

GAWLER REGION GEOCHEMICAL SURVEY, SOUTH AUSTRALIA

Patrice de Caritat, Megan Lech and Amy Kernich

CRC LEME OPEN FILE REPORT 211

ABSTRACT

A low-density geochemical survey of the Gawler region in South Australia was carried out. Samples of transported regolith were collected at 42 sites in a 53,636 km² area, giving an average sample density of ~1 site per 1277 km². The sampling sites were strategically located near the lower end of large catchments so as to target transported regolith materials that best represent all source lithologies within each catchment. Floodplain or overbank settings accumulate sediments that generally are fine grained and well mixed, and as such are best able to yield a sample representative of the average composition of the catchment. We call these sediments 'outlet sediments' because in some cases they also include an aeolian component.

At each site, a surface sediment sample ('top outlet sediment' or TOS) was collected from a depth of 0 to 10 cm and a deeper sediment sample ('bottom outlet sediment' or BOS) was collected from a depth of ~60-90 cm. The TOS sample was well mixed over the area of a shallow pit and the BOS sample was collected from 3-5 auger holes (or over the bottom of a soil pit) in order to account for local soil heterogeneity (composite samples). All regolith samples were described in terms of texture, Munsell soil colour (dry and moist) and field pH, and each sampling site was described and photographed. At 25 additional sites, some close to regolith sampling sites, groundwater was also collected to compare to the sediment geochemistry; one rainwater sample from a plastic rainwater tank was also collected.

In the laboratory, a split of each bulk sediment sample was subjected to laser particle size analysis (LPSA) and to pH 1:5 (soil:water solution) and electrical conductivity (EC) 1:5 measurements. The remainder of the sample was dried and split into two parts, one for archiving, and the other for analysis. The split for analysis was sieved and the <180 µm and <75 µm fractions were submitted for analysis for over 60 elements by X-ray fluorescence (XRF), inductively coupled plasma-mass spectrometry (ICP-MS) and ion selective electrode (ISE) analyses at Geoscience Australia (XRF), Acme Laboratories in Vancouver (ICP-MS) and ALS Chemex in Brisbane (ISE) laboratories. At six sites a number of additional size fractions were separated and analysed to determine which size fractions yield the most useful geochemical information. Heavy mineral fractions of a few samples were separated by panning and separation using tetrabromoethane (density 2.955) and analysed by AutoGeoSEM at CSIRO Exploration & Mining (Perth). All resulting data are given in Appendices, as are quality control results.

The groundwater samples were analysed for major and minor element concentrations by inductively coupled plasma-emission spectrometry (ICP-ES) and ion chromatography (IC) at the Australian National University, and by ICP-MS at the

University of Canberra. The concentration of Au (and a few other elements) in solution was determined by adsorbing Au on an activated carbon sachet, then ashing and digesting the carbon and analysing by ICP-MS at Ultra Trace Laboratory, Perth. The isotopic composition of O and H of water (Monash University), C and O of dissolved bicarbonate and S and O of dissolved sulfate (University of Calgary) were determined by mass spectrometric methods.

Preliminary investigation suggests that patterns relating to bedrock type (e.g., ultramafic) and mineralisation (e.g., gold) are revealed by the regolith geochemical maps. The groundwater survey was too sparse to support independent interpretation, but when combined with the regolith maps, the groundwater maps indicate corroboration of some of the findings (e.g., As distribution as a pathfinder for Au mineralisation). The Gawler geochemical survey demonstrates that outlet sediments are a useful and widespread sampling medium in Australia and that applying a low-density approach is informative and cost-effective for geochemical surveys over large areas.