TWO-DIMENSIONAL RESISTIVITY MODEL RESULTS

TOPAZ PROJECT

JUAB COUNTY, UTAH

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Geothermal Branch

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TABLE OF CONTENTS

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INTRODUCTION

On January 20, 1982, EXPLORATION GEOTHERMICS received four (4) dipole-dipole resistivity pseudo-sections from AMAX EXPLORATION, INC. These profiles form the basis for the resistivity survey report on the TOPAZ project submitted December 9, 1981 by Mining Geophysical Surveys (Reference 1). The contents in the pseudo-sections were used to produce 2-D geoelectric models using the compter code developed by Dey and Morrison, 1976 (Reference 2). This code carries out a finite difference solution to Poisson's equation for the electric potential in a defined two-dimensional earth. EXPLORATION GEOTHERMICS presently carries out this calculation on a Cyber 203. To obtain an appropriate fit, approximately twelve 'trial-and-error' forward solutions were required per model.

DISCUSSION OF MODELING RESULTS

Figures 1 through 4 show the modeling results. The lower pseudo-section in these figures contains the observed field data. Immediately above the field data pseudo-section is a theoretical computer derived pseudo-section for the 2-D model shown at the top of the figure. The profile locations are spotted on the base map provided by Mining Geophysical Surveys (Plate 1).

Model for Line 2

The field data for Line 2, the most westerly of the four modeled, can be adequately modeled by conductive blocks contained in a 200 ohm-meter half-space (see Figure 1). The most interesting of these blocks, from a geothermal standpoint, is the somewhat isolated 20 ohm-meter block that is required in order to model the swath of low apparent resistivity values measured at the northern end of the line in the vicinity of station SPD3-C5.

The model for the southern portion of this line, beginning in the vicinity of SPD2-C7, is characterized by material of resistivity of 35 ohm-meter overlying a 200 ohm-meter basement. The electrical basement for this area occurs at a depth of approximately 2,000 feet. The near-surface in this area grades upwards from the 35 ohm-meter value to values as high as 200 ohm-meter. The 200 ohm-meter unit has greater vertical extent that the other near-surface resistive units and may represent a dike-like feature.

South of station SPD1-C6, the material over basement can be modeled by two layers with the less resistive layer being the deeper of the two.

Model for Line 4

Line 4 (Figure 2) is a mile east of Line 2. In order to fit the field data for this line, a more complex two-dimensional model is required than is the case for Line 2. Most units of the model for Line 4 have slightly higher resistivity than do the corresponding units for Line 2. The 250 ohm-meter horst-like block between stations SPD2-C6 and SPD3-C3 correlates well with the similar 200 ohm-meter structure on Line 2. The down dropped block to the north of this feature correlates with the 20 ohm-meter unit on Line 2. On Line 4, however, the resistivity of this unit is 150 ohm-meter. This change in resistivity could represent an increasing temperature and/or porosity in a northwesterly direction along the strike of this structure.

South of SPD2-C6 the geoelectric section is characterized by 35 to 40 ohm-meter material over basement with the overburden unit thickening to the south. The depth to basement increases from 2,000 feet near station SPD2-6 to 3,000 feet at the southern end of the line.

The near-surface resistivity in the southern half of the Line 4 model is uniformly high except for a small, limited depth extent conductor (35 ohm-meter) at the major contact between the conductive overburden to the south and the resistive rocks to the north. This small surface block is located between stations SPD2-C5 and SPD2-C6.

Model for Line 1

Line 1 (Figure 3) is a mile east of Line 4. Correlation of the geoelectric structure in the model for this line with the structure found for Lines 4 and 2 is difficult. This suggests the region immediately west of Line 1 contains a three-dimensional structure. Correlation is possible, however, between the structure for Line 1 and Line 3. Line 3 is one mile east of Line 1. The model for Line 1 is dominated by high resistivity units to the north and lower resistivity units to the south. The profile on which this model is based extends into the lower reaches of the Spor Mountain Range. The transition to more resistive rock associated with the mountain range is clearly evident in the model near station SPD2-C1. Just north of this location, a 300 ohm-meter dike-like feature is present in the model. The mountain range is characterized in the model by large resistive blocks having resistivities of 150 and 300 ohm-meter.

The depth to basement for the southern portion of the model is of the order of 5,000 feet. The electrode spacings used to collect the field data were, however, not sufficient to allow accurate determination of basement depths of this magnitude.

Model for Line 3

The geoelectric model for Line 3, one mile east of Line 1, is characterized by large, high resistivity blocks to the north in the mountainous area and tabular, low resistivity units to the south (Figure 4). The transition between these two types of structures occurs between stations SPD1-7 and SPD2-1.

A block with a resistivity value of 650 ohm-meter is required to properly model data collected in the vicinity of station SPD2-C4. This high resistivity value is probably associated with low porosity crystalline rock.

REFERENCES CITED

1. Wieduwilt, W.G., 1981, Resistivity Survey, Topaz Project, Juab County, Utah: Report by Mining Geophysical Surveys, December 9, 1981.

2. Dey, A., and Morrison, H.F., 1976, Resistivity Modeling for Arbitrarily Shaped Two-dimensional Structures. Parts 1 and 2: Berkeley Laboratory Report No. LBL-5223.

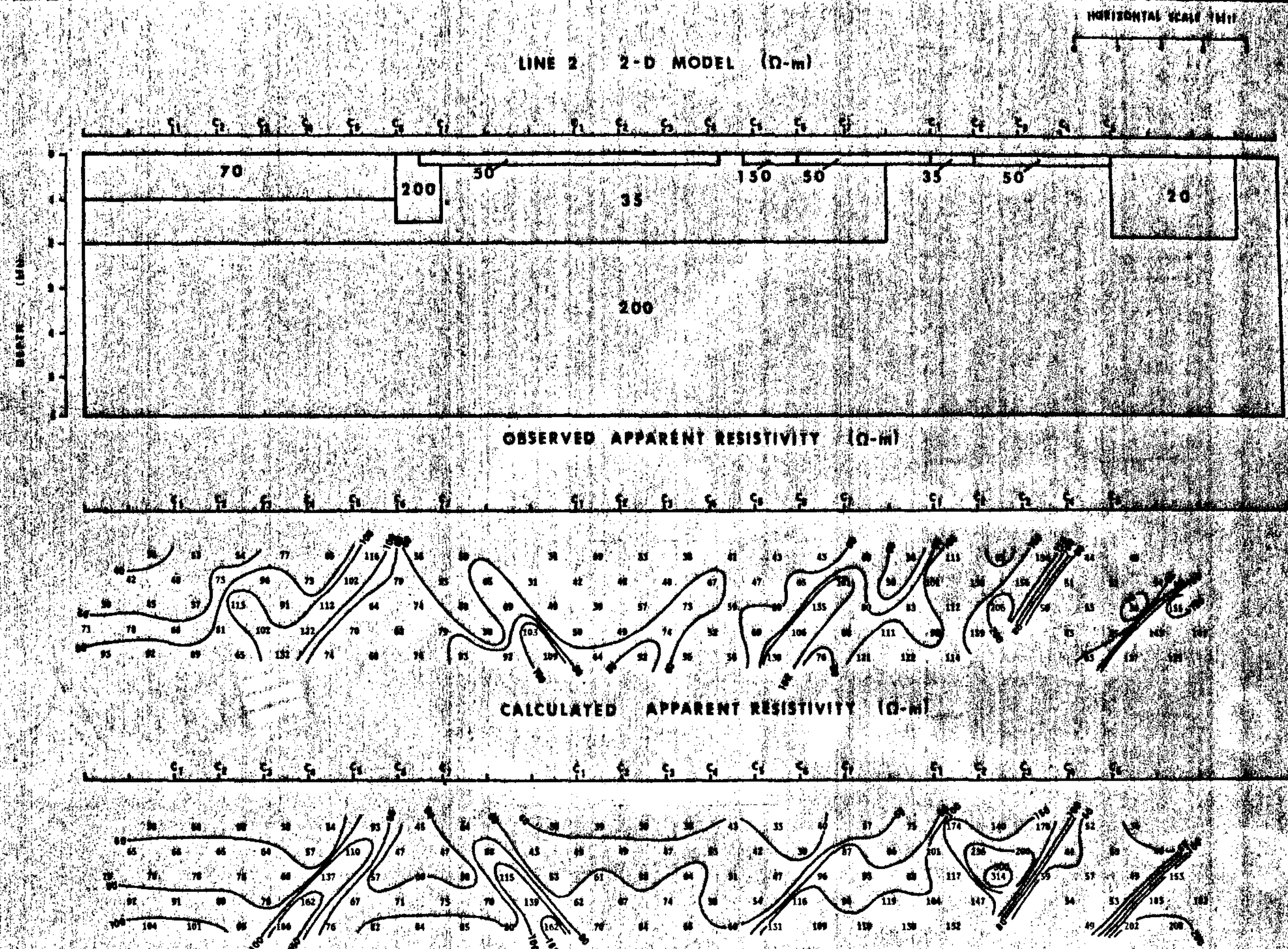


Figure 11: 2-D resistivity model and calculated and observed apparent resistivity pseudosections for line 2.

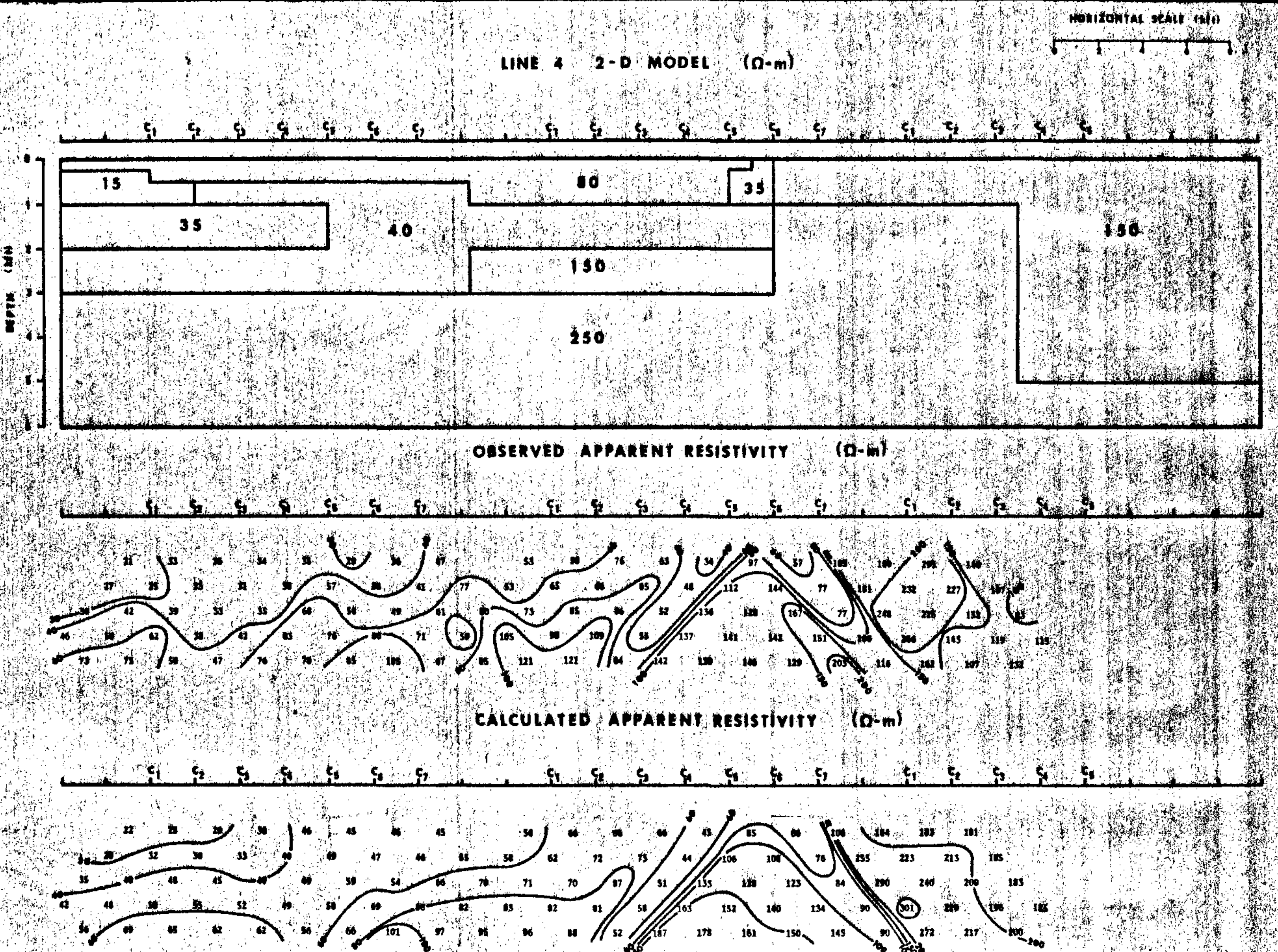


Figure 2: 2-D resistivity model and calculated and observed apparent resistivity pseudosections for line 4.

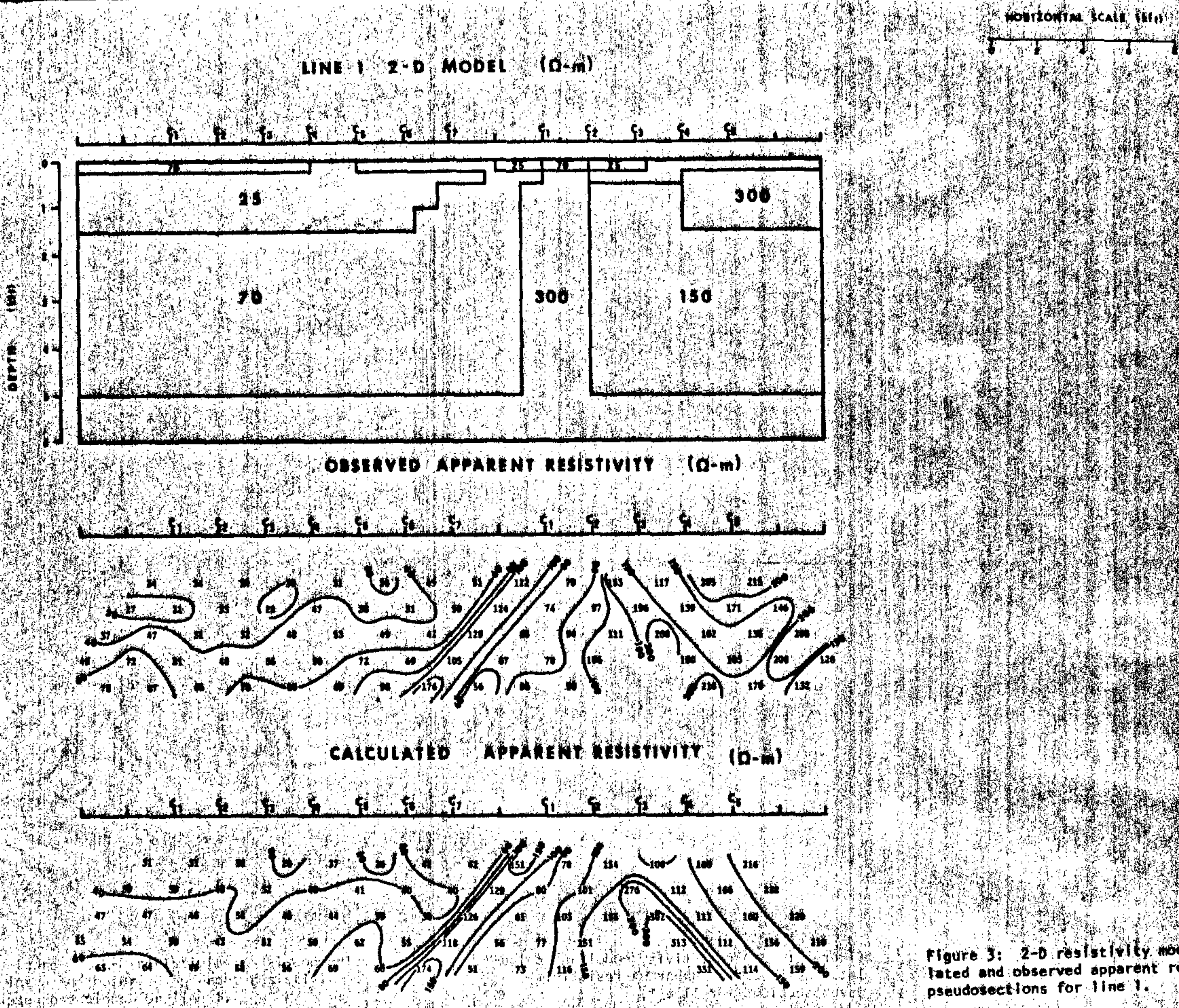


Figure 3: 2-D resistivity model and calculated and observed apparent resistivity pseudosections for line 1.

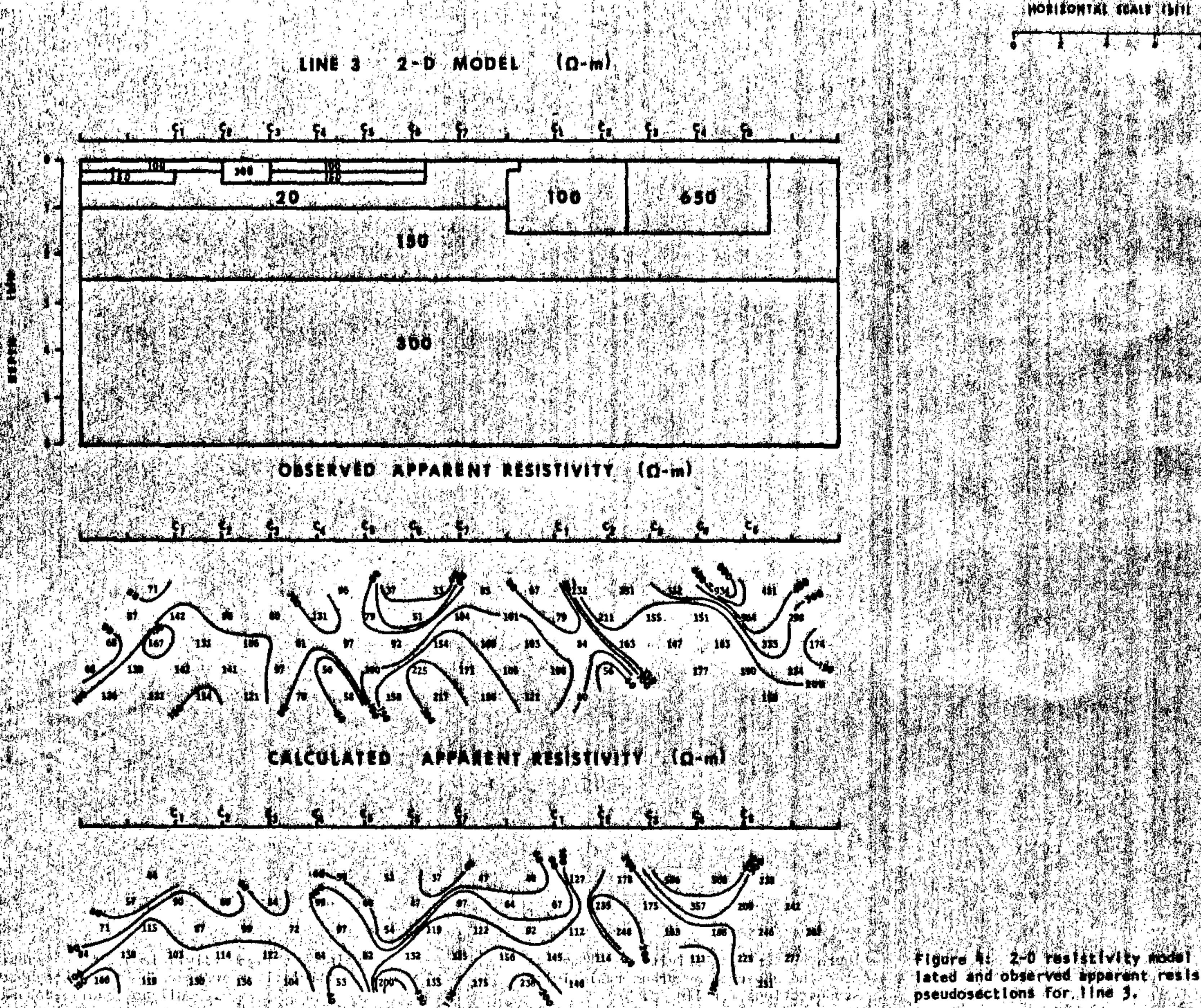
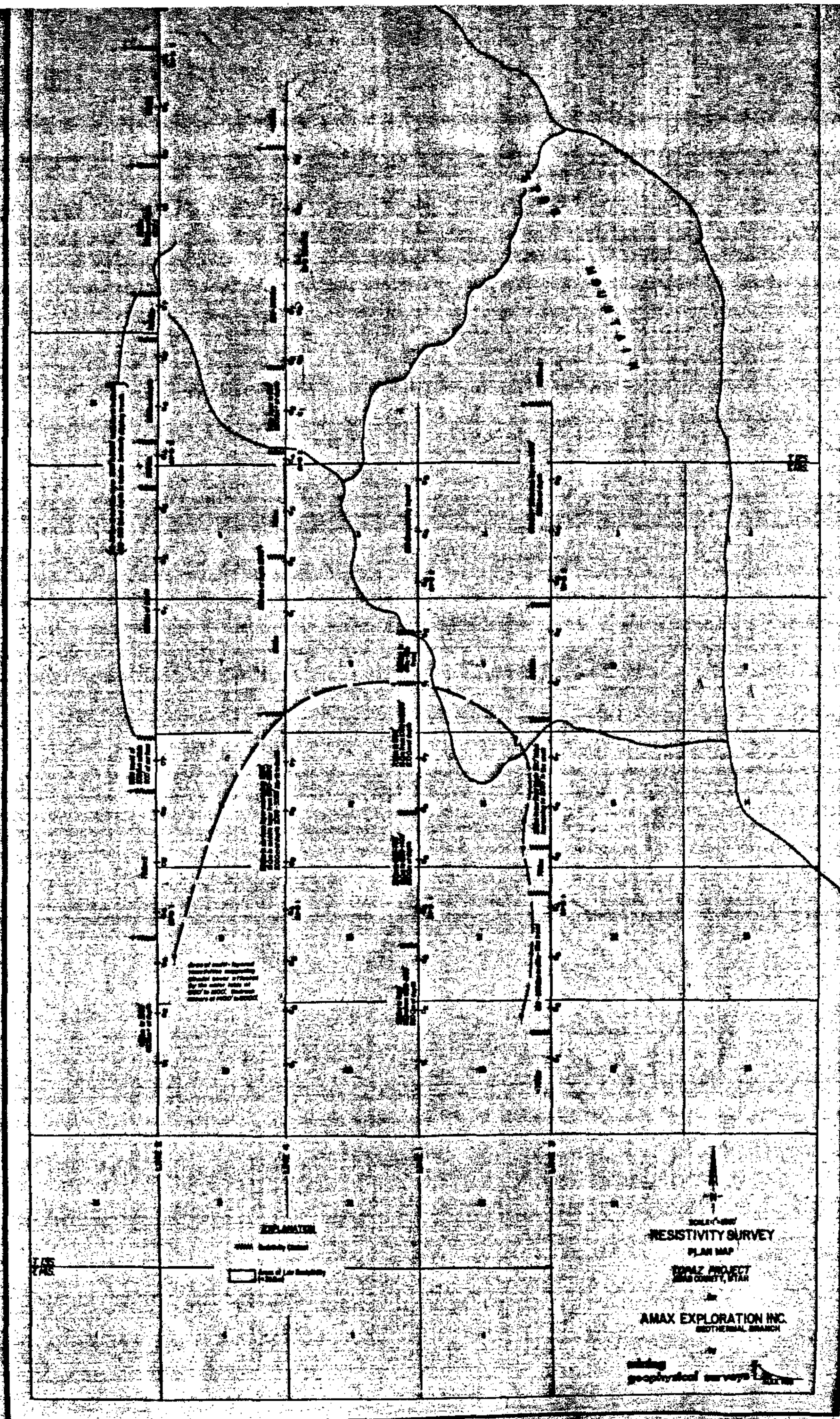


Figure 4: 2-D resistivity model and calculated and observed apparent resistivity pseudosections for line 3.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