

STATE OF OREGON  
DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES  
1069 State Office Building  
Portland, Oregon 97201

OPEN FILE REPORT 0-75-4

GEO THERMAL GRADIENT DATA  
VALE AREA, MALHEUR COUNTY, OREGON

Don Hull, Economic Geologist  
Baker Field Office, 2033 First St., Baker 97814  
Telephone 503-523-3133

Preliminary data from a geothermal project funded by  
U.S. Bureau of Mines Contract No. S0122129  
released June 1975

1975

# GEOHERMAL STUDIES IN THE VALE AREA, MALHEUR COUNTY, OREGON

Don Hull, Economic Geologist

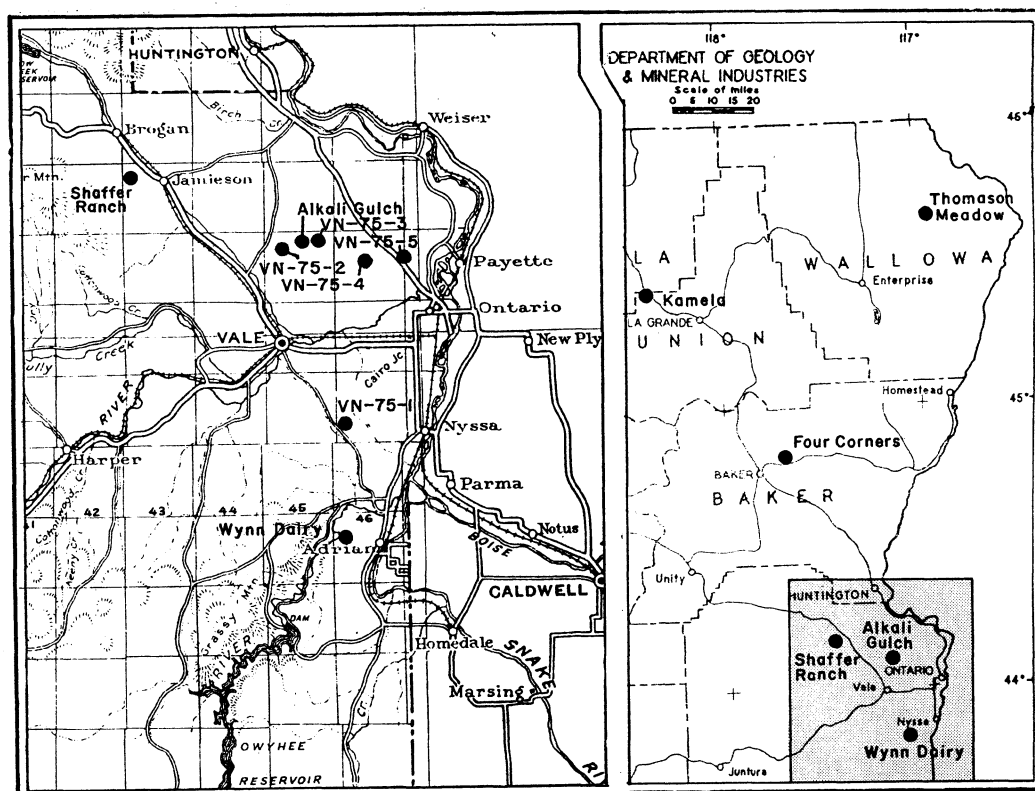
The Oregon Department of Geology and Mineral Industries has been engaged in studies of Oregon's geothermal energy potential for the past 10 years. The results of these activities have been published in The ORE BIN (v. 28, no. 7, p. 125-135; v. 29, no. 11, p. 209-231; v. 34, no. 4, p. 68-71; v. 35, no. 1, p. 6-7). Detailed studies of heat flow have been conducted since 1972 in the vicinity of Vale in northern Malheur County, southeastern Oregon (see map) under contract with the U.S. Bureau of Mines. The studies, initiated by R. G. Bowen in cooperation with Dr. David D. Blackwell of Southern Methodist University, are continuing, and a detailed report is being prepared summarizing the research to date. The preliminary results are being released in the hope they will aid in the exploration for and development of geothermal resources.

The final phase of the current geothermal investigation of the Vale area, consisting of the drilling of five holes to obtain heat-flow data, was completed in May and June 1975. All gradients are uncorrected for topographic effects. Hole locations are shown on the map.

Four of the five holes in the Vale area were drilled to a depth of 152 meters (500 feet) in silt-stone of the Idaho Group of Pliocene age. Hole VN-75-2 was drilled in silty claystone from 0 to 95 feet and in altered basalt(?) from 95 feet to a total depth of 203 feet. Drilling was done by a combination of air rotary, down-hole hammer, and coring techniques.

Hole VN-75-2 encountered warm artesian water at a depth of 105 feet which flowed at a rate of 10 to 14 gallons per minute with a temperature of 75°F (24°C) and a well-head pressure of 5 pounds per square inch. The average gradient was measured after the hole had been cemented to stop the artesian flow, but the gradient reflects the presence of the thermal water at shallow depth.

The Department also has a continuing program of measuring temperature gradients in pre-drilled holes, such as water wells and mineral exploration holes. The results from holes measured from 1971 through 1973 were placed on open-file status in March 1975 (open-file report O-75-3). Information from holes probed in 1975 to date are included in the following data.



TEMPERATURE-DEPTH LOGLocation Mitchell Butte - Malheur Co. Oregon - NW 1/4, NW 1/4, Sec 7, T. 21 S., R. 46 ECompany \_\_\_\_\_ Drill Hole No. Wynn #1Date May 9, 1975 Depth Drilled 250 - Zero Depth 2,260 ft.Probe, Cable, Bridge BR-1 Operator D. HullComments Well N E. of Owyhee R. near Mitchell Butte hot spr. 9' SWL

| <u>Depth</u>                 | <u>Resistance</u>                     | <u>Temperature</u>                     | <u><math>\Delta T/\Delta z</math></u> | <u>Comments</u>                                                                                                     |
|------------------------------|---------------------------------------|----------------------------------------|---------------------------------------|---------------------------------------------------------------------------------------------------------------------|
| <u>5m</u>                    | <u>4958.7 <math>\Omega</math></u>     | <u>14.88° C</u>                        | <u>134 °C/km</u>                      |                                                                                                                     |
| <u>10</u>                    | <u>4823.9</u>                         | <u>15.55</u>                           | <u>51</u>                             |                                                                                                                     |
| <u>15</u>                    | <u>4775.0</u>                         | <u>15.81</u>                           | <u>60</u>                             | Temp. drifting<br>= 0.02 in this<br>region probably<br>due to convection<br>well and/or<br>seepage from<br>aquifers |
| <u>20</u>                    | <u>4715.5</u>                         | <u>16.11</u>                           | <u>78</u>                             |                                                                                                                     |
| <u>25</u>                    | <u>4642.0</u>                         | <u>16.50</u>                           | <u>102</u>                            |                                                                                                                     |
| <u>30</u>                    | <u>4548.1</u>                         | <u>17.01</u>                           | <u>112</u>                            |                                                                                                                     |
| <u>35</u>                    | <u>4446.0</u>                         | <u>17.57</u>                           | <u>132</u>                            |                                                                                                                     |
| <u>40</u>                    | <u>4329.5</u>                         | <u>18.23</u>                           | <u>134</u>                            |                                                                                                                     |
| <u>45</u>                    | <u>4215.4</u>                         | <u>18.90</u>                           | <u>138</u>                            |                                                                                                                     |
| <u>50</u>                    | <u>4102.0</u>                         | <u>19.59</u>                           | <u>138</u>                            |                                                                                                                     |
| <u>55</u>                    | <u>3990.0 = 2 <math>\Omega</math></u> | <u>20.28</u>                           | <u>100</u>                            |                                                                                                                     |
| <u>60</u>                    | <u>3913.3</u>                         | <u>20.78</u>                           | <u>100</u>                            |                                                                                                                     |
| <u>65</u>                    | <u>3837.0</u>                         | <u>21.28</u>                           | <u>96</u>                             |                                                                                                                     |
| <u>70m</u>                   | <u>3765.0 = 2 <math>\Omega</math></u> | <u>21.76 <math>\approx</math> 71°F</u> |                                       |                                                                                                                     |
| <u>50m</u>                   | <u>4103.0</u> ✓                       |                                        |                                       |                                                                                                                     |
| <u>Av. grad 15m to 70m =</u> |                                       | <u>21.76 - 15.81</u>                   | <u>= 108.2</u>                        |                                                                                                                     |
|                              |                                       | <u>55</u>                              |                                       |                                                                                                                     |

LOCATION: KAMELA, OREGON  
HOLE NUMBER: 1-35836  
DATE MEASURED: 11/15/74

| DEPTH<br>METERS | TEMPERATURE<br>DEG C | GRADIENT<br>DEG C/KM |
|-----------------|----------------------|----------------------|
| 15.0            | 5.780                | .0                   |
| 20.0            | 5.760                | -4.0                 |
| 25.0            | 5.950                | 38.0                 |
| 30.0            | 6.330                | 76.0                 |
| 35.0            | 6.580                | 50.0                 |
| 40.0            | 6.725                | 28.0                 |
| 45.0            | 6.810                | 18.0                 |
| 50.0            | 6.920                | 22.0                 |
| 55.0            | 6.950                | 6.0                  |
| 60.0            | 7.000                | 10.0                 |
| 65.0            | 7.030                | 6.0                  |
| 70.0            | 7.130                | 20.0                 |

Av. gradient from 10m - 70m =  $32.5^{\circ}\text{C}/\text{km}$

LOCATION: THOMASON MEADOW, ORE.  
HOLE NUMBER: 3-47826  
DATE MEASURED: 11/23/74

| DEPTH<br>METERS | TEMPERATURE<br>DEG C | GRADIENT<br>DEG C/KM |
|-----------------|----------------------|----------------------|
| 10.0            | 6.140                | .0                   |
| 15.0            | 6.340                | 40.0                 |
| 20.0            | 6.570                | 46.0                 |
| 25.0            | 6.730                | 32.0                 |
| 30.0            | 6.830                | 20.0                 |
| 35.0            | 6.986                | 30.0                 |
| 40.0            | 7.100                | 24.0                 |
| 45.0            | 7.190                | 18.0                 |
| 50.0            | 7.300                | 22.0                 |
| 55.0            | 7.350                | 10.0                 |
| 60.0            | 7.410                | 12.0                 |
| 65.0            | 7.490                | 16.0                 |

Average gradient 10m to 65m =  $24.5^{\circ}\text{C}/\text{km}$

LOCATION: BAKER, OREGON  
HOLE NUMBER: B-41534  
DATE MEASURED: 11/12/74

| DEPTH<br>METERS | TEMPERATURE<br>DEG C | GRADIENT<br>DEG C/KM |
|-----------------|----------------------|----------------------|
| 10.0            | 10.900               | .0                   |
| 15.0            | 11.550               | 130.0                |
| 20.0            | 11.950               | 80.0                 |
| 25.0            | 12.110               | 32.0                 |
| 30.0            | 12.510               | 80.0                 |
| 35.0            | 12.970               | 92.0                 |
| 40.0            | 13.420               | 90.0                 |
| 45.0            | 13.480               | 12.0                 |
| 50.0            | 13.720               | 48.0                 |
| 55.0            | 13.940               | 44.0                 |
| 60.0            | 14.140               | 40.0                 |
| 65.0            | 14.400               | 52.0                 |
| 70.0            | 14.610               | 42.0                 |
| 75.0            | 14.830               | 44.0                 |
| 80.0            | 14.990               | 32.0                 |
| 85.0            | 15.190               | 40.0                 |
| 90.0            | 15.410               | 44.0                 |
| 95.0            | 15.600               | 38.0                 |
| 100.0           | 15.700               | 20.0                 |
| 105.0           | 15.380               | 36.0                 |
| 110.0           | 16.000               | 24.0                 |
| 115.0           | 16.090               | 18.0                 |
| 120.0           | 16.290               | 40.0                 |
| 125.0           | 16.420               | 26.0                 |
| 130.0           | 16.460               | 8.0                  |

Four Corners B.L.M. well

Average gradient 15-130 m = 42.7 °/km

# TEMPERATURE-DEPTH LOG

Location NW $\frac{1}{4}$  NW $\frac{1}{4}$  sec. 30, T. 19 S., R. 46 E., Malheur County  
 Company Burd Drilling Co. Drill Hole No. VN - 75 - 1  
 Date June 4, 1975 Depth Drilled 500 ft.-152 m. Zero Depth 2885 ft. elev.  
 Probe, Cable, Bridge BR-1 / WB-3 Operator E. Widman - D. Hull  
 Comments Dry hole; no water in PVC inner casing

| <u>Depth</u> | <u>Resistance</u> | <u>Temperature</u> | <u><math>\Delta T / \Delta x</math></u> | <u>Comments</u> |
|--------------|-------------------|--------------------|-----------------------------------------|-----------------|
| 5 m          | 5304.5 * ohm      | 13.24 ° C          |                                         |                 |
| 10           | 5000.6            | 14.67              | 286 °C/km                               |                 |
| 15           | 4952.5            | 14.91              | 48 °                                    |                 |
| 20           | 4883.2            | 15.25              | 68 °                                    |                 |
| 25           | 4801.0            | 15.67              | 84 °                                    |                 |
| 30           | 4710.0            | 16.14              | 94 °                                    |                 |
| 35           | 4620.0            | 16.62              | 96 °                                    |                 |
| 40           | 4538.8            | 17.06              | 88 °                                    |                 |
| 45           | 4453.3            | 17.53              | 94 °                                    |                 |
| 50           | 4372.7            | 17.99              | 92 °                                    |                 |
| 55           | 4294.6            | 18.44              | 90 °                                    |                 |
| 60           | 4214.1            | 18.91              | 94 °                                    |                 |
| 65           | 4139.7            | 19.36              | 90 °                                    |                 |
| 70           | 4070.8            | 19.78              | 84 °                                    |                 |
| 75           | 3990.0            | 20.28              | 100 °                                   |                 |
| 80           | 3917.4            | 20.75              | 94 °                                    |                 |
| 85           | 3838.8            | 21.26              | 102 °                                   |                 |
| 90           | 3774.7            | 21.69              | 86 °                                    |                 |
| 95           | 3718.5            | 22.07              | 76 °                                    |                 |
| 100          | 3647.6            | 22.57              | 100 °                                   |                 |

# TEMPERATURE-DEPTH LOG

Location Lincoln Bench - NW<sup>1</sup>/<sub>4</sub> NW<sup>1</sup>/<sub>4</sub>, sec. 30, T. 19 S., R. 46 E., Malheur County  
 Company \_\_\_\_\_ Drill Hole No. VN - 75 - 1  
 Date June 4, 1975 Depth Drilled 500 ft.-152 m Zero Depth \_\_\_\_\_  
 Probe, Cable, Bridge BR - 1 / WB-3 Operator E. Widman - D. Hull  
 Comments \_\_\_\_\_

[illegible]

### TEMPERATURE-DEPTH LOG

Location NW<sup>1</sup> of NE<sup>1</sup>, sec. 8, T. 17 S., R. 45 E. - Malheur Co., Oregon  
 Company Burd Drilling Co. Drill Hole No. VN - 75 - 2  
 Date June 4, 1975 Depth Drilled 203 ft - 62 m Zero Depth 2,365 ft. elev.  
 Probe, Cable, Bridge BR-1 / WB - 3 Operator E. Widman / D. Hull  
 Comments \_\_\_\_\_

[illegible]

TEMPERATURE-DEPTH LOG

Location NE 1/4 of SE 1/4, sec. 2, T. 17 S., R. 45 E., Malheur County, Oregon  
 Company \_\_\_\_\_ Drill Hole No. VN-75-3  
 Date May 13, 1975 4:15 PM Depth Drilled 500 ft - 152 m Zero Depth 2,760 ft.  
 Probe, Cable, Bridge BR-1 / WB-3 Operator D. Hull  
 Comments \_\_\_\_\_

| <u>Depth</u> | <u>Resistance</u> | <u>Temperature</u> | <u><math>\Delta T / \Delta x</math></u> | <u>Comments</u> |
|--------------|-------------------|--------------------|-----------------------------------------|-----------------|
| 5m           | 4690 ohm          | 16.25 ° C          |                                         |                 |
| 10           | 5077.1            | 14.30              | -390°C/km                               |                 |
| 15           | 5078.0            | 14.30              | 0                                       |                 |
| 20           | 5043.6            | 14.46              | 32                                      |                 |
| 25           | 5000.7            | 14.67              | 42                                      |                 |
| 30           | 4952.2            | 14.91              | 48                                      |                 |
| 35           | 4892.9            | 15.21              | 60                                      |                 |
| 40           | 4827.4            | 15.54              | 66                                      |                 |
| 45           | 4777.7            | 15.79              | 50                                      |                 |
| 50           | 4716.0            | 16.11              | 64                                      |                 |
| 55           | 4642.4            | 16.50              | 78                                      |                 |
| 60           | 4576.0            | 16.86              | 72                                      |                 |
| 65           | 4498.6            | 17.28              | 84                                      |                 |
| 70           | 4425.0            | 17.69              | 82                                      |                 |
| 75           | 4342.5            | 18.16              | 94                                      |                 |
| 80           | 4249.             | 18.70              | 108                                     |                 |
| 85           | 4175.7            | 19.14              | 88                                      |                 |
| 90           | 4117.4            | 19.49              | 70                                      |                 |
| 95           | 4061.0            | 19.84              | 70                                      |                 |
| 100          | 3993.9            | 20.26              | 84                                      |                 |
| 105          | 3930.3            | 20.67              | 82                                      |                 |



TEMPERATURE-DEPTH LOG

Location NE $\frac{1}{4}$  of SW $\frac{1}{4}$  sec. 16, T. 17 S., R. 46 E., Malheur County, Oregon  
 Company Burd Drilling Co. Drill Hole No. VN-75-4  
 Date June 4, 1975 Depth Drilled 500' TD - 152 m Zero Depth 2,520 ft.  
 Probe, Cable, Bridge WB-3 / BR-1 Operator D. Hull / E. Widman  
 Comments Current irrigation uphill to south from drill site

| <u>Depth</u> | <u>Resistance</u> | <u>Temperature</u> | <u><math>\Delta T / \Delta x</math></u> | <u>Comments</u> |
|--------------|-------------------|--------------------|-----------------------------------------|-----------------|
| 5 m          | 5508.9 ohm        | 12.32 °C           | 206 °C/km                               |                 |
| 10           | 5279.6            | 13.35              | 142                                     |                 |
| 15           | 5128.8            | 14.06              | 94                                      |                 |
| 20           | 5029.3            | 14.53              | 148                                     |                 |
| 25           | 4880.3            | 15.27              | 110                                     |                 |
| 30           | 4772.3            | 15.82              | 104                                     |                 |
| 35           | 4673.0            | 16.34              | 96                                      |                 |
| 40           | 4583.5            | 16.82              | 104                                     |                 |
| 45           | 4487.2            | 17.34              | 104                                     |                 |
| 50           | 4394.7            | 17.86              | 110                                     |                 |
| 55           | 4299.5            | 18.41              | 110                                     |                 |
| 60           | 4206.1            | 18.96              | 110                                     |                 |
| 65           | 4114.6            | 19.51              | 108                                     |                 |
| 70           | 4026.6            | 20.05              | 134                                     |                 |
| 75           | 3921.5            | 20.72              | 142                                     |                 |
| 80           | 3813.7            | 21.43              | 112                                     |                 |
| 85           | 3730.6            | 21.99              | 114                                     |                 |
| 90           | 3648.6            | 22.56              | 86                                      |                 |
| 95           | 3588.2            | 22.99              | 114                                     |                 |
| 100          | 3509.9            | 23.56              | 112                                     |                 |
| 105          | 3433.3            | 24.12              |                                         |                 |



TEMPERATURE-DEPTH LOGLocation NW $\frac{1}{4}$  of NE $\frac{1}{4}$ , sec. 13, T. 17 S., R. 46 E., Malheur County, OregonCompany \_\_\_\_\_ Drill Hole No. VN-75-5Date June 3, 1975 Depth Drilled 500 ft. - 152 m Zero Depth 2,400 ft.Probe, Cable, Bridge BR-1 / WB-3 Operator E. Widman / D. Hull

Comments \_\_\_\_\_

| <u>Depth</u> | <u>Resistance</u> | <u>Temperature</u> | <u><math>\Delta T / \Delta x</math></u> | <u>Comments</u> |
|--------------|-------------------|--------------------|-----------------------------------------|-----------------|
| 5 m          | 5614.7 ohm        | 11.86° c           |                                         |                 |
|              |                   |                    | 380° C/km                               |                 |
| 10           | 5192.4            | 13.76              |                                         |                 |
|              |                   |                    | 66                                      |                 |
| 15           | 5122.2            | 14.09              |                                         |                 |
|              |                   |                    | 70                                      |                 |
| 20           | 5049.4            | 14.44              |                                         |                 |
|              |                   |                    | 58                                      |                 |
| 25           | 4988.4            | 14.73              |                                         |                 |
|              |                   |                    | 66                                      |                 |
| 30           | 4922.0            | 15.06              |                                         |                 |
|              |                   |                    | 66                                      |                 |
| 35           | 4856.8            | 15.39              |                                         |                 |
|              |                   |                    | 68                                      |                 |
| 40           | 4789.2            | 15.73              |                                         |                 |
|              |                   |                    | 68                                      |                 |
| 45           | 4724.0            | 16.07              |                                         |                 |
|              |                   |                    | 68                                      |                 |
| 50           | 4659.7            | 16.41              |                                         |                 |
|              |                   |                    | 72                                      |                 |
| 55           | 4592.0            | 16.77              |                                         |                 |
|              |                   |                    | 72                                      |                 |
| 60           | 4526.2            | 17.13              |                                         |                 |
|              |                   |                    | 74                                      |                 |
| 65           | 4459.5            | 17.50              |                                         |                 |
|              |                   |                    | 72                                      |                 |
| 70           | 4394.8            | 17.86              |                                         |                 |
|              |                   |                    | 74                                      |                 |
| 75           | 4330.0            | 18.23              |                                         |                 |
|              |                   |                    | 74                                      |                 |
| 80           | 4265.5            | 18.60              |                                         |                 |
|              |                   |                    | 82                                      |                 |
| 85           | 4197.6            | 19.01              |                                         |                 |
|              |                   |                    | 74                                      |                 |
| 90           | 4135.1            | 19.38              |                                         |                 |
|              |                   |                    | 92                                      |                 |
| 95           | 4060.1            | 19.84              |                                         |                 |
|              |                   |                    | 56                                      |                 |
| 100          | 4016.4            | 20.12              |                                         |                 |
|              |                   |                    | 86                                      |                 |
| 105          | 3948.0            | 20.55              |                                         |                 |





TEMPERATURE-DEPTH LOGPage 2

Location Alkali Gulch (BLM stock well)  
 Company \_\_\_\_\_ Drill Hole No. \_\_\_\_\_  
 Date April 17, 1975 Depth Drilled \_\_\_\_\_ Zero Depth \_\_\_\_\_  
 Probe, Cable, Bridge \_\_\_\_\_ Operator \_\_\_\_\_  
 Comments \_\_\_\_\_

| <u>Depth</u> | <u>Resistance</u> | <u>Temperature</u> | <u>ATAx</u> | <u>Comments</u>    |
|--------------|-------------------|--------------------|-------------|--------------------|
| <u>105M</u>  | <u>3503</u>       | <u>23.61</u>       | <u>22</u>   |                    |
| <u>110</u>   | <u>3487</u>       | <u>23.72</u>       | <u>18</u>   | <u>fluctuating</u> |
| <u>115</u>   | <u>3476</u>       | <u>23.81</u>       | <u>14</u>   |                    |
| <u>120</u>   | <u>3466</u>       | <u>23.88</u>       |             | <u>fluctuating</u> |
| <u>125</u>   | <u>3466</u>       | <u>23.88</u>       | <u>30</u>   |                    |
| <u>130</u>   | <u>3446.4</u>     | <u>24.03</u>       | <u>30</u>   | <u>fluctuating</u> |
| <u>135</u>   | <u>3425.6</u>     | <u>24.18</u>       | <u>12</u>   | "                  |
| <u>140</u>   | <u>3418</u>       | <u>24.24</u>       | <u>22</u>   | "                  |
| <u>145</u>   | <u>3403</u>       | <u>24.35</u>       | <u>14</u>   | "                  |
| <u>150</u>   | <u>3394</u>       | <u>24.42</u>       | <u>16</u>   | "                  |
| <u>155</u>   | <u>3383.3</u>     | <u>24.50</u>       | <u>16</u>   |                    |
| <u>160</u>   | <u>3373</u>       | <u>24.58</u>       | <u>6</u>    |                    |
| <u>165</u>   | <u>3370</u>       | <u>24.61</u>       | <u>10</u>   |                    |
| <u>170</u>   | <u>3363.6</u>     | <u>24.66</u>       | <u>8</u>    |                    |
| <u>175</u>   | <u>3357.7</u>     | <u>24.70</u>       | <u>4</u>    |                    |
| <u>180</u>   | <u>3355.4</u>     | <u>24.72</u>       | <u>0</u>    | <u>Bottom ?</u>    |
| <u>185</u>   | <u>3354.8</u>     | <u>24.72</u>       |             |                    |
| <u>190</u>   | <u>3354.8</u>     |                    |             |                    |

Av. gradient 15 to 175m =  $\frac{10.14^{\circ}\text{C}}{160\text{m}} = 63.4^{\circ}\text{C/Km}$

" " 15 to 180m =  $61.6^{\circ}\text{C/Km}$

## TEMPERATURE-DEPTH LOG

Location SE 1/4, sec. 7, T. 16 S, R. 43 E. - Malheur Co - Harry Schaffer Run.  
 Company \_\_\_\_\_ Drill Hole No. \_\_\_\_\_  
 Date May 6, 1975 Depth Drilled 404 TO Zero Depth 2,800 ft.  
 Probe, Cable, Bridge BR-1 Operator D. Hull  
 Comments SWL @ 155 ft. deep

|     | Depth                                          | Resistance                                     | Temperature | $\Delta T/\Delta x$ | Comments                               |
|-----|------------------------------------------------|------------------------------------------------|-------------|---------------------|----------------------------------------|
| 5m  | 0 2:43<br>3 2:46<br>5 2:48<br>7 2:50           | 5755.0<br>5882.0<br>5944.0<br>5989.0           | 9.53 °C     | 780 °C/km           | Rapid drift                            |
| 10m | 0 2:53<br>3 2:56<br>5 2:58<br>7 3:10           | 5392.0<br>5367.0<br>5343.0<br>5331.7           | 13.43       | 124                 | " "                                    |
| 15m | 0 3:03<br>3 3:06<br>5 3:08<br>7 3:10           | 5236.0<br>5186.0<br>5173.1<br>5167.2           | 14.05       | 58                  |                                        |
| 20m | 0 3:13<br>3 3:16<br>5 3:18<br>7 3:20           | 5113.6<br>5094.0<br>5088.3<br>5085.1           | 14.34       | 50                  |                                        |
| 25m | 0 3:23<br>3 3:26<br>5 3:28<br>7 3:30           | 5055.5<br>5041.6<br>5036.8<br>5032.9           | 14.59       | 46                  |                                        |
| 30m | 0 3:33<br>3 3:36<br>5 3:38<br>7 3:40           | 5091.4<br>4988.4<br>4984.7<br>4992.5           | 14.82       | 44                  |                                        |
| 35m | 0 3:43<br>3 3:46<br>5 3:48<br>7 3:50           | 4960.0<br>4947.2<br>4942.7<br>4940.1           | 15.04       | 42                  |                                        |
| 40m | 0 3:53<br>3 3:56<br>5 3:58<br>7 4:00           | 4917.6<br>4905.5<br>4901.3<br>4898.2           | 15.25       | 102                 |                                        |
| 45m | 0 4:03<br>3 4:06<br>5 4:08<br>7 4:10<br>9 4:12 | 4783.7<br>4786.2<br>4784.9<br>4784.8<br>4784.7 | 15.76       | 22                  |                                        |
| 50m |                                                | 4761.8                                         | 15.87       | 42                  | CK. on way out<br>4654.3 ± 2.0         |
| 55m |                                                | 4721.6                                         | 16.08       | 40                  |                                        |
| 60m |                                                | 4683.0 ± 1                                     | 16.28       | 42                  | Slow drift; proba<br>due to convection |
| 65m |                                                | 4643.5 ± 0.5                                   | 16.49       | 10                  | CK. 65 m - 4643.0                      |
| 70m |                                                | 4635.3 4635.3 ± 0.2                            | 16.54       | 14                  | CK. 70 m again<br>4634.0               |
| 75m |                                                | 4622.0                                         | 16.61       | 8                   | CK 4624.8 on w-<br>out - 4621.         |
| 80m |                                                | 4614.9 ± 0.5                                   | 16.65       | 52                  | on way out<br>4608.5                   |
| 85m |                                                | 4566.6                                         | 16.91       | 16                  |                                        |
| 90m |                                                | 4555.5                                         | 16.97       | 16                  |                                        |
| 95m |                                                | 4540.2                                         | 17.05       |                     |                                        |

