UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

# ADDITIONAL SCHLUMBERGER SOUNDINGS NEAR JEAN, NEVADA

By

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Open-File Report 89-663

1989

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In April 1988, the U.S. Geological Survey in cooperation with the Las Vegas Valley Water District, made four Schlumberger soundings near Jean, Nevada, to extend two resistivity profiles that were obtained in a previous survey (Zohdy, 1988). The main purpose of this report is to release the new sounding data.

Figure 1 shows a station location map of all 40 soundings that are now available in the Jean area. Stations 37, 38, 39, and 40 are the new sounding stations. Figures 2, 3, 4, and 5, show the field data and the automatic interpretation of the four new soundings. The automatic interpretation is based on a new method (Zohdy, 1989) and on a new computer program for that method that was written for the IBM PC and compatible computers (Zohdy and Bisdorf, 1989).

Sounding 39 (figure 4) was made in a narrow valley with outcrops of limestone surrounding the sounding station. Here, the data obtained at electrode spacings greater than 200 m are affected by lateral inhomogeneities and cannot be fitted at those spacings with a theoretical sounding curve based on

horizontal layers.

Figure 6 shows two cross sections of interpreted resistivity. These two cross sections extend to the west two previously published cross sections D-D′ and E-E′ (Zohdy, 1988) and include the interpretation of the new soundings (37, 38, 39, and 40). In these cross sections, materials having resistivities between 45 and 200 ohm-meters are interpreted to represent alluvium saturated with fresh groundwater. Materials having resistivity of less than 45 ohm meters represent alluvium saturated with groundwater having total dissolved solids that may exceed the State of Nevada standard of 1000 milligrams per liter. Near-surface materials with resistivities in the hundreds of ohm-meters are either dry alluvium or dry Paleozoic limestone. Deep-seated materials with resistivities greater than 200 ohm-meters probably represent Paleozoic limestone as evidenced by data from test-well G, on section D-D′. The higher the resistivity of these deep-seated materials the less their porosity and therefore the less the potential for being a good aquifer. The main interest in this study is the alluvium aquifer which is ideally represented by materials with resistivities in the range between 75 and 150 ohm-meters.

Section D-D′ (figure 6), along the road to the town of Goodsprings, shows low-resistivity material at the western end of the section beneath sounding 40. This relatively low-resistivity material is interpreted as a sand and gravel aquifer containing potable water. This is new information indicating the presence of a small basin west of the nearly outcropping Paleozoic limestones beneath soundings 18 and 19.

Section E-E′ (figure 6) includes the interpretation of the new soundings 37, 38, and 39. The section shows that the fresh water aquifer in the alluvium (beneath soundings 30, 31, 32, and 33) continues to the west of sounding 33 and beneath the new soundings 37 and 38. The fresh-water aquifer was penetrated by the new well (Zohdy, 1988) to the north of section E-E′ (see Figure 1 for location). The presence of a sand and gravel aquifer beneath sounding 39 is questionable.

## REFERENCES

Zohdy, A.A.R., 1988, Groundwater exploration with Schlumberger soundings near Jean Nevada: U.S. Geol. Survey Open-File Report 88-291, 65 p.

-----, 1989, A new method for the automatic interpretation of Schlumberger and Wenner sounding curves: Geophysics, v. 54, p. 245-253.

Zohdy, A.A.R. and Bisdorf, R.J., 1989, Programs for the automatic processing and interpretation of Schlumberger sounding curves in QuickBASIC 4.0: U.S. Geol. Survey Open-File Report 89-137 A & B, 63 p. + disk with programs.

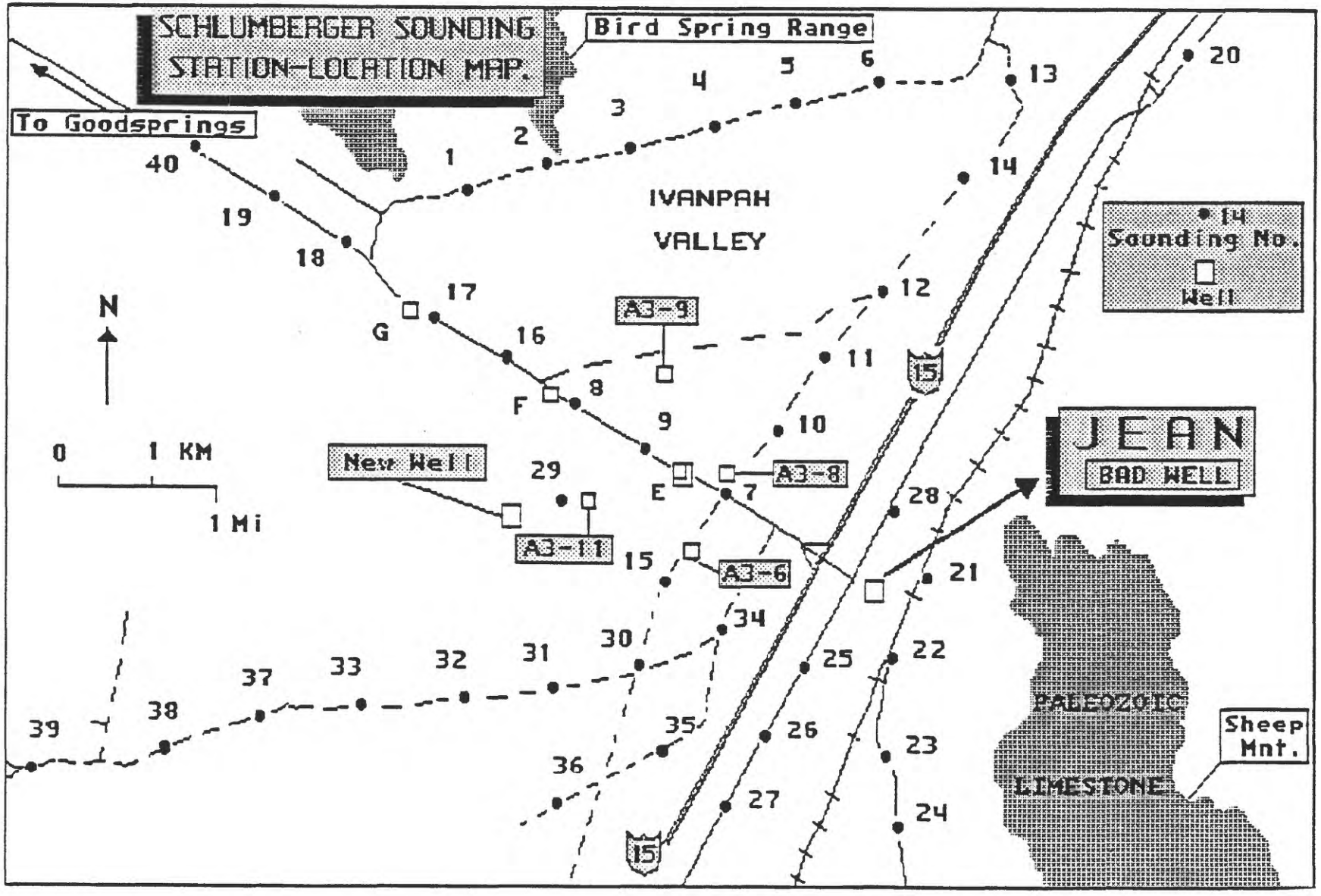
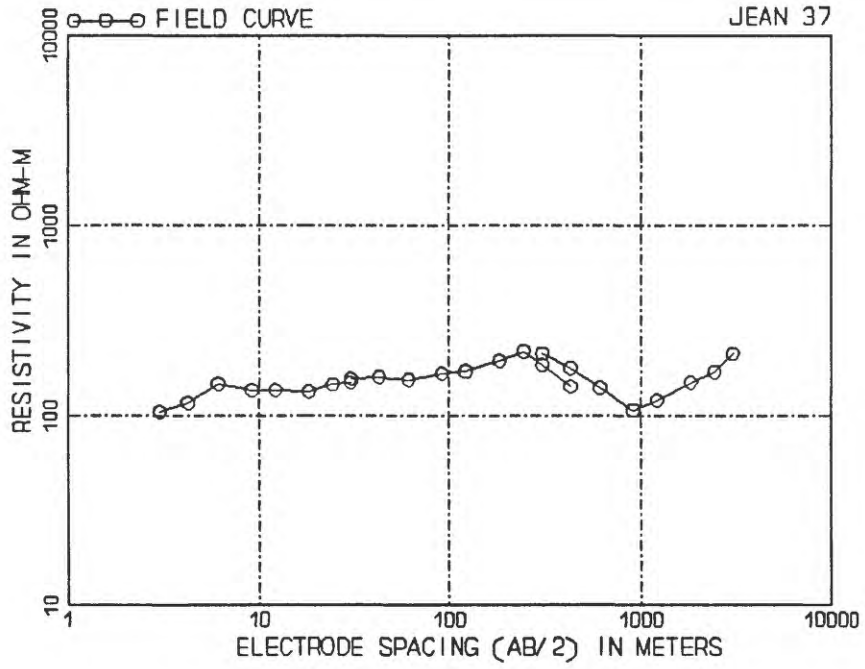
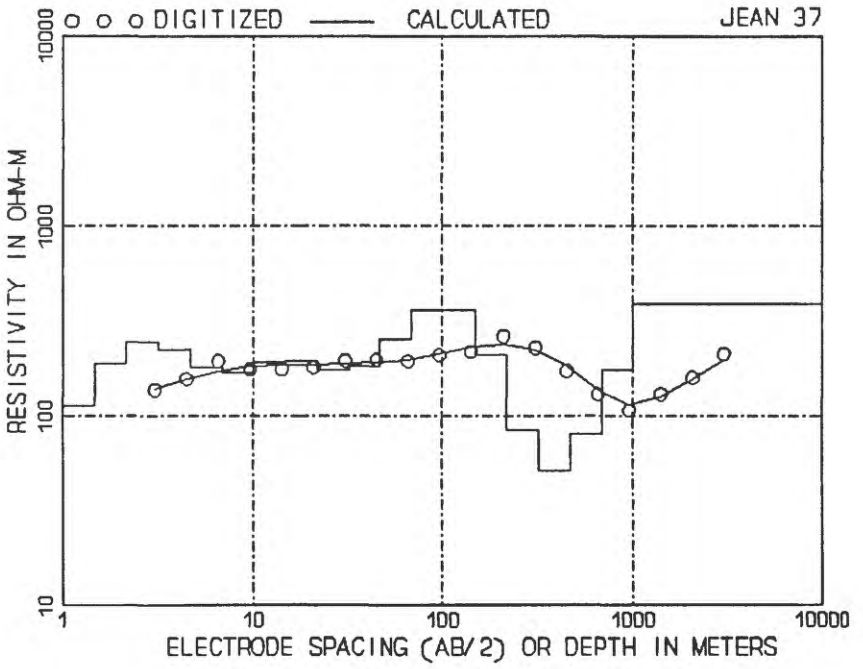



FIGURE 1. Map showing location of Schlumberger sounding stations, test wells (small squares), and production wells (large squares), near Jean, Nevada.

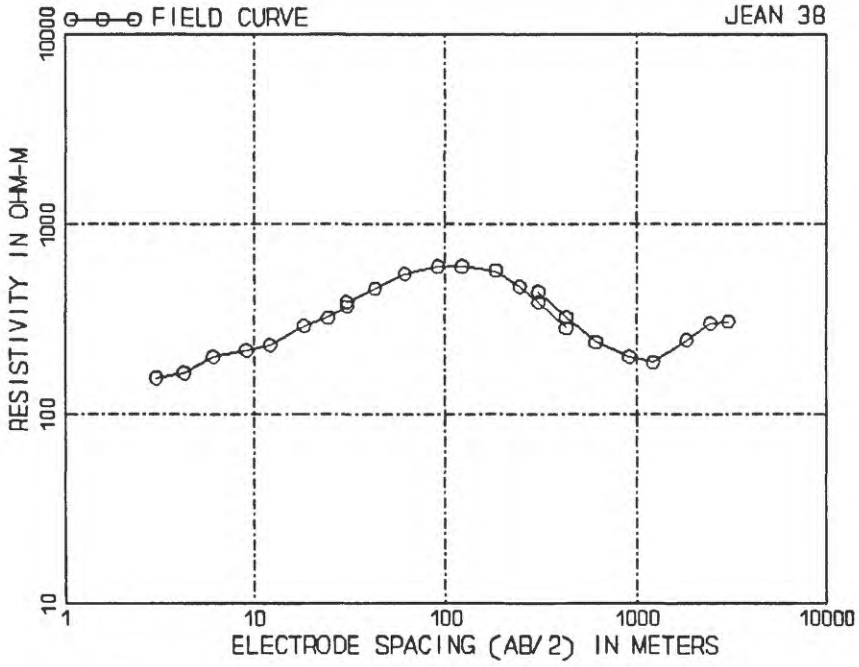


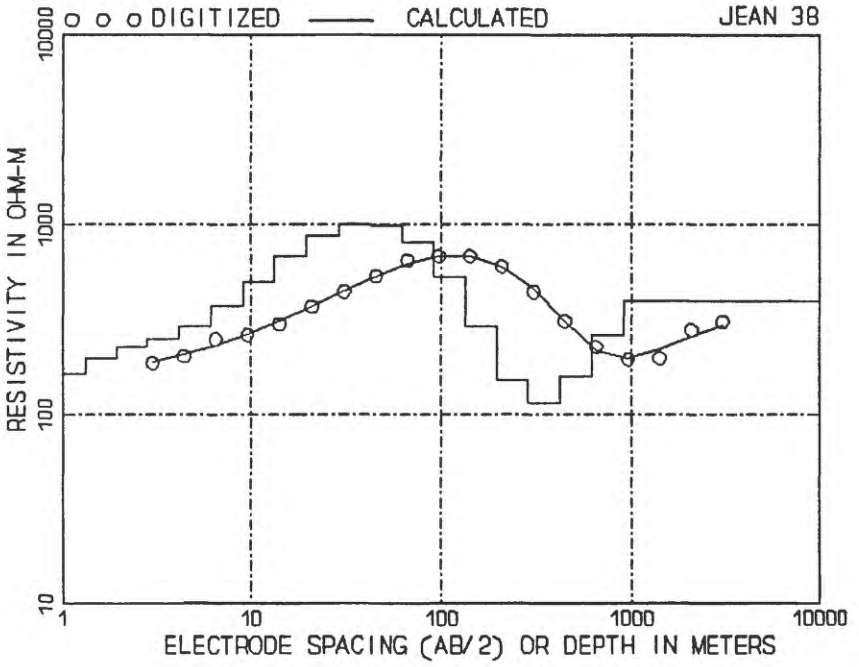




| AB/2, m ( ft ) | App. Res. | AB/2, m ( ft ) | App. Res. |
|---|---|---|---|
| 3.05 ( 10.00) | 105.00 | 121.92 ( 400.00) | 171.00 |
| 4.27 ( 14.00) | 117.00 | 182.88 ( 600.00) | 195.00 |
| 6.10 ( 20.00) | 147.00 | 243.84 ( 800.00) | 218.00 |
| 9.14 ( 30.00) | 136.00 | 304.80 ( 1000.00) | 185.00 |
| 12.19 ( 40.00) | 136.00 | 426.72 ( 1400.00) | 143.00 |
| 18.29 ( 60.00) | 134.00 | 304.80 ( 1000.00) | 212.00 |
| 24.38 ( 80.00) | 146.00 | 426.72 ( 1400.00) | 178.00 |
| 30.48 ( 100.00) | 150.00 | 609.60 ( 2000.00) | 140.00 |
| 30.48 ( 100.00) | 157.00 | 914.40 ( 3000.00) | 107.00 |
| 42.67 ( 140.00) | 160.00 | 1219.20 ( 4000.00) | 120.00 |
| 60.96 ( 200.00) | 155.00 | 1828.80 ( 6000.00) | 150.00 |
| 91.44 ( 300.00) | 167.00 | 2438.40 ( 8000.00) | 170.00 |
| | | 3048.00 (10000.00) | 212.00 |

| DEPTH, m ( ft ) | RESIS. | DEPTH, m ( ft ) | RESIS. |
|---|---|---|---|
| 1.48 ( 4.86) | 112.62 | 46.84 ( 153.69) | 182.16 |
| 2.17 ( 7.13) | 188.12 | 68.76 ( 225.58) | 254.39 |
| 3.19 ( 10.47) | 243.95 | 100.92 ( 331.11) | 360.67 |
| 4.68 ( 15.37) | 223.39 | 148.13 ( 486.00) | 359.67 |
| 6.88 ( 22.56) | 178.93 | 217.43 ( 713.35) | 211.74 |
| 10.09 ( 33.11) | 170.10 | 319.14 ( 1047.06) | 84.67 |
| 14.81 ( 48.60) | 191.41 | 468.44 ( 1536.87) | 51.47 |
| 21.74 ( 71.34) | 194.39 | 687.57 ( 2255.81) | 80.10 |
| 31.91 ( 104.71) | 174.07 | 1009.22 ( 3311.08) | 174.99 |
| | | 99999.00 (99999.00) | 391.28 |

FIGURE 2. Schlumberger sounding (Jean 37). Field data and interpretation.

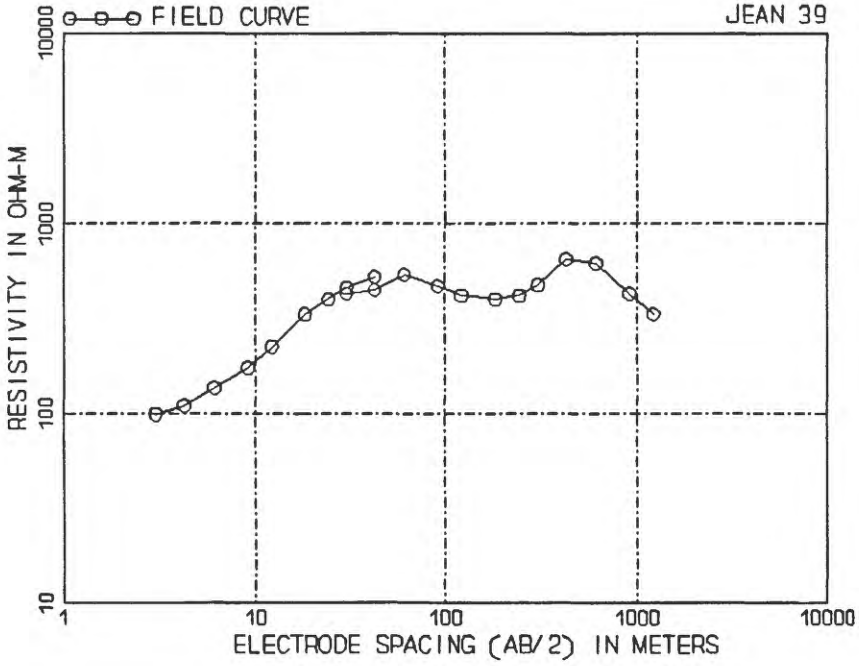


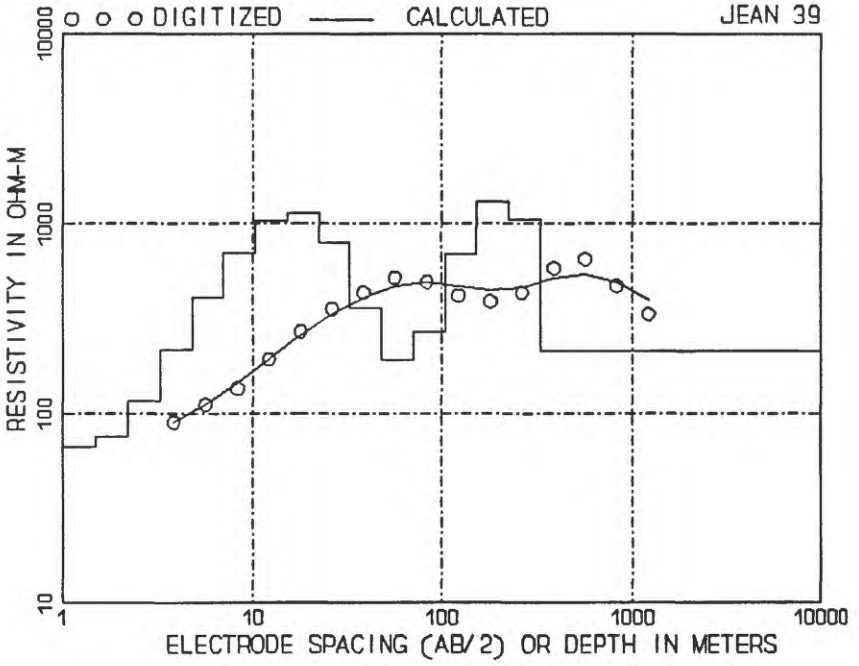




| AB/2, m ( ft ) | App. Res. | AB/2, m ( ft ) | App. Res. |
|---|---|---|---|
| 3.05 ( 10.00) | 155.00 | 121.92 ( 400.00) | 600.00 |
| 4.27 ( 14.00) | 165.00 | 182.88 ( 600.00) | 570.00 |
| 6.10 ( 20.00) | 200.00 | 243.84 ( 800.00) | 470.00 |
| 9.14 ( 30.00) | 217.00 | 304.80 ( 1000.00) | 390.00 |
| 12.19 ( 40.00) | 230.00 | 426.72 ( 1400.00) | 285.00 |
| 18.29 ( 60.00) | 292.00 | 304.80 ( 1000.00) | 440.00 |
| 24.38 ( 80.00) | 322.00 | 426.72 ( 1400.00) | 325.00 |
| 30.48 ( 100.00) | 370.00 | 609.60 ( 2000.00) | 240.00 |
| 30.48 ( 100.00) | 390.00 | 914.40 ( 3000.00) | 200.00 |
| 42.67 ( 140.00) | 460.00 | 1219.20 ( 4000.00) | 187.00 |
| 60.96 ( 200.00) | 550.00 | 1828.80 ( 6000.00) | 245.00 |
| 91.44 ( 300.00) | 600.00 | 2438.40 ( 8000.00) | 300.00 |
| | | 3048.00 (10000.00) | 307.00 |

| DEPTH, m ( ft ) | RESIS. | DEPTH, m ( ft ) | RESIS. |
|---|---|---|---|
| 1.33 ( 4.37) | 164.35 | 42.16 ( 138.32) | 998.42 |
| 1.96 ( 6.42) | 199.09 | 61.88 ( 203.02) | 990.21 |
| 2.87 ( 9.42) | 228.63 | 90.83 ( 298.00) | 807.86 |
| 4.22 ( 13.83) | 250.71 | 133.32 ( 437.40) | 529.45 |
| 6.19 ( 20.30) | 290.51 | 195.69 ( 642.02) | 288.48 |
| 9.08 ( 29.80) | 370.69 | 287.23 ( 942.35) | 150.89 |
| 13.33 ( 43.74) | 501.67 | 421.59 ( 1383.18) | 115.48 |
| 19.57 ( 64.20) | 679.22 | 618.81 ( 2030.23) | 159.10 |
| 28.72 ( 94.23) | 867.90 | 908.30 ( 2979.97) | 259.50 |
| | | 99999.00 (99999.00) | 394.38 |

Figure 3. Schlumberger sounding (Jean 38). Field data and interpretation.

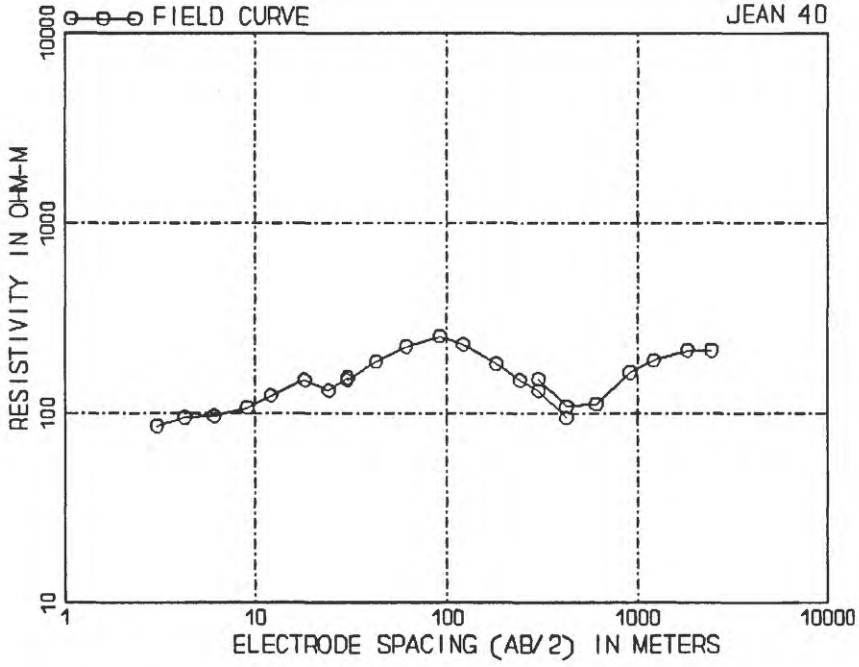


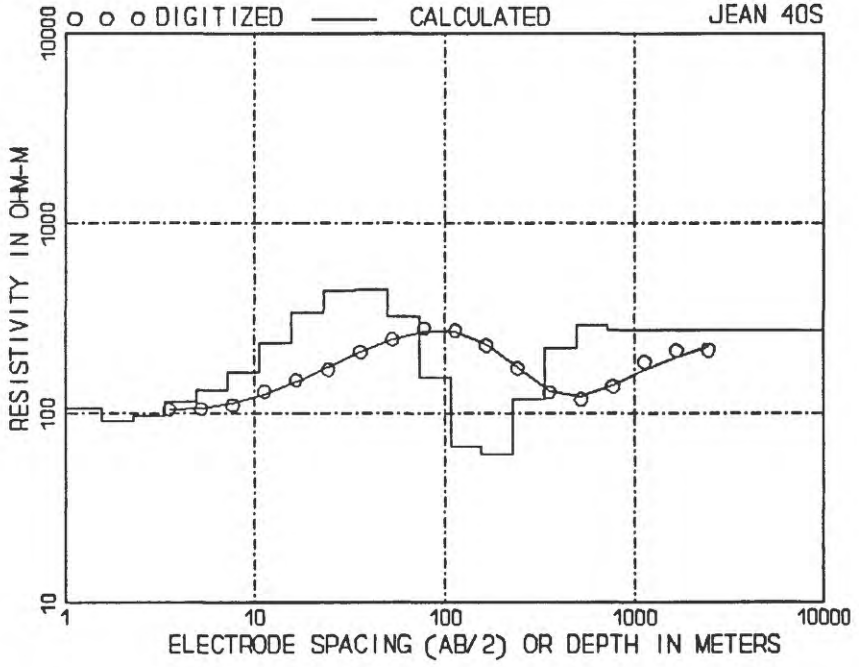




| AB/2, m ( ft ) | App. Res. | AB/2, m ( ft ) | App. Res. |
|---|---|---|---|
| 3.05 ( 10.00) | 99.00 | 60.96 ( 200.00) | 540.00 |
| 4.27 ( 14.00) | 110.00 | 91.44 ( 300.00) | 470.00 |
| 6.10 ( 20.00) | 136.00 | 121.92 ( 400.00) | 420.00 |
| 9.14 ( 30.00) | 174.00 | 182.88 ( 600.00) | 400.00 |
| 12.19 ( 40.00) | 225.00 | 243.84 ( 800.00) | 420.00 |
| 18.29 ( 60.00) | 333.00 | 304.80 ( 1000.00) | 475.00 |
| 24.38 ( 80.00) | 400.00 | 304.80 ( 1000.00) | 475.00 |
| 30.48 ( 100.00) | 460.00 | 426.72 ( 1400.00) | 650.00 |
| 42.67 ( 140.00) | 525.00 | 609.60 ( 2000.00) | 620.00 |
| 30.48 ( 100.00) | 430.00 | 914.40 ( 3000.00) | 430.00 |
| 42.67 ( 140.00) | 450.00 | 1219.20 ( 4000.00) | 335.00 |

| DEPTH, m ( ft ) | RESIS. | DEPTH, m ( ft ) | RESIS. |
|---|---|---|---|
| 1.52 ( 4.98) | 66.73 | 32.70 ( 107.28) | 795.59 |
| 2.23 ( 7.31) | 75.97 | 48.00 ( 157.46) | 363.55 |
| 3.27 ( 10.73) | 117.34 | 70.45 ( 231.13) | 192.04 |
| 4.80 ( 15.75) | 217.40 | 103.40 ( 339.25) | 268.54 |
| 7.04 ( 23.11) | 406.43 | 151.77 ( 497.94) | 696.26 |
| 10.34 ( 33.92) | 704.04 | 222.77 ( 730.88) | 1317.65 |
| 15.18 ( 49.79) | 1038.99 | 326.99 ( 1072.79) | 1048.70 |
| 22.28 ( 73.09) | 1137.03 | 99999.00 (99999.00) | 213.39 |

Figure 4. Schlumberger sounding (Jean 39). Field data and interpretation.




| AB/2, m ( ft ) | App. Res. | AB/2, m ( ft ) | App. Res. |
|---|---|---|---|
| 3.05 ( 10.00) | 86.00 | 121.92 ( 400.00) | 230.00 |
| 4.27 ( 14.00) | 95.00 | 182.88 ( 600.00) | 182.00 |
| 6.10 ( 20.00) | 97.00 | 243.84 ( 800.00) | 150.00 |
| 9.14 ( 30.00) | 107.00 | 304.80 ( 1000.00) | 132.00 |
| 12.19 ( 40.00) | 124.00 | 426.72 ( 1400.00) | 95.00 |
| 18.29 ( 60.00) | 150.00 | 304.80 ( 1000.00) | 152.00 |
| 24.38 ( 80.00) | 132.00 | 426.72 ( 1400.00) | 109.00 |
| 30.48 ( 100.00) | 155.00 | 609.60 ( 2000.00) | 112.00 |
| 30.48 ( 100.00) | 150.00 | 914.40 ( 3000.00) | 165.00 |
| 42.67 ( 140.00) | 187.00 | 1219.20 ( 4000.00) | 190.00 |
| 60.96 ( 200.00) | 225.00 | 1828.80 ( 6000.00) | 215.00 |
| 91.44 ( 300.00) | 255.00 | 2438.40 ( 8000.00) | 215.00 |

| DEPTH, m ( ft ) | RESIS. | DEPTH, m ( ft ) | RESIS. |
|---|---|---|---|
| 1.57 ( 5.14) | 106.90 | 49.51 ( 162.42) | 447.90 |
| 2.30 ( 7.54) | 90.97 | 72.66 ( 238.40) | 322.00 |
| 3.37 ( 11.07) | 97.28 | 106.66 ( 349.92) | 155.14 |
| 4.95 ( 16.24) | 114.37 | 156.55 ( 513.61) | 66.33 |
| 7.27 ( 23.84) | 131.95 | 229.78 ( 753.88) | 60.49 |
| 10.67 ( 34.99) | 164.78 | 337.27 ( 1106.54) | 118.46 |
| 15.65 ( 51.36) | 233.76 | 495.05 ( 1624.19) | 219.98 |
| 22.98 ( 75.39) | 341.13 | 726.64 ( 2383.98) | 288.86 |
| 33.73 ( 110.65) | 441.79 | 99999.00 (99999.00) | 272.79 |

Figure 5. Schlumberger sounding (Jean 40). Field data and interpretation.

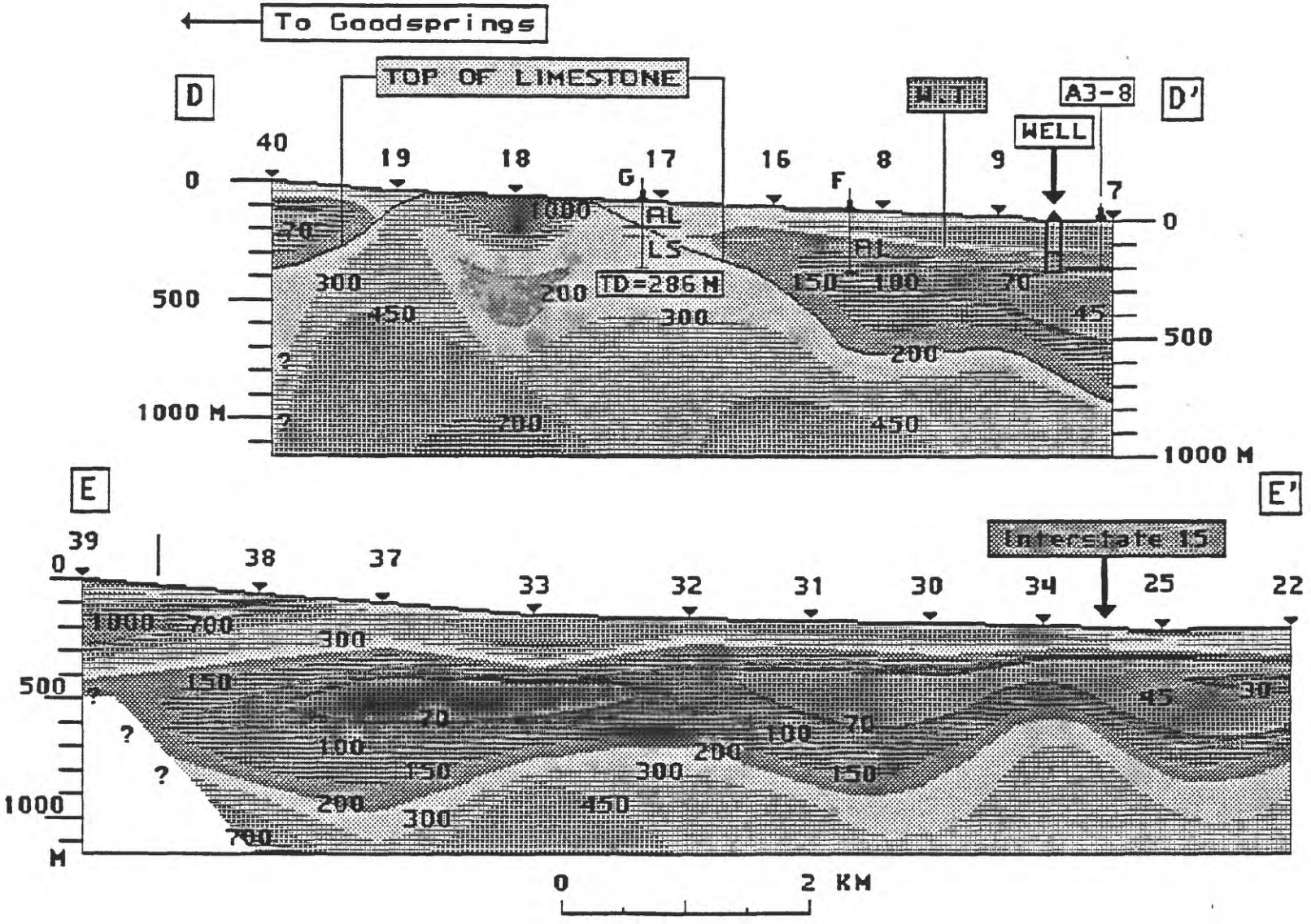



FIGURE 6. Geoelectric cross sections D-D' and E-E'. Interpreted resistivity contours in ohm-meters. Depth to top of limestone, coinciding with 200 ohm-meter contour, is based on interpretation and on test well G in cross section D-D'.