3. Surface survey

The surface survey was done in the Coober Pedy Precious Stones Field

Unlike traditional methods the maps show the true resistivity at the true location, so that geological features can be seen directly without further interpretation. The profile shows smooth resistivity contours with the Russo Beds being resistive and the silcrete horizon being most resistive particularly where it is thickest. Weathered, leached and bleached Bulldog Shale (good sandstone) is clearly contained within a moderate to high resistive zone (orange) while the underlying less weathered Bulldog Shale is confined to the low resistivity zone (green and blue).

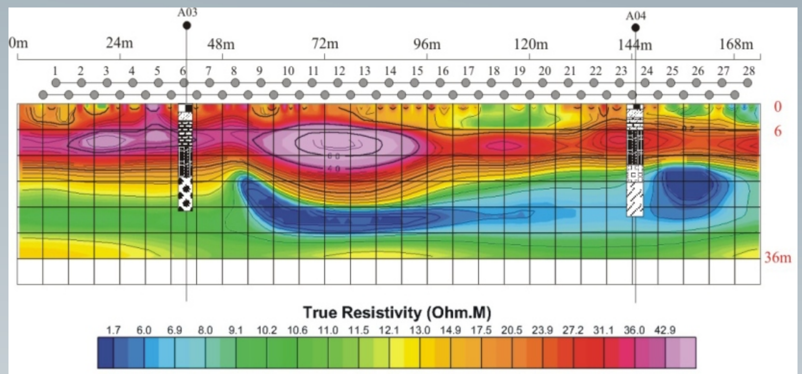

Figure 5. The inverted true resistivity profile from the surface survey done in the Coober Pedy Precious Stones Field.

4. Physical Modelling

Laboratory Down-hole Simulation

A down-hole simulation was conducted using a metal rod suspended in a water filled test tank, oriented near perpendicular to the plane of an electrode array simulating two boreholes as shown in Figure 6. This set up simulates a full 28 electrode array with 14 electrodes spaced at equal intervals in each borehole.

Figure 7 shows the inverted data with the position of the metal rod superimposed. The low resistivity (dark blue zone) of the metal rod is clearly visible. The halo and skewing visible in the image is a limitation of the water tank.

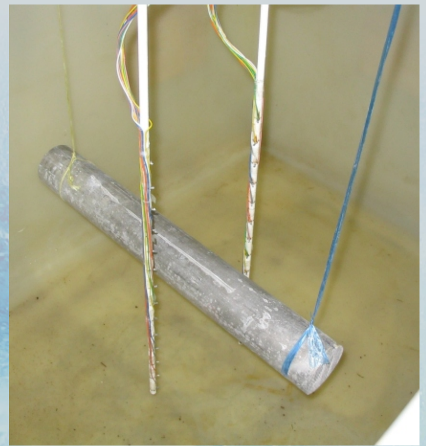

Figure 6. Test tank with suspended body between 2 simulated boreholes. Tap water was used during the test.

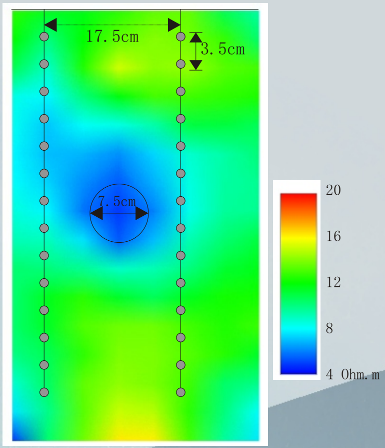

Figure 7. Inversion result with position of metal rod superimposed.

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FlashRES64

- The fastest geo-electric multi-electrode data acquisition system in the world (61 channel capacity)
- 60k data points may be collected using a free acquisition configuration with 64 electrodes
- Advanced 2.5D inversion system
- Specially designed for borehole-surface, borehole-borehole surveys
- Capable of high resolution surface surveys

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Australia

Advantages of FlashRES64 Resistivity Imaging system

- 61 Channel data acquisition system that allows 61 independent measurements to be made simultaneously.
- A novel free electrode configuration is used which can acquire data as in traditional data acquisition configurations (Schlumberger, Wenner etc) and MORE. For example, using 64 electrodes approx. 1000 data points may be collected with any one traditional method. However, with our novel free configuration method and 64 electrodes, over 60k data points can be collected.
- 2.5D inversion software can convert FlashRES64 data sets into a true resistivity image to show the underground geological structure directly.
- Inversion of the larger FlashRES64 data set obtains far superior images in comparison with smaller data sets obtained with traditional arrays.
- Real time full waveform display of current and potential measurements allow observation of noise, self potential and faulty electrode contact.

FlashRES64 is versatile and is capable of borehole-to-surface, borehole-to-borehole and surface resistivity surveys.

The special problems the system can be used to solve

- Detect caves and underground water resources
- Delineate ore bodies with the surface or crosshole method
- Delineate geological structures between tunnels with the crosshole method
- Data acquisition for laboratory resistivity and other specialized modelling

Main Specifications

Receiver:
Electrodes: 64
Channels: 61
Input impedence: >10^7 Ohm.m
AD resolution: 16 bits
Suppress for 50Hz: >80dB

Transmitter:
Three output voltage options:
30V, 90V, 250V
Current: <3A

Others:
working temperature: −20−+50 ℃
Working humidity: 95%RH
Instrument power: 12V Battery

FlashRES64

CASE STUDIES

1. Surface borehole survey

FlashRES64 was used to detect caves beneath and beside bridge legs. It is very important to accurately find caves for structural reasons (refer to figure 1). A surface−borehole resistivity survey was employed to resolve this problem. In this case, 16 electrodes were placed down a borehole and 48 electrodes were placed on the surface. FlashRES64 was able to collect all possible potential readings for each combination of current electrodes. This meant data was obtained for over 60k points. Figure 2 shows the inversion image obtained from the data set. It can be seen that there is a low resistivity anomaly on each side of the borehole. By drilling holes on both sides of the borehole, two caves were found which were subsequently filled with water and mud.

Fig. 1

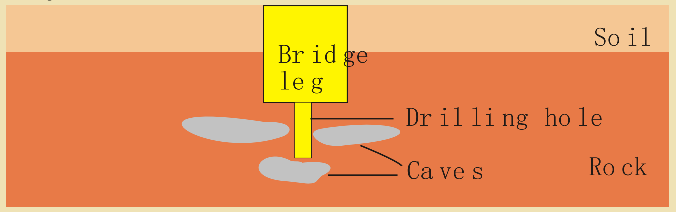
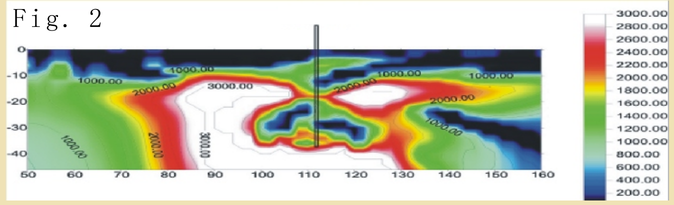


Fig. 2



2. Crosshole survey

In May 2006, a crosshole resistivity survey was conducted in the Hebei province of China to find aquifer zones. As shown in the diagram on the right, only 7 electrodes were used in the left borehole, and 14 electrodes were used in the right borehole. These were the only ranges that could be used for the electrodes, since other sections of the boreholes were cased with PVC pipes. The electrode interval is 6m. With a special data acquisition arrangement, about 2500 data points were collected in ten minutes. The data were inverted into a true resistivity section as shown in the right diagram. It is obvious that there is a high resistivity band in the middle part of the survey area which corresponds to a sandstone layer that decreases in thickness from right to left. The layers above and below the sandstone layer are limestone with high porosity. Limestone with a high water content has relatively low resistivity which is apparent in the resulting image. Borehole logging and core recording data concurred with the inversion image image.

Fig. 3

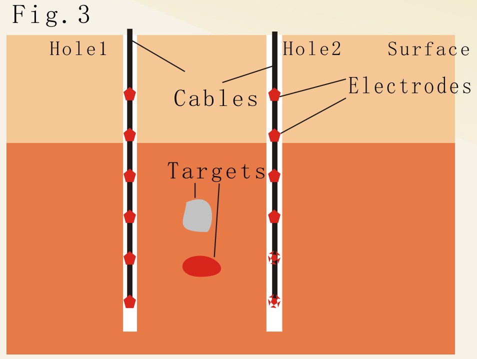


Fig. 4