APPENDIX 6

Vegetation sampling in the Curnamona

S.M.Hill
CRC LEME
School of Earth and Environmental Sciences
University of Adelaide SA 5005
steven.hill@adelaide.edu.au

Increasingly, mineral explorers are considering the advantages of taking plant samples in mineral exploration programs when trying to explore through transported cover. Some of the advantages of this technique are:

- widespread, and in some places abundant, plant cover across the landscape
- easy access to samples that in many cases are convenient to take
- an ability for plant organs to provide chemical expressions that have penetrated through the transported cover;
- the ability to selectively extract and concentrate some elements (e.g. hyper-accumulators)
- a potential ability to homogeneously amalgamate a chemical signature from an enlarged and potentially heterogeneous substrate
- environmentally passive exploration approach, with minimal site disturbance and need for remediation
- some proven exploration success and expression of buried mineralisation.

The following is a short account of how to take a plant sample as part of a biogeochemical exploration program.

Sampling program

- Decide upon the nature of the survey required, including the area, sample spacing and sample location. Some localities allow for plants to be sampled conveniently along a transect or a grid, whereas others need to be sampled opportunistically (e.g. in sparsely vegetated areas) or along a restricted landscape setting (e.g. trees along creek lines). Sample spacing will depend upon variables such as the plant species targeted, the size of the exploration target and associated dispersion halo.
- Choose a target plant species or several plant species. The best results are obtained when plants of the same species are sampled because their assay results are more comparable. This typically includes one of the most widespread and abundant plant species from the project area that is considered to have a reasonable chance of being deep-rooted. If there is existing knowledge on particular plant species in your area, then this may also influence the choice of target species. Choosing a plant species that is distinctive and easy to identify makes your job easier. In most cases, a small orientation program testing a range of species in different landscape, regolith and geological settings is recommended if time and money allow.
- For your chosen species, a uniform plant organ (e.g. leaves, twigs of similar diameter, bark, wood, fruits, flowers or roots) is recommended for sampling. The more uniform and consistent that your sample is, the more valuable the comparisons between sample assay results will be. As a general rule, plant leaves can be the easiest to sample and prepare for analysis. Try to target leaves of uniform age/ maturity in order to reduce sample variability.
- Temporal variations (especially time of year with respect to seasons or rainfall events in arid areas) can have an impact on the variability in your assay results. Try to sample within a limited time period, and be very careful when comparing assay results from samples taken at different times of year or in different climatic context.
- Plant sample duplicates are important for QA/QC measures. The degree of duplication will depend upon your own protocol; however depending on total sample population size, duplications in the order of one in 10 are typical.

Plant sampling

The general rule here is to obtain uniform, and therefore comparable, samples between your target plants. Assuming that you are targeting a consistent plant species and plant organ, some general considerations include:

- Before sampling, record the sample location (GPS coordinates), type and description of plant, and regolith-

landform site information

- Try to avoid sources of environmental contamination such as dust (e.g. from roads, ploughed pastures, drill rigs and mine sites). If possible, it is best to avoid samples that may be excessively influenced by dust—particularly because washing the sample later is typically less than effective and may leach or further contaminate for some elements. When selecting species to sample, try to avoid those plants that are likely to trap dust (e.g. because of coarse leaf hairs)
- Recommended sample bags are made of unbleached paper (brown paper lunch bags are ideal). These minimise sample sweating and decomposition and add minimal contamination to the sample. The opening of these bags can be folded over once the sample has been collected (avoid metal fasteners for the bags, such as staples or pins, because these can be a source of metal contamination).
- It is recommended that you wash hands, remove jewellery and preferably wear powder-free latex or nitrile gloves for each sample. This minimises contamination while sampling.
- Try to take samples from a uniform height and from around the plant canopy.
- The optimal sample size is still debated between some researchers, and will depend to some extent upon the analytical technique used. Typically, your sample should be no less than 20 g, and ideally several hundred grams (which usually comes to about half to two thirds of a brown paper lunch bag full).

Sample storage and preparation

Sample decomposition and contamination should be minimised during storage. A sheltered well-ventilated site is recommended. Samples may need to be rotated during short-term storage to avoid irregular sweating and decomposition. Low temperature, clean oven drying will desiccate and stabilise the sample. An oven temperature of less than 60° C for approximately 48 hours is recommended. Higher oven temperatures may volatilise some important chemical components from your samples. Once thoroughly dried, samples can be stored in snap-seal plastic bags for longer periods.

The type of preparation required will ultimately depend on the type of analytical technique to be performed. A standard technique suitable for most approaches is as follows:

- Thoroughly clean a mill using a combination of high purity ethanol, paper towel and compressed air. It is important to use the same degree of care to reduce contamination in the laboratory as was used in the field (i.e. wear powder-free latex or nitrile gloves).
- Different people prefer different types of mill. Adequate results have been obtained using household stainless steel coffee and spice mills with rotating blades. The contamination from these mills is less significant for soft plant organs such as leaves.
- Pre-contaminate the mill with a small amount of the sample to be prepared. Use a short milling time and discard this preliminary material before adding the main part of the sample.
- Once the sample is milled to a fine powder (typically a consistency approaching that of talcum-powder), remove it from the mill and store in a labelled, snap-seal plastic bag.
- Re-clean the mill.

Sample analysis

This will depend on time, budget and of course the element suite that you are interested in. Techniques such as ICP-MS, ICP-AES, XRF, INAA and AAS have all been widely and successfully used for the analysis of plant materials.

Standard and certified reference material should be included in your sample batch for submission. These are available for plant material, although presently no materials exist for Australian native vegetation.

For further information please consult CRC LEME's Guide to the use of biogeochemical techniques in mineral exploration in Australia (Hill 2008)

Target plants

The following tables provide a brief field description for the main plant species that have been biogeochemically characterised from the region, as well as a brief outline of some of their biogeochemical characteristics for mineral exploration.

References

Brown A and Hill SM, 2003. White Dam – detailed regolith-landform mapping as a tool for refining the interpretation of surface geochemical results. *MESA Journal 31*, 6-8.

Brown AD and Hill SM, 2005. White Dam Au-Cu Prospect, Curnamona Province, South Australia. In: CRM Butt, M Cornelius, KM Scott and IDM Robertson (eds), *Regolith Expression of Australian Ore Systems: A compilation of geochemical case histories and conceptual models*. pp. 392-394.

Cunningham GM, Mulham WE, Milthorpe PL and Leigh JH, 1992. *Plants of Western New South Wales*. Inkata press, 766 pp.

Eldridge DJ, 1988. Soil-landform and vegetation relations in the chenopod shrublands of western New South Wales. *Earth-Science Reviews* 25, 493-499.

Hulme KA and Hill SM, 2003. River red gums as a biogeochemical sampling medium in mineral exploration and environmental chemistry programs in the Curnamona Craton and adjacent regions of NSW and SA. *In:* Roach IC (ed.), *Advances in Regolith,* CRC LEME, pp. 205-210.

Hill SM, 2004. Biogeochemical sampling media for regional- to prospect-scale mineral exploration in regolith-dominated terrains of the Curnamona Province and adjacent areas in western NSW and eastern SA. *In:* Roach IC (ed.), *Regolith 2004,* CRC LEME, pp. 128-133.

Hill SM, Thomas M, Earl K and Foster KA, 2005. Flying Doctor Ag-Pb-Zn Prospect, Northern Leases, Broken Hill. *In:* CRM Butt, M Cornelius KM Scott and IDM Robertson (eds), *Regolith Expression of Australian Ore Systems: A compilation of geochemical case histories and conceptual models*. pp. 146-148. CRC LEME Monograph, Perth.

Hill SM and Hill LJ, 2003. Some important plant characteristics and assay overviews for biogeochemical surveys in western NSW. *In:* Roach IC (ed.), *Advances in Regolith,* CRC LEME, pp.187-192.

Irons NM and Quinlan EE, 1988. *A review of information relevant to the mulga rangelands of western New South Wales*. Soil Conservation Service of New South Wales Technical Report.

Kutsche F and Lay B, 2003. *Field Guide to the Plants of Outback South Australia.* Department of Water, Land and Biodiversity Conservation, South Australia. 304pp.

Neimanis M and Hill SM, 2006. Plant biogeochemical expression of uranium mineralisation in Australia: research outline and preliminary results. *In:* Fitzpatrick RW and Shand P (editors), *Proceedings of the CRC LEME Regolith Symposium, November 2006: Regolith 2006 consolidation and dispersion of ideas,* CRC LEME, Hahndorf, South Australia.

Neimanis M, Hill SM and Hore S, 2007. Plant biogeochemical expression of the Four Mile uranium mineralisation - Frome Embayment, South Australia. *In:* Cooper BJ and Keeling JL (editors), 5th Sprigg Symposium, November 2007: Regolith Mineral Deposits and Environment, *Geological Society of Australia Abstracts* No.87, pp.59-61.

Low C, Gore D, Taylor MP and Louie H, 2005. Black bluebush and old man saltbush biogeochemistry on a contaminated site: Broken Hill, New South Wales, Australia. *In:* Roach IC (ed.) *Regolith 2005 – Ten years of CRC LEME*, pp.213-218.

Moore P, 2005. *A Guide to Plants of Inland Australia*. Reed New Holland, Sydney, 503pp.

Senior AB and Hill SM, 2002. Regolith-landforms of the Pinnacles 1:25,000 sheet, western NSW: mapping and geochemical characterisation. *In:* Roach IC Regolith and landscapes in eastern Australia. *Proceedings of the CRC LEME regional regolith symposia 2002.*

Species	Description	Distribution	Sampling and Preparation	Biogeochemistry
 *Eucalyptus camaldulensis* River red gum	Large, typically single-stemmed tree up to 30 m tall with smooth white bark, with irregular red, brown, grey and yellow patches, and can have grey and rough bark at trunk base. Leaves are dull green to blue-green, 8-30 cm long and 7-20 mm wide, and drooping. Buds and fruits occur in clusters of 7-13, and buds have a rounded to slightly conical tip (beaked tip in southern and eastern forms). Flowers are white and can occur throughout most of the year. Long-lived with deep and spreading roots	Abundant along major watercourses	Leaves clean and easy to pick. Need to be well dried to avoid smearing in mill.	Hulme and Hill (2003) had up to 1.03 ppb Au in twigs near Teilta and up to 0.65 ppb Au in leaves. Hill (2004) reports 108-256ppm Zn, 1.9-3.7ppm Cd in leaves from trees over the Broken Hill Line of Lode. Hill (2004) reports over 300ppm Pb in leaves from near the Pinnacles Mine, later shown to overlie the Perseverance Lode.
 *Acacia victoriae* Prickly wattle	Small to medium shrub up to 5 m tall. Leaves are grey-green, broad-linear, > 2-5 cm long and 3-7 mm wide with one central vein and are rounded at the tip. Flowers are round, cream-bright yellow and occur singularly. Seed pods are broad and flat, 4-7.5 cm long and 6-13 mm wide, straight with large rounded leaves.	Common on calcareous soils associated with watercourses and flood plains.	Leaves clean but may be beyond easy reach (may need weighted line or ladder). Need to be well dried to avoid smearing in mill.	Hill (2004) reports up to 349ppm Zn in phyllodes from trees growing over the Broken Hill Line of Lode. From 62 samples phyllodes with up to 4.28ppm Cd, 221 ppm Zn, 49ppm Pb and 9ppm Cu overlying ineralisation at Flying Doctor (Hill *et al.*, 2005).
 *Acacia aneura* Mulga	Small upright tree up to 14 m tall, but also forms bushy shrubs 3-5 m tall. Variety of shapes with upright branches, 'Christmas tree' shape *(Acacia aneura var. conifera)*. Grey-green phyllodes, mostly narrow-linear, but can be broader, 3-11 cm long x 0.7-3 mm wide, with parallel veins. Yellow, cylindrical flower spikes, 8-25 mm long. Papery to woody, brown seed pods, 1-6 cm long and 0.4 – 2 cm wide. Variable intergrading and hybridising forms, including at least 10 varieties Long lived and deep-rooted	Widespread and locally abundant on hills and dunes	Clean phyllodes but can resist removal from twigs. Easy to mill phyllodes.	Hill (2004) reports up to 445 ppm Zn in phyllodes from trees growing over the Broken Hill Line of Lode. From 33 phyllode samples at Flying Doctor up to 0.12 ppm Cd, 12 ppm Cu, 14 ppm Pb, 63 ppm Zn (Hill *et al.*, 2005).
 *Casuarina pauper* Black oak	Variably shaped, bushy to upright tree up to 15 m tall, with dark grey fissured or scaly bark and slender, striated and jointed branchlets 1-2 mm thick. Leaves are 9-12 small pointed scales (resembling triangular teeth) at the tip of cylindrical branchlet nodes. Flowers are unisexual, with male flowers on sleder spikes at the end of the branchlets, and female flowers clustered in heads. Fruits are woody cones about 20 mm long with several rows of spiked valves each containing a winged seed. Long lived and deep-rooted	Widespread and locally abundant	Branchlets clean and easy to sample	Hill and Hill (2003).

Table 1 Common plant species of the Curnamona (continued over)

Species	Description	Distribution	Sampling and Preparation	Biogeochemistry
 *Callitris glaucophylla* White cypress pine	Erect pine-like tree up to 15 m tall, with rough, furrowed, stringy bark. Blue-grey to dark green, aromatic, cylindrical leaves covered in small scales. Seed cones are rounded, smooth-surfaced woody cones, up to 3 cm in diameter that split open into 6 segments. Long-lived to 100-200 years (Kutsche and Lay, 2003). Hybridises with other *Callitris* species where ranges overlap. Long lived and deep rooted	Widespread on SE slopes and on some dunes	Branchlets can be dusty but easy to sample	Hill and Hill (2003).
 *Maireana sedifolia* Pearl bluebush	Rounded, bright blue to whitish blue, multi-branched shrub to 1.5 m tall, with branches covered in woolly hairs. Leaves are alternate, succulent, linear to narrow egg-shaped, 4-8 mm long, rounded at the tip. Leaves join straight to the stem with no stalk. Flowers occur in pairs where the leaves join the stems. Fruits consist of rounded tubes, 2 mm long, and a horizontal wing 10 mm wide. Fruits are glossy yellow and pink to pale brown when dry. Reported to live at least 150-300 years (Irons and Quinlan 1988). Relatively deep tap-root system (up to 3 m) with shallow deciduous feeding roots (Cunningham *et al.* 1992).	Common perennial throughout the region. Associated with friable regolith substrates that allow root penetration, such as fractured bedrock or sites with regolith carbonate within 60 cm depth (Cunningham *et al.* 1992).	Leaf sampling is relatively simple, where mixed leaf and twig samples can be further separated after they fall apart during drying. Samples need to well ventilated before drying to avoid sweating and decomposition. Leaves mill easily once dried.	Hill and Hill (2003)
 *Maireana pyramidata* Black bluebush	Dark blue-green to grey, multi-branched shrub to 1.5 m tall. Leaves are alternate, succulent, linear to egg-shaped, 2-4 mm long, and covered in short hairs. Flowers are singular, occurring where the leaves join the stems, and can occur throughout the year following rain. Fruits are typically plentiful, light green, consisting of a flat tube and a wide horizontal wing, 10-15 mm wide that has a raised central section. Fruits become black when dry. Long lived to several decades (Kutsche and Lay, 2003).	Sheetwash-dominated erosional hills, rises and plains, where it may be co-dominant with *M.sedifolia* and/or *Atriplex vesicaria.*	Leaf sampling is relatively simple, where mixed leaf and twig samples can be further separated after they fall apart during drying. Samples need to well ventilated before drying to avoid sweating and decomposition. Leaves mill easily once dried.	Senior and Hill (2002) 34 samples in headwater catchment with buried quartz gahnite mineralised lode. Up to 55ppm Cu overlying lode. At Flying Doctor 71 leaves samples had up to 1.53 ppm Cd, 7 ppm Cu, 44 ppm Pb and 178 ppm Zn (Hill et al., 2005). Low et al. (2005) found higher metal concentrations in leaves, including higher Cd concentrations in leaves than soils from the same site. They had up to 600 ppm Zn in leaves from contaminated sites near the Broken Hill Line of Lode.
 *Atriplex vesicaria* Bladder saltbush	Erect to spreading shrub up to 70 cm tall. Leaves rigid, elliptical, 1-2.5 cm long. Male flowers in terminal spikes 2-4 cm long; female flowers in small clusters. Fruits have 2 vertical rounded 'wings', 8-15 mm long and wide joined together, with a puffy bladder on each side joined at the base of each wing. At least 8 sub-species have been defined, differing mainly in plant size and bladder appendages (Moore, 2005). Long-lived to 30 years (Kutsche and Lay, 2003). The root system is shallow, mostly penetrating to 30 cm (Eldridge 1988), although it may extend up to about 5 m.	This perennial is widespread throughout the region. Although found in association with most regolith types and landscape settings, bladder saltbush is most typically associated with clay-rich alluvial and sheetwash plains, particularly with distinctive 'contour-band' micro-topography.	Twigs are preferred sampling media, rather than leaves because of high salt contents in leaves.	Brown and Hill (2003) report detectable Au (>0.5ppb) in twigs overlying buried Cu-Au mineralisation at White Dam, with up to 0.081 ppb Au and 20 ppm Cu (Brown and Hill, 2005).

Table 1 Common plant species of the Curnamona

Species	Description	Distribution	Sampling and Preparation	Biogeochemistry
 *Eucalyptus camaldulensis* River red gum	Large, typically single-stemmed tree up to 30 m tall with smooth white bark, with irregular red, brown, grey and yellow patches, and can have grey and rough bark at trunk base. Leaves are dull green to blue-green, 8-30 cm long and 7-20 mm wide, and drooping. Buds and fruits occur in clusters of 7-13, and buds have a rounded to slightly conical tip (beaked tip in southern and eastern forms). Flowers are white and can occur throughout most of the year. Long-lived with deep and spreading roots	Abundant along major watercourses	Leaves clean and easy to pick. Need to be well dried to avoid smearing in mill.	Sampled at Four Mile Prospect (Neimanis *et al.*, 2007), results include: U range between <0.01 – 6.56 ppm Th range between 0.01 – 0.09 ppm Cu range between 0.52 – 6.27 ppm Mo range between 0.01 – 2.25 ppm Highest U concentrations occur along faults over mineralisation.
 *Eucalyptus intertexta* Gum-barked coolibah	Small to medium tree up to 20 m tall. Rough and thick bark at base of trunk, thinning above to flaky grey or red-brown bark, peeling from upper trunk and branches leaving smooth white bark. Leaves are dull grey to blue-green, 7-14 x 1-2 cm. Flowers are white in terminal clusters of 7, buds are club-shaped, with conical or rounded cap. Fruit 4-9 x 4-7 mm, ovoid with thin rim. Long-lived with deep roots along rock fractures	Widespread across hills and rises of weathered bedrock	Leaves clean but may be beyond easy reach (may need weighted line or ladder). Need to be well dried to avoid smearing in mill.	Hill (2004) reports up to 349 ppm Zn in phyllodes from trees growing over the Broken Hill Line of Lode. From 62 samples phyllodes with up to 4.28 ppm Cd, 221 ppm Zn, 49ppm Pb and 9ppm Cu overlying ineralisation at Flying Doctor (Hill *et al.*, 2005).
 *Eucalyptus gillii* Curly mallee	Mallee or low growing, multi-trunked tree, 3-6 m tall, with gnarled lower branches. Bark is rough up to 1 m above the ground, then grey, white to orange branches or stems. Leaves are whitish green-grey to silver, opposite with consecutive pairs at 90o to the last. Leaves 4-5 cm long and 15-25 mm wide, heart-shaped. Flowers are pale yellow, in groups of 3-9 on the end of stalks in late winter – summer. Long lived and deep-rooted	Widespread and locally abundant on hills and valleys, especially with calcareous soil	Leaves clean and easy to pick. Need to be well dried to avoid smearing in mill.	U contents between 0.12 - 6.59 ppm at Radium Ridge (Neimanis and Hill, 2006). Cu range between 4.79 – 33.42 ppm at Radium Ridge (Neimanis and Hill, 2006). Th range between 0.01 – 0.02 ppm at Radium Ridge (Neimanis and Hill, 2006).
 *Triodia irritans* Porcupine grass	Slow growing, long-lived, tussock-forming perennial grass with sharp cylindrical leaves. Leaves up to 30 cm long and 1-5 mm wide. Clumps with flower heads up to 1.5 m tall and can form rings and lobes several metres across. Long lived and very deep-rooted	Widespread and abundant on hills	Clean outer leaves but very spikey!!! Resinous residue in mill requires non-polar solvent to remove.	Recently sampled at Gunsight and Radium Ridge Prospects as part of Neimanis (PhD), results yet to be released.

Table 2 Common plant species of the Mt Painter - Beverley region (continued over)

Species	Description	Distribution	Sampling and Preparation	Biogeochemistry
 *Callitris glaucophylla* White cypress pine	Small upright tree up to 14 m tall, but also forms bushy shrubs 3-5 m tall. Variety of shapes with upright branches, 'Christmas tree' shape *(Acacia aneura var. conifera)*. Grey-green phyllodes, mostly narrow-linear, but can be broader, 3-11 cm long x 0.7-3 mm wide, with parallel veins. Yellow, cylindrical flower spikes, 8-25 mm long. Papery to woody, brown seed pods, 1-6 cm long and 0.4 – 2 cm wide. Variable intergrading and hybridising forms, including at least 10 varieties Long lived and deep-rooted	Widespread and locally abundant on hills and dunes	Clean phyllodes but can resist removal from twigs. Easy to mill phyllodes.	Yet to be sampled over mineralisation
 *Melaleuca glomerata* Inland tea-tree	Small to large bushy shrub to multi-stemmed tree with white papery bark. Branchlets and new leaves finely hairy. Grey, linear, finely pointed, alternate, hairy and soft leaves 15-50 x 1.5-2.5 mm. Cream to yellow flowers in rounded heads about 15 mm diameter at the end of short stalks. Fruit capsules about 2 mm across in dense clusters wrapped around stems. Moderate life span and shallow dense matted roots	Abundant along watercourses	Clean leaves and easy to pick. Easier to remove leaves from twigs when dry. Easy to mill leaves.	Max. U content 0.76 ppm at Four Mile Prospect (Neimanis *et al.,* 2007). Cu ranged between 1.17 – 7.90 ppm at Four Mile Prospect (Neimanis *et al.*, 2007). Th ranged between 0.02 – 0.28 ppm at Four Mile Prospect (Neimanis et al., 2007). Mo ranged between 0.15 – 4.19 ppm at Four Mile Prospect (Neimanis *et al.*, 2007)
 *Eremophila freelingii* Rock fuchsia bush	Rounded, erect shrub <2 m tall and wide, with 'parachute' shape canopy. Leaves grey-green or light green, 2-6 cm long and 2-8 mm wide, with tapered stalk and pointed tip, and covered in short sticky hairs. Flowers lilac, pinkish to pale blue tubes or bells, 20-27 mm long, with an upper lip of 2 lobes, and a lower of 3 lobes that extend further out than the upper. Flowers singularly or in groups of 2-3 on hairy sticky stalks. Fruit ovoid and hairy. Moderate life span and moderate root depth	Widespread and locally abundant on stony soils	Sticky leaves, but easy to pick. Can leave sticky residue in mill.	U content ranging between 0.02 - 0.94 ppm at Armchair Prospect (Neimanis and Hill, 2006). Ranged between 0.02-0.05 ppm U at Gunsight Prospect, and a sample from Streitberg Prospect had 0.36 ppm U (Neimanis and Hill, 2006). Cu content ranged between 3.62-13.99 at Gunsight Prospect; 10.65 – 24.9 ppm at Armchair Prospect; and, 19.44 ppm at Streitberg Prospect. Very high Ag values up to 70 ppb at Armchair Prospect and 41 ppb at Streitberg Prospect (Neimanis and Hill, 2006).
 *Casuarina pauper* Black oak	Variably shaped, bushy to upright tree up to 15 m tall, with dark grey fissured or scaly bark and slender, striated and jointed branchlets 1-2 mm thick. Leaves are 9-12 small pointed scales (resembling triangular teeth) at the tip of cylindrical branchlet nodes. Flowers are unisexual, with male flowers on sleder spikes at the end of the branchlets, and female flowers clustered in heads. Fruits are woody cones about 20 mm long with several rows of spiked valves each containing a winged seed. Long lived and deep-rooted	Widespread and locally abundant	Branchlets clean and easy to sample	Yet to be sampled over mineralisation here, but useful plant for biogeochemical exploration elsewhere (eg Tunkillia, SA)

Table 2 Common plant species of the Mt Painter - Beverley region (continued over)

Species	Description	Distribution	Sampling and Preparation	Biogeochemistry
 *Callitris glaucophylla* White cypress pine	Erect pine-like tree up to 15 m tall, with rough, furrowed, stringy bark. Blue-grey to dark green, aromatic, cylindrical leaves covered in small scales. Seed cones are rounded, smooth-surfaced woody cones, up to 3 cm in diameter that split open into 6 segments. Long-lived to 100-200 years (Kutsche and Lay, 2003). Hybridises with other *Callitris* species where ranges overlap. Long lived and deep rooted	Widespread on SE slopes and on some dunes	Branchlets can be dusty but easy to sample	Yet to be analysed from over mineralisation but useful plant for biogeochemical exploration elsewhere (eg central and western NSW). Recently sampled at Hodgkinson Prospect.
 *Melaleuca glomerata* Inland tea-tree	Large perennial grass with trunk to 2 m tall, round crowns of long, sword-like leaves, and short black trunk or trunks. Leaves 4-sided rhomboid in cross-section, 1.5-2.5 mm wide, and grey-green. Flower-spikes, 5-60 cm long and 20-40 mm wide, at the end of rigid thick stalk, 20-70 cm long, typically in autumn to late winter. Flower-spikes contain flowers surrounded by bracts, with white anthers and stamens. Flower-spike develops long-pointed, dark brown beak-like fruits in the spike. Long lived and deep rooted	Widespread on exposed hills	Leaves clean and easy to sample	U contents generally lower than other plants and only up to 0.09 ppm at Radium Ridge and 0.02 ppm at Streitberg Prospect (Neimanis and Hill, 2006). Cu up to 3.13 ppm at Radium Ridge (Neimanis and Hill, 2006). Ag and Th at or below analytical detection limits of 2 ppb and 0.01 ppm respectively (Neimanis and Hill, 2006).

Table 2 Common plant species of the Mt Painter - Beverley region