LOW-DENSITY GEOCHEMICAL SURVEY IN THE CENTRAL GAWLER CRATON: PRELIMINARY RESULTS AND IMPLICATIONS FOR MINERAL EXPLORATION

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INTRODUCTION

Low-density geochemical surveys provide a cost-effective means to assess the composition of near-surface materials over large areas. Many countries in the world have already compiled geochemical atlases based on such data. These have been used for a number of applications, including:

- Establishing baselines from which future changes can be measured;
- Designing geologically sensible targets for remediation of contaminated sites;
- Supporting decision-making regarding appropriate land-use;
- Exploring for natural resources; and,
- Studying links between geology and plant/animal health (geohealth).

A series of pilot projects were initiated by CRC LEME and Geoscience Australia, in collaboration with State and Northern Territory agencies, to help establish sampling and analytical protocols relevant to Australian landscapes and climates. The Gawler Craton (Figure 1) was chosen as one of the pilot studies because of the particular challenge posed to geochemical mapping by the region's low-relief, paucity of major drainage systems, presence (in places, abundance) of aeolian material in the landscape and near-ubiquitous cover concealing basement rocks. The region is also highly prospective for Au, Cu-Au and U deposits.

METHODS

Using a hydrological analysis, 42 sites near the outlets of large catchments were selected within the 82,000 km^2 survey area (one site per 1954 km^2 on average) (Figure 2). At each site, two ~10-cm thick samples of transported regolith were taken, one at the surface (TOS) and the other between 60 and 90 cm depth (BOS). These were described, dried, sieved (<180 μm and < 75 μm) and analysed (including for Au to 0.1 ppb). Additionally, groundwater samples were collected from bores and wells at 25 locations, filtered (<0.45 μm) and analysed. Finally, statistical and exploratory data analyses were carried out and geochemical maps prepared.

RESULTS & DISCUSSION

Results pertinent to Au exploration are of particular interest here. The first observation is that the geochemical results outline the central Gawler gold province reasonably well. Most of the catchments known to include Au deposits or Au occurrences show measurable Au in one or more of the regolith samples/fractions (Figure 3). Additionally, there appears to be a qualitative inverse relationship between the concentration of Au in the regolith and the distance from the known Au mineralisation. The scale of dispersion appears to be of the same order of magnitude as the catchments themselves. If these relationships are verified on a regional basis, the results of this survey could be useful to unearth new, yet undiscovered Au occurrences in the central Gawler Craton.

The correlation between Au concentrations in the two size fractions (Figure 4) is more robust for the bottom samples (BOS) than for the surface samples (TOS). The most poorly correlated pairs of samples are from areas far removed from any mines or deposits. Thus, they are more likely to be a result of nugget effects, rather than wind-blown additions to the surface regolith of fine Au or Au-bearing grains from mines (contamination).

All Au concentrations in the groundwater samples were below the detection limit (1 ng/L), so here we use dissolved As as a pathfinder/indicator for Au mineralisation. The map of As concentrations in groundwater (Figure 5) shows that only a few samples were collected near known Au occurrences or deposits. However, there is a suggestion that groundwater could be a useful sampling medium for Au exploration in the region.

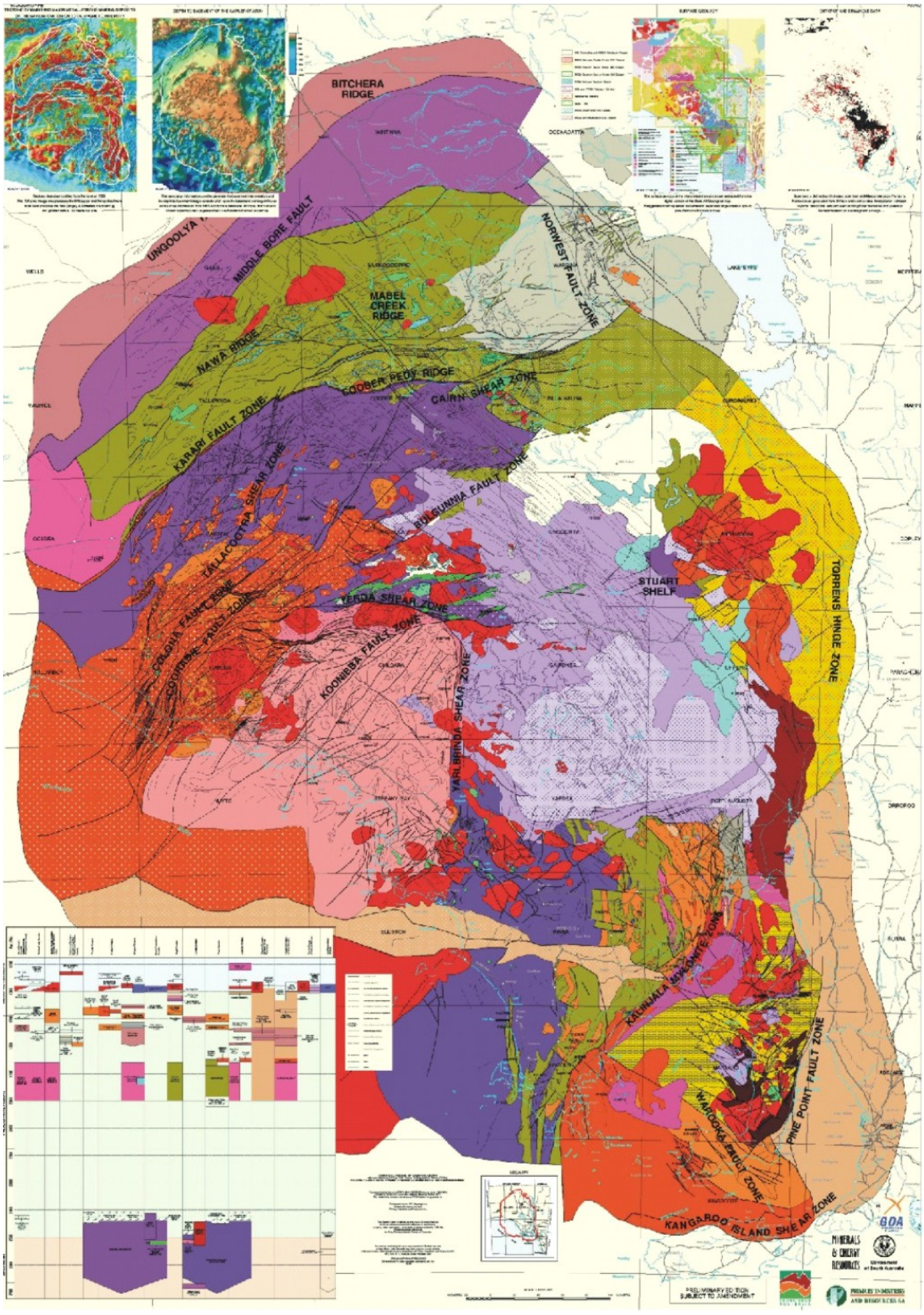

Figure 1. Simplified basement geology of the Gawler Craton (PIRSA).

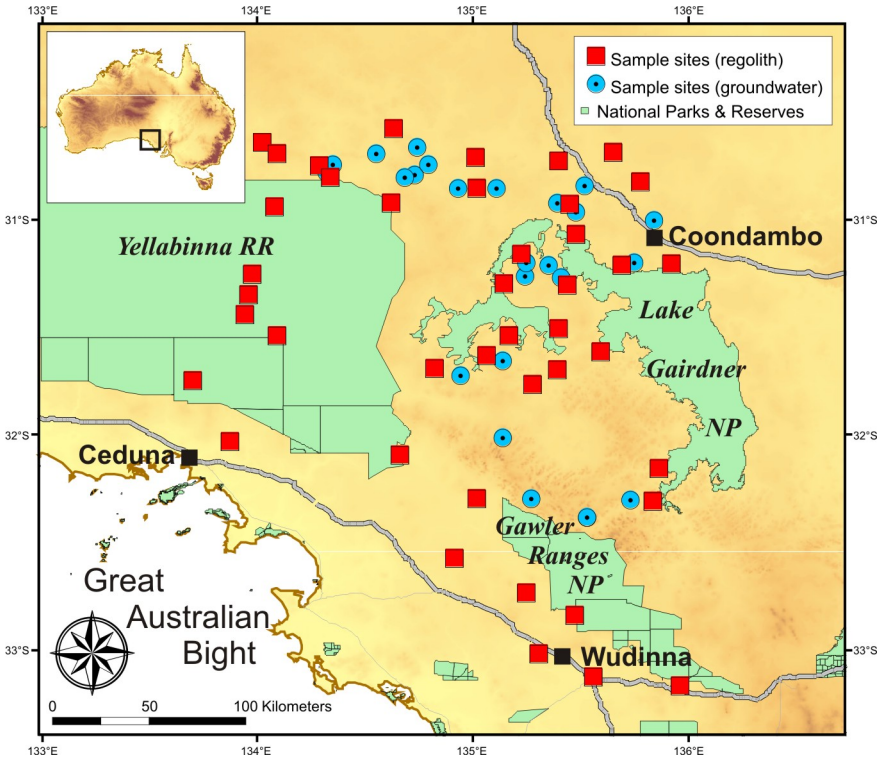

Figure 2. Location of the central Gawler Craton (SA) study area and regolith and groundwater sampling sites.

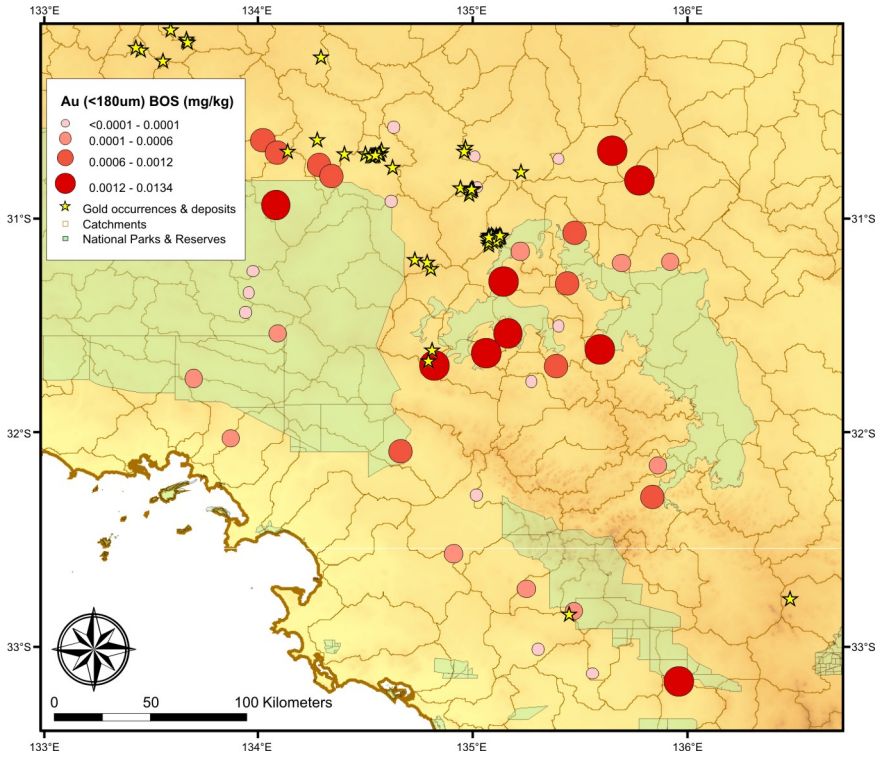

Figure 3. Au concentrations in <180 µm fraction of bottom regolith samples (BOS) from the Gawler geochemical survey.

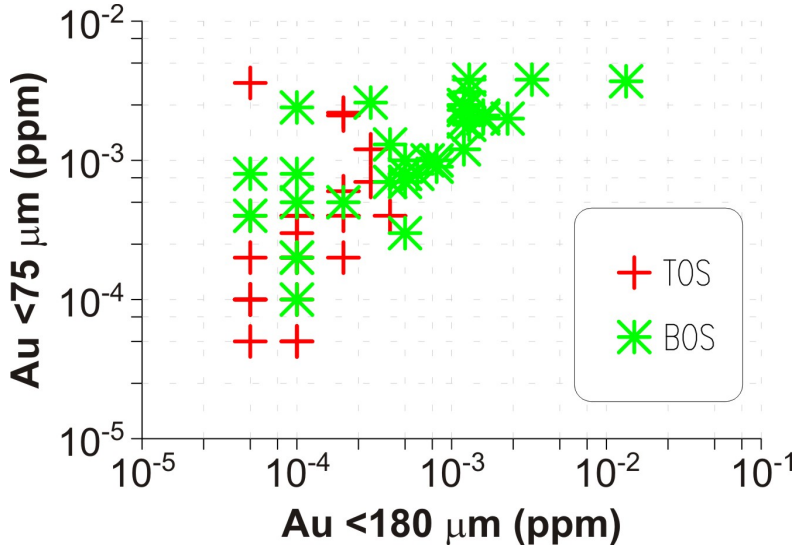

Figure 4. Scatter diagram of Au concentrations in <180 and <75 μm fractions of regolith samples from the Gawler geochemical survey.

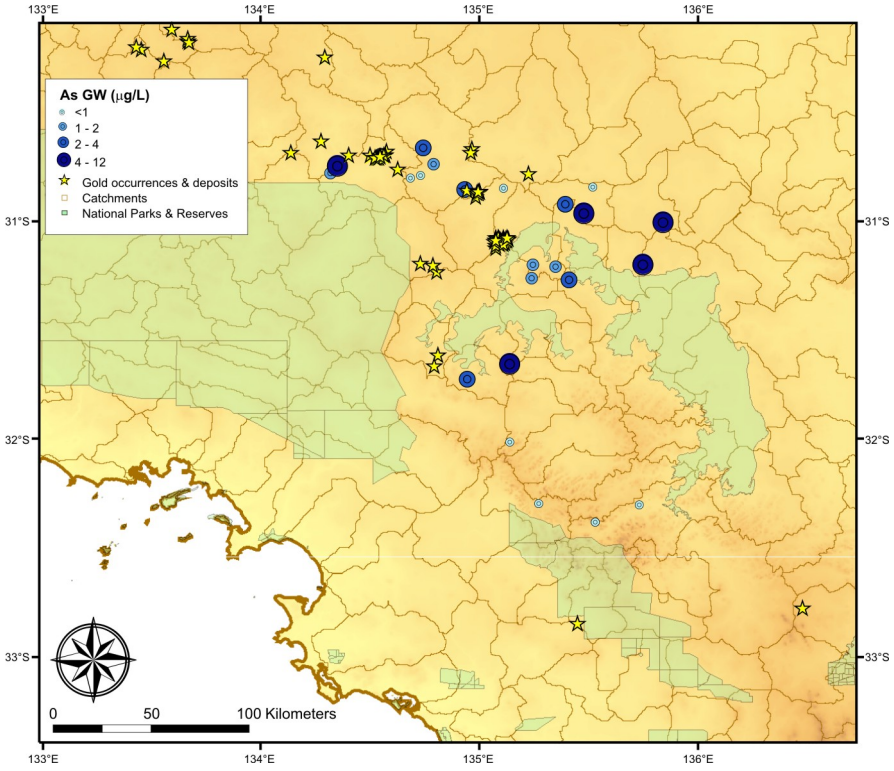

Figure 5. As concentrations in <0.45 μm filtered groundwater samples from the Gawler geochemical survey.

CONCLUSIONS

A pilot low-density geochemical survey conducted in the central Gawler Craton area shows that both the regolith and groundwater are sampling media that can detect proximity to known Au mineralisation. The presence of several anomalous samples in the region suggests that yet undiscovered Au occurrences may still be found. This pilot survey was undertaken in one of the most challenging settings possible in Australia and demonstrates the robustness of the geochemical survey approach developed by CRC LEME and Geoscience Australia.