2D REGOLITH MAPPING WITH GROUND PENETRATING RADAR AND TIME DOMAIN EM AT A RECENTLY DISCOVERED Cu-Au OREBODY: WHITE DAM, CURNAMONA CRATON, SA

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INTRODUCTION

White Dam is a Cu-Au prospect approximately 31 km NE of Olary, in the Curnamona Craton of South Australia. It was discovered by a regional geochemical soil survey, in the area where the deposit is sub-cropping. Much of the area, however, is buried by less than 2 m of transported regolith. There is limited bedrock exposure in the area, and the thickness of the regolith increases to the north. Although the topography is very subdued, there are several distinct and mappable regolith types in and around the area of mineralisation (Brown & Hill 2003). Six north-south orientated costeans have recently been dug through the regolith into bedrock in and around the mapped zone of mineralisation. The sides of each costean are 'windows' into the regolith profile, but they are limited in their extent and are expensive and labour intensive to create. These provide an invaluable basis for correlation with geophysical expressions of the regolith in this area, and from this develop a more efficient means of characterising the regolith profile across the area.

This study has used two geophysical methods: Ground Penetrating Radar (GPR); and Time Domain Electromagnetics (TEM). The systems used in the survey were the pulseEKKO 100 GPR from Sensors and Software Ltd., and the early-time NanoTEM developed by Zonge Engineering. NanoTEM data estimate the conductivity profiles of the subsurface, which will provide information about the conductivity of the regolith as well as the underlying bedrock. GPR will provide information about interfaces such as those between regolith and bedrock, as well as between distinct layers in the regolith. The conductivity data from the NanoTEM profiles may also be used to further interrogate the GPR data, as the conductivity of the subsurface is intimately related to the rate at which the GPR signals are attenuated with depth. GPR signals can penetrate several tens of metres, which is beyond the depth of transported regolith in this area, and extends into the underlying weathered bedrock. The GPR and nanoTEM surveys in the White Dam area were conducted between 25 and 29 August, 2003.

GROUND PENETRATING RADAR SURVEY PROFILES

Seven GPR profiles were conducted in the White Dam area (Figure 1). Two pairs of antennae were used: a longer 25 MHz antenna providing deeper signal penetration but lesser resolution; and a shorter 50 MHz antenna providing higher resolution but less signal penetration. A separation of 2 m between the transmitting and receiving antennae was used for the 50 MHz surveys, with a step size (the distance both antennae are moved along the survey line between readings) of 50 cm. For the 25 MHz surveys, the separation was 4 m, and the step size was 1 metre. Small saltbush and bluebush shrubs between 5 and 20 cm high were abundant, and hampered the positioning of the antennae flat against the ground. Most of the area was covered by a 50 m grid of star-pickets. These were used to align the geophysical survey profiles parallel to the costeans.

A single vehicle was used to carry both NanoTEM and GPR equipment sets to the accommodation at Tikalina Station (Figure 2) with only one set of equipment being used on each day. The GPR, for example, fits easily into the back of a tray-back vehicle, along with a trolley courtesy of Zonge Engineering. The GPR antennae were stored in long wooden boxes which were secured to the roof of the vehicle.

The Figure 3 shows survey logistics and Figures 4 and 5 show some preliminary results. The GPR data plots show reflections from profiles equivalent to the costeans, as they were carried out approximately 20 m from the sides of the costeans.

TIME DOMAIN ELECTROMAGNETISM SURVEY PROFILES

The nanoTEM data were collected with a configuration of 20 x 20 m transmitter loop and 5 x 5 m receiver loop as shown in Figure 6. Two NanoTEM profiles were conducted with a length of 400 m and 520 m.

These time domain EM data were processed and inverted quickly to produce preliminary resistivity plots which are shown in Figure 7. The lower plot is the first line, and the upper plot is the second line. Along the first survey line, 2D depth-resistivity distribution demarcates a more highly resistive region in the middle and less resistive regions on both ends of the profile. The higher resistivities are also extended towards both sides

In: Roach I.C. ed. 2003. *Advances in Regolith*, pp. 86-90. CRC LEME.

at shallow depth. Similarly, on the second survey line (eastern), the depth-resistivity distribution shows the presence of a thick depositional formation with lower resistivity values on the northern side and shallow, resistive basement on the southern side of the profile. The very low resistivity (ca. 2 Ωm) zone on the second plot is at 5-10 m depth.

CONCLUSION
Initial results from the GPR and NanoTEM surveys show that combined data sets can be used to constrain geophysical structures of the regolith. Linking the attenuation of GPR with resistivity can be used to better interpret each section.

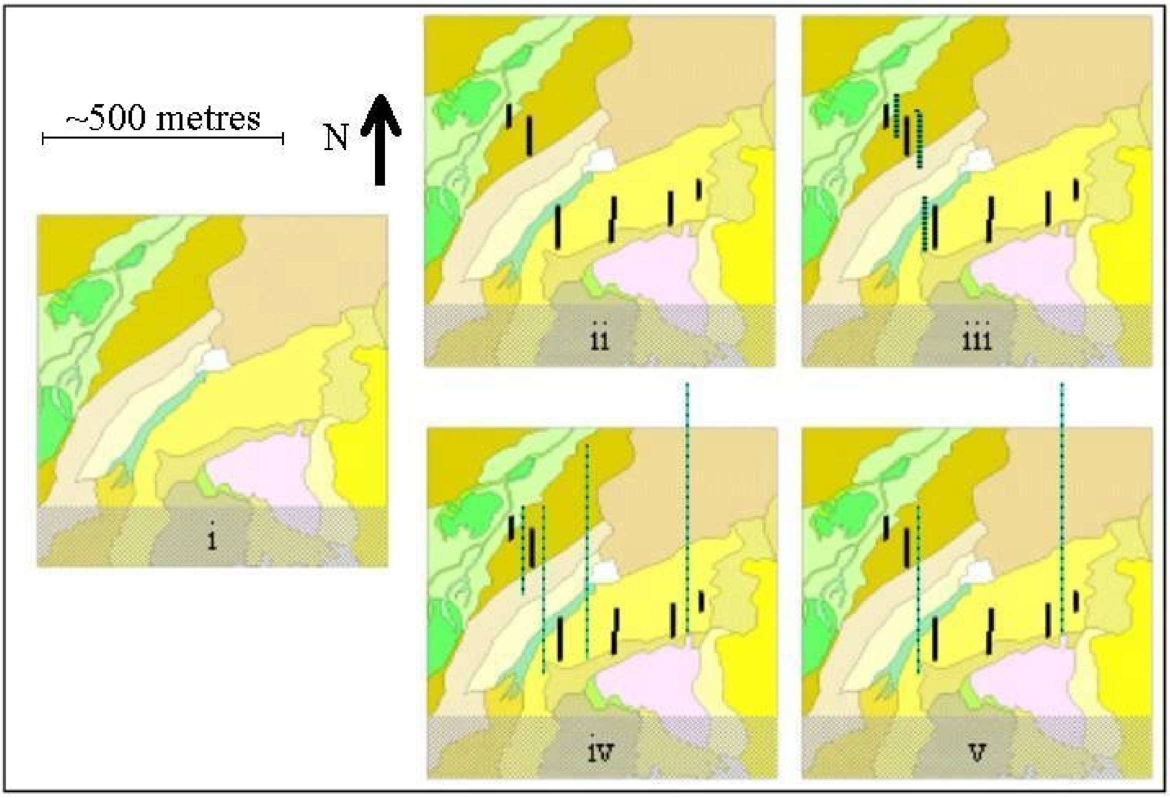

Figure 1: Diagrams show a summary of the survey lines conducted in White Dam. (i) A regolith-landform map of White Dam area (Brown & Hill 2003); (ii) the locations of the 6 costeans; (iii) the three lines of 50MHz GPR; (iv) the four lines of 25MHz GPR and (v) the two NanoTEM lines.

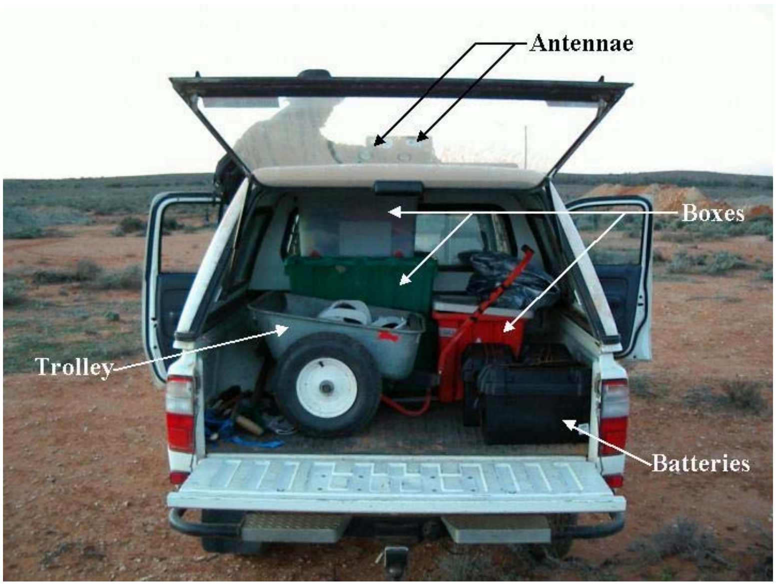

Figure 2: Field vehicle with equipment.

Figures 3a and b: GPR survey using 50 MHz antennae (a) and 25 MHz antennae (b)

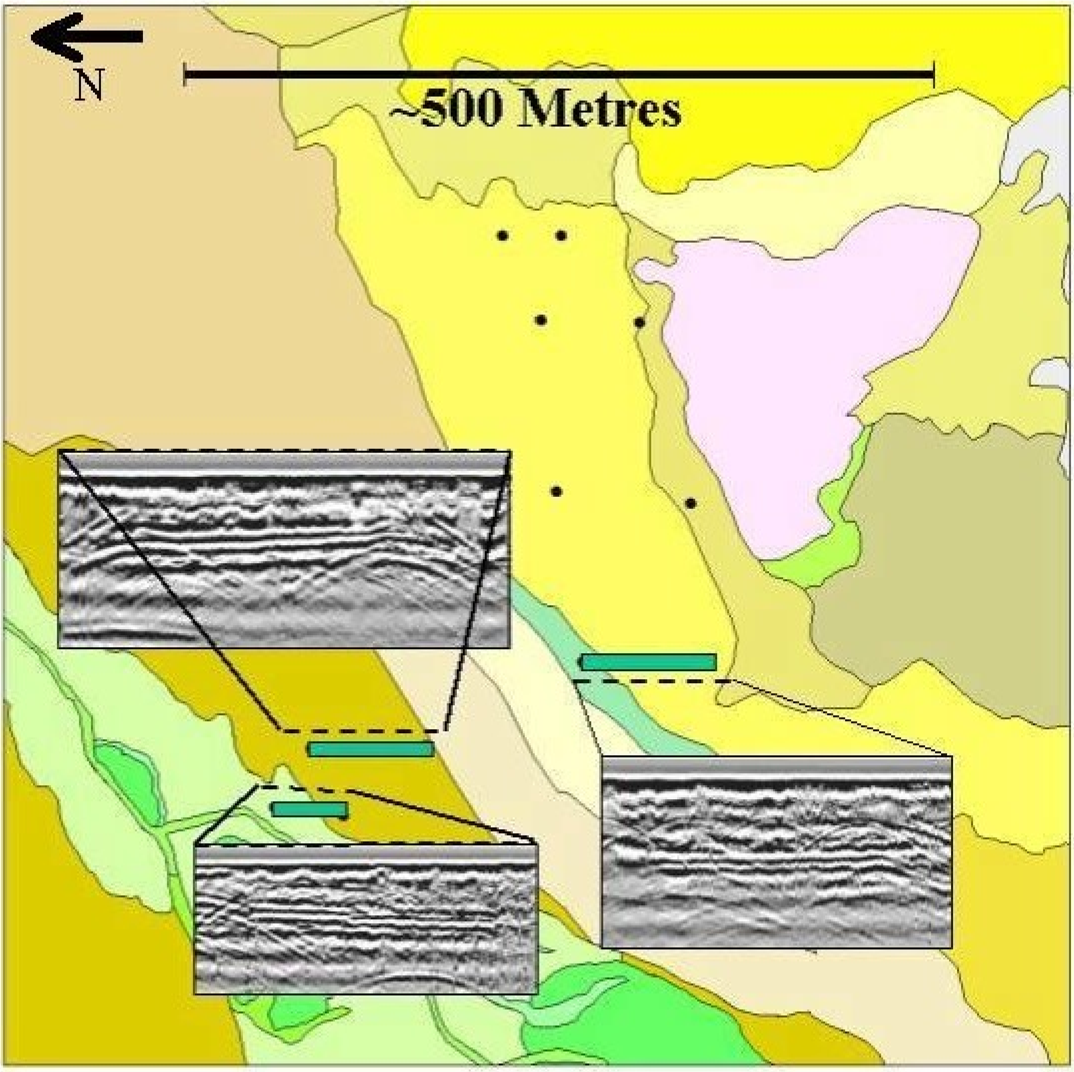

Figure 4: 50 MHz data sets and shown as cross section reflection profiles. The vertical scale is about 150 ns two-way travel time, which converts to a depth scale of about 10 m. A spherical coefficient gain was applied to the data, which has not been migrated.

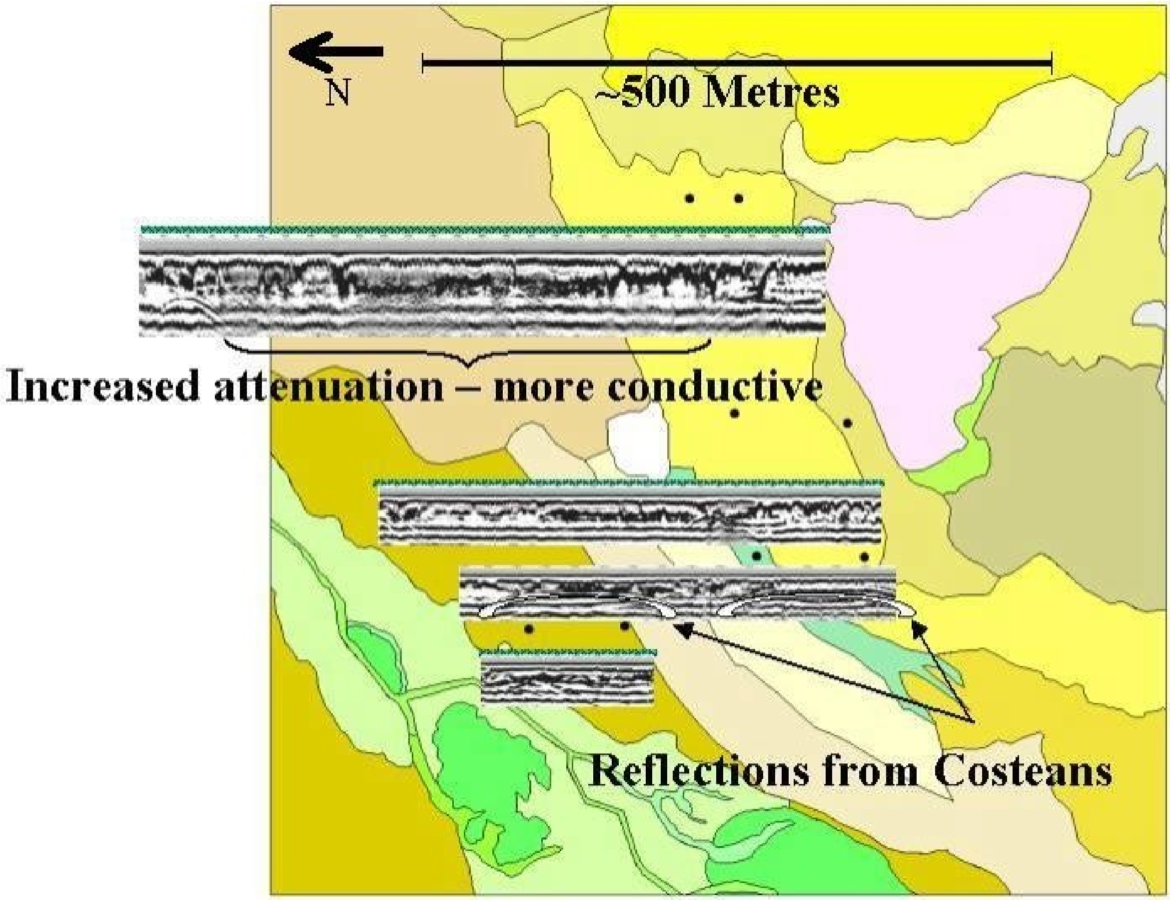

Figure 5: 25 MHz data sets and shown as cross section reflection profiles. The vertical scale is about 250 ns two-way travel time, which converts to a depth scale of about 20 m. Spherical coefficient gain was applied to the data, which has not been migrated

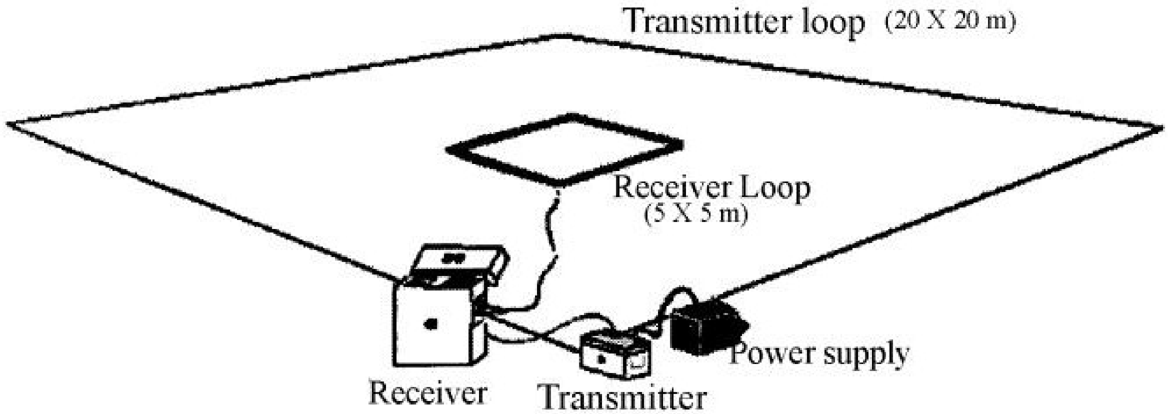

Figure 6: NanoTEM field configuration with outer transmitter loop and inner receiver loop.

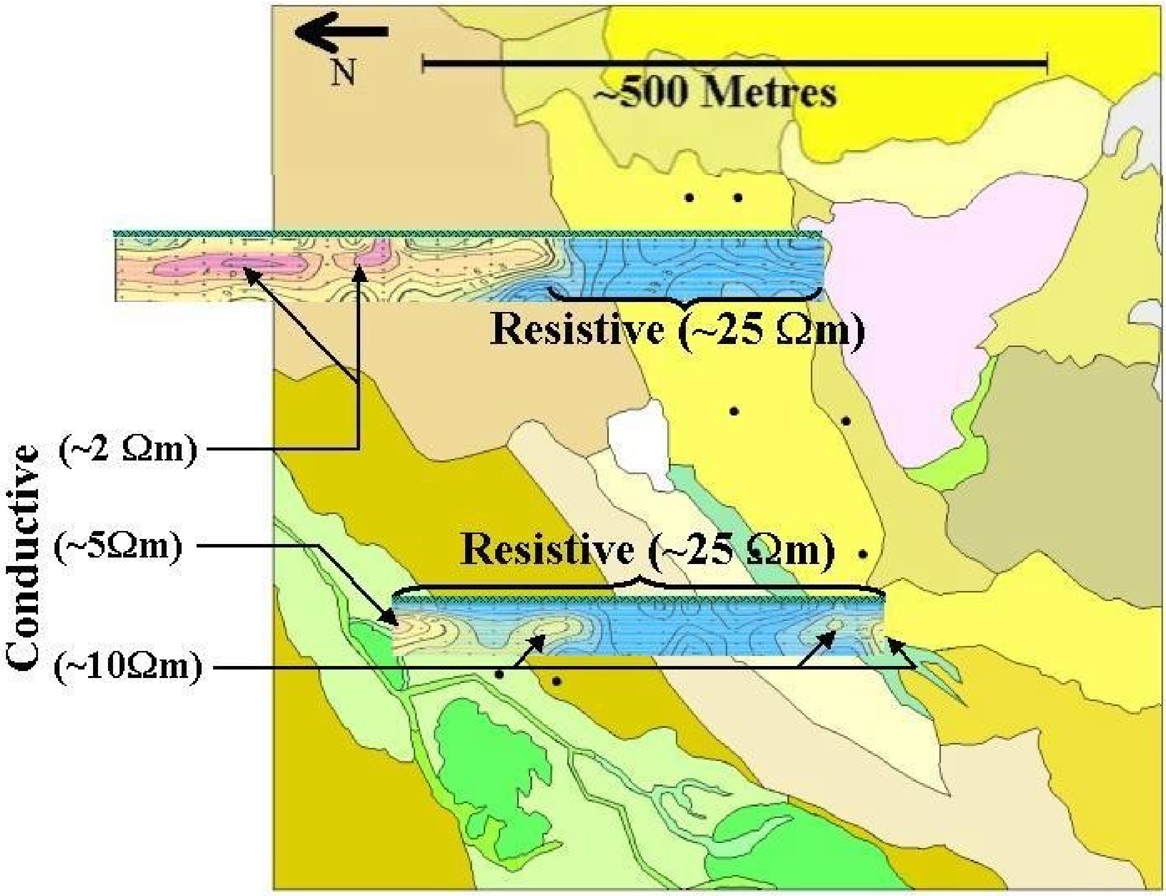

Figure 7: Resistivity sections inverted from NanoTEM data. The depth scale is approximately 40 m

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Acknowledgments: We thank Mike Hatch and Zonge Engineering for their persistent and ongoing support. Flinders University of South Australia kindly lent the GPR system for the survey.