TEC-5

ELECTRICAL RESISTIVITY SURVEY AT
NORTH VALE PROSPECT
MALHEUR COUNTY, OREGON

Prepared for
AMAX EXPLORATION, INC.
Geothermal Group

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by
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Abstract

A reconnaissance electrical resistivity survey was conducted by Terraphysics in the area north of Vale, Malheur county. Oregon.

A combination of telluric and magnetotelluric methods were used. Data were obtained at two frequencies, 8 Hz and 0.05 Hz. Some d.c. resistivity measurements were also obtained.

The results appear to delineate a number of geological formations in the area. The two frequency data provided some indication of the electrical resistivity properties as a function of depth.

A large area of low apparent resistivity ($<$ 10 ohm meters) is indicated. The data suggest this zone may be fairly thick.

The data also suggest a number of inhomogeneities or possible contacts or faults may occur in the area.

The present results by themselves are inconclusive to the possible existence of a geothermal reservoir. Additional electrical survey work is recommended in the area.

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Introduction

Terraphysics conducted electrical surveys in the vicinity of Vale, Malheur county, Oregon, on behalf of the Geothermal Group of Amax Exploration, Inc. The work was performed during the intervals 24-27 September and 12-13 October 1975. Telluric, magnetotelluric (MT) and d.c. resistivity measurements were made.

Survey Objective

The objective of the survey was to aid in the evaluation of the geothermal energy potential in the area. Various hot springs exist in the region.

Many geophysical techniques are used to evaluate a geothermal area. Since a decrease in resistivity usually occurs where the temperature of the earth increases, an electrical resistivity survey can be a useful diagnostic technique. The resistivity change with temperature can be on the order of $2.5\%/C^{o}$ (Keller and Frischnecht, 1970). Consequently, resistivity decreases on the order of a factor of 5 or more may be associated with geothermal brines (Keller, 1970). Intrinsic resistivities of less than 10 ohm meters may be expected.

If a geothermal area is at a sufficiently high temperature that a vapor phase is present, higher electrical resistivities are likely. Zohdy, et. al. (1973) report intrinsic resistivities of about 75-130 ohm meters for a vapor-dominated layer in Yellowstone National Park.

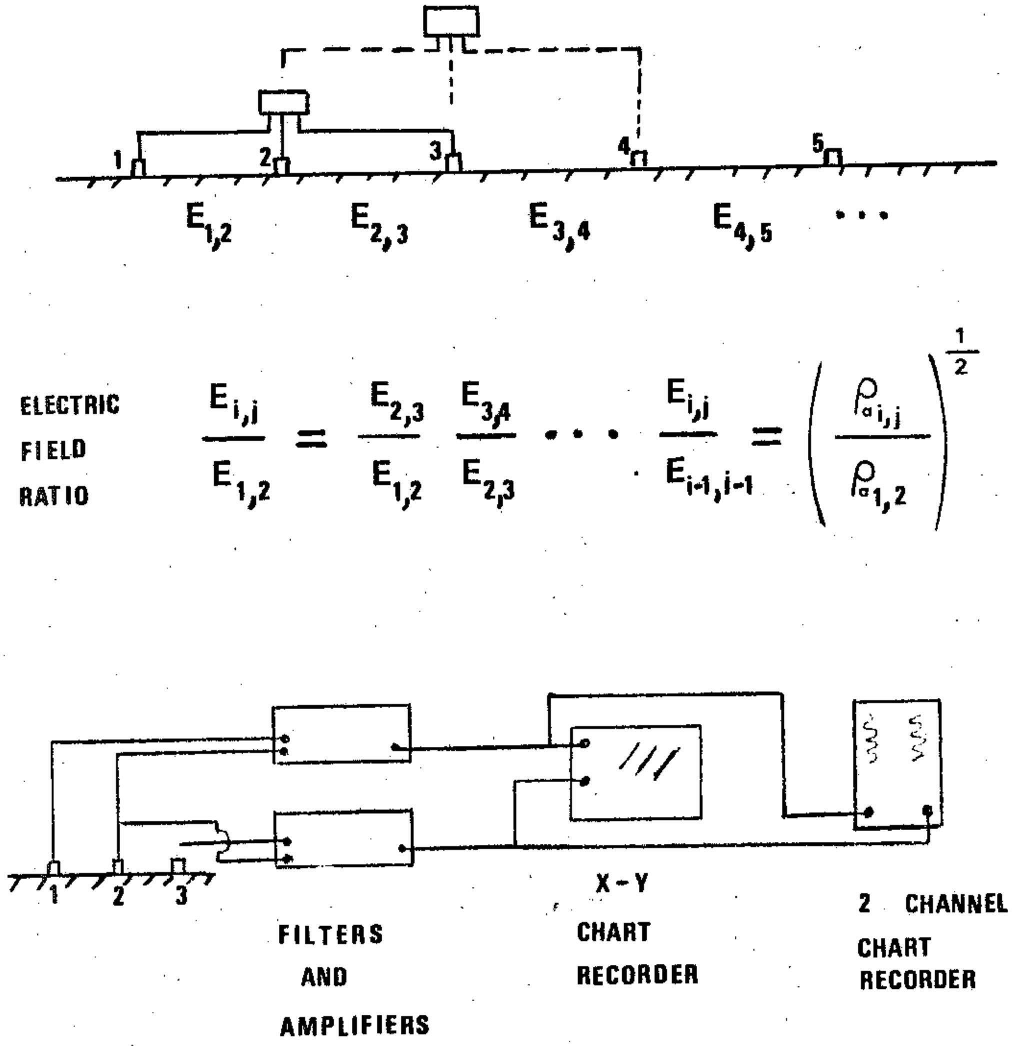
Procedure and Instrumentation

A combination of telluric and magnetotelluric methods were used as a reconnaissance technique. The collinear telluric method is illustrated in Figure 1, and has been described by Dahlberg (1945) and Boissonnas and Leonardon (1948). The technique involves measuring the ratio of the electric fields (E) between two adjacent collinear dipoles. After the readings are completed at one station the instruments are moved to the next site and the next dipole ratio is measured.

The electric field ratio is proportional to the square root of the apparent resistivity ratio beneath the particular dipoles (see Figure 1) (Slankis and Becker, 1969; Slankis, Telford and Becker, 1972). Successive ratios are referenced back to an initial dipole so that a relative resistivity profile across the region results.

The equipment used are itemized in Table 1 and are illustrated in the schematic of Figure 1. Porous pots are used as electrodes for the telluric dipoles. Each electrode consists of a porous ceramic cup and a copper rod in a saturated copper sulphate solution. Voltages from two adjacent telluric dipoles are narrow-band filtered, amplified (2 Ithaco filters) and then displayed on a X-Y chart recorder (Simpson). The voltage ratio is easily measured as the slope of the resulting X-Y plot. An example of such data is shown in Figure 2. Measurements are usually made at 0.05 Hz and may be supplemented by data at other frequencies, such as 8 Hz. Monitoring of the higher frequency provides additional depth information. A theoretical example is described in Appendix A.

Magnetotelluric measurements are made at intervals along the telluric lines. These provide control points to calibrate the relative telluric profiles. Continuous profiles of apparent resistivity values across the area are obtained.



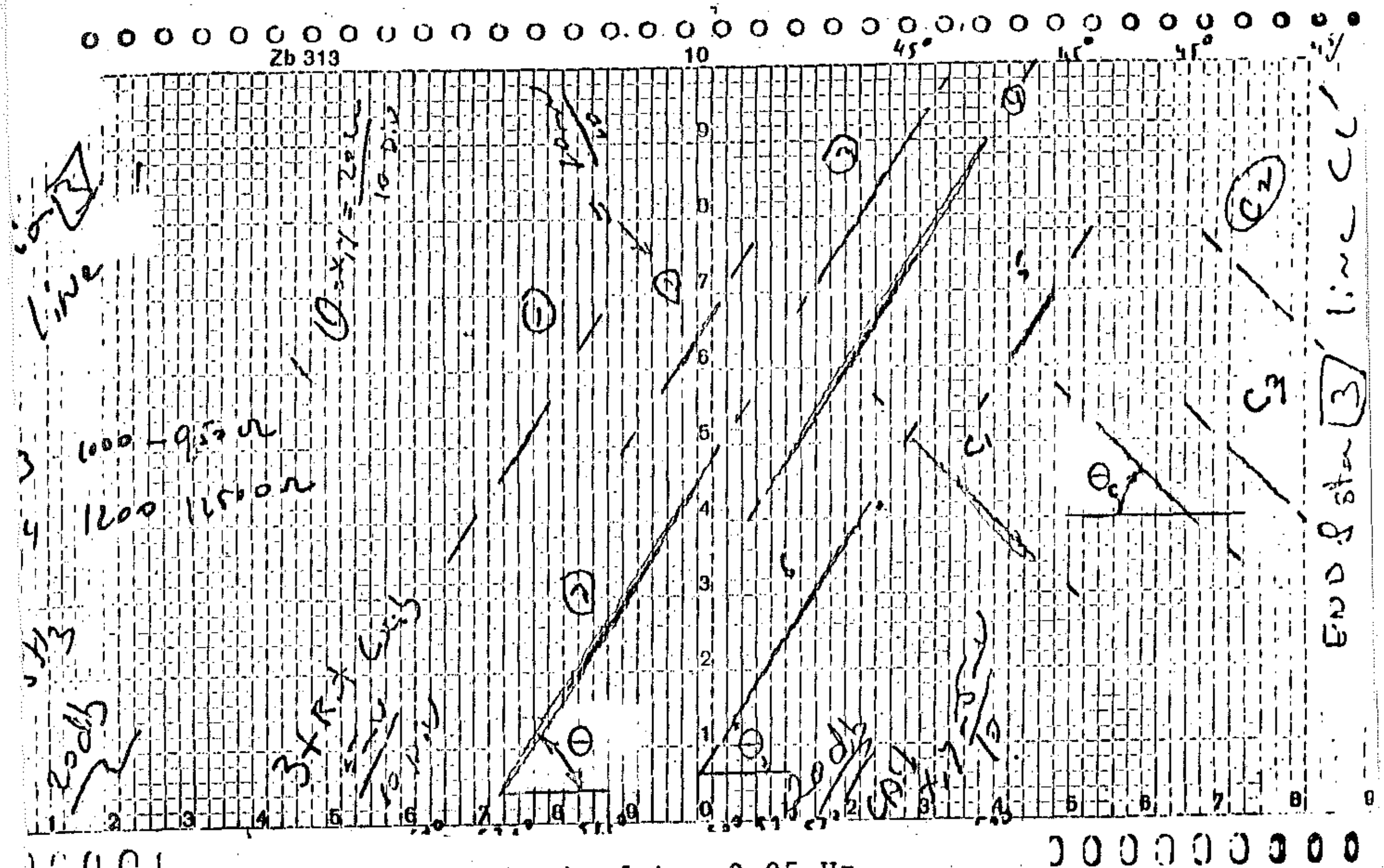
$$\frac{E_{i,j}}{E_{1,2}} = \frac{E_{2,3}}{E_{1,2}}\,\frac{E_{3,4}}{E_{2,3}}\cdots\frac{E_{i,j}}{E_{i-1,i-1}} = \left(\frac{\rho_{a\,i,j}}{\rho_{a\,1,2}}\right)^{\frac{1}{2}}$$

Figure 1. Collinear telluric method and instrumentation

Table 1

SURVEY EQUIPMENT

4	Ithaco model 4211 filters with amplifier options
2	Simpson X-Y model 2745 chart recorders
1	2 channel Brush 222 chart recorder
1	2 channel Gulton model TR 722J chart recorder
1	Develco 3 component superconducting Josephson Junction magnetometer
1	Tektronix 2 channel oscilloscope
2	2 channel amplifiers
1	2 channel 60 Hertz notch filter
1	Equipment trailer
5	reels wire (30,000 feet)
1	Toyota Landcruiser 4 wheel drive
1	Chevrolet 1/2 ton pickup with instrument camper shell
1	500 watt d.c. resistivity transmitter
1	Vacuum pump (for pumping vacuum on cryogenic devices)
1	Liquid He Transfer line
1	Liquid He Level indicator
1	Simpson digital voltmeter
1	100 liter Liquid He dewar (Rental)



Telluric data, 0.05 Hz

Figure 2. The X axis represents the voltage monitored from dipole 2-3 and the Y axis represents dipole 3-4. The ratio of the voltages of these adjacent dipoles is determined from the tangent of the angle Θ from the expression

$$\frac{V_{3,4}}{V_{2,3}} = \frac{\mathrm{TAN}\ \Theta}{\mathrm{TAN}\ \Theta_c}$$

Calibration of the instruments is taken into consideration by the measurement of the angle Θ_c

The electric field ratio is obtained from the expression

$$\frac{E_{3,4}}{E_{2,3}} = \frac{V_{3,4}}{L_{3,4}} \cdot \frac{L_{2,3}}{V_{2,3}} = \frac{L_{2,3}}{L_{3,4}} \frac{\mathrm{TAN}\ \Theta}{\mathrm{TAN}\ \Theta_c}$$

Where $L_{2,3}$ and $L_{3,4}$ are the lengths of the dipoles 2-3 and 3-4 respectively.

The electric field (E_x) is measured at the same stations used for the collinear telluric data. The orthogonal magnetic field component H_y is measured using a Josephson Junction ("J.J.") magnetometer. Scalar apparent resistivities ρ_{a_x} are calculated from the expression

$$\rho_{a_x} = \frac{.2}{f} \left(\frac{E_x}{H_y}\right)^2$$

where E_x is in millivolts/km, H_y is in gammas and f is the frequency in Hertz (Hz).

Measurements normally are made at a narrow-band frequency of 0.05 Hz. Additional measurements at other frequencies such as .1, .8 and 8 Hz are sometimes obtained.

The orthogonal pair of field components E_y and H_x are measured at some stations. The resulting determination of apparent resistivity ρ_{a_y} gives an indication of the anisotropic nature of the earth.

D.C. resistivity measurements were taken in some areas. Wenner arrays with spacings up to 400 meters are sometimes used. These provide near-surface resistivity information.

Where warranted dipole-dipole arrays are used to obtain deeper resistivity properties. Measurements are obtained with 300 to 1000 meter dipoles having separations up to 3 km. These techniques provide a check on the 8 Hz telluric and MT data.

In summary, the field procedure is as follows:

1) Telluric lines are run in a direction normal to geologic strike where feasible.
2) MT measurements are made at appropriate sites to calibrate the telluric lines.

3) D.C. resistivity measurements are taken to determine shallow resistivities.
4) Results of the above may warrant supplementary deeper resistivity soundings and/or electromagnetic (EM) measurements over possible geothermal target zones.

Field Operation at North Vale

In the north Vale survey, telluric dipoles ranging from 0.5 to 1.2 km in length were employed, depending on topographic conditions. Telluric measurements were made at 8 and 0.05 Hz.

Geologic strike in the area runs between north and northwest. A telluric line was run northeast-southwest as determined by roads and access, and as specified by the client. Sixteen (16) telluric stations were measured and a total of six (6) MT stations were occupied at strategic locations on the telluric line. In addition, seven (7) d.c. resistivity measurements were made.

Composition of Crew

A detailed summary of the work and personnel is documented in Appendix B. The personnel involved on the project are listed below.

A. Pessah	Party Chief	Instrumentation, survey and data analysis
P. Guzman	Field Hand	Wire crew, equipment maintenance

In addition, John Wood from Amax Exploration, Inc., assisted in the field on four days.

Teraphysics personnel worked a total of ten (10) field man days in the north Vale area of Oregon over a period of five (5) days.

Operating Conditions

The weather was generally favorable and work proceeded smoothly except for one day when very low amplitude signal levels delayed the work. The work on 13 October was somewhat impeded by very muddy road conditions.

The personnel stayed at the Tapederio Motel in Ontario, Oregon during the work. Maximum commuting time to the furthest station was about 90 minutes.

Specific vehicles used in the project were a Toyota Landcruiser (4-wheel drive), a Chevrolet 1/2 ton pickup with a camper shell and an equipment trailer (see Table 1).

DATA

The location of the telluric line and stations are shown in Plate 1.

The telluric profiles are plotted in Figure 3. The relative electric field strength is plotted on the left side ordinate. The station locations are projected on the abscissa at the top of the plot. The E-field ratio is plotted midway between the electrode stations.

Each station represents an average of 4 to 12 measurements. In some cases, in particular when the ground becomes anisotropic, wide variations in the telluric ratio were observed. The various values are plotted. An average value of these data are also plotted with standard deviations shown as error bars. A summary of the telluric data for 0.05 Hz is presented in Table 2.

MT readings are shown in the rectangles at their corresponding locations. The average resistivity and standard deviation are indicated. Telluric values between MT readings on a given profile were adjusted linearly to correspond to the MT readings. An apparent resistivity scale in ohm meters is shown on the right side ordinate. A summary of all the magnetotelluric data are also presented in Table 3.

Contour maps of apparent resistivities for the 8 and 0.05 Hz frequencies are depicted in Plates 2 and 3 as described from the profile data. The apparent resistivities are plotted in logarithmic contour intervals. Since only one line was surveyed, the contour lines are arbitrarily drawn perpendicular to the survey direction.

Orthogonal telluric measurements were obtained at station 5A. A wide variation in both the phase and the amplitude ratio were observed between the orthogonal dipoles over a period of time. The direction of the electric field varied between N 15° E to N 60° W with an average of about N 23° W.

The results of d.c. resistivity measurements are summarized in Table 4 and are plotted in Figure 4. These were taken in the area of stations 3 to 6.

Table 2

Telluric Data, North Vale, Line CC'
0.05 Hz

Location Station Ratio	Electric Field ∓ Standard Deviation (Ratio of Adjacent Stations)	Comments
2-3/1-2	.43 ∓ .07	
3-4/2-3	1.21 ∓ .05 .81 + .33	2 values ellipse, some negative ratios
4-5/3-4		all data indicated negative ratio
5-6/4-5	1.12 ∓ .59	ellipses, wide variation in ratio, low amplitude signal levels
6-7/5-6	1.22 ∓ .01 .73 ∓ .17	2 groups, ellipses
	ave. all .87 ∓ .30	
7-8/6-7	1.38 ∓ .09	ellipses
8-9/7-8	1.02 ∓ .25 .47 ∓ —	ellipses 2 groups
	ave. all .81 ∓ .45	
9-10/8-9	1.09 ∓ .43	ellipses, wide variation in values
10-11/9-10	.97 ∓ .20	ellipses, multi-values, low amplitude signal levels
1-22/20-21	.85 ∓ .14	
2-23/21-22	1.55 ∓ .04	

Table 2 (continued)

Telluric Data, North Vale Line CC'
0.05 Hz

Location Station Ratio	Electric Field ∓ Standard Deviation (Ratio of Adjacent Stations)	Comments
23-24/22-23	1.79 ∓ .10	slight elliptical pattern
24-25/23-24	.91 ∓ .02 1.24 ∓ .27	ellipses 2 groups
25-26/24-25	2.96 ∓ .19	
26-27/25-26	.47 ∓ .02	

(NUMBER OF SAMPLES)

LINE & STATION	LENGTH IN METERS	DATE	0.05 Hz	8.0 Hz			COMMENTS
CC' 1-2	777	9/24	70 ∓ 54 (18)	13.6 ∓ 11.0 (28)			
4-5A	884	9/24	4.8 ∓ 3.4 (12)	7.0 ∓ 4.6 (24)			Very low signals
5A-5B	991	9/24	7.2 ∓ 4.4 (23)	8.4 ∓ 7.0 (24)			
8-9	1140	9/26	3.0 ∓ 2.3 (24) large phase shift	2.8 ∓ 2.1 (22)			8 Hz very noisy, 60 Hz pickup
20-21	853	9/27	27 ∓ 11 (26)	10.0 ∓ 5.2 (22)			
25-26	511	9/27	811 ∓ 335 (26)	98 ∓ 56 (23)			

Table 4

D.C. Resistivity Data, North Vale Area

Location	Type Array	a spacing	Apparent Resistivity ohm meters
Line CC' Station			
3	Wenner	15	33.1
5A	Wenner	15	31.3
6	Wenner	15	25.7
3-4	Wenner	304	14.0
5A-6	Wenner	312	11.1
2-3 to 5-6	Dipole-Dipole	dipole center to center 1930 meters	< 10

Sources of Error

The principal sources of error in the telluric-magnetotelluric methods are:

1) Station locations and dipole lengths are determined from topographical maps, bench marks, and actual field measurements. In general, dipole lengths are determined to within 5%. The possibility of the accumulation of small errors yielding a large uncertainty after a number of stations was reduced by taking magnetotelluric measurements at intervals along the telluric profiles. Telluric values between MT readings were adjusted linearly to correspond to the MT values.

2) Errors due to instrumentation are kept to a minimum. At each frequency reading, the instruments were calibrated. In some cases, calibrations were taken before and after the data.

3) In cases where the earth becomes highly anisotropic, a phase shift can occur between measurements of adjacent telluric dipoles. In this case, the E-field ratio depends upon the polarization of the incident field and, in general, wide variations in both amplitude and phase are observed. Then attempts are made to obtain information over as much of the area as possible with MT readings and d.c. resistivity measurements.

4) In some areas, considerable noise is observed on the higher frequency data, 8 Hz; this is probably caused by local industrial electrical activity. Attempts are made to minimize any error from these near field sources by careful inspection of each cycle of data on high speed oscillographic records. Considerable scatter in the data usually results, however, in those areas.

Discussion of Data

Geological Province

The Vale area lies at the border between the Blue Mountains and Basin and Range Provinces in the eastern central part of the state of Oregon. This area is "characterized by north trending mountain ranges and intervening flat valleys, which are blanketed with alluvium or recent lava flows." (McKee, 1972) "The rocks consist primarily of extensive sheets of solidified lava. Much of the lava is basalt, but some widespread silicic ash flows and tuffs are present." (McKee, 1972). Nonmarine sandstone, shale and conglomerates are interbedded with the volcanic strata.

North Vale Area

The area surveyed was about 22 kilometers northwest of the town of Vale, Oregon. A number of thermal springs exist in the area. The water at Vale hot springs, 0.8 kilometers east of Vale, has a temperature of 92°C. (Waring, 1965). Neal hot springs (sometimes refered to as Jordon hot springs) is about 19 kilometers northwest of Vale and has a water temperature of about 75°C. Another hot spring is also indicated 32 kilometers northwest of Vale near Willow Creek (Waring, 1965).

Three geological groups are indicated in the general area.

1) Quaternary alluvium, lake sediments, fluvio-glacial deposits, and pumice.
2) Younger Cenozoic (Miocene and Pliocene) nonmarine (continental) sedimentary rocks, ash flows tuff, some interbedded rhyolite flows and domes and

3) Younger Cenozoic (Miocene and Pliocene) basalt and andesite flows and minor continental sedimentary rocks (McKee, 1972).

A detailed geological mapping for the surveyed area was not available for a direct comparison with the present results. The resistivity profile in Figure 3 and the data in Plates 2 and 3 possible reflect contacts between the different rock types.

(a) 8 Hz Data

The 8 Hz apparent resistivity data shown in Figure 3 and mapped on Plate 2, range from 2.8 to 100 ohm meters. A number of troughs and peaks are observed.

A large general low (< 10 ohm meters) occurs between stations 3 to 11 and stations 20 to 23. The lowest values of 2.8 ohm meters occur between stations 8 to 9 and 10 to 11.

On the southwest end of the line, the apparent resistivity gradually increases to a value of about 14 ohm meters.

On the northeast end of the line, an apparent resistivity high peak of 98 ohm meters occurs between stations 25 to 26.

(b) 0.05 Hz Data

The 0.05 Hz data reflect deeper resistivity properties of the area. The profile shown in Figure 3 exhibits much the same pattern of troughs and peaks as the 8 Hz data.

A large apparent resistivity low (<10 ohm meters) again occurs between stations 4 to 11. The lowest value observed of about 3 ohm meters occurs between stations 8 to 11. These low resistivity values could be associated with Quaternary alluvium lake bed deposits, hot geothermal brines, or a combination of the two cases.

Within the statistics of the data, the apparent resistivity values for the two frequencies are about the same (see Figure 3), for example at station 8-9, an apparent resistivity of 3.0 ± 2.3 ohm meters was measured at 0.05 Hz vs 2.8 ± 2.1 ohm meters at 8 Hz. This suggests that the conductive zone is fairly thick.

The apparent skin depth for an apparent resistivity of 3 ohm meters is about 3900 meters at 0.05 Hz and about 308 meters at 8 Hz. The actual sensing depths, however, are usually much less than these values depending upon the actual situation. Additional multifrequency MT data, with a complete model solution, would be required to determine the actual properties and depths.

The 0.05 Hz data exhibited variations in both the amplitude ratio and the phase for the entire segment between stations 4 to 11. The phase shift manifests itself by elliptical patterns on the X-Y chart records. These comments are indicated in Table 2. A maximum of about 10% of the scatter in the data can be attributed to instrumentation noise at the lowest amplitude signal levels. The majority of the scatter in the data exceeded this level. These results are not fully understood. Computer calculations with two dimensional models indicate that such results can occur when lateral resistivity inhomogeneities are present in the area.

A negative telluric ratio was observed between stations 3-4 and 4-5. This result is also not fully understood. This situation may arise when the direction of the total electric field is approximately perpendicular to the survey line. The orthogonal telluric measurement at station 5 supports this hypothesis. The survey line was in a direction N 42° E and the direction of the electric field was observed to vary between N 15° E to N 60° W.

While this negative ratio is not usable for the profile calculations, this result suggests an inhomogeneity or possible fault or contact may occur in this area.

On the northeast section of the line, the 0.05 Hz profile follows the pattern of the 8 Hz data very closely for stations 20 to 27.

A high resistivity peak of 811 ohm meters occurs at stations 25-26. This may be reflecting possible younger Cenozoic basalt or andesite flows.

The apparent resistivity values for the 0.05 Hz data are all higher than the 8 Hz values for the area between stations 20-27. The 0.05 Hz values range from 19 to 811 ohm meters, while the 8 Hz data range between 5 to 98 ohm meters. This suggests that this area becomes more resistive with depth.

At the southwest end of the survey line (stations 1-2), an increase in apparent resistivity also occurs. An apparent resistivity of 70 ohm meters is observed at 0.05 Hz and a value of about 14 ohm meters occurs at 8 Hz. This suggests the area is becoming more resistive with depth and to the southwest.

Since the telluric response to lateral resistivity changes is different for different frequencies, the above depth interpretations are subject to some uncertainty. Two dimensional modelling of the area would be required to evaluate the effect.

(c) D.C. Resistivity

D.C. resistivity measurements were taken between stations 2 to 6 to check the 8 Hz and 0.05 Hz results. The data are plotted in Figure 4. The results indicate that the area becomes slightly more resistive to the southwest, however, it also becomes much more conductive with depth. Values of 33 to 25 ohm meters are observed at 15 meter Wenner "a" spacings and values of 14 to 11 ohm meters are observed at 300 meter Wenner "a" spacings. The signals for the dipole-dipole array were buried in the background noise, only a bound on the value could be indicated. At a dipole-dipole separation of 1930 meters, between stations 2-3 and 5-6, the apparent resistivity is less than 10 ohm meters.

These results are in reasonable agreement with the telluric magnetotelluric data. Between stations 4-5 the data indicates an apparent resistivity value between 11 and 14 ohm meters at a Wenner "a" spacing of 300 meters. This is the same order of magnitude as the 8 Hz data there (7.0 ohm meters, skin depth 470 meters for stations 4-5A and 8.4 ohm meters, skin depth 515 meters for the orthogonal MT measurement, stations 5A-5B). The dipole-dipole result at a separation of 1930 meters ($\rho_a < 10$ ohm meters), is in reasonable agreement with the 0.05 Hz data (4.8 ohm meters, skin depth 4930 meters for stations 4-5A and 7.2 ohm meters, skin depth 6040 meters for the orthogonal MT measurement, stations 5A-5B).

These d.c. resistivity results support the telluric-magnetotelluric indication that the area becomes resistive to the southwest and they support the presence of a fairly conductive region at depth ($<$ 10 ohm meters).

Summary and Recommendations

The present survey suggests a fairly thick low apparent resistivity zone ($<$10 ohm meters) exists in the area. These results may be reflecting Quaternary alluvium, a geothermal brine or a combination of the two cases. An electrical survey alone cannot always provide a clear distinction between the situations.

A number of possible inhomogeneities, contacts or faults are suggested in the area.

On the northeast segment of the survey line, a high apparent resistivity peak is observed (811 ohm meters at 0.05 Hz). This may be reflecting younger Cenozoic basalt or andesite flows. The data suggest that this area becomes more resistive with depth.

The present results by themselves are inconclusive to the possible existence of a geothermal reservoir.

A more detailed geological study of the area should be obtained for correlation with the present work.

An extension of the survey line further to the southwest and additional survey work closer to the Willow Creek and Neal hot springs may provide clues to the existence of a possible geothermal reservoir in the area.

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APPENDIX A

Theoretical telluric results over hypothetical models are shown in Figures A1 and A2. The difference between the two models in the inclusion of a 1 ohm meter body in Figure A2. This could be representative of a geothermal target.

Two points are of particular note.

(1) The telluric response is characteristically dominated by resistivity variations occurring beneath the measuring stations. This is seen in both the figures.

(2) The use of multifrequencies provides some initial determination of depth information. For example, a significant difference is observed between the 0.03 Hz telluric response over the two models. The 8 Hz response is not effected. The 8 Hz E.M. wave in this case does not significantly penetrate to the depth of the 1 ohm meter body. (The skin depth of an 8 Hz E.M. wave is 562 meters in a 10 ohm meter material. The top of the 1 ohm meter body was 500 meters deep). These results place a bound on the depth of the anomoly observed on the 0.03 Hz data. It must be deeper than a few hundred meters and less than a few thousand meters. A more precise depth could, of course, be determined with intermediate frequency data.

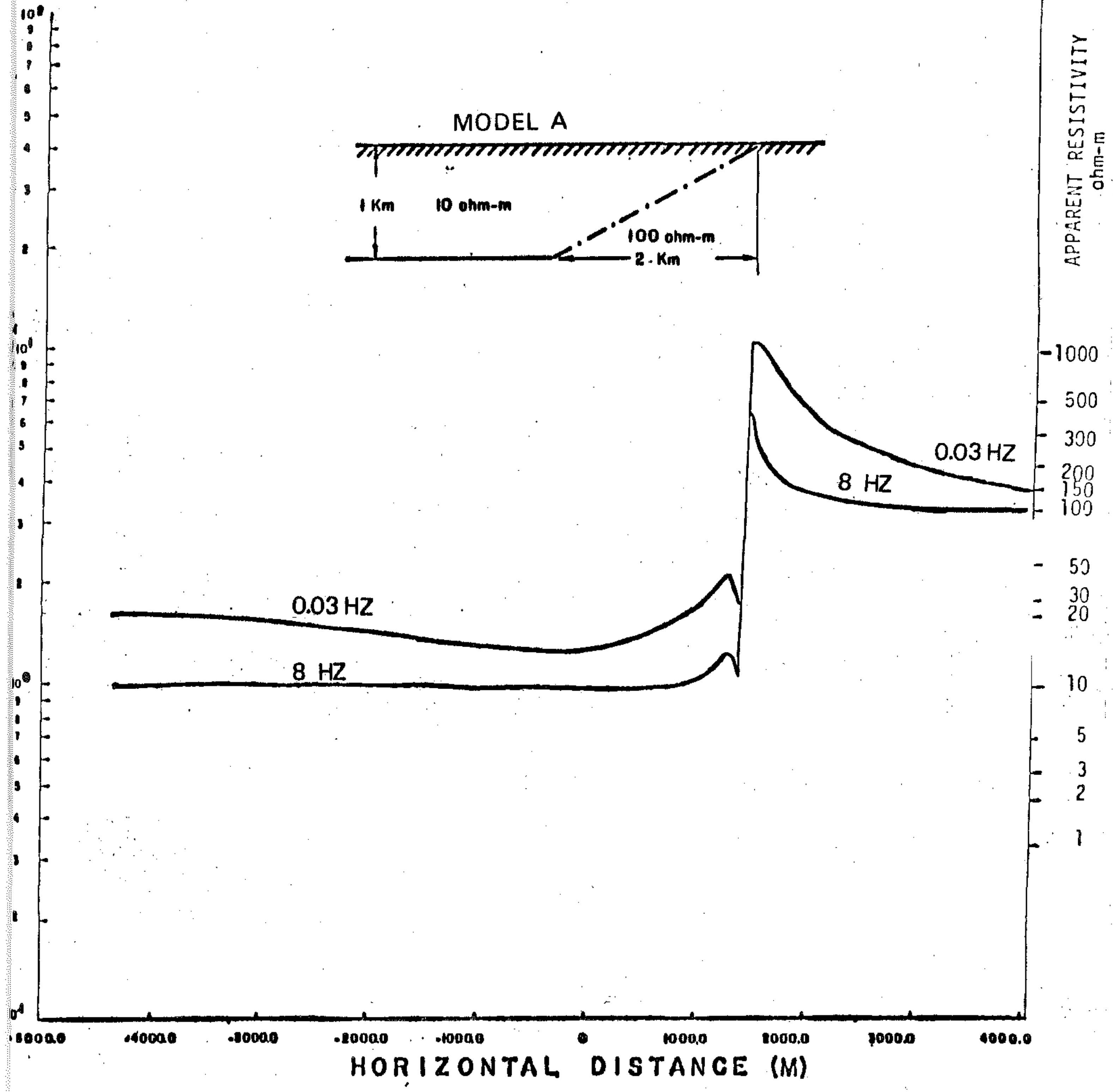

Figure A1. Telluric response at 8 Hz and at 0.03 Hz over Model A.

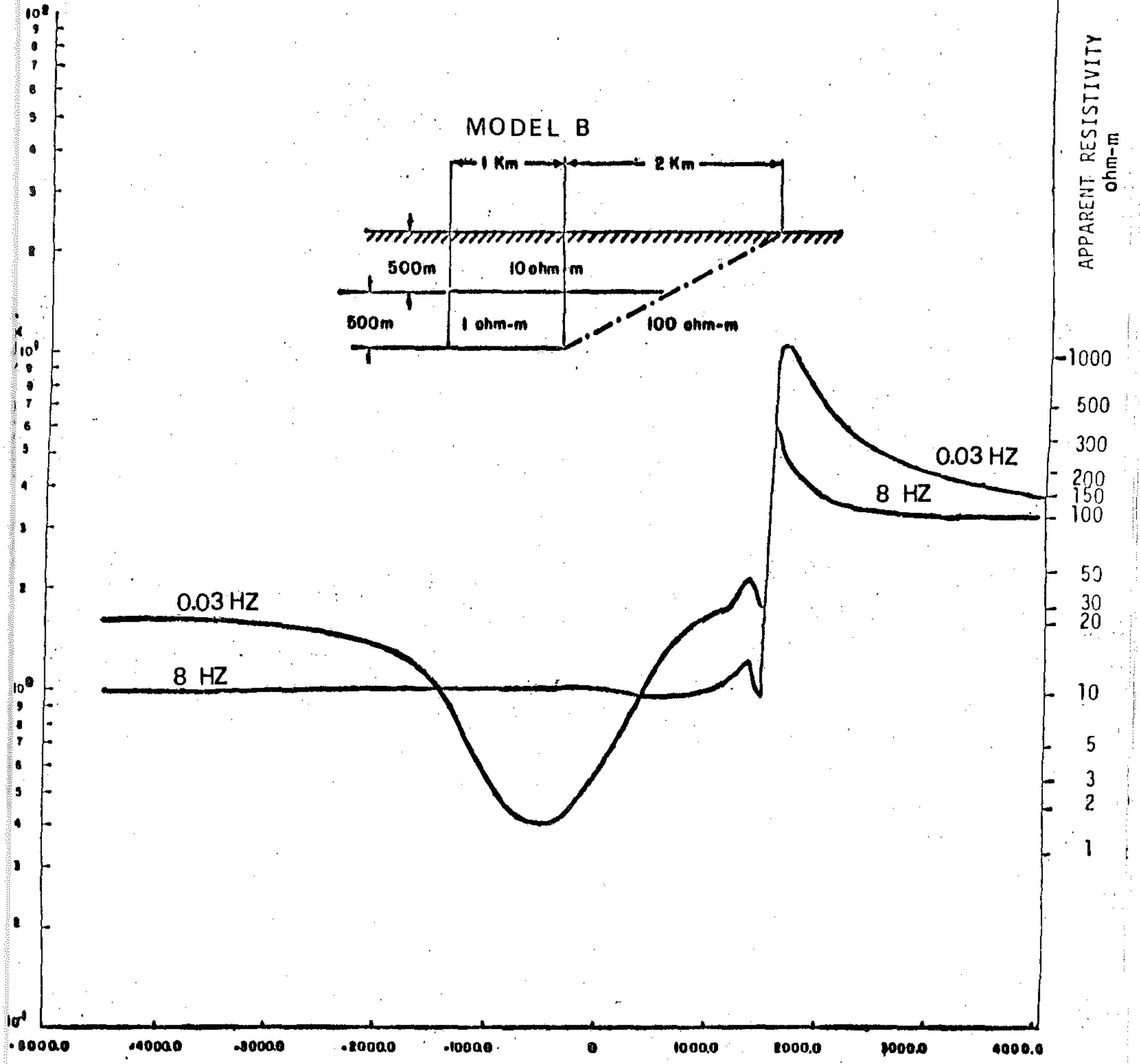

Figure A2. Telluric response at 8 Hz and at 0.03 Hz over Model B, inclusion of a 1 ohm-m body at 500 meters depth.

Appendix B

Personnel and Operations Summary

MONTH

Sept./October

TERRAPHYSICS

PROJECT North Vale, Oregon

DAY	DATE	TECHNIQUE	TOTAL STATIONS	LOCATIONS	FREQ.S Hz					PERSONNEL				
					05	01	08	8		MAZZELLA	PESSAH	GUZMAN	HARVEY	WOOD (AMAX)
SEPTEMBER														
		T	3	Line CC' ST 2, 3, 4	X			X			X	X		X
Wed.	24th	OT	1	Line CC' Orthogonal 5A	X			X			X	X		X
		MT	3	Line CC' ST (1-2), (4-5A), (5A-5B)	X			X			X	X		X
Thu.	25th	T	3	Line CC' ST 5A, 6, 7 (Very poor signal level ST 8)	X			X			X	X		X
Fri.	26th	T	3	Line CC' ST 8, 9, 10	X			X			X	X		X
		MT	1	Line CC' ST (8-9)	X			X			X	X		X
Sat.	27th	T	6	Line CC' ST 21, 22, 23, 24, 25, 26	X			X			X	X		X
		MT	2	Line CC' ST (20-21), (25-26)	X			X			X	X		X
OCTOBER														
Sun.	12th			Mobilization to Vale, Oregon and unload							X	X		
Mon.	13th	R	3	Line CC' ST 6, 3, 5A 50' Wenner							X	X		
			2	Line CC' ST (3 to 4) 1000' W, ST (5A to 6) 1025' W										
			1	Line CC' Dipole-Dipole (DD) ST (2-3) to (5-6) 6340' W										
				(Very muddy roads)										

TECHNIQUE CODES T - TELLURICS OT - ORTHOGONAL TELLURICS MT - MAGNETOTELLURICS

R - D.C. RESISTIVITY EM - ELECTROMAGNETIC (ACTIVE)

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