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INTERPRETATION OF A DIPOLE-DIPOLE ELECTRICAL RESISTIVITY SURVEY, COLADO GEOTHERMAL AREA, PERSHING COUNTY, NEVADA

Claron E. Mackelprang

September, 1980

MASTER

Work performed under Contract No. DE-AC07-80ID12079

EARTH SCIENCE LABORATORY
University of Utah Research Institute
Salt Lake City, Utah

Prepared for
U.S. Department of Energy
Division of Geothermal Energy

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PREPARED FOR DEPARTMENT OF ENERGY
DIVISION OF GEOTHERMAL ENERGY
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ABSTRACT

An electrical resistivity survey in the Colado geothermal area, Pershing County, Nevada has defined areas of low resistivity on each of five lines surveyed. Some of these areas appear to be fault controlled. Thermal fluids encountered in several drill holes support the assumption that the hot fluids may be associated with areas of low resistivity. The evidence of faulting as interpreted from modeling of the observed resistivity data is therefore particularly significant since these structures may be the conduits for the thermal fluids.

Sub-alluvial fault zones are interpreted to occur between stations 0-5 NW on Line D and on Line A between stations 4 NW and 4 SE. Fault zones are also interpreted on Line C near stations 1 NW, 1 SE, and 3 SE, and on Line E between stations 2-4 NW and near 1 SE. No faulting is evident under the alluvial cover on the southwest end of Line B.

A deep conductive zone is noted within the mountain range on two resistivity lines. There is no definite indication that thermal fluids are associated with this resistivity feature.

INTRODUCTION

The Colado geothermal area is located in Pershing County approximately 7 miles northeast of Lovelock, Nevada (Figure 1). The main area of geothermal exploration is along the west flank of the West Humboldt Range, lying between the railroad sidings of Kodak and Woolsey (Plate I), a distance about 4.5 miles.

The Earth Science Laboratory Division, University of Utah Research Institute (ESL/UURI) undertook an electrical resistivity survey in April, 1980 to characterize the electrical resistivity distribution of the resource area in support of the Getty Oil Company geothermal exploration effort. Their interest in the geothermal potential of the area was stimulated when, while drilling on mining claims nearby, they encountered a light flow of steam and thermal waters (Wayne Shaw, personal communication).

An earlier geophysical survey designed specifically for the evaluation of the geothermal potential in the Colado area was performed in 1977 for Getty Oil Company by Electrodyne Surveys of Sparks, Nevada. Numerous techniques (AMT-MT, TDEM, Telluric, Electrical Resistivity, Gravity and Ground Magnetic) were applied with mixed results.

A comparison of this dipole-dipole resistivity survey with the Electrodyne resistivity surveys shows the two data sets to be incompatible. The dipole-dipole data are more definitive in delinating not only areas of low apparent resistivity but structurally controlled areas as well. The data sets from the survey by Electrodyne are not supportive of each other; technique application and processing errors are involved, and Electrodyne notes discrepancies in their report.

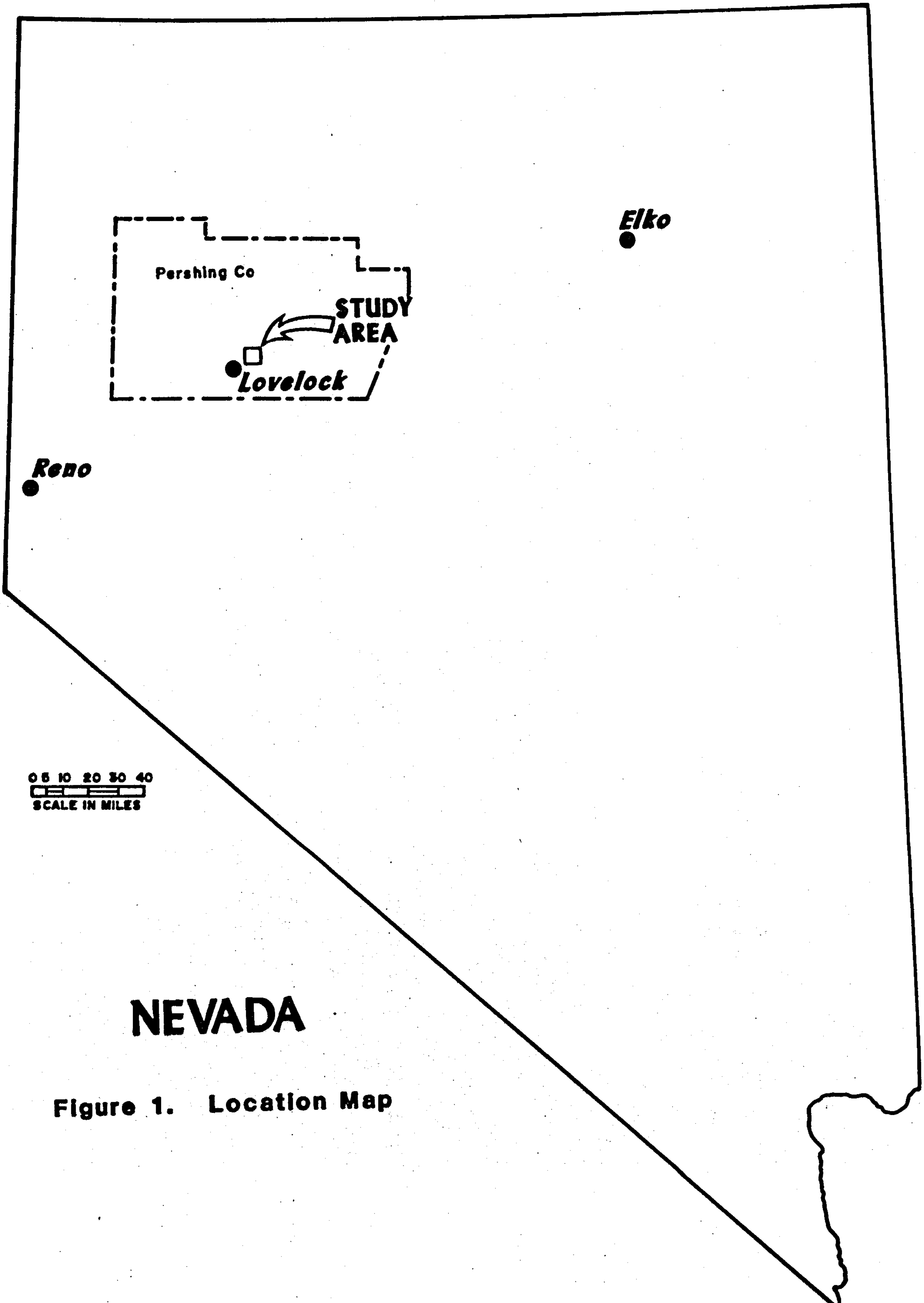

Figure 1. Location Map

GENERAL GEOLOGY

The Colado geothermal area is indicated by hot water wells in alluvium along the west flank of the West Humboldt Range. Shallow thermal gradient holes less than 500 feet deep have encountered thermal fluids upwards of 113.5°C at a depth of 250 feet.

To gain a better understanding of the geothermal environment, Sibbett (1980) recently mapped the geology of the West Humboldt Range (Plate I) adjacent to the geothermal area. The following is taken from the abstract of his report.

The West Humboldt Range consists mainly of Triassic to Jurassic slaty shale to quartzite of the Auld Lang Syne Group. Carbonate rocks of the Lovelock Formation have been thrust over the pelitic rock on the south end of the area. Erosional remnants of Tertiary tuffs and sediments overlay the metasediments in the range.

Several thrust faults are exposed south of Coal Canyon and a structural break in the Mesozoic rocks exists under Coal Canyon. Several low-angle faults occur to the north but their effect, if any, on the geothermal occurrence is not known.

The principal structures are high-angle faults striking north-northwest, northeast and north-south. The horst-to-graben transition along the range front consists of several step faults following an irregular south-to-north trend. The structural pattern noted along the west edge of the range probably continues to the west under the Quaternary alluvium. The thermal waters are thought to rise along a major fault or fault system to the base of the alluvium.

A more detailed geologic description of the Colado geothermal area can be found in Sibbett's (1980) report.

ELECTRICAL RESISTIVITY SURVEY

Survey Procedure

The field survey was conducted by JCW, Inc. of Salt Lake City, Utah during the period April 30 to May 6, 1980. The equipment used included a Scintrex Model IPC-7 15 Kw square-wave transmitter utilizing time-domain mode current generation. The potential field was measured with a Scintrex Model IPR-10 digital time-domain receiver. When electrical noise was severe, a Scintrex Model IPR-8A receiver was used in conjunction with a Hewlett Packard 7155B strip chart recorder. Transmitting electrodes were buried aluminum foil and/or steel stakes driven into the ground. The potential differences were recorded at the surface using porcelain porous pot electrodes.

The survey (Plate I) consisted of four 1000-foot dipole-dipole 7-spreads (7 transmitting electrodes) trending generally N55°W. These are normal to existing culture (railroad tracks, water lines, power lines, etc.) and mapped faults. An effort was also made to keep transmitting electrodes at least 500 feet from the cultural features.

A fifth line was oriented N27°E and crossed a bulge in the mountain range opposite drill holes having higher recorded temperatures. This line used 2000-foot dipoles to explore for a potential geothermal reservoir at greater depth within bedrock.

Data were acquired at n-spacings 1 through 6 on all lines whenever possible. Voltages were recorded over several transmitted cycles at each receiver site. These were averaged together before the computation of apparent resistivities. A few data points are obviously in error in spite of reasonable field precautions. High noise levels in the electrical signal may be the cause. The field data are thought, however, to be accurate to at least ±10% exclusive of these questionable points.

Survey Results

Plate I shows the location of the resistivity lines, superimposed on a geologic/topographic base map of the Colado area. The observed data are shown on Figures 2 through 6 with the interpreted resistivity distribution derived from modeling the field data. A two-dimensional IP-Resistivity program developed at the Earth Science Laboratory (Killpack, 1979) was used in the numerical modeling. While the computed models give a good fit to the observed data, they are non-unique. The resistivity sections on Figures 2 through 6 are from numerical models chosen as best fits to the observed apparent resistivity field data. Appendix Figures A1 through A5 show calculated resistivities based on these same models for comparison purposes.

Line D

This line (Figure 2) is at the northernmost end of the geothermal area and extends west from the range front. It was located for close proximity to drill holes 14-22, 13-26, and IGH-1; these holes have the highest recorded temperatures, to date, within the geothermal area. The observed data show a major resistivity discontinuity, interpreted as a fault, near station 3 NW. A conductive zone (<10 ohm-meters) also lies at depth beneath this station. A major change in topography south of station 1 SE introduces topographic effects in the field data.

Modeling results show that sharp contrasts (greater than a factor of 2) in resistivity occur between stations 4-5 NW, 3-4 NW, 2-3 NW, and 0-1 NW. These resistivity discontinuities are interpreted as faults. Only the discontinuity near station 0 corresponds to mapped structures.

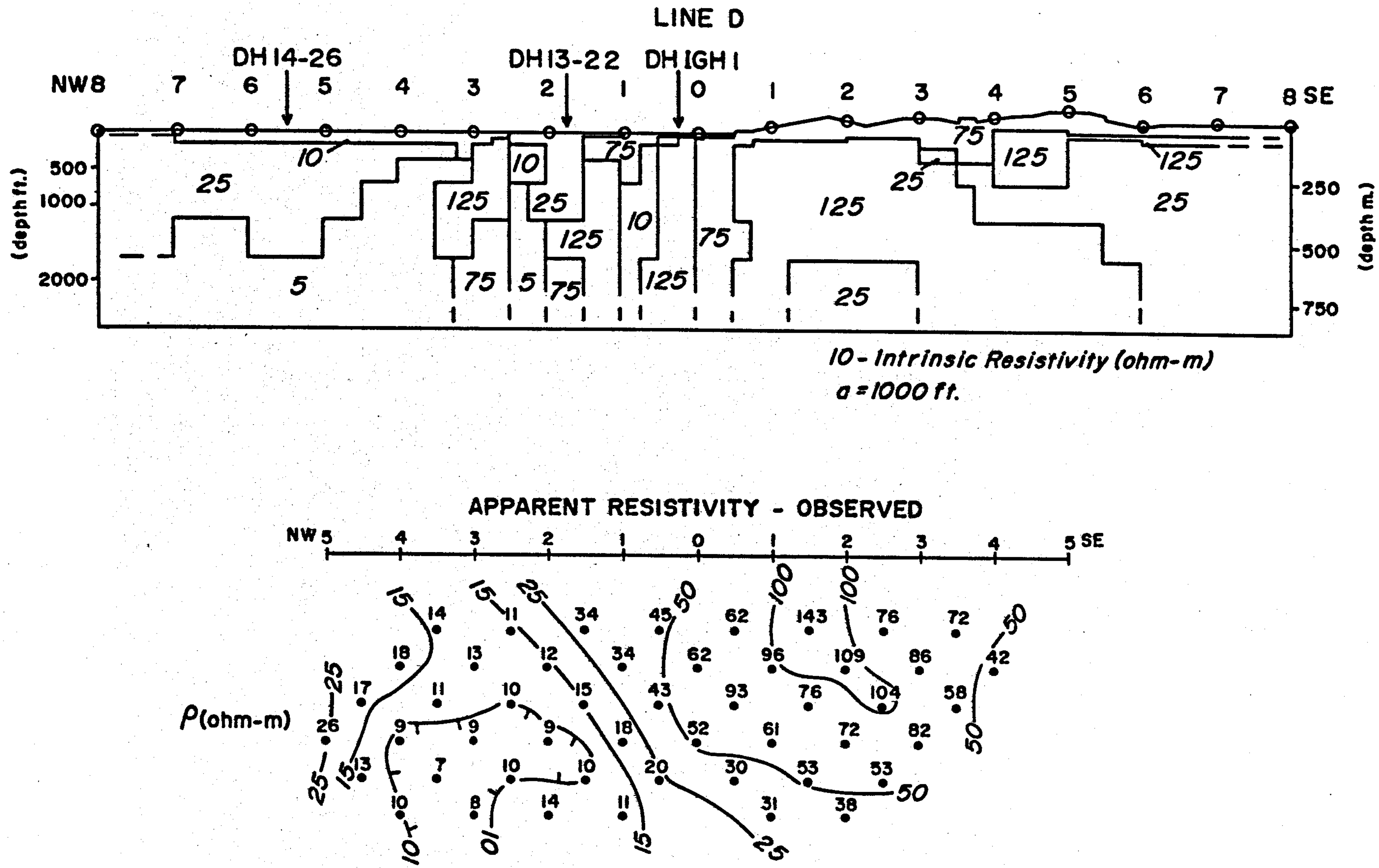

FIGURE 2 INTERPRETED RESISTIVITY SECTION AND OBSERVED APPARENT RESISTIVITY

LINE D - COLADO GEOTHERMAL AREA

PERSHING COUNTY, NEVADA

Scale 1:24,000

Northwest of station 3 NW is a surface layer about 150 feet thick having a resistivity of 10 ohm-meters. Beneath this lies a much thicker (1500 feet) and slightly more resistive (25 ohm-meter) layer. This in turn is underlain by very conductive material (5 ohm-meter) which extends downward to the limit of detectability.

Moderately conductive rocks are indicated at depths greater than 2000 feet in the mountain range between stations 0 to 3 SE. Similar rocks, with a resistivity of about 25 ohm-meters, are within approximately 250 feet of the surface between stations 5 and 6 SE.

Line A

Line A (Figure 3) was located south of, but still near, drill holes 14-22 and 15-21 so that the transmitting electrodes would cover the inferred hot zone which trends southwest from DH 14-22. The observed field data show conductive zones averaging 5-6 ohm-meters at moderate depth overlain by resistive near-surface material at both ends of the line. The central part of the line shows the conductive zone nearer the surface with the resistive zone beneath and extending to depth.

Modeling results show a thin (100 foot) surface layer with a resistivity of 10 ohm-meters extending between stations 1 SE and 2 NW. At 2 NW it apparently thickens abruptly to the northwest. Directly beneath this layer between stations 1 SE and 1 NW is a zone of 4 ohm-meter material with a variable thickness up to about 1000 feet. Between stations 1-2 NW this 4 ohm-meter material extends down a narrow zone to a depth of approximately 1500 feet where it then continues to the northwest. Similar resistivities occur on

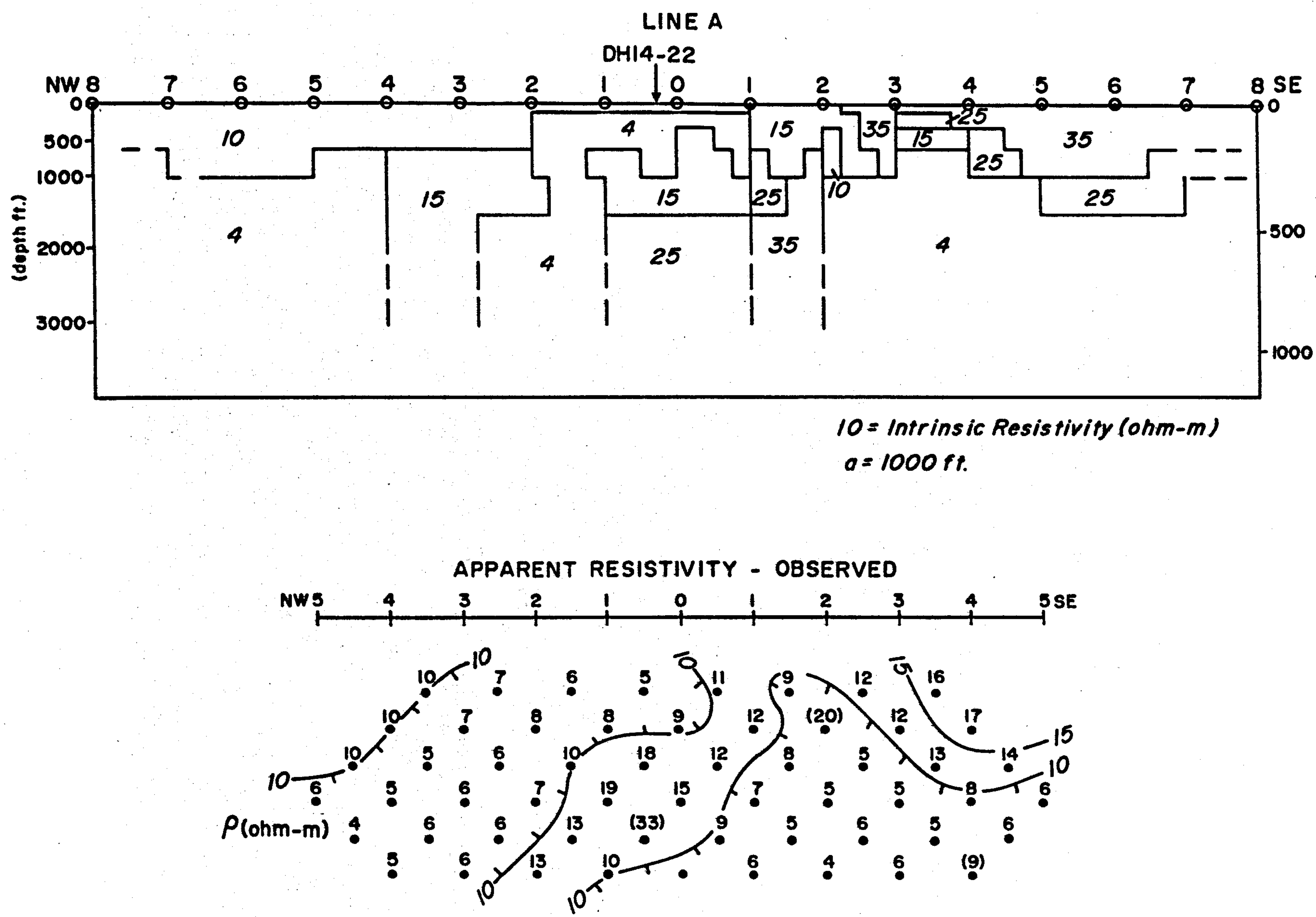

FIGURE 3 INTERPRETED RESISTIVITY SECTION AND OBSERVED APPARENT RESISTIVITY

LINE A - COLADO GEOTHERMAL AREA

PERSHING COUNTY, NEVADA

Scale 1:24,000

the southeast end, coming to within approximately 600 feet of the surface between stations 3-4 SE. A more resistive material (15-35 ohm-meter) occurs near surface between stations 1 and 8 SE. A 15 ohm-meter body also extends to depth beneath and adjacent to the 4 ohm-meter zone noted on the northwest end of the line.

Because the projected trend of high temperatures between drill holes 14-22 and 10-34 crosses Line A near station 0, it could be inferred that the conductive (4 ohm-meter) near-surface layer is indicative of shallow thermal fluids. Lending support to this interpretation is the shallow hot water aquifer shown on a log of drill hole IGH-1 (Getty Oil Co., personal letter). The conduit for these fluids appears to lie between stations 1-2 NW.

Line C

This line (Figure 4) extends northwest from Coal Canyon and passes near drill holes 8-34, 9-34 and 10-34. The field data show a conductive (< 5 ohm-meter) zone enclosed by slightly more resistive (5-10 ohm-meter) material at depth beneath stations 0-3 SE. DH 9-34 is located just south of Line C between stations 0-1 SE and is centered on the conductive zone.

Model results show a conductive, approximately 2 ohm-meter, zone at depth which is enclosed by 10 ohm-meter material. This conductive zone occurs at a depth of approximately 1000 feet. The temperature log of DH 9-34 suggests a possible heat source nearby. Thus, the 2 ohm-meter zone may indicate the presence of conductive thermal fluids. No faults are indicated by sharp resistivity contrasts in the data however, so the high temperatures noted are likely due to a pluming effect of thermal fluids down the hydraulic gradient

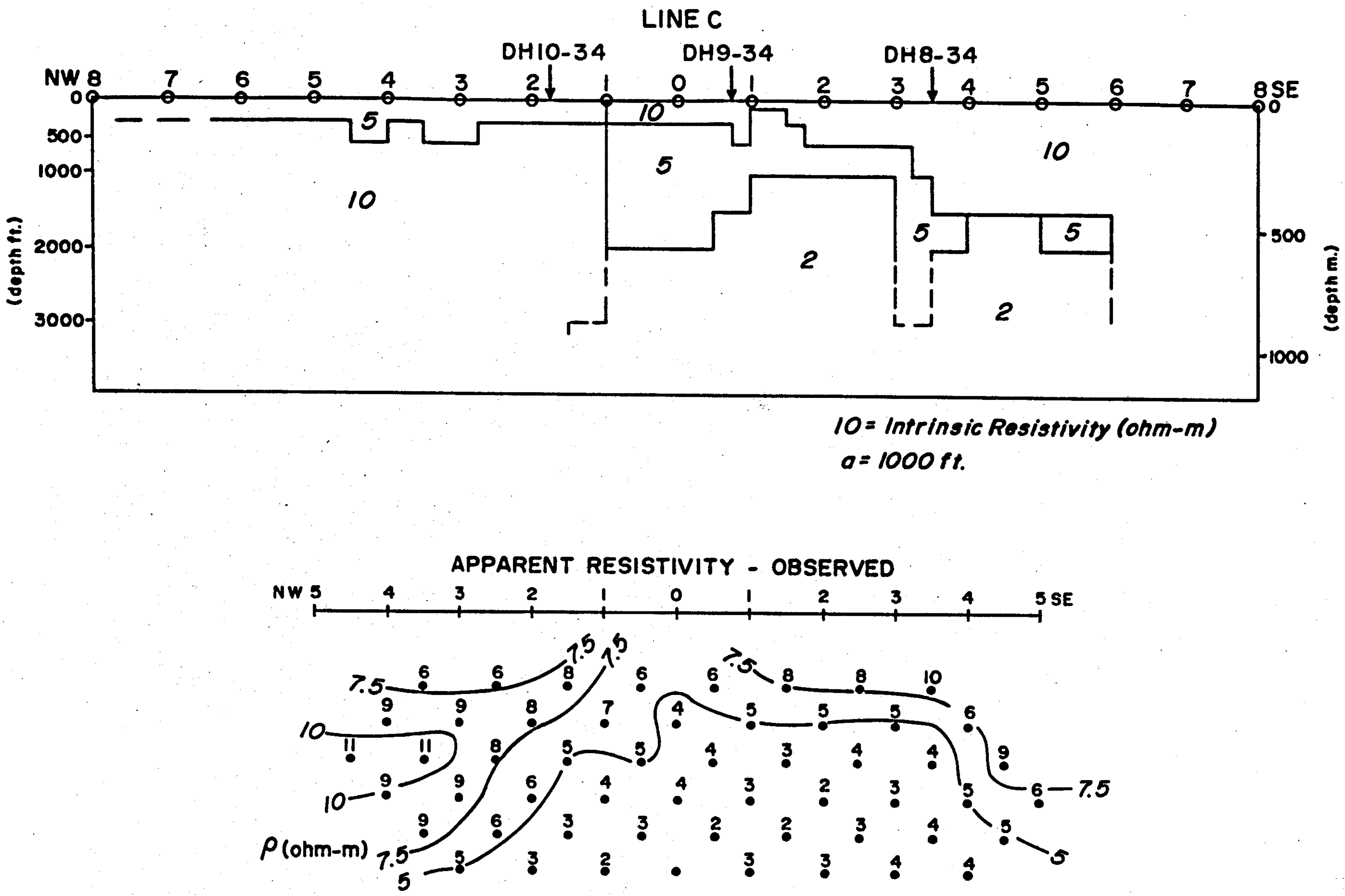

FIGURE 4 INTERPRETED RESISTIVITY SECTION AND OBSERVED APPARENT RESISTIVITY

LINE C - COLADO GEOTHERMAL AREA

PERSHING COUNTY, NEVADA

Scale 1:24,000

within an aquifer.

Line E

This line (Figure 5) is the southernmost line of the survey. Station 0 lies just north of drill hole IGH-2 (formerly DH 3-10). The field data indicate a resistive surface layer extending approximately from stations 3 NW to 5 SE and appearing thickest in the station interval 1 to 2 SE. Very conductive material is present at a depth of approximately 2000 feet and extends the entire length of the line. This conductive material comes closer to the surface on the northeast end of the line. Faulting is suggested by the field data between stations 5 and 6 SE and is supported by geologic mapping.

The model results show 25 ohm-meter material at the surface between stations 1 to 3 SE. This resistive body is overlain by material more conductive (10 ohm-meter) both to the northwest and southeast. A conductive (2.5 ohm-meter) layer occurs at a depth of about 2000 feet and extends both laterally and downward to the limits of detectability. The very conductive zone between stations 5 and 6 SE is interpreted as higher porosity and/or alteration probably associated with faulting.

Line B

This line (Figure 6) differs from the other lines in that 2000-foot dipoles are used. The observed resistivity values represent the integrated effect of a larger volume of earth, both horizontally and vertically, while the spatial resolution of the interpreted section is only half that of the 1000-foot dipole lines.

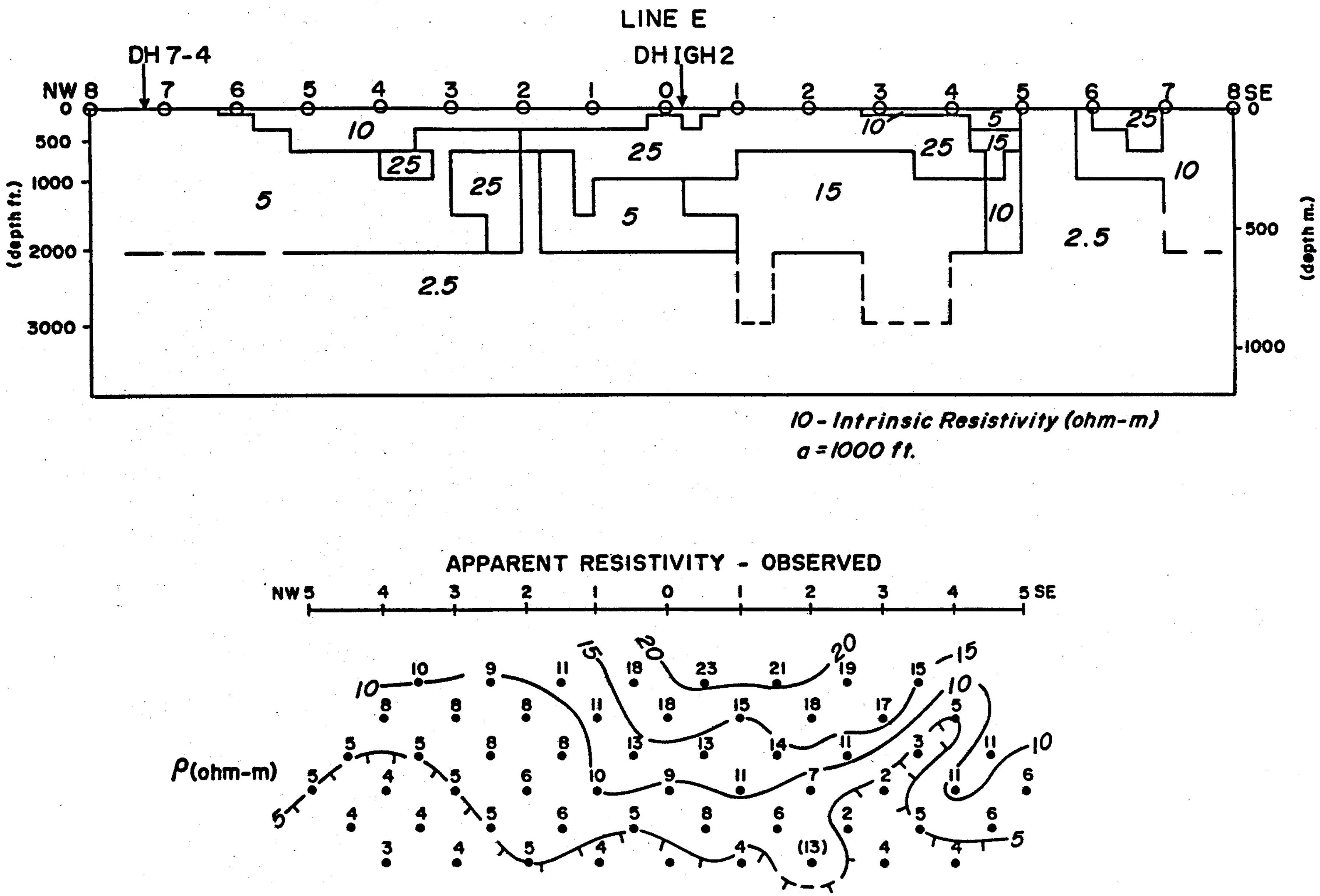

FIGURE 5 INTERPRETED RESISTIVITY SECTION AND OBSERVED APPARENT RESISTIVITY

LINE E - COLADO GEOTHERMAL AREA

PERSHING COUNTY, NEVADA

Scale 1:24,000

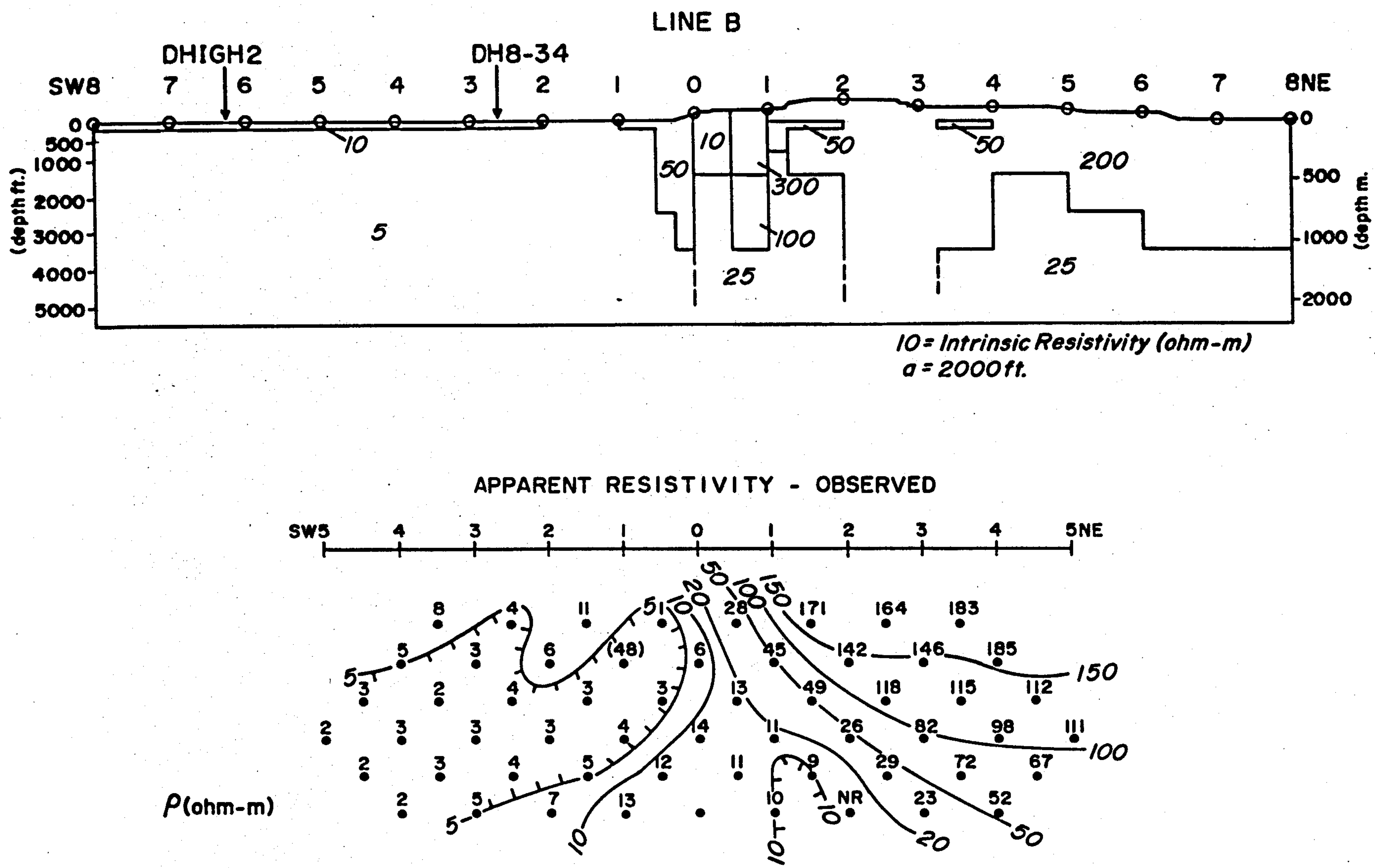

FIGURE 6 INTERPRETED RESISTIVITY SECTION AND OBSERVED APPARENT RESISTIVITY

LINE B - COLADO GEOTHERMAL AREA

PERSHING COUNTY, NEVADA

Scale 1:24,000

This profile trends northeast-southwest, subparallel to the dominant structure, and is more influenced by lateral (and non-two-dimensional) geometry within the earth. The line passes close to drill holes IGH-2 and 8-34, and between 17-24 and 18-24. The range front is encountered at about station 0 and the entire northeast end of the line crosses the range. Topographic effects are therefore present in the field data on this end of the line.

The model results show a major resistivity contrast, interpreted as a fault, between stations 0 and 1 SW. This appears to be the range front fault that separates the conductive valley fill with resistivities of 5-10 ohm-meters from the rocks of the range which have resistivities upwards of 200-300 ohm-meters. The valley fill is very uniform in resistivity with no anomalous contrasts indicative of buried faulting. The data of this resistivity line do not suggest the presence of a fault extending NW out of Coal Canyon into the valley.

Several resistivity contrasts, interpreted as faults, are noted on the northeast end of the line. Near-surface rocks in this area have resistivities averaging about 200 ohm-meters for the most part. The presence of fairly conductive (25 ohm-meters) areas in the mountain range is of interest. The area at depth between stations 0-2 NE is coincident with the conductive area noted at depth on Line D between stations 1 to 3 SE; the significance of this conductive area is not presently known. The 25 ohm-meter body between stations 4-5 NE may be due in part to lateral effects of alluvium close to the line.

DISCUSSION

Plate II is an overlay to Plate I and shows the electrical resistivity distribution at the depth of approximately 1000 feet for each of the five lines. This plate shows the sharp resistivity contrasts and their locations from which the faulting is inferred. The data source for Plate II is the computed models shown as Figures A1 through A5. There is good correlation with mapped structures within the mountain range. The detection of suballuvial faults away from the mountain front is of particular importance, for, while these faults may have been suspected, their approximate location was not known. Although shown as separate faults, several could be part of a single fault zone and it must be understood that the locations of these faults as shown on Plate II are to be considered as close approximations only. They are necessarily subject to the sensitivity of the dipole spacing used as well as the non-uniqueness of the computer modeling technique.

Plate III is an overlay to Plates I and II. It shows an interpreted schematic of the hydrothermal reservoir based upon resistivity contrasts. Areas interpreted to contain gravels saturated with thermal waters as well as areas containing the conduits for these waters have been denoted.

ACKNOWLEDGEMENTS

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Special thanks are given to Dawnetta Bolaris who provided drafting expertise and to Holly Baker who patiently typed this report and its revisions. Thanks are also given to those members of ESL staff who provided a careful review of this report's contents.

REFERENCES

Electrodyne Surveys, 1978, An Electrical Resistivity Survey of the Colado Hot Springs Prospect, Pershing County, Nevada: Volumes I & II submitted to Getty Oil Company: Earth Science Laboratory open-file release (NV/COL/GOC-1).

Getty Oil Company, 1979, Temperature Logs from Shallow Depth Drill Holes: Earth Science Laboratory open-file release (NV/COL/GOC-3).

Killpack, Terry J., Hohmann, Gerald W., 1979, Interactive Dipole-Dipole Resistivity and IP Modeling of Arbitrary Two-Dimensional Structures: Univ. of Utah Res. Inst., Earth Science Laboratory report 15, 120 p.

Sibbett, Bruce S., Bullett, Michael J., 1980, Geology of the Colado Geothermal area, Pershing County, Nevada: Univ. of Utah Res. Inst., Earth Science Laboratory report 38, 34 p.

APPENDIX

Computed Resistivity and Interpreted Sections

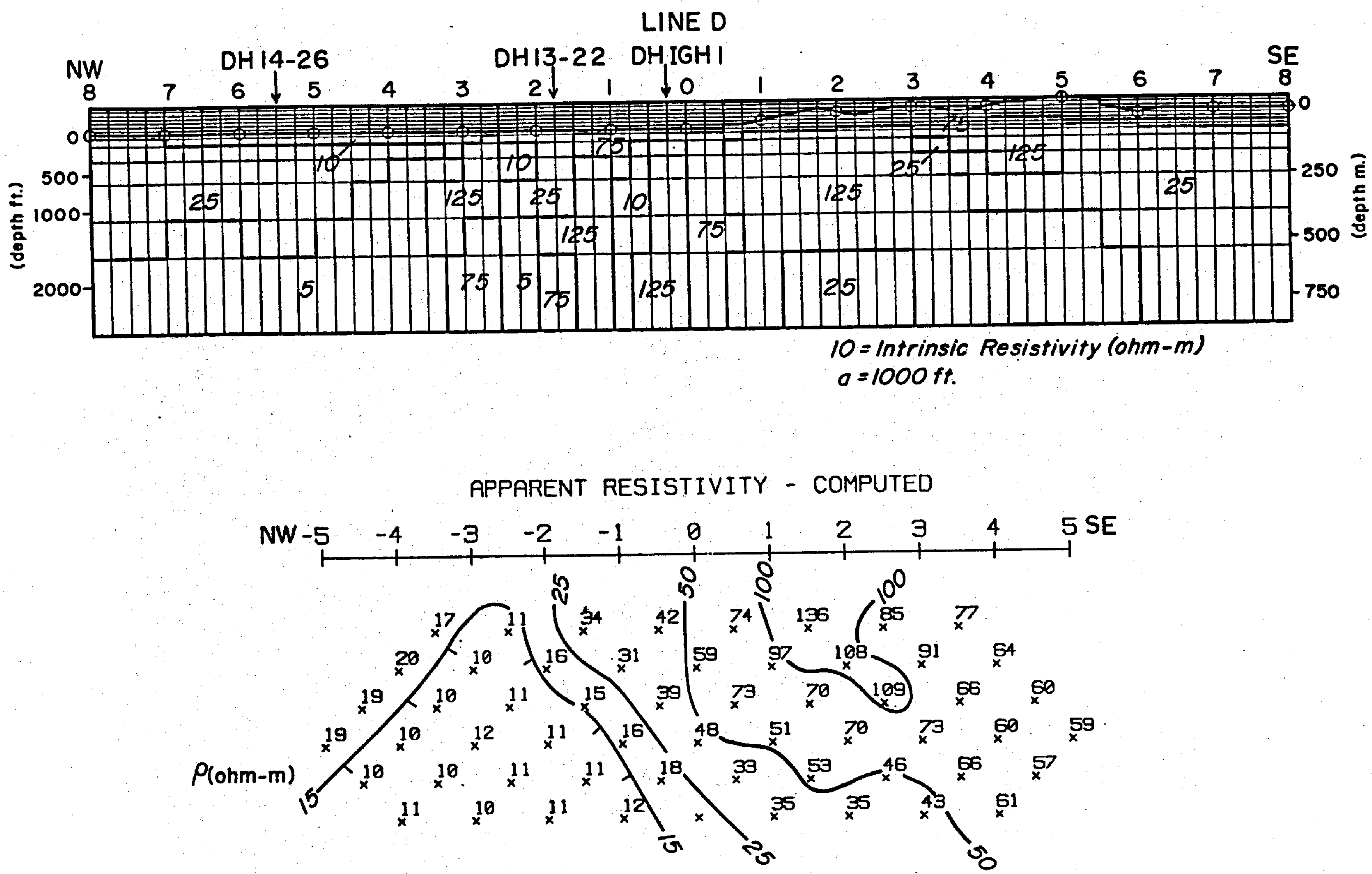


FIGURE A1 INTERPRETED RESISTIVITY SECTION AND COMPUTED APPARENT RESISTIVITY

LINE D - COLADO GEOTHERMAL AREA

PERSHING COUNTY, NEVADA

Scale 1:24,000

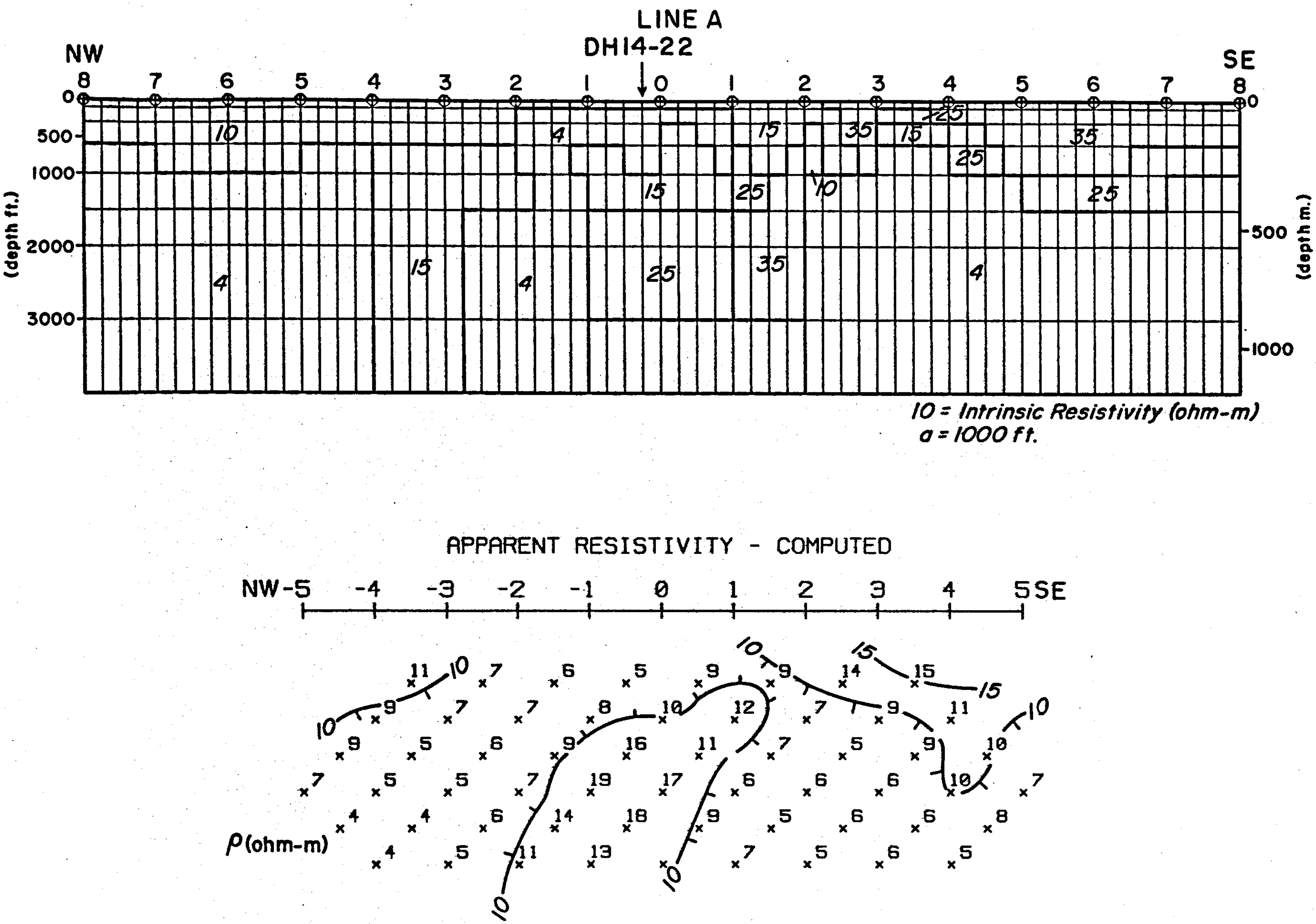
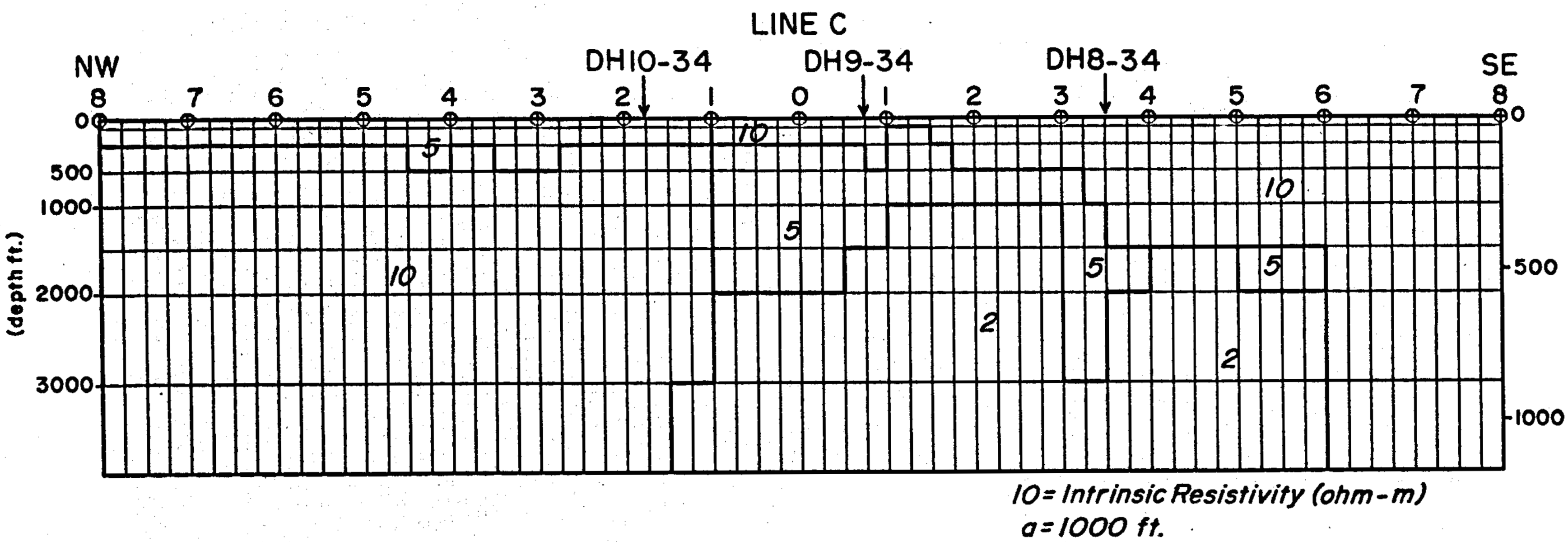


FIGURE A 2 INTERPRETED RESISTIVITY SECTION AND COMPUTED APPARENT RESISTIVITY

LINE A - COLADO GEOTHERMAL AREA

PERSHING COUNTY, NEVADA

Scale 1: 24,000



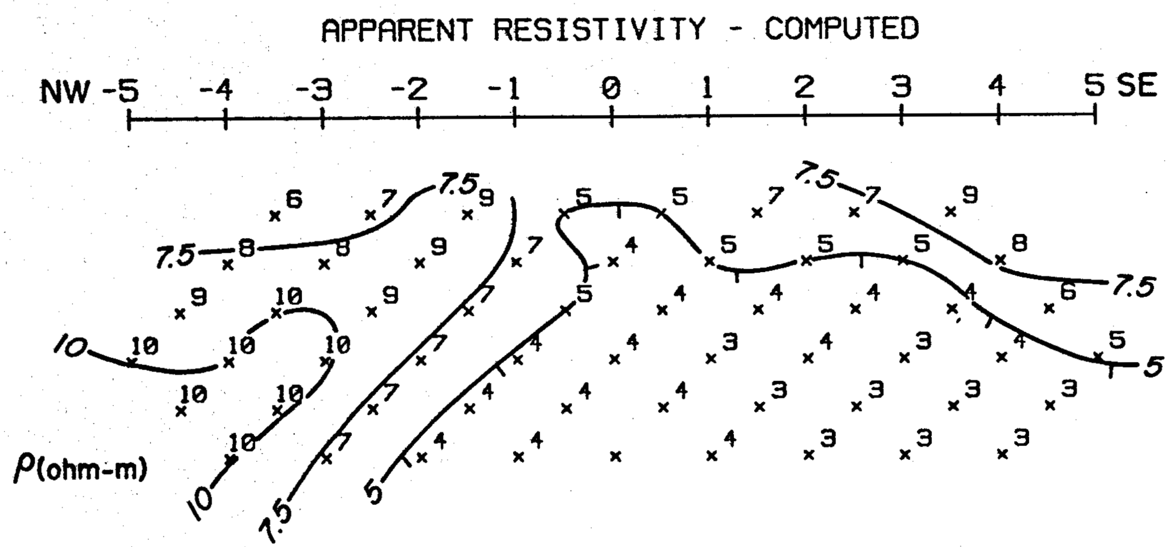


FIGURE A3 INTERPRETED RESISTIVITY SECTION AND COMPUTED APPARENT RESISTIVITY

LINE C - COLADO GEOTHERMAL AREA

PERSHING COUNTY, NEVADA

Scale 1:24,000

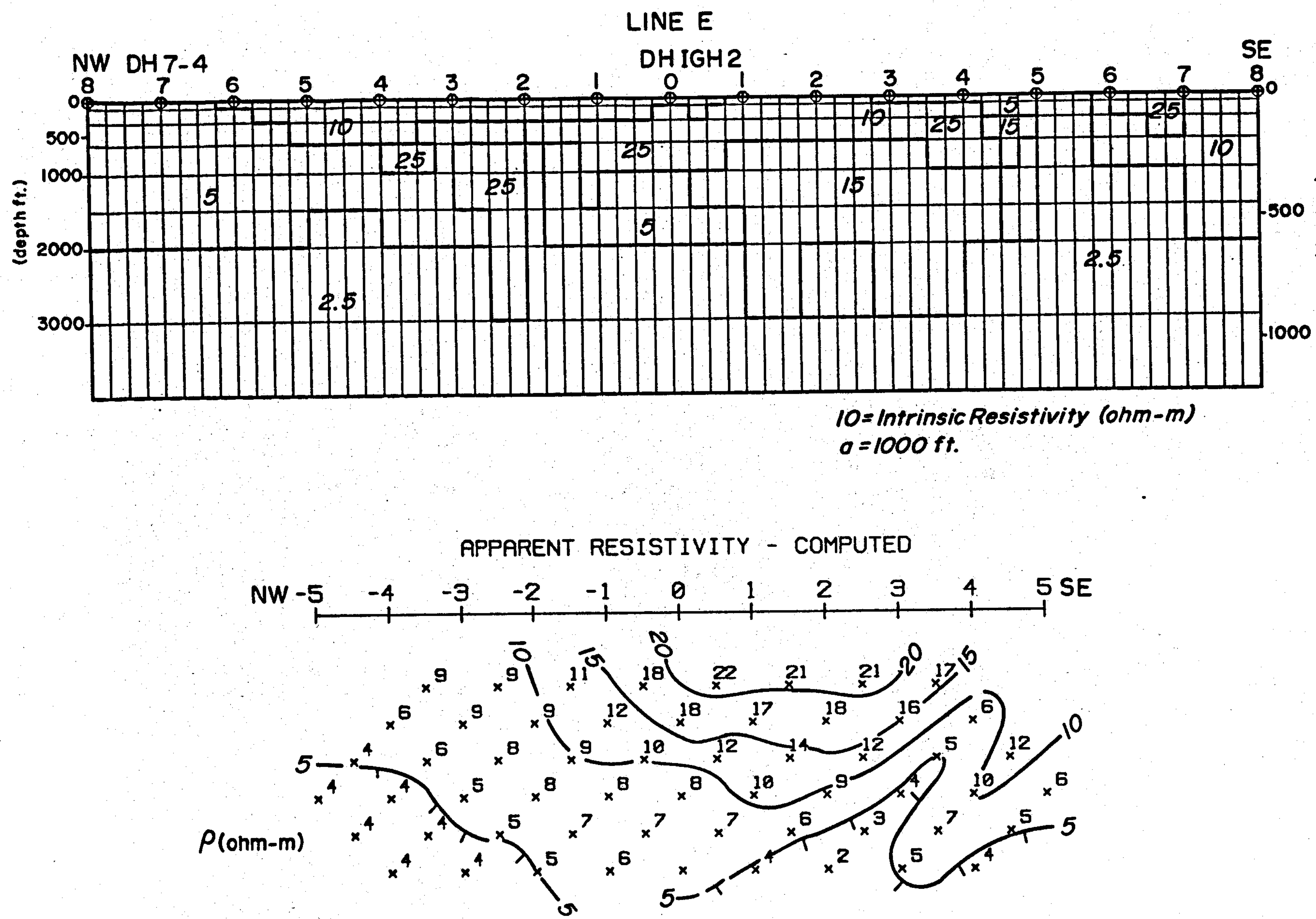


FIGURE A4 INTERPRETED RESISTIVITY SECTION AND COMPUTED APPARENT RESISTIVITY
LINE E-COLADO GEOTHERMAL AREA
PERSHING COUNTY, NEVADA
Scale 1:24,000

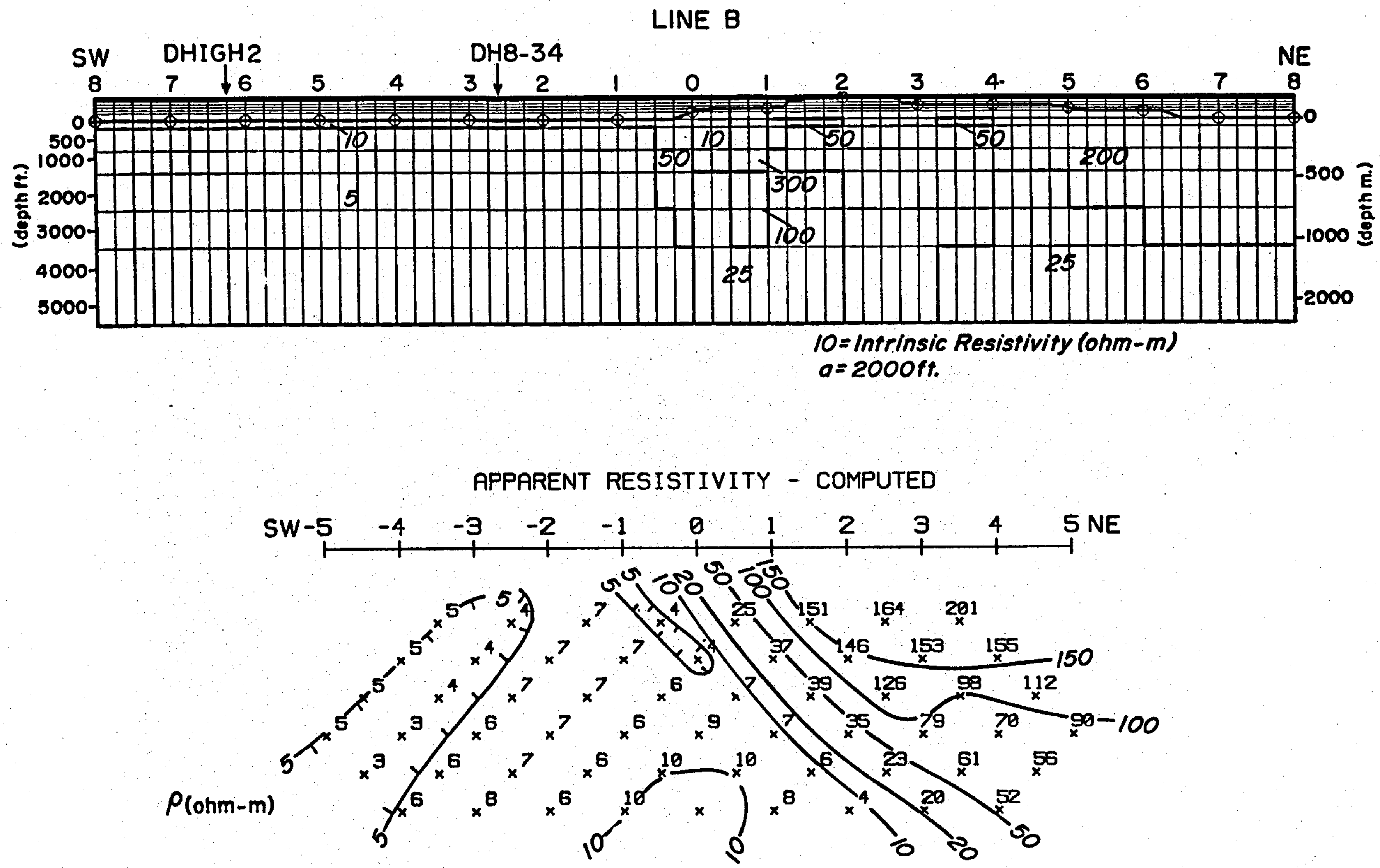
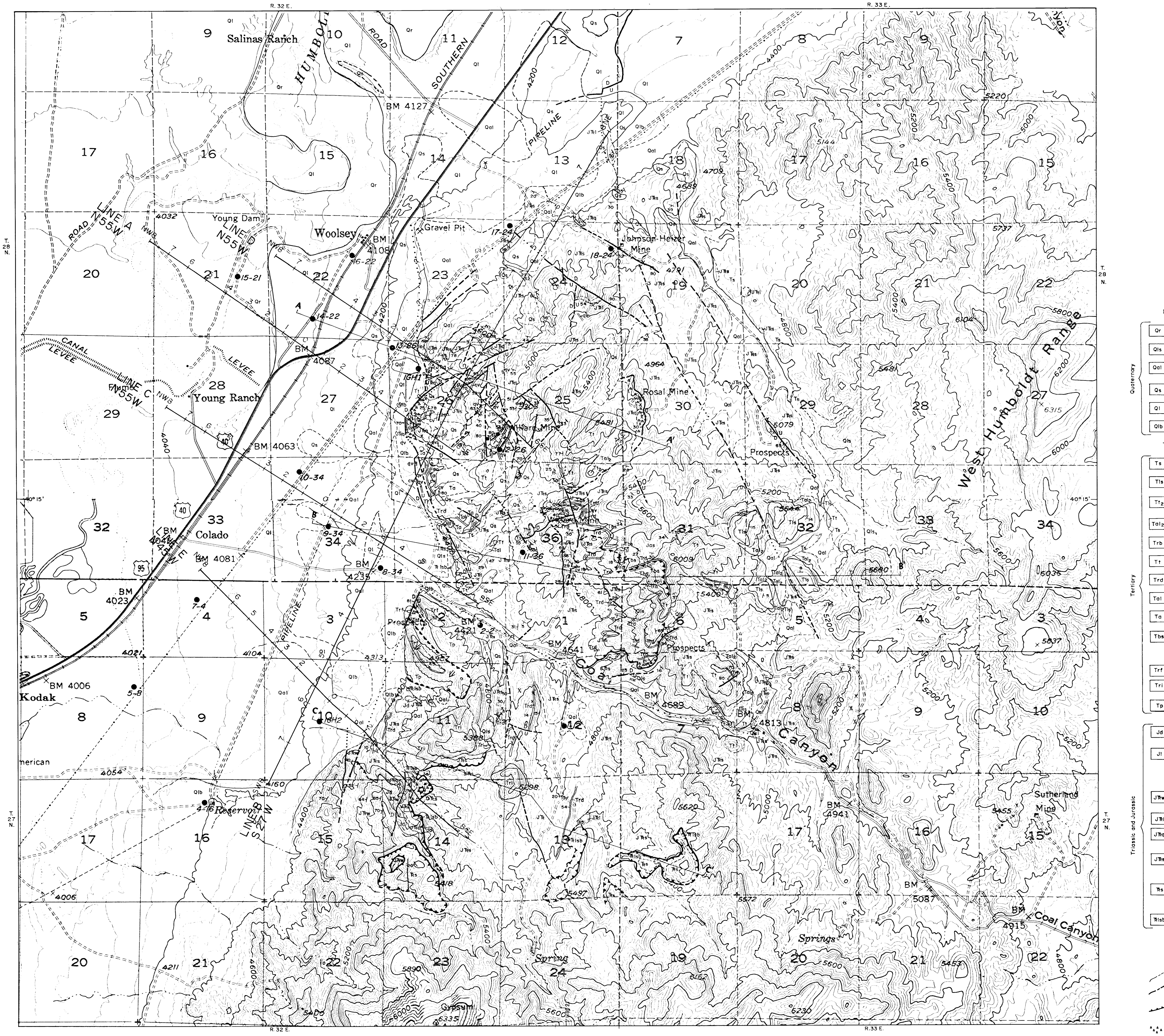


FIGURE A5 INTERPRETED RESISTIVITY SECTION AND COMPUTED APPARENT RESISTIVITY

LINE B-COLADO GEOTHERMAL AREA

PERSHING COUNTY, NEVADA

Scale 1:24,000



CORRELATION OF MAP UNITS

Quaternary: Qr, Qal, Qls; Qs; Ql, Qlb

Unconformity

Tertiary: Ts; Tls, Tt_2; Tal_2

Unconformity

Trb, Tt, Trd, Tal; Trf, Tri, Tp; Tbs

Unconformity

Ta

Unconformity

Mesozoic: Jd; Jl; JꞦw; JꞦs, JꞦq, JꞦl; Ꞧs; Ꞧlsb

DESCRIPTION OF MAP UNITS

Quaternary

Qr	Humboldt River channel and flood plain.
Qls	Landslide deposits.
Qal	Alluvial fans and colluvium.
Qs	Wind-deposited sand and silt, active and inactive, fills valleys in Humboldt Range and reworks Lahontan sediments.
Ql	Lake Lahontan deep water deposits.
Qlb	Lake Lahontan shore deposits, beach and deltas.

Tertiary

Tertiary units north of Coal Canyon

Ts	Tuffaceous mudstone and minor sand and gravel.
Tls	Lacustrine limestone with interbedded clastic sediments.
Tt_2	Pink non-welded ash-flow containing a few altered feldspar phenocrysts, devitrified glass shards, and fine-grained secondary quartz between the shards.
Tal_2	Alluvium, containing cobbles of ash-flow tuff in a clay and silt matrix.
Trb	Rhyolite breccia dikes contain fragments of ash-flow tuff in a glassy matrix and cut Tt.
Tt	White, welded ash-flow tuff, crystal poor with a few quartz phenocrysts.
Trd	Rhyolite sills and dikes, crystal poor, strongly flow banded. Some dikes are feeders to Tt and grade into pyroclastic dikes.
Tal	Coarse conglomerate containing clasts of limestone, quartzite and andesite in a sandy matrix.
Ta	Andesite lava flows which contain small plagioclase and altered mafic phenocrysts. The flows are dark gray to olive.
Tbs	Basalt sill with a diabasic texture. The sill intrudes JꞦs but its age is unknown.

Tertiary units south of Coal Canyon.

Trf	Rhyolite lava flow, crystal poor, devitrified.
Tri	Rhyolite intrusive dome or plug, yellowish brown, flow banded felsite.
Tp	Pyroclastic deposits, include perlites, minor ash-flow tuff, and tuff or ash altered to clay.

Triassic and Jurassic

Jd	Diorite, greenish gray and medium-grained. It is tentatively assigned a Jurassic age based on lithologic similarity to age dated rocks to the south (Speed, 1976).
Jl	Lovelock Formation, thick beds of gray limestone with minor shale beds (Speed, 1974).

Auld Lang Syne Group

JꞦw	Thick beds of light gray to tan limestone, gray orthoquartzite, and brown mudstone. The 50 to 100 feet thick limestone beds distinguish the sequence from the thin limestone beds in the pelite sequence (JꞦs, JꞦl, JꞦq).
JꞦl	Dark gray lenses of limestone within the pelite (JꞦs).
JꞦq	Orthoquartzite, gray to olive or reddish brown, fine-grained quartzite.
JꞦs	Slaty-shale, mudstone and minor siltstone beds. The shale which grades to slate is thinly bedded and weathers tan. The mudstone is medium-to dark-brown and poorly bedded. Thin argillaceous siltstone beds of limited extent are present within the slates.
Ꞧs	Siltstone, clean, well sorted siltstone to very fine sandstone, weathers to yellow and tan tones, occurs only in detached thrust plate. Assigned a Triassic age by Speed (1976).
Ꞧlsb	Limestone solution breccia exposed at the base of thrust sheets. The upper zone is an olive gray collapse breccia. The lower zone contains large blocks of folded gray limestone. The age of the limestone is unknown but it seems to underly the Triassic siltstone.

EXPLANATION OF MAP SYMBOLS

- Contact, dashed where approximate
- Fault, dashed where inferred, dotted where covered
- Thrust fault, dashed where inferred
- Breccia zone
- cv — Calcite vein
- qv — Quartz vein
- 55 — Strike and dip of bedding or compaction foliation
- 15-21 — Thermal gradient hole
- x — Prospect pit
- Adit
- Shaft

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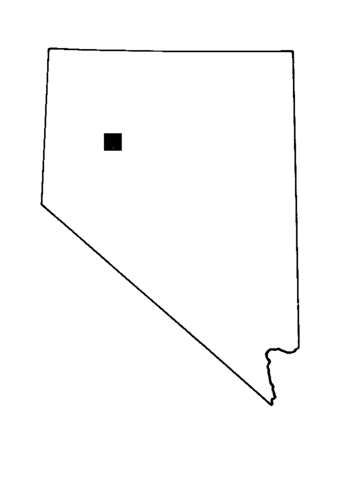
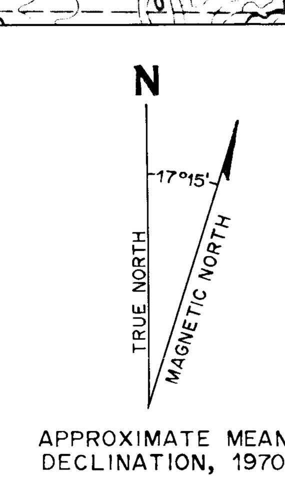
SCALE 1:24,000

1 ½ 0 1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 .5 0 1 KILOMETER



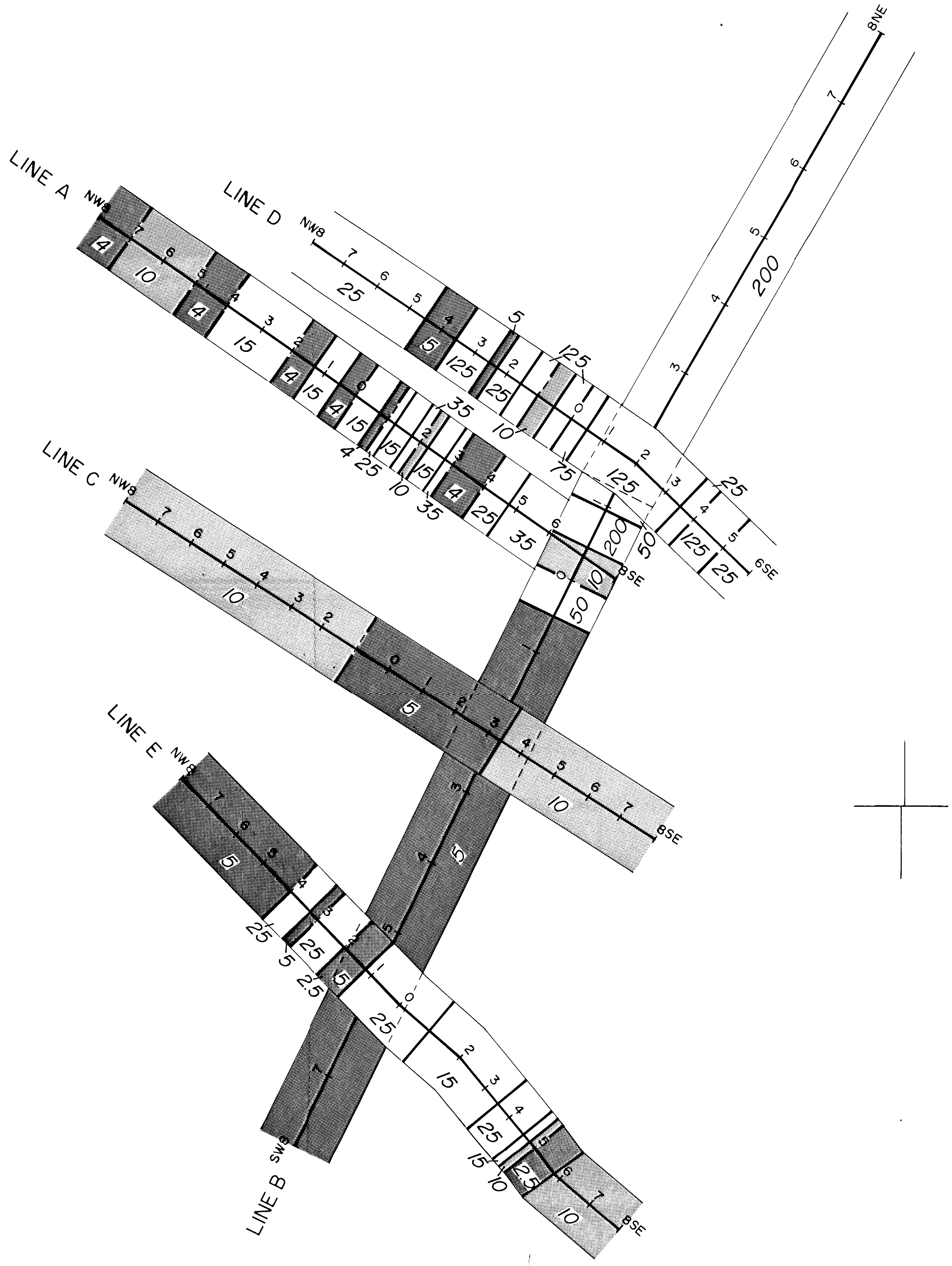


APPROXIMATE MEAN DECLINATION, 1970

Plate I
GEOLOGY MAP OF THE COLADO AREA PERSHING COUNTY, NEVADA

GEOLOGY BY BRUCE S. SIBBETT, 1980

PLATE II



EXPLANATION
(ohm-m)

- $\rho \leq 5$
- $5 < \rho \leq 10$
- $10 < \rho \leq 25$
- $25 < \rho \leq 50$
- $50 < \rho \leq 125$
- $\rho > 125$

PLATE II
INTERPRETED
ELECTRICAL RESISTIVITY DISTRIBUTION
at a DEPTH of 1000 FEET

COLADO GEOTHERMAL AREA

PERSHING COUNTY, NEVADA
SCALE 1:24,000

EARTH SCIENCE LABORATORY
UNIVERSITY of UTAH RESEARCH INSTITUTE

R. 32 E. R. 33 E. T. 28 N. T. 27 N. 40° 15' 118° 21'

PLATE III

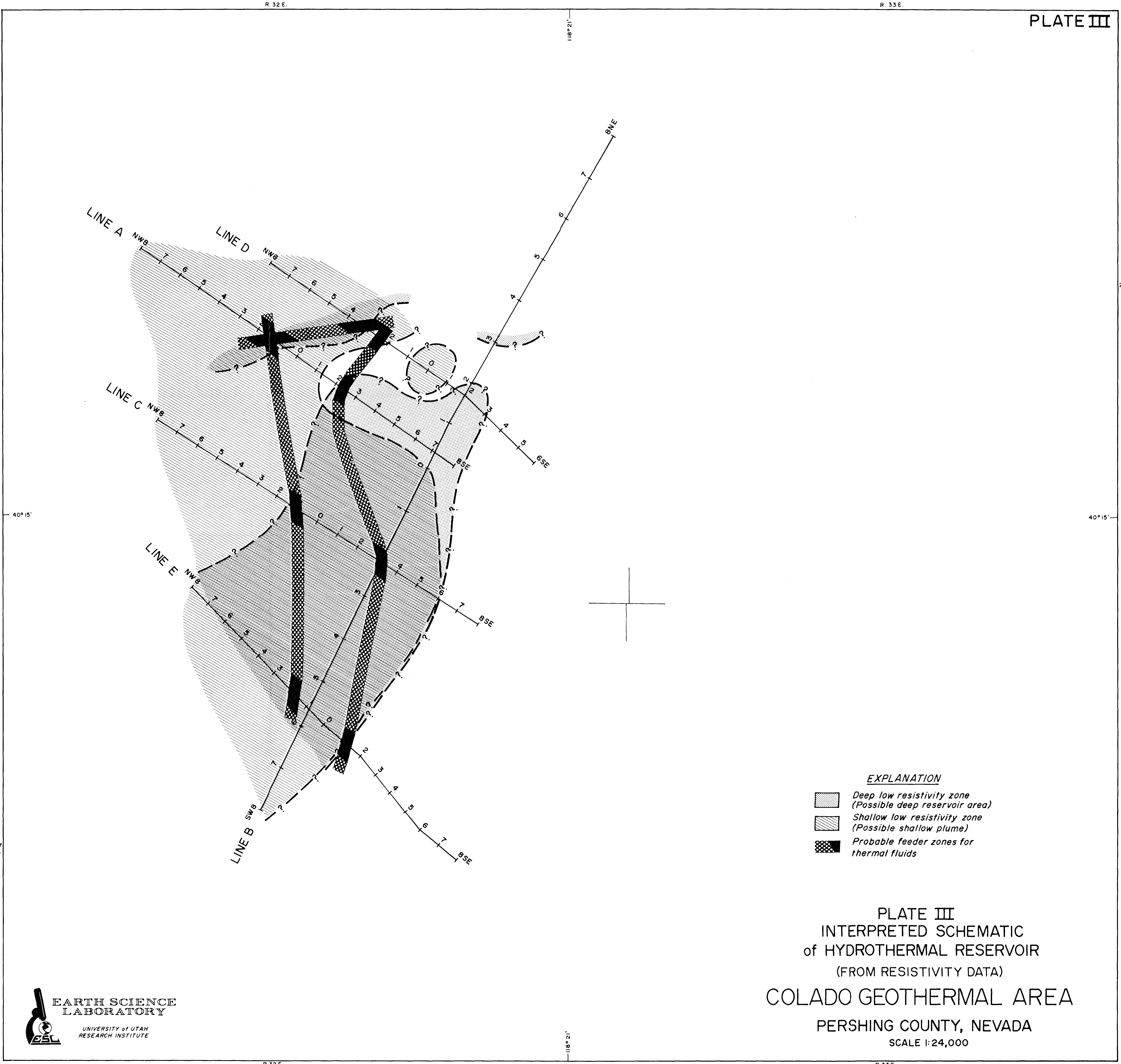


PLATE III
INTERPRETED SCHEMATIC
of HYDROTHERMAL RESERVOIR
(FROM RESISTIVITY DATA)

COLADO GEOTHERMAL AREA

PERSHING COUNTY, NEVADA

SCALE 1:24,000

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