the Douglas-Shawnee Group to the deeper marine lagoonal facies of the Council Grove Group which is comprised primarily of shales and limestones.

DATA ACQUISITION AND PROCESSING

Time domain EM measurements were made over a period of three and one-half days in November, 1983, at stations 1-20 (Figure 1) of the study area west of Pawhuska, Oklahoma. This area is the site of active oil production with numerous active and inactive wells, pipelines, power lines, and other man-made structures. The contaminated area is outlined on the surface by the presence of dead grass and several brine seeps. All TDEM measurements were made with a Mark II SIROTEM system designed by CSIRO (Buselli and O'Neill, 1977). A square, single wire on the earth's surface measuring either 152m or 76m on a side, was used as both the transmitting and receiving loop. The selection of the loop size used was controlled primarily by the proximity of cultural features. The larger loop was used whenever space permitted. When power lines, steel pipes, or steel fences (sources of distortion and noise in the TDEM data results) would be crossed because of the large loop dimensions, the smaller loop was used. The interval between stations along each of the TDEM traverses was approximately the length of the side of the transmitting loop except where the presence of cultural features required a larger spacing to minimize interference. The current driven through the transmitting loop ranged from 4 to 5 amperes.

The time-domain EM SIROTEM system operates by transmitting a step-function current into a wire loop. Eddy currents are induced in the earth by this changing primary field. During the transmitter off time, measurements are made of the transient voltage induced in the wire loop by secondary

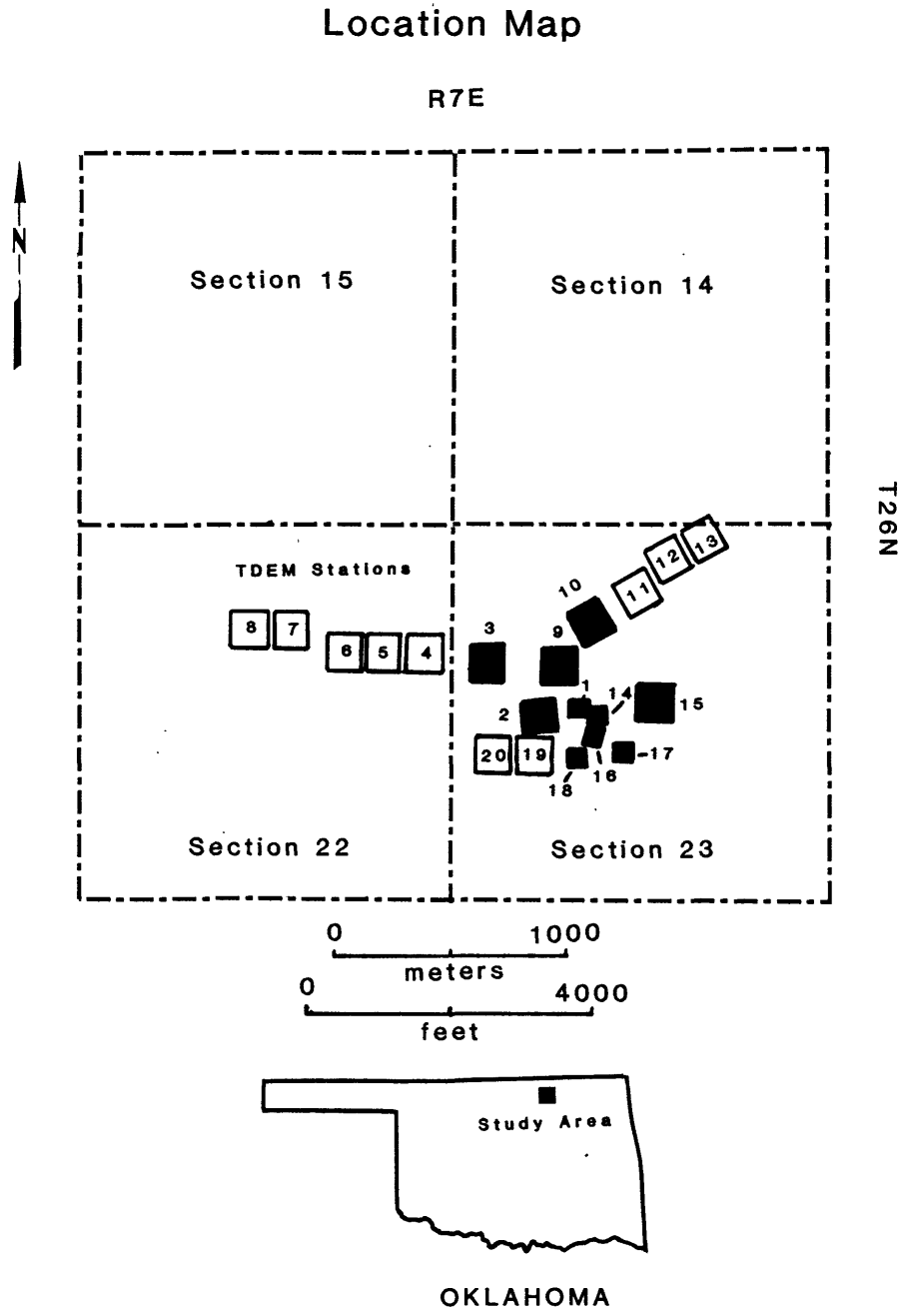

Figure 1. Location map of TDEM soundings.
Squares show the size of the loops.

magnetic fields generated by the decay of the eddy currents. The transient voltage decay curve is digitized at discrete intervals of time after transmitter turnoff and normalized by the transmitted current. For this study we made measurements at times ranging from 0.4 to 94.2 milliseconds after transmitter turnoff. The final recorded data values were the result of averaging 2048 observations at each time interval, a SIROTEM option which reduces the effect of random noise. At each station we made at least four soundings of 2048 observations, reversing the polarity of the loop between each sounding in order to check for consistency between results and also to reduce the effect of any DC offset present in the system. The normalized voltages were transformed into apparent resistivities (Raab and Frischknecht, 1983; Spies and Raiche, 1980) in the field using a micro-computer. Apparent resistivity vs. time results are intuitively easier to interpret than transient voltage curves. The apparent resistivity transformation also normalizes the raw data for differing loop sizes. Initial processing of some of the data in the field allowed for rapid comparison of results among different stations. These comparisons helped to verify that the equipment was operating properly and to ensure that the station spacing was adequate. Final data processing consisted of converting all the normalized voltages into apparent resistivities, editing out observations which were obviously bad, and averaging the four soundings at each station.

Station locations were selected to satisfy two general purposes. The first was to determine how the local geoelectrical section varied from inside the brine contaminated region through the transition zone and into the area outside the polluted region. For this purpose we made measurements along one long east-west traverse line. Second, efforts were made to pinpoint the center of the contaminated region and to describe its geometry as measured by the TDEM method. This was accomplished by making several soundings in and around the region of major contamination. The center of the wire loop is the nominal point of measurement for the TDEM method using the single loop configuration. Hence, the precision with which we were able to determine the horizontal position of various regions of pollution or non-pollution depended on the TDEM loop dimensions and station spacing used. In the case of this survey, the precision with which the center of the pollution was determined would be on the order of 35 to 50 meters. The determination of the boundaries of the obviously polluted zone has a precision on the order of 75 to 100 meters.

APPARENT RESISTIVITY RESULTS

Apparent resistivity curves for individual soundings indicate, in a general way, variations in the geoelectrical section with depth. In the TDEM method, the early time portion of the sounding curve reflects the resistivity of mostly near surface layers while the later time portion of the curve represents the resistivity of primarily deeper layers (Kaufman and Keller, 1983; Morrison et al., 1969; Negi and Verma, 1972; Wait, 1956). Consequently, apparent resistivity pseudo sections, somewhat similar to geologic cross sections, can be constructed with station locations along the horizontal axis and the time after transimitter turnoff on the vertical axis. Such a pseudo section shows approximate lateral and vertical variations in resistivity. Caution must be exercised in quantitative interpretations of pseudo sections because the relationship between time and depth depends on the resistivity.

Several such pseudo sections were constructed from the TDEM soundings (Figures 2a, 2b, and 2c). If one considers the long east-west traverse pseudo section (Figure 2a), a pronounced vertical low resistivity anomaly can be observed between stations 4 and 10, a region of known contamination. Pseudo sections for the shorter traverses (Figures 2b and 2c) also have a characteristic low resistivity anomaly centered over the polluted area. The apparent resistivity sounding curve for station 3 (Figure 3), and for other stations in this low resistivity region, display a characteristic trend of monotonically decreasing resistivity with time. In contrast, the portions of the pseudo sections away from the known contaminated region describe a pattern which appears to be more consistently and horizontally structured between stations. For example stations 4 to 8, 10 to 13, and stations 19 and 20 have sounding curves which describe an apparent resistivity structure which is more resistive near the surface, decreases in resistivity, than increases, and finally becomes less resistive at depth. Figure 4 illustrates a sounding curve, typical of this pattern, for station 8. Apparent resistivity measurements made at station 16 are the lowest of any of the stations and presumably indicate that station 16 is nearest the center of the highest concentration of brine. The apparent resistivity sounding curves provide information which defines the approximate boundaries and geometry of the contaminated area without the need for extensive computer interpretation. If more detailed information about true layer resistivities and layer depths is required then computer modeling or curve matching is necessary.

TDEM INVERSION RESULTS

One-dimensional layered earth models were calculated to explain variations in the apparent resistivity TDEM sounding curves for each station. This was done with the curve fitting inversion program "NLSTCO" (Anderson, 1982) which uses an adaptive non-linear least squares technique outlined by Dennis and others (1979). The program "NLSTCO" fits the observed data with a calculated geophysical model which has a finite number of layers, each layer having a specific thickness and resistivity (the lowermost layer is considered to have infinite thickness). Three or four layer models fit all the TDEM data from the study area very well. Final fits were accepted on the basis of visual agreement between observed and calculated curves and the minimization of least-square error. (see Appendix I for observed data and calculated curves with model parameters).

Geoelectric cross sections were drawn from the inversion results. The long east-west traverse cross section (Figure 5a) describes the changes in resistivities and layer thicknesses from the uncontaminated through the contaminated region. Outside the area of pollution (stations 4-8 and 10-13), a consistent four-layer earth model fits the TDEM data. This four-layer model represents variations in the electrical properties of the local stratigraphic section with depth. Electric well log information indicates that the geologic section in this part of Oklahoma is characterized by many thin alternating conductive and resistive units (Grieg, 1959). Measurements with the TDEM method cannot resolve these small-scale variations but instead are representative of larger changes in the bulk material properties of the local geologic section. There appears to be a rough correlation between the local stratigraphic group boundaries and the interfaces of the geoelectrical cross section in the uncontaminated area. Measurements made in the uncontaminated region of the study area with the large transmitting loop indicate that the

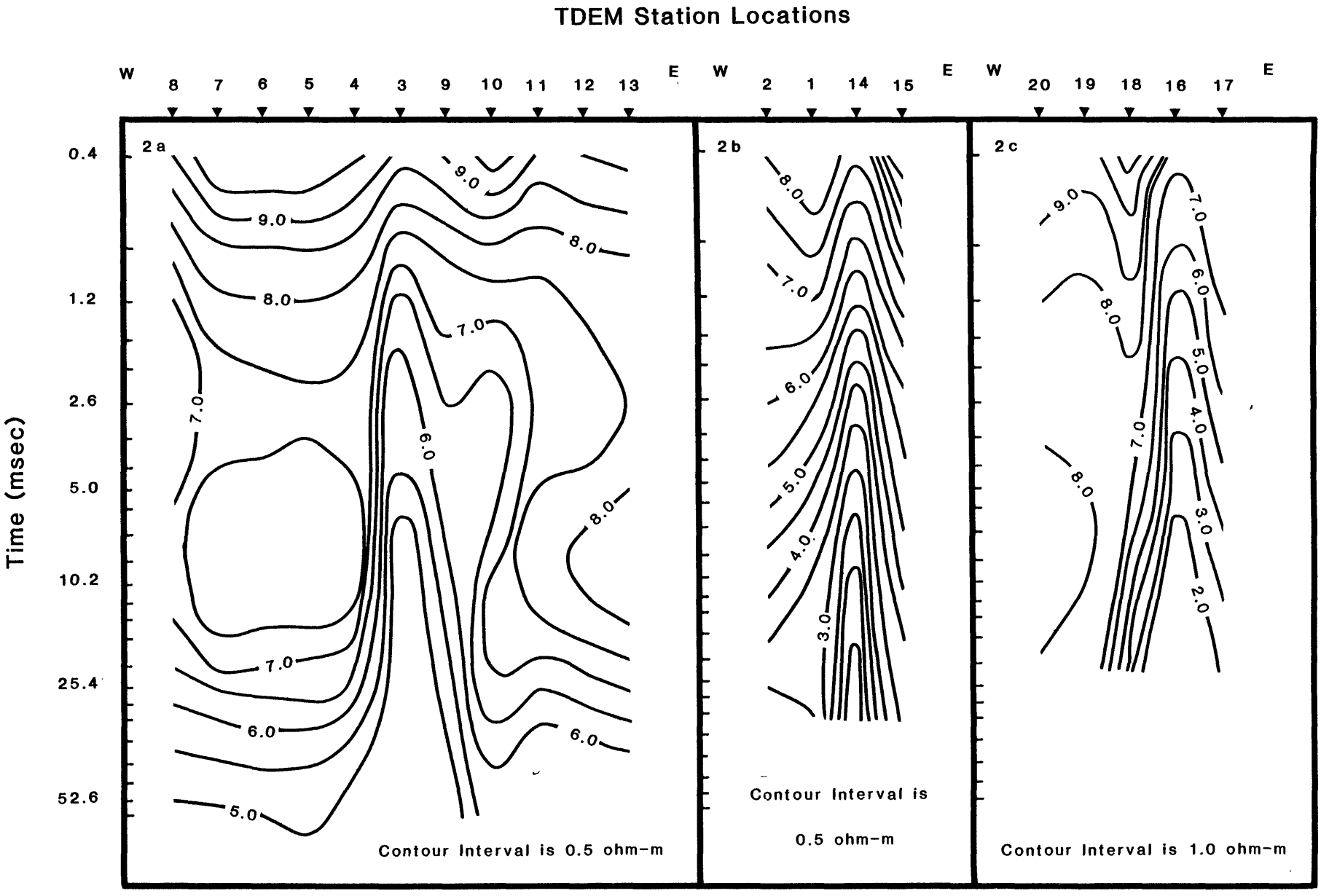

Figure 2(a, b, c). Apparent resistivity pseudo-sections for TDEM stations.

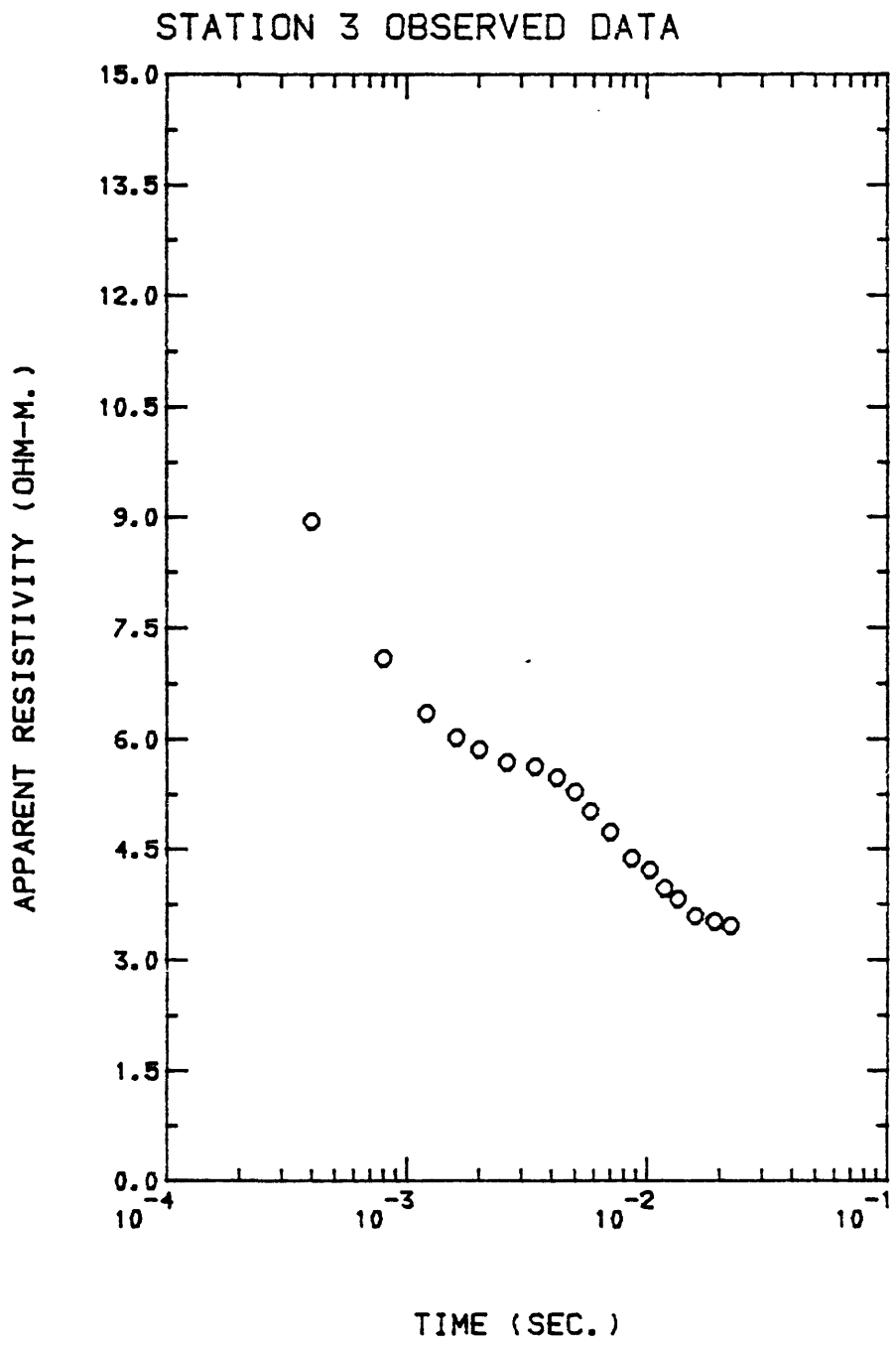

Figure 3. Apparent resistivity sounding curve for station 3.

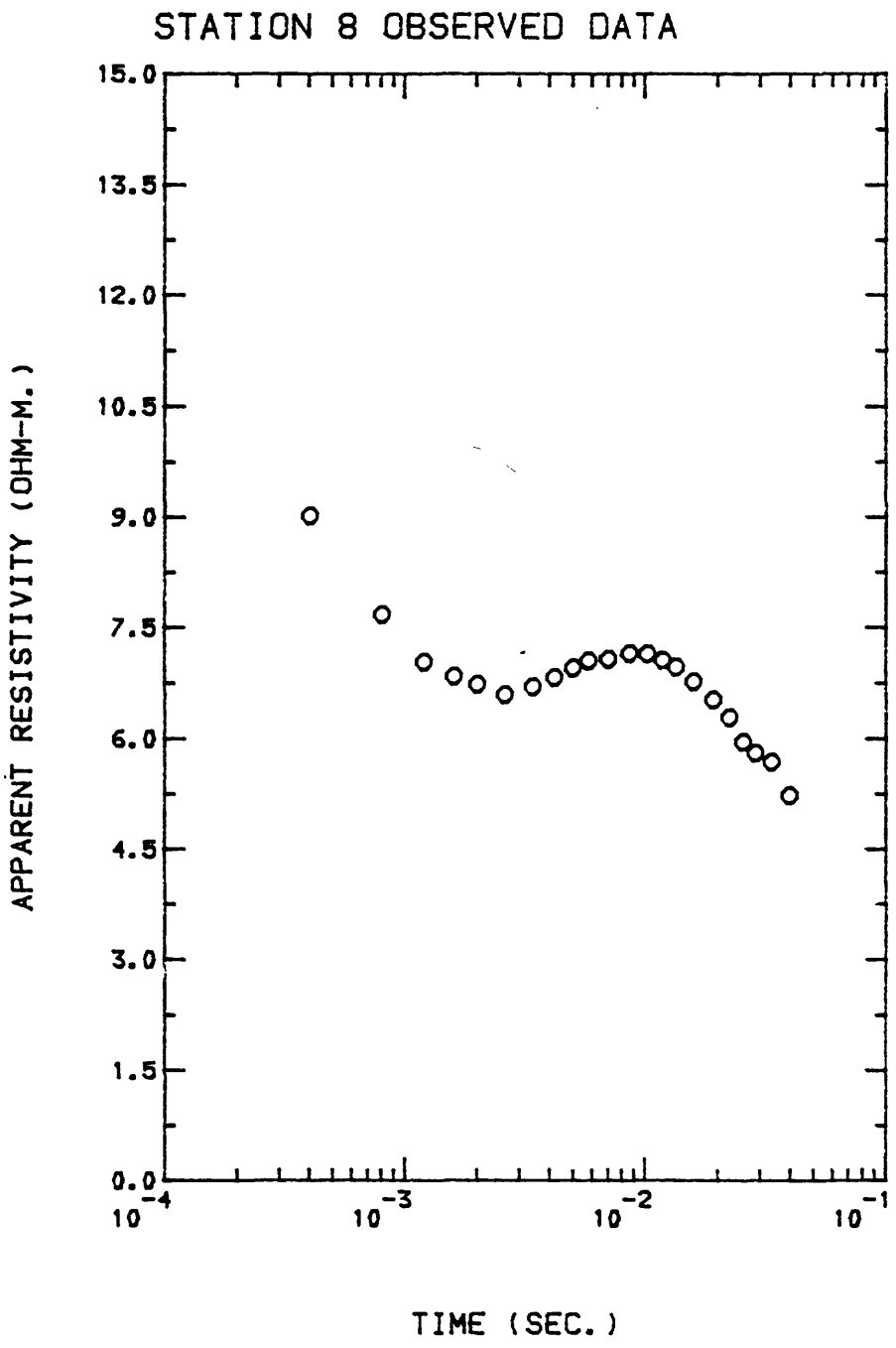

Figure 4. Apparent resistivity sounding curve for station 8.

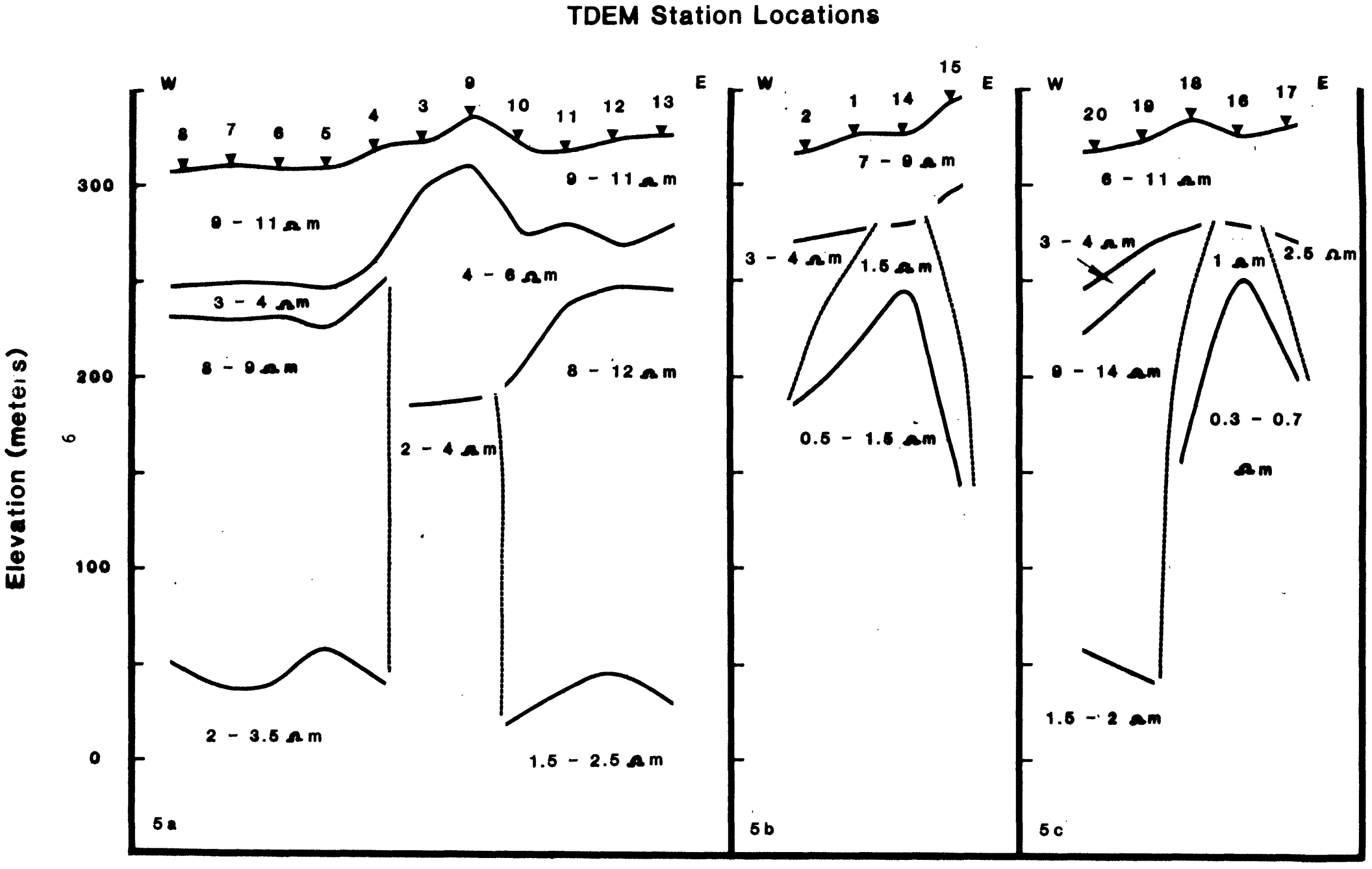

Figure 5(a, b, c). Interpreted geoelectric cross-sections for TDEM stations. Solid lines represent layer interfaces. Dashed lines indicate probable boundaries of brine contamination.

top of the deepest layer detected is at a depth of about 275m. Resistivity contrasts of 3:1 were delineated between layers. Since the geoelectric modeling results in the uncontaminated region are relatively uniform, the electrical effects of the brine, where present, should be very obvious.

In the contaminated region (stations 3 and 9) of the long east-west traverse, the sounding curves were best fit with three-layer models. Calculated first layer resistivities in the contaminated area were approximately the same as those calculated for stations outside the area of pollution. Apparently the brine is not very pervasive in the near surface although measurements with an EM-31 instrument, which has a depth of investigation limited to a few meters, indicated local resistivity lows near salt-water seeps (Ray Watts, 1983, oral comm.). The first and second layer interface occurs at a shallower depth inside the contaminated zone than outside but the resistivities for the second layer are about the same. The most distinctive difference between the uncontaminated and contaminated geoelectrical sections occurs in the third layer. The interpreted resistivities of the third layer are substantially lower and the thickness of the overlying layer is much less inside the contaminated region. The transition from the uncontaminated region to the contaminated one appears to be fairly rapid and cannot be distinctively characterized. There was more difficulty in fitting the soundings adjacent to the main contaminated area with one-dimensional models, particularly station 10. This is probably due to sharp lateral changes in the geoelectric section which make a simple one-dimensional model inadequate to totally describe the measured earth response.

TDEM stations along the shorter traverses were used primarily to outline the details of the contaminated area and to locate, as nearly as possible, the highest concentration of pollution. Two other resistivity cross sections (Figures 5b and 5c) illustrate the inversion results for these soundings. Most of the sounding curves in these last two cross sections were fit by three-layer models. Sounding curves for stations 19 and 20 were fit with four-layer models similar to those for stations 4-8 and 10-13 and so are interpreted as being outside the area of detectable contamination. Inside the contaminated area, the calculated models for stations 1, 2, and 14-18 all have a resistive first layer indicating, again, that the near surface concentration of brine is low compared to the concentration at depth. Resistivities and thicknesses of the second and third layers are highly variable among these stations. This is expected as the geometry of the contaminated zone would also be variable. Inconsistency of interpreted results among stations inside the polluted area is probably the result of variations in fracture distribution and rock pore space. The dynamics of brine flow through the earth produce lateral heterogeneities which affect the one-dimensional interpretations. The lowest overall interpreted resistivities and closest approach to the surface of a low resistivity layer occurs at station 16. Hence, one would predict that the highest concentration of brine occurs near this station. Considering all of the station results inside the contaminated area, it is apparent that the concentration of brine increases towards the southeast of the study area.

CONCLUSIONS

This study shows that the TDEM method is a potentially useful surface geophysical technique for defining and monitoring subsurface brine contamination. Qualitative interpretations of apparent resistivity results are sufficient to outline the general boundaries of the polluted region without extensive computer processing. Geoelectric cross sections estimated from the inversion results quantitatively describe the contaminated area in more detail. Although the resistivity of unpolluted strata in this area is low, the brine has a much lower resistivity such that its presence is easily recognized. Salt-water seeps and shallow EM surveys indicate that some brine contamination in the Pawhuska study area extends all the way to the surface. However, the calculated TDEM models indicate that the main concentration of brine is confined to depths ranging from about 50 to 150 meters below the surface. The top of the contaminated zone is nearest the surface at station 16, rapidly becoming deeper to either side of this station. This would suggest that the brine contamination is not confined to any particular stratigraphic horizon at present. Instead, its distribution is more probably controlled by the presence of steep fractures in the rock strata. Future movement of the brine could be readily monitored with the TDEM method now that the present geometry has been described.

Measurements of both lateral and vertical variations in the geoelectric section can be made rapidly with the TDEM method using the single loop configuration. This is an advantage over single electrode spacing DC-resistivity measurements which provide little depth information. Furthermore, the TDEM method is not as likely to be affected by cultural features and lateral variations in geology, as are other electrical methods, because of its small measurement array size versus depth of exploration. Consequently, the TDEM method can be used to describe contamination at greater depths than the DC-resistivity method or other EM methods even when cultural noise or lateral heterogeneities are present. As is the case with any electrical geophysical technique, the TDEM is most effective in regions with high resistivity contrasts. For example, weaker concentrations of brine could be detected more readily in regions of high resistivity host rocks than in low resistivity regions.

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Appendix I

The following tables and plots detail the inversion results for each of the TDEM station measurements. The title at the top of each page identifies the station number and number of layers in the calculated model (e.g. "POK1 - 3 LAYER (SN)" describes the results for a 3 layer model fit to the observed data of station 1). The tables of numeric results describe the following:

A = radius of a circular loop equivalent in area to the square loop used (A = 86m for 152m square loop and A = 43m for 76m square loop),

I = observation number,

OBS.Y(I) = observed apparent resistivity,

CAL = calculated apparent resistivity,

RES = the residual (OBS.Y(I)-CAL),

%RES.ERR = percent residual error (100*RES/CAL),

X(I,1) = the observed time in seconds,

RMSERR = root-mean-square error, the standard error of the residual vector,

CORRELATION MATRIX = derived from the computed covariance matrix,

STDERROR = the measure of error of each determined layer nonlinear parameter (PARMSOL.),

RELERROR = the relative error (STDERROR/PARMSOL.)

% ERROR = the percent error (100*RELERROR)

FINAL SOLUTION = the final solution vector where SIGMA(I) is the layer conductivity, THICK(I) is the layer thickness, RESISTIVITY is the layer resistivity (1/SIGMA(I)), LAYER DEPTH is the accumulated layer thicknesses.

The upper plot shows the observed apparent resistivity vs. time sounding curves and the calculated model curves for each station. The observed data are represented by the circles and the calculated curve by the solid line. The lower plot describes the layered earth model for each calculated solution.

```
<NLSTCO>:     POK1 - 3 LAYER (SN)
A= 0.860000E+02
***** X-CONVERGENCE *****
  I     OBS.Y(I)        CAL             RES          %RES.ERR       X(1,1)
  1  0.874590E+01  0.877195E+01 -0.261E-01 -0.297019E+00  0.400000E-03
  2  0.764470E+01  0.763607E+01  0.863E-02  0.113001E+00  0.800000E-03
  3  0.695700E+01  0.691382E+01  0.432E-01  0.624511E+00  0.120000E-02
  4  0.643090E+01  0.646058E+01 -0.297E-01 -0.459420E+00  0.160000E-02
  5  0.611380E+01  0.610562E+01  0.818E-02  0.133977E+00  0.200000E-02
  6  0.560830E+01  0.568000E+01 -0.717E-01 -0.126238E+01  0.260000E-02
  7  0.523120E+01  0.521991E+01  0.113E-01  0.216234E+00  0.340000E-02
  8  0.489420E+01  0.485931E+01  0.349E-01  0.718086E+00  0.420000E-02
  9  0.461410E+01  0.456908E+01  0.450E-01  0.985395E+00  0.500000E-02
 10  0.436890E+01  0.433049E+01  0.384E-01  0.886938E+00  0.580000E-02
 11  0.407280E+01  0.404773E+01  0.251E-01  0.619364E+00  0.700000E-02
 12  0.377190E+01  0.376492E+01  0.698E-02  0.185470E+00  0.860000E-02
 13  0.343340E+01  0.355063E+01 -0.117E+00 -0.330165E+01  0.102000E-01
 14  0.331040E+01  0.338382E+01 -0.734E-01 -0.216972E+01  0.118000E-01
 15  0.325910E+01  0.325019E+01  0.891E-02  0.274290E+00  0.134000E-01
 16  0.316250E+01  0.309073E+01  0.718E-01  0.232199E+01  0.158000E-01
** RMSERR=  0.59233379E-01
CORRELATION MATRIX
 1  0.1000E+01
 2  0.6531E+00  0.1000E+01
 3  0.4338E+00  0.4374E+00  0.1000E+01
 4  0.7277E+00  0.9507E+00  0.4224E+00  0.1000E+01
 5  0.3349E+00  0.3662E+00  0.5075E+00  0.2561E+00  0.1000E+01
  **PARM_SOL.    STD_ERROR    REL_ERROR     % ERROR **
 1  0.1313E+00  0.1639E-03  0.1248E-02  0.1248E+00
 2  0.3136E+00  0.1066E-02  0.3396E-02  0.3396E+00
 3  0.6385E+00  0.1326E-02  0.2077E-02  0.2077E+00
 4  0.5026E+02  0.3797E-03  0.7554E-05  0.7554E-03
 5  0.6105E+02  0.2981E-03  0.4883E-05  0.4883E-03
PARAMETER NAME       FINAL SOLUTION        RESISTIVITY   LAYER DEPTH
   1   SIGMA( 1) =  0.13132042E+00   1  0.76149621E+01
   2   SIGMA( 2) =  0.31379917E+00   2  0.31867516E+01
   3   SIGMA( 3) =  0.63846010E+00   3  0.15662686E+01
   4   THICK( 1) =  0.50259766E+02                      1  0.50259766E+02
   5   THICK( 2) =  0.61049957E+02                      2  0.11130972E+03
   6 * SHIFT     =  0.10000000E+01
     * FIXED
```

```
<NLSTCO>:     POK2 - 3 LAYER (SN)
A= 0.860000E+02
***** X-CONVERGENCE *****
  I     OBS.Y(I)       CAL            RES         %RES.ERR       X(I,1)
  1  0.797550E+01  0.798902E+01 -0.135E-01 -0.169259E+00  0.400000E-03
  2  0.714500E+01  0.714735E+01 -0.235E-02 -0.328573E-01  0.800000E-03
  3  0.673880E+01  0.672780E+01  0.110E-01  0.163553E+00  0.120000E-02
  4  0.654850E+01  0.651013E+01  0.384E-01  0.589369E+00  0.160000E-02
  5  0.634330E+01  0.634062E+01  0.268E-02  0.422870E-01  0.200000E-02
  6  0.602610E+01  0.610768E+01 -0.816E-01 -0.133561E+01  0.260000E-02
  7  0.576620E+01  0.579194E+01 -0.257E-01 -0.444364E+00  0.340000E-02
  8  0.550910E+01  0.548995E+01  0.191E-01  0.348745E+00  0.420000E-02
  9  0.526080E+01  0.522007E+01  0.407E-01  0.780175E+00  0.500000E-02
 10  0.501530E+01  0.497771E+01  0.376E-01  0.755206E+00  0.580000E-02
 11  0.468350E+01  0.467113E+01  0.124E-01  0.264810E+00  0.700000E-02
 12  0.434500E+01  0.435145E+01 -0.645E-02 -0.148285E+00  0.860000E-02
 13  0.408310E+01  0.409856E+01 -0.155E-01 -0.377241E+00  0.102000E-01
 14  0.388630E+01  0.389692E+01 -0.106E-01 -0.272587E+00  0.118000E-01
 15  0.368830E+01  0.373620E+01 -0.479E-01 -0.128210E+01  0.134000E-01
 16  0.350450E+01  0.353944E+01 -0.349E-01 -0.987102E+00  0.158000E-01
 17  0.342630E+01  0.334110E+01  0.872E-01  0.261003E+01  0.190000E-01
** RMSERR=  0.44916812E-01
CORRELATION MATRIX
 1  0.1000E+01
 2  0.3478E+00  0.1000E+01
 3 -0.5438E-01  0.2571E+00  0.1000E+01
 4  0.6826E+00  0.8213E+00 -0.2367E-01  0.1000E+01
 5 -0.3125E+00  0.1172E+00  0.8488E+00 -0.2857E+00  0.1000E+01
  **PARMSOL.    STDERROR    RELERROR     % ERROR **
 1  0.1366E+00  0.1331E-03  0.9744E-03  0.9744E-01
 2  0.2387E+00  0.4038E-03  0.1692E-02  0.1692E+00
 3  0.6119E+00  0.1781E-02  0.2910E-02  0.2910E+00
 4  0.4568E+02  0.3355E-03  0.7345E-05  0.7345E-03
 5  0.8107E+02  0.3236E-03  0.3992E-05  0.3992E-03
PARAMETER NAME       FINAL SOLUTION        RESISTIVITY   LAYER DEPTH
   1   SIGMA( 1) =  0.13664436E+00   1  0.73182673E+01
   2   SIGMA( 2) =  0.23872356E+00   2  0.41889458E+01
   3   SIGMA( 3) =  0.61191201E+00   3  0.16342219E+01
   4   THICK( 1) =  0.45675652E+02                      1  0.45675652E+02
   5   THICK( 2) =  0.81069572E+02                      2  0.12674522E+03
   6 * SHIFT     =  0.10000000E+01
     * FIXED
```

```
<NLSTCO>:     POK3 - 3 LAYER (SN)
A= 0.860000E+02
***** X-CONVERGENCE *****
  I     OBS.Y(I)       CAL            RES          %RES.ERR       X(I,1)
  1  0.894550E+01  0.897589E+01 -0.304E-01 -0.338540E+00  0.400000E-03
  2  0.709060E+01  0.699069E+01  0.999E-01  0.142924E+01  0.800000E-03
  3  0.635950E+01  0.635839E+01  0.111E-02  0.174585E-01  0.120000E-02
  4  0.602600E+01  0.608217E+01 -0.562E-01 -0.923581E+00  0.160000E-02
  5  0.586650E+01  0.592869E+01 -0.622E-01 -0.104889E+01  0.200000E-02
  6  0.568350E+01  0.576607E+01 -0.826E-01 -0.143206E+01  0.260000E-02
  7  0.563240E+01  0.557267E+01  0.597E-01  0.107184E+01  0.340000E-02
  8  0.548220E+01  0.537315E+01  0.109E+00  0.202956E+01  0.420000E-02
  9  0.528550E+01  0.518238E+01  0.103E+00  0.198984E+01  0.500000E-02
 10  0.502290E+01  0.499433E+01  0.286E-01  0.572119E+00  0.580000E-02
 11  0.473660E+01  0.474113E+01 -0.453E-02 -0.954554E-01  0.700000E-02
 12  0.437490E+01  0.445879E+01 -0.839E-01 -0.188141E+01  0.860000E-02
 13  0.421350E+01  0.422271E+01 -0.921E-02 -0.218019E+00  0.102000E-01
 14  0.396740E+01  0.402986E+01 -0.625E-01 -0.154992E+01  0.118000E-01
 15  0.382210E+01  0.387166E+01 -0.496E-01 -0.128002E+01  0.134000E-01
 16  0.359180E+01  0.367387E+01 -0.821E-01 -0.223383E+01  0.158000E-01
 17  0.351980E+01  0.347235E+01  0.475E-01  0.136658E+01  0.190000E-01
 18  0.345970E+01  0.331895E+01  0.141E+00  0.424092E+01  0.222000E-01
** RMSERR=  0.85014366E-01
CORRELATION MATRIX
 1  0.1000E+01
 2 -0.7342E-01  0.1000E+01
 3 -0.8036E+00 -0.1850E+00  0.1000E+01
 4  0.8624E+00  0.3112E+00 -0.8484E+00  0.1000E+01
 5 -0.7179E+00  0.1559E+00  0.7545E+00 -0.6712E+00  0.1000E+01
  **PARMSOL.    STDERROR    RELERROR     % ERROR **
 1  0.9174E-01  0.8072E-03  0.8799E-02  0.8799E+00
 2  0.2372E+00  0.2749E-03  0.1159E-02  0.1159E+00
 3  0.6022E+00  0.1908E-02  0.3168E-02  0.3168E+00
 4  0.2511E+02  0.3825E-03  0.1523E-04  0.1523E-02
 5  0.1134E+03  0.5404E-03  0.4766E-05  0.4766E-03
PARAMETER NAME       FINAL SOLUTION        RESISTIVITY   LAYER DEPTH
   1   SIGMA( 1) =  0.91736965E-01    1  0.10900731E+02
   2   SIGMA( 2) =  0.23717922E+00    2  0.42162209E+01
   3   SIGMA( 3) =  0.60221118E+00    3  0.16605470E+01
   4   THICK( 1) =  0.25107996E+02                      1  0.25107996E+02
   5   THICK( 2) =  0.11339624E+03                      2  0.13850424E+03
   6 * SHIFT     =  0.10000000E+01
     * FIXED
```

```
<NLSTCO>:     POK4 - 4 LAYER (SN)
A= 0.860000E+02
***** X-CONVERGENCE *****
   I     OBS.Y(I)        CAL             RES          %RES.ERR       X(I,1)
   1  0.958710E+01  0.958063E+01  0.647E-02  0.674994E-01  0.400000E-03
   2  0.833470E+01  0.836927E+01 -0.346E-01 -0.413033E+00  0.800000E-03
   3  0.785470E+01  0.781057E+01  0.441E-01  0.564989E+00  0.120000E-02
   4  0.759210E+01  0.755403E+01  0.381E-01  0.503959E+00  0.160000E-02
   5  0.749240E+01  0.743528E+01  0.571E-01  0.768234E+00  0.200000E-02
   6  0.727650E+01  0.737091E+01 -0.944E-01 -0.128079E+01  0.260000E-02
   7  0.731430E+01  0.739429E+01 -0.800E-01 -0.108182E+01  0.340000E-02
   8  0.743250E+01  0.747444E+01 -0.419E-01 -0.561102E+00  0.420000E-02
   9  0.758130E+01  0.755928E+01  0.220E-01  0.291258E+00  0.500000E-02
  10  0.769950E+01  0.764313E+01  0.564E-01  0.737497E+00  0.580000E-02
  11  0.771960E+01  0.772735E+01 -0.775E-02 -0.100343E+00  0.700000E-02
  12  0.777790E+01  0.774834E+01  0.296E-01  0.381533E+00  0.860000E-02
  13  0.771170E+01  0.769300E+01  0.187E-01  0.243123E+00  0.102000E-01
  14  0.759060E+01  0.757394E+01  0.167E-01  0.219968E+00  0.118000E-01
  15  0.743380E+01  0.741162E+01  0.222E-01  0.299325E+00  0.134000E-01
  16  0.711200E+01  0.715669E+01 -0.447E-01 -0.624472E+00  0.158000E-01
  17  0.676410E+01  0.679267E+01 -0.286E-01 -0.420589E+00  0.190000E-01
  18  0.645870E+01  0.645743E+01  0.127E-02  0.196275E-01  0.222000E-01
  19  0.617420E+01  0.617126E+01  0.294E-02  0.477126E-01  0.254000E-01
  20  0.589280E+01  0.590449E+01 -0.117E-01 -0.198020E+00  0.286000E-01
  21  0.553810E+01  0.556738E+01 -0.293E-01 -0.525984E+00  0.334000E-01
  22  0.523280E+01  0.521996E+01  0.128E-01  0.245984E+00  0.398000E-01
  23  0.482710E+01  0.493586E+01 -0.109E+00 -0.220353E+01  0.462000E-01
  24  0.482280E+01  0.471271E+01  0.110E+00  0.233599E+01  0.526000E-01
  25  0.454630E+01  0.452957E+01  0.167E-01  0.369453E+00  0.590000E-01
  26  0.435500E+01  0.430028E+01  0.547E-01  0.127259E+01  0.686000E-01
  27  0.404970E+01  0.406056E+01 -0.109E-01 -0.267415E+00  0.814000E-01
** RMSERR=  0.55680577E-01
CORRELATION MATRIX
  1  0.1000E+01
  2 -0.4968E+00  0.1000E+01
  3 -0.1594E+00 -0.6624E+00  0.1000E+01
  4  0.3859E+00 -0.8693E+00  0.5215E+00  0.1000E+01
  5  0.5175E+00 -0.4424E+00 -0.7835E-01  0.5577E+00  0.1000E+01
  6 -0.1654E+00  0.4247E+00 -0.3324E+00 -0.5451E+00 -0.4122E+00  0.1000E+01
  7 -0.2264E+00 -0.4541E+00  0.6975E+00  0.3774E+00 -0.3045E+00 -0.5696E+00
0.1000E+01
   **PARMSOL.    STDERROR    RELERROR     % ERROR **
  1  0.1120E+00  0.8719E-04  0.7788E-03  0.7788E-01
  2  0.3220E+00  0.3242E-03  0.1007E-02  0.1007E+00
  3  0.1299E+00  0.1160E-03  0.8924E-03  0.8924E-01
  4  0.5277E+00  0.5960E-03  0.1130E-02  0.1130E+00
  5  0.6065E+02  0.8379E-04  0.1381E-05  0.1381E-03
  6  0.1222E+02  0.4418E-04  0.3615E-05  0.3615E-03
  7  0.2022E+03  0.1944E-03  0.9614E-06  0.9614E-04
PARAMETER NAME        FINAL SOLUTION          RESISTIVITY    LAYER DEPTH
   1    SIGMA( 1) =  0.11195692E+00    1  0.89320078E+01
   2    SIGMA( 2) =  0.32196805E+00    2  0.31058981E+01
   3    SIGMA( 3) =  0.12994689E+00    3  0.76954517E+01
   4    SIGMA( 4) =  0.52768111E+00    4  0.18950839E+01
   5    THICK( 1) =  0.60654781E+02                       1  0.60654781E+02
   6    THICK( 2) =  0.12221029E+02                       2  0.72875809E+02
   7    THICK( 3) =  0.20223650E+03                       3  0.27511230E+03
   8 * SHIFT      =  0.10000000E+01   19
     * FIXED
```

```
<NLSTCO>:     POK5 - 4 LAYER (SN)
A= 0.860000E+02
***** X-CONVERGENCE *****
   I     OBS.Y(I)       CAL            RES         %RES.ERR       X(I,1)
   1  0.101070E+02  0.998047E+01  0.127E+00  0.126774E+01  0.400000E-03
   2  0.864810E+01  0.867072E+01 -0.226E-01 -0.260869E+00  0.800000E-03
   3  0.804040E+01  0.798058E+01  0.598E-01  0.749518E+00  0.120000E-02
   4  0.776080E+01  0.767402E+01  0.868E-01  0.113081E+01  0.160000E-02
   5  0.763130E+01  0.756468E+01  0.666E-01  0.880696E+00  0.200000E-02
   6  0.744260E+01  0.753472E+01 -0.921E-01 -0.122262E+01  0.260000E-02
   7  0.751460E+01  0.762177E+01 -0.107E+00 -0.140617E+01  0.340000E-02
   8  0.764200E+01  0.773075E+01 -0.888E-01 -0.114802E+01  0.420000E-02
   9  0.776830E+01  0.782949E+01 -0.612E-01 -0.781480E+00  0.500000E-02
  10  0.788360E+01  0.790781E+01 -0.242E-01 -0.306129E+00  0.580000E-02
  11  0.789340E+01  0.795100E+01 -0.576E-01 -0.724431E+00  0.700000E-02
  12  0.792420E+01  0.791793E+01  0.627E-02  0.791925E-01  0.860000E-02
  13  0.784810E+01  0.781804E+01  0.301E-01  0.384524E+00  0.102000E-01
  14  0.775990E+01  0.766323E+01  0.967E-01  0.126151E+01  0.118000E-01
  15  0.764280E+01  0.749444E+01  0.148E+00  0.197958E+01  0.134000E-01
  16  0.733830E+01  0.725130E+01  0.870E-01  0.119985E+01  0.158000E-01
  17  0.694240E+01  0.692536E+01  0.170E-01  0.245994E+00  0.190000E-01
  18  0.668600E+01  0.664154E+01  0.445E-01  0.669413E+00  0.222000E-01
  19  0.640220E+01  0.640941E+01 -0.721E-02 -0.112554E+00  0.254000E-01
  20  0.614610E+01  0.619301E+01 -0.469E-01 -0.757502E+00  0.286000E-01
  21  0.592430E+01  0.592216E+01  0.214E-02  0.361443E-01  0.334000E-01
  22  0.556250E+01  0.564647E+01 -0.840E-01 -0.148704E+01  0.398000E-01
  23  0.528800E+01  0.541330E+01 -0.125E+00 -0.231467E+01  0.462000E-01
  24  0.522610E+01  0.522768E+01 -0.158E-02 -0.301645E-01  0.526000E-01
  25  0.512810E+01  0.507707E+01  0.510E-01  0.100514E+01  0.590000E-01
  26  0.502600E+01  0.489162E+01  0.134E+00  0.274714E+01  0.686000E-01
  27  0.471470E+01  0.469588E+01  0.188E-01  0.400763E+00  0.814000E-01
  28  0.472770E+01  0.454843E+01  0.179E+00  0.394146E+01  0.942000E-01
** RMSERR=  0.94583228E-01
CORRELATION MATRIX
  1  0.1000E+01
  2 -0.3306E+00  0.1000E+01
  3 -0.2337E+00 -0.7025E-02  0.1000E+01
  4 -0.5086E+00  0.5905E+00  0.7098E-01  0.1000E+01
  5  0.1081E+00 -0.6524E+00 -0.2751E+00 -0.6501E+00  0.1000E+01
  6  0.1742E+00 -0.6539E+00 -0.4976E+00 -0.6244E+00  0.6643E+00  0.1000E+01
  7 -0.4155E+00  0.6030E+00  0.4149E+00  0.4061E+00 -0.6213E+00 -0.6474E+00
0.1000E+01
   **PARMSOL.    SIDERROR    RELERROR     % ERROR **
  1  0.1087E+00  0.8686E-04  0.7987E-03  0.7987E-01
  2  0.2732E+00  0.2537E-03  0.9288E-03  0.9288E-01
  3  0.1086E+00  0.1444E-03  0.1329E-02  0.1329E+00
  4  0.3619E+00  0.2759E-03  0.7624E-03  0.7624E-01
  5  0.6322E+02  0.8835E-04  0.1398E-05  0.1398E-03
  6  0.2172E+02  0.7828E-04  0.3604E-05  0.3604E-03
  7  0.1660E+03  0.1644E-03  0.9907E-06  0.9907E-04
PARAMETER NAME       FINAL SOLUTION          RESISTIVITY   LAYER DEPTH
   1   SIGMA( 1) =  0.10874362E+00   1  0.91959419E+01
   2   SIGMA( 2) =  0.27319255E+00   2  0.36604218E+01
   3   SIGMA( 3) =  0.10864662E+00   3  0.92041521E+01
   4   SIGMA( 4) =  0.36192998E+00   4  0.27629654E+01
   5   THICK( 1) =  0.63222656E+02                      1  0.63222656E+02
   6   THICK( 2) =  0.21718184E+02                      2  0.84940842E+02
   7   THICK( 3) =  0.16599657E+03                      3  0.25093741E+03
   8 * SHIFT     =  0.10000000E+01
   * FIXED
```

```
<NLSTCO>:     POK6 - 4 LAYER (SN)
A= 0.860000E+02
***** X-CONVERGENCE *****
   I     OBS.Y(I)       CAL            RES         %RES.ERR       X(I,1)
   1  0.100600E+02  0.992550E+01  0.134E+00  0.135506E+01  0.400000E-03
   2  0.853570E+01  0.857625E+01 -0.406E-01 -0.472875E+00  0.800000E-03
   3  0.791670E+01  0.794178E+01 -0.251E-01 -0.315819E+00  0.120000E-02
   4  0.765410E+01  0.765296E+01  0.114E-02  0.148666E-01  0.160000E-02
   5  0.749700E+01  0.753003E+01 -0.330E-01 -0.438600E+00  0.200000E-02
   6  0.731230E+01  0.746656E+01 -0.154E+00 -0.206603E+01  0.260000E-02
   7  0.741640E+01  0.750336E+01 -0.870E-01 -0.115891E+01  0.340000E-02
   8  0.756930E+01  0.758422E+01 -0.149E-01 -0.196778E+00  0.420000E-02
   9  0.772260E+01  0.766786E+01  0.547E-01  0.713901E+00  0.500000E-02
  10  0.781760E+01  0.774677E+01  0.708E-01  0.914284E+00  0.580000E-02
  11  0.780460E+01  0.781509E+01 -0.105E-01 -0.134251E+00  0.700000E-02
  12  0.783090E+01  0.782813E+01  0.277E-02  0.353723E-01  0.860000E-02
  13  0.778110E+01  0.777411E+01  0.699E-02  0.898826E-01  0.102000E-01
  14  0.767370E+01  0.765992E+01  0.138E-01  0.179899E+00  0.118000E-01
  15  0.756260E+01  0.751937E+01  0.432E-01  0.574884E+00  0.134000E-01
  16  0.726530E+01  0.730048E+01 -0.352E-01 -0.481822E+00  0.158000E-01
  17  0.707210E+01  0.698836E+01  0.837E-01  0.119828E+01  0.190000E-01
  18  0.668820E+01  0.670332E+01 -0.151E-01 -0.225596E+00  0.222000E-01
  19  0.639580E+01  0.645871E+01 -0.629E-01 -0.973991E+00  0.254000E-01
  20  0.610160E+01  0.622753E+01 -0.126E+00 -0.202208E+01  0.286000E-01
  21  0.590140E+01  0.593826E+01 -0.369E-01 -0.620784E+00  0.334000E-01
  22  0.564240E+01  0.564028E+01  0.212E-02  0.375871E-01  0.398000E-01
  23  0.525840E+01  0.538464E+01 -0.126E+00 -0.234454E+01  0.462000E-01
  24  0.543730E+01  0.518714E+01  0.250E+00  0.482260E+01  0.526000E-01
  25  0.502410E+01  0.502349E+01  0.607E-03  0.120930E-01  0.590000E-01
  26  0.485940E+01  0.481216E+01  0.472E-01  0.981605E+00  0.686000E-01
** RMSERR=  0.95608257E-01
CORRELATION MATRIX
  1  0.1000E+01
  2 -0.6031E+00  0.1000E+01
  3 -0.1180E+00 -0.3725E+00  0.1000E+01
  4  0.7075E-02 -0.1063E+00 -0.4739E-01  0.1000E+01
  5  0.5355E+00 -0.6156E+00  0.3169E+00 -0.1523E+00  0.1000E+01
  6 -0.5476E+00  0.3627E+00 -0.8936E-01 -0.1846E+00 -0.6450E+00  0.1000E+01
  7  0.3518E+00 -0.4446E+00 -0.1289E+00 -0.1661E+00  0.3081E-01 -0.2023E+00
0.1000E+01
   **PARMSOL.    STDERROR    RELERROR     % ERROR **
  1  0.1088E+00  0.1193E-03  0.1096E-02  0.1096E+00
  2  0.2943E+00  0.3128E-03  0.1063E-02  0.1063E+00
  3  0.1211E+00  0.1850E-03  0.1527E-02  0.1527E+00
  4  0.3991E+00  0.3300E-03  0.8269E-03  0.8269E-01
  5  0.6135E+02  0.1457E-03  0.2375E-05  0.2375E-03
  6  0.1653E+02  0.6930E-04  0.4193E-05  0.4193E-03
  7  0.1936E+03  0.1730E-03  0.8939E-06  0.8939E-04
PARAMETER NAME       FINAL SOLUTION          RESISTIVITY   LAYER DEPTH
   1   SIGMA( 1) =  0.10882939E+00    1  0.91886950E+01
   2   SIGMA( 2) =  0.29425162E+00    2  0.33984520E+01
   3   SIGMA( 3) =  0.12112258E+00    3  0.82560987E+01
   4   SIGMA( 4) =  0.39906955E+00    4  0.25058289E+01
   5   THICK( 1) =  0.61354164E+02                       1  0.61354164E+02
   6   THICK( 2) =  0.16526649E+02                       2  0.77880814E+02
   7   THICK( 3) =  0.19357233E+03                       3  0.27145316E+03
   8 * SHIFT     =  0.10000000E+01
     * FIXED
```

```
<NLSTCO>:     POK7 - 4 LAYER (SN)
A= 0.860000E+02
***** X-CONVERGENCE *****
   I     OBS.Y(I)        CAL             RES          %RES.ERR       X(I,1)
   1  0.102390E+02  0.101977E+02  0.413E-01  0.405254E+00  0.400000E-03
   2  0.851970E+01  0.860721E+01 -0.875E-01 -0.101674E+01  0.800000E-03
   3  0.788480E+01  0.784968E+01  0.351E-01  0.447401E+00  0.120000E-02
   4  0.756720E+01  0.751630E+01  0.509E-01  0.677188E+00  0.160000E-02
   5  0.741760E+01  0.738471E+01  0.329E-01  0.445332E+00  0.200000E-02
   6  0.725360E+01  0.732012E+01 -0.665E-01 -0.908667E+00  0.260000E-02
   7  0.733680E+01  0.736721E+01 -0.304E-01 -0.412747E+00  0.340000E-02
   8  0.745520E+01  0.745069E+01  0.451E-02  0.605559E-01  0.420000E-02
   9  0.757000E+01  0.754192E+01  0.281E-01  0.372376E+00  0.500000E-02
  10  0.769030E+01  0.763326E+01  0.570E-01  0.747316E+00  0.580000E-02
  11  0.772540E+01  0.772124E+01  0.416E-02  0.539011E-01  0.700000E-02
  12  0.781990E+01  0.777832E+01  0.416E-01  0.534596E+00  0.860000E-02
  13  0.776900E+01  0.778058E+01 -0.116E-01 -0.148771E+00  0.102000E-01
  14  0.774520E+01  0.772322E+01  0.220E-01  0.284575E+00  0.118000E-01
  15  0.756180E+01  0.764869E+01 -0.869E-01 -0.113598E+01  0.134000E-01
  16  0.746800E+01  0.752463E+01 -0.566E-01 -0.752628E+00  0.156000E-01
  17  0.735180E+01  0.731984E+01  0.320E-01  0.436569E+00  0.190000E-01
** RMSERR=  0.61502438E-01
CORRELATION MATRIX
  1  0.1000E+01
  2 -0.2348E+00  0.1000E+01
  3  0.3724E+00 -0.8215E+00  0.1000E+01
  4  0.3879E+00  0.1200E+00 -0.2167E+00  0.1000E+01
  5  0.4732E+00  0.3960E+00 -0.4533E-01  0.2028E+00  0.1000E+01
  6 -0.1243E+00 -0.7852E+00  0.4211E+00 -0.6182E-01 -0.6038E+00  0.1000E+01
  7 -0.1557E+00 -0.1376E+00  0.2468E+00 -0.6116E+00 -0.3380E+00 -0.1568E+00
0.1000E+01
   **PARMSOL.    STDERROR    RELERROR     % ERROR **
  1  0.1075E+00  0.9824E-04  0.9138E-03  0.9138E-01
  2  0.3167E+00  0.6608E-03  0.2087E-02  0.2087E+00
  3  0.1104E+00  0.2683E-03  0.2432E-02  0.2432E+00
  4  0.2804E+00  0.7809E-03  0.2786E-02  0.2786E+00
  5  0.6214E+02  0.1531E-03  0.2463E-05  0.2463E-03
  6  0.1859E+02  0.1466E-03  0.7888E-05  0.7888E-03
  7  0.1929E+03  0.3424E-03  0.1775E-05  0.1775E-03
PARAMETER NAME       FINAL SOLUTION        RESISTIVITY    LAYER DEPTH
   1   SIGMA( 1) =  0.10750577E+00    1  0.93018265E+01
   2   SIGMA( 2) =  0.31668228E+00    2  0.31577392E+01
   3   SIGMA( 3) =  0.11035218E+00    3  0.90618963E+01
   4   SIGMA( 4) =  0.28035095E+00    4  0.35669577E+01
   5   THICK( 1) =  0.62140251E+02                       1  0.62140251E+02
   6   THICK( 2) =  0.18590284E+02                       2  0.80730537E+02
   7   THICK( 3) =  0.19285446E+03                       3  0.27358499E+03
   8 * SHIFT     =  0.10000000E+01
     * FIXED
```

```
<NLSTCO>:     POK8 - 4 LAYER (SN)
A= 0.860000E+02
***** X-CONVERGENCE *****
   I     OBS.Y(I)        CAL             RES          %RES.ERR       X(I,1)
   1   0.901800E+01   0.898100E+01   0.370E-01   0.412031E+00   0.400000E-03
   2   0.767800E+01   0.770138E+01  -0.234E-01  -0.303610E+00   0.800000E-03
   3   0.703970E+01   0.706654E+01  -0.268E-01  -0.379868E+00   0.120000E-02
   4   0.684520E+01   0.680316E+01   0.420E-01   0.617946E+00   0.160000E-02
   5   0.673590E+01   0.669100E+01   0.449E-01   0.670985E+00   0.200000E-02
   6   0.659670E+01   0.666043E+01  -0.637E-01  -0.956806E+00   0.260000E-02
   7   0.670070E+01   0.671608E+01  -0.154E-01  -0.228937E+00   0.340000E-02
   8   0.683280E+01   0.682295E+01   0.985E-02   0.144436E+00   0.420000E-02
   9   0.695650E+01   0.692473E+01   0.318E-01   0.458849E+00   0.500000E-02
  10   0.705310E+01   0.701561E+01   0.375E-01   0.534392E+00   0.580000E-02
  11   0.707610E+01   0.711536E+01  -0.393E-01  -0.551743E+00   0.700000E-02
  12   0.715340E+01   0.715873E+01  -0.533E-02  -0.745090E-01   0.860000E-02
  13   0.714530E+01   0.713599E+01   0.931E-02   0.130422E+00   0.102000E-01
  14   0.705970E+01   0.706539E+01  -0.569E-02  -0.805483E-01   0.118000E-01
  15   0.696720E+01   0.694583E+01   0.214E-01   0.307707E+00   0.134000E-01
  16   0.677040E+01   0.676378E+01   0.662E-02   0.978168E-01   0.158000E-01
  17   0.653190E+01   0.650849E+01   0.234E-01   0.359645E+00   0.190000E-01
  18   0.629040E+01   0.625383E+01   0.366E-01   0.584732E+00   0.222000E-01
  19   0.595510E+01   0.602755E+01  -0.724E-01  -0.120193E+01   0.254000E-01
  20   0.580910E+01   0.583530E+01  -0.262E-01  -0.449029E+00   0.286000E-01
  21   0.568770E+01   0.557602E+01   0.112E+00   0.200294E+01   0.334000E-01
  22   0.523150E+01   0.528977E+01  -0.583E-01  -0.110157E+01   0.398000E-01
** RMSERR=  0.51060613E-01
CORRELATION MATRIX
  1   0.1000E+01
  2   0.3970E+00   0.1000E+01
  3  -0.3867E+00  -0.1965E+00   0.1000E+01
  4   0.1213E+00   0.2748E-01  -0.4121E+00   0.1000E+01
  5   0.4194E+00   0.6660E+00  -0.4437E+00   0.1552E-01   0.1000E+01
  6  -0.2176E+00  -0.5599E+00  -0.5670E+00   0.1112E+00  -0.1618E+00   0.1000E+01
  7  -0.4850E+00  -0.4418E+00   0.7015E+00  -0.3117E+00  -0.5536E+00  -0.2176E+00
0.1000E+01
   **PARMSOL.    STDERROR    RELERROR     % ERROR **
  1   0.1220E+00   0.6807E-04   0.5579E-03   0.5579E-01
  2   0.3443E+00   0.3879E-03   0.1127E-02   0.1127E+00
  3   0.1233E+00   0.1946E-03   0.1579E-02   0.1579E+00
  4   0.4141E+00   0.3660E-03   0.8839E-03   0.8839E-01
  5   0.5956E+02   0.1332E-03   0.2236E-05   0.2236E-03
  6   0.1647E+02   0.1730E-03   0.1050E-04   0.1050E-02
  7   0.1849E+03   0.2519E-03   0.1362E-05   0.1362E-03
PARAMETER NAME        FINAL SOLUTION          RESISTIVITY    LAYER DEPTH
    1    SIGMA( 1) =   0.12201339E+00    1   0.81958218E+01
    2    SIGMA( 2) =   0.34426531E+00    2   0.29047365E+01
    3    SIGMA( 3) =   0.12325591E+00    3   0.81132011E+01
    4    SIGMA( 4) =   0.41406697E+00    4   0.24150681E+01
    5    THICK( 1) =   0.59563831E+02                        1   0.59563831E+02
    6    THICK( 2) =   0.16474712E+02                        2   0.76038544E+02
    7    THICK( 3) =   0.18488774E+03                        3   0.26092630E+03
    8  * SHIFT     =   0.10000000E+01
       * FIXED
```

```
<NLSTCO>:     POK9 - 3 LAYER (SN)
A= 0.860000E+02
***** X-CONVERGENCE *****
  I     OBS.Y(I)        CAL            RES         %RES.ERR       X(I,1)
  1  0.906320E+01  0.903983E+01  0.234E-01  0.258467E+00  0.400000E-03
  2  0.763300E+01  0.765712E+01 -0.241E-01 -0.314974E+00  0.800000E-03
  3  0.719640E+01  0.717840E+01  0.180E-01  0.250801E+00  0.120000E-02
  4  0.696670E+01  0.694076E+01  0.259E-01  0.373740E+00  0.160000E-02
  5  0.681620E+01  0.679589E+01  0.203E-01  0.298814E+00  0.200000E-02
  6  0.654870E+01  0.664580E+01 -0.971E-01 -0.146108E+01  0.260000E-02
  7  0.645310E+01  0.650092E+01 -0.478E-01 -0.735524E+00  0.340000E-02
  8  0.638130E+01  0.637531E+01  0.599E-02  0.940240E-01  0.420000E-02
  9  0.630400E+01  0.627023E+01  0.338E-01  0.538532E+00  0.500000E-02
 10  0.620570E+01  0.617440E+01  0.313E-01  0.506925E+00  0.580000E-02
 11  0.607530E+01  0.604382E+01  0.315E-01  0.520812E+00  0.700000E-02
 12  0.592480E+01  0.590121E+01  0.236E-01  0.399774E+00  0.660000E-02
 13  0.584730E+01  0.577878E+01  0.685E-01  0.118568E+01  0.102000E-01
 14  0.565140E+01  0.567314E+01 -0.217E-01 -0.383125E+00  0.118000E-01
 15  0.561460E+01  0.558923E+01  0.254E-01  0.453979E+00  0.134000E-01
 16  0.538080E+01  0.547757E+01 -0.968E-01 -0.176666E+01  0.158000E-01
 17  0.531570E+01  0.535967E+01 -0.440E-01 -0.820362E+00  0.190000E-01
 18  0.531720E+01  0.526945E+01  0.478E-01  0.906249E+00  0.222000E-01
 19  0.528800E+01  0.518675E+01  0.101E+00  0.195214E+01  0.254000E-01
 20  0.508680E+01  0.512289E+01 -0.361E-01 -0.704455E+00  0.286000E-01
 21  0.503150E+01  0.504543E+01 -0.139E-01 -0.276183E+00  0.334000E-01
** RMSERR=  0.55392217E-01
CORRELATION MATRIX
 1  0.1000E+01
 2 -0.7086E+00  0.1000E+01
 3 -0.2608E+00 -0.2102E+00  0.1000E+01
 4  0.4936E+00 -0.1952E+00 -0.2035E+00  0.1000E+01
 5  0.1335E+00 -0.1065E+00 -0.8496E-01 -0.2403E+00  0.1000E+01
  **PARMSOL.    STDERROR    RELERROR     % ERROR **
 1  0.9224E-01  0.2324E-03  0.2520E-02  0.2520E+00
 2  0.1796E+00  0.1101E-03  0.6135E-03  0.6135E-01
 3  0.2473E+00  0.3182E-03  0.1287E-02  0.1287E+00
 4  0.2308E+02  0.6250E-04  0.2708E-05  0.2708E-03
 5  0.1353E+03  0.2906E-03  0.2147E-05  0.2147E-03
PARAMETER NAME       FINAL SOLUTION        RESISTIVITY   LAYER DEPTH
   1   SIGMA( 1) =  0.92241108E-01    1  0.10841153E+02
   2   SIGMA( 2) =  0.17955503E+00    2  0.55693231E+01
   3   SIGMA( 3) =  0.24734531E+00    3  0.40429311E+01
   4   THICK( 1) =  0.23075035E+02                      1  0.23075035E+02
   5   THICK( 2) =  0.13534109E+03                      2  0.15841614E+03
   6 * SHIFT     =  0.10000000E+01
     * FIXED
```

<NLSTCO>: POK10 - 4 LAYER (SN)

A= 0.860000E+02

***** X-CONVERGENCE *****

I	OBS.Y(I)	CAL	RES	%RES.ERR	X(I,1)
1	0.983380E+01	0.968211E+01	0.152E+00	0.156671E+01	0.400000E-03
2	0.799660E+01	0.812580E+01	-0.129E+00	-0.159001E+01	0.800000E-03
3	0.722850E+01	0.722656E+01	0.194E-02	0.268753E-01	0.120000E-02
4	0.679250E+01	0.672484E+01	0.677E-01	0.100616E+01	0.160000E-02
5	0.652710E+01	0.644841E+01	0.787E-01	0.122032E+01	0.200000E-02
6	0.618090E+01	0.625125E+01	-0.704E-01	-0.112538E+01	0.260000E-02
7	0.612700E+01	0.620077E+01	-0.738E-01	-0.118968E+01	0.340000E-02
8	0.609640E+01	0.625166E+01	-0.155E+00	-0.248357E+01	0.420000E-02
9	0.624950E+01	0.635605E+01	-0.107E+00	-0.167637E+01	0.500000E-02
10	0.642300E+01	0.647803E+01	-0.550E-01	-0.849455E+00	0.580000E-02
11	0.659040E+01	0.665584E+01	-0.654E-01	-0.983164E+00	0.700000E-02
12	0.689230E+01	0.686970E+01	0.226E-01	0.329053E+00	0.860000E-02
13	0.711820E+01	0.702830E+01	0.899E-01	0.127916E+01	0.102000E-01
14	0.725080E+01	0.712064E+01	0.130E+00	0.182796E+01	0.118000E-01
15	0.730410E+01	0.717233E+01	0.132E+00	0.183715E+01	0.134000E-01
16	0.721220E+01	0.718303E+01	0.292E-01	0.406103E+00	0.158000E-01
17	0.709220E+01	0.708754E+01	0.466E-02	0.657308E-01	0.190000E-01
18	0.686550E+01	0.694805E+01	-0.826E-01	-0.118813E+01	0.222000E-01
19	0.671700E+01	0.679497E+01	-0.780E-01	-0.114752E+01	0.254000E-01
20	0.653570E+01	0.661889E+01	-0.832E-01	-0.125684E+01	0.286000E-01
21	0.631360E+01	0.637519E+01	-0.616E-01	-0.966114E+00	0.334000E-01
22	0.615510E+01	0.610775E+01	0.473E-01	0.775212E+00	0.398000E-01
23	0.592750E+01	0.585701E+01	0.705E-01	0.120357E+01	0.462000E-01
24	0.573160E+01	0.564924E+01	0.824E-01	0.145783E+01	0.526000E-01
25	0.561170E+01	0.547931E+01	0.132E+00	0.241623E+01	0.590000E-01
26	0.529670E+01	0.526448E+01	0.322E-01	0.612097E+00	0.686000E-01
27	0.487020E+01	0.501210E+01	-0.142E+00	-0.283117E+01	0.814000E-01

** RMSERR= 0.10576237E+00

CORRELATION MATRIX

1	0.1000E+01					
2	0.1894E+00	0.1000E+01				
3	-0.2097E+00	-0.3160E+00	0.1000E+01			
4	-0.4184E+00	-0.1812E+00	-0.2187E-02	0.1000E+01		
5	-0.2065E+00	0.4585E+00	-0.4740E+00	0.1808E+00	0.1000E+01	
6	-0.6636E+00	-0.3212E+00	-0.2756E+00	0.1818E+00	0.2424E+00	0.1000E+01
7	0.1937E+00	0.2793E+00	-0.9737E-01	-0.6462E+00	-0.9554E-01	-0.1637E+00

0.1000E+01

	**PARMSOL.	STDERROR	RELERROR	% ERROR **
1	0.1113E+00	0.1278E-03	0.1148E-02	0.1148E+00
2	0.2195E+00	0.1334E-03	0.6078E-03	0.6078E-01
3	0.8127E-01	0.7067E-04	0.8696E-03	0.8696E-01
4	0.3802E+00	0.3699E-03	0.9730E-03	0.9730E-01
5	0.4537E+02	0.6600E-04	0.1455E-05	0.1455E-03
6	0.7803E+02	0.1420E-03	0.1820E-05	0.1820E-03
7	0.1784E+03	0.2229E-03	0.1249E-05	0.1249E-03

PARAMETER	NAME		FINAL SOLUTION		RESISTIVITY	LAYER	DEPTH
1	SIGMA(1)	=	0.11134638E+00	1	0.89809837E+01		
2	SIGMA(2)	=	0.21951656E+00	2	0.45554647E+01		
3	SIGMA(3)	=	0.81265189E-01	3	0.12305392E+02		
4	SIGMA(4)	=	0.38019896E+00	4	0.26302018E+01		
5	THICK(1)	=	0.45365967E+02			1	0.45365967E+02
6	THICK(2)	=	0.78034248E+02			2	0.12340022E+03
7	THICK(3)	=	0.17839940E+03			3	0.30179962E+03
8	* SHIFT	=	0.10000000E+01				
	* FIXED						

```
<NLSTCO>:     POK11 - 4 LAYER (SN)
A= 0.860000E+02
***** X-CONVERGENCE *****
   I     OBS.Y(I)       CAL            RES         %RES.ERR       X(I,1)
   1  0.881210E+01  0.881005E+01  0.205E-02  0.233059E-01  0.400000E-03
   2  0.774620E+01  0.771175E+01  0.344E-01  0.446715E+00  0.800000E-03
   3  0.729900E+01  0.734306E+01 -0.441E-01 -0.600090E+00  0.120000E-02
   4  0.716800E+01  0.720531E+01 -0.373E-01 -0.517775E+00  0.160000E-02
   5  0.723820E+01  0.715492E+01  0.833E-01  0.116396E+01  0.200000E-02
   6  0.708120E+01  0.716483E+01 -0.836E-01 -0.116725E+01  0.260000E-02
   7  0.719920E+01  0.724908E+01 -0.499E-01 -0.688081E+00  0.340000E-02
   8  0.738030E+01  0.738550E+01 -0.520E-02 -0.704522E-01  0.420000E-02
   9  0.761110E+01  0.751604E+01  0.951E-01  0.126473E+01  0.500000E-02
  10  0.773120E+01  0.764012E+01  0.911E-01  0.119211E+01  0.580000E-02
  11  0.776200E+01  0.778517E+01 -0.232E-01 -0.297660E+00  0.700000E-02
  12  0.786700E+01  0.786604E+01  0.959E-03  0.121906E-01  0.860000E-02
  13  0.783750E+01  0.784780E+01 -0.103E-01 -0.131261E+00  0.102000E-01
  14  0.773230E+01  0.775007E+01 -0.178E-01 -0.229255E+00  0.118000E-01
  15  0.757740E+01  0.758572E+01 -0.832E-02 -0.109665E+00  0.134000E-01
  16  0.723450E+01  0.731453E+01 -0.800E-01 -0.109408E+01  0.158000E-01
  17  0.684710E+01  0.691458E+01 -0.675E-01 -0.975842E+00  0.190000E-01
  18  0.651650E+01  0.653380E+01 -0.173E-01 -0.264837E+00  0.222000E-01
  19  0.623450E+01  0.620468E+01  0.298E-01  0.480643E+00  0.254000E-01
  20  0.596800E+01  0.590544E+01  0.626E-01  0.105943E+01  0.286000E-01
  21  0.556180E+01  0.552544E+01  0.364E-01  0.658104E+00  0.334000E-01
  22  0.518390E+01  0.513231E+01  0.516E-01  0.100512E+01  0.398000E-01
  23  0.466110E+01  0.481719E+01  0.439E-01  0.911438E+00  0.462000E-01
  24  0.453810E+01  0.455623E+01 -0.181E-01 -0.397913E+00  0.526000E-01
  25  0.433580E+01  0.434666E+01 -0.109E-01 -0.249781E+00  0.590000E-01
  26  0.400670E+01  0.410136E+01 -0.947E-01 -0.230799E+01  0.686000E-01
  27  0.378340E+01  0.383598E+01 -0.526E-01 -0.137073E+01  0.814000E-01
  28  0.363450E+01  0.363753E+01 -0.303E-02 -0.832541E-01  0.942000E-01
** RMSERR=  0.59153460E-01
CORRELATION MATRIX
  1  0.1000E+01
  2 -0.7275E+00  0.1000E+01
  3  0.1545E+00 -0.3770E+00  0.1000E+01
  4 -0.6382E+00  0.7317E+00 -0.3738E+00  0.1000E+01
  5 -0.1460E+00  0.9679E-01  0.6348E+00  0.8299E-02  0.1000E+01
  6  0.5493E+00 -0.7519E+00 -0.1549E+00 -0.6418E+00 -0.5492E+00  0.1000E+01
  7 -0.2375E+00  0.3632E+00 -0.5273E+00  0.3269E+00 -0.6214E+00 -0.6706E-01
0.1000E+01
   **PARMSOL.    STDERROR    RELERROR     % ERROR **
  1  0.1146E+00  0.7736E-04  0.6752E-03  0.6752E-01
  2  0.1796E+00  0.1723E-03  0.9591E-03  0.9591E-01
  3  0.1255E+00  0.9886E-04  0.7875E-03  0.7875E-01
  4  0.6368E+00  0.2395E-03  0.3761E-03  0.3761E-01
  5  0.3841E+02  0.3492E-04  0.9090E-06  0.9090E-04
  6  0.4196E+02  0.1722E-03  0.4104E-05  0.4104E-03
  7  0.2010E+03  0.9478E-04  0.4716E-06  0.4716E-04
PARAMETER NAME       FINAL SOLUTION          RESISTIVITY   LAYER DEPTH
   1   SIGMA( 1) =  0.11456151E+00    1  0.87289352E+01
   2   SIGMA( 2) =  0.17961265E+00    2  0.55675364E+01
   3   SIGMA( 3) =  0.12554061E+00    3  0.79655495E+01
   4   SIGMA( 4) =  0.63675863E+00    4  0.15704538E+01
   5   THICK( 1) =  0.38414776E+02                        1  0.38414776E+02
   6   THICK( 2) =  0.41962265E+02                        2  0.80377045E+02
   7   THICK( 3) =  0.20098236E+03                        3  0.28135941E+03
   8 * SHIFT     =  0.10000000E+01
     * FIXED
```

```
<NLSTCO>:     POK12 - 4 LAYER (SN)
A= 0.860000E+02
***** X-CONVERGENCE *****
  I     OBS.Y(I)       CAL             RES          %RES.ERR       X(I,1)
  1  0.905010E+01  0.901328E+01  0.368E-01  0.408534E+00  0.400000E-03
  2  0.804260E+01  0.797864E+01  0.640E-01  0.801617E+00  0.800000E-03
  3  0.760140E+01  0.758616E+01  0.152E-01  0.200945E+00  0.120000E-02
  4  0.743450E+01  0.744371E+01 -0.921E-02 -0.123781E+00  0.160000E-02
  5  0.738840E+01  0.739981E+01 -0.114E-01 -0.154132E+00  0.200000E-02
  6  0.726020E+01  0.742462E+01 -0.164E+00 -0.221456E+01  0.260000E-02
  7  0.736020E+01  0.752567E+01 -0.165E+00 -0.219871E+01  0.340000E-02
  8  0.753380E+01  0.766558E+01 -0.132E+00 -0.171907E+01  0.420000E-02
  9  0.778430E+01  0.779128E+01 -0.698E-02 -0.896111E-01  0.500000E-02
 10  0.795090E+01  0.790090E+01  0.500E-01  0.632811E+00  0.580000E-02
 11  0.801950E+01  0.801466E+01  0.484E-02  0.604000E-01  0.700000E-02
 12  0.812000E+01  0.805319E+01  0.668E-01  0.829653E+00  0.860000E-02
 13  0.806990E+01  0.800557E+01  0.643E-01  0.803519E+00  0.102000E-01
 14  0.793640E+01  0.789460E+01  0.418E-01  0.529482E+00  0.118000E-01
 15  0.776780E+01  0.772849E+01  0.393E-01  0.508650E+00  0.134000E-01
 16  0.747580E+01  0.747679E+01 -0.994E-03 -0.132972E-01  0.158000E-01
 17  0.708810E+01  0.712360E+01 -0.355E-01 -0.498358E+00  0.190000E-01
 18  0.676920E+01  0.678920E+01 -0.200E-01 -0.294613E+00  0.222000E-01
 19  0.648280E+01  0.650359E+01 -0.208E-01 -0.319686E+00  0.254000E-01
 20  0.625390E+01  0.624929E+01  0.461E-02  0.737312E-01  0.286000E-01
 21  0.588430E+01  0.592068E+01 -0.364E-01 -0.614461E+00  0.334000E-01
 22  0.570420E+01  0.557445E+01  0.130E+00  0.232751E+01  0.398000E-01
 23  0.519390E+01  0.530119E+01 -0.107E+00 -0.202394E+01  0.462000E-01
 24  0.501840E+01  0.506819E+01 -0.498E-01 -0.982363E+00  0.526000E-01
 25  0.487010E+01  0.487900E+01 -0.890E-02 -0.182359E+00  0.590000E-01
 26  0.467450E+01  0.465965E+01  0.149E-01  0.318727E+00  0.686000E-01
 27  0.447370E+01  0.442044E+01  0.533E-01  0.120495E+01  0.814000E-01
** RMSERR=  0.80479734E-01
CORRELATION MATRIX
  1  0.1000E+01
  2 -0.5780E+00  0.1000E+01
  3 -0.3694E+00 -0.1987E+00  0.1000E+01
  4  0.3062E+00 -0.4492E+00  0.8356E-02  0.1000E+01
  5  0.7279E+00 -0.5640E+00 -0.1872E+00  0.1630E+00  0.1000E+01
  6 -0.6087E-02 -0.8292E-01 -0.3962E+00 -0.3131E+00 -0.1396E-01  0.1000E+01
  7  0.2561E+00  0.6676E-01 -0.8078E-01  0.1212E+00  0.2544E+00 -0.2691E+00
0.1000E+01
   **PARMSOL.    STDERROR    RELERROR     % ERROR **
  1  0.1159E+00  0.1155E-03  0.9961E-03  0.9961E-01
  2  0.2105E+00  0.2352E-03  0.1117E-02  0.1117E+00
  3  0.1172E+00  0.9816E-04  0.8373E-03  0.8373E-01
  4  0.4542E+00  0.2115E-03  0.4658E-03  0.4658E-01
  5  0.5190E+02  0.1311E-03  0.2525E-05  0.2525E-03
  6  0.2484E+02  0.8347E-04  0.3361E-05  0.3361E-03
  7  0.1995E+03  0.1664E-03  0.8342E-06  0.8342E-04
PARAMETER NAME        FINAL SOLUTION          RESISTIVITY   LAYER DEPTH
   1    SIGMA( 1) =  0.11594135E+00    1  0.86250505E+01
   2    SIGMA( 2) =  0.21051973E+00    2  0.47501488E+01
   3    SIGMA( 3) =  0.11723619E+00    3  0.85297890E+01
   4    SIGMA( 4) =  0.45420533E+00    4  0.22016475E+01
   5    THICK( 1) =  0.51899040E+02                       1  0.51899040E+02
   6    THICK( 2) =  0.24836348E+02                       2  0.76735390E+02
   7    THICK( 3) =  0.19950998E+03  .27                  3  0.27624536E+03
   8 *  SHIFT     =  0.10000000E+01
     *  FIXED
```

```
<NLSTCO>:     POK13 - 4 LAYER (SN)
A= 0.860000E+02
***** X-CONVERGENCE *****
   I     OBS.Y(I)       CAL             RES          %RES.ERR       X(I,1)
   1  0.924060E+01  0.923409E+01  0.651E-02  0.705283E-01  0.400000E-03
   2  0.810360E+01  0.816737E+01 -0.638E-01 -0.780759E+00  0.800000E-03
   3  0.785830E+01  0.777774E+01  0.806E-01  0.103581E+01  0.120000E-02
   4  0.765950E+01  0.763368E+01  0.258E-01  0.338273E+00  0.160000E-02
   5  0.767070E+01  0.758791E+01  0.828E-01  0.109114E+01  0.200000E-02
   6  0.748410E+01  0.760491E+01 -0.121E+00 -0.158857E+01  0.260000E-02
   7  0.759660E+01  0.770255E+01 -0.106E+00 -0.137547E+01  0.340000E-02
   8  0.780290E+01  0.784814E+01 -0.452E-01 -0.576411E+00  0.420000E-02
   9  0.803990E+01  0.798625E+01  0.536E-01  0.671754E+00  0.500000E-02
  10  0.822010E+01  0.811898E+01  0.101E+00  0.124543E+01  0.580000E-02
  11  0.826250E+01  0.827161E+01  0.109E-01  0.131678E+00  0.700000E-02
  12  0.836880E+01  0.836255E+01  0.626E-02  0.747996E-01  0.860000E-02
  13  0.833890E+01  0.835619E+01 -0.173E-01 -0.206925E+00  0.102000E-01
  14  0.824230E+01  0.826477E+01 -0.225E-01 -0.271848E+00  0.118000E-01
  15  0.809640E+01  0.810602E+01 -0.962E-02 -0.118709E+00  0.134000E-01
  16  0.781830E+01  0.784669E+01 -0.284E-01 -0.361765E+00  0.158000E-01
  17  0.741710E+01  0.745160E+01 -0.345E-01 -0.463002E+00  0.190000E-01
  18  0.707550E+01  0.707555E+01 -0.510E-04 -0.721097E-03  0.222000E-01
  19  0.671700E+01  0.675478E+01 -0.378E-01 -0.559319E+00  0.254000E-01
  20  0.648240E+01  0.645097E+01  0.314E-01  0.487151E+00  0.286000E-01
  21  0.615650E+01  0.606652E+01  0.900E-01  0.148326E+01  0.334000E-01
  22  0.575020E+01  0.567160E+01  0.786E-01  0.138589E+01  0.398000E-01
  23  0.530520E+01  0.534212E+01 -0.369E-01 -0.691033E+00  0.462000E-01
  24  0.510900E+01  0.507520E+01  0.338E-01  0.666081E+00  0.526000E-01
  25  0.476930E+01  0.486125E+01 -0.920E-01 -0.189151E+01  0.590000E-01
  26  0.461450E+01  0.460592E+01  0.858E-02  0.186369E+00  0.686000E-01
** RMSERR=  0.68772636E-01
CORRELATION MATRIX
  1  0.1000E+01
  2 -0.7886E-01  0.1000E+01
  3 -0.2460E+00 -0.6682E+00  0.1000E+01
  4  0.2624E+00 -0.1075E+00 -0.4162E+00  0.1000E+01
  5  0.6784E+00  0.9391E-01 -0.1747E+00  0.2353E+00  0.1000E+01
  6 -0.5838E+00 -0.5197E+00  0.3423E+00 -0.6101E-01 -0.8068E+00  0.1000E+01
  7  0.3402E+00  0.4974E+00 -0.3776E+00 -0.2909E+00  0.2028E+00 -0.5120E+00
0.1000E+01
   **PARMSOL.    STDERROR    RELERROR     % ERROR **
  1  0.1123E+00  0.1010E-03  0.9002E-03  0.9002E-01
  2  0.1910E+00  0.1924E-03  0.1007E-02  0.1007E+00
  3  0.1149E+00  0.1116E-03  0.9717E-03  0.9717E-01
  4  0.5284E+00  0.3503E-03  0.6630E-03  0.6630E-01
  5  0.4928E+02  0.9150E-04  0.1857E-05  0.1857E-03
  6  0.2991E+02  0.1237E-03  0.4135E-05  0.4135E-03
  7  0.2131E+03  0.1007E-03  0.4728E-06  0.4728E-04
PARAMETER NAME        FINAL SOLUTION          RESISTIVITY    LAYER DEPTH
   1    SIGMA( 1) =  0.11225227E+00    1  0.89085064E+01
   2    SIGMA( 2) =  0.19098324E+00    2  0.52360616E+01
   3    SIGMA( 3) =  0.11487722E+00    3  0.87049456E+01
   4    SIGMA( 4) =  0.52835053E+00    4  0.18926829E+01
   5    THICK( 1) =  0.49275532E+02                       1  0.49275532E+02
   6    THICK( 2) =  0.29913124E+02                       2  0.79188660E+02
   7    THICK( 3) =  0.21308313E+03                       3  0.29227179E+03
   8 * SHIFT      =  0.10000000E+01
     * FIXED
```

```
<NLSTCO>:     POK15 - 3 LAYER (SN)
A= 0.860000E+02
***** X-CONVERGENCE *****
  I     OBS.Y(I)        CAL             RES          %RES.ERR       X(I,1)
  1  0.101610E+02  0.101374E+02  0.236E-01  0.233128E+00  0.400000E-03
  2  0.810950E+01  0.821591E+01 -0.106E+00 -0.129518E+01  0.800000E-03
  3  0.720010E+01  0.715374E+01  0.464E-01  0.648053E+00  0.120000E-02
  4  0.661620E+01  0.654265E+01  0.736E-01  0.112423E+01  0.160000E-02
  5  0.623100E+01  0.616541E+01  0.656E-01  0.106384E+01  0.200000E-02
  6  0.577970E+01  0.581967E+01 -0.400E-01 -0.686832E+00  0.260000E-02
  7  0.551170E+01  0.555770E+01 -0.460E-01 -0.827706E+00  0.340000E-02
  8  0.536400E+01  0.538315E+01 -0.191E-01 -0.355683E+00  0.420000E-02
  9  0.524420E+01  0.524523E+01 -0.103E-02 -0.195817E-01  0.500000E-02
 10  0.513850E+01  0.511875E+01  0.198E-01  0.385839E+00  0.580000E-02
 11  0.494340E+01  0.493383E+01  0.957E-02  0.193960E+00  0.700000E-02
 12  0.473330E+01  0.470278E+01  0.305E-01  0.649089E+00  0.860000E-02
 13  0.451340E+01  0.448703E+01  0.264E-01  0.587588E+00  0.102000E-01
 14  0.429070E+01  0.428760E+01  0.310E-02  0.722996E-01  0.118000E-01
 15  0.408570E+01  0.411179E+01 -0.261E-01 -0.634440E+00  0.134000E-01
 16  0.381700E+01  0.388686E+01 -0.699E-01 -0.179746E+01  0.158000E-01
 17  0.364660E+01  0.363721E+01  0.939E-02  0.258214E+00  0.190000E-01
** RMSERR=  0.54461695E-01
CORRELATION MATRIX
 1  0.1000E+01
 2  0.5398E+00  0.1000E+01
 3  0.3772E+00  0.5168E+00  0.1000E+01
 4  0.8007E+00  0.7701E+00  0.3003E+00  0.1000E+01
 5  0.7503E-01  0.3061E+00  0.4817E+00  0.8330E-01  0.1000E+01
  **PARMSOL.    STDERROR    RELERROR    % ERROR **
 1  0.1124E+00  0.1399E-03  0.1245E-02  0.1245E+00
 2  0.2931E+00  0.2433E-03  0.8300E-03  0.8300E-01
 3  0.7919E+00  0.2385E-02  0.3012E-02  0.3012E+00
 4  0.4775E+02  0.1757E-03  0.3679E-05  0.3679E-03
 5  0.1313E+03  0.2792E-03  0.2126E-05  0.2126E-03
PARAMETER NAME        FINAL SOLUTION          RESISTIVITY    LAYER DEPTH
   1    SIGMA( 1) =  0.11236245E+00    1  0.88997698E+01
   2    SIGMA( 2) =  0.29309717E+00    2  0.34118378E+01
   3    SIGMA( 3) =  0.79191375E+00    3  0.12627637E+01
   4    THICK( 1) =  0.47754841E+02                      1  0.47754841E+02
   5    THICK( 2) =  0.13132236E+03                      2  0.17907719E+03
   6  * SHIFT     =  0.10000000E+01
     * FIXED
```

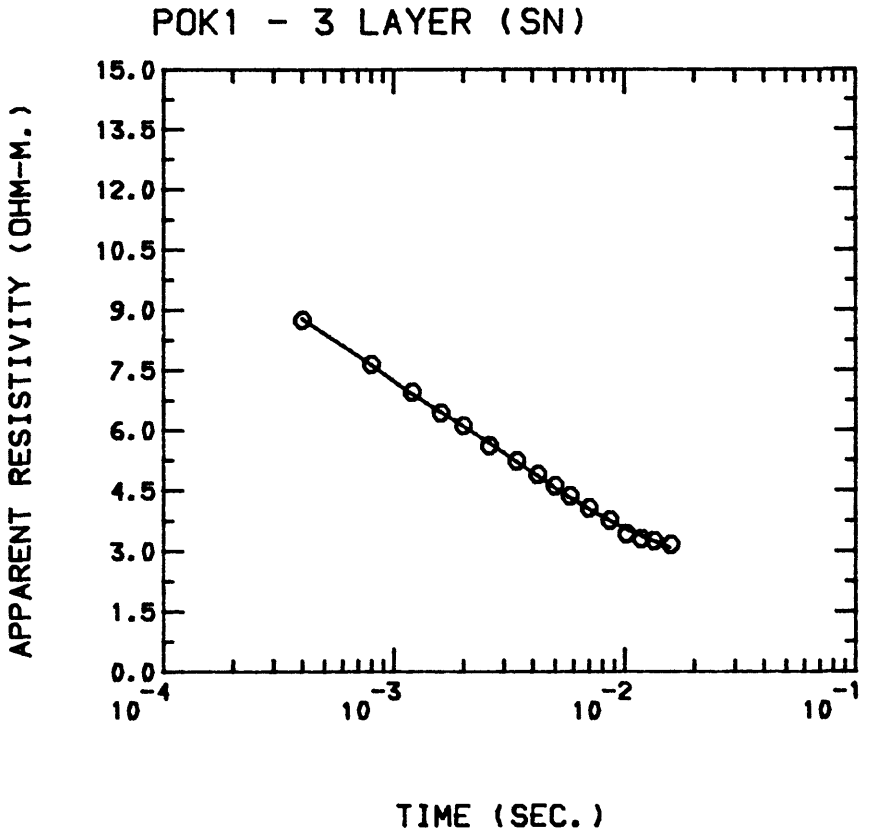
```
<NLSTCO>:     POK16 - 3 LAYER (SN)
A= 0.430000E+02
***** X-CONVERGENCE *****
  I     OBS.Y(I)       CAL             RES         %RES.ERR       X(I,1)
  1   0.733530E+01   0.731609E+01   0.192E-01   0.262537E+00   0.400000E-03
  2   0.586370E+01   0.582426E+01   0.394E-01   0.677195E+00   0.800000E-03
  3   0.479460E+01   0.483091E+01  -0.363E-01  -0.751710E+00   0.120000E-02
  4   0.415040E+01   0.419846E+01  -0.481E-01  -0.114478E+01   0.160000E-02
  5   0.371430E+01   0.374587E+01  -0.316E-01  -0.842718E+00   0.200000E-02
  6   0.323110E+01   0.323317E+01  -0.207E-02  -0.641402E-01   0.260000E-02
  7   0.281200E+01   0.275381E+01   0.582E-01   0.211299E+01   0.340000E-02
  8   0.250170E+01   0.241496E+01   0.867E-01   0.359186E+01   0.420000E-02
  9   0.224870E+01   0.216459E+01   0.841E-01   0.388562E+01   0.500000E-02
 10   0.204390E+01   0.197242E+01   0.715E-01   0.362384E+01   0.580000E-02
 11   0.179060E+01   0.175588E+01   0.347E-01   0.197749E+01   0.700000E-02
 12   0.154630E+01   0.155192E+01  -0.562E-02  -0.362040E+00   0.860000E-02
 13   0.137140E+01   0.140585E+01  -0.345E-01  -0.245058E+01   0.102000E-01
 14   0.124050E+01   0.129559E+01  -0.551E-01  -0.425214E+01   0.118000E-01
 15   0.113680E+01   0.120968E+01  -0.729E-01  -0.602468E+01   0.134000E-01
 16   0.103080E+01   0.111092E+01  -0.801E-01  -0.721242E+01   0.158000E-01
 17   0.938810E+00   0.101458E+01  -0.758E-01  -0.746848E+01   0.190000E-01
 18   0.875160E+00   0.943720E+00  -0.686E-01  -0.726484E+01   0.222000E-01
 19   0.830060E+00   0.888969E+00  -0.589E-01  -0.662667E+01   0.254000E-01
 20   0.800300E+00   0.845364E+00  -0.451E-01  -0.533069E+01   0.286000E-01
 21   0.764230E+00   0.794218E+00  -0.300E-01  -0.377580E+01   0.334000E-01
 22   0.750940E+00   0.743276E+00   0.766E-02   0.103115E+01   0.398000E-01
 23   0.736490E+00   0.704663E+00   0.318E-01   0.451661E+01   0.462000E-01
 24   0.722800E+00   0.674620E+00   0.482E-01   0.714179E+01   0.526000E-01
 25   0.724160E+00   0.650470E+00   0.737E-01   0.113287E+02   0.590000E-01
 26   0.677570E+00   0.621378E+00   0.562E-01   0.904311E+01   0.686000E-01
 27   0.643150E+00   0.591692E+00   0.515E-01   0.869682E+01   0.814000E-01
 28   0.633080E+00   0.569419E+00   0.637E-01   0.111801E+02   0.942000E-01
** RMSERR=  0.59840932E-01
CORRELATION MATRIX
 1   0.1000E+01
 2   0.2375E+00   0.1000E+01
 3  -0.2462E+00  -0.5926E+00   0.1000E+01
 4   0.5187E+00   0.7178E+00  -0.5317E+00   0.1000E+01
 5  -0.5400E+00  -0.3399E+00  -0.8231E-01  -0.5039E+00   0.1000E+01
  **PARMSOL.    STDERROR    RELERROR     % ERROR **
 1   0.1635E+00   0.4043E-03   0.2473E-02   0.2473E+00
 2   0.1175E+01   0.2187E-02   0.1861E-02   0.1861E+00
 3   0.3050E+01   0.3877E-02   0.1271E-02   0.1271E+00
 4   0.4696E+02   0.1746E-03   0.3718E-05   0.3718E-03
 5   0.2934E+02   0.2955E-03   0.1007E-04   0.1007E-02
PARAMETER NAME        FINAL SOLUTION          RESISTIVITY    LAYER DEPTH
   1    SIGMA( 1) =   0.16346213E+00    1   0.61176248E+01
   2    SIGMA( 2) =   0.11749289E+01    2   0.85111535E+00
   3    SIGMA( 3) =   0.30499487E+01    3   0.32787436E+00
   4    THICK( 1) =   0.46959518E+02                        1   0.46959518E+02
   5    THICK( 2) =   0.29337439E+02                        2   0.76296959E+02
   6 *  SHIFT      =   0.10000000E+01
     *  FIXED
```

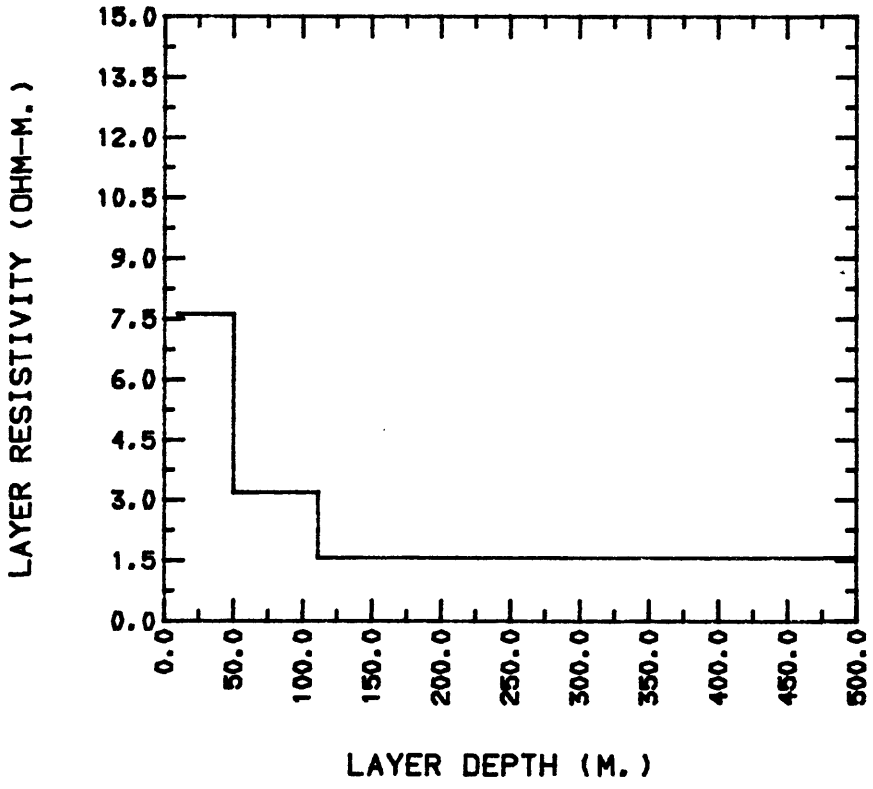
```
<NLSTCO>:     POK17 - 3 LAYER (SN)
A= 0.430000E+02
***** X-CONVERGENCE *****
  I     OBS.Y(I)        CAL            RES          %RES.ERR       X(I,1)
  1  0.881250E+01  0.875375E+01  0.587E-01  0.671132E+00  0.400000E-03
  2  0.779090E+01  0.781760E+01 -0.267E-01 -0.341483E+00  0.800000E-03
  3  0.722110E+01  0.711365E+01  0.107E+00  0.151051E+01  0.120000E-02
  4  0.671350E+01  0.668273E+01  0.308E-01  0.460373E+00  0.160000E-02
  5  0.632410E+01  0.637808E+01 -0.540E-01 -0.846356E+00  0.200000E-02
  6  0.578690E+01  0.595447E+01 -0.168E+00 -0.281413E+01  0.260000E-02
  7  0.537930E+01  0.544760E+01 -0.683E-01 -0.125373E+01  0.340000E-02
  8  0.502610E+01  0.497812E+01  0.480E-01  0.963911E+00  0.420000E-02
  9  0.472290E+01  0.458068E+01  0.142E+00  0.310480E+01  0.500000E-02
 10  0.436620E+01  0.424775E+01  0.118E+00  0.278863E+01  0.580000E-02
 11  0.391570E+01  0.383683E+01  0.789E-01  0.205562E+01  0.700000E-02
 12  0.354790E+01  0.342347E+01  0.124E+00  0.363456E+01  0.860000E-02
 13  0.321250E+01  0.311761E+01  0.949E-01  0.304378E+01  0.102000E-01
 14  0.283130E+01  0.287953E+01 -0.482E-01 -0.167480E+01  0.118000E-01
 15  0.263470E+01  0.268928E+01 -0.546E-01 -0.202967E+01  0.134000E-01
 16  0.247200E+01  0.246942E+01  0.258E-02  0.104456E+00  0.158000E-01
 17  0.208200E+01  0.225255E+01 -0.171E+00 -0.757158E+01  0.190000E-01
 18  0.198910E+01  0.208999E+01 -0.101E+00 -0.482716E+01  0.222000E-01
 19  0.192790E+01  0.196339E+01 -0.355E-01 -0.180755E+01  0.254000E-01
 20  0.177350E+01  0.186288E+01 -0.894E-01 -0.479772E+01  0.286000E-01
 21  0.172980E+01  0.174313E+01 -0.133E-01 -0.764702E+00  0.334000E-01
** RMSERR=  0.10415908E+00
CORRELATION MATRIX
 1  0.1000E+01
 2 -0.1900E+00  0.1000E+01
 3 -0.8819E-01  0.1801E+00  0.1000E+01
 4  0.2969E+00  0.2235E+00 -0.1510E+00  0.1000E+01
 5 -0.7348E+00  0.2226E-01  0.2409E+00 -0.8284E+00  0.1000E+01
  **PARMSOL.    STDERROR    RELERROR     % ERROR **
 1  0.1227E+00  0.1882E-03  0.1534E-02  0.1534E+00
 2  0.3844E+00  0.5001E-03  0.1301E-02  0.1301E+00
 3  0.1507E+01  0.1659E-02  0.1101E-02  0.1101E+00
 4  0.5873E+02  0.1635E-03  0.2784E-05  0.2784E-03
 5  0.6174E+02  0.2076E-03  0.3363E-05  0.3363E-03
PARAMETER NAME       FINAL SOLUTION        RESISTIVITY   LAYER DEPTH
   1   SIGMA( 1) =  0.12271909E+00   1  0.81486921E+01
   2   SIGMA( 2) =  0.38435772E+00   2  0.26017430E+01
   3   SIGMA( 3) =  0.15068927E+01   3  0.66361725E+00
   4   THICK( 1) =  0.58728069E+02                      1  0.58728069E+02
   5   THICK( 2) =  0.61735500E+02                      2  0.12046357E+03
   6 * SHIFT     =  0.10000000E+01
     * FIXED
```

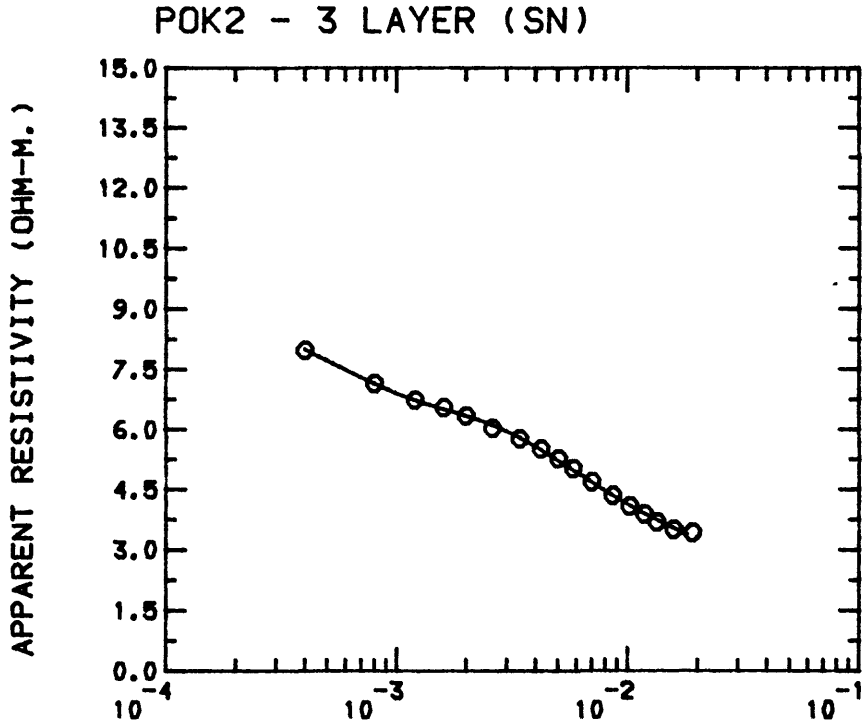
```
<NLSTCO>:     POK18 - 3 LAYER (SN)
A= 0.430000E+02
***** X-CONVERGENCE *****
  I     OBS.Y(I)       CAL             RES         %RES.ERR       X(I,1)
  1  0.113780E+02  0.113139E+02  0.641E-01  0.566282E+00  0.400000E-03
  2  0.942330E+01  0.972965E+01 -0.306E+00 -0.314859E+01  0.800000E-03
  3  0.866050E+01  0.863764E+01  0.229E-01  0.264629E+00  0.120000E-02
  4  0.816460E+01  0.807944E+01  0.852E-01  0.105405E+01  0.160000E-02
  5  0.788730E+01  0.777710E+01  0.110E+00  0.141693E+01  0.200000E-02
  6  0.748670E+01  0.757255E+01 -0.858E-01 -0.113365E+01  0.260000E-02
  7  0.731440E+01  0.737625E+01 -0.618E-01 -0.838490E+00  0.340000E-02
  8  0.713300E+01  0.713911E+01 -0.611E-02 -0.856076E-01  0.420000E-02
  9  0.683500E+01  0.680345E+01  0.315E-01  0.463692E+00  0.500000E-02
 10  0.642590E+01  0.643871E+01 -0.128E-01 -0.199001E+00  0.580000E-02
 11  0.594650E+01  0.588147E+01  0.650E-01  0.110562E+01  0.700000E-02
 12  0.548530E+01  0.518662E+01  0.299E+00  0.575860E+01  0.860000E-02
 13  0.479140E+01  0.462317E+01  0.168E+00  0.363887E+01  0.102000E-01
 14  0.410430E+01  0.417096E+01 -0.667E-01 -0.159808E+01  0.118000E-01
 15  0.375630E+01  0.379396E+01 -0.377E-01 -0.992690E+00  0.134000E-01
 16  0.328470E+01  0.336201E+01 -0.773E-01 -0.229953E+01  0.158000E-01
 17  0.302980E+01  0.293602E+01  0.938E-01  0.319399E+01  0.190000E-01
 18  0.287500E+01  0.261938E+01  0.256E+00  0.975898E+01  0.222000E-01
 19  0.262950E+01  0.237982E+01  0.250E+00  0.104915E+02  0.254000E-01
 20  0.197740E+01  0.219163E+01 -0.214E+00 -0.977512E+01  0.286000E-01
 21  0.176860E+01  0.197081E+01 -0.202E+00 -0.102604E+02  0.334000E-01
 22  0.187300E+01  0.175199E+01  0.121E+00  0.690700E+01  0.398000E-01
 23  0.132660E+01  0.159079E+01 -0.264E+00 -0.166077E+02  0.462000E-01
 24  0.132740E+01  0.146610E+01 -0.139E+00 -0.946058E+01  0.526000E-01
 25  0.150680E+01  0.136619E+01  0.141E+00  0.102921E+02  0.590000E-01
 26  0.115190E+01  0.124746E+01 -0.956E-01 -0.766014E+01  0.686000E-01
** RMSERR=  0.17178135E+00
CORRELATION MATRIX
 1  0.1000E+01
 2 -0.4033E-01  0.1000E+01
 3 -0.4804E+00 -0.4795E+00  0.1000E+01
 4  0.5654E+00  0.3330E+00 -0.6538E+00  0.1000E+01
 5 -0.9978E+00  0.2654E-01  0.5013E+00 -0.5879E+00  0.1000E+01
  **PARMSOL.    STDERROR    RELERROR     % ERROR **
 1  0.9382E-01  0.1899E-03  0.2024E-02  0.2024E+00
 2  0.2990E+00  0.4711E-03  0.1575E-02  0.1575E+00
 3  0.2960E+01  0.2472E-02  0.8351E-03  0.8351E-01
 4  0.6312E+02  0.2067E-03  0.3275E-05  0.3275E-03
 5  0.9740E+02  0.1931E-03  0.1983E-05  0.1983E-03
PARAMETER NAME        FINAL SOLUTION          RESISTIVITY    LAYER DEPTH
   1    SIGMA( 1) =  0.93822688E-01    1  0.10658402E+02
   2    SIGMA( 2) =  0.29903564E+00    2  0.33440831E+01
   3    SIGMA( 3) =  0.29602695E+01    3  0.33780709E+00
   4    THICK( 1) =  0.63124825E+02                       1  0.63124825E+02
   5    THICK( 2) =  0.97397148E+02                       2  0.16052197E+03
   6 * SHIFT      =  0.10000000E+01
     * FIXED
```

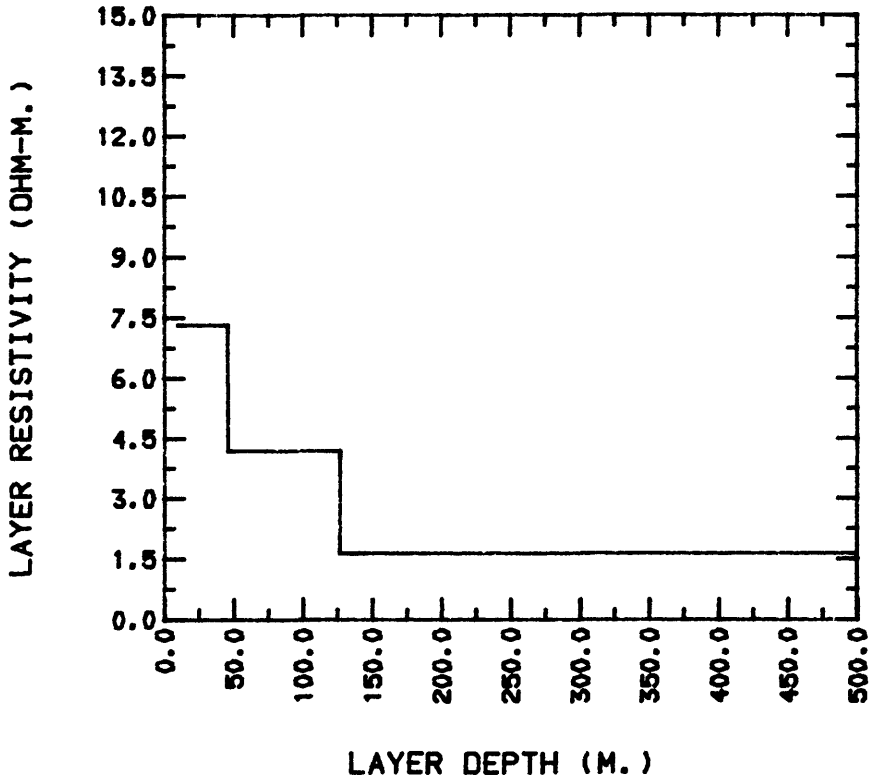
```
<NLSTCO>:     POK19 - 4 LAYER (SN)
A= 0.860000E+02
***** X-CONVERGENCE *****
   I     OBS.Y(I)        CAL             RES          %RES.ERR       X(I,1)
   1  0.943280E+01  0.940870E+01  0.241E-01  0.256190E+00  0.400000E-03
   2  0.829670E+01  0.813033E+01  0.166E+00  0.204629E+01  0.800000E-03
   3  0.763400E+01  0.765914E+01 -0.251E-01 -0.328214E+00  0.120000E-02
   4  0.742140E+01  0.748804E+01 -0.666E-01 -0.889964E+00  0.160000E-02
   5  0.737510E+01  0.743680E+01 -0.617E-01 -0.829701E+00  0.200000E-02
   6  0.729590E+01  0.746516E+01 -0.169E+00 -0.226731E+01  0.260000E-02
   7  0.755960E+01  0.759188E+01 -0.323E-01 -0.425128E+00  0.340000E-02
   8  0.786000E+01  0.776836E+01  0.916E-01  0.117964E+01  0.420000E-02
   9  0.808700E+01  0.793295E+01  0.154E+00  0.194193E+01  0.500000E-02
  10  0.821270E+01  0.808772E+01  0.125E+00  0.154529E+01  0.580000E-02
  11  0.828370E+01  0.825514E+01  0.286E-01  0.345928E+00  0.700000E-02
  12  0.817900E+01  0.833814E+01 -0.159E+00 -0.190856E+01  0.860000E-02
  13  0.828510E+01  0.830122E+01 -0.161E-01 -0.194234E+00  0.102000E-01
  14  0.779950E+01  0.816482E+01 -0.365E+00 -0.447430E+01  0.118000E-01
  15  0.772430E+01  0.796164E+01 -0.237E+00 -0.298107E+01  0.134000E-01
  16  0.836740E+01  0.763622E+01  0.731E+00  0.957521E+01  0.158000E-01
  17  0.774650E+01  0.716905E+01  0.577E+00  0.805475E+01  0.190000E-01
  18  0.712640E+01  0.673695E+01  0.389E+00  0.578080E+01  0.222000E-01
  19  0.569660E+01  0.637205E+01 -0.673E+00 -0.105688E+02  0.254000E-01
** RMSERR=  0.38773391E+00
CORRELATION MATRIX
  1  0.1000E+01
  2 -0.3938E+00  0.1000E+01
  3 -0.3296E+00 -0.2245E+00  0.1000E+01
  4  0.3810E+00 -0.6023E+00  0.2948E+00  0.1000E+01
  5  0.2279E+00  0.3366E+00 -0.6534E+00 -0.5985E+00  0.1000E+01
  6 -0.3564E-01 -0.4317E+00 -0.3649E+00  0.6633E-02 -0.8082E-01  0.1000E+01
  7 -0.5503E+00  0.3468E+00  0.3368E+00  0.1289E+00 -0.5480E+00 -0.1287E+00
0.1000E+01
   **PARMSOL.    STDERROR    RELERROR     % ERROR **
  1  0.1123E+00  0.6639E-03  0.5910E-02  0.5910E+00
  2  0.2711E+00  0.2224E-02  0.8204E-02  0.8204E+00
  3  0.1145E+00  0.9074E-03  0.7925E-02  0.7925E+00
  4  0.6560E+00  0.8903E-02  0.1357E-01  0.1357E+01
  5  0.5580E+02  0.9158E-03  0.1641E-04  0.1641E-02
  6  0.1680E+02  0.6526E-03  0.3884E-04  0.3884E-02
  7  0.2084E+03  0.9473E-03  0.4547E-05  0.4547E-03
PARAMETER NAME        FINAL SOLUTION          RESISTIVITY    LAYER DEPTH
   1    SIGMA( 1) =  0.11233958E+00    1  0.89015827E+01
   2    SIGMA( 2) =  0.27108079E+00    2  0.36889372E+01
   3    SIGMA( 3) =  0.11450509E+00    3  0.87332363E+01
   4    SIGMA( 4) =  0.65600693E+00    4  0.15243741E+01
   5    THICK( 1) =  0.55802982E+02                       1  0.55802982E+02
   6    THICK( 2) =  0.16804499E+02                       2  0.72607483E+02
   7    THICK( 3) =  0.20836276E+03                       3  0.28097025E+03
   8  * SHIFT     =  0.10000000E+01
     * FIXED
```

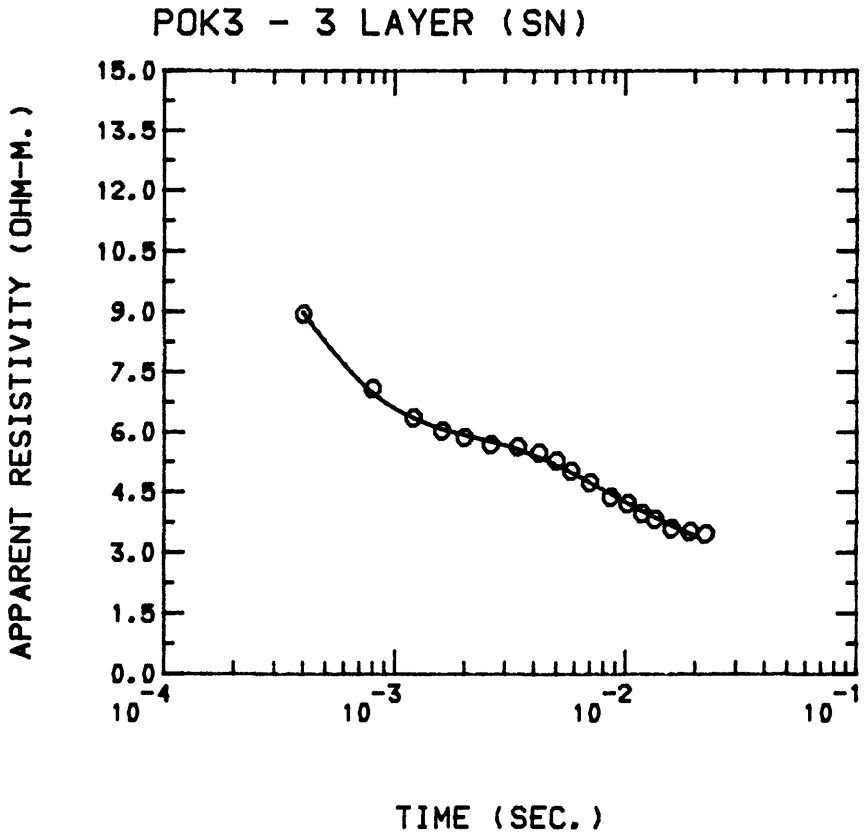
```
<NLSTCO>:     POK20 - 4 LAYER (SN)
A= 0.860000E+02
***** X-CONVERGENCE *****
  I     OBS.Y(I)       CAL            RES          %RES.ERR       X(I,1)
  1   0.100840E+02  0.100684E+02  0.156E-01  0.155085E+00  0.400000E-03
  2   0.872420E+01  0.875874E+01 -0.345E-01 -0.394308E+00  0.800000E-03
  3   0.805240E+01  0.799899E+01  0.534E-01  0.667692E+00  0.120000E-02
  4   0.773890E+01  0.769966E+01  0.392E-01  0.509432E+00  0.160000E-02
  5   0.765210E+01  0.764913E+01  0.297E-02  0.388370E-01  0.200000E-02
  6   0.761580E+01  0.772735E+01 -0.112E+00 -0.144357E+01  0.260000E-02
  7   0.794640E+01  0.798981E+01 -0.434E-01 -0.543345E+00  0.340000E-02
  8   0.827430E+01  0.825561E+01  0.187E-01  0.226358E+00  0.420000E-02
  9   0.854900E+01  0.850678E+01  0.422E-01  0.496300E+00  0.500000E-02
 10   0.875840E+01  0.871480E+01  0.436E-01  0.500321E+00  0.580000E-02
 11   0.887750E+01  0.888729E+01 -0.979E-02 -0.110119E+00  0.700000E-02
 12   0.893320E+01  0.895383E+01 -0.206E-01 -0.230435E+00  0.860000E-02
 13   0.884570E+01  0.886995E+01 -0.243E-01 -0.273395E+00  0.102000E-01
 14   0.867920E+01  0.866530E+01  0.139E-01  0.160375E+00  0.118000E-01
 15   0.846010E+01  0.844239E+01  0.177E-01  0.209738E+00  0.134000E-01
 16   0.805810E+01  0.809097E+01 -0.329E-01 -0.406236E+00  0.158000E-01
** RMSERR=  0.54664414E-01
CORRELATION MATRIX
 1  0.1000E+01
 2  0.1769E+00  0.1000E+01
 3 -0.3607E+00 -0.8592E+00  0.1000E+01
 4  0.5583E-01  0.4047E+00 -0.4254E+00  0.1000E+01
 5  0.6548E+00  0.5718E+00 -0.6918E+00  0.1407E+00  0.1000E+01
 6 -0.2986E+00 -0.8628E+00  0.6148E+00 -0.3733E+00 -0.5220E+00  0.1000E+01
 7 -0.4159E+00 -0.1117E+00  0.3484E+00 -0.1267E+00 -0.6248E+00 -0.1341E-02
0.1000E+01
  **PARMSOL.    STDERROR    RELERROR     % ERROR **
 1  0.1081E+00  0.7308E-04  0.6760E-03  0.6760E-01
 2  0.2925E+00  0.5786E-03  0.1978E-02  0.1978E+00
 3  0.7097E-01  0.3994E-03  0.5628E-02  0.5628E+00
 4  0.4505E+00  0.9057E-03  0.2010E-02  0.2010E+00
 5  0.6808E+02  0.1920E-03  0.2820E-05  0.2820E-03
 6  0.2353E+02  0.1945E-03  0.8263E-05  0.8263E-03
 7  0.1716E+03  0.1366E-03  0.7952E-06  0.7952E-04
PARAMETER NAME       FINAL SOLUTION        RESISTIVITY   LAYER DEPTH
   1   SIGMA( 1) =  0.10809863E+00   1  0.92508106E+01
   2   SIGMA( 2) =  0.29249194E+00   2  0.34188976E+01
   3   SIGMA( 3) =  0.70968419E-01   3  0.14090775E+02
   4   SIGMA( 4) =  0.45054793E+00   4  0.22195196E+01
   5   THICK( 1) =  0.68079651E+02                      1  0.68079651E+02
   6   THICK( 2) =  0.23534655E+02                      2  0.91614304E+02
   7   THICK( 3) =  0.17178998E+03                      3  0.26340430E+03
   8 * SHIFT     =  0.10000000E+01
     * FIXED
```

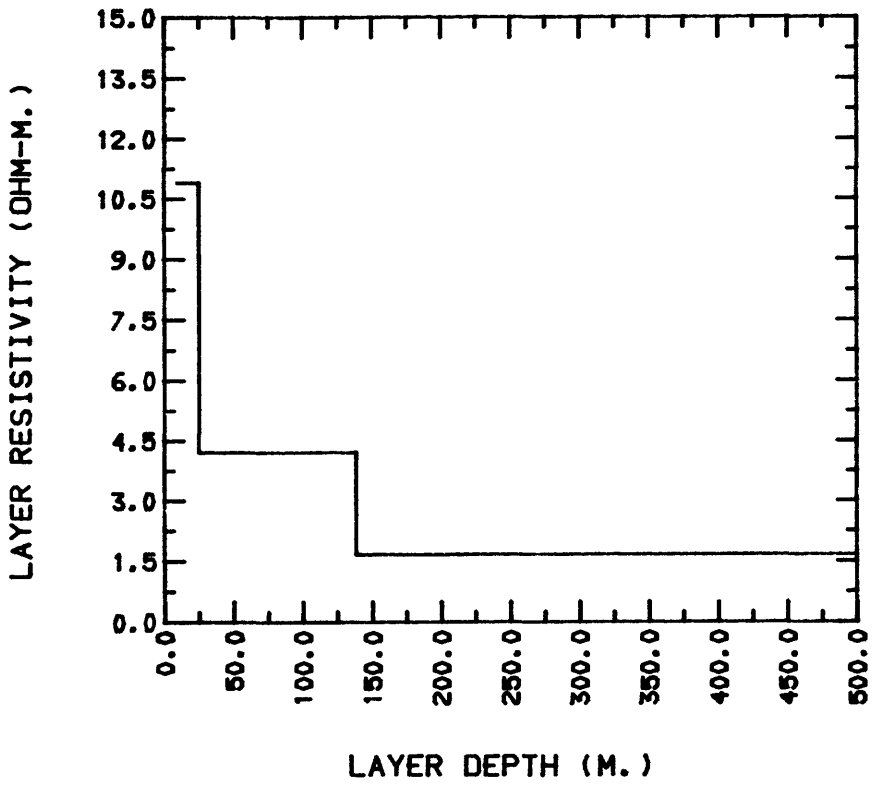

POK1 - 3 LAYER (SN)
APPARENT RESISTIVITY (OHM-M.)
15.0
13.5
12.0
10.5
9.0
7.5
6.0
4.5
3.0
1.5
0.0
10^-4
10^-3
10^-2
10^-1
TIME (SEC.)

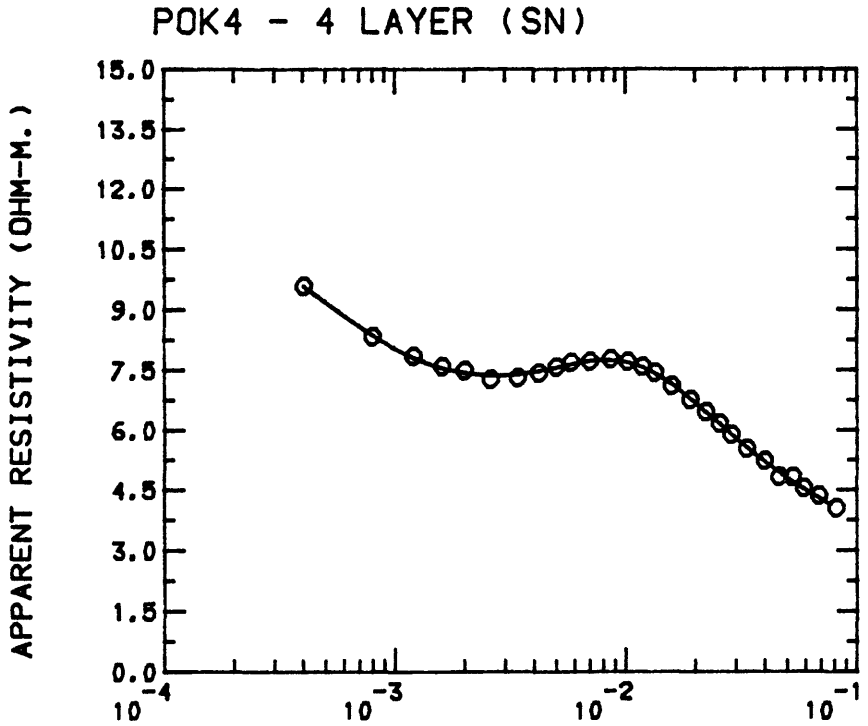

LAYER RESISTIVITY (OHM-M.)
15.0
13.5
12.0
10.5
9.0
7.5
6.0
4.5
3.0
1.5
0.0
0.0
50.0
100.0
150.0
200.0
250.0
300.0
350.0
400.0
450.0
500.0
LAYER DEPTH (M.)

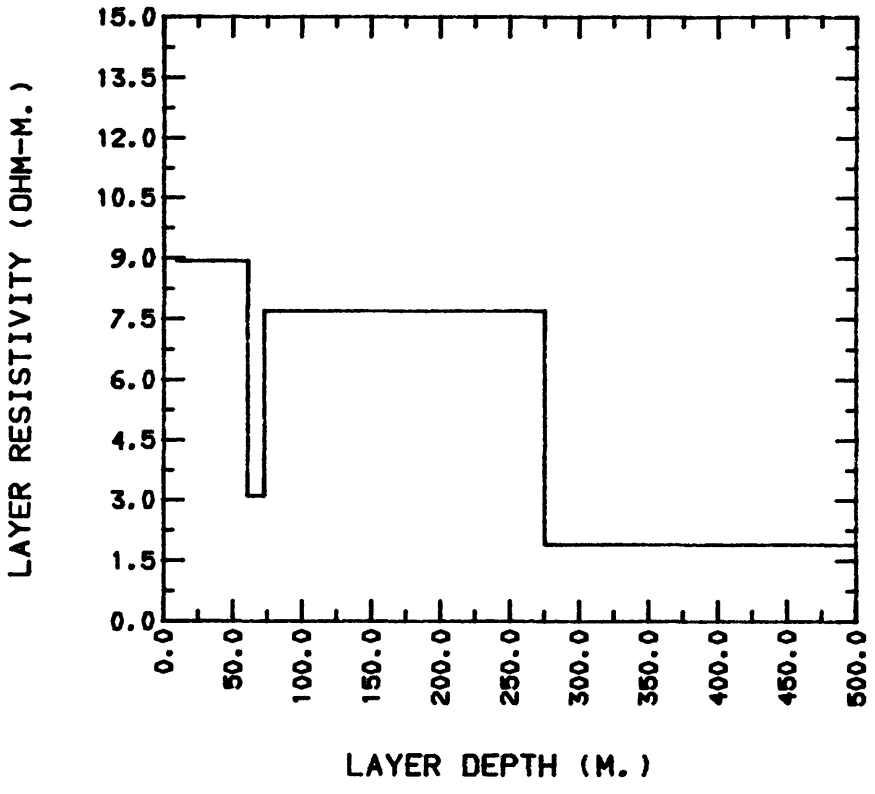

POK2 - 3 LAYER (SN)
APPARENT RESISTIVITY (OHM-M.)
15.0
13.5
12.0
10.5
9.0
7.5
6.0
4.5
3.0
1.5
0.0
10^-4
10^-3
10^-2
10^-1
TIME (SEC.)

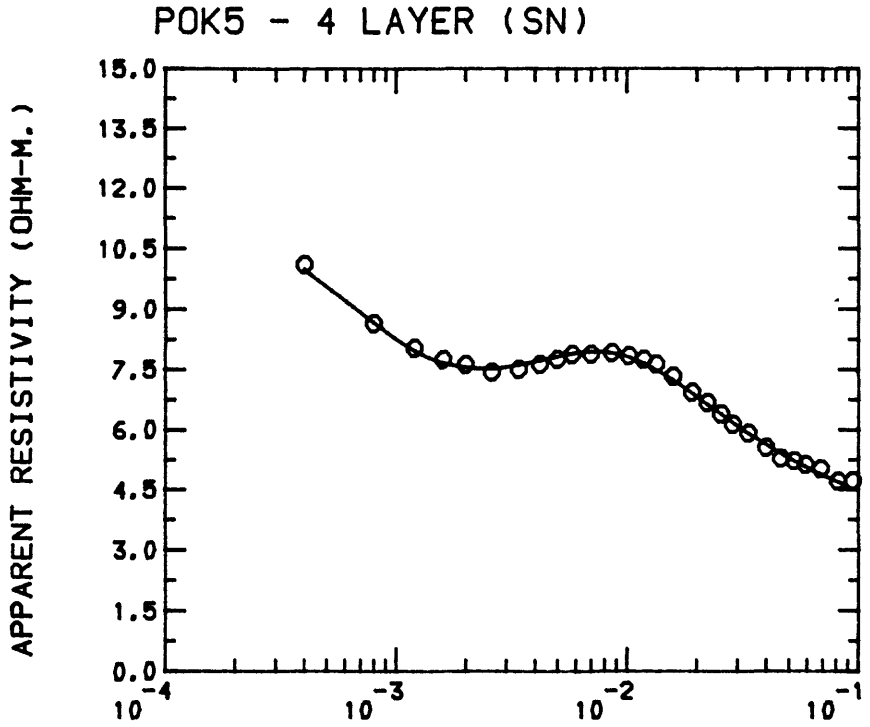

LAYER RESISTIVITY (OHM-M.)
15.0
13.5
12.0
10.5
9.0
7.5
6.0
4.5
3.0
1.5
0.0
0.0
50.0
100.0
150.0
200.0
250.0
300.0
350.0
400.0
450.0
500.0
LAYER DEPTH (M.)

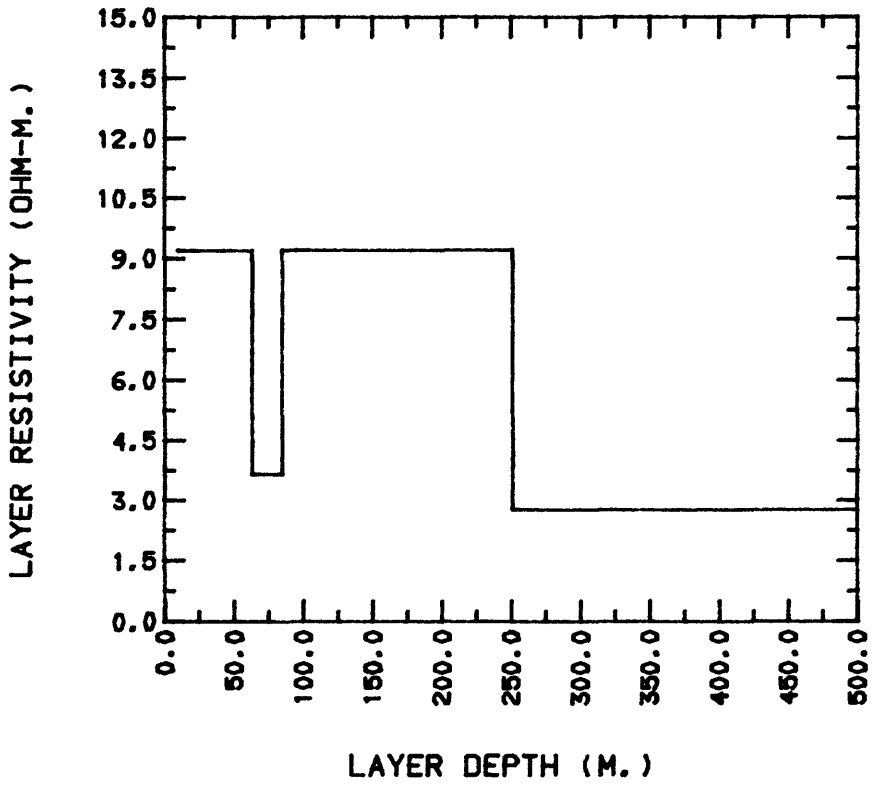

POK3 - 3 LAYER (SN)
APPARENT RESISTIVITY (OHM-M.)
15.0
13.5
12.0
10.5
9.0
7.5
6.0
4.5
3.0
1.5
0.0
10^-4
10^-3
10^-2
10^-1
TIME (SEC.)

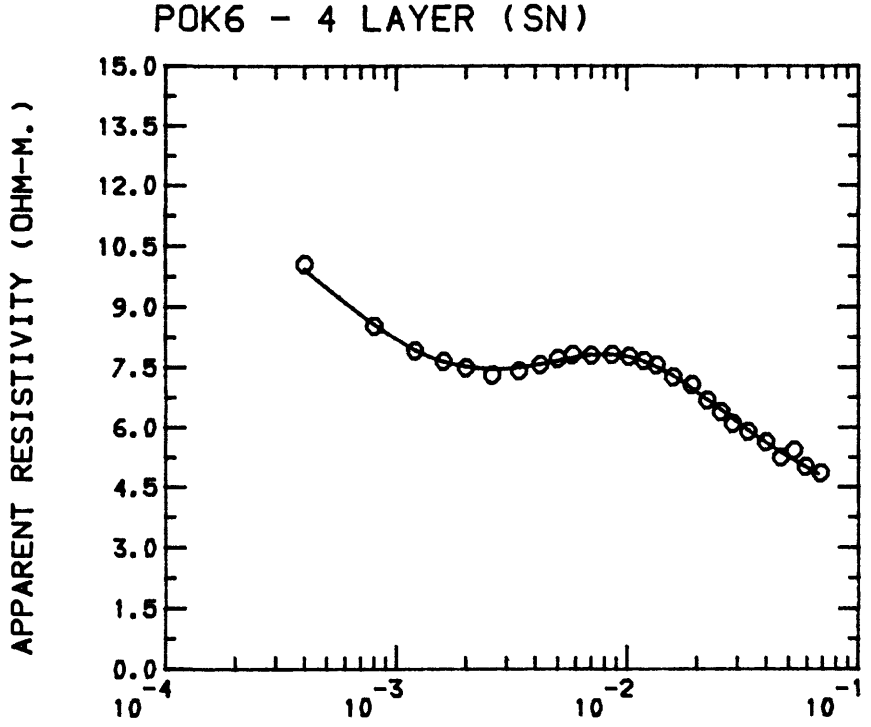

LAYER RESISTIVITY (OHM-M.)
15.0
13.5
12.0
10.5
9.0
7.5
6.0
4.5
3.0
1.5
0.0
0.0
50.0
100.0
150.0
200.0
250.0
300.0
350.0
400.0
450.0
500.0
LAYER DEPTH (M.)

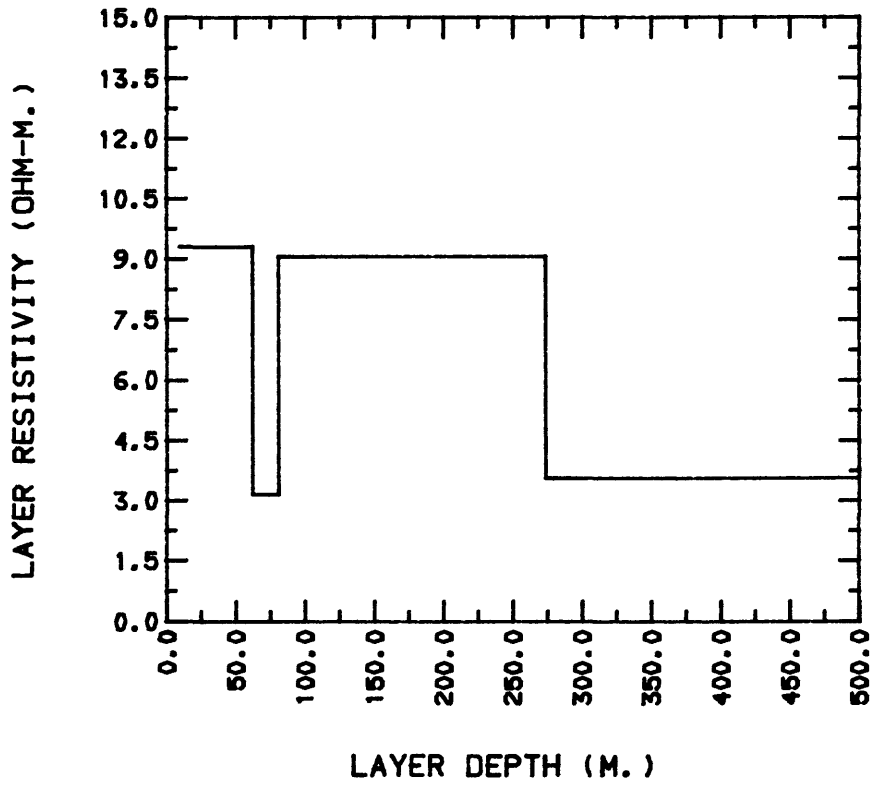

POK4 - 4 LAYER (SN)
APPARENT RESISTIVITY (OHM-M.)
15.0
13.5
12.0
10.5
9.0
7.5
6.0
4.5
3.0
1.5
0.0
10^-4
10^-3
10^-2
10^-1
TIME (SEC.)

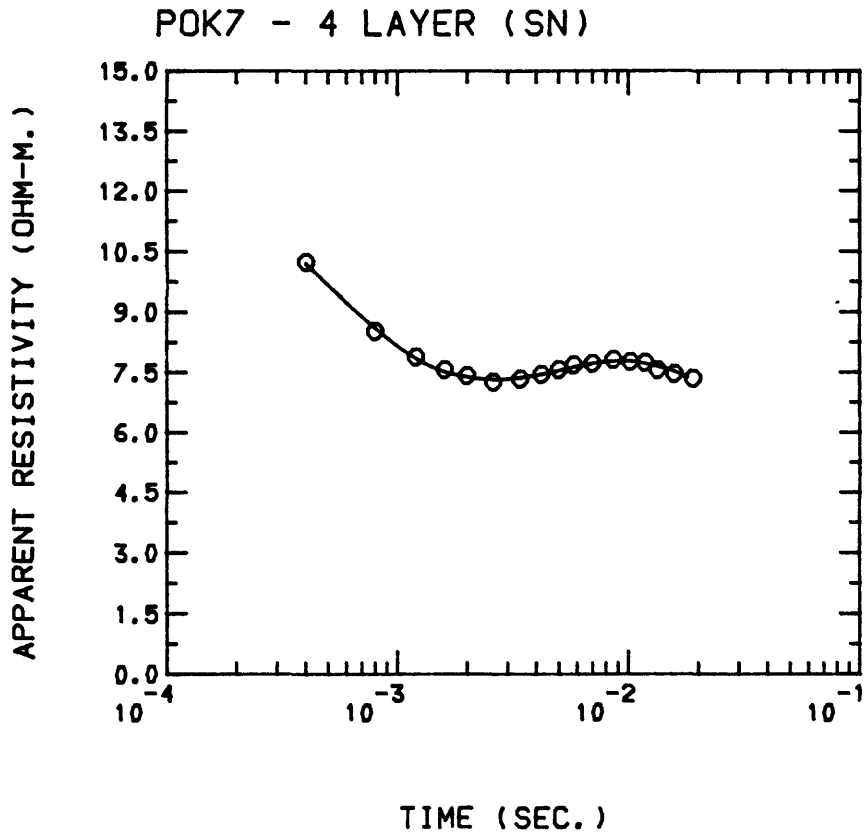

LAYER RESISTIVITY (OHM-M.)
15.0
13.5
12.0
10.5
9.0
7.5
6.0
4.5
3.0
1.5
0.0
0.0
50.0
100.0
150.0
200.0
250.0
300.0
350.0
400.0
450.0
500.0
LAYER DEPTH (M.)

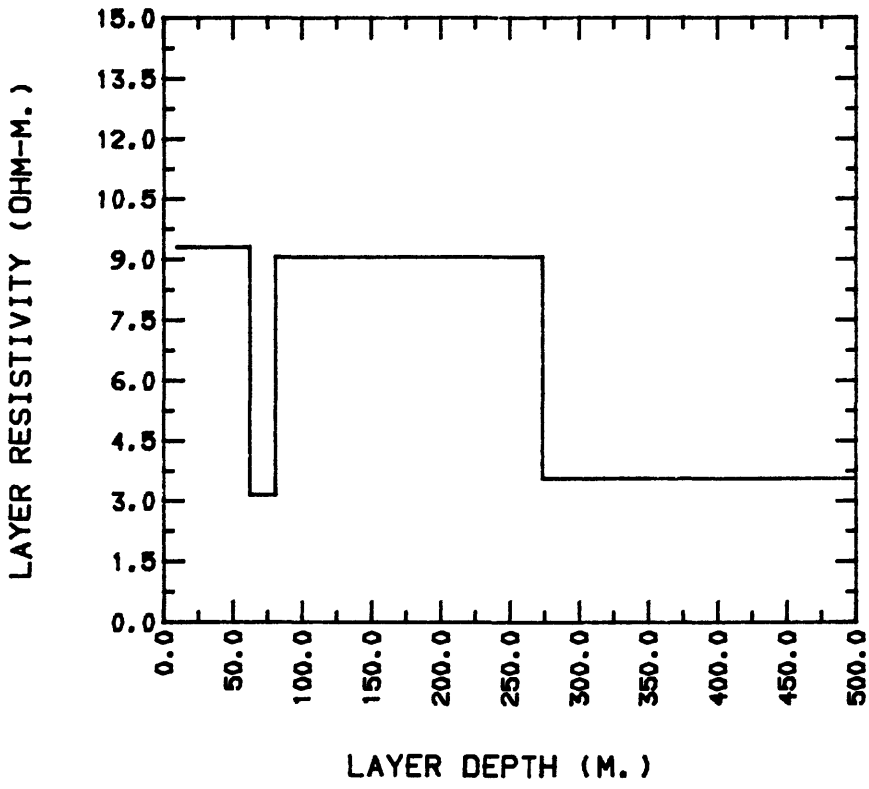

POK5 - 4 LAYER (SN)
APPARENT RESISTIVITY (OHM-M.)
15.0
13.5
12.0
10.5
9.0
7.5
6.0
4.5
3.0
1.5
0.0
10^-4
10^-3
10^-2
10^-1
TIME (SEC.)

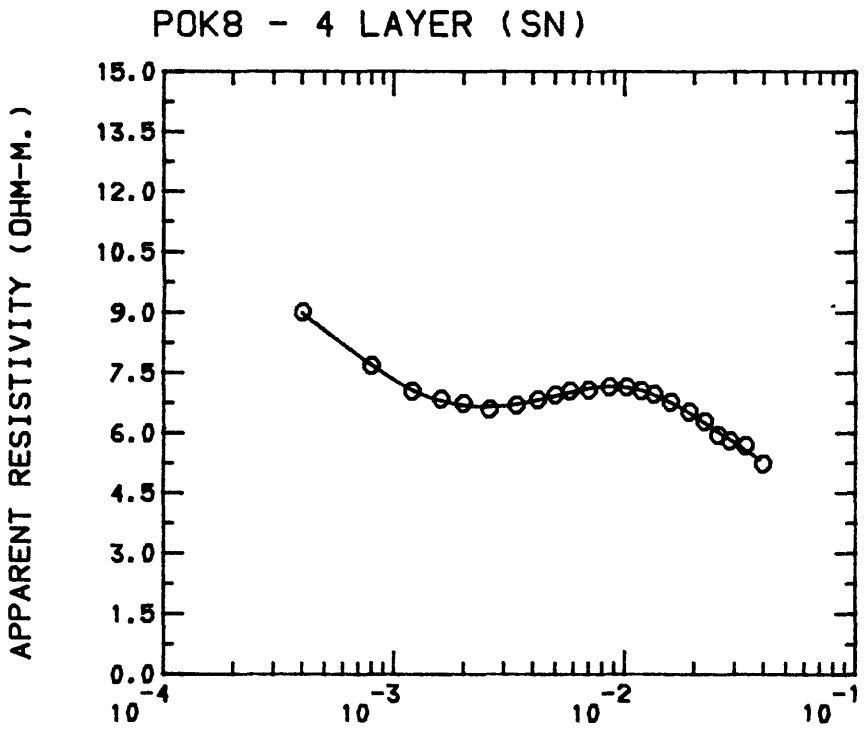

LAYER RESISTIVITY (OHM-M.)
15.0
13.5
12.0
10.5
9.0
7.5
6.0
4.5
3.0
1.5
0.0
0.0
50.0
100.0
150.0
200.0
250.0
300.0
350.0
400.0
450.0
500.0
LAYER DEPTH (M.)

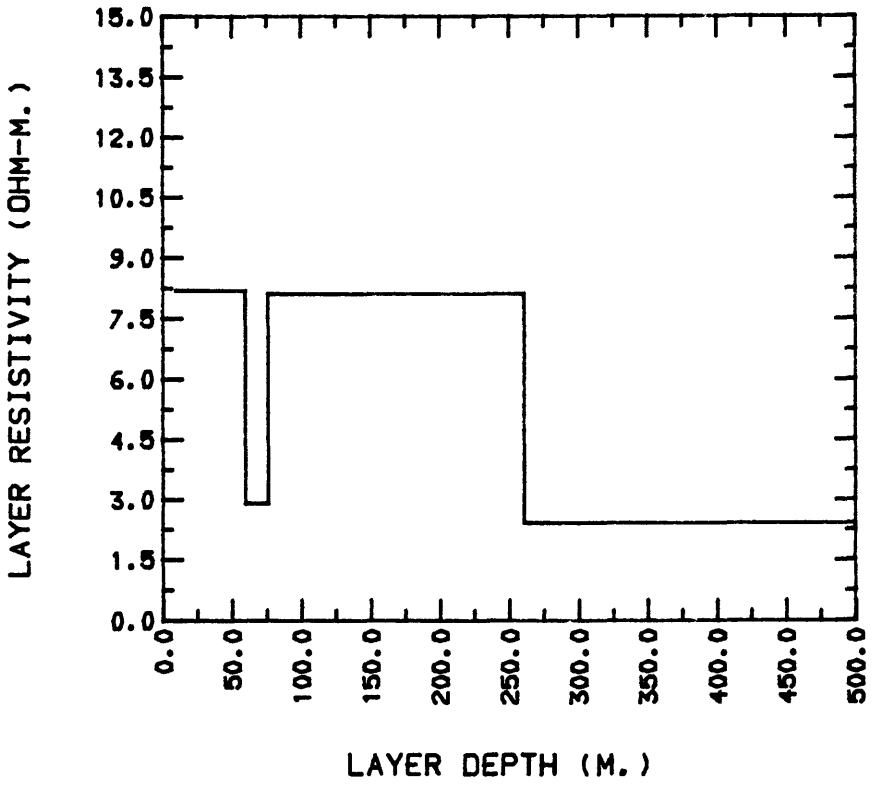

POK6 - 4 LAYER (SN)
APPARENT RESISTIVITY (OHM-M.)
15.0
13.5
12.0
10.5
9.0
7.5
6.0
4.5
3.0
1.5
0.0
10^-4
10^-3
10^-2
10^-1
TIME (SEC.)

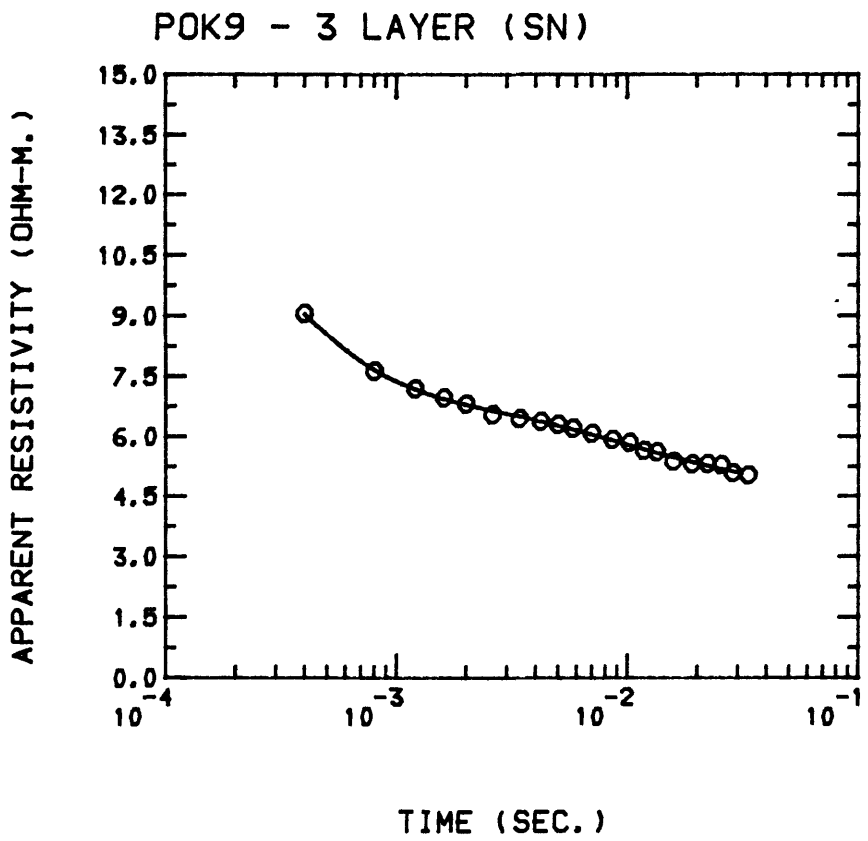

LAYER RESISTIVITY (OHM-M.)
15.0
13.5
12.0
10.5
9.0
7.5
6.0
4.5
3.0
1.5
0.0
0.0
50.0
100.0
150.0
200.0
250.0
300.0
350.0
400.0
450.0
500.0
LAYER DEPTH (M.)

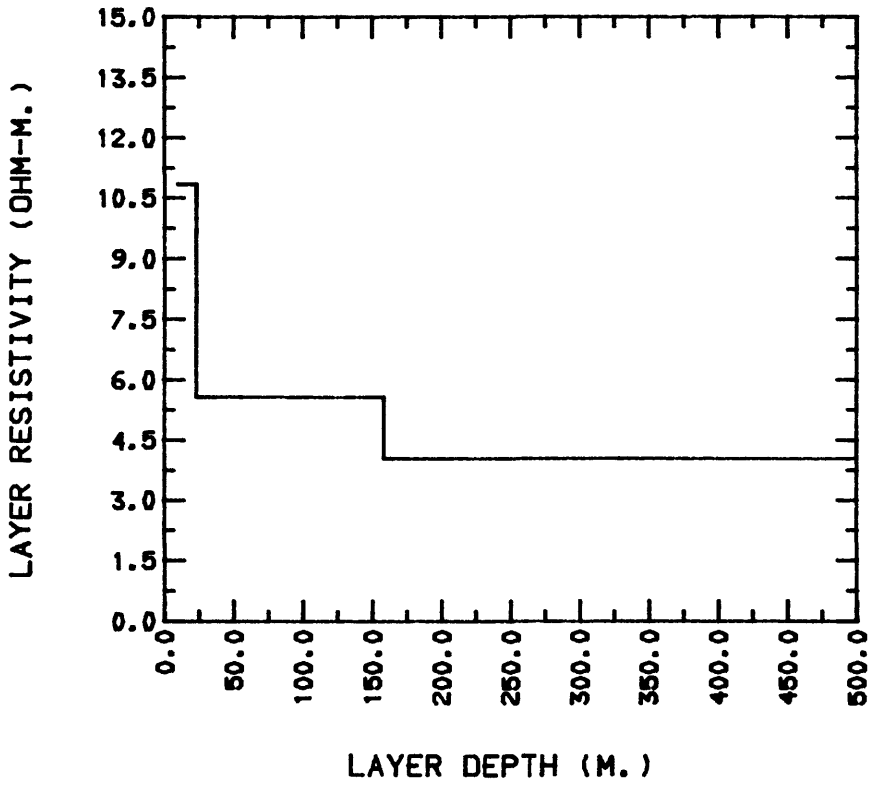

POK7 - 4 LAYER (SN)
APPARENT RESISTIVITY (OHM-M.)
15.0
13.5
12.0
10.5
9.0
7.5
6.0
4.5
3.0
1.5
0.0
10^-4
10^-3
10^-2
10^-1
TIME (SEC.)

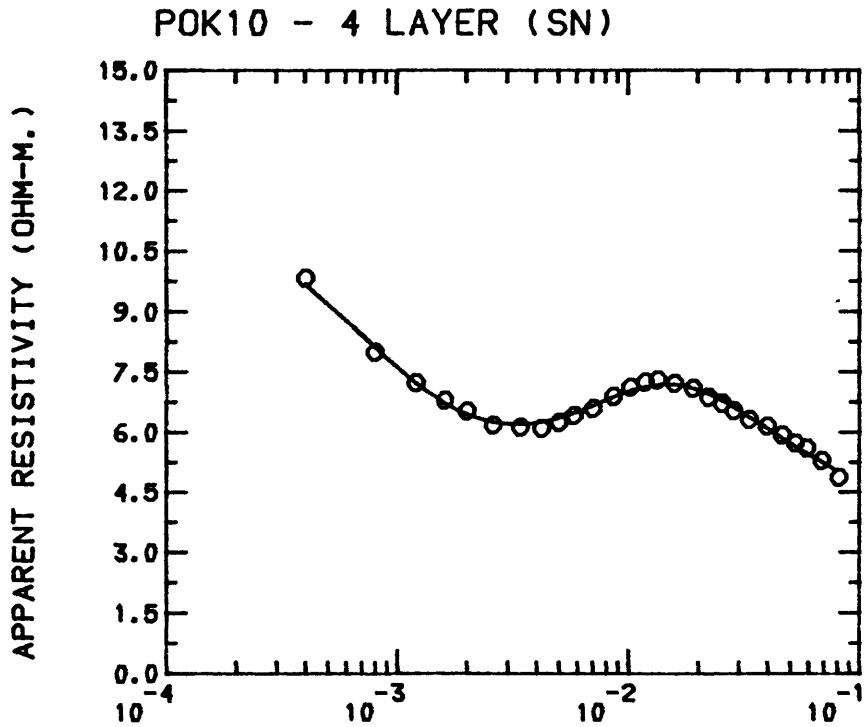

LAYER RESISTIVITY (OHM-M.)
15.0
13.5
12.0
10.5
9.0
7.5
6.0
4.5
3.0
1.5
0.0
0.0
50.0
100.0
150.0
200.0
250.0
300.0
350.0
400.0
450.0
500.0
LAYER DEPTH (M.)

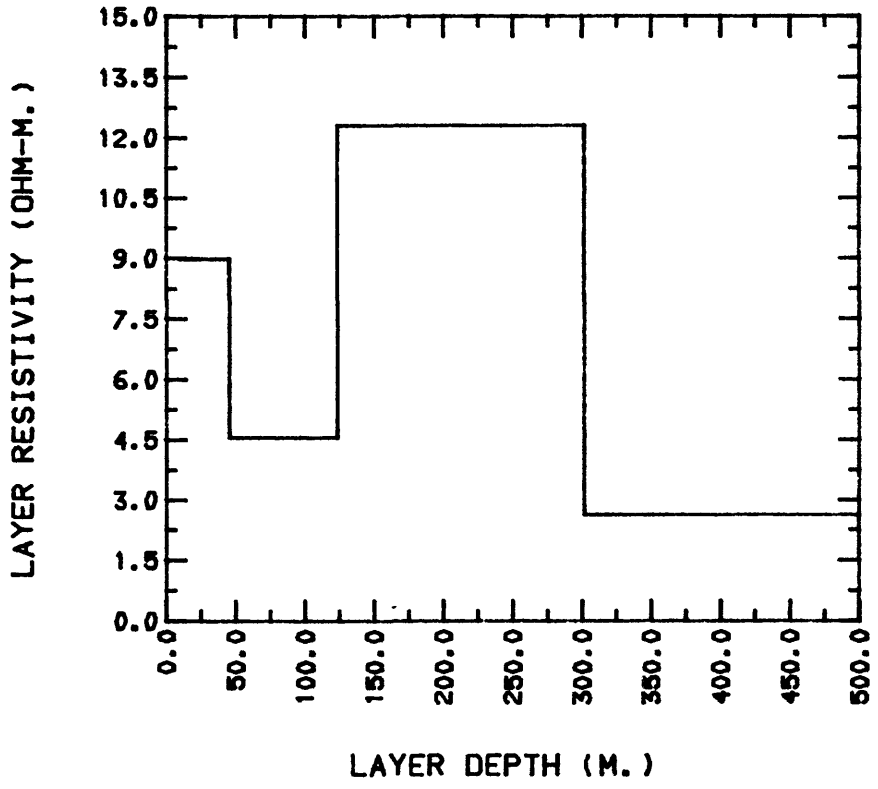

POK8 - 4 LAYER (SN)
APPARENT RESISTIVITY (OHM-M.)
15.0
13.5
12.0
10.5
9.0
7.5
6.0
4.5
3.0
1.5
0.0
10^-4
10^-3
10^-2
10^-1
TIME (SEC.)

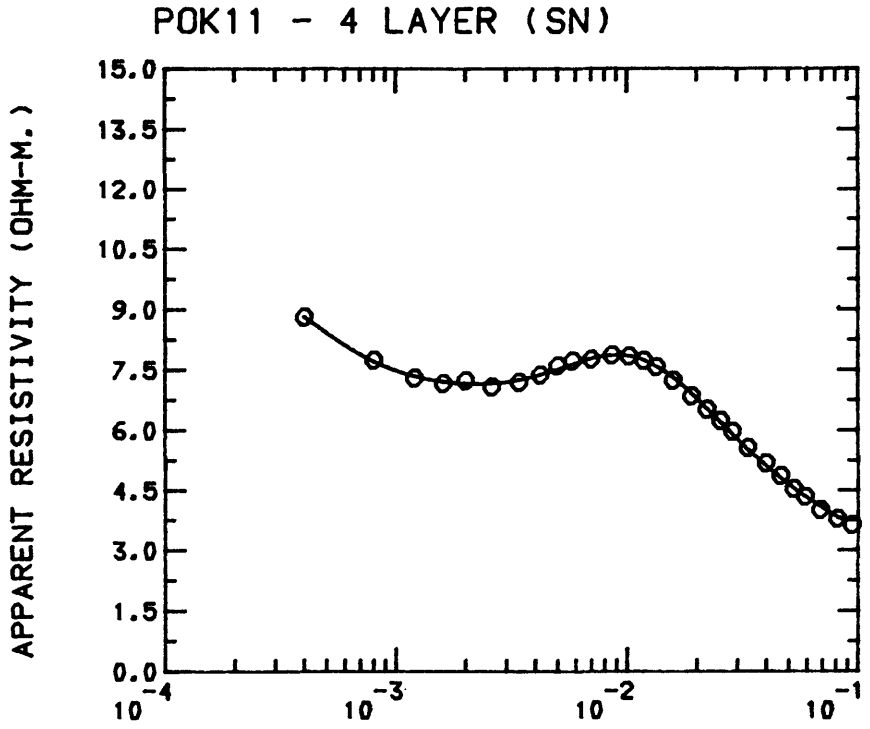

LAYER RESISTIVITY (OHM-M.)
15.0
13.5
12.0
10.5
9.0
7.5
6.0
4.5
3.0
1.5
0.0
0.0
50.0
100.0
150.0
200.0
250.0
300.0
350.0
400.0
450.0
500.0
LAYER DEPTH (M.)


POK9 - 3 LAYER (SN)
APPARENT RESISTIVITY (OHM-M.)
15.0
13.5
12.0
10.5
9.0
7.5
6.0
4.5
3.0
1.5
0.0
10^-4
10^-3
10^-2
10^-1
TIME (SEC.)


LAYER RESISTIVITY (OHM-M.)
15.0
13.5
12.0
10.5
9.0
7.5
6.0
4.5
3.0
1.5
0.0
0.0
50.0
100.0
150.0
200.0
250.0
300.0
350.0
400.0
450.0
500.0
LAYER DEPTH (M.)


POK10 - 4 LAYER (SN)
APPARENT RESISTIVITY (OHM-M.)
15.0
13.5
12.0
10.5
9.0
7.5
6.0
4.5
3.0
1.5
0.0
10^-4
10^-3
10^-2
10^-1
TIME (SEC.)


LAYER RESISTIVITY (OHM-M.)
15.0
13.5
12.0
10.5
9.0
7.5
6.0
4.5
3.0
1.5
0.0
0.0
50.0
100.0
150.0
200.0
250.0
300.0
350.0
400.0
450.0
500.0
LAYER DEPTH (M.)


POK11 - 4 LAYER (SN)
APPARENT RESISTIVITY (OHM-M.)
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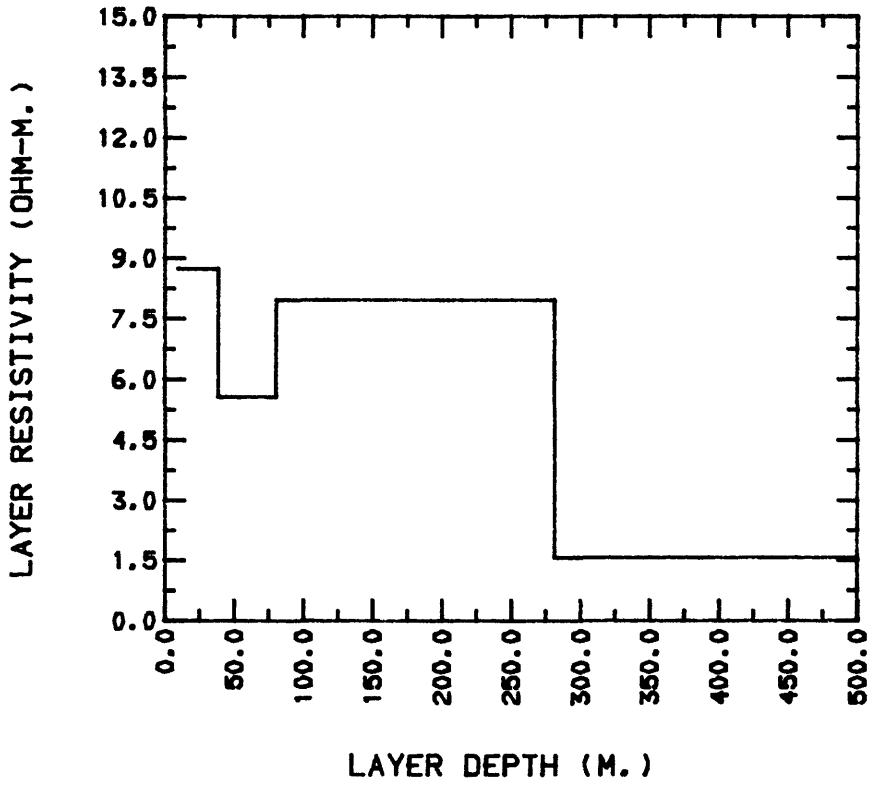
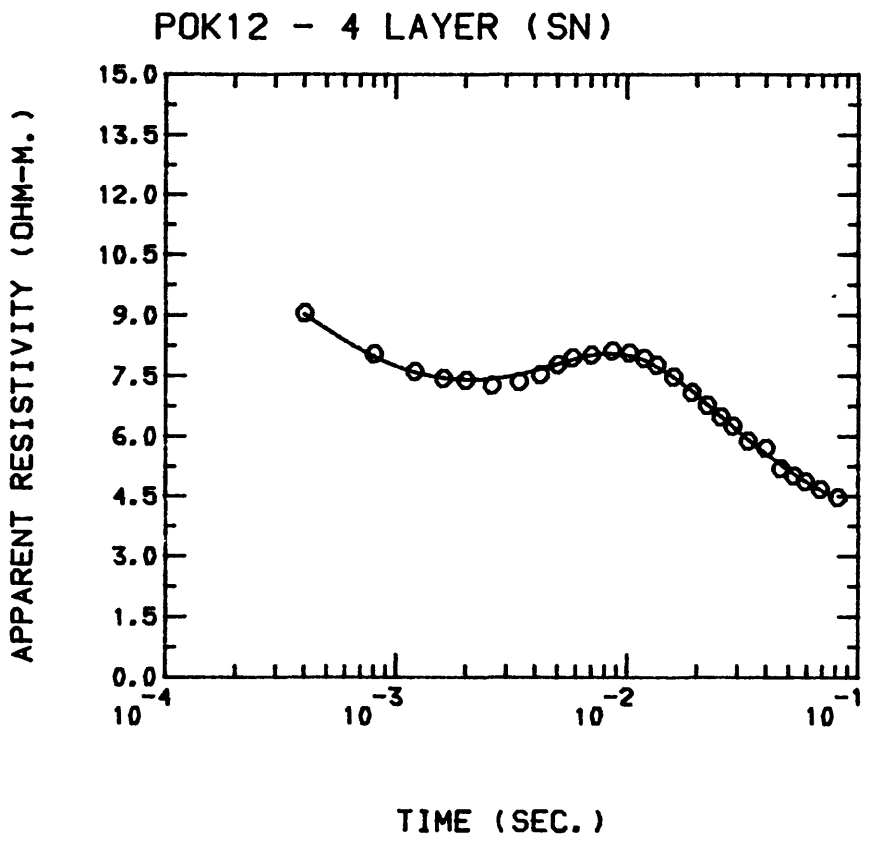
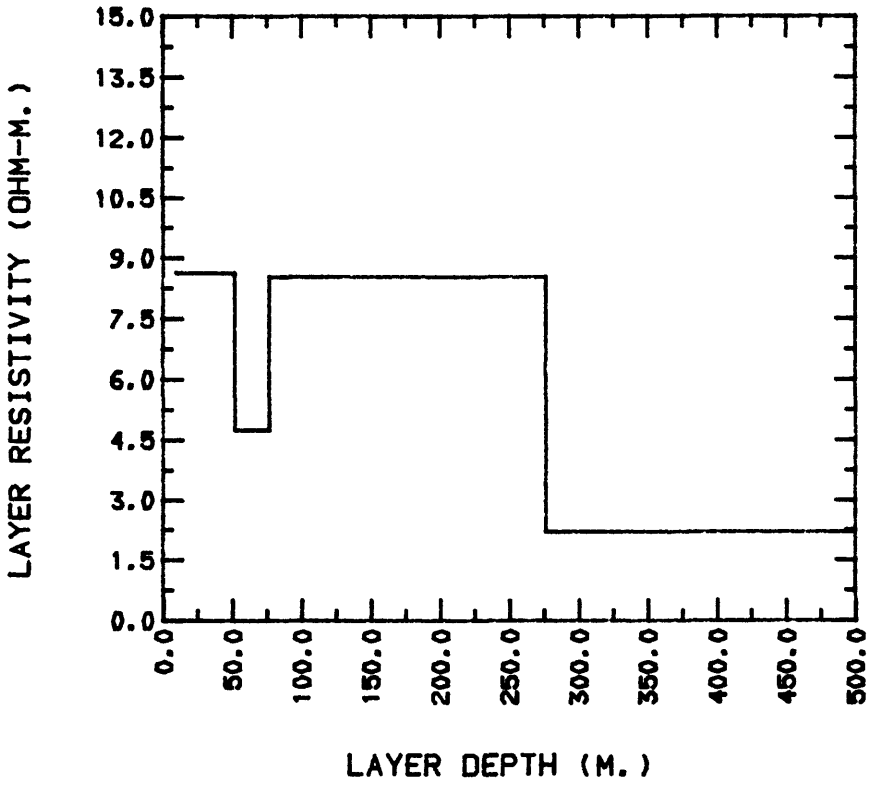
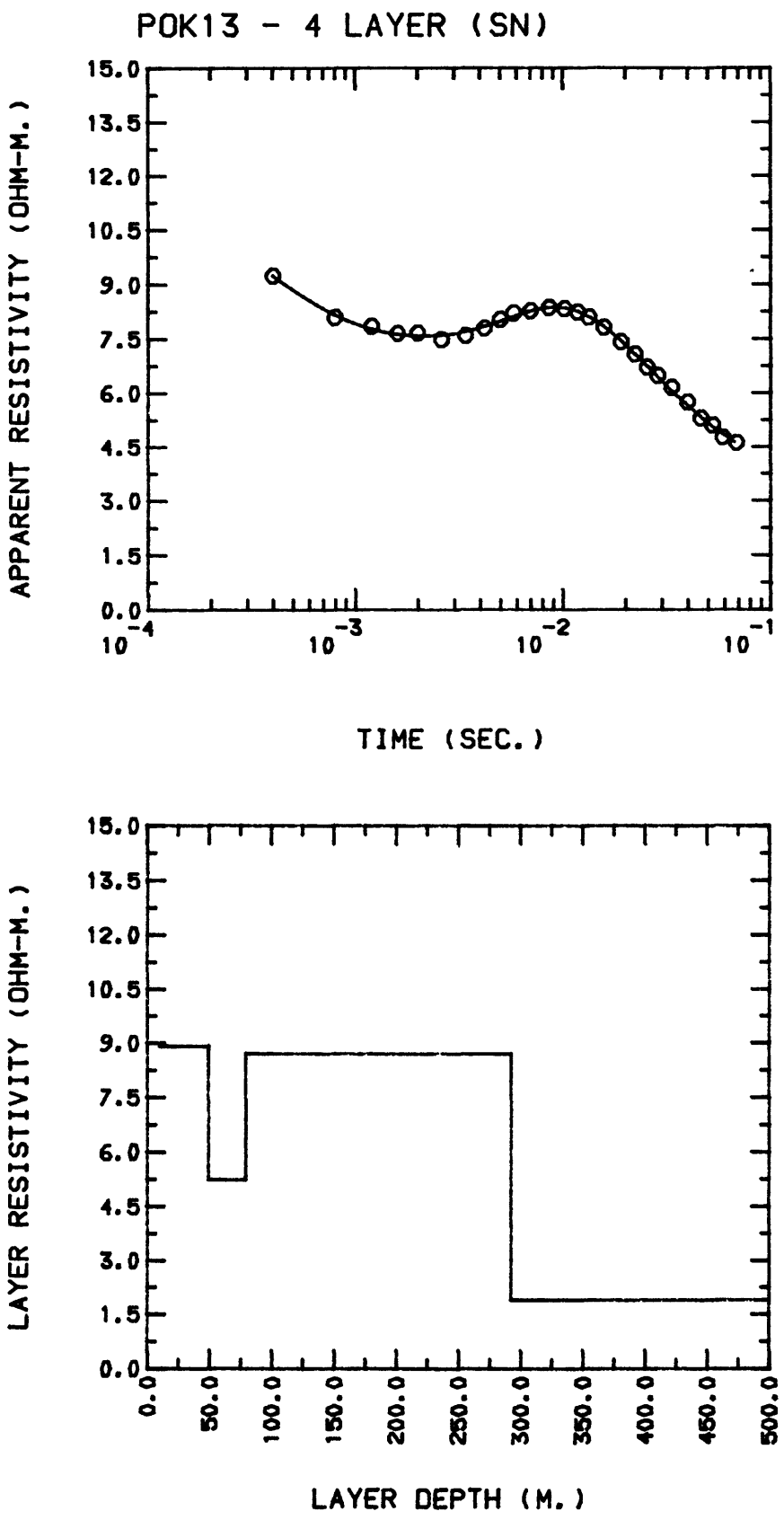
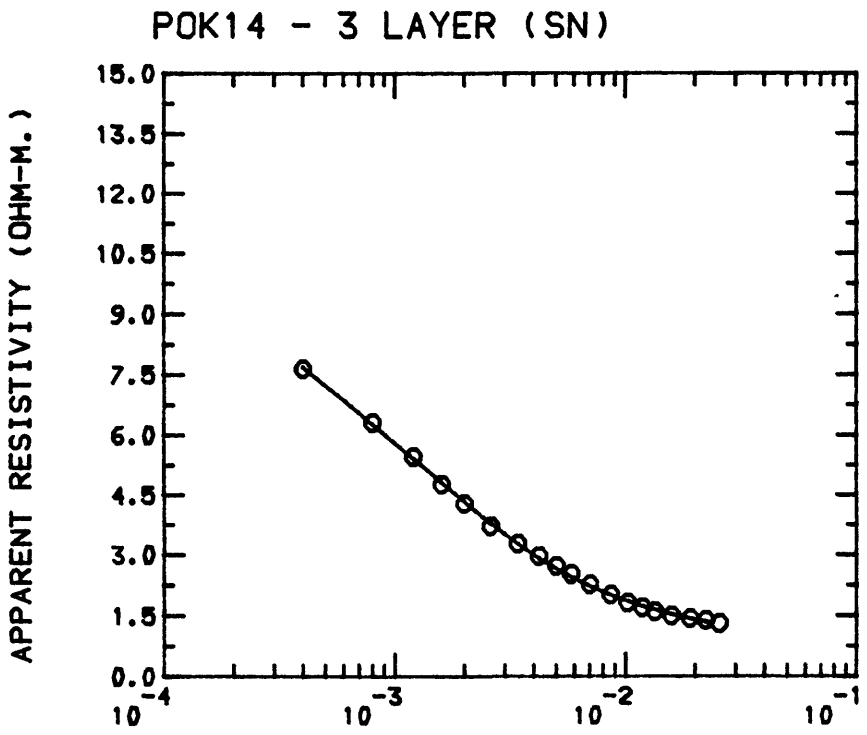
13.5
12.0
10.5
9.0
7.5
6.0
4.5
3.0
1.5
0.0
10^-4
10^-3
10^-2
10^-1
TIME (SEC.)

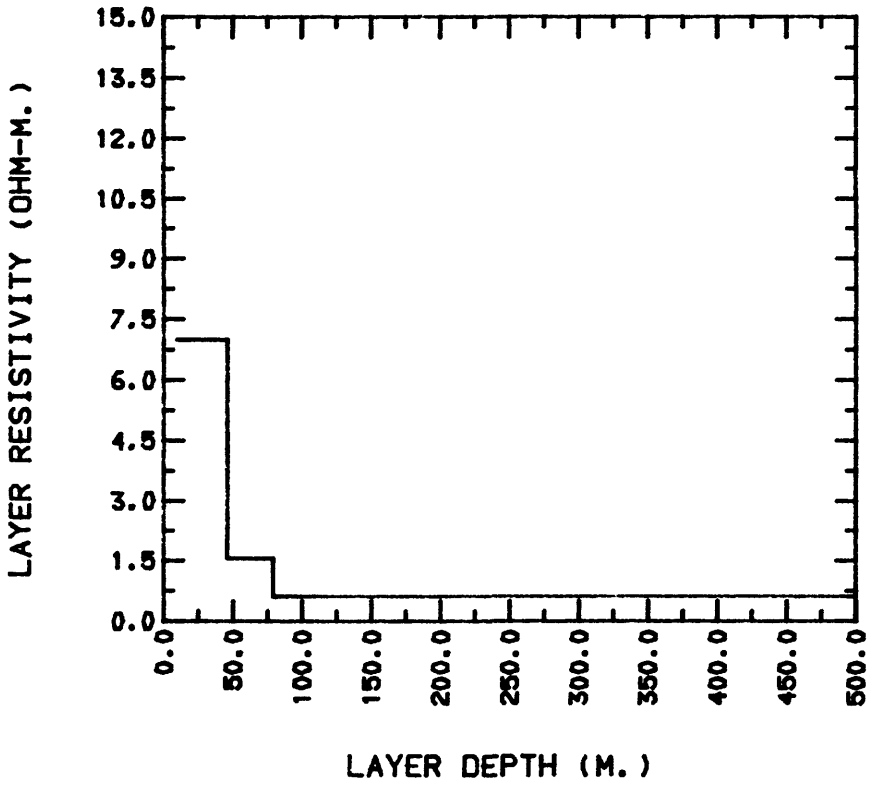

LAYER RESISTIVITY (OHM-M.)
15.0
13.5
12.0
10.5
9.0
7.5
6.0
4.5
3.0
1.5
0.0
0.0
50.0
100.0
150.0
200.0
250.0
300.0
350.0
400.0
450.0
500.0
LAYER DEPTH (M.)

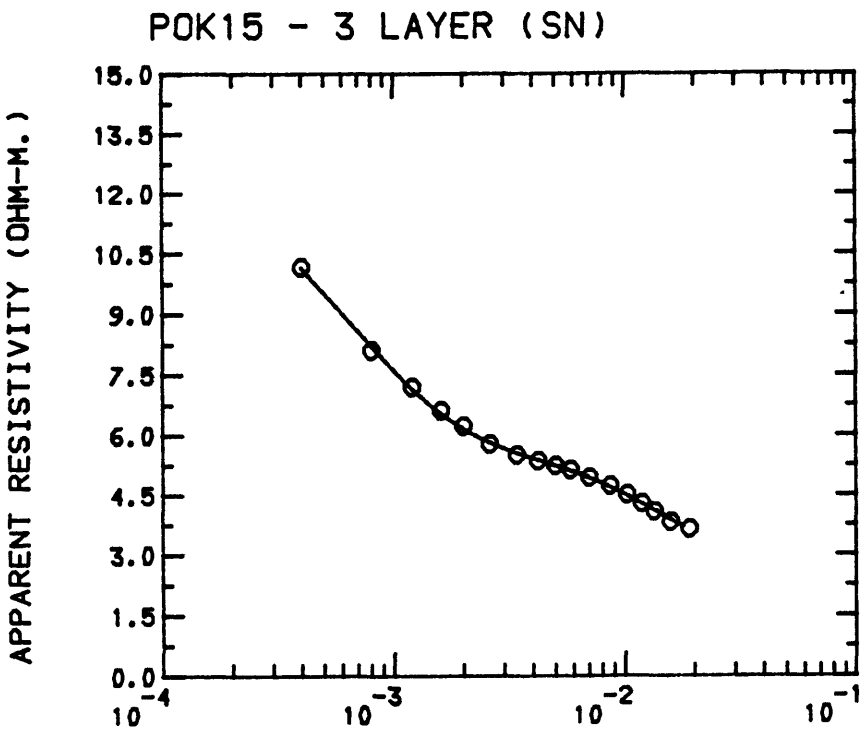

POK12 - 4 LAYER (SN)
APPARENT RESISTIVITY (OHM-M.)
15.0
13.5
12.0
10.5
9.0
7.5
6.0
4.5
3.0
1.5
0.0
10^-4
10^-3
10^-2
10^-1
TIME (SEC.)

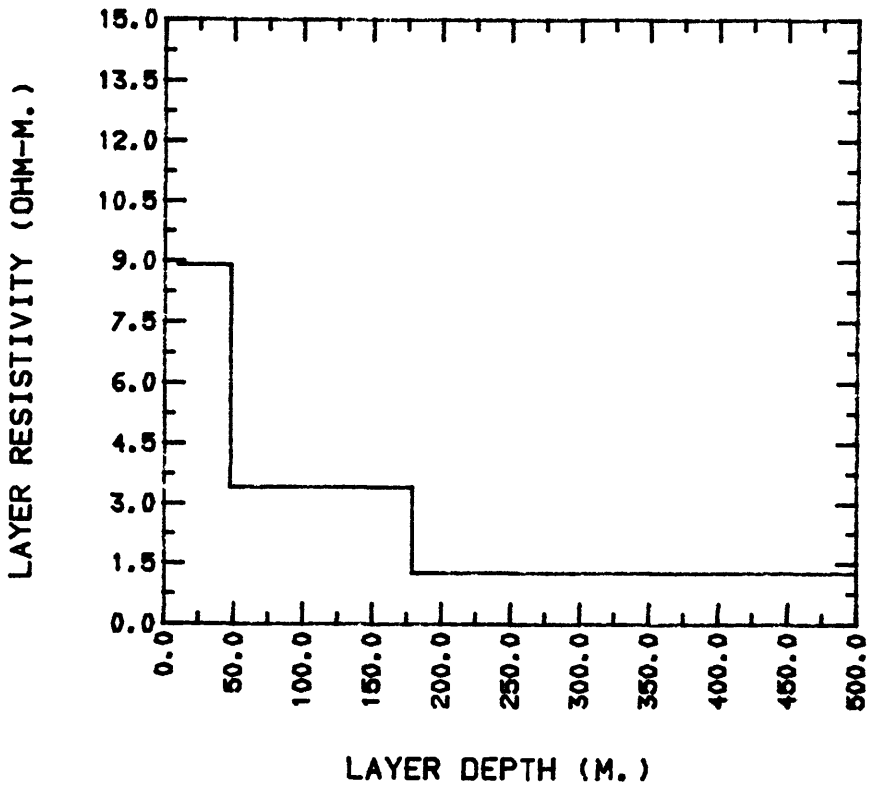

LAYER RESISTIVITY (OHM-M.)
15.0
13.5
12.0
10.5
9.0
7.5
6.0
4.5
3.0
1.5
0.0
0.0
50.0
100.0
150.0
200.0
250.0
300.0
350.0
400.0
450.0
500.0
LAYER DEPTH (M.)

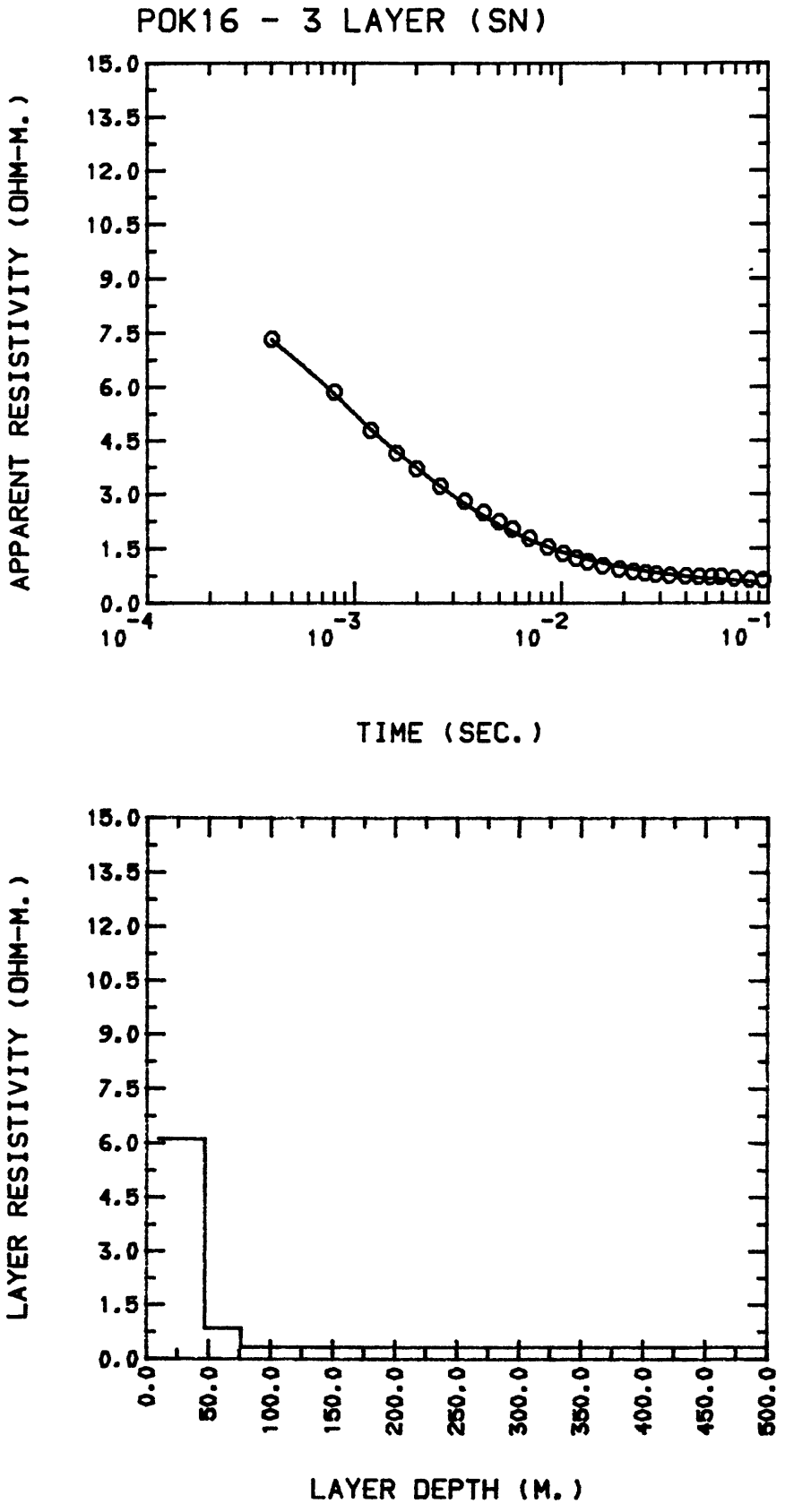

POK13 - 4 LAYER (SN)
APPARENT RESISTIVITY (OHM-M.)
15.0
13.5
12.0
10.5
9.0
7.5
6.0
4.5
3.0
1.5
0.0
10^-4
10^-3
10^-2
10^-1
TIME (SEC.)
LAYER RESISTIVITY (OHM-M.)
0.0
50.0
100.0
150.0
200.0
250.0
300.0
350.0
400.0
450.0
500.0
LAYER DEPTH (M.)

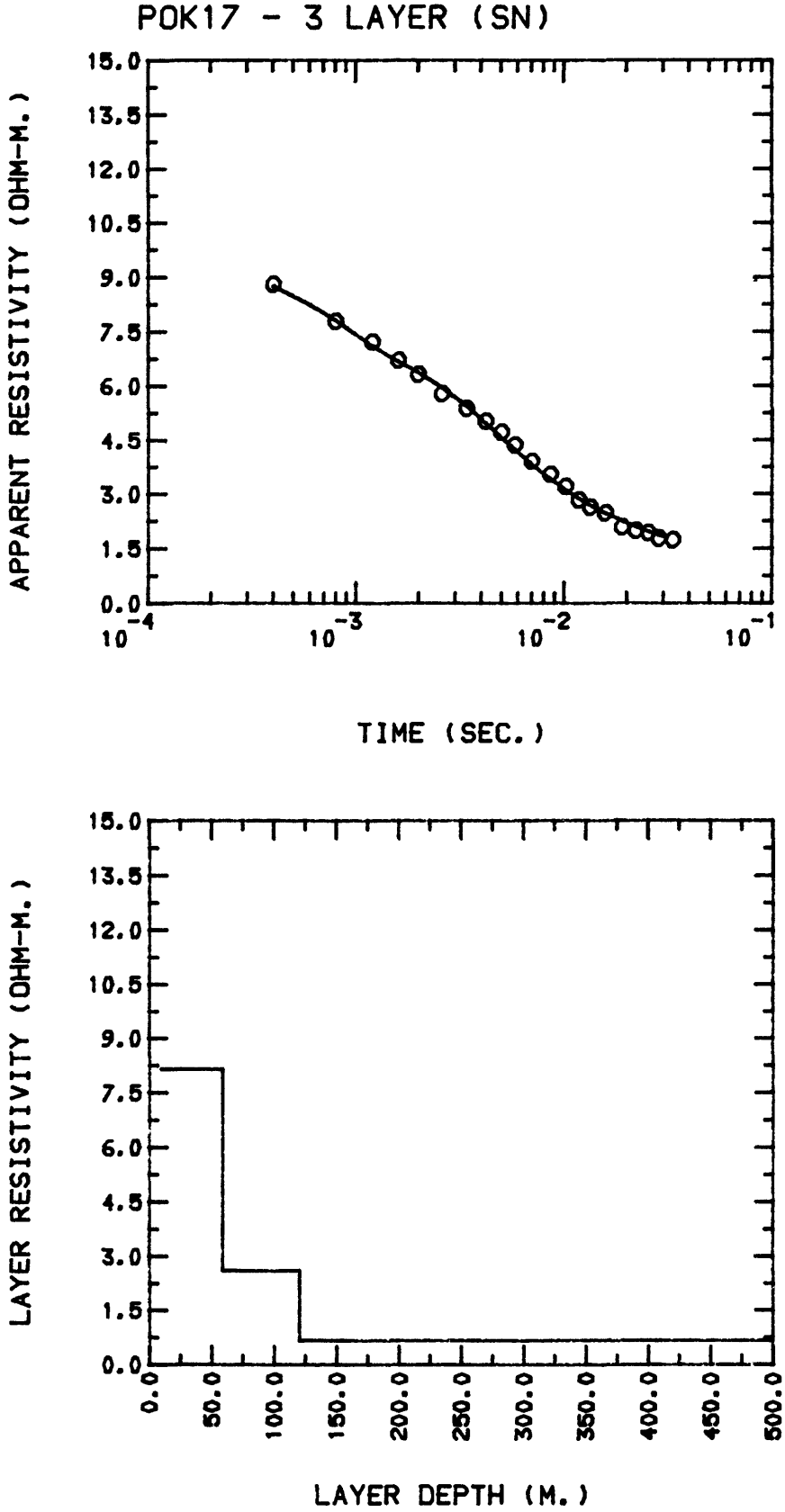

POK14 - 3 LAYER (SN)
APPARENT RESISTIVITY (OHM-M.)
15.0
13.5
12.0
10.5
9.0
7.5
6.0
4.5
3.0
1.5
0.0
10^-4
10^-3
10^-2
10^-1
TIME (SEC.)

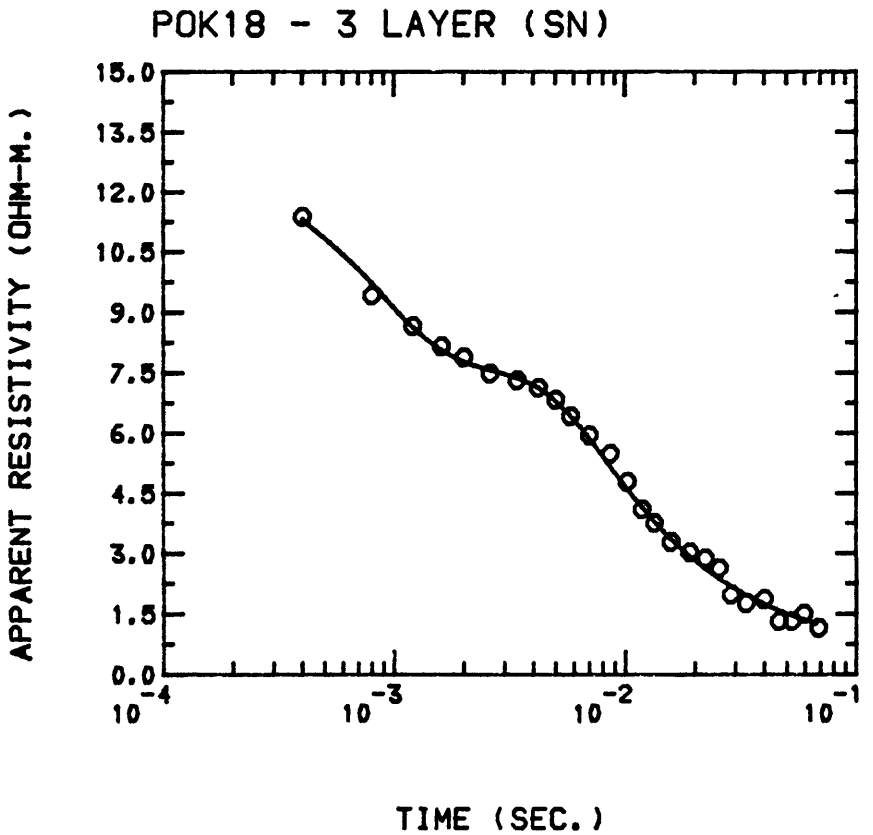

LAYER RESISTIVITY (OHM-M.)
15.0
13.5
12.0
10.5
9.0
7.5
6.0
4.5
3.0
1.5
0.0
0.0
50.0
100.0
150.0
200.0
250.0
300.0
350.0
400.0
450.0
500.0
LAYER DEPTH (M.)


POK15 - 3 LAYER (SN)
APPARENT RESISTIVITY (OHM-M.)
15.0
13.5
12.0
10.5
9.0
7.5
6.0
4.5
3.0
1.5
0.0
10^-4
10^-3
10^-2
10^-1
TIME (SEC.)


LAYER RESISTIVITY (OHM-M.)
15.0
13.5
12.0
10.5
9.0
7.5
6.0
4.5
3.0
1.5
0.0
0.0
50.0
100.0
150.0
200.0
250.0
300.0
350.0
400.0
450.0
500.0
LAYER DEPTH (M.)


POK16 - 3 LAYER (SN)
APPARENT RESISTIVITY (OHM-M.)
15.0
13.5
12.0
10.5
9.0
7.5
6.0
4.5
3.0
1.5
0.0
10^-4
10^-3
10^-2
10^-1
TIME (SEC.)
LAYER RESISTIVITY (OHM-M.)
0.0
50.0
100.0
150.0
200.0
250.0
300.0
350.0
400.0
450.0
500.0
LAYER DEPTH (M.)


POK17 - 3 LAYER (SN)
APPARENT RESISTIVITY (OHM-M.)
15.0
13.5
12.0
10.5
9.0
7.5
6.0
4.5
3.0
1.5
0.0
10^-4
10^-3
10^-2
10^-1
TIME (SEC.)
LAYER RESISTIVITY (OHM-M.)
0.0
50.0
100.0
150.0
200.0
250.0
300.0
350.0
400.0
450.0
500.0
LAYER DEPTH (M.)


POK18 - 3 LAYER (SN)
APPARENT RESISTIVITY (OHM-M.)
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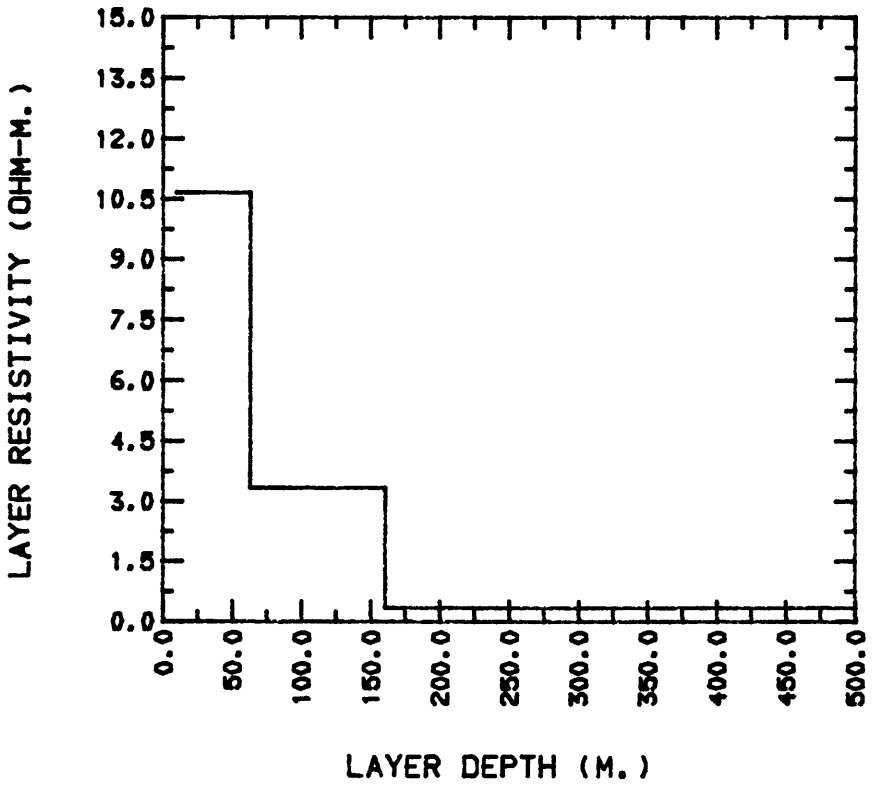
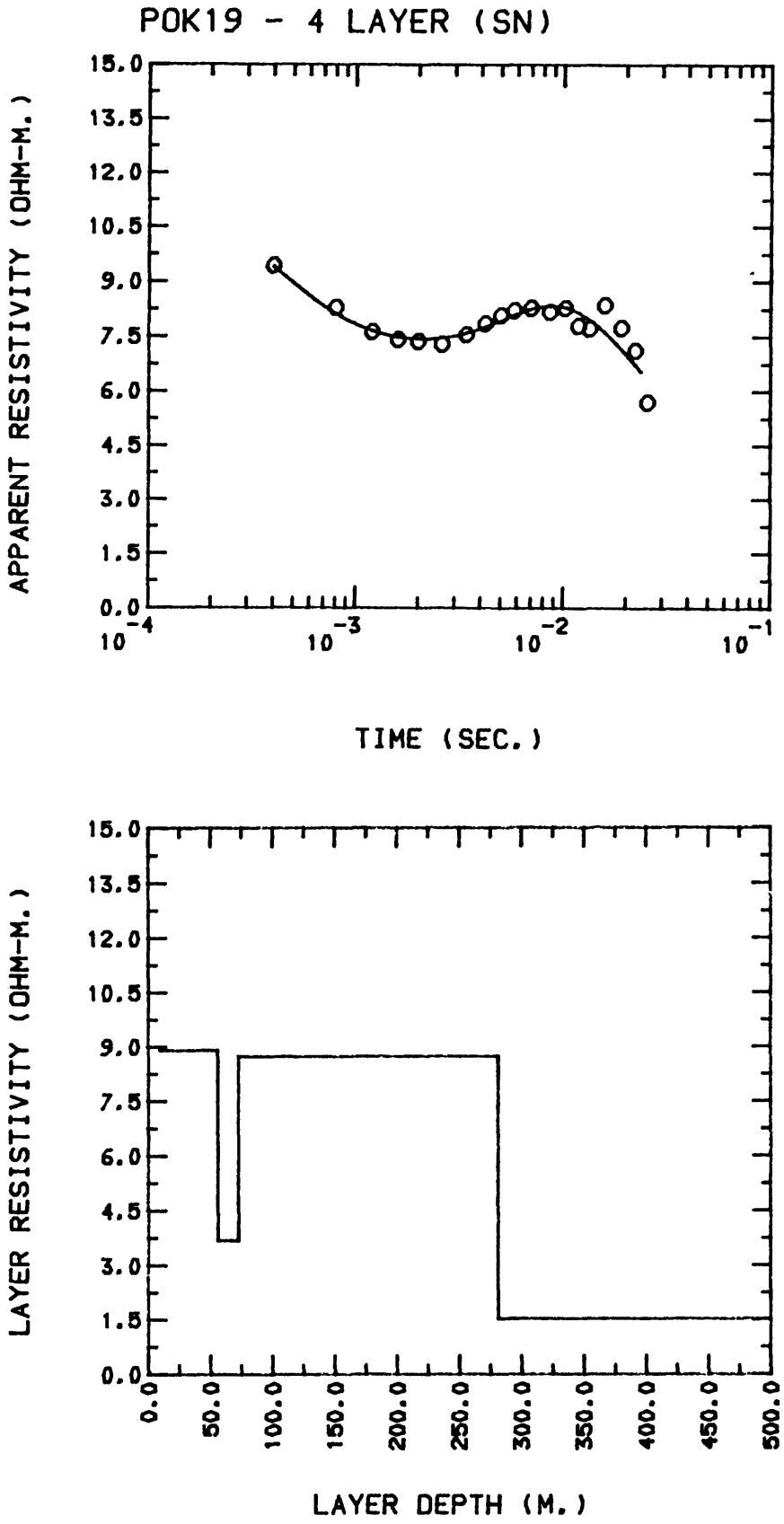
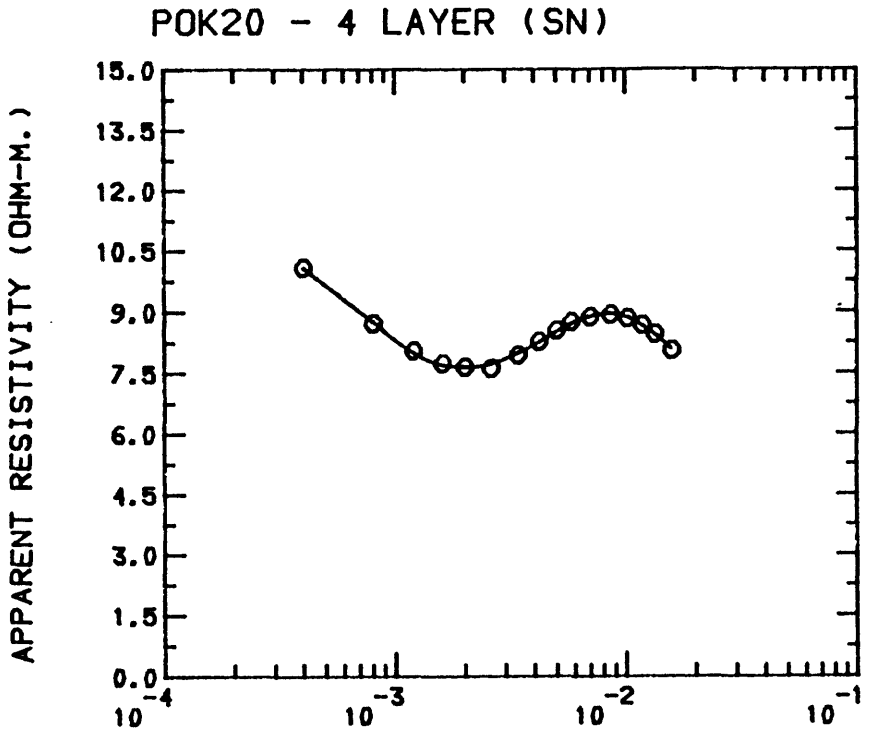
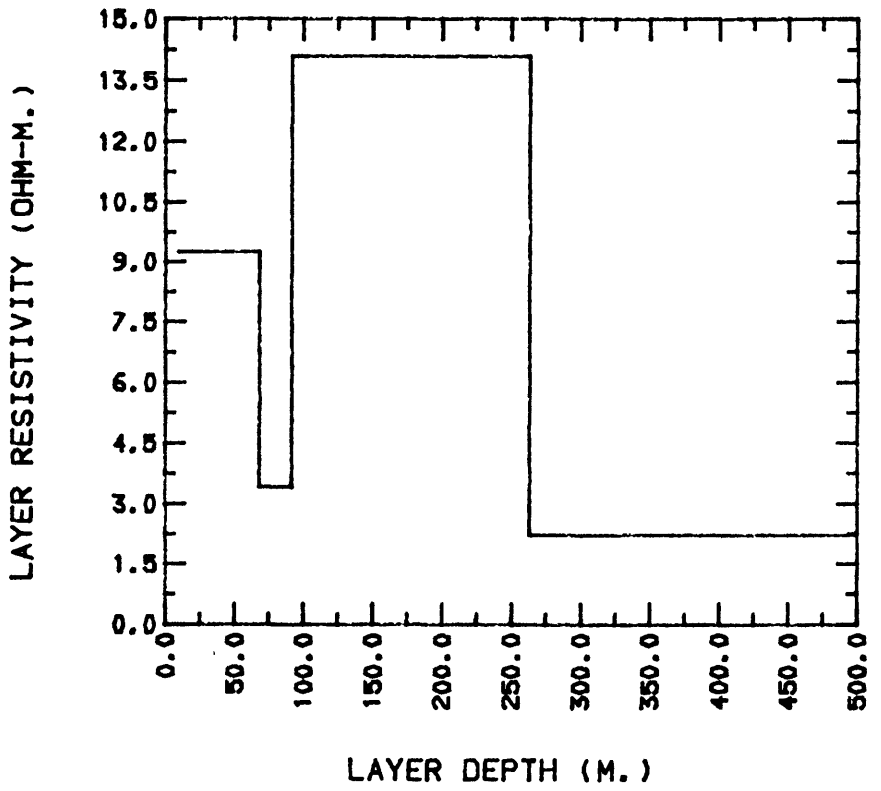
13.5
12.0
10.5
9.0
7.5
6.0
4.5
3.0
1.5
0.0
10^-4
10^-3
10^-2
10^-1
TIME (SEC.)


LAYER RESISTIVITY (OHM-M.)
15.0
13.5
12.0
10.5
9.0
7.5
6.0
4.5
3.0
1.5
0.0
0.0
50.0
100.0
150.0
200.0
250.0
300.0
350.0
400.0
450.0
500.0
LAYER DEPTH (M.)


POK19 - 4 LAYER (SN)
APPARENT RESISTIVITY (OHM-M.)
15.0
13.5
12.0
10.5
9.0
7.5
6.0
4.5
3.0
1.5
0.0
10^-4
10^-3
10^-2
10^-1
TIME (SEC.)
LAYER RESISTIVITY (OHM-M.)
0.0
50.0
100.0
150.0
200.0
250.0
300.0
350.0
400.0
450.0
500.0
LAYER DEPTH (M.)


POK20 - 4 LAYER (SN)
APPARENT RESISTIVITY (OHM-M.)
15.0
13.5
12.0
10.5
9.0
7.5
6.0
4.5
3.0
1.5
0.0
10^-4
10^-3
10^-2
10^-1
TIME (SEC.)


LAYER RESISTIVITY (OHM-M.)
15.0
13.5
12.0
10.5
9.0
7.5
6.0
4.5
3.0
1.5
0.0
0.0
50.0
100.0
150.0
200.0
250.0
300.0
350.0
400.0
450.0
500.0
LAYER DEPTH (M.)