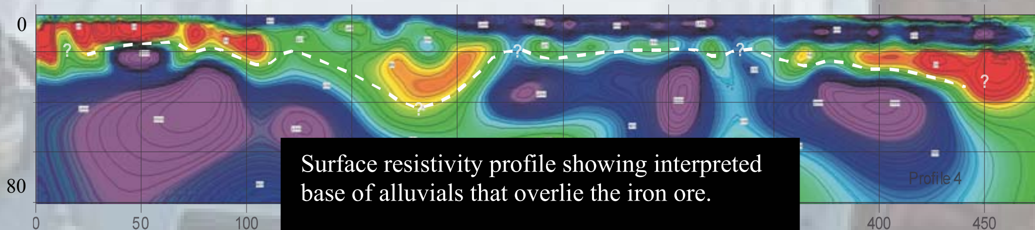
Mining Case Study: Mapping Iron Ore Deposits

Subsurface Imaging undertook a series of high resolution geophysical trials at a Western Australian iron ore prospect. The deposit is pisolitic which can exceed 40 m in thickness, and is overlain by up to 40 m of alluvium. The alluvial deposit grades into the ore zone of clay/pisolite at depths of 40 – 60 m. The objective of the resistivity imaging was to map out the top boundary of the ore package in order to track areas where a major alluvial channel has eroded into this.



Surface resistivity profile showing interpreted base of alluvials that overlie the iron ore.

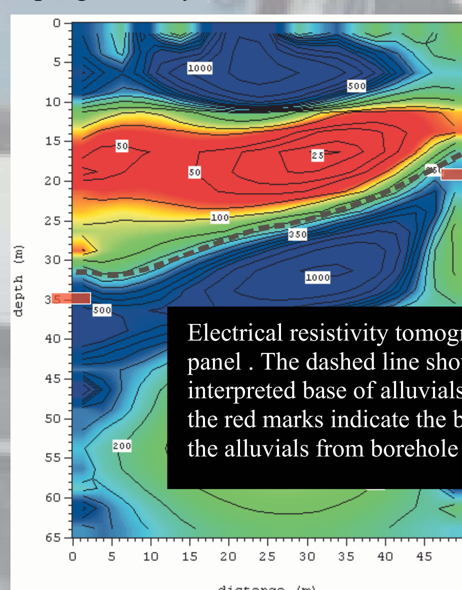
The resistivity methods used to track the alluvial channel were:

- Surface electrical resistivity imaging to track the alluvial channel
- Crosshole electrical resistivity tomography (ERT) also to track the alluvial channel

Five 475 m long surface resistivity profiles were acquired, three of these along existing northeast-southwest gridlines, and along two oblique lines cutting across the former. These provided cross-sectional images to a depth of approximately 70 m. In addition, eight panels of crosshole ERT were acquired using boreholes on these lines. This afforded a direct comparison between surface and crosshole ERT for different borehole configurations.

These approaches confirmed an electrical structure where the resistive ore zone (typically hundreds to a few thousand Ohm.m) was overlain by conductive alluvial, and underlain by progressively more conductive ore/clay waste.

Surface ERT delineated the geometry of the alluvial channel to a vertical resolution of about 5 m, and a lateral resolution of a few 10s of metres. The ore zone appeared to become progressively more conductive towards



Electrical resistivity tomography panel . The dashed line shows the interpreted base of alluvials, and the red marks indicate the base of the alluvials from borehole data.

the northeast, where the alluvial channel development was at maximum thickness. It is not clear if this

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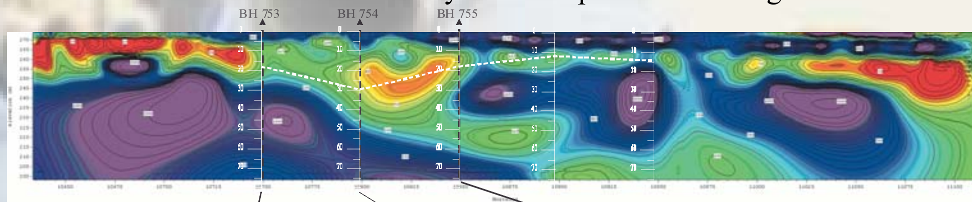
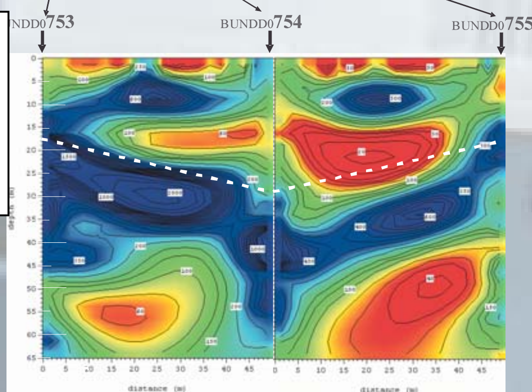
corresponds to alluvial contamination, or a transition to more friable ore.

Overall, the crosshole ERT provided a reliable indication of electrical structure to a borehole spacing of up to about 75 metres. This was indicated by the good correlation between surface and crosshole ERT.





Comparison between the results from surface resistivity and crosshole resistivity tomography.

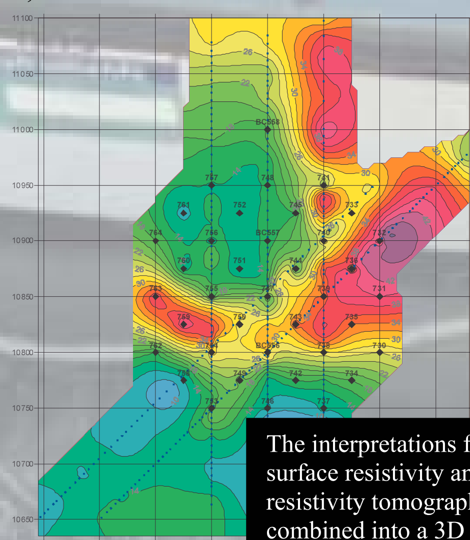
Clearly the tomography shows a greater level of detail. However, it would take several crosshole panels to covers the same area as a full surface resistivity image.

It was possible to map the alluvial boundary very precisely, often to a precision of 1 – 2 metres, and in addition, the results at a 100 m borehole spacing were superior to those which might be theoretically predicted.

Survey rates for this work were one or two 475 m surface resistivity lines per day and about 4 crosshole ERT panels per day. Crosshole ERT requires direct electrical coupling to the environs of the borehole. Generally this is easily achievable, but a different procedures for casing boreholes, or a change in groundwater level could require that the surveying strategy be modified.

It is concluded that surface resistivity is applicable for mapping the alluvial channel geometry at this, and similar deposits. A large area could be efficiently and cost effectively covered in a short time and by using electrode configurations which concentrate in the zone of interest.

Surface resistivity imaging is a fast and cost effective alternative to extensive in mine drilling. Crosshole resistivity data can compliment either surface resistivity and/or existing boreholes to clarify more complex areas.



The interpretations from the surface resistivity and resistivity tomography is combined into a 3D surface of the base of the alluvials. This data can help in ore volume assessment and mine planning.

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