United States Department of the Interior

U.S. Geological Survey

WATER RESOURCES DISCIPLINE
Arizona Water Science Center
520 North Park Avenue, Suite 221
Tucson, Arizona 85719
(520) 670-6671 FAX (520) 670-5592
http://az.water.usgs.gov/

May 10, 2007

Mr. David Swanson, Project Manager
Nye County Nuclear Waste Repository Project Office
1210 East Basin Rd. #6
Pahrump, NV 89060

RE: Results from dipole-dipole direct-current resistivity survey, Nye County, Nevada

Dear Dave:

The U.S. Geological Survey in cooperation with the Nye County Nuclear Waste Repository Project Office conducted a dipole-dipole direct-current resistivity survey to better characterize the Paintbrush Canyon Fault system in lower Fortymile Wash down gradient of Yucca Mountain. This fault system trends south-southwest approximately 2 miles from the eastern edge of the proposed Yucca Mountain high-level-radioactive-waste repository to near the area where U.S. Highway 95 intersects the western edge of lower Fortymile Wash (figs. 1 and 2). Little is known about the role this fault system plays in ground-water flow and transport from Yucca Mountain to ground-water monitoring equipment located downgradient in Amargosa Valley primarily south of U.S. Highway 95 (fig. 2).

Data collection for the dipole-dipole resistivity survey consisted of measurements made from December 2006 to January 2007. The survey line trended north to south with a "bend" to the southwest on the lower half of the survey, illustrated in the profile line A to A' (fig. 2). The spacing between each electrode site was 300 meters and every other electrode was used as a pair creating 600-meter dipoles. The survey line was 10 km long and large spacings between dipoles were necessary for greater depth of investigation. Measured data points were plotted during the data collection process as a check for survey completeness (fig. 3). A pseudosection of measured voltages was also plotted as a process of data collection (fig. 4).

Data modeling consisted of calculating an apparent resistivity pseudosection, an inverse resistivity model and a linear resistivity response. A calculated apparent resistivity pseudosection was plotted which shows areas of greater resistivity from electrode positions 1 to 18 and areas of lower resistivity from electrodes 20 to 36 (fig. 5). An inverse model section was calculated which shows a distinct change in resistivity between electrodes 18 and 20 (figs. 5 and 6). An inverse model section with compensated topography was calculated to distinguish any topographic effects in the data (fig.6).

A linear resistivity response plot was used to look at lateral changes throughout the survey (fig. 7). The resistivity response plot confirms areas of resistivity change near electrode 20 (fig. 7). The resistivity response plot also shows resistivity changes near electrodes 7 to 12 and 33 to 34 (fig. 7). These areas are associated with probable mapped faults from gravity anomalies (Slate and others, 1999).

Resistivity data collected in this study correspond spatially with mapped faults from gravity anomalies and contribute to the greater understanding of the Paintbrush Canyon Fault system. More detailed information is needed in the area of electrodes 12 to 23 to determine the extent of faulting in the subsurface.

As a result of this survey and discussions with you and other Nye County staff at our April 24, 2007 meeting, the USGS will prepare a proposal that will describe and discuss future work. The proposal will include a workplan that describes work and costs associate with (1) the transient electromagnetic (TEM) surveys needed to better define the subsurface in the area between electrodes 12 and 23 (fig. 2); (2) the preparation of a USGS Series report or journal article that summarizes the findings of the dipole-dipole resistivity survey and TEM investigations; and (3) the attendance of next year's Devil's Hole Workshop.

Thank you very much and if you have any questions please feel free to contact us. I can be reached at 520-670-6671 X 222, or by email at jphoffma@usgs.gov.

Sincerely,

John P Hoffmann
Associate Director, AZWSC

cc: Nick Melcher, USGS, Tucson
Robert J. Hart, USGS, Flagstaff
Jamie Macy, USGS, Flagstaff
Robert Burrows, USGS, Henderson, NV
Kathy Gilmore, Nye County
Jamie Walker, Nye County
Levi Kryder, Nye County
Judd Sampson, Nye County
John Klenke, Nye County

Figures attached

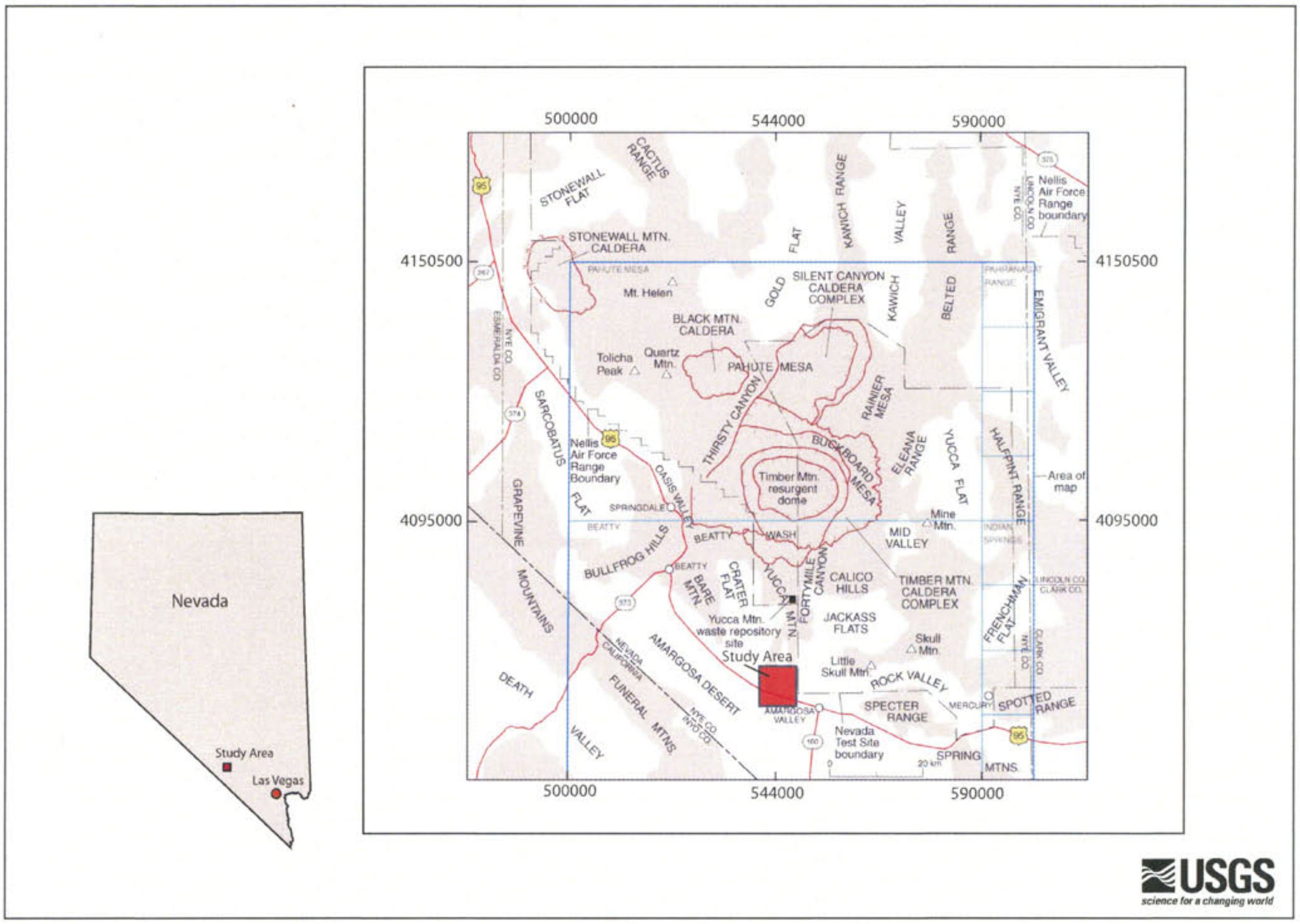

Figure 1. Location map of Nevada and area surrounding Yucca Mountain (after Slate and others, 1999).

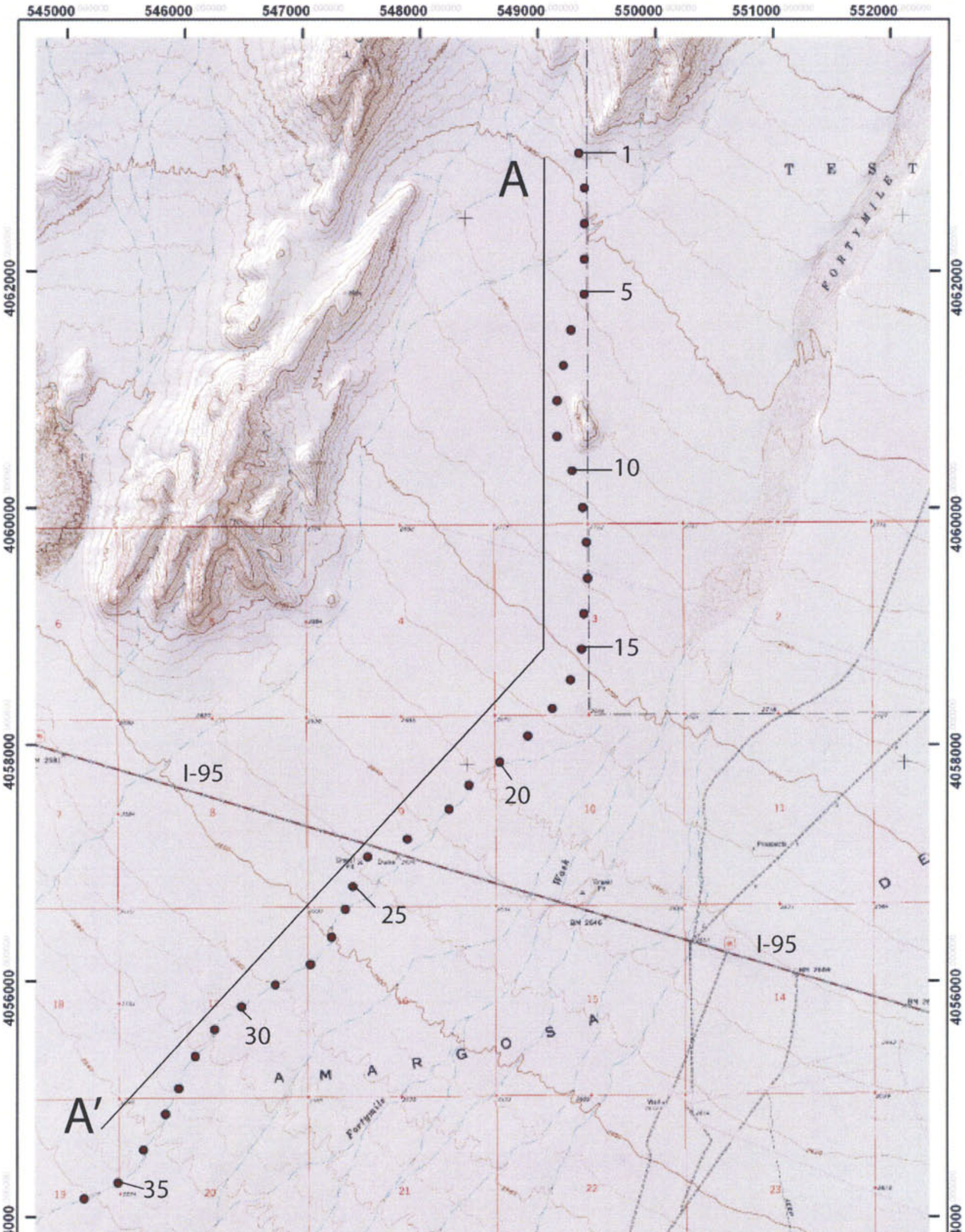

Figure 2. Map of study area with electrode positions marked with red dots. The Resistivity profile is marked from A to A′.

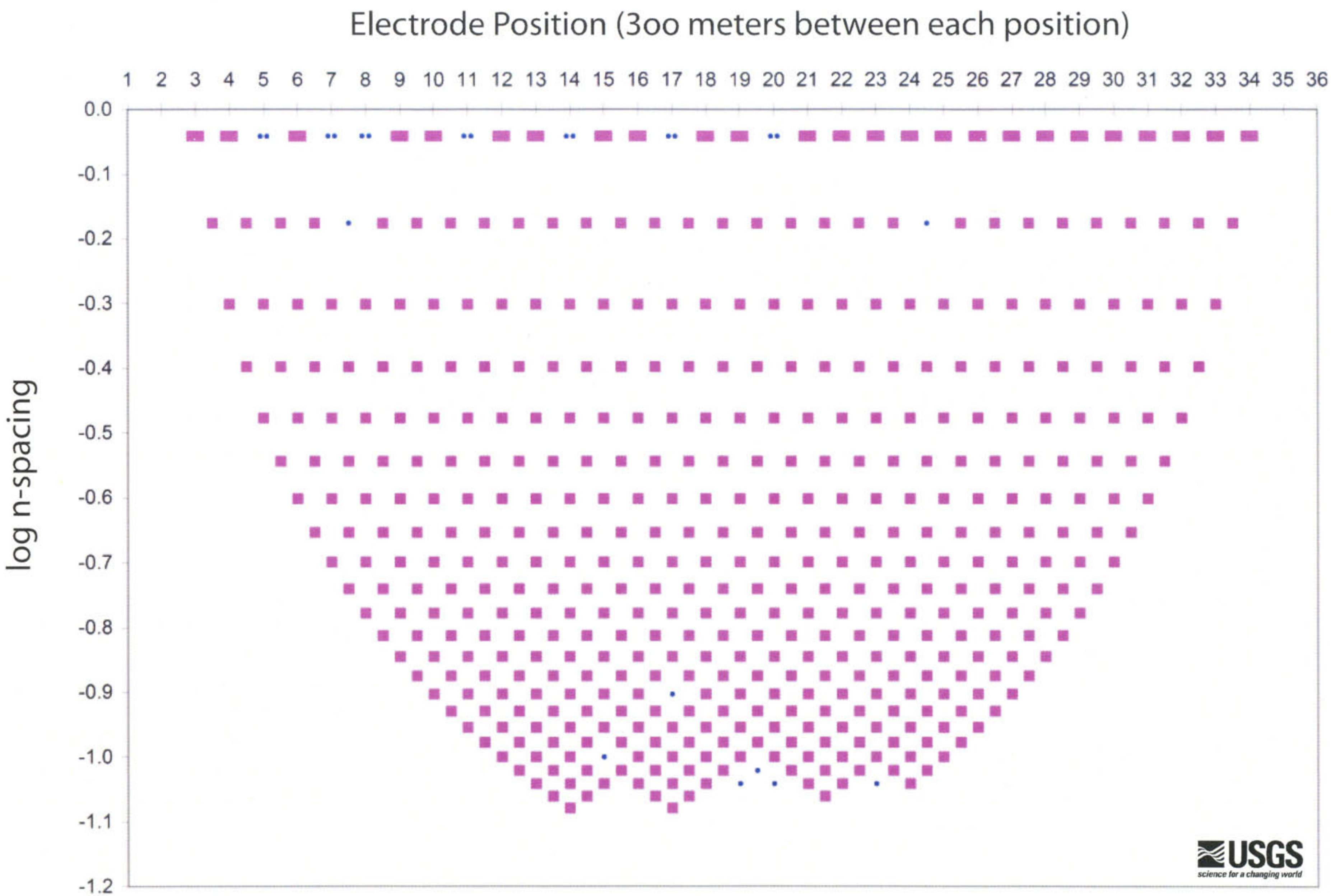

Figure 3. Dipole-dipole simulation of measured data. Red squares indicate measured data point and blue dots indicate missing data point.

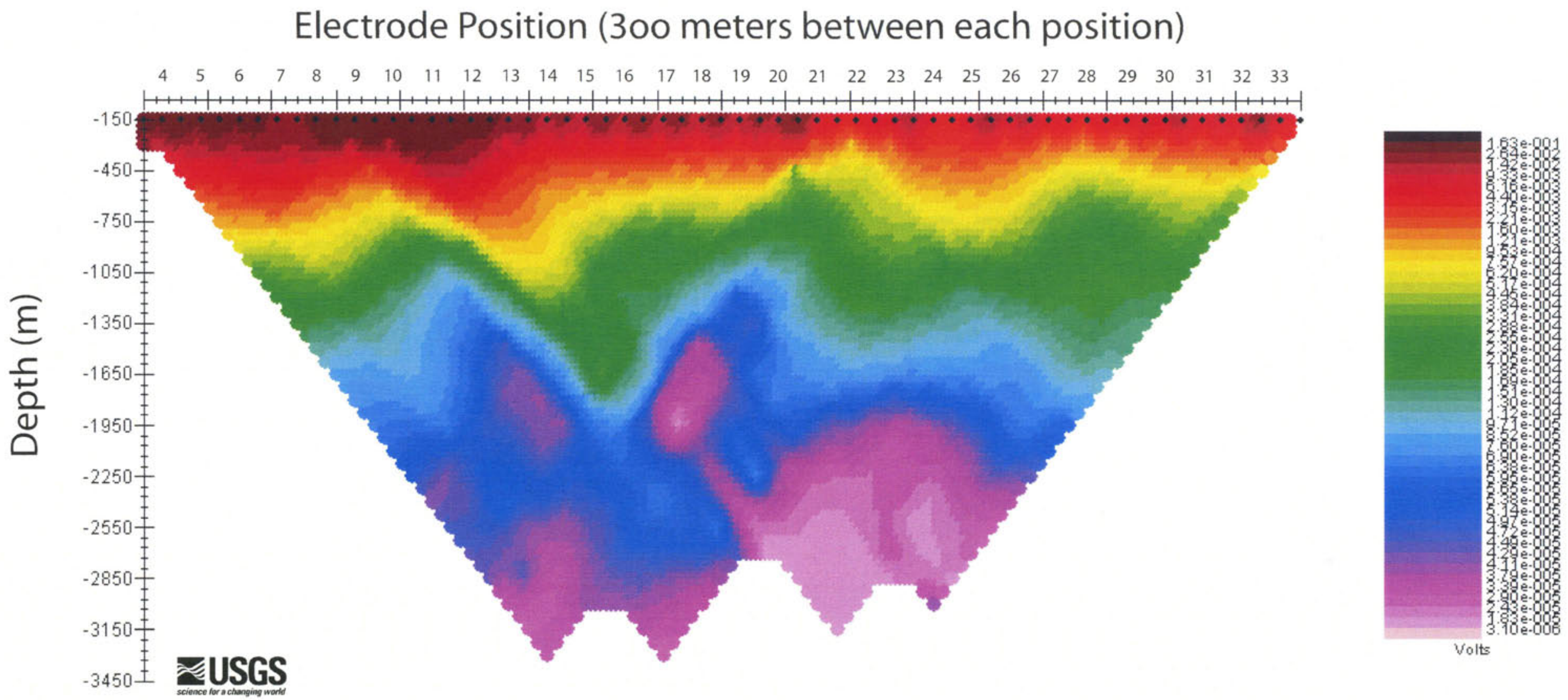

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Figure 4. Pseudosection of voltages measured during resistivity survey. Units are volts and the pseudosection was plotted and interpolated by PetRos Eikon EMIGMA software.

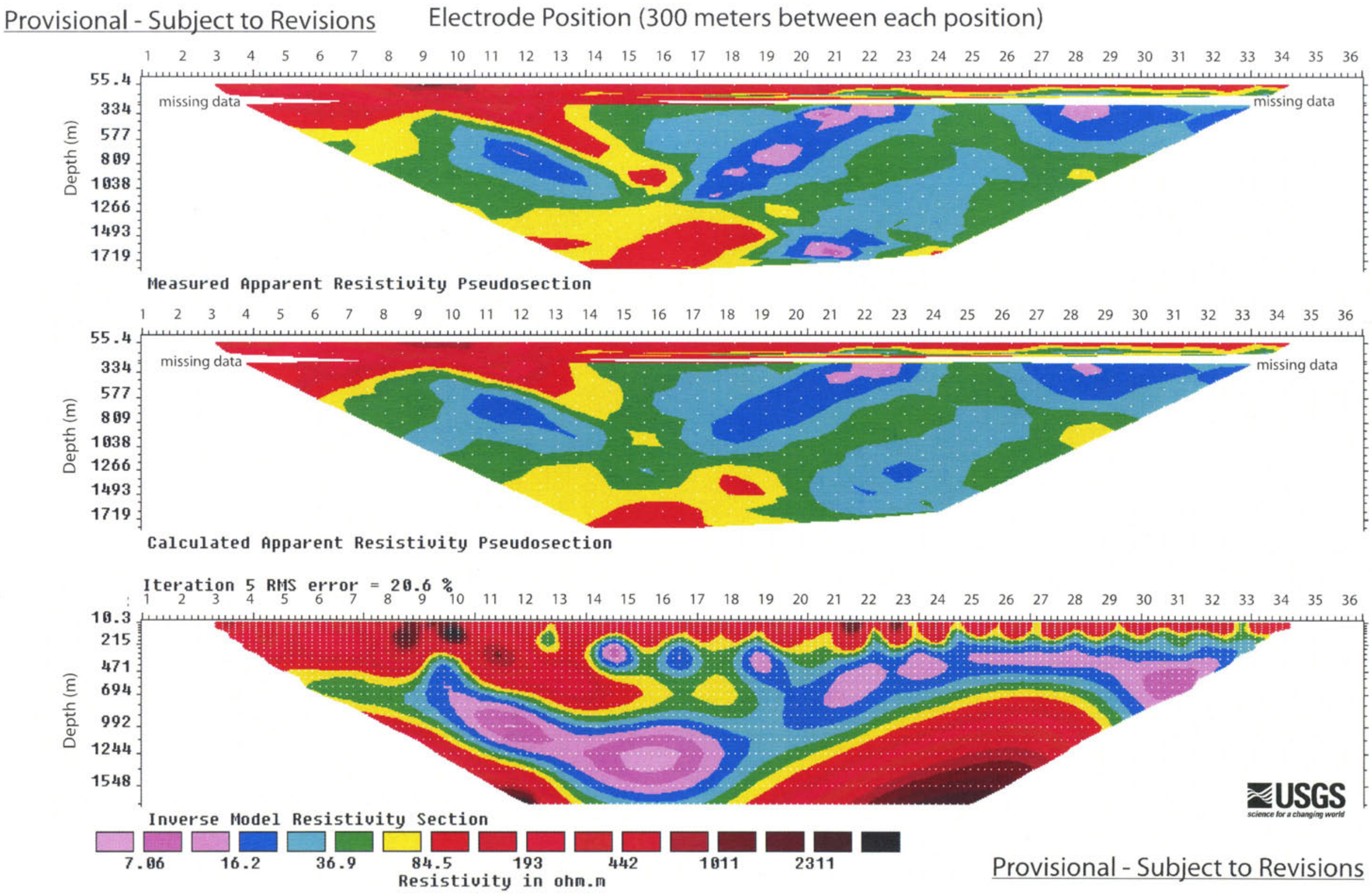

Figure 5. Measured and calculated apparent resistivity pseudosections using Loke Res2D software. Inverse model resistivity section also using Loke Res2D. Areas with warm colors (yellow, orange, red) have high resistivity and areas with cool colors (purple, blue, green) have low resistivity. The measured and calculated apparent resistivity pseudosections show areas of high resistivity from electrode positions 1 to18 and a change to lower resistivity from electrode positions 20 to 34. The inverse modeled data shows a distinct change in resistivity near electrode positions 18 to 20 which may be the Paintbrush Canyon Fault system.

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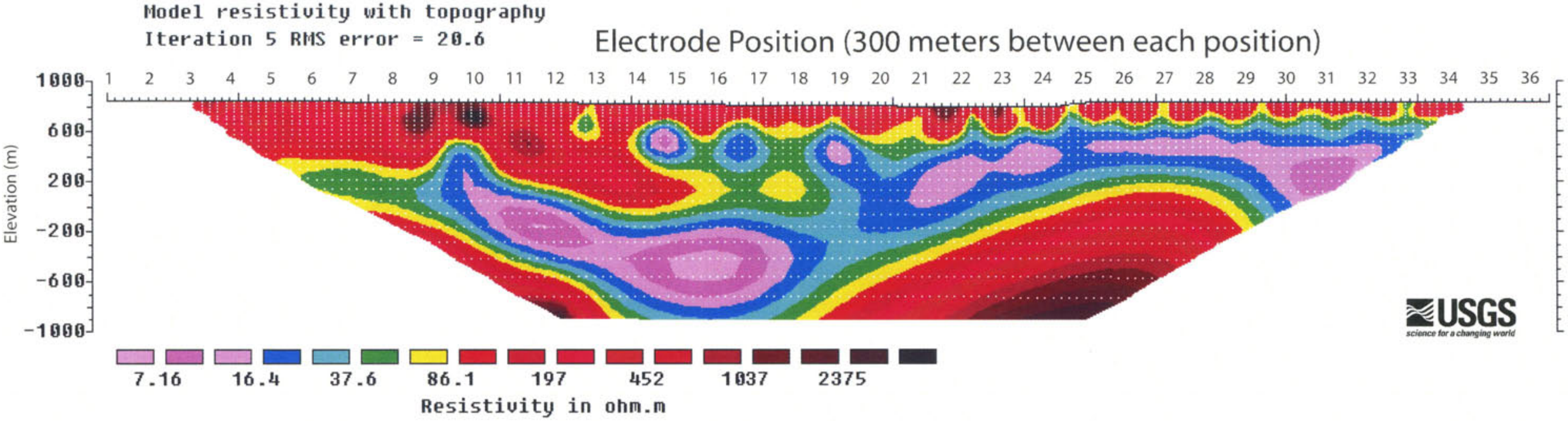

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Figure 6. Inverse model resistivity section with compensated topography. Inverse model with topography confirms areas of higher resistivity from electrode positions 1 to 18 and lower resistivity from position 20 to 34. There is a distinct change in resistivity near electrode position 18 to 20. Inverse model resitivity section was calculated by Loke Res2D software.

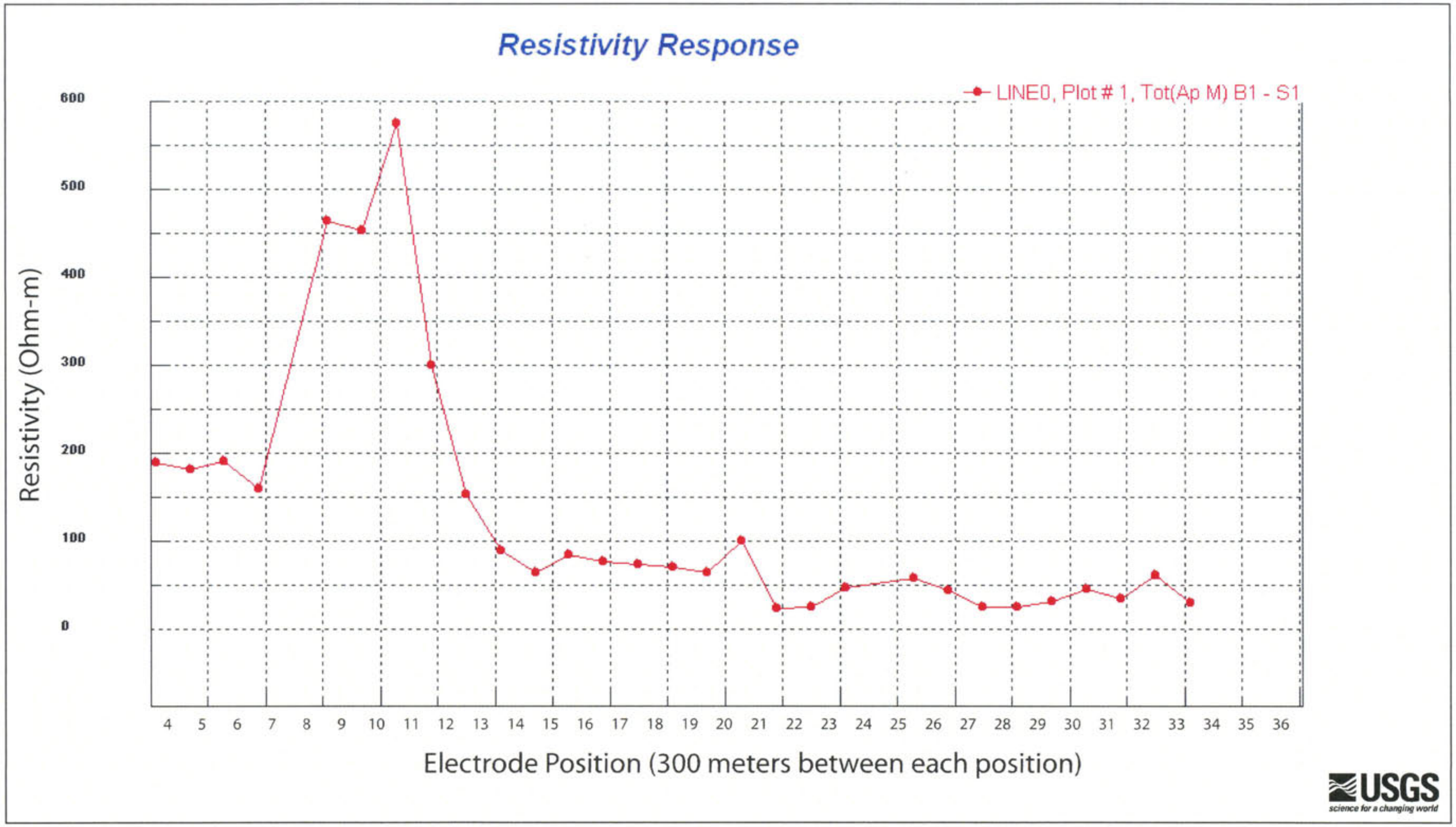

Figure 7. Linear resistivity response calculated using PetRos Eikon EMIGMA software. The peak near electrode position 20 indicates a possible fault zone. The large peak near electrode positions 8 to 10 also indicate possible faulting associated with an outcrop tuffaceous bedrock from the Paintbrush Group.