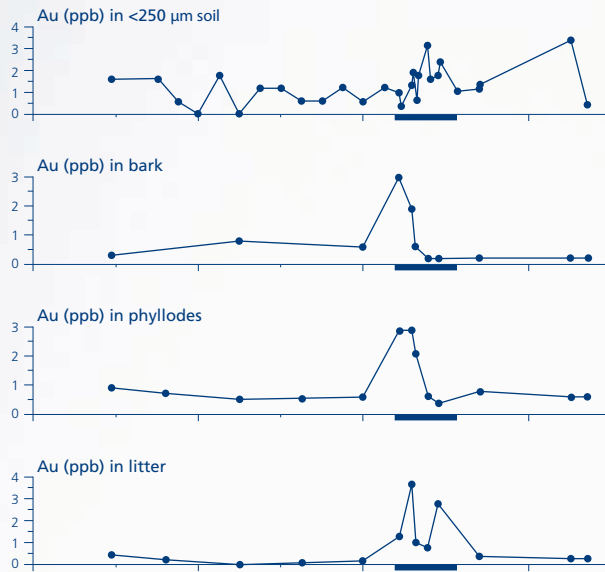
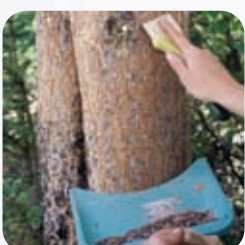


Biogeochemistry in Mineral Exploration



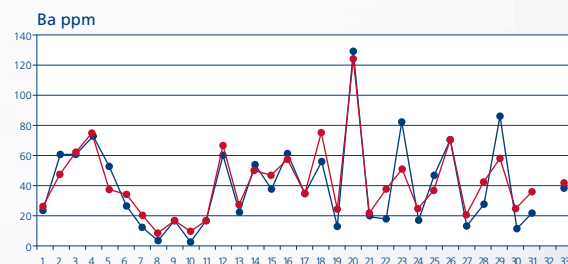
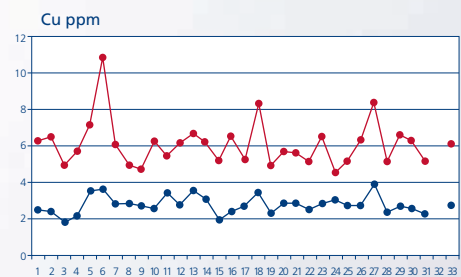
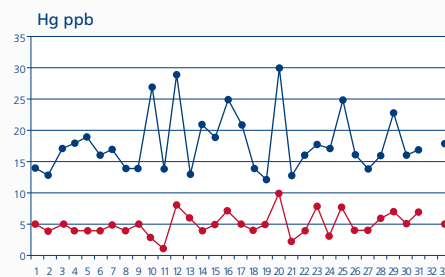
*Gold in soil and vegetation at Moolart well gold deposit (after Anand et al., 2007).

Biogeochemistry, or more precisely, phytogeochemistry, uses plants as another sample medium for exploration. Since vascular plants have evolved over 400 Ma to survive a wide range of physical and chemical conditions, they have developed mechanisms to absorb and scavenge elements and translocate them to foliage, twigs, bark, flowers and seeds. Hence plants are sophisticated geochemical samplers, able to integrate material from a much wider area than a taking a single soil sample.

Chemical analysis of the plant tissue can be used to identify anomalous areas. Biogeochemistry is particularly useful as a guide to the underlying geology in areas of transported cover, where the signature in the vegetation can be better than the soils.

Vegetation is widespread and samples are easy and cheap to collect, with a low environmental impact, compared with more invasive exploration sampling techniques. The levels of metals in plants are low, compared with soils, so care must be exercised to minimise contamination when sampling. Site selection away from anthropogenic impact is important too.

All plant tissue (foliage, twigs, bark, flowers, seeds, litter) can be analysed and an orientation study to determine the most useful species and the tissue types to be sampled is recommended.



Foliage —●—
Twigs —●—

Foliage and bark often give the strongest geochemical signature. Sample around a tree or shrub at about the same height, taking samples of approximately the same age. Collect enough to fill a large soil sample packet or a small calico bag and air dry in the field if possible. To prevent mould, do not store in plastic bags for long periods.



In the lab, samples are prepared in dedicated facilities. Samples are dried, the foliage separated from twigs and extraneous material removed from litter, as required, before being milled in specialised equipment.

Approximately 2g of pulp is digested using a modified aqua regia digest and analysed by ICP-OES and ICP-MS. Multielement analyses are the most useful for biogeochemical interpretation so the full suite of elements is recommended. Detection limits for salt bush and other samples that are particularly enriched may be higher if extra dilutions are required.



Biogeochemistry Package



Element	Range ppm	Element	Range ppm	Element	Range ppm
Ag	5ppb - 10	Hg	2ppb - 50	Sb	0.02 - 500
Al	5 - 2%	Ho	0.1ppb - 50	Sc	0.01 - 200
As	0.2 - 1000	In	2ppb - 50	Se	0.02 - 50
Au	0.5ppb - 10	K	10 - 5%	Si	10 - 1%
B	5 - 1000	La	5ppb - 200	Sm	1ppb - 200
Ba	0.1 - 1%	Li	0.02 - 500	Sn	0.05 - 50
Be	0.01 - 50	Lu	0.1ppb - 50	Sr	0.05 - 2000
Bi	5ppb - 100	Mg	10 - 2%	Ta	5ppb - 50
Ca	20 - 5%	Mn	0.5 - 2000	Tb	0.5ppb - 50
Cd	5ppb - 50	Mo	0.02 - 200	Te	0.02 - 50
Ce	10ppb - 200	Na	20 - 5%	Th	5ppb - 200
Co	0.02 - 200	Nb	2ppb - 50	Ti	0.5 - 500
Cr	0.2 - 500	Nd	5ppb - 200	Tl	0.01 - 50
Cs	1ppb - 50	Ni	0.2 - 2000	Tm	0.5ppb - 50
Cu	0.1 - 5000	P	1 - 5000	U	2ppb - 2000
Dy	0.5ppb - 50	Pb	0.02 - 1000	V	0.2 - 500
Er	0.5ppb - 50	Pd	2ppb - 10	W	0.02 - 50
Eu	0.2ppb - 50	Pr	1ppb - 200	Y	5ppb - 50
Fe	10 - 5%	Pt	1ppb - 10	Yb	2ppb - 50
Ga	5ppb - 200	Rb	0.01 - 500	Zn	0.2 - 2000
Gd	0.5ppb - 50	Re	2ppb - 50	Zr	0.05 - 50
Hf	0.5ppb - 50	S	10 - 1%		

Biogeochemistry package Dry preparation & modified aqua regia digest / ICP-OES & ICP-MS BG/OM01



*Anand, R.R., Cornelius, M. & Phang, C., 2007. Use of vegetation and soil in mineral exploration in areas of transported overburden, Yilgarn Craton, Western Australia: a contribution towards understanding metal transportation processes. *Geochemistry: Exploration, Environment, Analysis*, 7, 267- 288.

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