MINERAL MAPPING AND SPECTRAL LOGGING OF THE GAWLER CRATON

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A major campaign of spectral core logging was undertaken between 29 September 2003 and 25 January 2004 at PIRSA's Glenside Core Storage Facility using the HyLogger core scanner developed by CSIRO's Detection Technologies Group. The HyLogger offers an objective means of capturing detailed mineralogical data while providing a high-resolution digital image of the drill core. The instrument is built around a visible to short wave infrared spectrometer coupled with a high quality linescan camera. A computer-controlled X-Y table manages the rate of core feed and provides the precision needed to integrate the data sets. PIRSA was an active sponsor in the development of the system undertaken by CSIRO with AMIRA International (Project P685) sponsorship.

106 of the 357 holes scanned with the HyLogger in the recent campaign addressed regolith issues. 58 of the holes where chip trays. High resolution images of the core trays and automated mineralogical logs plotted by depth constitute the main products. With ancillary information provided, assay data, lithological logs and petrophysical logs can be incorporated with the interactive display.

Central Gawler Gold projects identified for this analysis included the Tarcoola Gold Mine, Barns Prospect, Tunkillia, and Lake Harris Greenstone Belt. By way of demonstration this presentation will focus on the Tarcoola Gold Mine. In this example a strong correlation has been found between the mineralogy of the weathering/alteration profile and the distribution of Au (Mauger et al., 2004).

Selected to investigate the relationship between recorded Au values and alteration minerals, 12 diamond holes from the Perseverance Prospect, BHP holes TD001-TD012, were scanned during the campaign.

Analysis of individual holes revealed the overriding spectroscopic pattern to be controlled by weathering and host lithology (Figure 1). Depth of weathering, indicated by the presence of kaolin and goethite, is variable but extends to around 70m. Host lithologies beyond the base of weathering show evidence of hydrothermal alteration in the form of hematite and phengitic white mica. Mineral species identified from HyLogger which were found to be common across holes included kaolin, illite, muscovite, phengite, montmorillonite, hematite, goethite, chlorite, carbonate, alunite, and jarosite.

Given their close spatial proximity, it proved possible to merge all 12 holes in a single file for analysis emphasising mineralogical associations and trends. Kaolin and goethite clearly characterise the weathered zone to 70m. This zone also includes sulphate species alunite and jarosite (Figure 2) – both weathering products of sulphides. Near the base of the weathered zone there is a distinct smectitic zone which corresponds with high iron oxide

(FeOx) intensity and the highest recorded Au values (max 64 ppm). Variation in wavelength of the Al(OH) absorption, which reflects changes in white mica geochemistry, does not correlate with variations in Au grade (Figure 3). Although overall white mica composition is predominantly phengitic a negative correlation between the presence of illite and Au was observed in unweathered rock.

The presence of hematite and phengitic white mica in cores of unweathered rock are indicative of hydrothermal alteration (Figure 3). Chlorite, carbonate and epidote and the depletion of Al(OH) minerals correlate with thin intrusions of diorite.

The understanding of the regolith at this stage is that there exists a zone of supergene Au enrichment near the base of the weathered zone characterised by the presence of highly crystalline kaolinite, smectite and alunite interpreted as the products of weathering an illite and sulphide primary assemblage. Below the supergene zone weathering continues but with little or no sulphate. Au values are elevated below the supergene zone but there has yet to be identified a clear correlation with alteration mineralogy. Further work is needed to verify the mineralogical trends further a field within the mineralised zone and to better quantify the alteration system at depth.

References:

Mauger, A.J., Keeling, J.L. & Huntington, J.F., 2004, Bringing remote sensing down to earth: CSIRO HyLogger as applied in the Tarcoola Goldfield, South Australia. 12th ARSPC, Fremantle, October 2004.

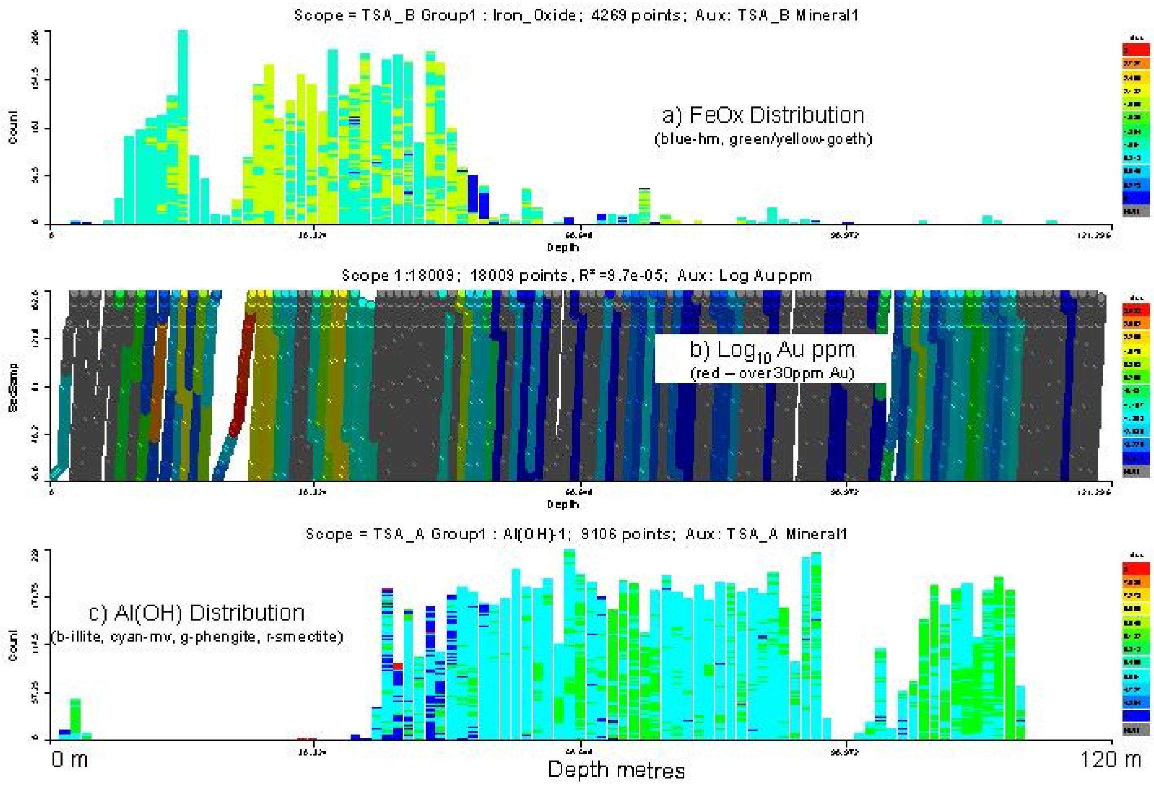
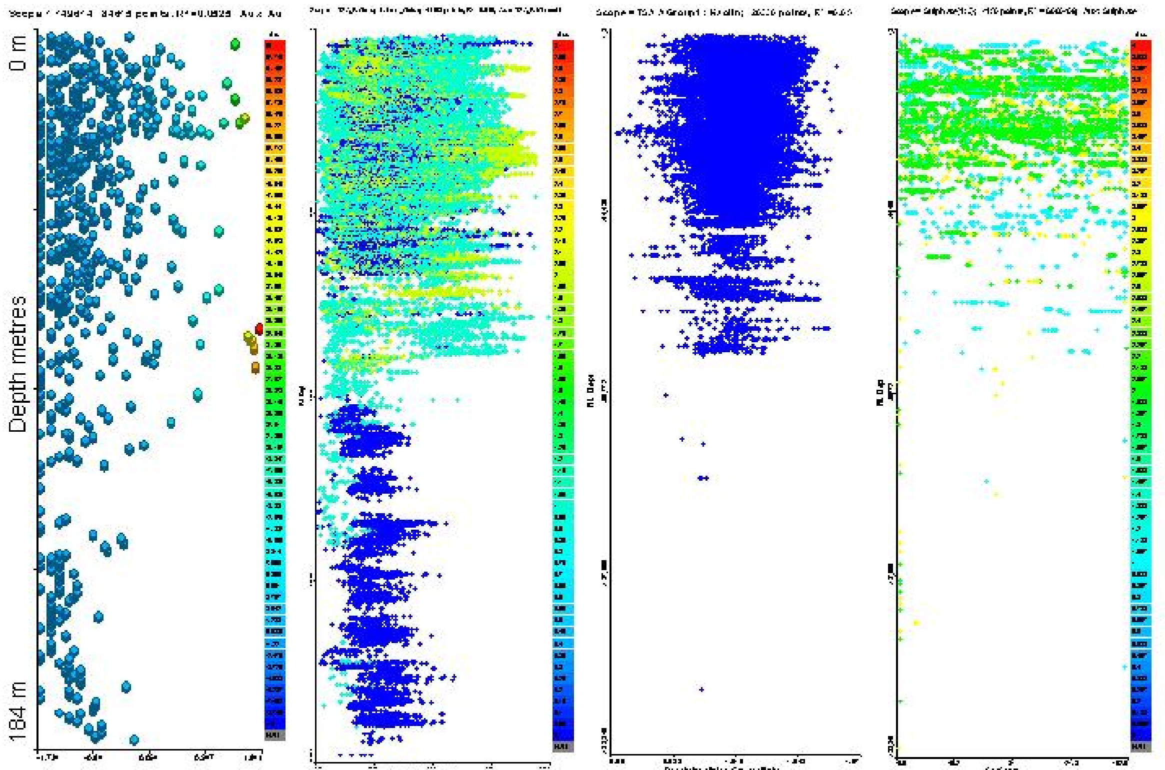


Figure 1: Tarcoola Ridge Drillhole TD001: Histograms showing downhole mineral distribution.



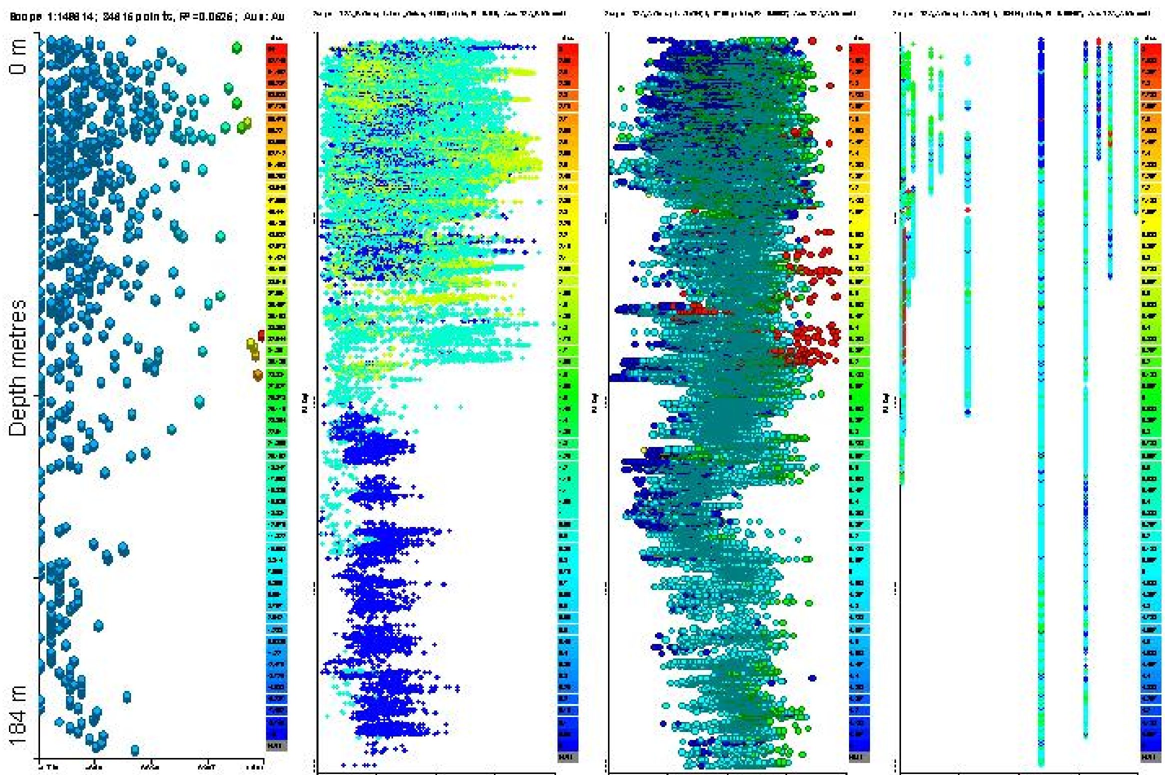
a) Log_{10} Au ppm (coloured by Au ppm 0-64)

b) FeOx Intensity (blue-hm, green/yellow-goeth)

c) Kaolin Distribution

d) Sulphate Distribution (y-Na-Alunite, g-K-Alunite, b-Jarosite)

Figure 2: Tarcoola Ridge Drillholes TD001-TD012 combined showing weathering



a) Log_{10} Au ppm (coloured by Au ppm 0-64)

b) FeOx Intensity (blue-hm, green/yellow-goeth)

c) Wavelength Al(OH) (red-smect, blue-illite, cyan-mv, green-pheng)

d) Collar Easting (drillholes coloured by Al(OH))

Figure 3: Tarcoola Ridge Drillholes TD001-TD012 combined showing Al(OH) & FeOX distribution.