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OPEN FILE REPORT SERIES

SUPERGENE GOLD DISPERSION IN THE REGOLITH AT THE KANOWNA BELLE AND BALLARAT LAST CHANCE DEPOSITS, WESTERN AUSTRALIA.

D.J. Gray

CRC LEME OPEN FILE REPORT 226

November 2008

(CRC LEME Restricted Report 155R / E&M Report 772R, 2000
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CRC LEME is an unincorporated joint venture between CSIRO-Exploration & Mining, and Land & Water, The Australian National University, Curtin University of Technology, University of Adelaide, Geoscience Australia, Primary Industries and Resources SA, NSW Department of Primary Industries and Minerals Council of Australia.

Headquarters: CRC LEME c/o CSIRO Exploration and Mining, PO Box 1130, Bentley WA 6102, Australia

The CRC LEME–AMIRA Project 504 "**SUPERGENE MOBILIZATION OF GOLD IN THE YILGARN CRATON"** was carried out over the period 1998 to 2001. Twelve reports resulted from this collaborative project.

CRC LEME acknowledges the support of companies associated with and represented by the Australian Mineral Industries Research Association (AMIRA), and the major contribution of researchers from CSIRO Exploration and Mining.

Although the confidentiality periods of the research reports have expired, the last in July 2002, they have not been made public until now. In line with CRC LEME technology transfer goals, re-releasing the reports through the **CRC LEME Open File Report (OFR) Series** is seen as an appropriate means of making available to the mineral exploration industry, the results of the research and the authors' interpretations. It is hoped that the reports will provide a source for reference and be useful for teaching.

OFR 217 – Characteristics of gold distribution and hydrogeochemistry at the Carosue Dam prospect, Western Australia – DJ Gray, NB Sergeev and CG Porto.

OFR 218 – Gold distribution, regolith and groundwater characteristics at the Mt Joel prospect, Western Australia – CG Porto, NB Sergeev and DJ Gray.

OFR 219 – Supergene gold dispersion at the Argo and Apollo deposits, Western Australia – AF Britt and DJ Gray

OFR 220 – Geochemistry, hydrogeochemistry and mineralogy of regolith, Twin peaks and Monty Dam gold prospects, Western Australia – NB Sergeev and DJ Gray.

OFR 221 - Supergene gold dispersion in the Panglo Gold deposit, Western Australia – DJ Gray.

OFR 222 – Gold concentration in the regolith at the Mt Joel prospect, Western Australia – DJ Gray.

OFR 223 – Gold dispersion in the regolith at the Federal Deposit, Western Australia – NB Sergeev and DJ Gray.

OFR 224 – Supergene gold dispersion in the regolith at the Cleo deposit, Western Australia – AF Britt and DJ Gray.

OFR 225 – Distribution of gold arsenic chromium and copper in the regolith at the Harmony Deposit, northern Yilgarn, Western Australia – AF Britt and DJ Gray

OFR 226 – Supergene gold dispersion in the regolith at the Kanowna Belle and Ballarat Last Chance deposits, Western Australia – DJ Gray

OFR 227 – Supergene gold dispersion, regolith and groundwater of the Mt Holland region, Southern Cross province, Western Australia – AF Britt and DJ Gray.

OFR 228 – Supergene mobilization of gold and other elements in the Yilgarn Craton, *Western Australia* – ***FINAL REPORT*** – DJ Gray, NB Sergeev, CG Porto and AF Britt

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PREFACE

The principal objective of CRC LEME-AMIRA Project 504, *Supergene mobilization of gold and other elements in the Yilgarn Craton*, is to determine the mechanisms of supergene/secondary depletion, enrichment and dispersion of Au and other elements, so as to improve selection of drilling targets and further optimize interpretation of geochemical data.

The Kanowna Belle and Ballarat Last Chance Gold Deposits are located approximately 20 km NNE of Kalgoorlie. This region has saline and acidic groundwaters and is strongly influenced by palaeochannel systems. A major palaeochannel system (QED) occurs to the northwest of the study area. The two deposits studied in this report have thin (generally < 10 m) transported cover. Mineralization in the residual regolith occurs in the partially oxidized zone (equivalent to saprock and the lower saprolite). There is a major contrast in the degree of depletion between the two deposits which could be due to geomorphological and/or geological factors.

The Kanowna region offers a useful area in which to investigate Au dispersion in residual regolith. Comparisons with study sites of similar bedrock, regolith development and palaeotopography have the potential to further our understanding of the differences in Au dispersion at different sites and thus this study fits well within the objectives of the Project.

D.J. Gray
Project Leader
December 2000

ABSTRACT

The Kanowna Belle and BLC Au deposits are located approximately 20 km NNE of Kalgoorlie, at latitude 30° 36' S and longitude 121° 36' E. The Kanowna study area is within the folded volcano-sedimentary sequence to the southeast of the Scotia-Kanowna granitoid. The region has undergone widespread carbonation and metamorphic grade is lower to mid greenschist facies, increasing to lower amphibolite facies adjacent to the granitic core.

Palaeotopography, regolith transitions and Au geochemistry of the Kanowna Belle and BLC Au deposits have been displayed using the program Mining Visualization System ©. Using logging provided by Delta Gold N.L., the residual profile has been divided into bedrock, partially oxidized (equivalent to saprock and lower saprolite) and completely oxidized (upper saprolite and above) regolith. Transported cover, composed of colluvial, alluvial and aeolian sediments, overlies the entire region. The regolith layers and Au distribution were modelled and the average thickness and Au concentration of each regolith layer calculated. Gold concentrations were also calculated as a function of elevation and on either side of the base of weathering, the base of complete oxidation and the unconformity.

Kanowna Belle is positioned along a valley flank, and contains primarily felsic / volcanic lithologies with near vertical ore shoots. Refractory primary Au is associated with pyrite and minor arsenopyrite, chalcopyrite and sphalerite. The regolith is 50 – 80 m deep, comprising mean thicknesses of 16 m partially oxidized regolith, 27 m completely oxidized regolith and 5 m transported cover. There is substantial deepening of the regolith over the mineralized structure. The highest grades occur in the partially-oxidized zone, with upward reduction in Au concentration in the completely-oxidized zone, and lowest grades in the transported cover. There is a clear increase in Au concentrations upward from the weathering front, with the depletion occurring above the base of the completely oxidized zone. Depletion is greater than 85% in upper saprolite.

The distribution of Au in the partially oxidized zone is still highly correlated with underlying mineralization, but relatively enriched in concentration. The "blanket" of Au enrichment in saprolite appears not to be due to chemical dispersion, but instead appears to be a consequence of the combination of residual enrichment up to the depletion front and a sharp depletion front, with absolute chemogenic enrichment restricted to the top few (1 to 5) metres of the this zone.

Ballarat Last Chance (BLC) is located along a subdued ridge, with primarily ultramafic lithologies and mineralization associated with sulphide-rich pods. The high S content may well be the cause of the deeper weathering within the mineralized zone. Primary Au is free and associated with quartz veins. Variation in Au concentration between different regolith units is much more subdued than at Kanowna Belle, although there does appear to be a gradual upward decrease in Au concentration in the completely oxidized zone, with a weak depletion of about 45%, similar to that at Mt Percy.

The weaker depletion at BLC and Mt Percy than at Kanowna Belle and other Kalgoorlie sites may reflect a combination of the geomorphological setting (near the top of a ridge, with a low water-table) and lithology (buffering by ultramafic rocks).

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1 INTRODUCTION

1.1 Objective

The principal objective of CRC LEME-AMIRA Project 504, *Supergene mobilization of gold and other elements in the Yilgarn Craton*, is to determine the mechanisms of supergene/secondary depletion, enrichment and dispersion of Au and other elements, so as to improve selection of drilling targets and further optimize interpretation of geochemical data.

Within this framework, this study has investigated the geochemical dispersion of Au at the Kanowna Belle and Ballarat Last Chance (BLC) Au deposits using the Mining Visualization System (MVS ™) program. This program is a useful tool for visualizing the three-dimensional patterns of Au distribution in the regolith and calculating amounts of depletion and enrichment.

1.2 Kanowna area description (from van Noort, in prep)

The Kanowna Belle and BLC Au deposits are located within the mining leases held by Delta Gold N.L. approximately 20 km NNE of Kalgoorlie, at latitude 30° 36' S and longitude 121° 36' E (Figure 1). They are located in the Boorara Domain, and within the Harper Lagoon structural zone, that extends from the Kanowna Shear Zone to the Mt Monger Fault. The dominant structural feature is the Scotia-Kanowna Anticline, a large upright, shallowly SE plunging fold, cored by the Scotia-Kanowna Granitoid. The study area is within the folded volcano-sedimentary sequence to the southeast of the granitoid. The region has undergone widespread carbonation and metamorphic grade is lower to mid greenschist facies, increasing to lower amphibolite facies adjacent to the granitic core.

Gold mineralization in the Kanowna region is hosted within the upper felsic succession of the Gindalbi Formation, incorporated within a variety of lithologies, including komatiites, high-Mg basalts, polymictic conglomerate, felsic conglomerate, fine grained epiclastic rocks and felsic porphories. Deposit styles include laminated quartz veins, quartz stockwork/vein arrays and mineralized alteration haloes in shear zones.

The deposits are situated in the catchments of the Roe palaeodrainage. The region is defined by Clarke (1994) as a partial etchplain, where relief is controlled by lithology and the position of incised palaeodrainages. Low hills comprise fresh, commonly mafic lithologies, whereas valley slopes, pediments and pediplains are often developed over more deeply weathered, commonly felsic lithologies. Palaeodrainages may cross-cut the Archaean stratigraphy and may comprise over 100 m of transported materials. They are currently occupied by playas or wide alluvial valleys. Lateritic residuum is rare within the area and form low mesas. Groundwaters are acid and saline, with moderate dissolved Au. The locations of the study areas are shown in Figure 2.

2 3D GRIDDING, VISUALIZATION AND AU CONCENTRATION CALCULATIONS

Regolith transitions and geochemistry were studied with the 3D visualization program MVS (Mining Visualisation System; © C Tech Development Corporation), using Delta Gold geochemical and logging information for a 4400 x 4000 m rectangular area (AMG 362800 - 367200 mE, 6611700 - 6615700 mN). There were major variations in logging quality and consistency, showing major spatial and temporal variations, presumably due to changes in staff and different emphases on regolith units. Only those logged regolith boundaries were used which showed good stability were used. For the Kanowna Belle and BLC sites the regolith transitions used were the base of unoxidized (weathering front), base of complete oxidation and the unconformity between residuum and transported overburden. After careful checking and filtering of the logging, the regolith transitions were delineated and used in later geochemical modelling. The processed data has also been used by van Noort (in prep) for his investigations of the QED palaeochannels.

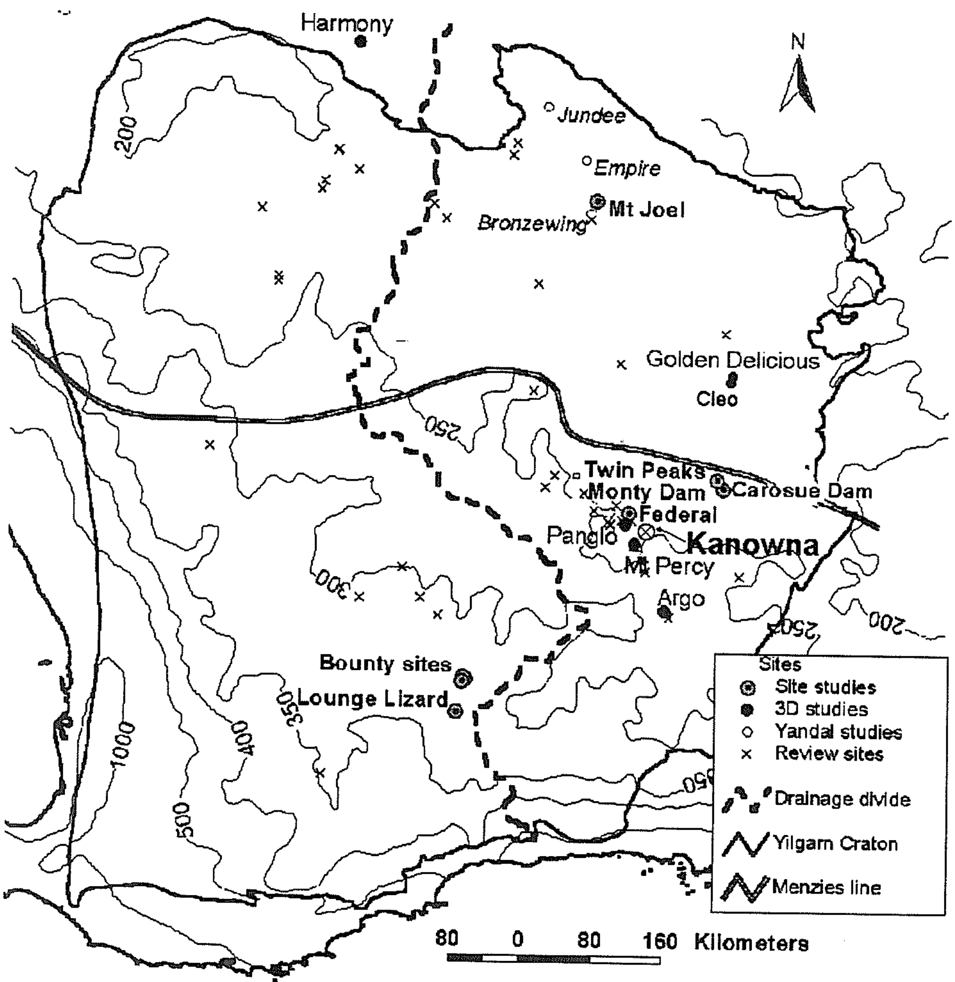

Figure 1: Location of the Kanowna area, and other sites investigated within AMIRA P504, along with the Yilgarn Craton boundary, major N-S drainage divide, Menzies line and rainfall isohyets (courtesy Bureau of Meteorology).

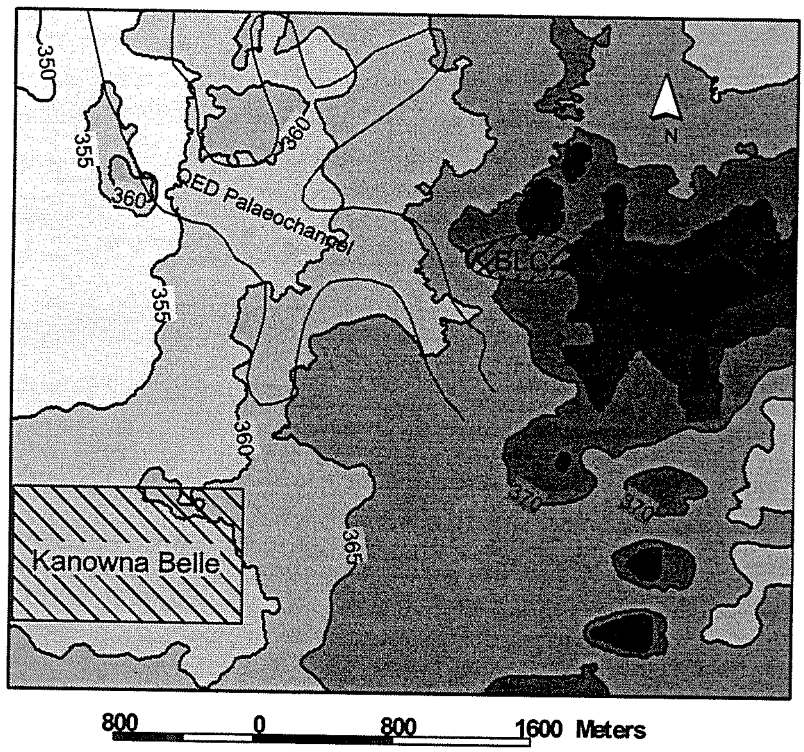

Figure 2: Position of Kanowna deposits, with surface elevation given in meters.

Regolith horizons were gridded, and 'point' anomalies removed from the input data prior to final gridding. Although this has the potential to bias the data, it was necessary to give coherent weathering horizons. For pictorial presentations, the Au data were log-transformed (base 10) before gridding. Although this affects the magnitude of the mineralization, it enhances the detail of subtle supergene redistributions. For Au concentration calculations (see below), untransformed data were used. In some cases, surface geochemical data were collected by analysis of 4 m composites, which can lead to deeper and weaker surface anomalies (*e.g.*, a horizon that is 1 m at 0.5 ppm, then 3 m at 0.1 ppm, will effectively be 4 m at 0.2 ppm where 4 m composites are used).

Gold concentrations were calculated with untransformed data. No attempt was made to model different densities for different regolith units. As the Au concentration data are as mass per unit mass rather than mass per unit volume, uniform density has only a minor influence on most calculations. The calculated concentrations do not compensate for leaching of mobile constituents: if half of the minerals have been leached then Au grade will double by residual concentration. Gold concentrations were calculated for slices defined either by elevation (e.g., 390-393 m RL) or vertical distance from a regolith boundary (*e.g.*, 3-6 m above the unconformity). Most investigations used 3 m vertical spacings.

Figure 3 illustrates nominal 3 m slices taken progressively down from the surface and the unconformity. In both cases, the slices become truncated downwards, as the analysis does not include the next regolith horizon. While this may be arithmetically correct, it can lead to over- or under-estimations of concentrations as the slices get further from the reference (*i.e.*, the surface and the unconformity, respectively). This is because, ultimately, the slice being analyzed is incomplete, due to increasing truncation. This is not a problem in the accuracy of the calculation but its geometry affects its meaning and usefulness – *i.e.*, its reliability. A reliability factor can be expressed as the mass of the slice divided by the mass of an untruncated slice (Figure 3). A reliability index of 85% indicates that the slice is 15% truncated.

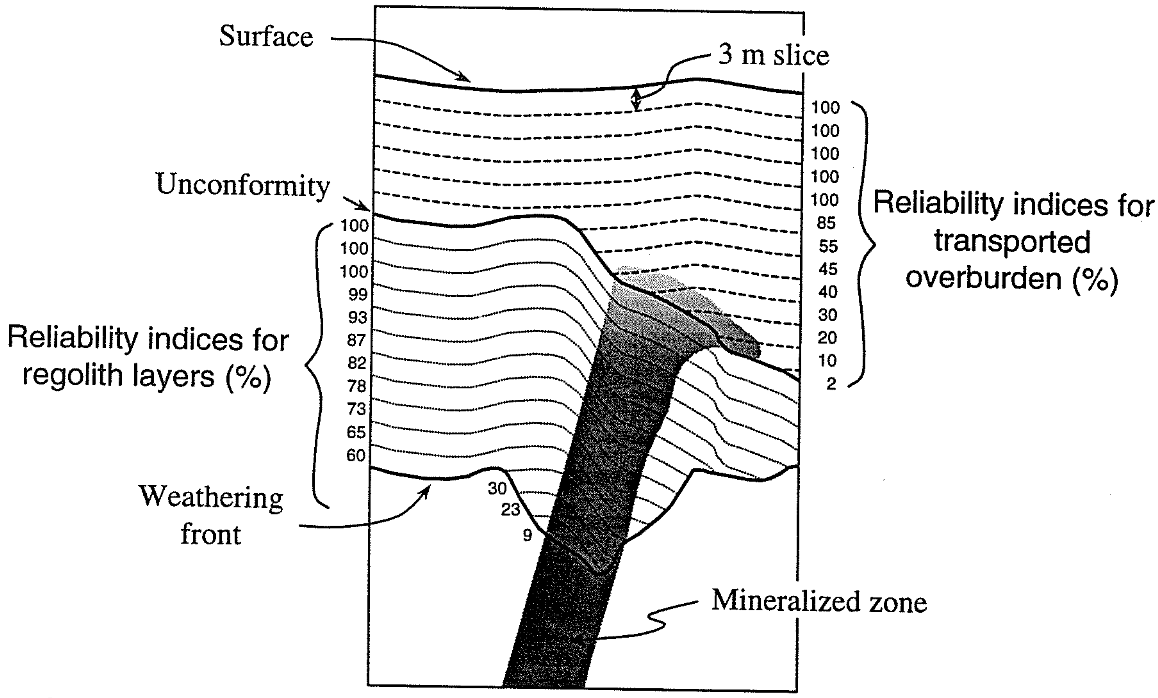

Figure 3: Diagrammatic representation of reliability indices and slices paralleling the upper surface and limited by the unconformity, as used in calculations of Au concentration shown in Figure 4.

As the reliability index decreases, significant errors begin to occur. Figure 4 shows the Au concentration measurement for each slice down from the unconformity. Although the deeper slices are truncated (Figure 4A), they can still contain mineralized material, as in this example (Figure 3). Thus, a similar mass of Au is being divided by smaller and smaller amounts of regolith, which leads to anomalous Au concentrations (Figure 4B). In this example, the results indicate that the deepest slice has up to 440 ppb Au even though the "real" Au content is invariant at 80 ppb, except for the leached zone at the top of the *in situ* regolith.

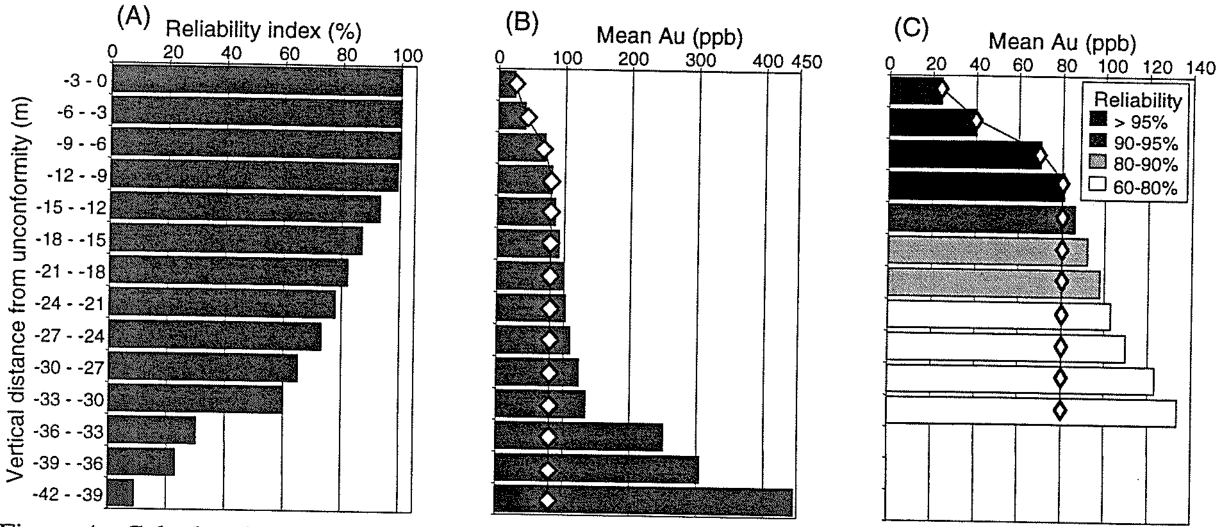

Figure 4: Calculated (A) regolith reliability, (B) unfiltered Au concentration and (C) filtered (> 60% reliability) Au concentration colour coded to reliability. Diamonds represent expected Au concentration if there were no truncation. Data based on situation represented in Figure 3.

When all the slices with reliability indices less than 60% are removed, the remaining results can be coded for reliability (Figure 4C). A much clearer picture of the Au trends is observed, illustrating the depletion at the unconformity. Note that this example is for the maximum possible overestimation of Au grade (the maximum overestimation = 100 ÷ reliability: *e.g.*, when reliability is 60%, maximum overestimation is 1.67; when reliability is 90%, maximum overestimation is 1.11). In other cases, underestimation can occur for samples with low reliability, due to truncated intersection with mineralization. In summary, those samples with reliabilities less than 80% are suspect (but can still be valuable if treated with caution), whereas those with reliability less than 60% should generally not be used.

3 3D MODELLING AT KANOWNA BELLE

Kanowna Belle is positioned along a valley flank (Figure 2), and contains dominantly felsic / volcanic lithologies with near vertical ore shoots. Refractory primary Au is associated with pyrite and minor arsenopyrite, chalcopyrite and sphalerite; Au is strongly depleted in the upper regolith and concentrated at and below the base of complete oxidation.

The regolith at Kanowna Belle is 50 – 80 deep, comprising (Delta logging) mean thicknesses of 16 m partially oxidized regolith, 27 m completely oxidized regolith and 5 m transported cover (Figure 5). The highest grades occur in the partially-oxidized zone, with upward reduction in Au concentration in the completely-oxidized zone, and lowest grades in the transported cover (Figure 6). There is a clear increase in Au concentrations upward from the weathering front (Figure 7), with the depletion occurring above the base of the completely oxidized zone (Figure 8). Depletion in upper saprolite is greater than 85%.

There is substantial deepening of the regolith over the mineralized structure (Figure 9 and Figure 10). At first sight, there appears to be well developed broadening of the Au distribution in the regolith, extending to a few hundred metres from the main orebody (Figure 10). The upper boundary of this enrichment zone corresponds to the logged base of complete oxidation (which is possibly equivalent to the upper to mid-saprolite transition). However, the depth of the supergene enrichment changes considerably sloping up from the orebody (Figure 10). In addition, the Au distribution in the partially oxidized zone is still highly correlated with underlying mineralization, but enriched relative to the underlying rock (Figure 10). Thus, it is suggested that the observed "blanket" of Au enrichment in the saprolite is not due to chemical dispersion. Instead, the geometry appears to be a consequence of the combination of residual enrichment up to the depletion front and a sharp depletion front; absolute, chemical enrichment is restricted to the top few (1 to 5) metres of the this zone. Many of these features are also observed in cut-off diagrams (Figure 11).

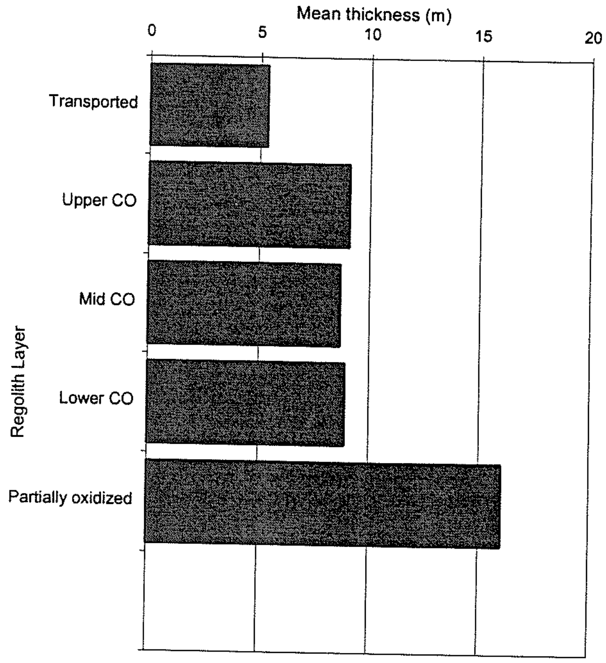

Figure 5: Mean thicknesses of regolith zones at Kanowna Belle. The completely oxidized zone (CO) is split to enhance Au data.

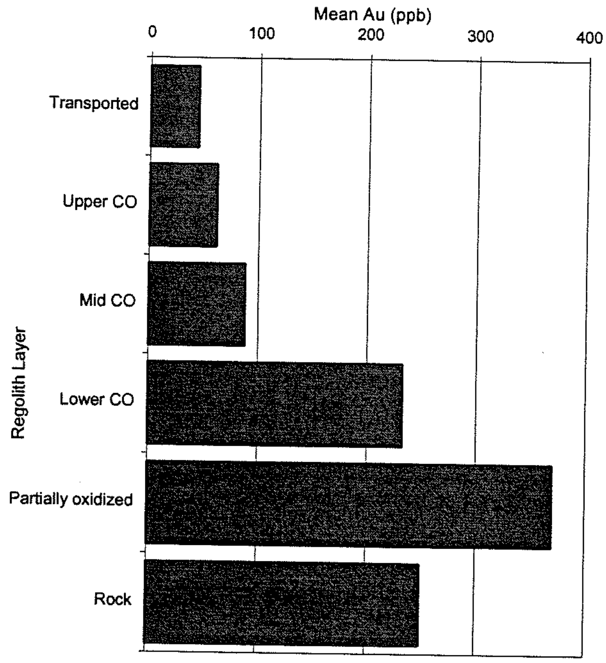

Figure 6: Mean Au concentrations of regolith zones at Kanowna Belle.

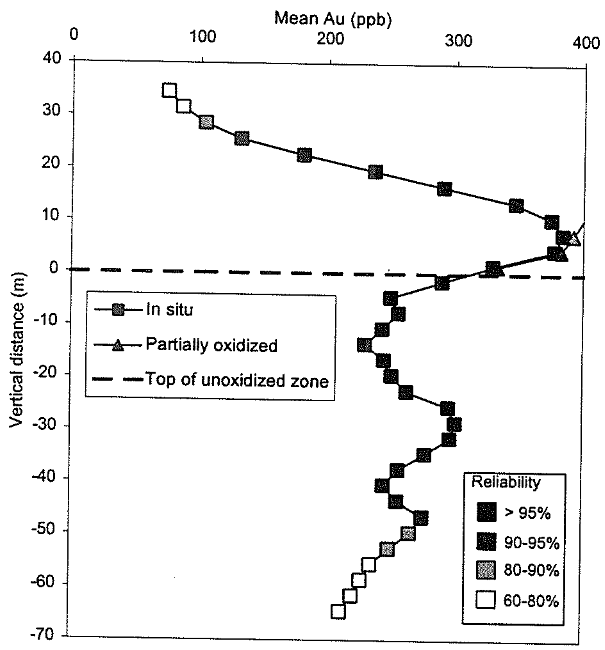

Figure 7: Mean Au concentration vs. vertical distance from the weathering front (top of unoxidized zone) at Kanowna Belle.

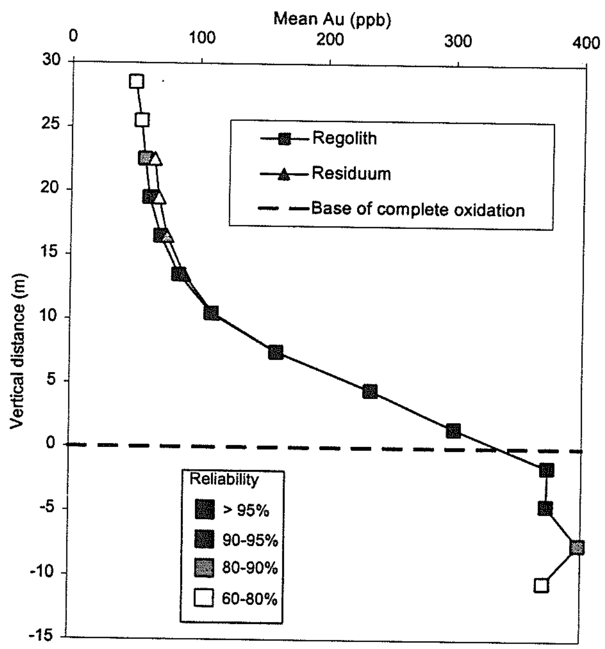

Figure 8: Mean Au concentration vs. vertical distance from the base of complete oxidation at Kanowna Belle.

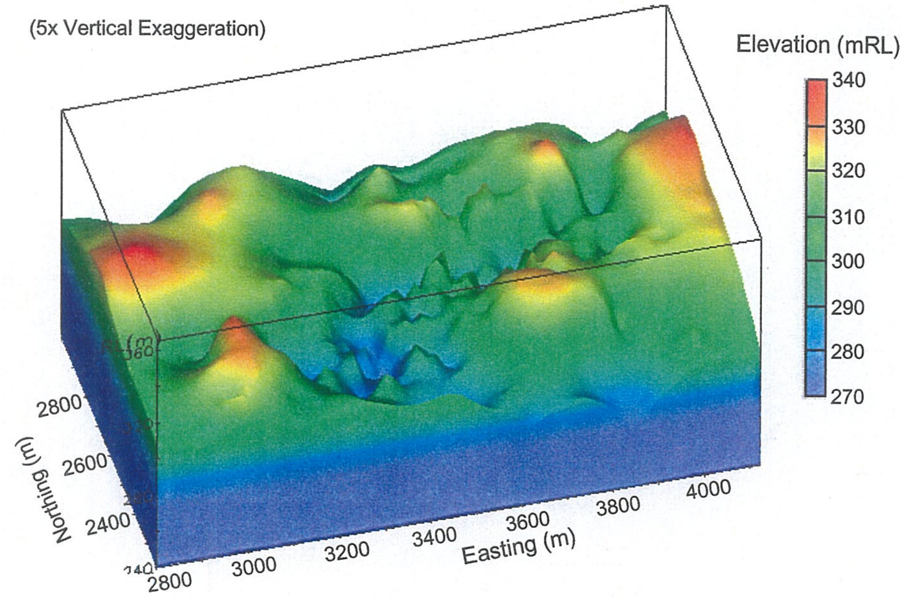

Figure 9: Kanowna Belle – base of weathering

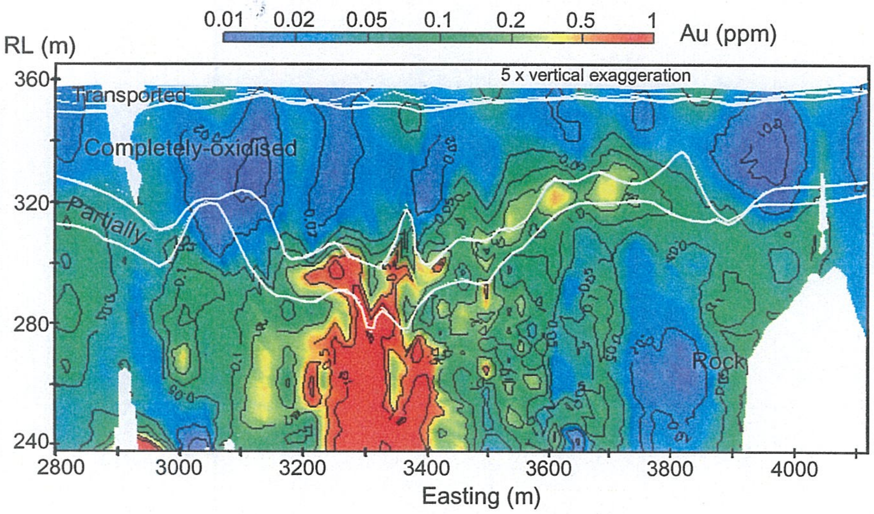

Figure 10: Kanowna Belle 6612500 mN – contoured Au concentrations.

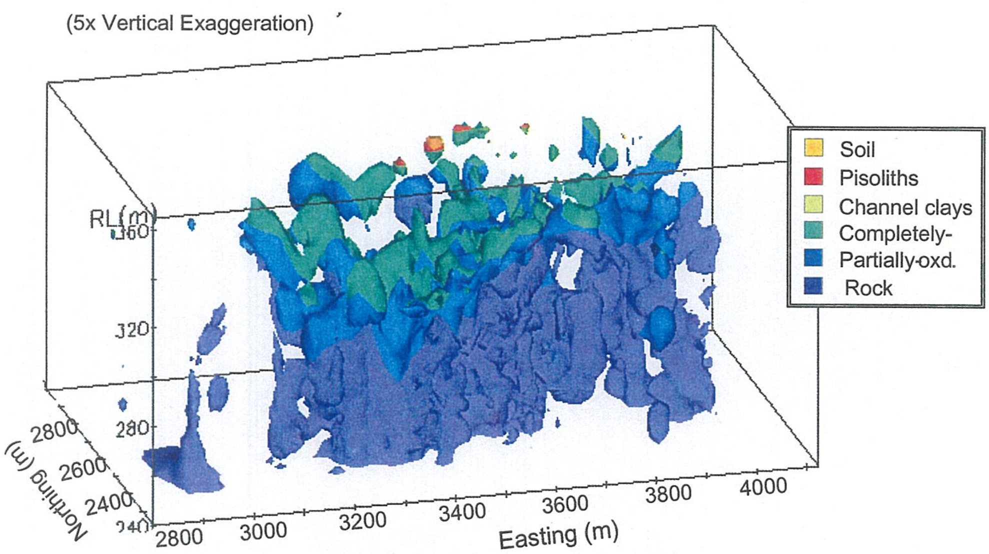

Figure 11: Kanowna Belle - 200 ppb Au cut-off

4 BALLARAT LAST CHANCE

Ballarat Last Chance (BLC) is located along a subdued ridge, with dominantly ultramafic lithologies and mineralization associated with sulphide-rich pods. The high S content may well be the cause of the markedly deeper weathering within the mineralized zone (365500 mE, Figure 12). Primary Au is free and associated with quartz veins. Variation in Au concentration between different regolith units (Figure 14 - Figure 17) is much more subdued than at Kanowna Belle (Section 1) although there does appear to be a gradual upward decrease in Au concentration in the completely oxidized zone (Figure 15), although this is only weakly evident in cut-off diagrams (*e.g.*, Figure 13).

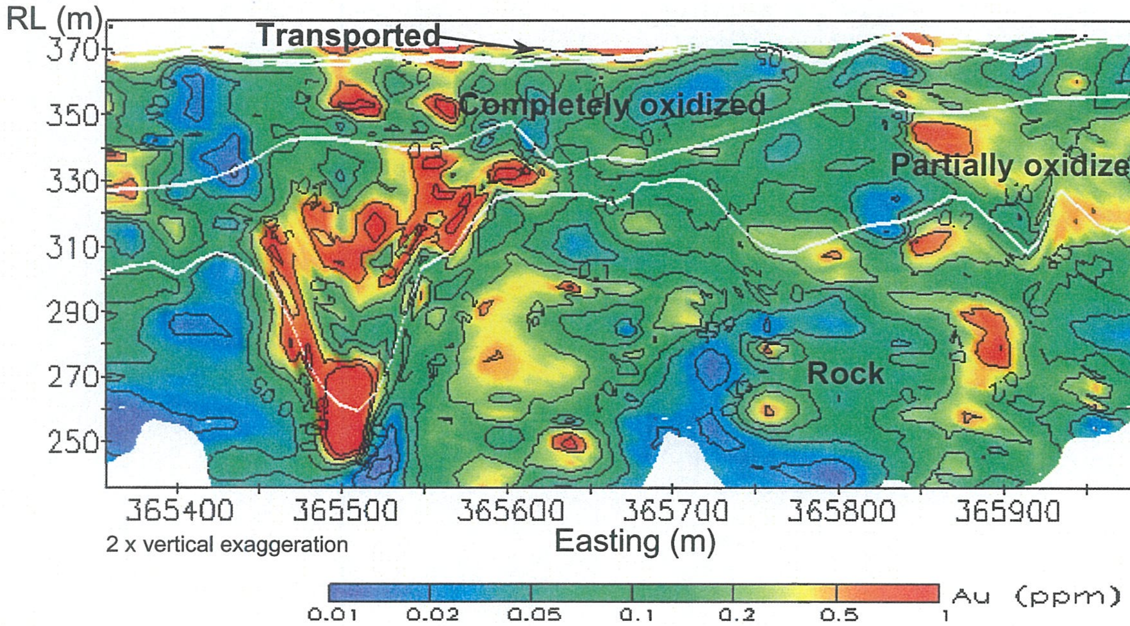

Figure 12: Ballarat Last Chance, Au concentration for 6614350 mN section.

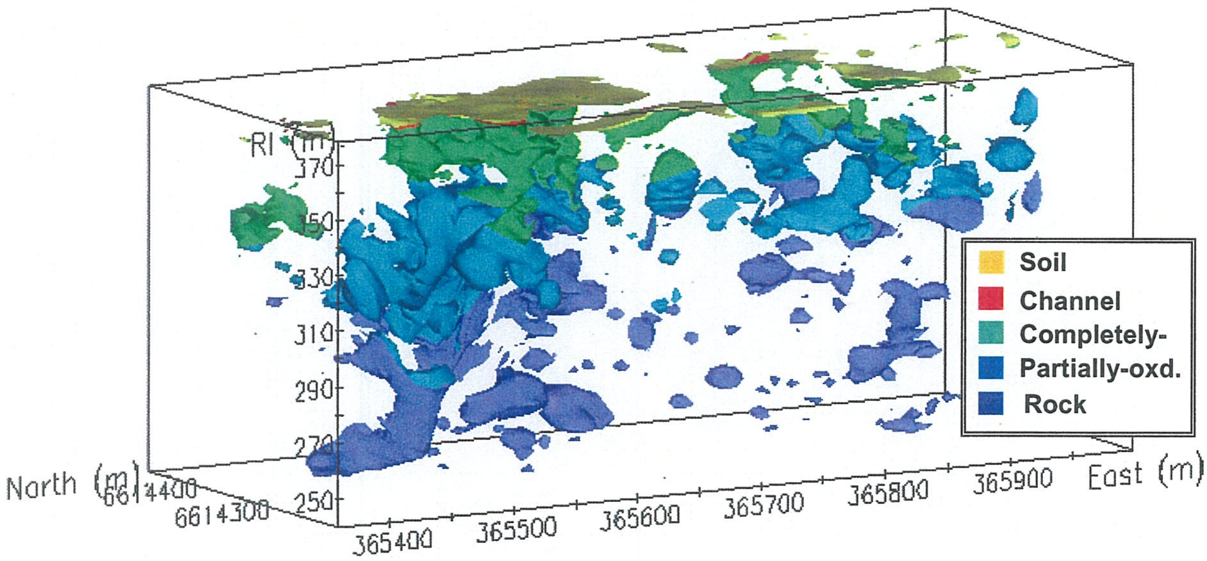

Figure 13: Ballarat Last Chance - 500 ppb Au cut-off (2 x vertical exaggeration)

Gold depletion at BLC is approximately 45%, which is significantly less than at Kanowna Belle and other Kalgoorlie sites. This lesser depletion may reflect a combination of factors. Ballarat Last Chance occurs near the top of a ridge (Figure 2). As such, groundwaters may be fresher, due to a greater component of meteoric water. Such groundwaters have much lower Au concentrations than saline groundwaters, and are therefore less likely to mobilize Au (Gray *et al.*, 2000). Additionally, the regional water table in this area is very flat, with depth to watertable increasing from less than 10 m near the playa to 50 - 100 m below surface at the groundwater divides (Kern, 1996). Thus, the water table is expected to be approximately 15 m lower in the profile at BLC than at Kanowna Belle, which would result in lesser depletion at BLC than at other sites with lower elevation. Lithology may also be an additional factor: the rocks at BLC are dominantly ultramafic, which commonly buffer otherwise acidic groundwaters to neutral pH (*e.g.*, at the nearby Panglo Au deposit; Gray, 1990), resulting in groundwaters with lower Au solubilities.

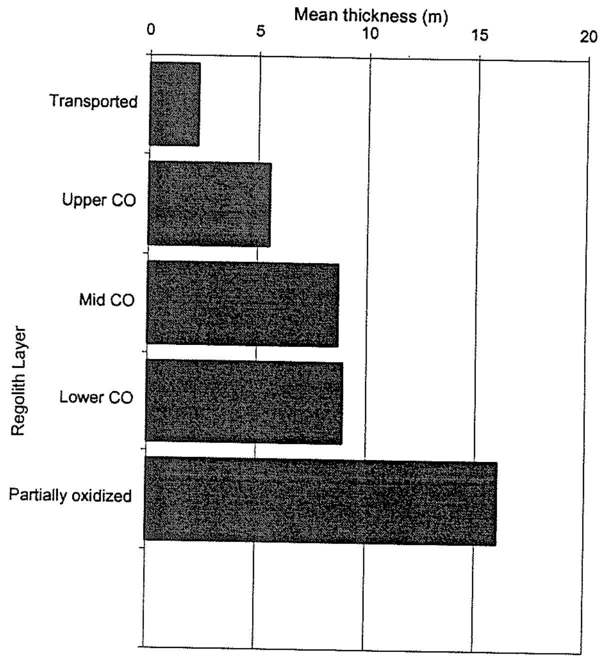

Figure 14: Mean thicknesses of regolith zones at BLC. The completely oxidized zone (CO) is split to enhance Au data.

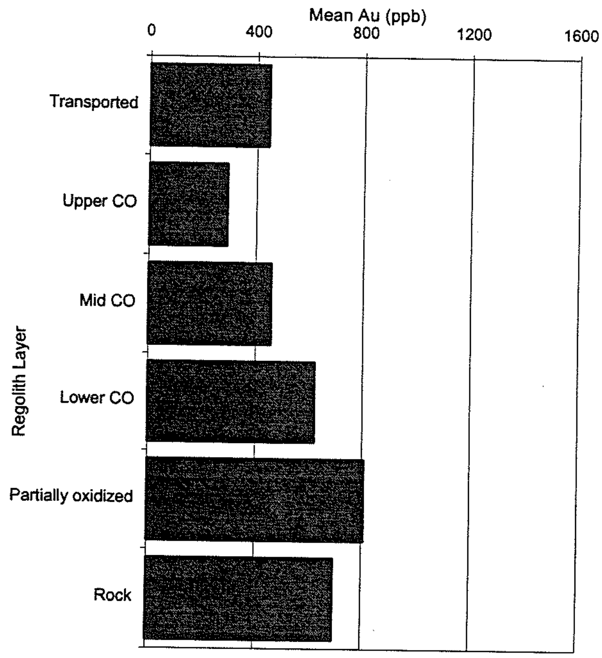

Figure 15: Mean Au concentrations of regolith zones at BLC.

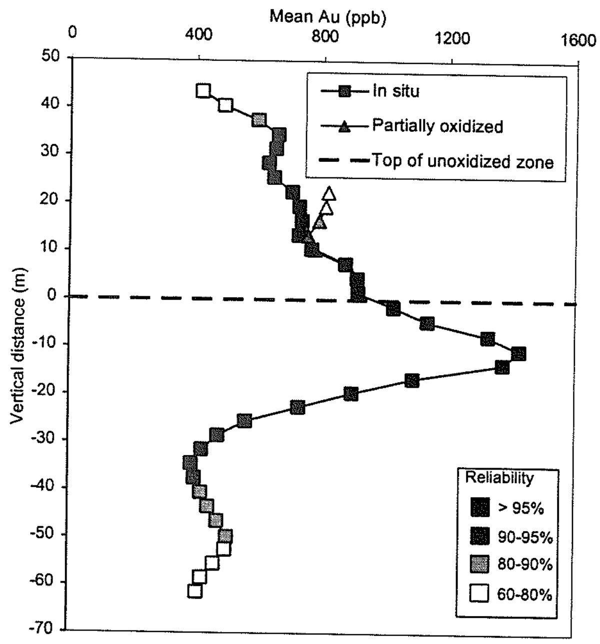

Figure 16: Mean Au concentration vs. vertical distance from the weathering front (top of unoxidized zone) at BLC.

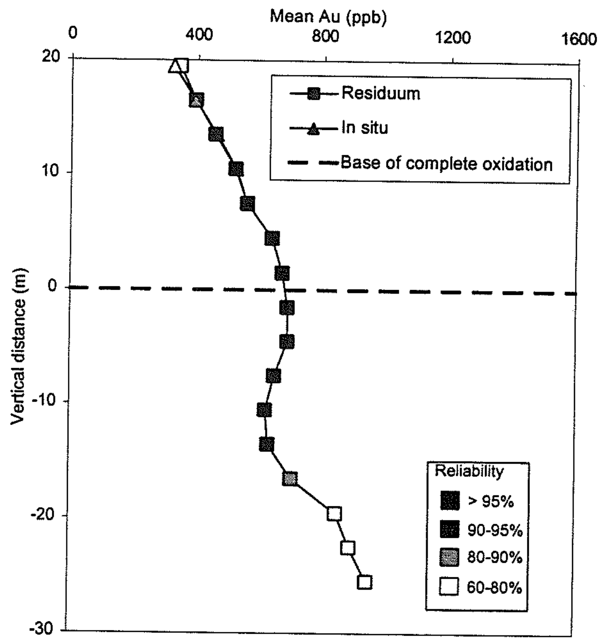

Figure 17: Mean Au concentration vs. vertical distance from the base of complete oxidation at BLC.

5 CONCLUSIONS

Results for the Kanowna Belle and BLC deposits suggest primary bedrock influence on supergene Au mobility, although geomorphology may also be an important factor. The bedrock at Kanowna Belle consists dominantly of felsic volcanic rocks and the primary Au is associated with pyrite, minor arsenopyrite, chalcopyrite and sphalerite. Gold is strongly depleted in the upper regolith but concentrated below the base of complete oxidation (BOCO) (Figure 10). This compares closely with other deposits in the Kalgoorlie area [*e.g.*, Panglo (Gray, 1999), Federal (Sergeev and Gray, 2000)]. In contrast, mineralization at BLC is associated mainly with ultramafic rocks, which buffer groundwaters to neutral pH, causing lesser Au solubilities (Section 4). Although the primary Au is free and associated with quartz veins (Alex Aaltonen, Delta Gold N.L., personal communication, September 2000), there is considerably less Au depletion in the regolith with Au mostly confined to primary structures (Figure 12). Gold depletion is also expected to be lesser for sites higher in the landscape, as discussed briefly in Section 4, and in detail in Gray *et al.* (2000). The lower Au depletion at BLC is similar to that at Mt Percy, in which mineralization is also associated with ultramafic rocks. Both sites are situated on drainage divides (Butt, 1991; Gray *et al.*, 2000).

ACKNOWLEDGEMENTS

The authors acknowledge the assistance of Delta Gold N.L., with particular thanks for the provision of the database and for advice onsite. Cajetan Phang is thanked for reviewing this report prior to release. Dr Charles Butt provided advice and support during the progress of this study.

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APPENDIX: CONTENTS OF ENCLOSED CD

The accompanying CD contains the Kanowna Picture Database as Bitmap files (BMP) in separate directories under Ballarat Last Chance and Kanowna Belle and Virtual Reality Modelling Language (VRML) files (WRL) under Interactive, as listed below.

↪ Ballarat Last Chance
- ↪ Data
- ↪ East
- ↪ Layers
- ↪ North
- ↪ Plans

↪ Kanowna Belle
- ↪ Data
- ↪ Layers
- ↪ Plans
- ↪ East
- ↪ North

↪ Interactive
- ↪ Images
- ↪ vrmls

A1 SITE DIRECTORY DESCRIPTION

(i) The East directory includes vertical slices at constant easting, with plots named according to the particular easting.

(ii) The North directory includes vertical slices at constant northing, with plots named according to the particular northing.

(iii) The Layers directory includes the various layers, either separately with Au distribution coloured so as to show the characteristics of the various layers (*e.g.*, ParOxd-Au.bmp), or merged to show the stratigraphy (All.bmp) with a particular Au grade cut-off (*e.g.*, 50ppbAu.bmp).

(iv) The Plans directory includes plans of regolith distribution or calculated Au grade at a particular RL (*e.g.*, the plot of the calculated Au distributions at 300 mRL is named 300mRL-Au.bmp).

A1.1 Bitmaps provided:

A1.1.1 Ballarat Last Chance

A1.1.1.1 East directory

File:	**Depicts:**
365400mE.bmp	Au distribution for 365400mE North/RL slice
365450mE.bmp	Au distribution for 365450mE North/RL slice
365500mE.bmp	Au distribution for 365500mE North/RL slice
365550mE.bmp	Au distribution for 365550mE North/RL slice
365600mE.bmp	Au distribution for 365600mE North/RL slice
365650mE.bmp	Au distribution for 365650mE North/RL slice
365700mE.bmp	Au distribution for 365700mE North/RL slice
365750mE.bmp	Au distribution for 365750mE North/RL slice
365800mE.bmp	Au distribution for 365800mE North/RL slice
365850mE.bmp	Au distribution for 365850mE North/RL slice
365900mE.bmp	Au distribution for 365900mE North/RL slice
365950mE.bmp	Au distribution for 365950mE North/RL slice
366000mE.bmp	Au distribution for 366000mE North/RL slice

A1.1.1.2 Layers directory

File:	Depicts:
50ppbAu.bmp	Coloured regolith stratigraphic layers with a 0.05 ppm Au grade cut-off
100ppbAu.bmp	Coloured regolith stratigraphic layers with a 0.1 ppm Au grade cut-off
200ppbAu.bmp	Coloured regolith stratigraphic layers with a 0.2 ppm Au grade cut-off
500ppbAu.bmp	Coloured regolith stratigraphic layers with a 0.5 ppm Au grade cut-off
1ppmAu.bmp	Coloured regolith stratigraphic layers with a 1 ppm Au grade cut-off
All.bmp	All regolith stratigraphic layers coloured
All-Au.bmp	Au distribution in all regolith stratigraphic layers
ParOxd-Au.bmp	Au distribution to base of completely oxidized
Rock-Au.bmp	Au distribution in fresh rock
TopChan-Au.bmp	Au distribution to top of channel
Unconf-Au.bmp	Au distribution to unconformity

A1.1.1.3 North directory

File:	Depicts:
6614250mN.bmp	Au distribution for 6614250mN East/RL slice
6614300mN.bmp	Au distribution for 6614300mN East/RL slice
6614350mN.bmp	Au distribution for 6614350mN East/RL slice
6614400mN.bmp	Au distribution for 6614400mN East/RL slice
6614400mN.bmp	Au distribution for 6614450mN East/RL slice

A1.1.1.4 Plans directory

File:	Depicts:
240mRL-Au.bmp	Au distribution at 240 mRL
240mRL-Reg.bmp	Regolith distribution at 240 mRL
250mRL-Au.bmp	Au distribution at 250 mRL
250mRL-Reg.bmp	Regolith distribution at 250 mRL
260mRL-Au.bmp	Au distribution at 260 mRL
260mRL-Reg.bmp	Regolith distribution at 260 mRL
270mRL-Au.bmp	Au distribution at 270 mRL
270mRL-Reg.bmp	Regolith distribution at 270 mRL
280mRL-Au.bmp	Au distribution at 280 mRL
280mRL-Reg.bmp	Regolith distribution at 280 mRL
290mRL-Au.bmp	Au distribution at 290 mRL
290mRL-Reg.bmp	Regolith distribution at 290 mRL
300mRL-Au.bmp	Au distribution at 300 mRL
300mRL-Reg.bmp	Regolith distribution at 300 mRL
310mRL-Au.bmp	Au distribution at 310 mRL
310mRL-Reg.bmp	Regolith distribution at 310 mRL
320mRL-Au.bmp	Au distribution at 320 mRL
320mRL-Reg.bmp	Regolith distribution at 320 mRL
330mRL-Au.bmp	Au distribution at 330 mRL
330mRL-Reg.bmp	Regolith distribution at 330 mRL
340mRL-Au.bmp	Au distribution at 340 mRL
340mRL-Reg.bmp	Regolith distribution at 340 mRL
350mRL-Au.bmp	Au distribution at 350 mRL
350mRL-Reg.bmp	Regolith distribution at 350 mRL
360mRL-Au.bmp	Au distribution at 360 mRL
360mRL-Reg.bmp	Regolith distribution at 360 mRL
365mRL-Au.bmp	Au distribution at 365 mRL
365mRL-Reg.bmp	Regolith distribution at 365 mRL
370mRL-Au.bmp	Au distribution at 370 mRL
370mRL-Reg.bmp	Regolith distribution at 370 mRL

A1.1.2 Kanowna Belle

A1.1.2.1 East directory

File:	Depicts:
362800mE.bmp	Au distribution for 362800mE North/RL slice
362900mE.bmp	Au distribution for 362900mE North/RL slice
363000mE.bmp	Au distribution for 363000mE North/RL slice
363100mE.bmp	Au distribution for 363100mE North/RL slice
363200mE.bmp	Au distribution for 363200mE North/RL slice
363300mE.bmp	Au distribution for 363300mE North/RL slice
363400mE.bmp	Au distribution for 363400mE North/RL slice
363500mE.bmp	Au distribution for 363500mE North/RL slice
363600mE.bmp	Au distribution for 363600mE North/RL slice
363700mE.bmp	Au distribution for 363700mE North/RL slice
363800mE.bmp	Au distribution for 363800mE North/RL slice
363900mE.bmp	Au distribution for 363900mE North/RL slice
364000mE.bmp	Au distribution for 364000mE North/RL slice
364100mE.bmp	Au distribution for 364100mE North/RL slice

A1.1.2.2 Layers directory

File:	Depicts:
20ppbAu.bmp	Coloured regolith stratigraphic layers with a 0.02 ppm Au grade cut-off
50ppbAu.bmp	Coloured regolith stratigraphic layers with a 0.05 ppm Au grade cut-off
100ppbAu.bmp	Coloured regolith stratigraphic layers with a 0.1 ppm Au grade cut-off
200ppbAu.bmp	Coloured regolith stratigraphic layers with a 0.2 ppm Au grade cut-off
500ppbAu.bmp	Coloured regolith stratigraphic layers with a 0.5 ppm Au grade cut-off
1ppmAu.bmp	Coloured regolith stratigraphic layers with a 1 ppm Au grade cut-off
2ppmAu.bmp	Coloured regolith stratigraphic layers with a 2 ppm Au grade cut-off
5ppmAu.bmp	Coloured regolith stratigraphic layers with a 5 ppm Au grade cut-off
200ppb+DH.bmp	Coloured regolith stratigraphic layers with a 0.2 ppm Au grade cut-off and showing drillhole Au concentration
Stratigraphy.bmp	All regolith stratigraphic layers coloured
Au-bco.bmp	Au distribution to base of completely oxidized
Au-bow.bmp	Au distribution to base of weathering
Au-surface.bmp	Au distribution to surface
Au-unconf.bmp	Au distribution to unconformity
Base_comp.bmp	Base of completely oxidized
Base_weath.bmp	Base of weathering
Surface.bmp	Surface
Unconfor.bmp	Unconformity

A1.1.2.3 North directory

File:	Depicts:
6612250mN.bmp	Au distribution for 6612250mN East/RL slice
6612300mN.bmp	Au distribution for 6612300mN East/RL slice
6612350mN.bmp	Au distribution for 6612350mN East/RL slice
6612400mN.bmp	Au distribution for 6612400mN East/RL slice
6612450mN.bmp	Au distribution for 6612450mN East/RL slice
6612500mN.bmp	Au distribution for 6612500mN East/RL slice
6612550mN.bmp	Au distribution for 6612550mN East/RL slice
6612600mN.bmp	Au distribution for 6612600mN East/RL slice
6612650mN.bmp	Au distribution for 6612650mN East/RL slice
6612700mN.bmp	Au distribution for 6612700mN East/RL slice
6612750mN.bmp	Au distribution for 6612750mN East/RL slice
6612800mN.bmp	Au distribution for 6612800mN East/RL slice
6612850mN.bmp	Au distribution for 6612850mN East/RL slice
6612900mN.bmp	Au distribution for 6612900mN East/RL slice

6612950mN.bmp	Au distribution for 6612950mN East/RL slice
6613000mN.bmp	Au distribution for 6613000mN East/RL slice

A1.1.2.4 Plans directory

File:	Depicts:
240mRL-Au.bmp	Au distribution at 240 mRL
240mRL-Reg.bmp	Regolith distribution at 240 mRL
250mRL-Au.bmp	Au distribution at 250 mRL
250mRL-Reg.bmp	Regolith distribution at 250 mRL
260mRL-Au.bmp	Au distribution at 260 mRL
260mRL-Reg.bmp	Regolith distribution at 260 mRL
270mRL-Au.bmp	Au distribution at 270 mRL
270mRL-Reg.bmp	Regolith distribution at 270 mRL
280mRL-Au.bmp	Au distribution at 280 mRL
280mRL-Reg.bmp	Regolith distribution at 280 mRL
290mRL-Au.bmp	Au distribution at 290 mRL
290mRL-Reg.bmp	Regolith distribution at 290 mRL
300mRL-Au.bmp	Au distribution at 300 mRL
300mRL-Reg.bmp	Regolith distribution at 300 mRL
310mRL-Au.bmp	Au distribution at 310 mRL
310mRL-Reg.bmp	Regolith distribution at 310 mRL
320mRL-Au.bmp	Au distribution at 320 mRL
320mRL-Reg.bmp	Regolith distribution at 320 mRL
330mRL-Au.bmp	Au distribution at 330 mRL
330mRL-Reg.bmp	Regolith distribution at 330 mRL
340mRL-Au.bmp	Au distribution at 340 mRL
340mRL-Reg.bmp	Regolith distribution at 340 mRL
350mRL-Au.bmp	Au distribution at 350 mRL
350mRL-Reg.bmp	Regolith distribution at 350 mRL
360mRL-Reg.bmp	Regolith distribution at 360 mRL

A2 INTERACTIVE

The enclosed CD contains a folder called "interactive". It consists of:

- A web page – "Kanowna.htm" and an associated "images" folder.
- A folder called "vrmls" which contains VRMLs (files written with Virtual Reality Modelling Language). These are 3D images that the user can manipulate and view from different angles.
- An installation file (cosmo_win95nt_eng.exe) for Cosmo Player.

You will need to have a web browser installed on your computer (but it does not have to be connected to an outside line). You will need a plug-in, such as COSMO Player, that will enable your internet browser to display the VRMLs. To install Cosmo Player from this CD, follow the steps below (which are also set out on the web page).

Note: The computer will need at least 200 Mhz and 64 MB to run the VRMLs effectively.

A2.1 Instructions for viewing VRMLs

1. Open the CD, then open the "interactive" folder. Click on the icon named "cosmo_win95nt_eng.exe" and it will launch with prompts. Read the first page, close any open Windows programs, then click NEXT.
2. Agree to the Licence Agreement and click YES.

3. It will determine which internet browsers are on your system and list some options. Choose the option that you usually use, e.g. Netscape Communicator 4.5 or Internet Explorer (provided with Windows). Some users will have older systems and will need to choose "Other". Click NEXT.
4. Choose the destination folder using the BROWSE button. Then click NEXT. The plug-in will now install itself.
5. It will then ask you if you would like to associate all VRML related files (.wrl, .wrz, .wrl.gz) with Cosmo Player. Choose YES.
6. Set up is complete. You should be able click on the options below and use the VRMLs.

A2.2 Web Page

A web page is provided as a convenient way of navigating through the VRMLs. In particular, it provides a handy reference to the regolith legend as this feature is not supported by the VRMLs.

Either open the page through your browser (File Menu – Open Page) or if your computer is configured to recognise htm/html files then just click on the "Kanowna.htm" icon to launch the page.

A2.3 VRMLs provided:

A2.3.1 Kanowna Belle 3D Au Cut-offs

CRC LEME created 3D models of Au distributions at the Kanowna Belle deposit. The colours match the regolith legend and show all those parts of each regolith layer that have, for example, 300 ppb Au concentration or greater.

File:	Depicts:
KB-50ppbAu.wrl	Au distribution with 50 ppb cut-off at Kanowna Belle
KB-100ppbAu.wrl	Au distribution with 100 ppb cut-off at Kanowna Belle
KB-200ppbAu.wrl	Au distribution with 200 ppb cut-off at Kanowna Belle
KB-500ppbAu.wrl	Au distribution with 500 ppb cut-off at Kanowna Belle
KB-1ppmAu.wrl	Au distribution with 1 ppm cut-off at Kanowna Belle
KB-2ppmAu.wrl	Au distribution with 2 ppm cut-off at Kanowna Belle
KB-5ppmAu.wrl	Au distribution with 5 ppm cut-off at Kanowna Belle

A2.3.2 Ballarat Last Chance Au Distribution

CRC LEME created 3D models of Au distribution in each of the regolith layers at the Ballarat Last Chance deposit. The colours match the Au concentration legend.

File:	Depicts:
BLC-All-Au.wrl	Block model showing Au distribution in all layers
BLC-Chan-Au.wrl	Block model showing Au distribution to the top of the channel
BLC-Insitu-Au.wrl	Block model showing Au distribution in all in situ layers
BLC-ParOxd-Au.wrl	Block model showing Au distribution to the top of the partially oxidized layer
BLC-Rock-Au.wrl	Block model showing Au distribution in bedrock

A2.3.3 Ballarat Last Chance 3D Au Cut-offs

CRC LEME created 3D models of Au distributions at the Ballarat Last Chance deposit. The colours match the regolith legend and show all those parts of each regolith layer that have, for example, 300 ppb Au concentration or greater.

File:	Depicts:
BLC-100ppbAu.wrl	Au distribution with 100 ppb cut-off at Ballarat Last Chance
BLC-200ppbAu.wrl	Au distribution with 200 ppb cut-off at Ballarat Last Chance
BLC-300ppbAu.wrl	Au distribution with 300 ppb cut-off at Ballarat Last Chance

BLC-400ppbAu.wrl	Au distribution with 400 ppb cut-off at Ballarat Last Chance
BLC-500ppbAu.wrl	Au distribution with 500 ppb cut-off at Ballarat Last Chance
BLC-1ppmAu.wrl	Au distribution with 1 ppm cut-off at Ballarat Last Chance
BLC-2ppmAu.wrl	Au distribution with 2 ppm cut-off at Ballarat Last Chance

A3 PORTABLE DOCUMENT FORMAT

The enclosed CD contains a folder called "Report". It consists of:

- This report as a Microsoft Word (DOC) file.
- This report as a Portable Document Format (PDF) file.
- An installation file (rs405eng.exe) for Adobe® Acrobat® Reader™ (version 4.05 + Search for Windows 95, 98, & NT 4.0). This is free software that lets you view, navigate and print Adobe® Portable Document Format (PDF) files. If Acrobat Reader is required for other computer platforms, the appropriate version can be downloaded from www.adobe.com/ products/ acrobat/ readstep.html. Acrobat Reader may already be installed as part of your browser program. If so, you need only double click on the PDF file.