Biogeochemical expression of the area NW of Area 223, Tunkillia, Gawler Craton, South Australia

Trent William Ames

School of Earth and Environmental Science,
Geology & Geophysics, University of Adelaide

The University of Adelaide, SA 5005 Australia
E-mail: trent.ames@student.adelaide.edu.au
Tel: +61 (08) 8345 3883
Mob: +61 0433 776 032

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Supervised by Dr. Steven M. Hill

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1. ABSTRACT

The Tunkillia Au-prospect in the Central Gawler Craton is an arid area consisting of extensive faulting covered by a longitudinal dunefield. The landscape is a difficult environment for most surficial exploration techniques, where possible mineralisation suggested by a large Au-in-calcrete anomaly is covered by excessive amounts of aeolian cover. The dunefield that dominates the Tunkillia area is extensively colonised by vegetation, with two species selected for sampling in this study based on past results. The area has a variety of regolith-landforms that overlay the mineralisation in the area. *Casuarina pauper* and *Eucalyptus concinna* were sampled over a variety of landscapes to help express Au mineralisation using Au analyses in conjunction with other element suites such as Mo, As, Ag and Ce. Bore hole data was tested as a medium to help constrain localised mineralisation and to test the viability of this method. This research has major implications for other areas of the Central Gawler Craton and similar landscapes, suggesting biogeochemical exploration is a useful sampling medium over different scales, providing sufficient orientation studies have been conducted to constrain the best species and organs for sampling in the area. This study helps to identify biogeochemical exploration as a powerful tool for mineral exploration undercover by plotting chemical values from samples over spatial regolith landform maps. This can assist in highlighting potential mineralisation in conjunction with other studies such as soil sampling, as well as helping suggest rock types of the underlying substrate. This study has found areas that could potentially host Au mineralisation, and also has had success in suggesting rock types of the underlying substrate in parts of the area.

KEY WORDS: regolith, Tunkillia, Central Gawler Craton, mineral exploration, plant biogeochemistry, aeolian dunefield, under cover exploration, gold

2. INTRODUCTION

Since the 1930s there has been mineral exploration from the prospect to regional-scale using applications of plant biogeochemistry, mostly in humid environments in North America and Europe (Brooks 1983; Tkalich 1938). The application of plant biogeochemistry in arid environments, such as found in Australia, has been limited in its practice for mineral exploration. There are two main reasons for this: 1. the application and knowledge of plant biogeochemistry in these environments is limited (Lowrey & Hill 2006); 2. the abundance and minor success of other more popular sampling media, such as regolith carbonates and soils, results in the potential applications of plant biogeochemistry for mineral exploration being recognised less in these arid environments (Lintern et al. 1997). Therefore more research is required to highlight the potential uses of plant biogeochemistry as an exploration tool. This study is focused on using biogeochemical results to highlight underlying substrate and suggest any possible mineralisation, and suggest its effectiveness as an exploration tool.

Plants are a useful tool for mineral exploration in Australia due to their physiology. Hulme and Hill (2005) found that plants in arid environments in Australia generally have a deep root system of up to tens of metres to reach the lower water table. This means that by analysing aspects of plants such as leaves and stems, a representative sub-surface geochemical profile through the plant's root network for mineral exploration and substrate identification purposes can be obtained. Many Australian environments are highly weathered and have large amounts of transported cover, such as the Tunkillia aeolian dune fields, where more conventional geochemical analysis such as soil sampling of carbonates can have limited efficiency. In these areas plant analysis can be a more effective tool for under-cover mineral exploration and profile analysis.

The physiology of a plant allows us to utilise them as a powerful mineral exploration tool. The root system of plants enables the production of an expression of the sub-surface geochemistry through sampling of surface plant media, such as leaves, twigs, fruit and stems. This can be especially useful in arid environments where plant roots can extend up to tens of metres, as a deeper root system lets us explore for a deeper sub-surface profile (Hulme & Hill 2005). Some plants have a deeper root system due to a lower rainfall, and increased aeolian cover and dune fields impede other exploration techniques such as carbonate and soil sampling which makes this a useful technique.

Hill (2009) has outlined why plant biogeochemical sampling is advantageous in some settings for mineral exploration. Plant sampling is generally a less expensive alternative to other techniques, and has a lower impact on the environment. It is also effective in almost any area as plants are abundant in most landscapes. Sampling of plants is efficient and relatively requires a small workforce. However, there are drawbacks that include the lack of knowledge of plant sampling application for mineral exploration in Australian environments. Sampling over different time periods across an area can also be difficult due to seasonal variations such as drought periods, effecting the growth of plants and therefore the biogeochemical characteristics. These problems can be countered if sampling is conducted at the same time, and further research is directed into the physiology of plant cell structures, and the same species or similar are used for the sampling. This is because different plant cell structures may affect the uptake and mobility of different elements through the plant.

Accounting for up to 40% of the landscapes of the Australian continent, aeolian dune fields have a major influence on the use of surficial exploration techniques for expressing the underlying substrate. The dense vegetation cover with possible deep root systems in some of these areas makes plant biogeochemical exploration a potentially powerful exploration method in these areas. Previous studies that have been conducted in areas dominated by aeolian dune fields have found encouraging results, but most have generally had some form of constraint. Studies by Hall *et al* (1973) were an early application of plant biogeochemistry in arid environments in Western Australia. The results were not positive as a result of the plant species selected have a shallow root system. The study also had a limited number of elements selected in the assay suite, and the low analytical analytical detection limit used restricted the accuracy of the results. Plant biogeochemical analysis has been a powerful tool in aeolian dune fields near Wudinna in the central Gawler Craton, South Australia. These studies, conducted by Mayo (2005) and Mayo & Hill (2005) have provided knowledge in relation to plant species, landscape controls, and plant organs most suitable for sampling for biogeochemical analysis. The main drawback from this study is the area had a lack of mineralisation, so using biogeochemical analysis as a mineral exploration tool could not be analysed completely. Mayo and Hill (2005) sampled different surficial plant tissue (litter, phyllodes, bark, and branch wood, but did not sample leaves) and found the best results came from litter. Lintern (2004) has studied the effectiveness of plant biogeochemical analysis. This study in the Barns Gold Prospect in the northern Eyre Peninsula is an area where mineralisation is known, but there has been a high human impact as a result from agriculture and previous drilling exploration. Another weakness was the lack of specificity in Lintern's plant sampling, in relation to species and organ differentiation. An initial plant biogeochemical survey was conducted by Thomas (2004) in the Tunkillia area, but the number and distribution of samples in the area was limited. The chemical assay suite that was analysed was also inadequate, for example it did not contain Au.

Hulme and Hill (2003) conducted a biogeochemical survey in the Curnamona Craton which found that the best sampling media of river red gums is the leaves. This finding was also suggested by Lowrey (2007) whose research was in the Tunkillia area. This study did have a spatial limitation associated, where only one transect was analysed for assay results and the number of samples was restricted. Reid *et al* (2005) conducted research to test the validity of biogeochemical sampling in areas that are regolith-dominated. The project was conducted in the Tanami Desert, and the results suggested that plants in arid areas with deep root systems are powerful tools for transporting signatures of undercover mineralisation to the surface. This hypothesis was also tested by Anand *et al* (2007) in the Yilgarn Craton, whose results supported the idea of plant sampling as an effective tool for mineral exploration under cover. They found that litter was the best sampling media compared with leaves, stem, and branches. Litter could leach metals back into the soil, while leaves, stems and branches could have dust contamination originating from different areas through aeolian sources, although this was not found in these studies. Further study by Reid *et al* (2009) has suggested that chemical signatures that are displayed from plant species differs due to element mobility within the plant, and the access the root system has through the regolith profile. It was found that root depth is a major control on the ability of a plant species to extract metals from under-cover mineralisation. Further research is required into how the element expression from biogeochemical analysis can reflect the underlying substrate, and also into how groundwater movement and soil properties can also affect the results.

Recently there have been plant biogeochemical investigations in the Tunkillia area that have had positive results. Lowrey (2007) conducted research in the area with plant sampling of a range of species and different media from these species (leaves, twigs, fruit) in mineralised zones at Tunkillia. He suggested that alternative exploration methods are required for mineral exploration, especially in areas that have large cover depths. It was found that leaves were the best sampling media for biogeochemical analysis due to availability, results in the chemical assay, and the general lack of contamination. Lowrey (2007) helped constrain the plant species that are most effective for sampling in the Tunkillia area. It also supported the hypothesis for plant biogeochemical sampling as a powerful tool for mineral exploration for Au in areas that are dominated by regolith cover such as Tunkillia.

The hypothesis that leaves are the best sampling media has also been recognised by Hall *et. al.* (1973) who found leaves could distinguish between background and anomalous values, and Cole (1991) who found leaves the most effective medium for mineralisation analytical detection.

The study by Lowrey has led to further research in the Tunkillia area. One study that has been conducted to further the research was Vasey (2009). This study was a biogeochemical analysis of the Tunkillia area, focusing on the Yarlbrinda Shear Zone in Minotaur's 'BRAVO' area. Vegetation was sampled and analysed for a 53 element suite, and then narrowed down to the main elements that were found by Lowrey. Vasey decided on similar conclusions as Lowrey, suggesting that biogeochemical recycling could differ between plants on dune crests and swales. The plant species that is selected can also have a major influence on the iogeochemical analytical results. Vasey (2009) found that *C. pauper* and *C. Conocephala* are the two most effective species for biogeochemical sampling in the 'BRAVO' area.

Hopkinson (2009) studied the 'Tomahawk' area at Tunkillia with biogeochemical expression that has suggested that paleodrainage systems may have a large effect on the regolith expression of mineralisation in the area; however in the 'Tomahawk' area the paleodrainage had little effect on element mobility. Variables that can influence the biogeochemical signature of plant samples were identified, and include species, element availability, paleoscape and contemporary controls, and mineralisation expression. It was found that the plant sampling at 'Tomahawk' suggests that it is a transported anomaly, and that the plants were extracting from a deeper bedrock source.

Most mineralisation sites in the central Gawler Craton are found using Au-in-calcrete near surface geological expression, and the mineralisation at Tunkillia is no exception (Ferris & Wilson 2004). In the Tunkillia 'anomaly' smaller areas of discrete mineralisation have been constrained by diamond (DD), rotary air blast (RAB), reverse circulation (RC) drilling, and more recently by plant biogeochemical analysis (e.g. Lowrey 2007; Vasey 2009; Hopkinson 2009). Vegetation that is prominent in the Tunkillia mineralisation zone is also found throughout the central Gawler Craton, meaning that the results of this study and other biogeochemical studies have large implications in the field of mineral exploration in areas similar to Tunkillia in the central Gawler Craton.

This study uses biogeochemical analysis in the area over differing landforms, for example across paleochannel and sheetflow regolith landforms, as well as aeolian dunes. The plant species were selected due to their penetrative root systems, and their abundance in the study area. It is unknown as to whether mineralisation is present in the study area; it is however situated on the Au-in-calcrete anomaly, so mineralisation may be present.

The research challenge is to help constrain the location of under-cover mineralisation and identify the underlying substrate in the Tunkillia area using plant biogeochemical analysis in an area that has had previous exploration with drilling and calcrete analysis. The regolith landform map is used to help determine what significance regolith has on biogeochemical dispersion pathways, and how this can have an influence on mineral exploration under-cover. The aim of this project is to use biogeochemical sampling in aeolian dunefields coupled with previous research of the calcrete geochemistry to suggest the underlying substrate, and highlight any areas of potential mineralisation. A detailed regolith-landform map of the area will be created to assist in interpretation of the results in regards to the contemporary landscape, and explore any possible controls it may have on element expression. This will help further knowledge about the applications of plant biogeochemical analysis in environments with under-cover mineralisation such as Tunkillia, and provide basis for further analyses and promote awareness of the power of this analytical technique in comparison to more conventional methods.

3. SETTING

3.1 Location and Land Use

The Tunkillia Au-prospect is in the Central Gawler Craton (approximate coordinates: N6547471 E475814), approximately 570km north west of Adelaide (Figure 1). Four-wheel drive vehicles that have moderate clearance are required for transportation through the prospect, though there is reasonable access in the area due to station and exploration tracks, and drilling tracks. Minimal grazing occurs in the Tunkillia area due to poor access and land availability, but it does occur to the north of the prospect.

3.2 Climate

Tunkillia has an arid to semi-arid climate, resulting in generally mild to hot and dry summer season, and a cold winter period. The closest weather station is at Tarcoola, approximately 40 km north-north west. The average annual rainfall is 174 mm, with the year prior to this study receiving above average rainfall of 239.8 mm with an average monthly rainfall of 19.9 mm. Recent records have given average rainfalls for winter of approximately 18.8 mm/month, spring 27.5 mm/month, autumn 25 mm/month and summer 8.6 mm/month. The month before this study had a very low rainfall of 2.6 mm, but the month the study was conducted had a high rainfall of 41 mm. The average temperature in the area varies, but for summer maximum averages are approximately 35° C and 19° C in winter and minimums of 16° C in summer and 5° C in winter (Bureau of Meteorology 2010).

3.3 Regional Geology and geomorphology

The Tunkillia area is on the northern part of the N-S trending Yarlbrinda Shear Zone and hosts Archean Palaeoproterozoic granites and gneisses that have granite intrusions dated to the Mesopreoterozoic Hiltaba Suite. Ferris and Wilson (2004) highlight the surrounding lithologies, which are mainly from the Tunkillia Suite (1690-1670). These are foliated granitoids of mainly granodiorite composition, with coarser grained minor intrusive dykes. The majority of the area is under aeolian cover with only a few exposed bedrock areas surrounding the deposit to the north and north-west. The cover is generally Tertiary and Quaternary weathered sands overlying the bedrock (Martin & Wilson 2004).

There are two main mineralisation bodies that have been defined by drilling following regional calcrete survey:- ‘Area 223’ and ‘Area 191’. Mineralisation here is generally parallel with the main shear direction, and found in lode style quartz deposits (Ferris and Wilson 2004; Martin and Wilson 2004). The Au mineralisation is associated with sulphides, mostly pyrite, in areas of alteration in sericite and chlorite. Hydrothermal fluid is thought to be the source of the Au mineralisation focused along the Yarlbrinda Shear Zone from granitic release (Ferris and Wilson 2004). In the area NW of ‘Area 223’ the main cover is sand dunes, with minor areas of sheetflow and paleodrainage deposits, resulting in insufficient calcrete for a thorough analysis, or the calcrete may have been too deep for analysis.

3.4 Landscape and regolith

Lowrey & Hill (2006) have found that the area is dominated by aeolian dune fields that are approximately 20-30m deep and are made of weathered Au-depleted bedrock and aeolian sands. The dunes trend east-west and are approximately 250m apart and have crests approximately 10m high (Lowrey & Hill 2006). These dunes have been categorised by Lowrey & Hill (2006) into three phases (Phase I, II, III) that are migrating west to north-east. Phase I dunes are the most mature of the phases, that are fine to medium-grained, well-sorted, quartzose sand.

Phase II dunes are dominated by red/brown clayey sands. These dunes are also host to rhizomorphic regolith carbonates (Mayo & Hill 2005).

Phase III dunes are the youngest, and consist of light red-brown quatrzose sand, that is well-sorted and fine to medium-grained, and often form on top of Phase I and Phase II dunes. Vegetation on Phase I and Phase II dunes is generally similar, but this can be hard to determine as it is often partially covered by sand. Figure 2 (Lowrey 2007) highlights the differences between the three dune phases.

3.5 Vegetation

The vegetation at Tunkillia is partially controlled by the climate and also by the landform settings. Plants are often found in thickets as chenopod shrublands or low open woodlands with deep root systems to reach the low water table. Thomas (2004) has suggested the deep root system of the plants based on an orientation study, but more research into the general physiology of the species would be useful in biogeochemical studies.

The dominant vegetation on phase I dunes include both shrublands and woodlands, with dominant vegetation including mulga (*Acacia aneura*), horse mulga (*Acacia ramulosa*), and sometimes Walker’s pea (*Bossiaea walker*). The dunes also sometimes have a more solid surface which helps differentiate between the phases. (Lowrey 2007; Vasey 2009).

The dominant vegetation on phase II dunes are primarily woodlands with minor shrublands, with dominant vegetation including red mallee (*Eucalyptus socialis*) with sparse horse mulga (*A. ramulosa*) and Walker's pea (*Bossiaea walkeri*), with a prominent Spinifex shrub growth.

The dominant vegetation on phase III dunes includes some woodland that is primarily covered with sand, and then a shrubland overgrowth. As these dunes are still mobile, vegetation can differ, with early shrub and grass colonisation.

Inter-dune swales have a variety of vegetation that is controlled by the underlying regolith. For the swales that are mainly sand dominated without underlying regolith carbonates are dominantly colonised by Victoria Desert mallee (*Eucalyptus concinna*), black oak (*Casuarina* pauper), horse mulga (*A. ramulosa*) and umbrella wattle (*Acacia ligulata*), with sparse daisy bluebush (*Cratystylis conocephala)*, pearl bluebush (*Maireana sedifolia*) and Walker's pea (*B. walkeri*) (Lowrey 2007, Vasey 2009). Areas that have a strong underlying regolith carbonate are dominated by black oaks (*Casuarina pauper*), pearl bluebush (*M. sedifolia*) and daisy bluebush (*C. conocephala*) (Cunningham *et al.* 1992).

4. METHODS

4.1 Sampling procedure

The species chosen for this study are mainly found in the Central Gawler Craton and surrounding semi-arid desert environments (Figure 3). A total of 150 samples were taken from two species, Great Victorian Desert mallee (*Eucalyptus concinna*) and black oak (*Casuarina pauper*). Leaves were the main sampling medium used for the study, and at each location they were collected homogenously from around the tree canopy. Leaves of a similar age and health were collected when possible. A species count summary of the samples taken from the area is shown in Table 1, while Tables 2 and 3 show statistical summaries separated by species, and Table 4 is the statistical summary for both species. The area was split into six transects in the area north west of the mineralisation zone at 'Area 223'. These transects, trending NE-SW (Figure 4), were approximately 1 km in length and had separations of approximately 200 m. Different species along the transects are shown in Figure 5. This area of study was chosen due to its high vegetation density, was close to the 'Area 223' mineralisation, and had been previously drilled, but core profiling suggests that the drill holes were not to a sufficient depth to constrain mineralisation (Minotaur Exploration pers comm). The transects crossed the main landscape settings in the area, and also included area that is thought to be ‘background’ material. Samples were collected approximately every 50 m, but this varied due to landscape controls and vegetation density. Drilling in the area was not recent, so dust contamination should be minimised, although it will be present as this is an aeolian dune field setting.

Sample collection was conducted using methods outlined by Hill & Hill (2003), with a few minor changes. The samples were collected manually rather than using Teflon© coated pruning clippers, and no gloves were worn. Contamination sources such as jewellery, sunscreen, and other biogenic sources were minimised throughout the sampling period by washing hands after eating and sunscreen application, and removing jewellery before sampling. Dust contamination was minimised by avoiding samples that were close to previous drill holes in the area where possible. Samples were not washed due to limited effectiveness and possible leaching (Hill *et al.* 2005).

4.2 Sample Preparation and Analysis

Samples were stored in brown paper bags in the field and during transportation until they were dried at the University of Adelaide in ovens at 60ºC for 48 hours. The ovens were at an appropriate temperature level to reduce the chance of volatising any of the elements. Once the samples were dried, they were sorted to remove any twigs, fruits, seeds, and unwanted/damaged leaves. The samples were milled using a stainless steel coffee grinder in a fume cabinet to minimise sample contamination. Between each sample the coffee grinder was cleaned using compressed air then wiping with pure ethanol. The grinder was also pre-contaminated with a small amount of each sample before milling. Once milling was complete, the samples were re-packaged into small sealed envelopes for transportation to ACME laboratories in Canada. At ACME laboratories the samples were analysed using a Perkin Elmer Elan 6000 ICP mass spectrometer (ICP-MS).

The samples then undergo acid digestion and then are analysed using ICP-MS for a 53 element suite (analytical detection limit in parentheses) including: Ag (2 ppb); Al (0.01%); As (0.1 ppm); Au (0.2 ppb); B (1 ppm); Ba (0.1 ppm); Be (0.1 ppm); Bi (0.02 ppm); Ca (0.01%); Cd (0.01 ppm); Ce (0.01 ppm); Co (0.01 ppm); Cr (0.1 ppm); Cs (0.005 ppm); Cu

(0.01 ppm); Fe (0.001%); Ga (0.1 ppm); Ge (0.01 ppm); Hf (0.001 ppm); Hg (1 ppb); In (0.02 ppm); K (0.01%); La (0.01 ppm); Li (0.01 ppm); Mg (0.001%); Mn (1 ppm); Mo (0.01 ppm); Na (0.01%); Nb (0.01 ppm); Ni (0.1 ppm); P (0.001%); Pb (0.01 ppm); Pd (2 ppb); Pt (1 ppb); Rb (0.1 ppm); Re (1 ppb); S (0.01%); Sb (0.02 ppm); Sc (0.1 ppm); Se (0.1 ppm); Sn (0.02 ppm); Sr (0.5 ppm); Ta (0.001 ppm); Te (0.02 ppm); Th (0.01 ppm); Ti (1 ppm); Tl (0.02 ppm); U (0.01 ppm); V (2 ppm); W (0.1 ppm); Y (0.001 ppm); Zn (0.1 ppm); and Zr (0.01 ppm). Chemical analysis results are shown in Appendix 1. Sample duplicates and control blanks (one in every thirty samples) are included for quality assurance/ quality control purposes, with tables and results shown in Appendix 2.

4.3 Regolith Landform Mapping

Regolith-landform mapping was undertaken in the area at a local (1: 4700) scale using two main methods:

1. Photo interpretation of the study area on a 1:80000 scale aerial photo (Department of Environment and Natural Resources 1996; obtained in person from R Dart 2010) to trace RLU boundaries onto A3 transparency film.
2. Minor field observations made while sampling of approximately 30 field-sites throughout the study area, identifying main regolith units and minor vegetation. GPS (Global Positioning System) coordinates were recorded with a Garmin GPS unit to ± 5 m horizontal accuracy. Altitude was not recorded due to the small overall topographic variation and GPS inaccuracy.

Once digitised with GIMP© the map was georectified using ArcMap 9.3 to conform to the Australian Map Grid (AMG) GDA 1994, zone 53 (Appendix 3).

4.4 Biogeochemical Mapping/Geophysical Mapping

The element results were examined using Iogas (Version 4.2) and Statistica (Version 9; Trial) for spatial and statistical trends of all elements. Using Iogas (Version 4.2) and Statistica (Version 9; Trial) dendrograms, principal component analysis, correlation matrices and probability plots were created and elements were selected to represent Au-mineralisation (Appendix 4). Using these results the initial 53 element suite was narrowed down to 13 elements known to be associated with Au-mineralisation, pathfinder elements, and elements that had strong correlation with Au, including S, Fe, Mo, Cu, Pb, Zn, Ag, Au, Ca, and pathfinders Se, Hg, As and Rare Earth Element Ce. Distribution and ranked variable maps were created spatially in Iogas, and the results of these 13 elements were imported into ArcMap (Version 9.3) to overlay aerial photos and regolith images for interpretation.

4.5 Bore Hole analysis

Previous studies have been run in the Tunkillia area that included bore-hole water studies. Some of these bore-holes are located in the study area (Gray *et al* 2005). The results for these have been compared to the biogeochemical results using Microsoft Excel (Office 2010) to compare the table values. With more data, Iogas (Version 4.2) could have been used to created correlation plots and ArcMap (Version 9.3) to create spatial diagrams.

5. RESULTS

5.1 General

The ICP-MS chemical analysis results for all elements are shown in Appendix 1, with the results for the thirteen selected elements being included in Table 5. The results are described for the thirteen selected elements (Ag, As, Au, B, Ca, Ce, Cu, Fe, Hg, Mo, Pb, Se, Zn) for the two plant species, along with assays that may be indicators of minor detrital contamination included. Elements were selected based on certain criteria shown in Table 6, along with the criteria mentioned in section 4.4. Selected maps that highlight Au mineralisation are included in Figure 6, with the full set of biogeochemical maps included in Appendix 6.

5.2 Species Differentiation

Each element had different numbers of category levels or breaks based on populations identified by visual interpretation of element correlation maps (See Appendix 4). The levels were generally equally spaced by Jenks natural selection breaks (even breaks), but the values for some of the elements were changed to better suit the data. The elements that had values below analytical detection limit had that as their first category, and the largest number of splits into data sub-populations is 5. The biogeochemical results show a few spatial patterns in the area indicative of distribution patterns:

1. Higher concentrations for most elements found in the north-east of the target area (e.g. Au in *C. pauper,* Figure 7);
2. Higher concentrations along the southern zone in the study area (e.g. Ce in *E. concinna,* Figure 7);
3. Irregular high and low concentrations distributed throughout the area (e.g. B in *E. concinna,* Figure 7);
4. Below analytical analytical detection limit values for most sites (e.g. Ag in both species, Figure 7).

The differentiation in the analytical results between species has been summarised (see tables 3 & 4). The biogeochemical maps for Au in both species have been included, and then for selected elements in both species that best constrain Au-mineralisation out of the tested elements (see Figure 6).

5.3 Contamination

While contamination was kept to a minimum during sample collection and preparation, it can still be present due to external factors. We can analyse the chemical assay results for Al, Ti and Zr to check for detrital contamination, mainly through dust as this is an aeolian deposition (Mitchell 1960). These elements are useful for checking contamination as they have low availability to the plants, or cannot be taken up by the plants into their tissue. This results in generally lower values for these elements, and any higher assay results can suggest contamination. The Al concentrations **are** mainly below analytical detection limit, with a few samples containing a low content (≤0.02%) for both *C. pauper* and *E. concinna* suggesting low clay contamination.

The concentrations values for Ti have a low content (≤ 3) in all samples of *C. pauper* and *E. concinna*.

The concentrations values for Zr have a low content for both *C. pauper* (≤0.15 ppm) and *E. concinna* (≤0.06 ppm).

The generally low results for these elements suggest that there is minimal contamination, and that care that was put in to maximise results accuracy.

5.4 Split Probability Plots

The split probability plots for the samples taken (Figure 8) are used to express the elements from the underlying substrate. These plots compare values against a theoretical distribution, in this case the y-axis is a theoretical normal distribution, and the x-axis is the standard deviations or 'N-score' for the element. If the elements are normally distributed they would be a straight line on the plot; in this case the elements all deviate from a straight line and have significant values. The Mo results for *C. pauper* and for *E. concinna* show a generally low concentration, with minor larger values for both species. The results for Cu are generally increasing for both species, apart from some higher values found in *C. pauper.* The Pb results are generally low values for both species, with only a few higher values, especially evident in *E. concinna*. The Zn concentrations are stable and relatively high values for both species, with one larger value in *C. pauper*. Concentration values for Ag are low for both species, apart from one large value it *E. concinna*. The Fe results are relatively low for both species, with the exception of one higher value for *C. pauper*. Concentrations for As are generally low for both species, with some higher values in *C. pauper*. Concentrations for Au are steady for small to medium ranged values for both species, and one large peak value (4 ppm) found in *E. concinna*. The Ca concentrations are generally high values for both species, with a minor peak in *C. pauper*. The B concentrations are low for both species, apart from a few larger values. Concentrations for Hg are generally high for both species. The Se concentrations are generally low for both species, with one large value for *C. pauper*. The Ce concentrations are generally low to medium values, with results that are elevated slightly for *E. concinna*, but the highest result being found in *C. pauper.*

5.5 Distribution Plots & Area Results (Large Values)

The distribution plots for each species are shown in Appendix 7 & 8, and highlight areas of large element concentrations for each species. These plots highlight certain spatial patterns that are both within and between species.

For *C. Pauper,* Mo, Cu, Pb, Zn, Fe, Au, Hg and Se all have higher concentrations in the north-east of the project area. These could be reflecting potential mineralisation, but more probably most are reflections of the underlying substrate. Cu, Fe and Zn are mainly concentrated in the northern most transects, with lower concentrations as you go further south. The values for Pb are fairly low for a majority of the area, apart from two larger values in the north. These could be related to the higher values for Fe and Cu, with some form of deposit undercover, or could be increased due to a higher amount of pollution from more recent drilling. The concentrations for Mo are low for most of the area, with a few larger values in the north-east. This could again be representative of a differing underlying substrate or mineralisation. Concentrations for Au and Se follow a similar trend in the project area, with larger values in the north-east trending to the south-west. The larger values in the north-east of the area could link to the other elements with high values, but these are the only two elements that show a trend across the area for *C. pauper*.

The As concentrations are low for a majority of the area, with larger values located along the eastern and western sections of the area. Concentration values for B are similar, in the sense that there are large values along the eastern and western sections of the area. The main difference is that B concentrations are also generally high throughout the rest of the area, unlike As.

The other elements area generally isolated from the other elements in terms of where the larger values are spatially located. The concentrations for Ag are below analytical detection limit for most samples, with only two above analytical detection limits on the southernmost transect. The concentration values for Ca are consistently large throughout the area, rather than any specific concentration. This is likely due to Ca being an element that is very useful for plants in nutrient uptake. The concentrations for Ce in samples are large in the southern section of the area, decreasing as you head further north.

The concentrations for the elements in *E. Concinna* also have spatial patterns that could reflect differ underlying substrates or depositions.

The concentrations for Mo, Cu, Pb, Zn, and partially Au and Se are located mainly in the northern section of the area. The larger values are again generally located along the northern transects, but the spatial pattern is not as strong for most of the elements. The Cu concentrations are generally higher in the north-west, which links closely with Zn. The Pb values are generally low throughout the area, with the larger hits located in the north. Concentrations for Au, Se, and As are generally higher in the northern area, but larger values are also found along the western section of the project area.

The Ag concentration values are generally below analytical detection limit, with values above analytical detection found along the southernmost section, with the largest being 196 ppb.

The concentration values for Fe, Ca, and B are all generally high throughout the area. There are no evident spatial patterns to the concentrations for these elements, with large hits sporadically spread throughout the area.

The concentration values for Ce are large in the southern section of the area, and decrease as you head north. There is a minor correlation with the Hg values, which are higher in the southern section, but the concentrations are generally low throughout the area.

The concentration values for Se have a minor correlation with Ce and Hg, with some of the larger values along the southern transect, and generally low for a majority of the area. The difference is that Se values are generally higher through the middle of the area from west to east.

There are similarities and differences between species based on the spatial patterns highlighted within species. The concentration values for Ag, Pb, Zn, Ce, Ca, B and Cu are very similar between the species. The concentrations for B and Ca for both species are sporadically spread throughout the area for both species. The Ag concentrations were found along the southernmost transect for both species. The Zn, Pb, and Cu concentration values are higher for both species in the north of the area, with few large values randomly spaced.

There are minor similarities between species in regards to Au, Mo, and Se values. The Au concentrations are similar where the values are generally higher in the northern section, but in *C. pauper* the values trend down to the south-west, while they do not for *E. concinna*. The concentration values for Mo are generally high in the northern section for both species, but there are also randomly spread higher values for *E. concinna*. The sample concentrations for Se have larger hits in the south-west of the area, but for *C. pauper* this trends up to the north-east.

The concentration values for Hg and Fe differ greatly between the species. The Hg concentration values are focused in the northern section for *C. pauper* while they are focused in the south and middle for *E. concinna.* For *C. pauper* the large Fe values are located mainly in the north of the area, while for *E. concinna* the large values for Fe are found spread sporadically throughout the area.

5.6 Bore Hole data analysis

Table comparisons have been used to check the validity of this style of sampling against other more conventional methods. There is not enough bore hole data to accurately give this representation, and the units of measurement are not the same meaning that this comparison has a lower accuracy. The values between plant biogeochemical analysis and bore hole data greatly differed, suggesting it is not valid to use these techniques in conjunction with each other. With a larger bore hole study however, patterns within studies may correlate well with patterns between studies, even if individual data point values are very different. Further research would be useful in determining how well spatial patterns in areas correlate based on the study techniques used.

6. DISCUSSION: MODEL OF BIOGEOCHEMICAL EXPRESSION OF MINERALISATION

Mineralisation and the biogeochemical signature of elements in plants are influenced by a number of environmental and biological and geochemical variables.

6.1 Different Plant Species

Due to plant species having variances in their biogeochemical characteristics, their ability to express mineralisation and elements associated with mineralisation differs. Split probability plots and distribution maps were used to express the difference in elements uptake between species, as each species show mineralisation differently.

Casuarina pauper generally occurs on calcareous soils in woodland areas, sand plains, or alluvial swamps in the Tunkillia area. They generally are not found on dune swales. As a result, the number of samples is lower than for *Eucalyptus concinna*. Most of the elements showed some elevated results in *C. pauper*. The elements Mo, Cu, Pb, Zn, Ag, Fe, As, Au, Hg, Se and Ce have local areas of elevated results within *C. Pauper*, with Ca and B being the only elements that has irregular distribution. These elements can give a general area of mineralisation as they seem to be associated together, with certain elements (e.g. As, Mo) creating minor halos. These larger assay values suggest that there is a deep rooting system associated with *C. pauper*, which allows the underlying mineralisation and substrate to be expressed through the aeolian cover.

Eucalyptus concinna generally colonises sandy swales that are quartzose rich and sometimes on dunes. This allows for a larger number of samples to be taken compared to *Casuarina* *pauper.* Mo, Pb, Zn, Cu, As, Hg, Se, Ce, Ag, and Au have localised areas of elevated results that could highlight underlying mineralisation. This area partially covers the area that is highlighted by the results for *Casuarina pauper* (Figure 9). The elements B, Ca, and Fe have a sporadic and irregular distribution in the area with no defined localised areas of elevated values. These results suggest that the rooting system allow *E. concinna* to penetrate underlying cover.

The results suggest that the uptake of certain elements is controlled by the proportion of these elements in the underlying substrate and that mineralisation can be highlighted through certain elements. The results suggest that Ca, and likely Hg and B, are elements that may have irregular distribution patterns in areas with aeolian cover, and may therefore be less useful for exploration undercover. This observation may be skewed due to the different physiology of the plants in the area, and their biological element requirements.

6.2 Rooting and water availability

The sampling for this project was done in a time period of generally low rainfall for the Tunkillia area. This results in decreased water in the surficial soils, resulting in lower water availability. As a result the roots access groundwater mainly deep sources. This is important as previous studies (Brooks 1972, Hulme & Hill 2004) have found that rainfall has a tendency to influence the trace metal contents in plants. Assay results are generally higher in the dry season, which is when the sampling was conducted.

This is important in the Tunkillia area due to the residency of the groundwater in the area. It has been found that the groundwaters are relatively saline (~3.5%), which suggests a lack of flow in the water or a pooling effect with long residency (Gray & Pirlo 2005). As a result the groundwaters have a long time of contact with the surrounding rock, allowing for leeching to occur, and as a result the groundwaters should reflect the underlying substrate. The two species used in this study have deep root systems that rely on groundwater, and hence the assay results should closely reflect the underlying substrate due to this long term residency and leeching. This suggests that the results should reflect the underlying substrate and any possible mineralisation rather than transported materials.

6.3 Landscape Setting

Due to the changing landscape settings of the Tunkillia area, the biogeochemical characteristics also have large variations. There are four main regolith landform units highlighted in this study that can be used to highlight biogeochemical variations due to landscape: The two species sampled in this study populate all of the regolith units, but show preferences.

C. pauper dominates mainly sandy plains and also alluvial swamps/depositional plains in the area. These areas contain less aeolian cover, but were less prevalent in the target area. These settings are generally older landscapes which allows for element accumulation, suggesting that these areas are likely better for mineralisation prospects.

E. concinna dominates dune swales which were the dominant landform in the target area, along with sand plains. The cover on these swales is generally less than the surrounding cover, which allows for deep root systems to more readily access the underlying substrate.

While there is a largely varying contemporary landscape, is it not evident that the results are influenced by the changing landscape in the area for most elements. The Ce concentrations could be influenced by a migrating landscape, where it is less prevalent in areas with higher dune cover. This suggests that the assay results are controlled by a source that is undercover, most likely the underlying substrate. The deep plant roots can therefore be used to outline potential mineralisation and the underlying substrate.

6.4 Element Availability

Element availability differs due to element uptake by ions, immobilisation of ions in roots, metal ion precipitation, cell membrane permeability, and metal ions being released during leeching (Kabata-Pendias 2001).

Plants absorb Au readily due to its high mobility in soluble forms. It travels easily though soils and also, once inside the plant, travels easily throughout it (Kabata-Pendias 2001).

Concentrations of Ag in plants differ between species and samples due to the amount of the metal in soils. This makes it a powerful tool for biogeochemical sampling, and can becoming majorly increased in areas of mineralisation (Kabata-Pendias 2001).

A major chemical pollutant for plants is Pb and can be toxic at high levels. The main source of Pb is pollution, but can also be seasonal varied or sourced from anomalies (Kabata-Pendias 2001).

The amount of Ce in soils and the underlying substrate are the main controls of Ce in plants. Certain plants also have a higher ability to absorb this element (Kabata-Pendias 2001).

A common element in plants that is closely tied to the amount in the underlying soils is Zn. It is generally inhibited by cell membrane permeability in plants, but has also been suggested to be highly mobile (Kabata-Pendias 2001).

The amount of Cu uptake differs between plants, but it is likely to enter all plants in its disassociated forms. It is generally suggested to be actively absorbed by plants, making it useful for mineralisation undercover (Kabata-Pendias 2001).

Uptake of Fe is controlled by plant metabolism, and is absorbed in multiple charge stages. The uptake is not transported well through plant tissues, and is influenced by environmental factors (Kabata-Pendias 2001).

A common element in most plants is As whose absorption does vary between species so levels can vary (Kabata-Pendias 2001).

The element Mo has a high mobility in soils and plants, and is readily absorbed. Values generally reflect the underlying soils (Kabata-Pendias 2001).

Readily absorbed by plants and differs between species, Hg can be sourced in plants from the air or more commonly from soils in areas with low pollution. (Kabata-Pendias 2001).

Generally associated with amount in underlying soils, Se uptake varies between species but is generally readily taken up (Kabata-Pendias 2001).

Readily absorbed by plants, B generally has high values that reflect the underlying soils. It is absorbed at different levels between species and is essential for plant metabolism (Kabata-Pendias 2001).

Essential element for plants, Ca has ready uptake levels and reflects the underlying soils. The uptake varies between species (Kabata-Pendias 2001).

6.5 Bedrock Expression

The Yarlbrinda Shear Zone has internal structures that tend north-east to south-west shown in the geophysics in figure 10. A detailed knowledge of the underlying geology of the study area is undefined due to the large amount of aeolian cover. There are certain elements that are elevated in the area that could reflect the underlying substrate.

The high Fe concentrations that are found in the north of the area could be representative of two possibilities; 1) there could be a localised underlying deposit or mineralisation or; 2) the underlying substrate could be mafic rich, and hence Fe is absorbed by the plants. This is reflected by the higher values of Zn and Cu that are also localised in the north of the area, as these can also be sourced from mafic rocks.

The concentration results for Ce that are localised in the southern section of the area could be controlled by the underlying substrate. Rocks that are high is Ce include Bastnaesite, which can be sourced from altered granitic breccia. This is highly likely, as the Tunkillia area is suggested to have a granitic substrate, which is likely altered by the Yarlbrinda Shear Zone. The larger Ag concentrations are also located in this area and some large Au values, which could be indicative of an ore body like at Olympic Dam Cu–U–Au–Ag body, that has high values for Ce as well (PIRSA 2010).

Rocks that are rich in Mo include rocks that have residual amounts of hornblende and minor chloritisation of biotite (Varmo 1953). In the northern section of the map, where the larger concentrations for Mo are generally found, this could suggest underlying mafic gneiss, which would coincide with the suggestion of a mafic underlying substrate from Fe, Zn, and Cu results.

Generally Se is not found in its pure form in the environment; it is instead found mixed with other minerals such as sulphides, or copper, lead, or silver (eco-USA 1989). It is also common in sedimentary rocks, but is generally taken up by plants as a result of the soils, so it suggests that some of the aeolian material has come from a sedimentary source.

Galena is almost the only source of natural Pb in the environment. The other main source of Pb is pollution. Therefore, the higher Pb concentrations in the north of the area could suggest a higher amount of pollution. This is likely as galena is also an important ore for Ag, but the larger concentrations for Ag are located along the southernmost transect, while the larger Pb values are located to the north of the area.

7. DISCUSSION: IMPLICATIONS FOR MINERAL EXPLORATION

7.1 Targets from study

Studying the assay results for this area can give us broad areas of suggested mineralisation (Figure 11) that can be narrowed down for target areas based on Au assay results and supporting elements.

1. High Priority: These areas have large values for Au assay results supported by other element assay results
2. Medium Priority: These areas have lower values for Au or surrounding element assays.
3. Low Priority: These have high or medium Au results, but low values for other elements.

There are 4 main areas of mineralisation that have been highlighted, but there may also be other minor areas that have not been defined. Area A is high priority, area B is medium priority, and areas C & D are low priority. These targets are defined by the criteria stated above.

Area A has relatively high Au values, which are supported by assays results of Mo, Cu, and Zn. The Mo results seem to be forming a halo that may surround mineralisation. There are also higher values for other elements that can suggest mineralisation, or a mafic rich substrate. The mafic rich substrate suggests granitic igneous intrusions, and as the mineralisation at Tunkillia is thought to be a result of hydraulic release during igneous intrusion and vein formation, this could highlight potential mineralisation.

Area B is an area that has a very high Au result (4 ppm) but relatively low results for other elements, apart from B. This suggests that mineralisation is potential based on Au results, but it doesn’t have support from the other elements.

Areas C & D are areas that have medium Au results that are supported by higher Ag values in these areas. This is also supported by Ce results, which can suggest an ore body similar to the style at Olympic Dam. In the Tunkillia area, the Ag to Au ratio is 4:1, therefore the larger Ag concentrations in the area that coincide with larger Au values could represent miner mineralisation veins.

7.2 Limited Biogeochemical Exploration

The use of plant biogeochemical methods as mineral exploration tools has been limited in Australia until recent studies. This study helps to show the importance of these methods in constraining mineralisation in areas with intense aeolian cover. The suggested mineralisation that has been identified shows the effectiveness of biogeochemical exploration at even small scales (10s m).

A useful method for mineral exploration in areas with large cover would follow these steps:

1. Geophysical exploration of target area, to highlight structural bodies and sulphide structures
2. Regolith carbonate sampling to highlight 'Au-in-calcrete' anomalies
3. Biogeochemical analysis on a smaller scale to check mineralisation in 'Au-in-calcrete' anomalies
4. RAB drilling in the most promising areas
5. If RAB drilling is successful, then further drilling techniques may be used, depending on the requirements of the project

7.3 Regional and Further Applications

The Tunkillia area is a spatially large 'Au-in-calcrete' anomaly that has smaller areas of localised mineralisation that have been found by drilling and biogeochemical surveys. The area still leaves much to be uncovered through exploration techniques.

Plant biogeochemical analysis has been suggested to be a powerful tool in this style of landscape, but does have weaknesses. The area needs to have an abundance of vegetation that is suitable for sampling (i.e. deep rooted and available). It also needs to be in an area that is has relatively low pollution and agricultural influence, to get accurate assay results. The plant species used in this area were fairly evenly spread over the landscapes, but this may not be the same in all areas. It is hard to find a single species that is representative of an area, so multiple species need to be used which can make result interpretation harder. On larger scales different vegetation may not be as useful for exploration due to their physiology.

8. CONCLUSION

8.1 Landscape

The results from this study have major implications on the use of biogeochemical analysis for mineral exploration in areas dominated by aeolian cover. Regolith-landform mapping highlighted the dunes and swales that dominate the area; the results however do not seem to be influenced by this suggesting that plant biogeochemical analysis, when used correctly, samples the underlying substrate. The trends in the area have a minor north-east to south-west trend, which suggests a bedrock mineralisation control. Most drilling, regolith carbonate, and soil sampling programs assay for Au alone, but by making this a multi-element suite we can constrain mineralisation to a higher degree, and locate mineralisation by associate elements that may otherwise be missed.

8.2 Plant Biogeochemistry

This study has highlighted the effectiveness of plant biogeochemistry as a suitable tool for prospect-scale mineral exploration. It also highlights the need for orientation programs before selecting specific species. In this case *E. concinna* & *C. pauper* were selected based on the orientation study by Lowrey (2007). These species have been shown to be effective for constraining undercover mineralisation in areas of undercover mineralisation like Tunkillia. While exploration may result in contamination, all tasks were done in a method to reduce contamination, which is highlighted in assay results for Al, In, Ti and Zr.

Biogeochemical sampling is a powerful tool, but is limited by the spacing between samples and vegetation availability, so it is recommended that it is followed up with another exploration technique such as calcrete sampling.

Plant biogeochemical exploration has many advantages over other surficial techniques such as soil sampling and carbonate sampling which include (Hill 2009):

1. It is cost effective (compared to soil assays) without the need for specialised equipment and with limited human resources
2. Negligible environmental impacts
3. Time effective (~100 samples per day)

4. Useful in areas with limited outcrop exposure
5. Useful in areas with limited accessibility and large amounts of cover

8.3 Further Research

This research suggests that plant biogeochemical analysis can be a useful tool for highlighting potential mineralisation and the rocks of the underlying substrate in areas with large amounts of aeolian cover. Further research into the Tunkillia area is still needed to fully investigate this project. More research into the plant physiology is required, especially into how their interior cell structure affects elements mobility, and how the tree roots uptake different elements at altered rates. Another study that would be useful for more research depth would be an in depth ground water study, in regards to the changes in water table levels, and also a soil study. The soil study should focus on water absorption rates and how the elements move through the soil. These studies would provide a much greater analysis of the area, and increase the potential of plant biogeochemical analysis drastically.

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References

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, Environement, Analysis* **7**, 267-288.

BUREAU OF METEOROLOGY. 2010. Climate statistics for Australian locations, Tarcoola www.bom.gov.au/climate/averages/tables/cm_016044.shtml

BROOKS R. R. 1972. *Geobotany and biogeochemistry in Mineral Exploration*. Harper & Row, New York.

BROOKS R. R. 1983. Biological methods of prospecting for minerals. *John Wiley & Sons, Inc, Canada.*

COLE M. M. 1991. Remote sensing, geobotany and biogeochemistry in analytical detection of Thalanga zinc-lead-copper deposit near Charters Towers, Queensland, Australia. *Transactions of the institute of mining and metallurgy section B.* **100**, 1-10.

CUNNINGHAM G.M., MULHAM W.E., MILTHORPHE P.L., and LEIGH J.H. 1992. Plants of Western New South Wales. *Soil conservation service of New South Wales.*

FERRIS G. & WILSON M. 2004. Tunkillia Project- Proterozoic shear-zone-hosted gold mineralisation within the Yarlbrinda Shear Zone. *MESA* **35**, 6-12.

GRAY D.J. & PIRLO M. 2005. *Hydrogeochemistry of the Tunkillia Gold Prospect, South Australia.* CRC LEME open file report **194**. CRC LEME, Bentley.

HALL J. S. BOTH R. A. & SMITH F. A. 1973. A comparative study of rock, soil, and plant chemistry in relation to nickel mineralisation in the Pioneer area, Western Australia. *Proceedings Australasian Institute of Mining and Metallurgy.* **247**(11-22).

HILL S. M. & HILL L. J. 2003. Some important plant characteristics and assay overviews for biogeochemical surveys in western New South Wales. *In: Roach (Ed) Advances in Regolith CRC LEME*, 187-192.

HILL S. M. BROWN A. HULME K. PETTS A. REID N. & MAYO A. 2005. Using biogeochemistry and geoecology yo explore through transported cover for mineralisation, Mineral Exploration through Cover, pp 7-10.

HILL S. M. 2009. Vegetation Sampling in the Gawler Craton. *School of Earth and Environmental Sciences, University of Adelaide.*

HOPKINSON A. L. 2009. Biogeochemical expression of the 'Tomahawk' Au-in-calcrete anomaly, Tunkillia, Gawler Craton, South Australia. Honours, University of Adelaide, Adelaide, (unpubl.)

HULME K. & HILL S. M. 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. *Advances in Regolith CRC LEME*, 205-210.

HULME K. & HILL S. M. 2004. Seasonal Element variations of Eucalyptus Camaldulensis Biogeochemistry and Implications for Mineral Exploration: An example from Teilta Curnamona Province, Western NSWSEASONAL ELEMENT *Regolith 2004, CRC LEME*, 151-156.

HULME K. & HILL S. M. 2005. River red gum biogeochemistry associations with substrate: bedrock penetrators or stream sediment amalgamators? *In*: I.C. Roach (ed), *Regolith 2005 – Ten Years of CRC LEME,* pp. 145- 151. CRC LEME, Bentley.

KABATA-PENDIAS A. 2001. *Trace Elements in Soils and Plants*. CRC Press LLC, Florida.

LINTERN M. J, BUTT C. R. M. & SCOTT K. M. 1997. Gold in vegetation and soil – three case studies from the goldfields of southern Western Australia. *Journal of Geochemical Exploration*. **58**, 1-14.

LOWREY J. & HILL S. 2006. Plant biogeochemistry of Au-mineralistion burried by an aeolian dunefield, Tunkillia, S.A. *CRC LEME, School of Earth and Environmental Sciences*, 217-220.

LOWREY J. 2007. Plant Biogeochemical expression of Au-Mineralisation buried by an aeolian dunefield, Tunkillia, south australia. *CRC LEME, School of Earth and Environmental Sciences*, 1-23.

MARTIN A. R. & WILSON M. H. 2004. Information Memorandum – Lake Everard Project including Tunkillia Prospect and Area 223 Gold Deposit. *Helix Resources Ltd Pty*, http://helix.net.au/tunkillia.24.html

MAYO A. M. 2005. Plant biogeochemistry and geobotany in an aeolian dunefield of the Central Gawler Craton, South Australia. *BSc. Hons Thesis, Department of Geology and Geophysics, University of Adelaide.*

MAYO A. M. & HILL S. M. 2005. Mineral exploration through and aeolian dunefield near Wudinna, Gawler Craton , South Australia: A framework of plant biogeochemistry and geobotany. *Regolith 2005 -Ten years of CRC LEME*, 223-228.

MITCHELL R C 1960 Contamination problems in soil and plant analysis. J. Sci. Food Agric. 11, 553–560.

REID N., HILL S. M. & LEWIS D. M. 2005. Tanami Geobotany and Biogeochemistry: Towards its characterisation, role in regolith evolution and implications for mineral exploration. *Regolith 2005 - Ten years of CRC LEME*, 256-259.

REID N., HILL S. M. & LEWIS D. M. 2009. Biogeochemical expression of buried gold mineralisation in semi-arid nothern Australia: penetration of transported cover at the Titania Gold Prospect, Tanami Desert, Australia. *Geochemistry: Exploration, Environment, Analysis* 9, 267-273.

SMITH B. H. & KEELE R. A. 1984. Some observations on the geochemistry of gold mineralisation in the weathered zone at Norseman, Western Australia. *Journal of Geochemical Exploration.* **22**, 1-20

TKALICH S. M. 1938. *Vest. Dal'ne Vost. Fil. Akad. Nauk SSSR.* **32**, 3.

THOMAS M. 2004. Biogeochemical Data Ranges from Tunkillia Prospect, Central Gawler Craton, South Australia. *Regolith 2004, CRC LEME*, 362-364.

VASEY B. S. S. 2009. Biogeochemical expression of geophysical targets within the Yarlbrinda Shear Zone south of Tunkillia, Gawler Craton, South Australia. Honours, University of Adelaide, Adelaide, (unpubl.)

PROGRAMS

ESRI (1995) *ArcGis* (Version 9.3). Available at http://www.esri.com

ioGlobal (2010) *ioGas* (Version 4.2). Available at http://www.ioglobal.net/Downloads/Products.aspx

Statsoft (2010) *Statistica* (Version 9). Available at http://www.statsoft.com/products/

Figure Captions

FIGURES

Figure 1


SOUTH AUSTRALIA
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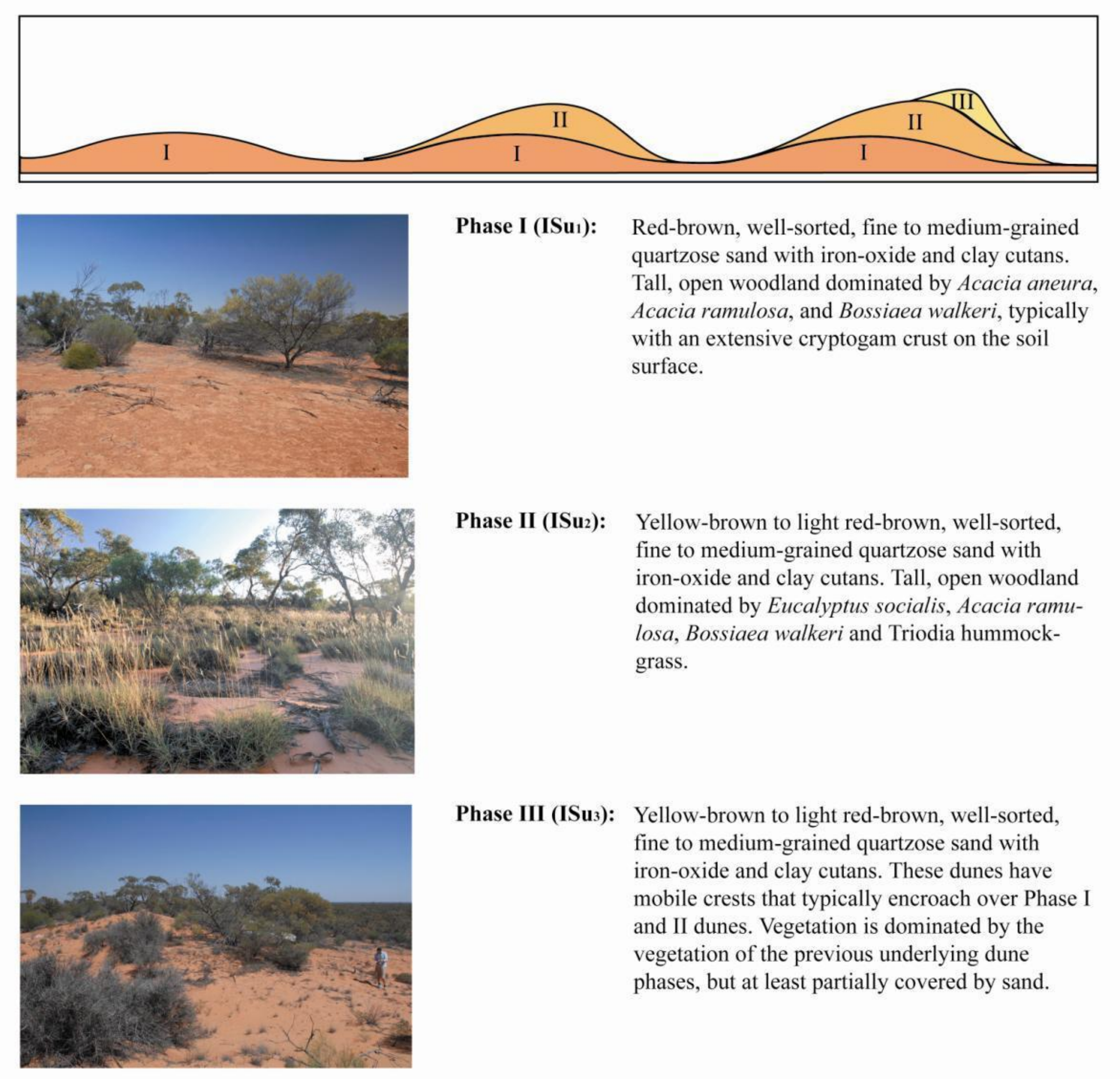
Tunkillia
Ceduna
Whyalla
Adelaide
N
0
200
Kilometres

Figure 2



Phase I (ISu$_1$): Red-brown, well-sorted, fine to medium-grained quartzose sand with iron-oxide and clay cutans. Tall, open woodland dominated by *Acacia aneura*, *Acacia ramulosa*, and *Bossiaea walkeri*, typically with an extensive cryptogam crust on the soil surface.

Phase II (ISu$_2$): Yellow-brown to light red-brown, well-sorted, fine to medium-grained quartzose sand with iron-oxide and clay cutans. Tall, open woodland dominated by *Eucalyptus socialis*, *Acacia ramulosa*, *Bossiaea walkeri* and Triodia hummock-grass.

Phase III (ISu$_3$): Yellow-brown to light red-brown, well-sorted, fine to medium-grained quartzose sand with iron-oxide and clay cutans. These dunes have mobile crests that typically encroach over Phase I and II dunes. Vegetation is dominated by the vegetation of the previous underlying dune phases, but at least partially covered by sand.

Figure 3

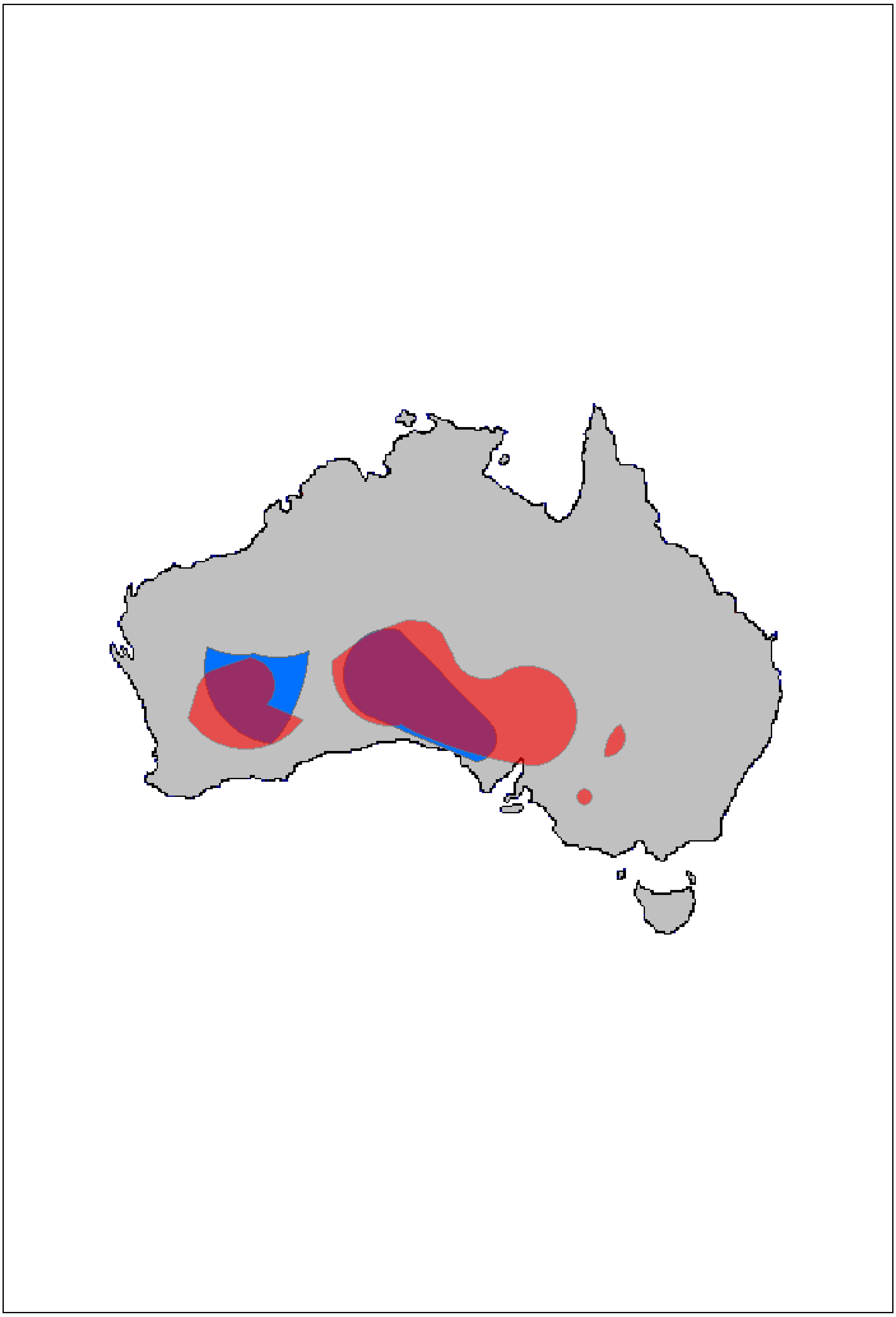


Figure 4

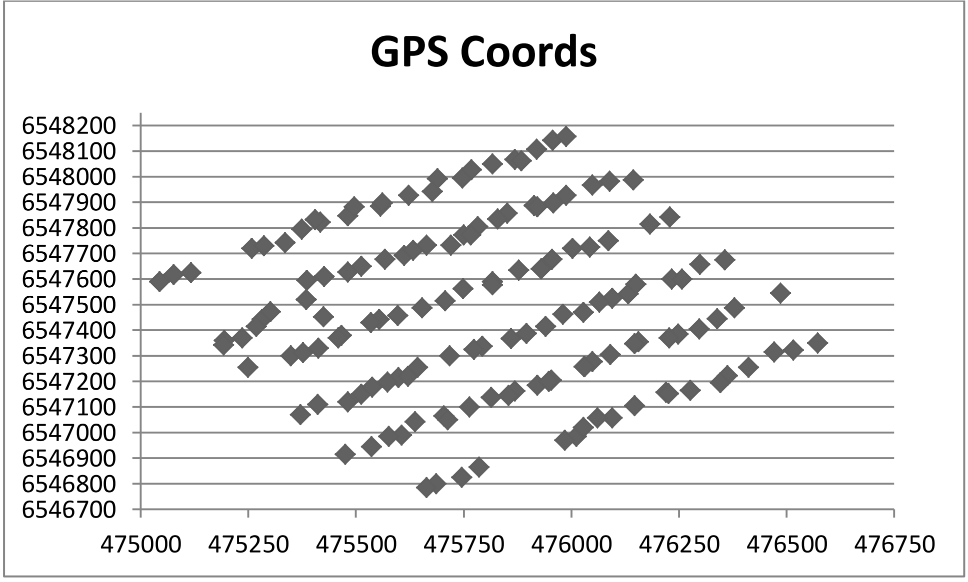

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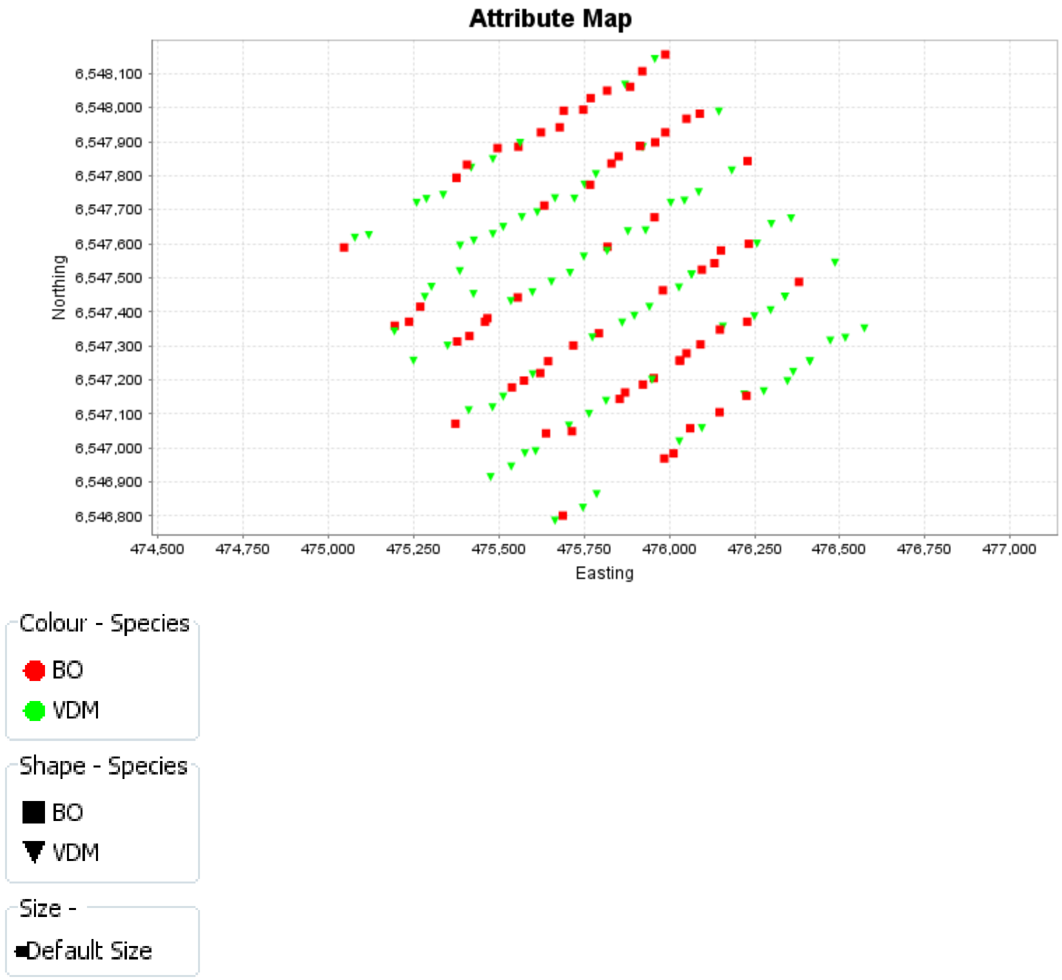
Figure 5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474,750
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475,250
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475,750
476,000
476,250
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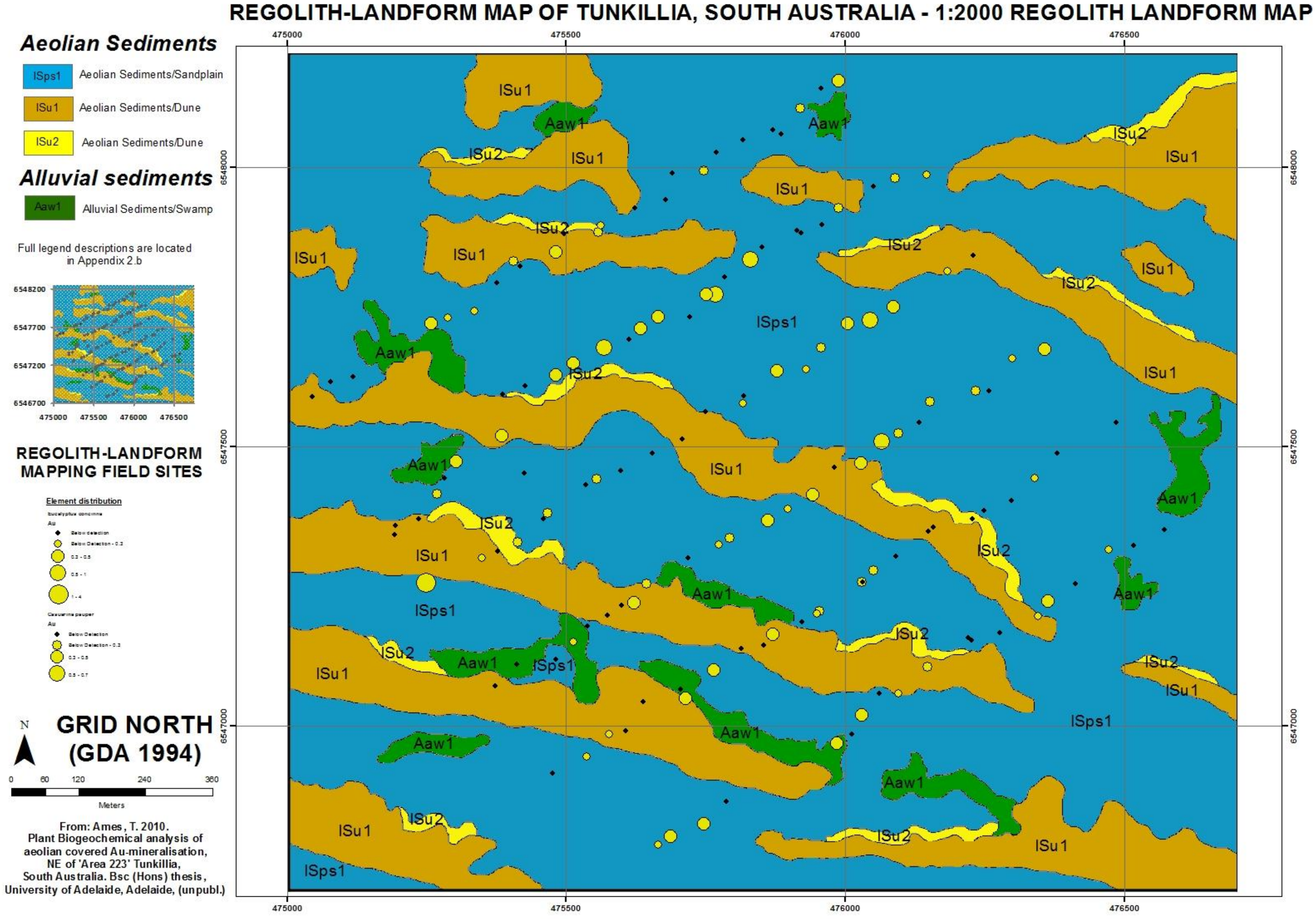
Easting
Colour - Species
BO
VDM
Shape - Species
BO
VDM
Size -
Default Size

Figure 6.1



REGOLITH-LANDFORM MAP OF TUNKILLIA, SOUTH AUSTRALIA - 1:2000 REGOLITH LANDFORM MAP

From: Ames, T. 2010.
Plant Biogeochemical analysis of
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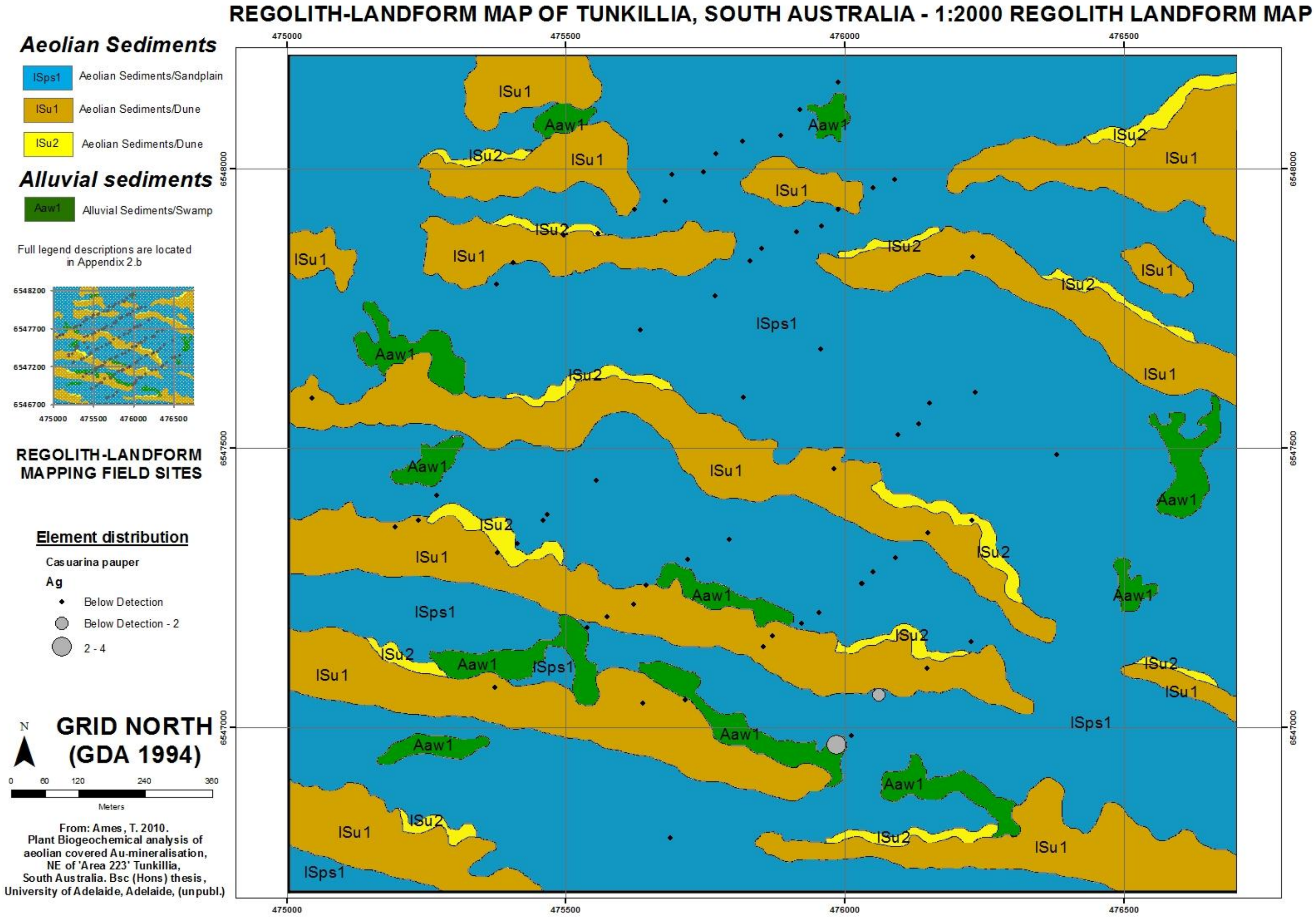
NE of 'Area 223' Tunkillia,
South Australia. Bsc (Hons) thesis,
University of Adelaide, Adelaide, (unpubl.)

Figure 6.2


REGOLITH-LANDFORM MAP OF TUNKILLIA, SOUTH AUSTRALIA - 1:2000 REGOLITH LANDFORM MAP
Aeolian Sediments
ISps1 Aeolian Sediments/Sandplain
ISu1 Aeolian Sediments/Dune
ISu2 Aeolian Sediments/Dune
Alluvial sediments
Aaw1 Alluvial Sediments/Swamp
Full legend descriptions are located in Appendix 2.b
REGOLITH-LANDFORM MAPPING FIELD SITES
Element distribution
Casuarina pauper
Ag
Below Detection
Below Detection - 2
2 - 4
N
GRID NORTH (GDA 1994)
0 60 120 240 360
Meters
From: Ames, T. 2010. Plant Biogeochemical analysis of aeolian covered Au-mineralisation, NE of 'Area 223' Tunkillia, South Australia. Bsc (Hons) thesis, University of Adelaide, Adelaide, (unpubl.)
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6547200
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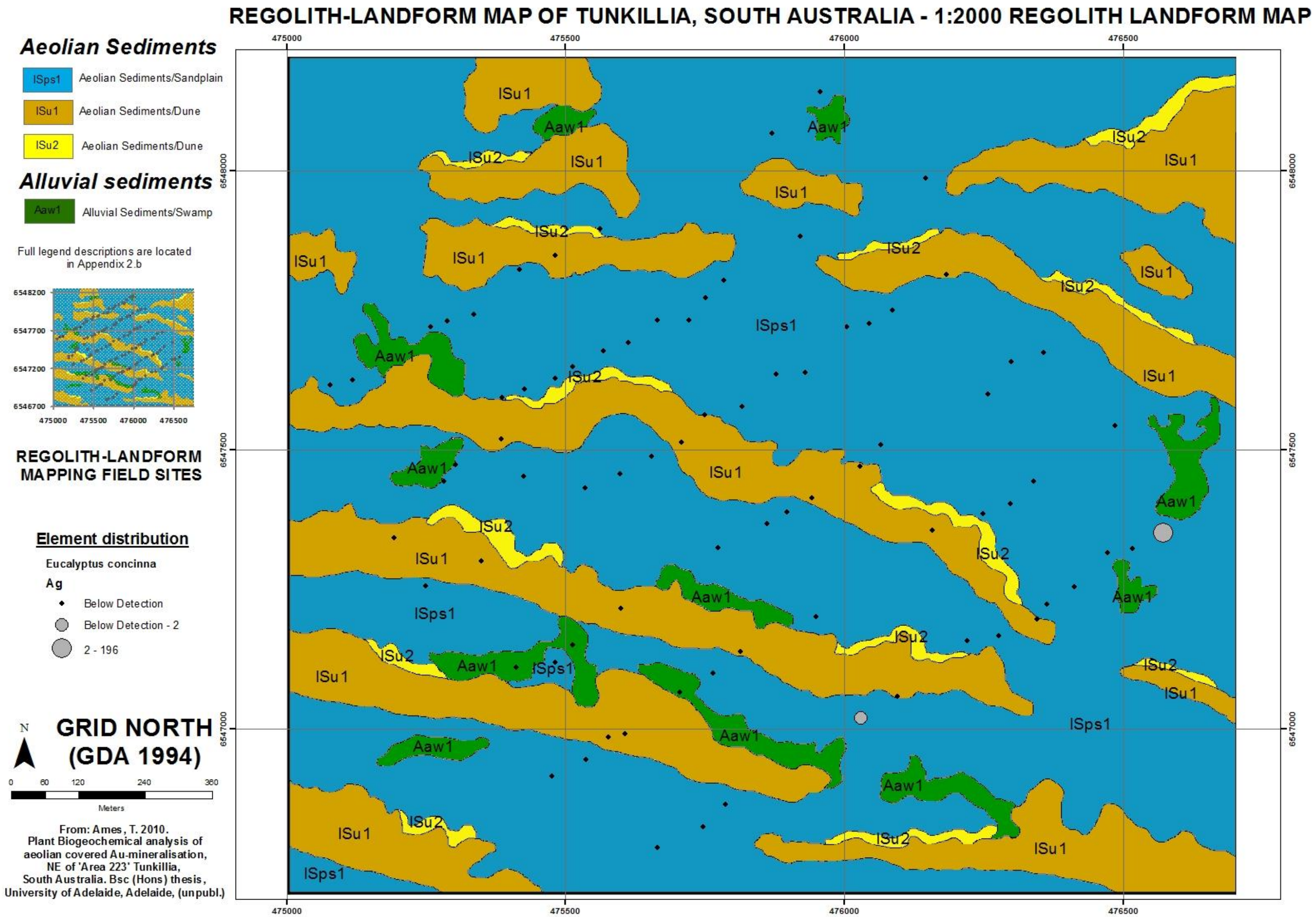
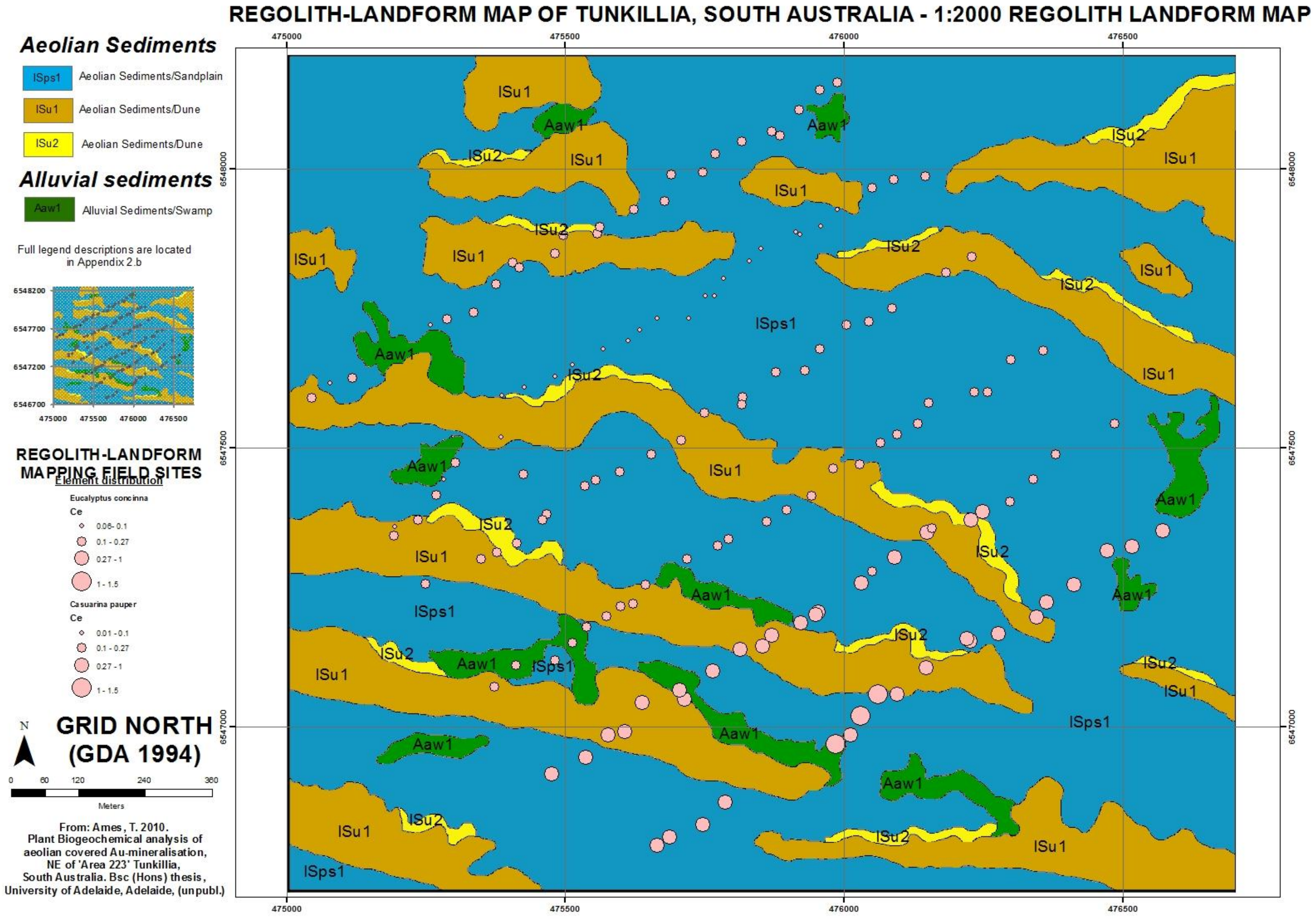
ISu1
ISu2
ISps1
Aaw1

Figure 6.3



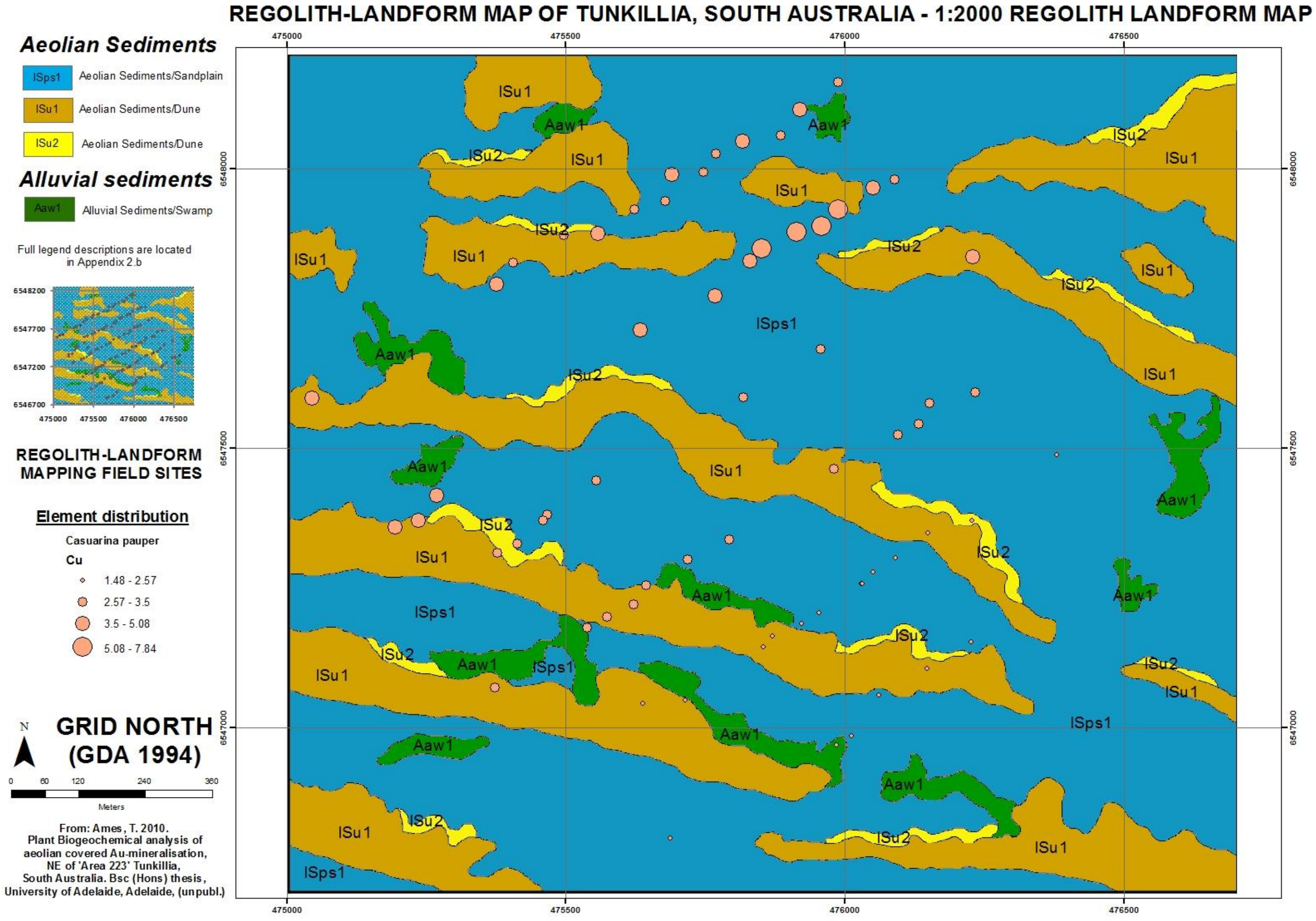
From: Ames, T. 2010. Plant Biogeochemical analysis of aeolian covered Au-mineralisation, NE of 'Area 223' Tunkillia, South Australia. Bsc (Hons) thesis, University of Adelaide, Adelaide, (unpubl.)

Figure 6.4



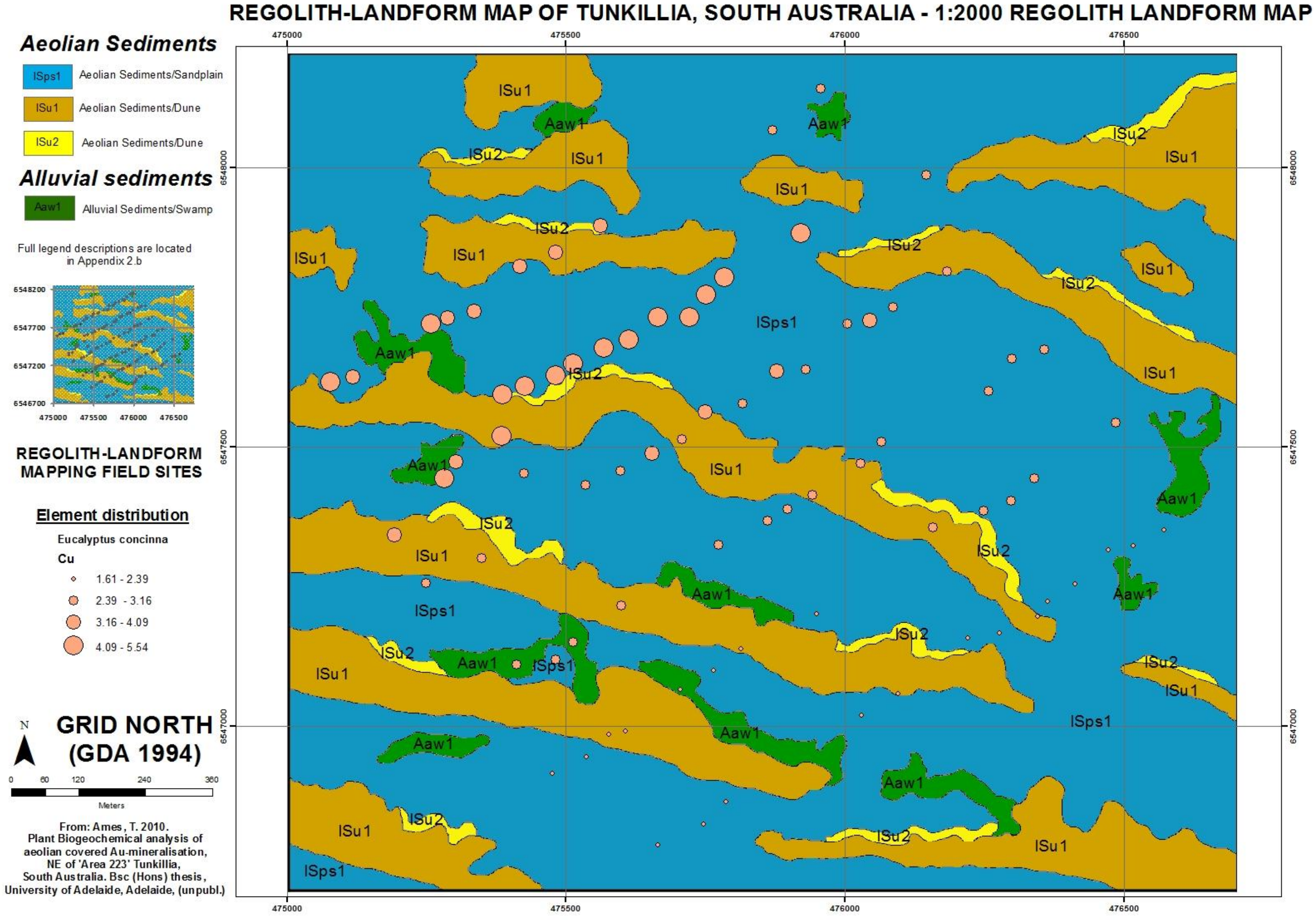
From: Ames, T. 2010.
Plant Biogeochemical analysis of aeolian covered Au-mineralisation, NE of 'Area 223' Tunkillia, South Australia. Bsc (Hons) thesis, University of Adelaide, Adelaide, (unpubl.)

Figure 6.5



From: Ames, T. 2010.
Plant Biogeochemical analysis of aeolian covered Au-mineralisation, NE of 'Area 223' Tunkillia, South Australia. Bsc (Hons) thesis, University of Adelaide, Adelaide, (unpubl.)

Figure 6.6



REGOLITH-LANDFORM MAP OF TUNKILLIA, SOUTH AUSTRALIA - 1:2000 REGOLITH LANDFORM MAP

From: Ames, T. 2010.
Plant Biogeochemical analysis of aeolian covered Au-mineralisation, NE of 'Area 223' Tunkillia, South Australia. Bsc (Hons) thesis, University of Adelaide, Adelaide, (unpubl.)

Figure 6.7

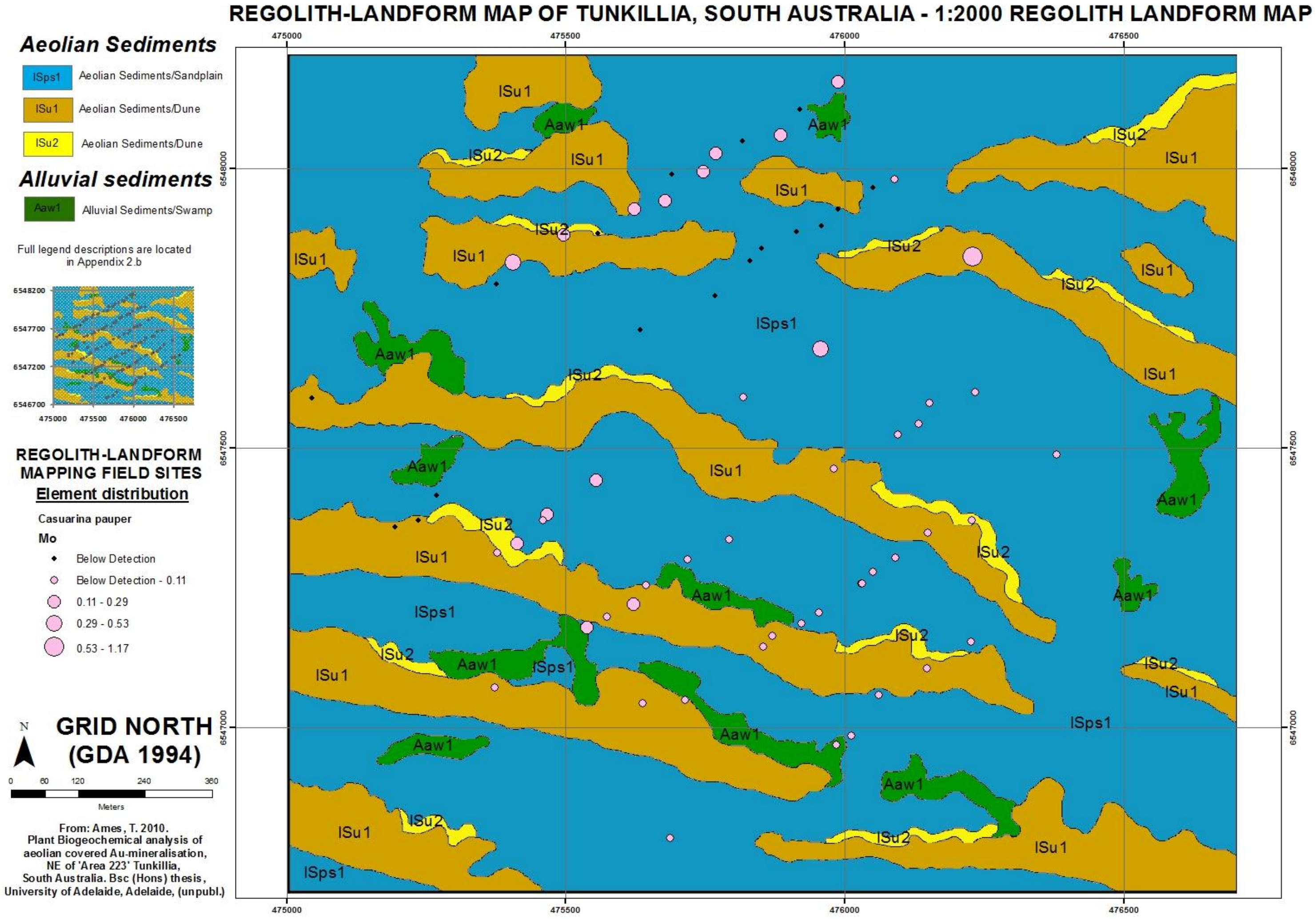
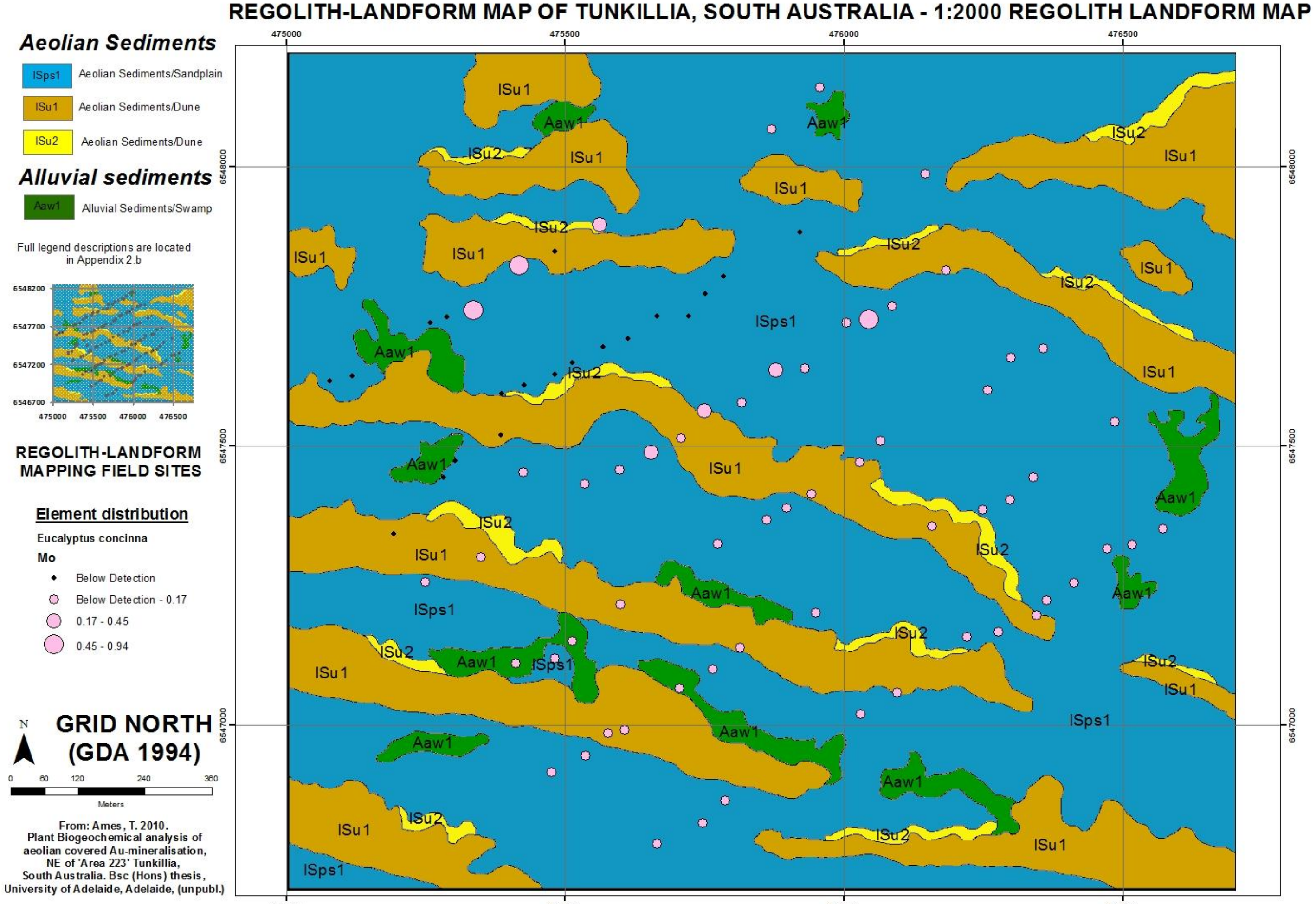
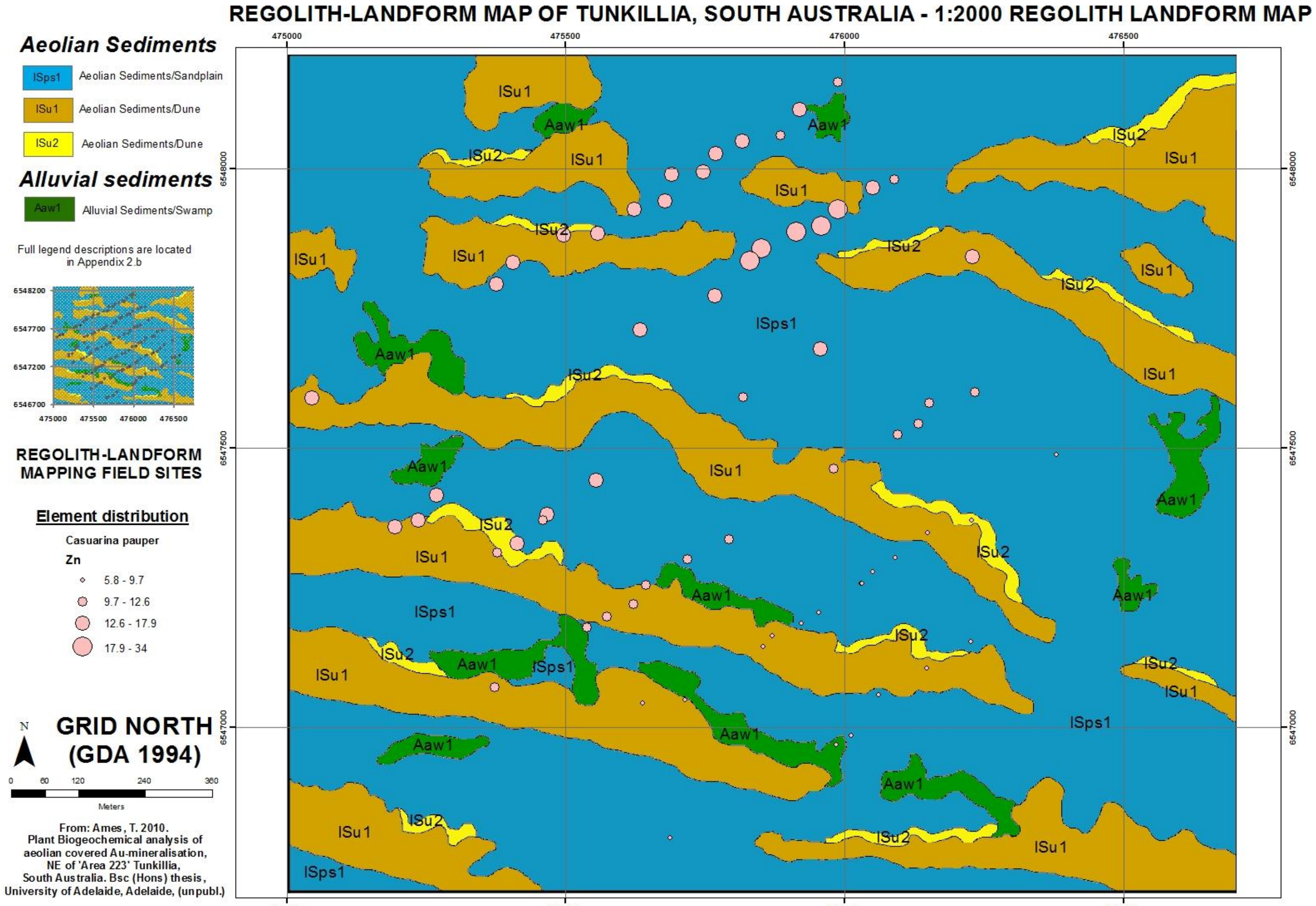

REGOLITH-LANDFORM MAP OF TUNKILLIA, SOUTH AUSTRALIA - 1:2000 REGOLITH LANDFORM MAP
Aeolian Sediments
ISps1 Aeolian Sediments/Sandplain
ISu1 Aeolian Sediments/Dune
ISu2 Aeolian Sediments/Dune
Alluvial sediments
Aaw1 Alluvial Sediments/Swamp
Full legend descriptions are located in Appendix 2.b
6548200
6547700
6547200
6546700
475000 475500 476000 476500
REGOLITH-LANDFORM MAPPING FIELD SITES
Element distribution
Casuarina pauper
Mo
Below Detection
Below Detection - 0.11
0.11 - 0.29
0.29 - 0.53
0.53 - 1.17
N
GRID NORTH (GDA 1994)
0 60 120 240 360
Meters
475000
475500
476000
476500
6548000
6547500
6547000
ISu1
ISu2
ISps1
Aaw1
ISps1
From: Ames, T. 2010. Plant Biogeochemical analysis of aeolian covered Au-mineralisation, NE of 'Area 223' Tunkillia, South Australia. Bsc (Hons) thesis, University of Adelaide, Adelaide, (unpubl.)

Figure 6.8



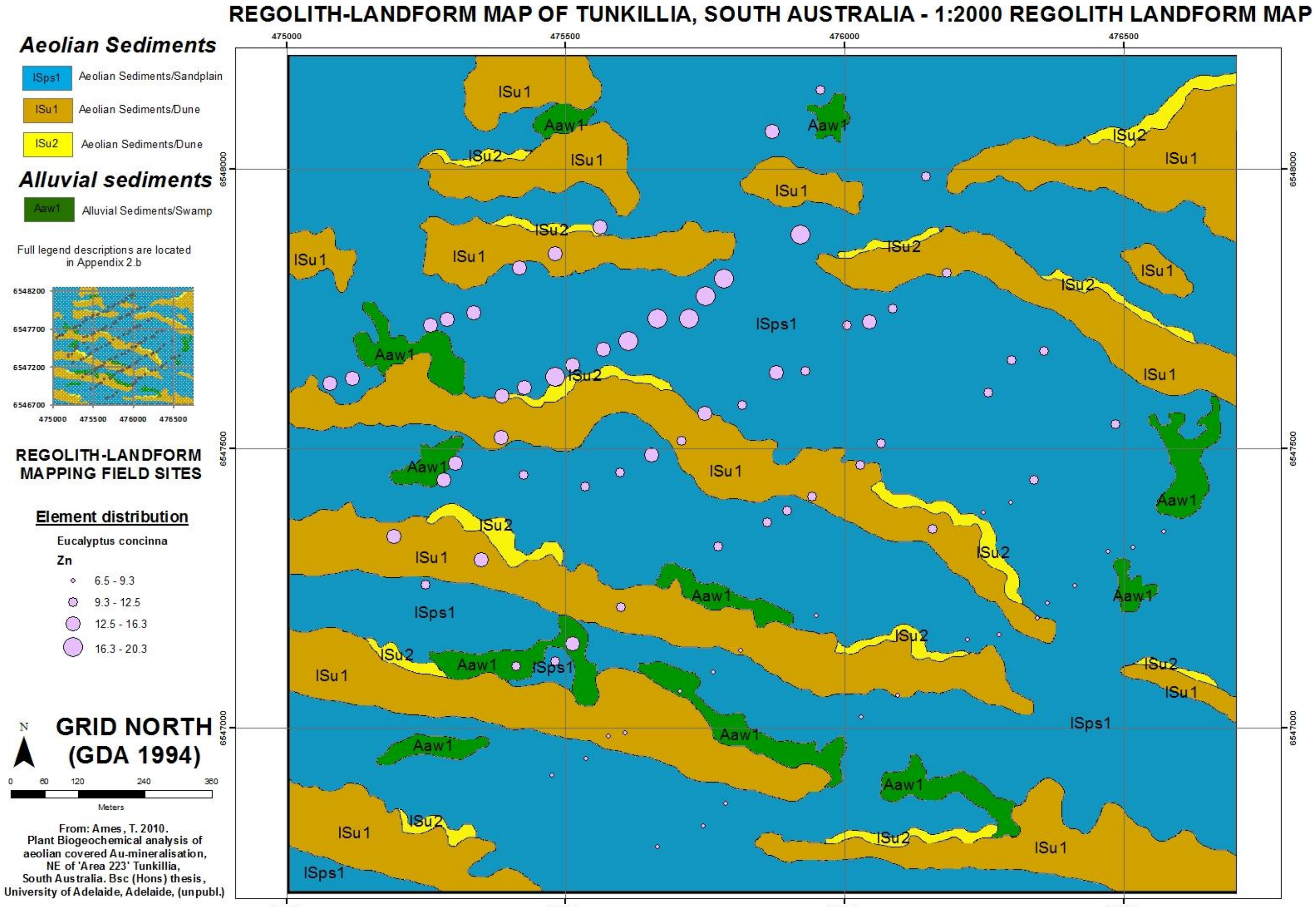
From: Ames, T. 2010.
Plant Biogeochemical analysis of aeolian covered Au-mineralisation, NE of 'Area 223' Tunkillia, South Australia. Bsc (Hons) thesis, University of Adelaide, Adelaide, (unpubl.)

Figure 6.9



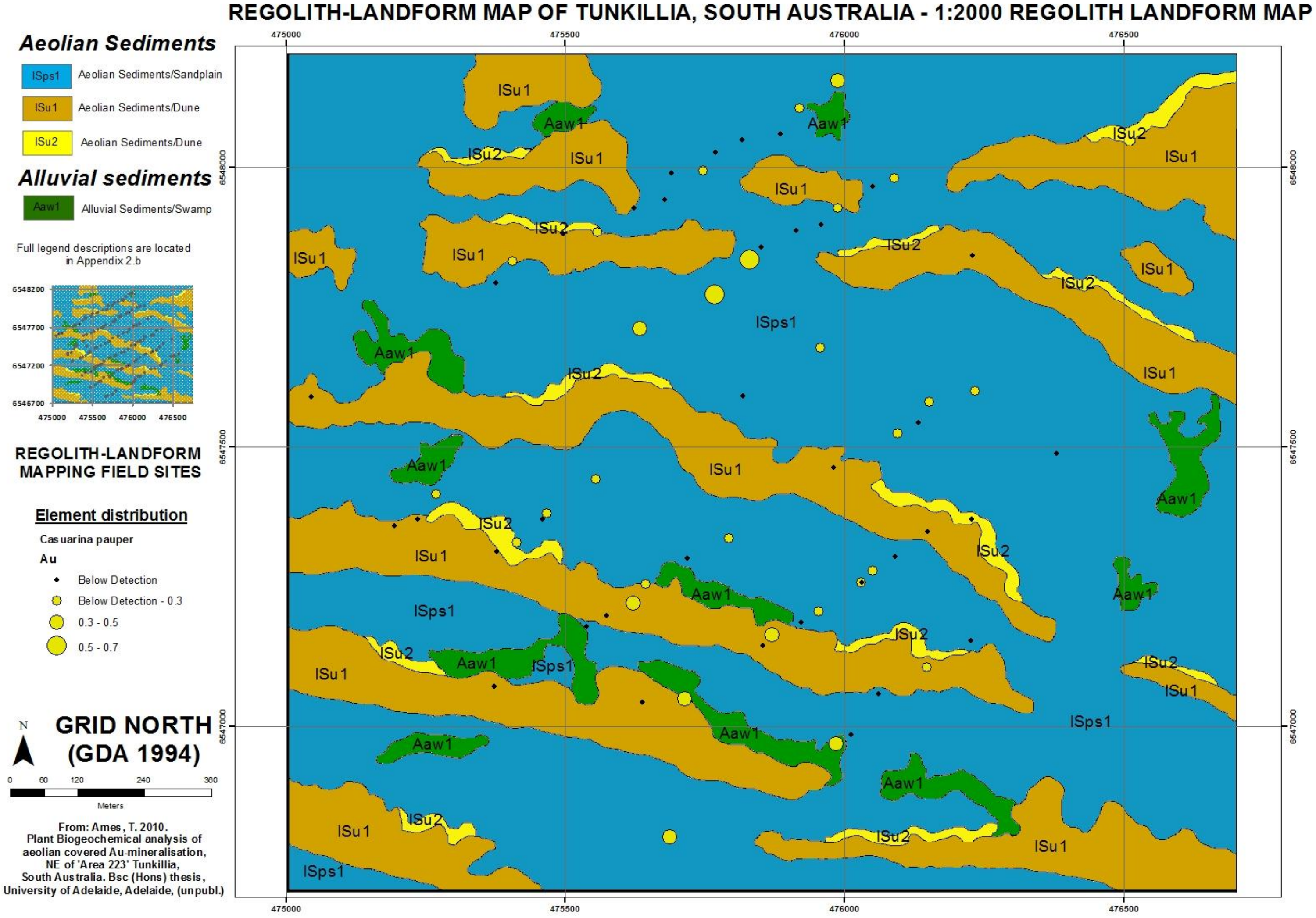
From: Ames, T. 2010.
Plant Biogeochemical analysis of aeolian covered Au-mineralisation, NE of 'Area 223' Tunkillia, South Australia. Bsc (Hons) thesis, University of Adelaide, Adelaide, (unpubl.)

Figure 6.10



From: Ames, T. 2010.
Plant Biogeochemical analysis of aeolian covered Au-mineralisation, NE of 'Area 223' Tunkillia, South Australia. Bsc (Hons) thesis, University of Adelaide, Adelaide, (unpubl.)

Figure 7.1



From: Ames, T. 2010. Plant Biogeochemical analysis of aeolian covered Au-mineralisation, NE of 'Area 223' Tunkillia, South Australia. Bsc (Hons) thesis, University of Adelaide, Adelaide, (unpubl.)

Figure 7.2

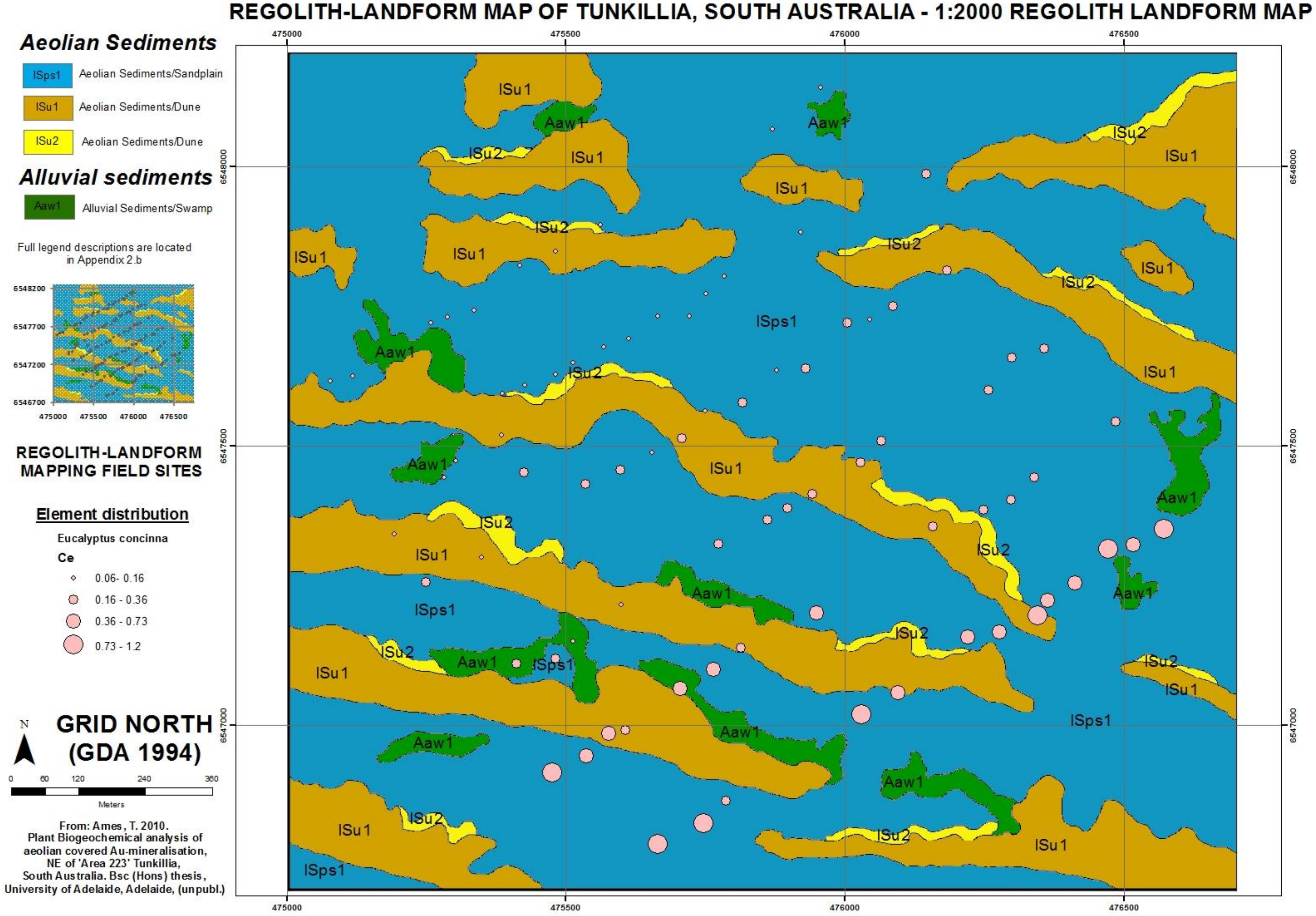
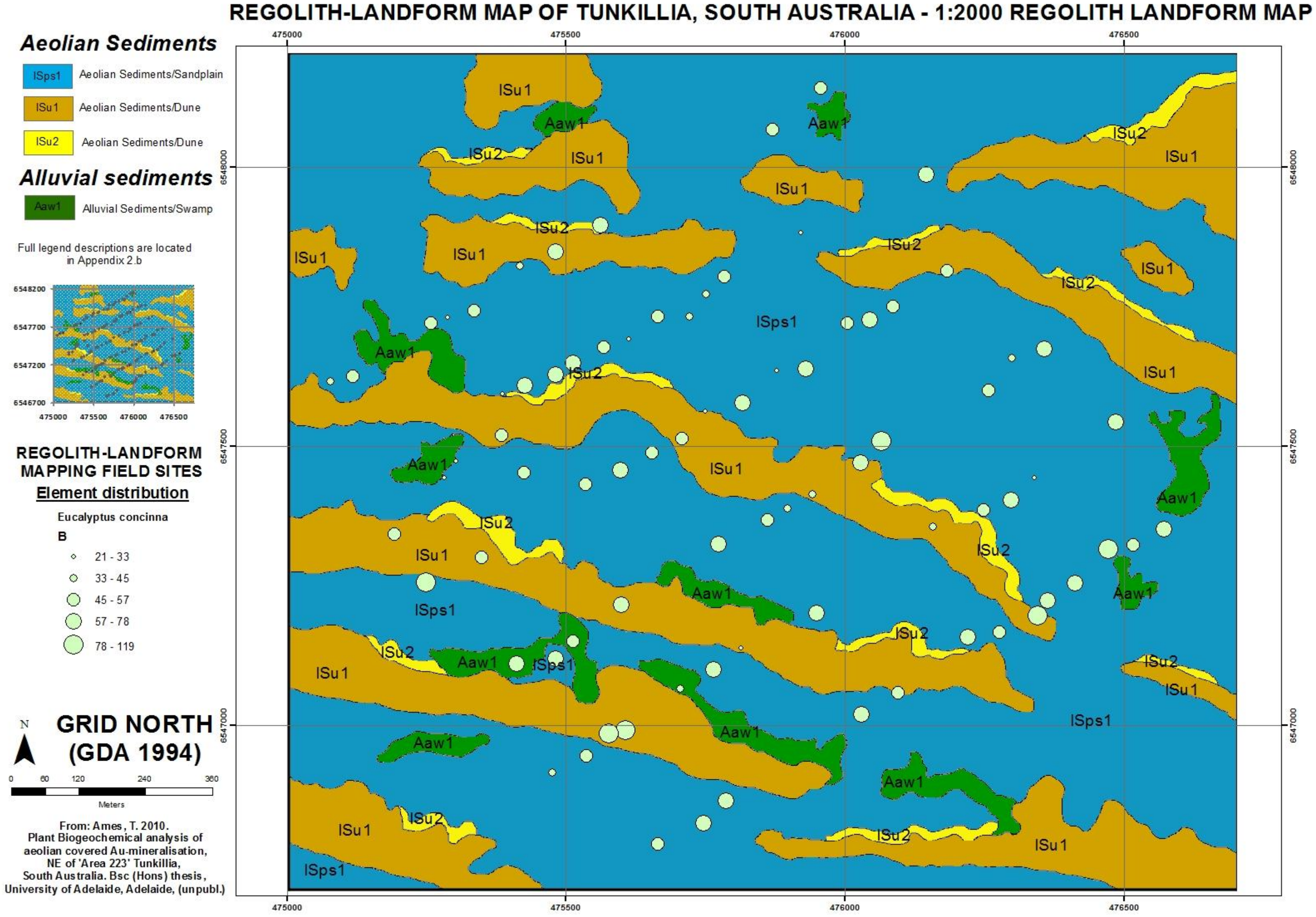
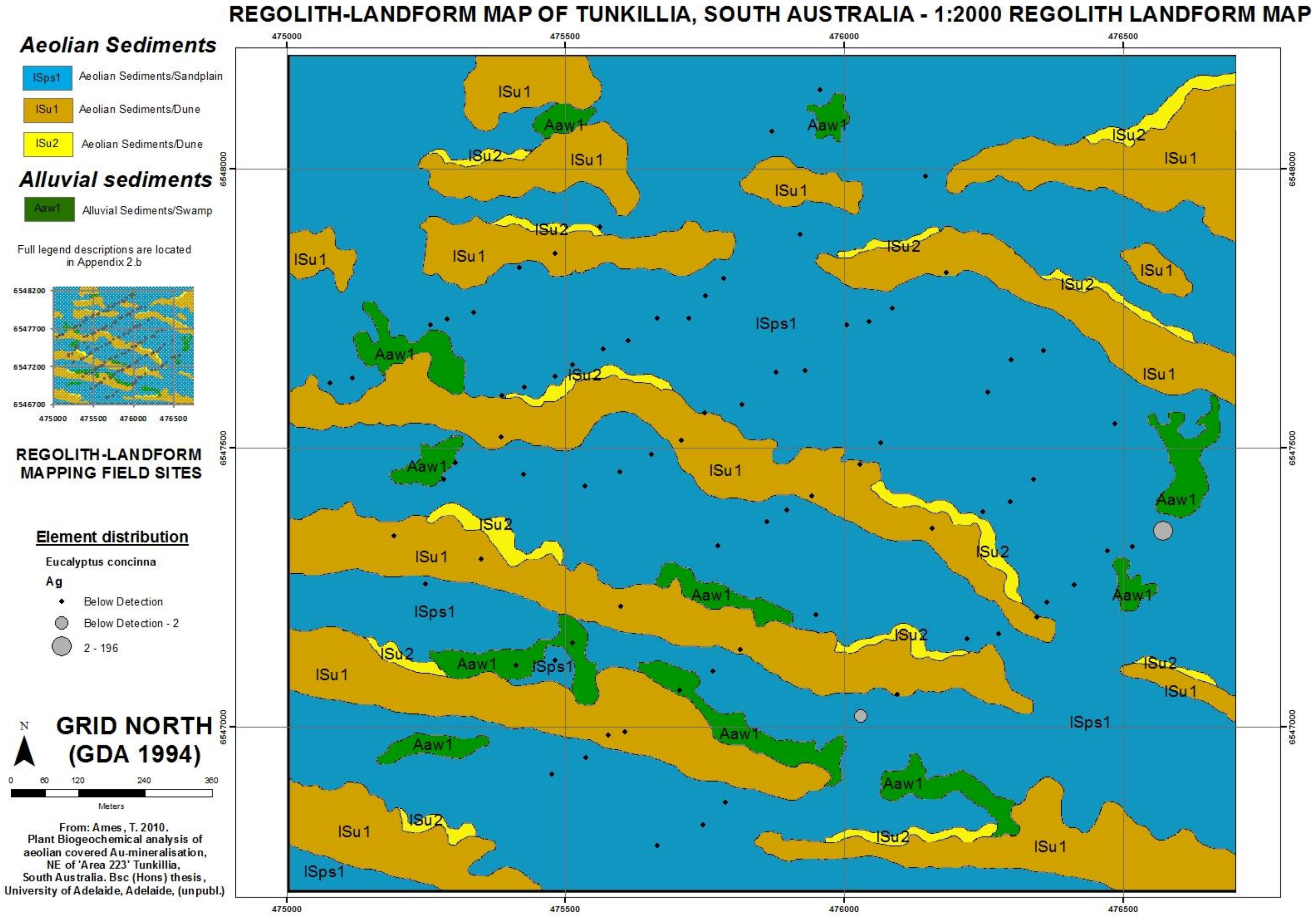

REGOLITH-LANDFORM MAP OF TUNKILLIA, SOUTH AUSTRALIA - 1:2000 REGOLITH LANDFORM MAP
Aeolian Sediments
ISps1 Aeolian Sediments/Sandplain
ISu1 Aeolian Sediments/Dune
ISu2 Aeolian Sediments/Dune
Alluvial sediments
Aaw1 Alluvial Sediments/Swamp
Full legend descriptions are located in Appendix 2.b
6548200
6547700
6547200
6546700
475000
475500
476000
476500
REGOLITH-LANDFORM MAPPING FIELD SITES
Element distribution
Eucalyptus concinna
Ce
0.06- 0.16
0.16 - 0.36
0.36 - 0.73
0.73 - 1.2
N
GRID NORTH (GDA 1994)
0
60
120
240
360
Meters
From: Ames, T. 2010. Plant Biogeochemical analysis of aeolian covered Au-mineralisation, NE of 'Area 223' Tunkillia, South Australia. Bsc (Hons) thesis, University of Adelaide, Adelaide, (unpubl.)
6548000
6547500
6547000
ISu1
ISu2
Aaw1
ISps1

Figure 7.3



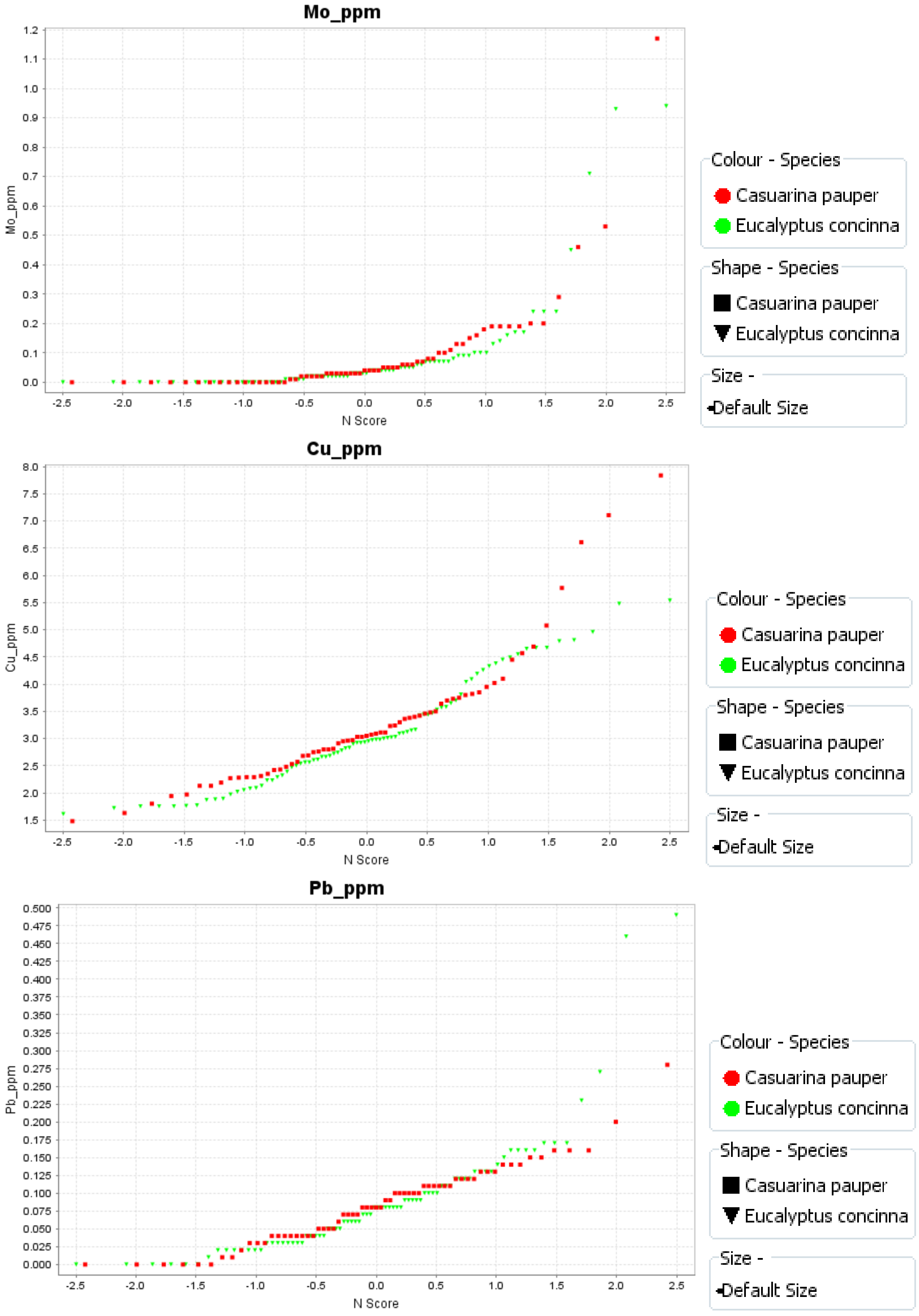
From: Ames, T. 2010. Plant Biogeochemical analysis of aeolian covered Au-mineralisation, NE of 'Area 223' Tunkillia, South Australia. Bsc (Hons) thesis, University of Adelaide, Adelaide, (unpubl.)

Figure 7.4



From: Ames, T. 2010. Plant Biogeochemical analysis of aeolian covered Au-mineralisation, NE of 'Area 223' Tunkillia, South Australia. Bsc (Hons) thesis, University of Adelaide, Adelaide, (unpubl.)

Figure 8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0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
-2.5
-2.0
-1.5
-1.0
-0.5
0.0
0.5
1.0
1.5
2.0
2.5
N Score
Colour - Species
Casuarina pauper
Eucalyptus concinna
Shape - Species
Casuarina pauper
Eucalyptus concinna
Size -
Default Size
Cu_ppm
Cu_ppm
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
-2.5
-2.0
-1.5
-1.0
-0.5
0.0
0.5
1.0
1.5
2.0
2.5
N Score
Colour - Species
Casuarina pauper
Eucalyptus concinna
Shape - Species
Casuarina pauper
Eucalyptus concinna
Size -
Default Size
Pb_ppm
Pb_ppm
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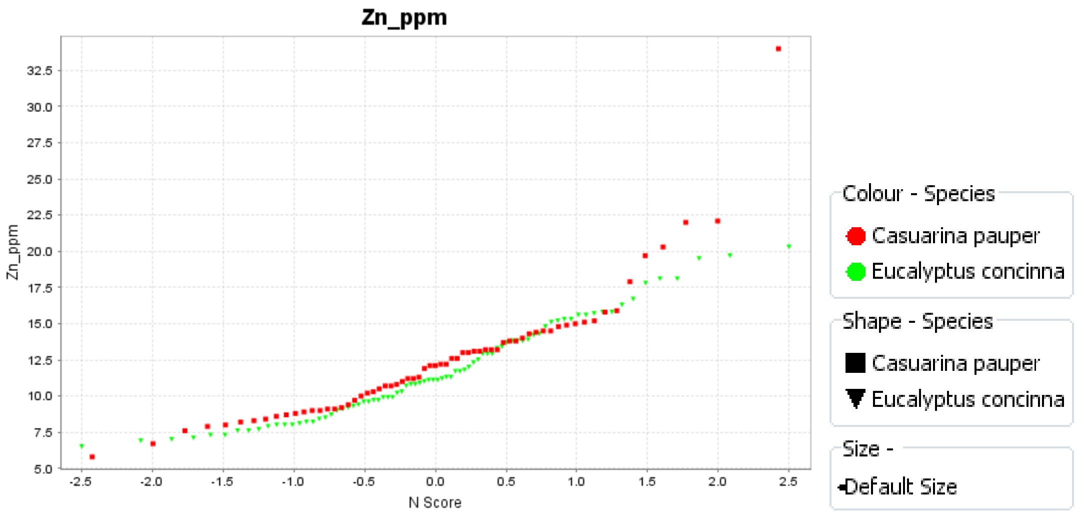
0.475
0.450
0.425
0.400
0.375
0.350
0.325
0.300
0.275
0.250
0.225
0.200
0.175
0.150
0.125
0.100
0.075
0.050
0.025
0.000
-2.5
-2.0
-1.5
-1.0
-0.5
0.0
0.5
1.0
1.5
2.0
2.5
N Score
Colour - Species
Casuarina pauper
Eucalyptus concinna
Shape - Species
Casuarina pauper
Eucalyptus concinna
Size -
Default Size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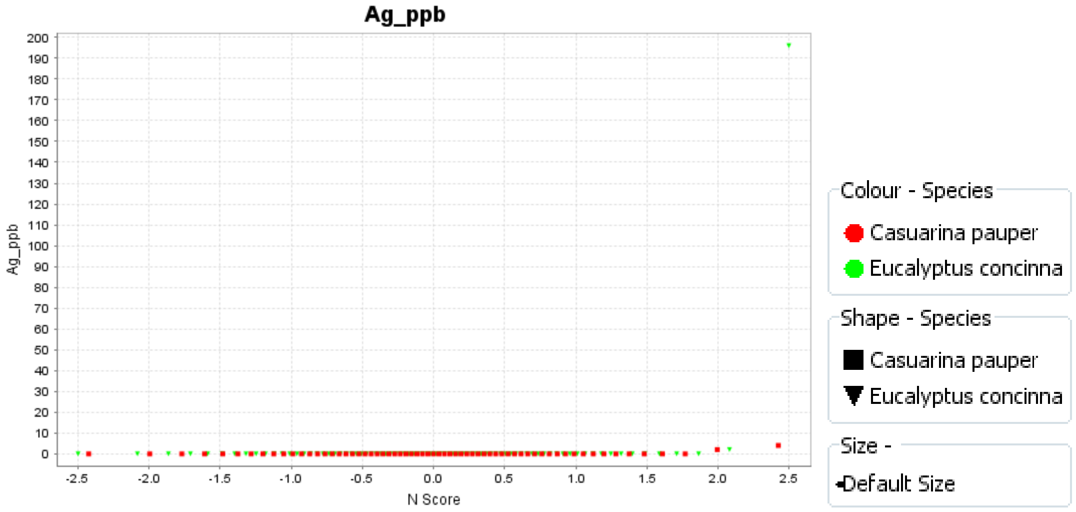
27.5
25.0
22.5
20.0
17.5
15.0
12.5
10.0
7.5
5.0
Zn_ppm
-2.5
-2.0
-1.5
-1.0
-0.5
0.0
0.5
1.0
1.5
2.0
2.5
N Score
Colour - Species
Casuarina pauper
Eucalyptus concinna
Shape - Species
Casuarina pauper
Eucalyptus concinna
Size -
Default Size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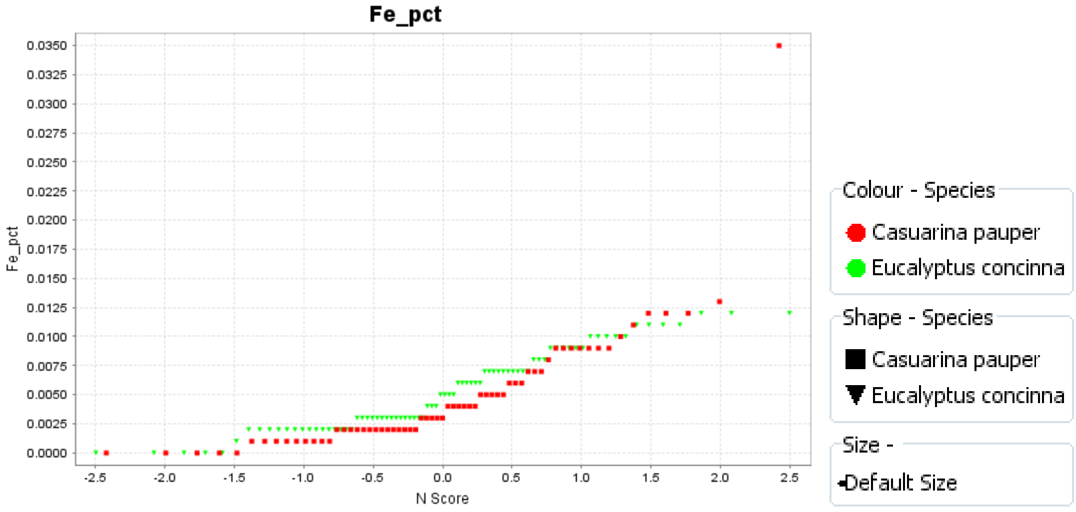
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
Ag_ppb
-2.5
-2.0
-1.5
-1.0
-0.5
0.0
0.5
1.0
1.5
2.0
2.5
N Score
Colour - Species
Casuarina pauper
Eucalyptus concinna
Shape - Species
Casuarina pauper
Eucalyptus concinna
Size -
Default Size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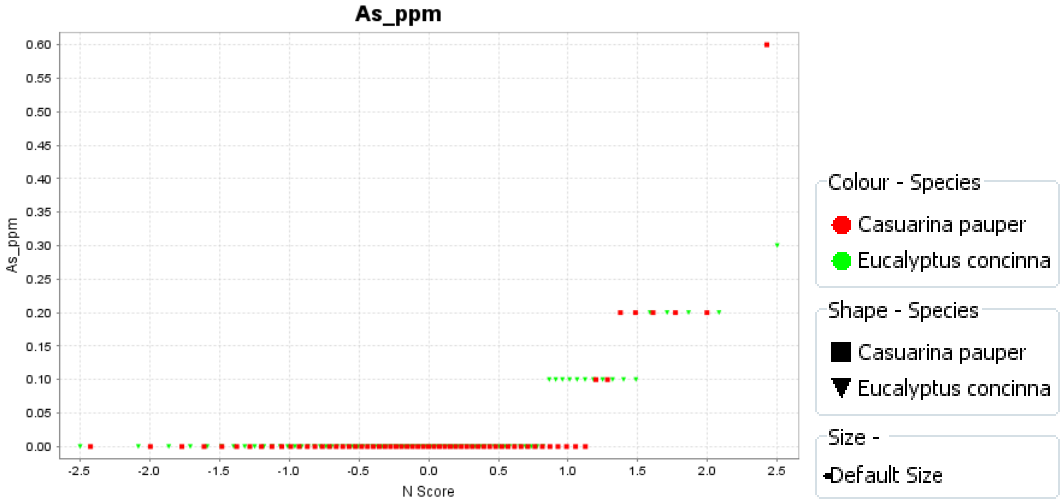
0.0325
0.0300
0.0275
0.0250
0.0225
0.0200
0.0175
0.0150
0.0125
0.0100
0.0075
0.0050
0.0025
0.0000
Fe_pct
-2.5
-2.0
-1.5
-1.0
-0.5
0.0
0.5
1.0
1.5
2.0
2.5
N Score
Colour - Species
Casuarina pauper
Eucalyptus concinna
Shape - Species
Casuarina pauper
Eucalyptus concinna
Size -
Default Size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As_ppm
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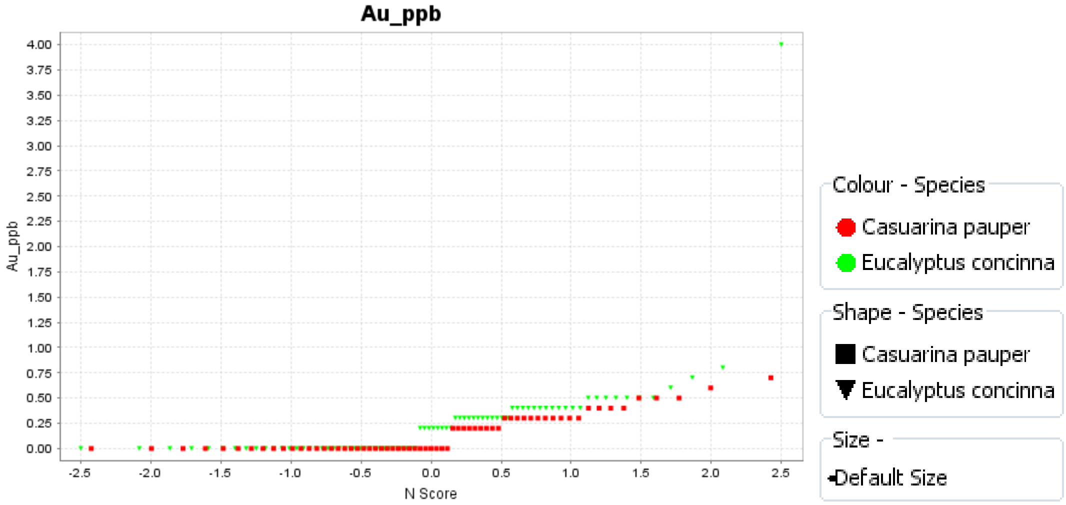
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
-2.5
-2.0
-1.5
-1.0
-0.5
0.0
0.5
1.0
1.5
2.0
2.5
N Score
Colour - Species
Casuarina pauper
Eucalyptus concinna
Shape - Species
Casuarina pauper
Eucalyptus concinna
Size -
Default Size


Au_ppb
Au_ppb
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3.50
3.25
3.00
2.75
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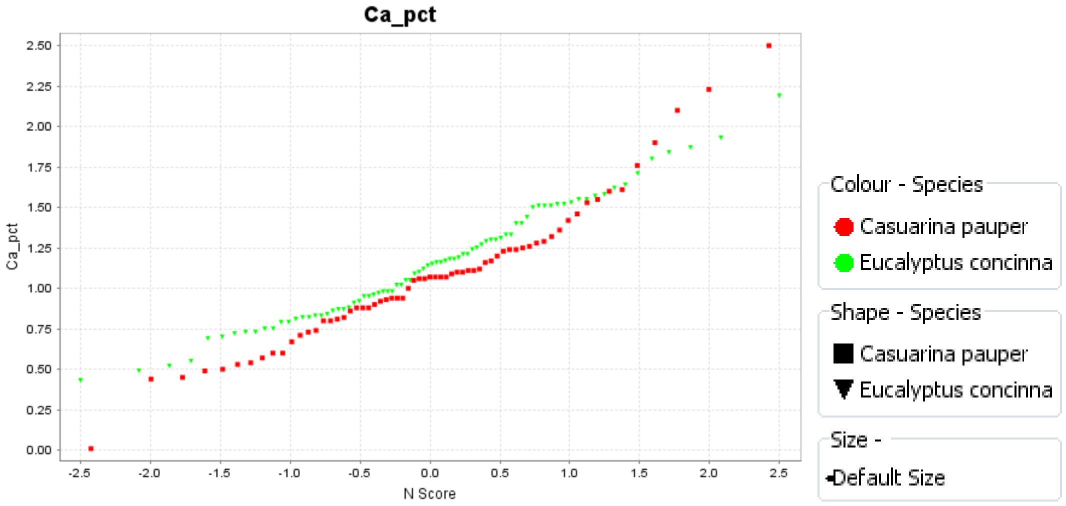
1.50
1.25
1.00
0.75
0.50
0.25
0.00
-2.5
-2.0
-1.5
-1.0
-0.5
0.0
0.5
1.0
1.5
2.0
2.5
N Score
Colour - Species
Casuarina pauper
Eucalyptus concinna
Shape - Species
Casuarina pauper
Eucalyptus concinna
Size -
Default Size


Ca_pct
Ca_pct
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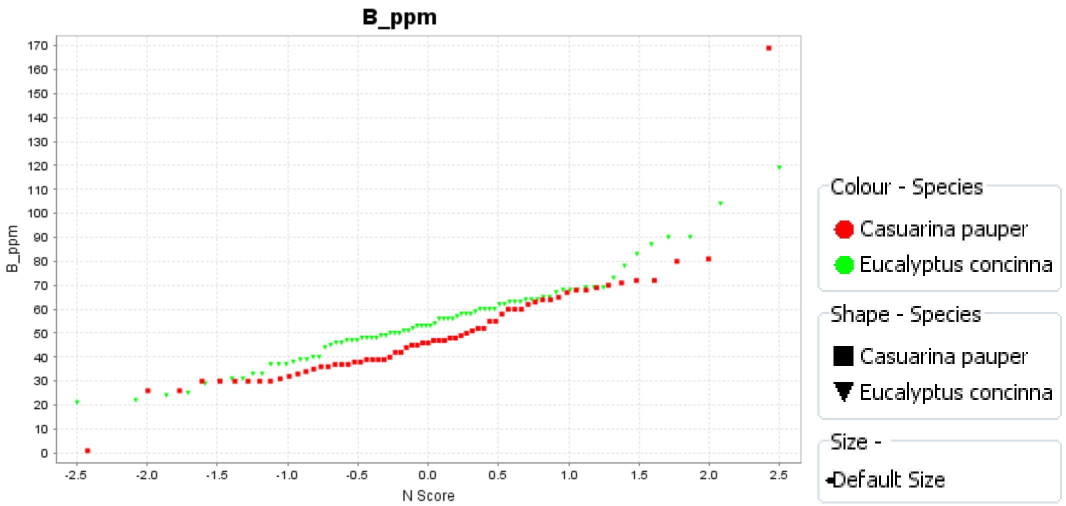
2.25
2.00
1.75
1.50
1.25
1.00
0.75
0.50
0.25
0.00
-2.5
-2.0
-1.5
-1.0
-0.5
0.0
0.5
1.0
1.5
2.0
2.5
N Score
Colour - Species
Casuarina pauper
Eucalyptus concinna
Shape - Species
Casuarina pauper
Eucalyptus concinna
Size -
Default Size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B_ppm
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150
140
130
120
110
100
90
80
70
60
50
40
30
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10
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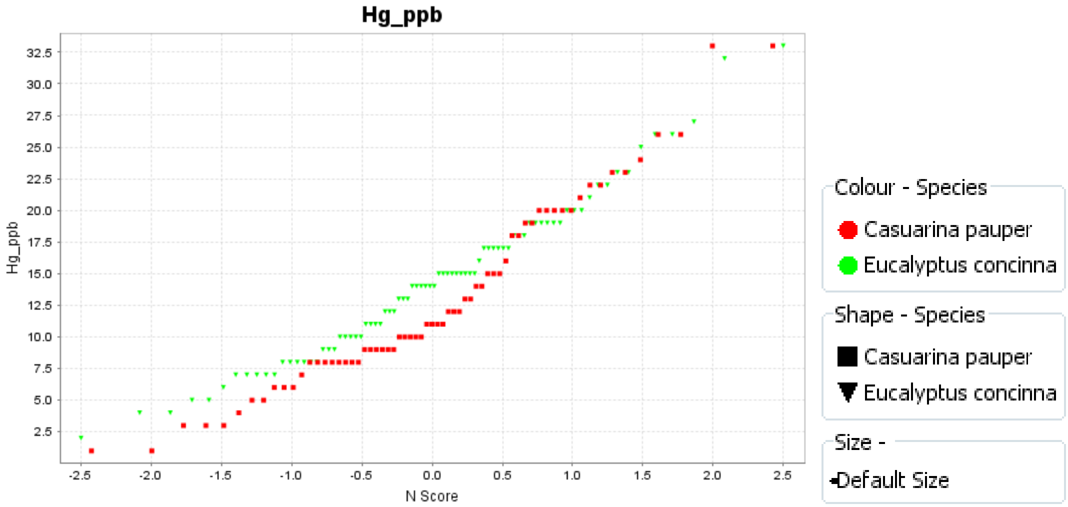
-2.5
-2.0
-1.5
-1.0
-0.5
0.0
0.5
1.0
1.5
2.0
2.5
N Score
Colour - Species
Casuarina pauper
Eucalyptus concinna
Shape - Species
Casuarina pauper
Eucalyptus concinna
Size -
Default Size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Hg_ppb
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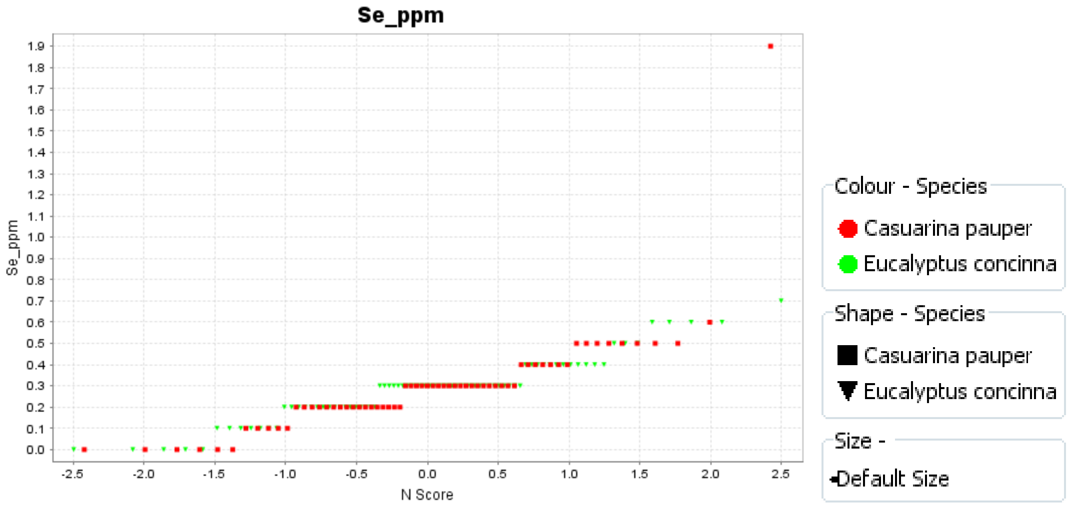
27.5
25.0
22.5
20.0
17.5
15.0
12.5
10.0
7.5
5.0
2.5
-2.5
-2.0
-1.5
-1.0
-0.5
0.0
0.5
1.0
1.5
2.0
2.5
N Score
Colour - Species
Casuarina pauper
Eucalyptus concinna
Shape - Species
Casuarina pauper
Eucalyptus concinna
Size -
Default Size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Se_ppm
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1.6
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1.4
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1.2
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0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
-2.5
-2.0
-1.5
-1.0
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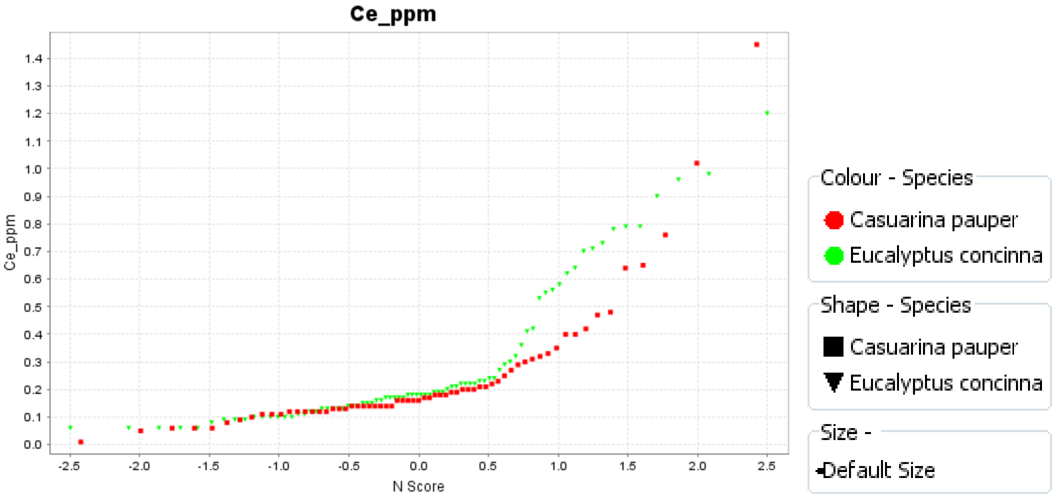
0.0
0.5
1.0
1.5
2.0
2.5
N Score
Colour - Species
Casuarina pauper
Eucalyptus concinna
Shape - Species
Casuarina pauper
Eucalyptus concinna
Size -
Default Size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Ce_ppm
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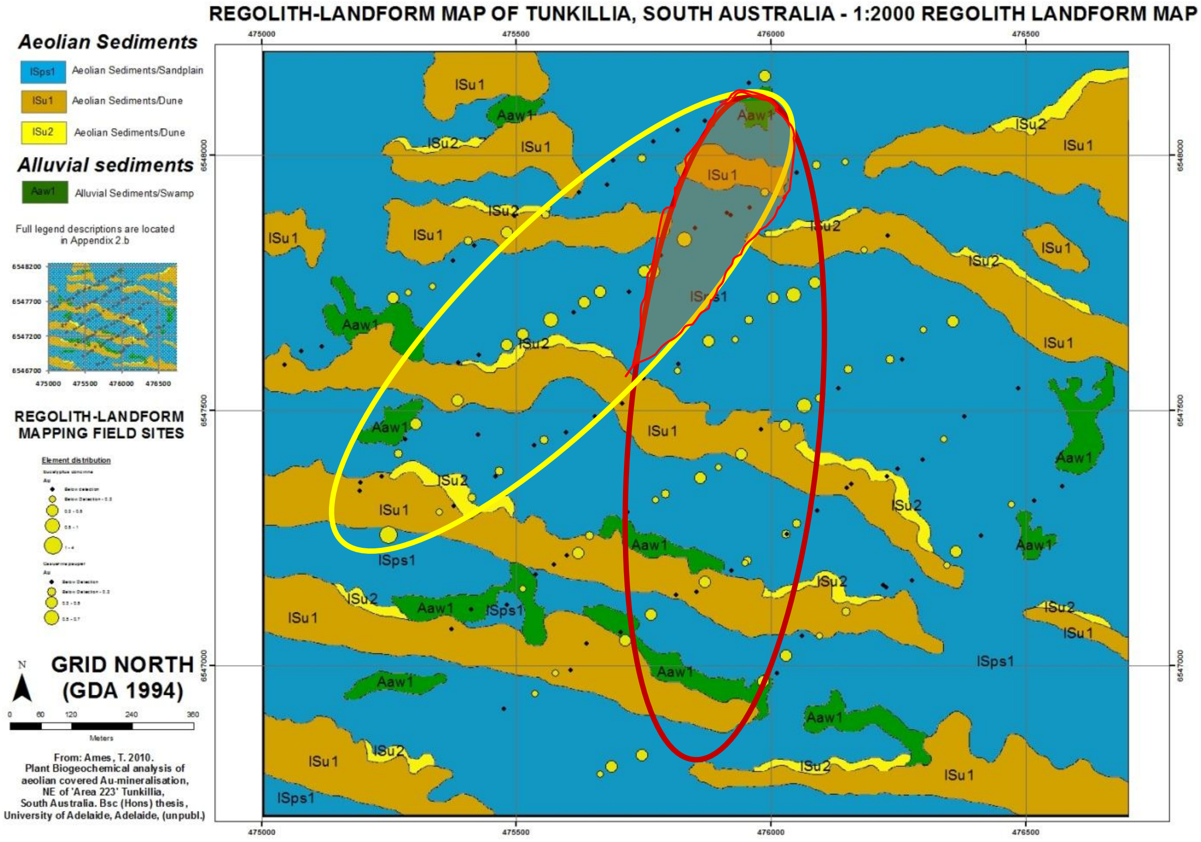
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
1.1
1.2
1.3
1.4
-2.5
-2.0
-1.5
-1.0
-0.5
0.0
0.5
1.0
1.5
2.0
2.5
N Score
Colour - Species
Casuarina pauper
Eucalyptus concinna
Shape - Species
Casuarina pauper
Eucalyptus concinna
Size -
Default Size

Figure 9



From: Ames, T. 2010.
Plant Biogeochemical analysis of aeolian covered Au-mineralisation, NE of 'Area 223' Tunkillia, South Australia. Bsc (Hons) thesis, University of Adelaide, Adelaide, (unpubl.)

Figure 10

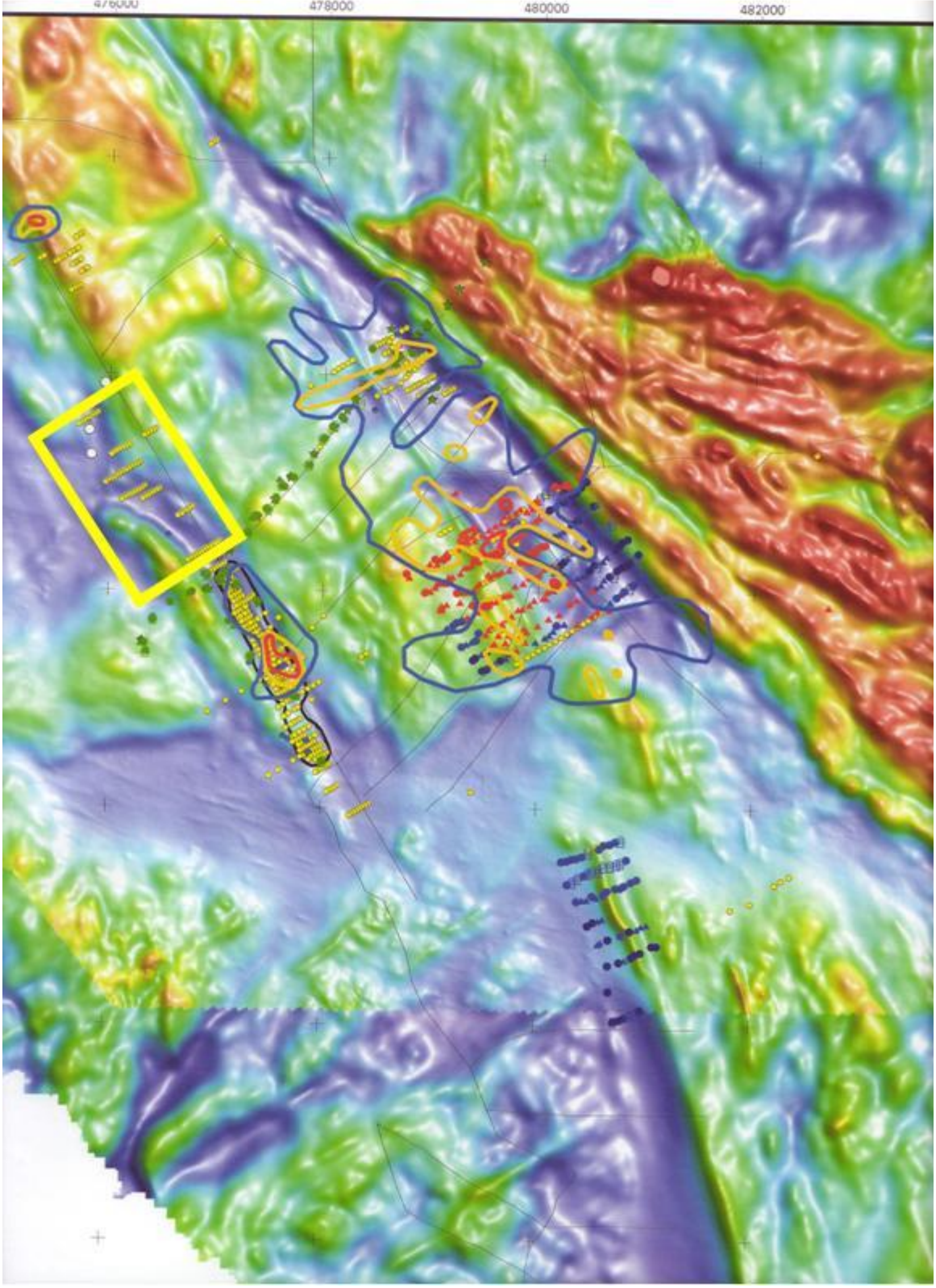
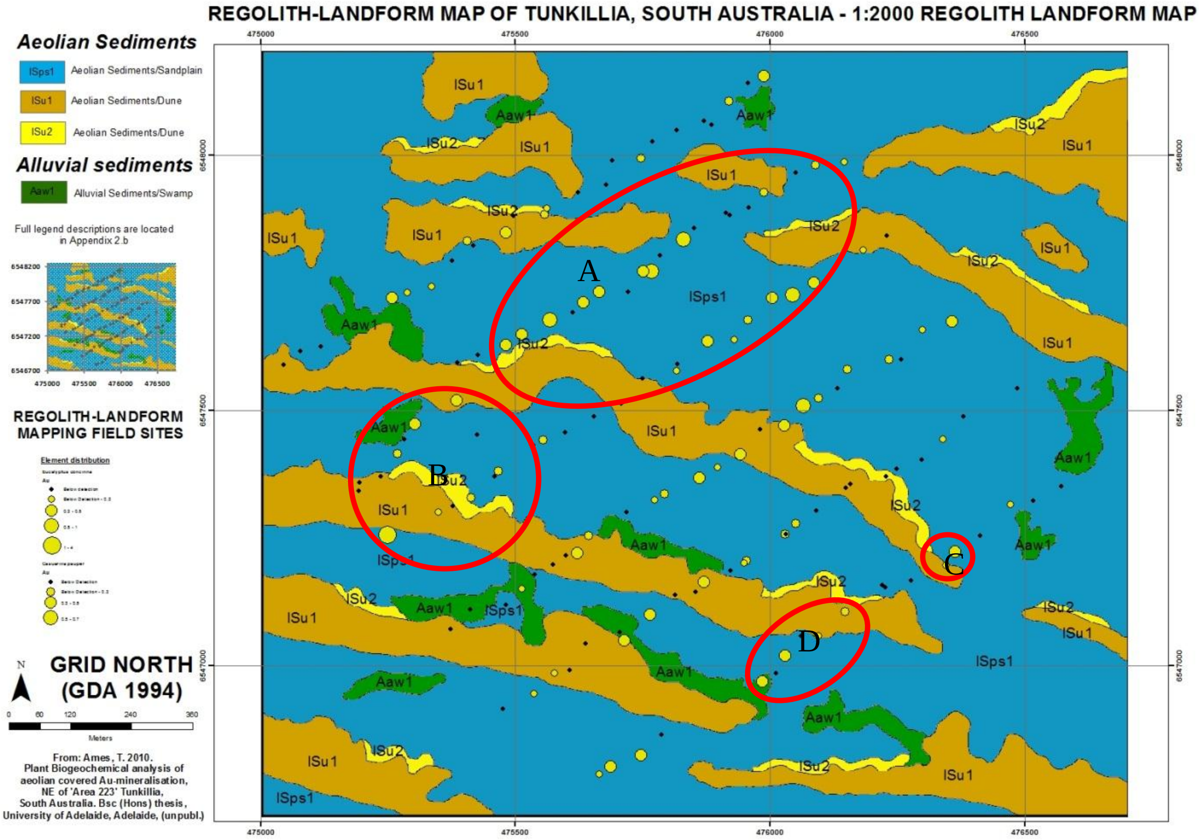
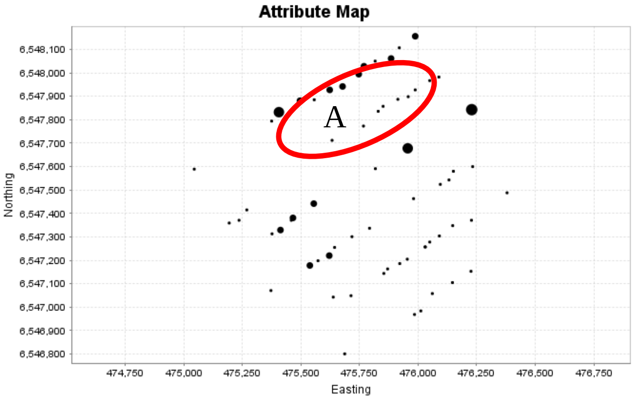


Figure 11.1



From: Ames, T. 2010.
Plant Biogeochemical analysis of aeolian covered Au-mineralisation, NE of 'Area 223' Tunkillia, South Australia. Bsc (Hons) thesis, University of Adelaide, Adelaide, (unpubl.)

Figure 11.2
Mo



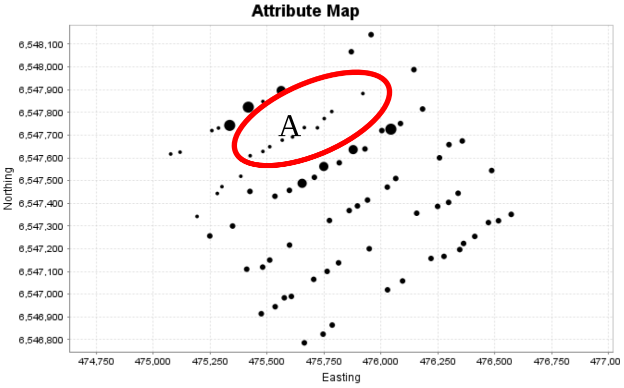


Figure 11.3
Cu

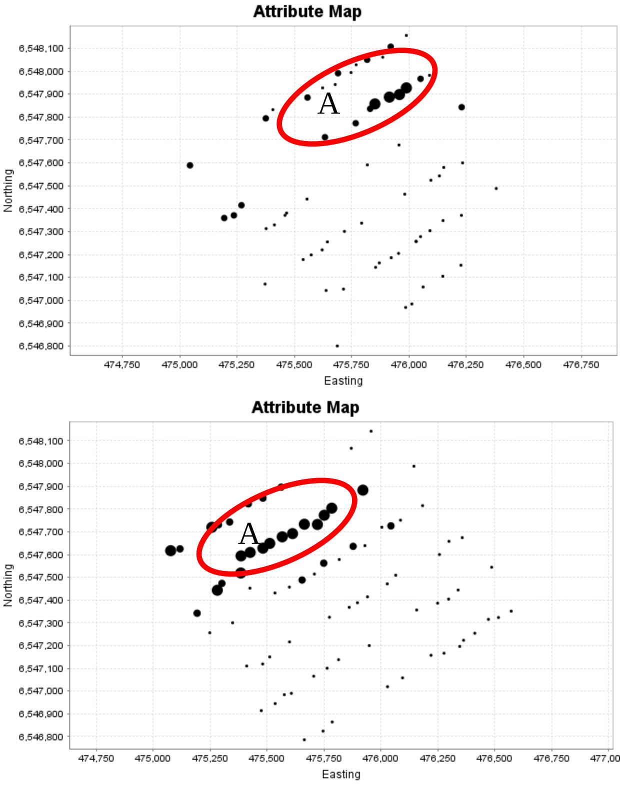


Figure 11.4
Zn

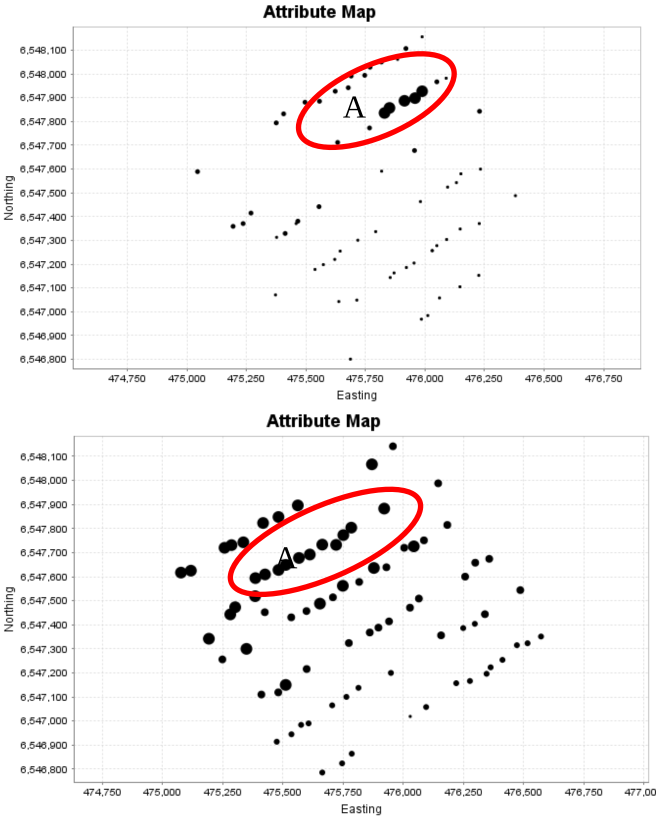
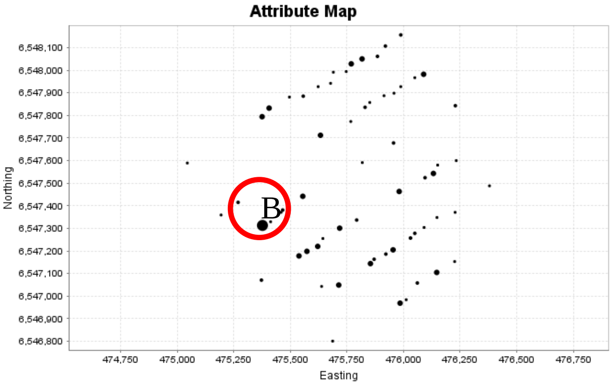


Figure 11.5
B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6,547,900
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6,547,600
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6,547,300
6,547,200
6,547,100
6,547,000
6,546,900
6,546,800
B
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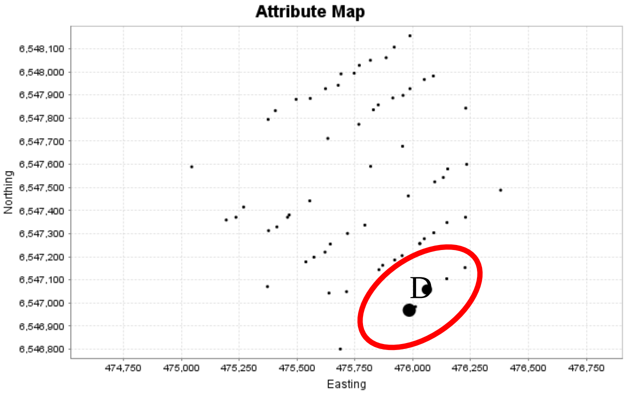
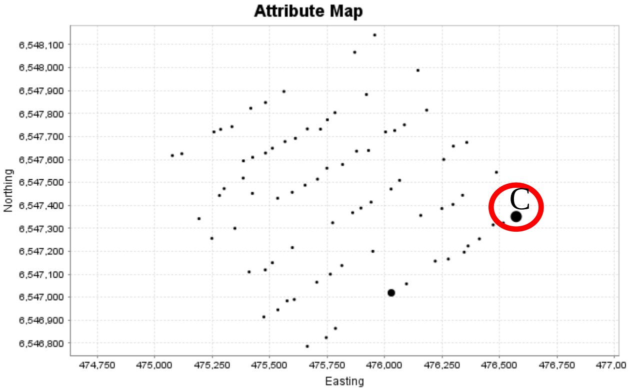
475,250
475,500
475,750
476,000
476,250
476,500
476,750
Easting

Figure 11.6
Ag





Tables

Table 1: Species Count Summary

Species	**Count**
Eucalyptus concinna	80
Casuarina pauper	65

Table 2: Summary Statistics for *Eucalyptus concinna*

	Mo (ppm)	**Cu (ppm)**	**Pb (ppm)**	**Zn (ppm)**	**Ag (ppb)**	**Fe (%)**	**As (ppm)**	**Au (ppb)**	**Ca (%)**	**B (ppm)**	**Hg (ppb)**	**Se (ppm)**	**Ce (ppm)**
Mean	0.083375	3.082125	0.087625	11.74625	0.05	0.0053	0.0275	0.24375	1.137875	54.175	14.3	0.28625	0.281
Standard Error	0.019169	0.108568	0.009316	0.379965	0.05	0.000385	0.006884	0.053155	0.040263	1.967841	0.71299	0.016084	0.027215
Median	0.03	2.94	0.08	11.1	0	0.005	0	0.2	1.11	53	14	0.3	0.18
Mode	0	1.75	0.08	13.8	0	0.003	0	0	1.51	56	15	0.3	0.1
Standard Deviation	0.171456	0.971066	0.083321	3.398508	0.447214	0.00344	0.061572	0.475433	0.360125	17.6009	6.377174	0.143856	0.243418
Sample Variance	0.029397	0.942969	0.006942	11.54986	0.2	1.18E-05	0.003791	0.226036	0.12969	309.7918	40.66835	0.020695	0.059252
Kurtosis	16.28588	-0.35371	10.45812	-0.43616	80	-1.0345	5.811092	50.18471	-0.01981	1.994887	0.33019	0.684424	1.159279
Skewness	3.932052	0.617775	2.709373	0.579283	8.944272	0.289778	2.426465	6.395479	0.487249	0.847222	0.593417	0.299365	1.510475
Range	0.94	3.91	0.49	13.6	4	0.012	0.3	4	1.76	98	31	0.7	0.96
Minimum	0	1.63	0	6.7	0	0	0	0	0.43	21	2	0	0.06
Maximum	0.94	5.54	0.49	20.3	4	0.012	0.3	4	2.19	119	33	0.7	1.02
Sum	6.67	246.57	7.01	939.7	4	0.424	2.2	19.5	91.03	4334	1144	22.9	22.48
Count	80	80	80	80	80	80	80	80	80	80	80	80	80
Confidence (95%)	0.038156	0.2161	0.018542	0.756301	0.099523	0.000766	0.013702	0.105802	0.080142	3.916889	1.419171	0.032014	0.05417

Table 3: Summary Statistics for *Casuarina pauper*

	Mo (ppm)	Cu (ppm)	Pb (ppm)	Zn (ppm)	Ag (ppb)	Fe (%)	As (ppm)	Au (ppb)	Ca (%)	B (ppm)	Hg (ppb)	Se (ppm)	Ce (ppm)
Mean	0.090308	3.270923	0.082923	12.49846	3.061538	0.004892	0.027692	0.146154	1.078462	49.56923	12.93846	0.295385	0.234
Standard Error	0.021062	0.147614	0.006771	0.541674	3.015017	0.000642	0.011289	0.022369	0.054392	2.67727	0.906143	0.030809	0.024644
Median	0.04	3.05	0.08	12.1	0	0.003	0	0	1.07	47	11	0.3	0.16
Mode	0	3.11	0.04	13.2	0	0.002	0	0	1.07	30	8	0.3	0.14
Standard Deviation	0.169807	1.190105	0.054593	4.367118	24.30784	0.005172	0.091015	0.180344	0.438525	21.58484	7.305556	0.248389	0.198689
Sample Variance	0.028834	1.416349	0.00298	19.07172	590.8712	2.68E-05	0.008284	0.032524	0.192304	465.9053	53.37115	0.061697	0.039478
Kurtosis	26.14043	4.323187	1.297064	8.393422	64.96809	17.07447	24.80833	0.216461	1.563982	13.81946	0.175264	27.09317	5.988509
Skewness	4.583916	1.823409	0.684907	2.212103	8.059364	3.309702	4.545423	0.971289	0.737039	2.596548	0.733172	4.239026	2.341051
Range	1.17	6.22	0.28	27.5	196	0.035	0.6	0.7	2.49	168	32	1.9	1.01
Minimum	0	1.62	0	6.5	0	0	0	0	0.01	1	1	0	0.01
Maximum	1.17	7.84	0.28	34	196	0.035	0.6	0.7	2.5	169	33	1.9	1.02
Sum	5.87	212.61	5.39	812.4	199	0.318	1.8	9.5	70.1	3222	841	19.2	15.21
Count	65	65	65	65	65	65	65	65	65	65	65	65	65
Confidence (95%)	0.042076	0.294893	0.013527	1.082119	6.023188	0.001282	0.022552	0.044687	0.108661	5.348461	1.810228	0.061548	0.049233

Table 4: Summary Statistics for both *Eucalyptus concinna* and *Casuarina pauper*

	Ce (ppm)	**Fe (%)**	**Mo (ppm)**	**Cu (ppm)**	**Pb (ppm)**	**Zn (ppm)**	**Ag (ppb)**	**As (ppm)**	**Au (ppb)**	**Ca (%)**	**B (ppm)**	**Hg (ppb)**	**Se (ppm)**
Mean	0.312828	0.005028	0.08434483	3.125241	0.07765517	11.79241	1.468965517	0.028275862	0.22137931	1.116276	52.77931	13.69655	0.28896552
Standard Error	0.030194	0.000354	0.01411156	0.092418	0.00511085	0.32535	1.351671846	0.006395599	0.03742408	0.031569	1.692429	0.559259	0.01643859
Median	0.18	0.004	0.03	2.97	0.07	11.2	0	0	0	1.07	50	13	0.3
Mode	0.14	0.002	0	1.75	0.04	13.8	0	0	0	0.88	60	8	0.3
Standard Deviation	0.363585	0.004261	0.16992569	1.112857	0.06154282	3.917732	16.27628437	0.07701321	0.45064556	0.380137	20.37955	6.734369	0.19794684
Sample Variance	0.132194	1.82E-05	0.02887474	1.238452	0.00378752	15.34862	264.917433	0.005931034	0.20308142	0.144504	415.326	45.35172	0.03918295
Kurtosis	11.82979	15.58073	20.1577969	2.632327	9.51715044	6.322687	144.666473	21.91920374	46.6315798	0.77383	8.765603	0.233896	29.6447331
Skewness	3.11494	2.644441	4.22356965	1.241615	1.98910034	1.599406	12.02114807	3.996977133	6.18814382	0.685336	2.126565	0.671226	3.76128446
Range	2.27	0.035	1.17	6.59	0.46	28.9	196	0.6	4	2.07	148	32	1.9
Minimum	0.05	0	0	1.25	0	5.1	0	0	0	0.43	21	1	0
Maximum	2.32	0.035	1.17	7.84	0.46	34	196	0.6	4	2.5	169	33	1.9
Sum	45.36	0.729	12.23	453.16	11.26	1709.9	213	4.1	32.1	161.86	7653	1986	41.9
Count	150	150	150 (37<DL)	150	150 (12<DL)	150	150 (142<DL)	150 (126<DL)	150 (75<DL)	150	150	150	150 (12<DL)
Confidence Level(95.0%)	0.059681	0.000699	0.02789256	0.182671	0.01010199	0.643079	2.671680825	0.012641381	0.0739715	0.062398	3.345214	1.105417	0.03249211

Table 5: Assay results for 13 selected elements

Mo	Cu	Pb	Zn	Ag	Fe	As	Au	Ca	B	Hg	Se	Ce	Northing	Easting	Species	Sample
<0.01	7.84	<0.01	34	<2	0.001	0.1	0.2	0.01	1	1	0.1	0.01	6547927	475988	BO	223N 001
<0.01	7.11	<0.01	22.1	<2	0.001	<0.1	<0.2	1.09	31	8	0.3	0.05	6547898	475958	BO	223N 002
<0.01	6.61	<0.01	22	<2	0.002	<0.1	<0.2	0.5	30	3	<0.1	0.06	6547887	475914	BO	223N 003
<0.01	5.77	<0.01	20.3	<2	0.002	<0.1	<0.2	0.45	33	4	<0.1	0.06	6547857	475851	BO	223N 004
<0.01	5.54	<0.01	20.3	<2	0.002	0.3	<0.2	0.49	22	5	0.3	0.06	6547883	475921	VDM	223N 005
<0.01	5.48	<0.01	19.7	<2	0.002	<0.1	<0.2	0.43	56	4	0.3	0.06	6547804	475784	VDM	223N 006
<0.01	5.08	<0.01	19.7	<2	0.005	<0.1	0.7	1.2	55	12	1.9	0.06	6547836	475830	BO	223N 007
<0.01	4.96	<0.01	19.5	<2	0.003	<0.1	<0.2	0.86	39	9	0.4	0.06	6547732	475721	VDM	223N 008
<0.01	4.81	<0.01	18.1	<2	0.005	<0.1	0.4	0.82	37	11	0.4	0.06	6547773	475751	VDM	223N 009
<0.01	4.79	<0.01	18.1	<2	0.004	<0.1	<0.2	1.31	33	13	0.2	0.06	6547692	475612	VDM	223N 010
<0.01	4.69	<0.01	17.9	<2	0.005	<0.1	0.6	0.82	42	9	0.2	0.08	6547773	475767	BO	223N 011
<0.01	4.67	<0.01	17.8	<2	0.003	<0.1	0.4	0.88	64	10	0.4	0.08	6547628	475482	VDM	223N 012
<0.01	4.67	0.49	16.7	<2	0.004	0.1	0.5	0.55	54	8	0.2	0.09	6547733	475664	VDM	223N 013
<0.01	4.65	0.46	16.3	<2	<0.001	<0.1	<0.2	0.75	30	5	0.2	0.09	6547594	475386	VDM	223N 014
<0.01	4.57	0.28	15.9	<2	0.003	<0.1	0.5	1.17	63	24	0.3	0.09	6547712	475633	BO	223N 015
<0.01	4.55	0.27	15.8	<2	0.002	<0.1	<0.2	0.92	24	2	<0.1	0.09	6547443	475282	VDM	223N 016
<0.01	4.49	0.23	15.8	<2	0.006	0.2	0.8	1.27	46	13	0.4	0.1	6547678	475567	VDM	223N 017
<0.01	4.45	0.2	15.8	<2	0.001	<0.1	<0.2	0.81	26	5	<0.1	0.1	6547359	475194	BO	223N 018
<0.01	4.45	0.17	15.7	<2	0.007	<0.1	0.4	0.96	58	11	0.3	0.1	6547649	475512	VDM	223N 019
<0.01	4.38	0.17	15.6	<2	0.006	0.1	<0.2	0.82	44	10	0.5	0.1	6547617	475077	VDM	223N 020
<0.01	4.33	0.17	15.6	<2	0.007	<0.1	<0.2	1.52	60	15	0.4	0.1	6547609	475426	VDM	223N 021
<0.01	4.26	0.16	15.3	<2	0.006	<0.1	0.4	1.15	48	13	0.3	0.1	6547720	475258	VDM	223N 022
<0.01	4.19	0.16	15.3	<2	0.005	<0.1	0.4	1.5	53	11	0.3	0.1	6547519	475385	VDM	223N 023
<0.01	4.1	0.16	15.2	<2	0.004	<0.1	<0.2	0.92	64	10	0.2	0.11	6547794	475375	BO	223N 024

<0.01	4.09	0.16	15.2	<2	0.003	<0.1	0.5	0.73	31	6	0.3	0.11	6547473	475302	VDM	223N 025
<0.01	4.04	0.16	15.1	<2	0.007	<0.1	0.5	1.71	60	19	0.4	0.11	6547848	475482	VDM	223N 026
<0.01	4.02	0.16	15.1	<2	0.006	<0.1	0.3	1.55	47	8	0.2	0.11	6547415	475269	BO	223N 027
<0.01	3.95	0.16	15	<2	0.006	<0.1	0.3	0.9	46	11	0.3	0.11	6547885	475557	BO	223N 028
<0.01	3.85	0.15	14.9	<2	0.008	<0.1	<0.2	2.1	58	26	0.2	0.12	6547371	475236	BO	223N 029
<0.01	3.82	0.15	14.8	<2	0.002	<0.1	<0.2	0.44	26	3	<0.1	0.12	6547991	475690	BO	223N 030
<0.01	3.81	0.15	14.8	<2	0.006	<0.1	<0.2	1.29	48	12	0.3	0.12	6547342	475193	VDM	223N 031
<0.01	3.8	0.14	14.5	<2	0.003	<0.1	<0.2	0.6	69	10	0.3	0.12	6548050	475817	BO	223N 032
<0.01	3.75	0.14	14.5	<2	0.002	0.2	<0.2	0.86	37	9	0.3	0.12	6547589	475045	BO	223N 033
<0.01	3.73	0.14	14.4	<2	0.004	<0.1	0.2	1.16	49	15	0.4	0.12	6548107	475920	BO	223N 034
<0.01	3.7	0.14	14.3	<2	0.005	<0.1	<0.2	0.52	56	7	0.2	0.12	6547625	475118	VDM	223N 035
<0.01	3.7	0.13	14.3	<2	<0.001	<0.1	<0.2	0.74	36	9	0.2	0.12	6547967	476050	BO	223N 036
<0.01	3.65	0.13	14.2	<2	0.009	<0.1	0.2	0.73	31	17	0.3	0.13	6547731	475287	VDM	223N 037
1.17	3.64	0.13	14	<2	0.007	<0.1	<0.2	0.94	46	14	0.4	0.13	6547843	476229	BO	223N 038
0.94	3.58	0.13	13.9	<2	0.008	0.2	0.3	1.12	47	15	0.3	0.13	6547743	475336	VDM	223N 039
0.93	3.57	0.13	13.8	<2	0.009	<0.1	0.6	0.81	63	19	0.3	0.13	6547726	476044	VDM	223N 040
0.71	3.53	0.13	13.8	<2	0.005	<0.1	<0.2	1.55	37	12	0.3	0.13	6547823	475418	VDM	223N 041
0.53	3.5	0.13	13.8	<2	0.001	<0.1	0.3	1.06	52	6	0.2	0.13	6547678	475956	BO	223N 042
0.46	3.48	0.12	13.8	<2	0.006	<0.1	0.2	1.36	62	12	0.3	0.13	6547832	475406	BO	223N 043
0.45	3.47	0.12	13.8	<2	0.01	<0.1	0.5	0.75	33	15	0.2	0.13	6547636	475878	VDM	223N 044
0.29	3.46	0.12	13.7	<2	0.002	<0.1	<0.2	0.53	37	6	<0.1	0.14	6547881	475496	BO	223N 045
0.24	3.44	0.12	13.7	<2	0.009	<0.1	<0.2	0.84	29	20	0.3	0.14	6547562	475749	VDM	223N 046
0.24	3.44	0.12	13.4	<2	0.002	<0.1	0.3	0.72	63	10	0.2	0.14	6547896	475562	VDM	223N 047
0.24	3.42	0.12	13.3	<2	0.007	0.1	<0.2	1.19	52	14	0.3	0.14	6547488	475654	VDM	223N 048
0.2	3.42	0.12	13.2	<2	0.009	<0.1	<0.2	1.61	42	20	0.3	0.14	6547927	475623	BO	223N 049
0.2	3.4	0.12	13.2	<2	0.005	0.2	0.3	1.24	71	22	0.5	0.14	6547442	475555	BO	223N 050
0.19	3.38	0.11	13.2	<2	0.005	<0.1	<0.2	1.07	39	12	0.4	0.14	6547942	475678	BO	223N 051

0.19	3.36	0.11	13.1	<2	0.007	<0.1	0.2	1.46	45	13	0.3	0.14	6547381	475466	BO	223N 052
0.19	3.3	0.11	13.1	<2	0.002	<0.1	0.2	0.67	39	11	0.3	0.14	6547994	475747	BO	223N 053
0.19	3.24	0.11	13	<2	0.009	<0.1	0.2	0.88	32	15	0.5	0.14	6547329	475413	BO	223N 054
0.18	3.23	0.11	13	<2	0.011	<0.1	<0.2	1.9	65	20	0.5	0.14	6548028	475769	BO	223N 055
0.17	3.16	0.11	12.9	<2	0.009	<0.1	0.3	1.21	51	19	0.3	0.15	6547300	475349	VDM	223N 056
0.17	3.15	0.11	12.9	<2	0.006	<0.1	<0.2	1.18	53	15	0.5	0.15	6548067	475870	VDM	223N 057
0.16	3.12	0.11	12.9	<2	0.007	<0.1	0.3	1.4	46	18	0.3	0.15	6547150	475512	VDM	223N 058
0.16	3.11	0.11	12.6	<2	0.002	0.2	<0.2	0.49	45	8	0.2	0.16	6548061	475885	BO	223N 059
0.15	3.11	0.1	12.6	<2	0.009	0.2	<0.2	1.11	68	19	0.5	0.16	6547178	475538	BO	223N 060
0.14	3.1	0.1	12.5	<2	0.01	0.1	<0.2	1.57	56	19	0.4	0.16	6548142	475957	VDM	223N 061
0.13	3.09	0.1	12.3	<2	0.01	0.1	<0.2	0.95	60	17	0.2	0.16	6547216	475599	VDM	223N 062
0.13	3.09	0.1	12.2	<2	0.002	<0.1	0.5	1.07	47	5	0.2	0.16	6548156	475988	BO	223N 063
0.13	3.07	0.1	12.2	<2	0.009	<0.1	0.4	1.53	72	22	0.5	0.16	6547220	475621	BO	223N 064
0.11	3.05	0.1	12.1	<2	0.004	<0.1	0.2	1.29	60	8	0.3	0.16	6547982	476089	BO	223N 065
0.1	3.03	0.1	12.1	<2	0.035	0.6	<0.2	1	68	18	0.3	0.17	6547301	475718	BO	223N 066
0.1	3.03	0.1	12	<2	<0.001	<0.1	0.2	0.83	58	8	0.3	0.17	6547988	476145	VDM	223N 067
0.1	3.03	0.1	11.9	<2	0.001	<0.1	0.2	0.93	52	10	0.4	0.17	6547337	475793	BO	223N 068
0.1	3.02	0.1	11.8	<2	0.007	0.1	0.3	1.51	56	19	0.3	0.17	6547815	476183	VDM	223N 069
0.1	3.01	0.09	11.7	<2	0.011	<0.1	0.4	1.18	53	23	0.2	0.17	6547368	475861	VDM	223N 070
0.09	3	0.09	11.7	<2	0.002	<0.1	0.5	0.98	47	9	0.3	0.17	6547751	476086	VDM	223N 071
0.09	2.98	0.09	11.3	<2	0.007	<0.1	0.5	1.33	45	15	0.3	0.17	6547414	475941	VDM	223N 072
0.09	2.98	0.09	11.3	<2	0.009	<0.1	0.4	1.09	50	12	0.2	0.18	6547720	476004	VDM	223N 073
0.08	2.97	0.09	11.3	<2	0.01	<0.1	<0.2	1.1	64	20	0.2	0.18	6547198	475573	BO	223N 074
0.08	2.97	0.09	11.2	<2	0.007	0.1	0.3	1.51	62	25	0.4	0.18	6547639	475930	VDM	223N 075
0.08	2.96	0.09	11.2	<2	0.009	0.1	0.3	0.88	35	19	0.5	0.18	6547255	475644	BO	223N 076
0.07	2.95	0.08	11.2	<2	0.007	<0.1	<0.2	1.24	34	20	0.1	0.18	6547591	475818	BO	223N 077
0.07	2.95	0.08	11.1	<2	0.003	<0.1	0.2	1.21	65	18	0.6	0.18	6547324	475774	VDM	223N 078

0.07	2.93	0.08	11.1	<2	0.003	<0.1	0.3	1.52	69	14	0.3	0.18	6547578	475817	VDM	223N 079
0.07	2.92	0.08	11.1	<2	0.008	<0.1	0.2	1.3	40	17	0.3	0.18	6547388	475897	VDM	223N 080
0.07	2.92	0.08	11	<2	<0.001	<0.1	<0.2	1.16	48	8	<0.1	0.18	6547514	475708	VDM	223N 081
0.07	2.91	0.08	11	<2	0.009	<0.1	<0.2	1.05	60	21	0.3	0.19	6547463	475981	BO	223N 082
0.07	2.9	0.08	10.9	<2	0.012	<0.1	<0.2	1.24	69	18	0.3	0.19	6547457	475598	VDM	223N 083
0.07	2.83	0.08	10.8	<2	0.01	0.1	0.4	0.87	63	17	0.5	0.19	6547471	476028	VDM	223N 084
0.06	2.82	0.08	10.8	<2	0.003	0.1	<0.2	0.83	51	10	0.3	0.19	6547431	475535	VDM	223N 085
0.06	2.81	0.08	10.8	<2	0.012	<0.1	0.3	1.25	44	16	0.5	0.19	6547524	476095	BO	223N 086
0.06	2.8	0.08	10.7	<2	<0.001	<0.1	<0.2	0.54	39	1	<0.1	0.2	6547371	475459	BO	223N 087
0.06	2.8	0.08	10.7	<2	0.009	0.2	<0.2	0.94	60	18	0.5	0.2	6547543	476132	BO	223N 088
0.06	2.78	0.08	10.7	<2	0.011	0.2	<0.2	0.91	49	26	0.6	0.2	6547452	475425	VDM	223N 089
0.05	2.76	0.07	10.5	<2	0.003	<0.1	0.3	1.11	38	10	0.3	0.2	6547600	476233	BO	223N 090
0.05	2.75	0.07	10.3	<2	0.004	<0.1	<0.2	0.73	169	33	0.1	0.21	6547313	475377	BO	223N 091
0.05	2.74	0.07	10.3	<2	0.007	<0.1	0.7	1.05	90	17	0.2	0.21	6547509	476065	VDM	223N 092
0.05	2.72	0.07	10.2	<2	0.01	<0.1	4	1.8	104	27	0.6	0.21	6547256	475249	VDM	223N 093
0.05	2.69	0.07	10.2	<2	0.002	<0.1	0.3	0.8	39	8	0.2	0.21	6547580	476151	BO	223N 094
0.05	2.68	0.07	10	<2	0.013	<0.1	<0.2	1.28	51	23	0.2	0.22	6547071	475372	BO	223N 095
0.05	2.68	0.07	9.9	<2	0.009	<0.1	<0.2	1.25	53	22	0.3	0.22	6547600	476257	VDM	223N 096
0.05	2.66	0.06	9.9	<2	0.011	<0.1	<0.2	1.84	78	33	0.1	0.22	6547110	475411	VDM	223N 097
0.05	2.66	0.06	9.9	<2	0.008	<0.1	0.3	1.51	40	16	0.2	0.22	6547658	476299	VDM	223N 098
0.04	2.61	0.06	9.7	<2	0.003	<0.1	<0.2	1.55	59	17	0.2	0.22	6547119	475481	VDM	223N 099
0.04	2.6	0.06	9.7	<2	0.003	<0.1	0.4	0.95	64	7	0.4	0.23	6547674	476357	VDM	223N 100
0.04	2.57	0.06	9.7	<2	0.001	<0.1	<0.2	1.1	30	9	0.1	0.23	6547488	476380	BO	223N 101
0.04	2.56	0.06	9.6	<2	0.003	<0.1	0.3	1.33	25	7	0.4	0.23	6547444	476339	VDM	223N 102
0.04	2.56	0.05	9.6	<2	0.003	<0.1	<0.2	0.7	37	4	<0.1	0.24	6547356	476157	VDM	223N 103
0.04	2.54	0.05	9.4	<2	0.002	<0.1	<0.2	1.14	64	14	<0.1	0.24	6547544	476486	VDM	223N 104
0.04	2.53	0.05	9.4	<2	0.012	<0.1	0.3	1.32	55	26	0.4	0.25	6547278	476050	BO	223N 105

0.04	2.5	0.05	9.3	<2	0.011	<0.1	<0.2	1.58	65	26	0.7	0.27	6547404	476297	VDM	223N 106
0.04	2.48	0.05	9.2	<2	0.002	<0.1	0.3	1.23	36	9	0.3	0.27	6547257	476030	BO	223N 107
0.04	2.47	0.05	9.2	<2	0.002	<0.1	<0.2	0.69	57	14	0.1	0.29	6547386	476249	VDM	223N 108
0.04	2.43	0.05	9.1	<2	0.004	<0.1	<0.2	0.8	47	11	0.6	0.29	6547186	475922	BO	223N 109
0.03	2.42	0.05	9.1	<2	0.002	<0.1	<0.2	1.07	30	11	0.2	0.3	6547371	476228	BO	223N 110
0.03	2.39	0.04	9.1	<2	0.012	<0.1	<0.2	1.02	21	23	0.1	0.3	6547138	475814	VDM	223N 111
0.03	2.35	0.04	9	<2	0.001	<0.1	<0.2	0.94	37	3	0.2	0.31	6547348	476148	BO	223N 112
0.03	2.32	0.04	9	<2	0.006	<0.1	<0.2	1.3	83	20	0.4	0.32	6546990	475607	VDM	223N 113
0.03	2.31	0.04	9	<2	0.001	<0.1	<0.2	1.12	40	8	0.3	0.32	6547304	476091	BO	223N 114
0.03	2.29	0.04	8.9	<2	0.004	<0.1	0.4	0.71	30	6	0.3	0.33	6546801	475687	BO	223N 115
0.03	2.29	0.04	8.8	<2	<0.001	<0.1	<0.2	0.57	48	8	0.2	0.35	6547257	476031	BO	223N 116
0.03	2.29	0.04	8.7	<2	0.012	<0.1	<0.2	1.87	62	32	0.6	0.36	6546864	475786	VDM	223N 117
0.03	2.28	0.04	8.7	<2	0.012	<0.1	0.2	1.26	70	23	0.3	0.4	6547205	475954	BO	223N 118
0.03	2.27	0.04	8.6	<2	0.003	<0.1	<0.2	0.6	30	7	0.2	0.4	6546984	476012	BO	223N 119
0.03	2.23	0.04	8.5	<2	0.002	<0.1	0.2	1.62	69	15	0.1	0.41	6547200	475949	VDM	223N 120
0.03	2.23	0.04	8.4	<2	0.002	<0.1	0.2	0.98	48	7	<0.1	0.42	6547058	476095	VDM	223N 121
0.03	2.19	0.04	8.4	<2	<0.001	<0.1	0.4	1.07	50	13	0.3	0.42	6547163	475870	BO	223N 122
0.02	2.13	0.04	8.3	<2	0.003	<0.1	0.3	2.5	80	33	0.2	0.47	6547105	476147	BO	223N 123
0.02	2.13	0.03	8.2	<2	0.002	<0.1	<0.2	1.6	81	14	0.3	0.48	6547144	475854	BO	223N 124
0.02	2.13	0.03	8.2	<2	0.003	0.1	<0.2	1.53	58	19	0.3	0.53	6547157	476220	VDM	223N 125
0.02	2.09	0.03	8.2	<2	0.002	<0.1	0.5	0.87	60	11	0.1	0.55	6547100	475764	VDM	223N 126
0.02	2.08	0.03	8.1	<2	0.002	<0.1	<0.2	1.02	50	8	0.2	0.56	6547166	476277	VDM	223N 127
0.02	2.05	0.03	8	<2	0.003	<0.1	<0.2	0.79	38	9	0.1	0.58	6547065	475705	VDM	223N 128
0.02	2.02	0.03	8	<2	0.007	<0.1	0.4	1.05	68	15	0.3	0.62	6547223	476363	VDM	223N 129
0.02	1.97	0.03	8	<2	0.005	<0.1	0.4	2.23	72	20	0.4	0.64	6547049	475714	BO	223N 130
0.02	1.97	0.03	8	<2	0.004	<0.1	<0.2	2.19	73	20	0.3	0.64	6547254	476412	VDM	223N 131
0.02	1.94	0.03	7.9	<2	0.002	<0.1	<0.2	1.42	30	8	0.3	0.65	6547043	475638	BO	223N 132

0.02	1.89	0.03	7.9	<2	0.003	<0.1	<0.2	1.17	47	8	0.4	0.7	6547323	476516	VDM	223N 133
0.02	1.88	0.03	7.7	<2	0.001	<0.1	0.3	1.1	87	15	0.3	0.71	6546984	475576	VDM	223N 134
0.02	1.87	0.02	7.7	<2	0.007	<0.1	<0.2	0.96	56	12	0.3	0.73	DUP 024			223N 135
0.02	1.87	0.02	7.6	<2	0.002	<0.1	0.2	1.64	50	15	0.2	0.73	6546945	475536	VDM	223N 136
0.02	1.8	0.02	7.6	<2	0.001	<0.1	<0.2	1.06	38	10	0.1	0.76	6547153	476226	BO	223N 137
0.02	1.77	0.02	7.6	<2	0.003	<0.1	<0.2	0.79	39	10	0.2	0.78	6546914	475475	VDM	223N 138
0.02	1.76	0.02	7.3	<2	0.002	0.1	0.3	1.93	119	22	0.2	0.79	6547196	476346	VDM	223N 139
0.01	1.75	0.02	7.3	<2	<0.001	<0.1	0.2	0.98	49	7	0.3	0.79	6546786	475664	VDM	223N 140
0.01	1.75	0.02	7.1	<2	0.003	0.2	0.3	1.16	90	21	0.3	0.9	6547315	476472	VDM	223N 141
0.01	1.75	0.02	7	<2	<0.001	<0.1	0.4	1.4	67	14	0.3	0.96	6546824	475746	VDM	223N 142
0.01	1.72	0.02	6.9	196	0.002	<0.1	<0.2	0.97	68	8	0.1	0.98	6547351	476572	VDM	223N 143
0.01	1.63	0.01	6.7	4	<0.001	<0.1	0.5	0.88	67	9	0.2	1.02	6546969	475985	BO	223N 144
0.01	1.62	0.01	6.5	3	0.001	<0.1	0.3	1.57	50	12	0.4	1.02	DUP 131			223N 145
0.01	1.61	0.01	6.5	2	0.002	<0.1	0.4	1.44	68	14	0.2	1.2	6547019	476029	VDM	223N 146
0.01	1.6	0.01	6.2	2	0.003	<0.1	0.3	0.97	36	12	0.2	1.28	DUP 102			223N 147
0.01	1.48	0.01	5.8	2	0.002	<0.1	<0.2	1.76	48	15	0.4	1.45	6547058	476061	BO	223N 148
0.01	1.38	0.01	5.6	2	0.003	0.2	0.4	1.02	46	7	0.3	1.66	DUP 003			223N 149
0.01	1.25	0.01	5.1	2	0.003	<0.1	<0.2	1.28	62	16	0.2	2.19	DUP092			223N 150

Table 6: Element list and selection criteria

ELEMENT	Precision (Dunn, 2007)	Above Analytical detection Values	Related Minerals	Y/N? (or Maybe)	NOTES
Mo	High	113	Cu-Mo, Cu-Au-Mo, W-Mo	Y	Good exploration tool in past research, Good analytical detection in most species and tissues, high mobility
Cu	High	150	Cu-Mo-Au	Y	Useful in exploration, good analytical detection levels, good indication of mineralisation
Pb	High for values > 1ppm	138	Ag, Au, Cu, Zn	Y	Analytical spikes rare, hence good exploration indicator
Zn	Extremely good	150	Cu, Ag, Au, Al, Pb	Y	Generally always above analytical detection limit, changes can be due to health of plant tissue, past research with Au mineralisation
Ag	Fairly good, especially at higher values	8 (at 2ppb)	Au, Cu, Cd, Al, Pb	Y	Can have rare spikes that may not have relation to data,
Ni	Very good	137	Fe, minor Au	N	Generally above analytical detection limit in plant tissue, generally Ni-hyper accumulation plants are rare
Co	Generally good	129	Fe, Ni, Au, As, Sb	N	Generally above analytical detection limit, generally bound to Fe organic complexes, Ni in mafic/ultramafic environments, can be spatial with peripheral enrichment to central Au
Mn	Very Good	150	Mg, Zn, Fe, B, K, Co, Cu	N	Generally always above analytical detection, once taken up by plant generally immobile, essential plant minerals = Mg, Zn, Fe, B, K, Co, Cu
Fe	Very good	140	Au, As, Sb, Cr	Y	Accumulates with Au, As, Sb and Cr is locally Au rich areas
As	Generally poor	24	Sb, Bi, Cu, Ag, Au	Y	Close to analytical detection limit, values below 1ppm should be treated with caution, good Au pathfinder
U	Very Good	47	Fe, Ag, Cu, Zn, Th	N	Quite mobile, can detect mineralisation with minor enrichment, generally associated with most mineralisation due to high mobility
Au	Some spikes, but	75	Ag, Cu, As, Sb,	Y	Due to nugget effect Au pathfinder elements are important (As, Bi,

	generally good		Hg, Bi		Sb, Te, Se) and other associated ore minerals
Th	Good, bad at low levels	18	U, REE	N	Inferior precision at low levels, affinity for U
Sr	Excellent	150	Ca, Ba	N	Good data plotting, high precision and accuracy, similar to Ca function,
Cd	Excellent	17	Zn, Au	M/N	Generally good values in repeat studies and duplicates, can be a pathfinder element for Au
Sb	Fair to poor	2	Au, As, Sb	M/N (maybe at HDL)	Low values have low precision, Au Pathfinder element
Bi	Very good precision	12	Au, Ag, Cu, As	M/N	Au pathfinder element, associated with many different types of mineralisation
V	Medium to low with lower values	21	P, Sometimes Au, Mo	N	Can substitute for Mo in N fixing, sometimes associated with late stage epithermal Au deposits
Ca	Excellent	150	Mn, Fe, Al	Y	Essential for plants, should always be above analytical detection limit, limited mineral exploration usage
P	Excellent	150	C, N, S, U	N	Essential for plants, therefore always above analytical detection, can assist with defining mineralisation location in relation to U
La	Very Good	146	REE, Ce, Fe	M/N	Nd REE has a strong spatial relationship to Au deposits, so La or Ba might represent this, all REE have strong correlation to each other
Cr	Very Good	146	Co, Mg, Au sometimes, Th, U	N	High values above analytical detection limit result in good precision, if field data spikes do occur it is usually contamination, identify ultramafic areas
Mg	Excellent	150	Ca, Ba, Sr, P, B, K, Mn, S, Zn	N	Analytical artefacts are unlikely to occur, essential for plants, limited use for exploration, lots of element associations (rare with ore)
Ba	Excellent	150	Mg, Ca, Sr, Be, Ra, Pb, Zn, Au Sometimes	M/Y	Bi-valent element, alkaline earth, can be associated with mineralisation as a peripheral zone
Ti	Very good	150	Cd, Re, Zn	N	Generally above analytical detection limit, high values can suggest contamination, species related

B	Very good to excellent	150	Mn, C, Na, Mg	Y	Essential for plant metabolism, low geochemical exploration significance, can be enriched with base metal deposits
Al	Good to very good	24	Cu, Ag, Au	N	High spikes should be suspect of contamination, essential for many plants, can highlight clay rich areas
Na	Moderately good	150	Fe, Na	N	More concentrated in foliage than twigs, can have high contamination in coastal areas
K	Excellent	150	Mo, Cu	N	Essential macronutrient for plants, trends can reflect bedrock alteration,
W	Poor	0	Sn	N	None above analytical detection limit, does not readily enter plants, any values are likely contamination
Sc	Fair to poor	127	Al, Ba, Ga, REE, S, Se	N	No real importance to mineral exploration, likely geochemical affinities of these elements
Tl	Excellent for values > 0.05ppm, else poor	0	K, Rb, Au, As, Sb, Ag	M/N (at HDL)	None above analytical detection limit, reflects K, form from hydrothermal processes, enriched in polymetallic deposits, excellent gold indicator when above analytical detection
S	Fair to poor	150	Pb, Au, Ag	N	Data is semi-quantitative, essential to plants in trace amounts, found in twigs, can be useful for exploration in commodity metals and sulphides
Hg	Excellent	150	Au, As, Cu, Ag	Y	Generally above analytical detection, can be airborne contamination, pathfinder element for Au and other metals
Se	Poor	138	S, Pt, Pd	Y	Au pathfinder, follows S, low precision
Te	Poor	7	Au, Se, Fe, S, Zn, Cu, Pb	N	Barely detectable in plants, single point values may be analytical artefacts, useful in ashed samples
Ga	Very poor	0	Zn, Cu, Ge, Al	N	Any high values should be scrutinised
Cs	Moderate to very good	87	K, Rb, Au, As, Sb	N	Contamination sources sparse so large spikes are generally accurate, can be linked to hydrothermal mineralisation
Ge	Poor	34	Zn, Cu, Pb, Fe,	N	Rare element, poor precision suggest care with Ge results

			Si		
Hf	Poor to fair	89	Zr	N	Erratic spikes in data, rarely important in exploration, high values suggest contamination from dust
Nb	Poor	0	Ta	N	No values above analytical detection, low mobility in natural environment
Rb	Excellent	150	K, Sr	N	No spikes common in data, abundant element, no known biological control
Sn	Fair to poor	15	C, Fe	N	Low concentrations due to no ready access for plants, high values in casuarina
Ta	Poor	0	Li, Cs	N	No values above analytical detection limit
Zr	Generally good	146	Ti, Cl	N	Availability to plants is low, so concentrations are generally low, can be airborne dust contamination, generally used to show contamination
Y	Very goo	150	P, REE	N	Closely follows REE
Ce	Excellent	150	REE, La, Ce, Fe	Y	REE, Nd REE has a strong spatial relationship to Au deposits
In	Very good	0	Sn, Zn	N	Unusual for plants to be above analytical detection limit
Re	Excellent	96	Pt, Nb, REE, Mo, Cu, Au	N	Rarest elements, mainly related to Mo
Be	Very good	1	Cu, k, Cl	N	Rarely found above analytical detection limit
Li	Fair	150	Ta, Li, Cs	N	Data should be interpreted with large intervals, calcium inhibits Li uptake
Pd	Good	0	Pt, Ir, Os, Rh, Ru	N	Rare elements, likely contaminated if near highways etc
Pt	Poor	2	Pr, Ir, Os, Rh, Ru	N	Rare elements, likely contaminated if near highways etc

Appendices

Appendix 1: Chemical assay results table

				Mo	Cu	Pb	Zn	Ag	Ni	Co	Mn	Fe	As	U	Au	Th	Sr	Cd	Sb	Bi	V	Ca
				PPM	PPM	PPM	PPM	PPB	PPM	PPM	PPM	%	PPM	PPM	PPB	PPM	PPM	PPM	PPM	PPM	PPM	%
	Northing	Easting	Species	0.01	0.01	0.01	0.1	2	0.1	0.01	1	0.001	0.1	0.01	0.2	0.01	0.5	0.01	0.02	0.02	2	0.01
Sample																						
223N 001	6547927	475988	BO	<0.01	3.1	0.04	11.7	<2	1	0.02	37	0.006	0.2	<0.01	0.8	<0.01	104.1	<0.01	<0.02	<0.02	<2	1.27
223N 002	6547898	475958	BO	0.01	2.95	0.02	9.1	<2	0.8	0.05	76	<0.001	<0.1	<0.01	<0.2	<0.01	56.1	<0.01	<0.02	<0.02	<2	0.54
223N 003	6547887	475914	BO	0.24	2.35	0.08	9.6	<2	0.9	0.03	35	0.005	<0.1	<0.01	0.6	<0.01	29.6	<0.01	<0.02	<0.02	<2	0.82
223N 004	6547857	475851	BO	0.16	2.32	0.09	15.3	<2	1	0.03	42	0.009	<0.1	<0.01	0.2	<0.01	29.2	<0.01	<0.02	<0.02	<2	0.73
223N 005	6547883	475921	VDM	0.01	2.93	0.1	14.8	<2	1.4	0.05	60	0.002	<0.1	<0.01	0.5	<0.01	43.7	<0.01	<0.02	<0.02	<2	0.87
223N 006	6547804	475784	VDM	0.02	1.77	0.08	8.4	<2	1.7	0.02	66	0.002	<0.1	0.05	3.2	<0.01	83	<0.01	<0.02	<0.02	<2	1.67
223N 007	6547836	475830	BO	0.46	2.81	0.12	8	<2	1.8	0.03	50	0.013	<0.1	<0.01	<0.2	0.02	51.5	<0.01	<0.02	<0.02	<2	1.28
223N 008	6547732	475721	VDM	0.04	2.96	<0.01	12.6	<2	1.5	0.03	124	0.002	<0.1	0.02	<0.2	<0.01	54.1	<0.01	<0.02	<0.02	<2	0.97
223N 009	6547773	475751	VDM	0.02	2.29	<0.01	13.7	<2	1.4	0.05	85	0.001	<0.1	<0.01	<0.2	<0.01	60.8	<0.01	<0.02	<0.02	<2	1.06
223N 010	6547692	475612	VDM	0.02	2.61	<0.01	11.9	<2	1.4	0.03	90	0.002	<0.1	0.02	<0.2	<0.01	94.7	<0.01	<0.02	<0.02	<2	1.6
223N 011	6547773	475767	BO	0.05	1.75	0.08	7.9	<2	1	0.02	38	0.009	<0.1	<0.01	0.4	<0.01	43.1	<0.01	<0.02	<0.02	<2	1.09
223N 012	6547628	475482	VDM	<0.01	3.95	<0.01	9.7	<2	1.4	0.33	72	0.002	<0.1	0.02	<0.2	<0.01	42	<0.01	<0.02	<0.02	<2	0.53
223N 013	6547733	475664	VDM	0.01	3.03	<0.01	11.1	<2	1	0.03	60	0.003	<0.1	<0.01	<0.2	<0.01	29.7	<0.01	<0.02	<0.02	<2	0.7
223N 014	6547594	475386	VDM	0.04	3.36	<0.01	13.2	<2	2	0.07	70	0.003	<0.1	<0.01	<0.2	<0.01	69.2	<0.01	<0.02	<0.02	<2	1.28
223N 015	6547712	475633	BO	0.04	2.13	0.08	8.2	<2	1.4	0.02	42	0.008	<0.1	<0.01	<0.2	0.01	90.4	<0.01	<0.02	<0.02	<2	2.1
223N 016	6547443	475282	VDM	0.03	2.72	0.01	13.4	<2	0.9	0.04	58	0.002	<0.1	<0.01	0.2	<0.01	74.3	<0.01	<0.02	<0.02	<2	0.98
223N 017	6547678	475567	VDM	0.01	4.09	0.04	13.8	<2	0.7	0.05	50	0.002	<0.1	0.02	<0.2	<0.01	84.5	<0.01	<0.02	<0.02	<2	1.02
223N 018	6547359	475194	BO	0.02	2.56	0.04	7.3	<2	0.6	0.03	32	0.007	<0.1	<0.01	<0.2	<0.01	59.1	<0.01	<0.02	<0.02	<2	0.94
223N 019	6547649	475512	VDM	0.01	4.81	<0.01	9.2	<2	1.5	0.21	54	0.002	<0.1	0.02	<0.2	<0.01	26.1	<0.01	<0.02	<0.02	<2	0.44
223N 020	6547617	475077	VDM	0.05	3.81	0.05	11.2	<2	0.5	0.3	32	0.002	<0.1	0.02	<0.2	<0.01	35	<0.01	<0.02	<0.02	<2	0.5
223N 021	6547609	475426	VDM	<0.01	3.82	0.01	15.7	<2	1.3	0.05	78	0.003	<0.1	<0.01	<0.2	<0.01	46.7	<0.01	<0.02	<0.02	<2	0.79
223N 022	6547720	475258	VDM	0.03	7.84	0.05	15.2	<2	0.8	0.19	36	0.002	<0.1	0.07	<0.2	<0.01	50.8	<0.01	<0.02	<0.02	<2	0.69
223N 023	6547519	475385	VDM	0.02	3.57	0.08	11	<2	1	0.08	50	0.001	<0.1	<0.01	<0.2	<0.01	44.3	<0.01	<0.02	<0.02	<2	0.81
223N 024	6547794	475375	BO	0.04	1.61	0.1	7.7	<2	0.5	0.04	75	0.009	<0.1	<0.01	<0.2	<0.01	50.8	<0.01	<0.02	<0.02	<2	1.05
223N 025	6547473	475302	VDM	<0.01	2.69	0.08	12.2	<2	1.4	0.03	144	0.002	<0.1	0.03	<0.2	<0.01	63.1	<0.01	<0.02	<0.02	<2	1.14

223N 026	6547848	475482	VDM	0.02	1.89	0.2	7.1	<2	1.2	0.23	41	0.004	<0.1	0.07	<0.2	<0.01	64	<0.01	<0.02	<0.02	<2	0.73
223N 027	6547415	475269	BO	0.07	3.44	0.02	15.1	<2	0.9	0.03	31	0.004	<0.1	<0.01	<0.2	<0.01	75.4	<0.01	<0.02	<0.02	<2	0.92
223N 028	6547885	475557	BO	0.06	2.28	0.11	10.7	<2	1.1	0.02	50	0.012	<0.1	<0.01	<0.2	0.01	73	<0.01	<0.02	<0.02	<2	1.24
223N 029	6547371	475236	BO	0.04	2.43	0.1	12.6	<2	0.7	0.06	23	0.009	<0.1	<0.01	<0.2	0.01	54.6	<0.01	<0.02	<0.02	<2	0.84
223N 030	6547991	475690	BO	0.05	3.7	0.16	22.1	<2	0.8	0.08	38	0.01	<0.1	<0.01	<0.2	<0.01	100.5	<0.01	<0.02	<0.02	<2	1.1
223N 031	6547342	475193	VDM	0.03	2.48	0.06	5.1	<2	0.3	0.03	18	0.002	<0.1	<0.01	<0.2	<0.01	90.5	<0.01	<0.02	<0.02	<2	0.45
223N 032	6548050	475817	BO	0.04	1.87	0.07	10	<2	0.5	0.03	46	0.007	<0.1	<0.01	0.4	<0.01	57.5	<0.01	<0.02	<0.02	<2	0.96
223N 033	6547589	475045	BO	0.05	2.82	0.05	8.9	<2	0.7	0.03	31	0.006	<0.1	<0.01	<0.2	<0.01	80.2	<0.01	<0.02	<0.02	<2	1.29
223N 034	6548107	475920	BO	0.04	1.48	0.08	9.4	<2	0.4	0.01	58	0.007	<0.1	<0.01	0.7	<0.01	52.6	<0.01	<0.02	<0.02	<2	1.05
223N 035	6547625	475118	VDM	0.02	2.68	<0.01	9.1	<2	1.1	0.03	39	0.001	<0.1	<0.01	<0.2	<0.01	104.9	<0.01	<0.02	<0.02	<2	0.94
223N 036	6547967	476050	BO	0.06	1.76	0.06	9.3	<2	0.2	<0.01	30	0.009	<0.1	<0.01	0.3	0.02	67.1	<0.01	<0.02	<0.02	<2	1.21
223N 037	6547731	475287	VDM	0.03	7.11	0.02	11.3	<2	1	0.95	52	0.002	0.2	0.04	<0.2	<0.01	38.3	<0.01	<0.02	<0.02	<2	0.49
223N 038	6547843	476229	BO	0.03	1.75	0.07	13.8	<2	0.4	0.04	32	0.006	0.1	<0.01	<0.2	<0.01	30.6	<0.01	<0.02	<0.02	<2	0.82
223N 039	6547743	475336	VDM	0.01	5.48	0.03	12.9	<2	1.1	0.21	35	0.002	0.3	0.01	<0.2	<0.01	40.2	<0.01	<0.02	0.1	<2	0.49
223N 040	6547726	476044	VDM	0.03	3.24	0.06	12.5	<2	1	0.05	88	0.003	0.2	0.07	0.3	<0.01	101.7	<0.01	<0.02	<0.02	<2	1.16
223N 041	6547823	475418	VDM	0.02	4.65	0.04	9.9	<2	0.8	0.22	36	0.002	<0.1	0.06	0.3	<0.01	69.9	<0.01	<0.02	<0.02	<2	0.72
223N 042	6547678	475956	BO	0.1	2.23	0.11	8.6	<2	0.9	0.03	25	0.007	0.1	<0.01	<0.2	<0.01	69.6	<0.01	<0.02	<0.02	<2	1.19
223N 043	6547832	475406	BO	0.07	2.6	0.1	7.9	4	1.1	0.06	69	0.009	0.2	<0.01	<0.2	<0.01	61.1	<0.01	<0.02	<0.02	<2	0.94
223N 044	6547636	475878	VDM	0.02	2.83	0.04	13.2	<2	1	0.05	91	0.003	<0.1	0.01	0.3	<0.01	96.5	0.01	<0.02	<0.02	<2	0.97
223N 045	6547881	475496	BO	0.04	2.29	0.12	13.8	<2	0.5	0.04	18	0.011	0.2	<0.01	<0.2	0.01	52.8	<0.01	<0.02	<0.02	<2	0.91
223N 046	6547562	475749	VDM	0.02	3.53	0.03	17.9	<2	1.2	0.07	136	0.003	0.2	<0.01	0.4	<0.01	38	<0.01	<0.02	<0.02	<2	1.02
223N 047	6547896	475562	VDM	0.02	4.69	0.04	9.7	<2	0.8	0.14	40	0.003	<0.1	0.04	<0.2	<0.01	75.1	<0.01	<0.02	<0.02	<2	0.6
223N 048	6547488	475654	VDM	0.02	2.75	0.05	16.7	<2	1	<0.01	75	0.002	0.1	0.04	0.3	<0.01	128.9	<0.01	<0.02	<0.02	<2	1.93
223N 049	6547927	475623	BO	0.19	3	0.08	11.7	<2	0.3	0.02	26	0.009	0.2	<0.01	<0.2	<0.01	55	<0.01	<0.02	<0.02	<2	1.11
223N 050	6547442	475555	BO	0.14	2.13	0.16	7.6	<2	0.9	0.03	37	0.01	0.1	<0.01	0.4	<0.01	49.3	<0.01	<0.02	<0.02	<2	0.87
223N 051	6547942	475678	BO	0.08	1.62	0.11	10.9	<2	0.4	<0.01	27	0.009	<0.1	<0.01	<0.2	<0.01	71	<0.01	<0.02	<0.02	<2	1.61
223N 052	6547381	475466	BO	0.06	2.23	0.11	8.7	<2	0.9	0.04	39	0.007	0.1	<0.01	0.3	<0.01	110	<0.01	<0.02	<0.02	<2	1.51
223N 053	6547994	475747	BO	0.08	1.75	0.08	9.9	<2	0.4	<0.01	32	0.005	0.2	<0.01	0.3	<0.01	60.9	<0.01	<0.02	<0.02	<2	1.24
223N 054	6547329	475413	BO	0.06	2.8	0.12	9.6	<2	0.6	0.03	32	0.006	<0.1	<0.01	<0.2	<0.01	95.3	<0.01	<0.02	<0.02	<2	1.18
223N 055	6548028	475769	BO	0.03	2.39	0.11	13.9	<2	0.4	0.02	33	0.01	0.1	<0.01	<0.2	<0.01	92.9	<0.01	<0.02	<0.02	<2	1.57

223N 056	6547300	475349	VDM	0.01	2.66	0.07	9.1	<2	0.4	0.02	21	0.003	0.1	<0.01	<0.2	<0.01	100.9	<0.01	<0.02	<0.02	<2	0.83
223N 057	6548067	475870	VDM	0.05	1.63	0.01	6.5	<2	0.4	0.02	39	0.002	<0.1	<0.01	<0.2	<0.01	52	<0.01	<0.02	<0.02	<2	0.43
223N 058	6547150	475512	VDM	0.01	4.02	0.04	15.3	<2	1.3	0.08	43	0.003	<0.1	<0.01	<0.2	<0.01	63.2	<0.01	<0.02	<0.02	<2	0.79
223N 059	6548061	475885	BO	0.07	1.6	0.1	8	<2	0.6	0.02	48	0.01	<0.1	<0.01	4	0.01	176.1	<0.01	<0.02	<0.02	<2	1.8
223N 060	6547178	475538	BO	0.2	2.05	0.07	18.1	<2	1.3	0.04	26	0.009	0.1	<0.01	0.3	<0.01	37.5	<0.01	<0.02	<0.02	<2	0.88
223N 061	6548142	475957	VDM	0.02	3.73	0.04	8	<2	0.7	0.21	35	0.004	0.1	0.03	0.5	<0.01	37.4	<0.01	<0.02	<0.02	<2	0.55
223N 062	6547216	475599	VDM	0.02	1.87	0.1	7.3	2	1	0.03	41	0.008	0.2	<0.01	0.3	<0.01	54.8	<0.01	<0.02	<0.02	<2	1.12
223N 063	6548156	475988	BO	0.11	1.25	0.13	5.8	196	0.3	0.01	35	0.009	<0.1	<0.01	0.6	<0.01	28.3	<0.01	<0.02	<0.02	<2	0.81
223N 064	6547220	475621	BO	0.06	2.42	0.12	14.3	2	0.9	0.02	68	0.007	<0.1	<0.01	<0.2	<0.01	138.5	<0.01	<0.02	<0.02	<2	1.24
223N 065	6547982	476089	BO	0.09	2.47	0.16	13	<2	0.5	0.03	44	0.005	<0.1	<0.01	0.7	<0.01	46.1	<0.01	<0.02	<0.02	<2	1.2
223N 066	6547301	475718	BO	0.13	1.72	0.16	6.9	<2	0.3	0.03	29	0.01	0.1	<0.01	<0.2	0.01	52.3	<0.01	<0.02	<0.02	<2	0.95
223N 067	6547988	476145	VDM	0.02	2.53	0.03	12.3	<2	0.2	0.03	34	0.001	<0.1	<0.01	<0.2	<0.01	111.3	<0.01	<0.02	<0.02	<2	1.09
223N 068	6547337	475793	BO	0.05	2.31	0.12	10.3	<2	1.1	0.04	36	0.007	<0.1	<0.01	<0.2	<0.01	104.4	<0.01	<0.02	<0.02	<2	1.52
223N 069	6547815	476183	VDM	<0.01	3.58	0.04	14.5	<2	1	0.04	70	0.002	0.2	<0.01	<0.2	<0.01	45.5	<0.01	<0.02	<0.02	<2	0.86
223N 070	6547368	475861	VDM	0.04	2.97	0.09	15.9	<2	0.7	0.09	61	0.003	<0.1	0.01	<0.2	<0.01	95	<0.01	<0.02	<0.02	<2	1.17
223N 071	6547751	476086	VDM	0.03	2.92	0.04	34	<2	0.9	0.03	114	0.003	0.1	<0.01	<0.2	<0.01	87.4	0.02	<0.02	<0.02	<2	1.53
223N 072	6547414	475941	VDM	0.01	4.55	0.03	15.6	<2	2.5	0.09	81	0.002	<0.1	0.01	<0.2	<0.01	82.3	<0.01	<0.02	<0.02	<2	1.07
223N 073	6547720	476004	VDM	0.1	4.38	0.13	11.1	<2	2.3	0.05	35	0.003	<0.1	<0.01	0.4	<0.01	42.3	<0.01	<0.02	<0.02	<2	0.95
223N 074	6547198	475573	BO	0.24	3.75	0.06	11.3	<2	2.8	0.05	31	0.005	<0.1	<0.01	<0.2	<0.01	41.6	<0.01	0.03	<0.02	<2	1.07
223N 075	6547639	475930	VDM	0.29	2.97	0.09	9	<2	4.1	0.05	54	0.003	<0.1	0.02	0.2	<0.01	89.8	<0.01	<0.02	<0.02	<2	1.21
223N 076	6547255	475644	BO	0.45	3.03	0.12	9.7	<2	4	0.1	50	0.005	<0.1	<0.01	<0.2	<0.01	75.4	<0.01	<0.02	<0.02	<2	1.55
223N 077	6547591	475818	BO	0.71	3.38	0.14	13.7	<2	6	0.1	31	0.012	<0.1	<0.01	0.3	0.01	65.4	<0.01	<0.02	0.02	<2	1.25
223N 078	6547324	475774	VDM	0.93	3.07	0.14	10.7	<2	6.1	0.1	19	0.006	<0.1	0.03	<0.2	<0.01	173.4	<0.01	<0.02	0.03	<2	1.3
223N 079	6547578	475817	VDM	1.17	3.3	0.11	19.7	<2	7.8	0.13	58	0.007	<0.1	<0.01	0.4	<0.01	59.4	0.01	<0.02	0.05	<2	1.05
223N 080	6547388	475897	VDM	0.94	3.03	0.1	13.8	<2	7.1	0.11	61	0.007	<0.1	0.03	<0.2	<0.01	86.7	<0.01	<0.02	0.02	<2	0.96
223N 081	6547514	475708	VDM	0.53	2.8	0.05	12.2	<2	4.7	0.09	110	0.004	<0.1	0.03	0.4	<0.01	50.7	<0.01	<0.02	<0.02	<2	0.71
223N 082	6547463	475981	BO	<0.01	3.23	0.46	15.8	<2	<0.1	0.26	45	0.035	0.6	0.19	<0.2	0.09	51.6	0.48	0.38	0.25	<2	1
223N 083	6547457	475598	VDM	<0.01	1.8	0.04	8.2	<2	2	0.02	50	0.001	<0.1	0.02	<0.2	<0.01	92.4	<0.01	<0.02	<0.02	<2	1.12
223N 084	6547471	476028	VDM	<0.01	3.01	0.08	13.1	<2	1.6	0.02	44	0.002	<0.1	<0.01	<0.2	<0.01	89	<0.01	<0.02	<0.02	<2	1.42
223N 085	6547431	475535	VDM	<0.01	3.47	0.01	10.8	<2	1.1	0.08	71	<0.001	<0.1	0.04	0.5	<0.01	84.1	<0.01	<0.02	<0.02	<2	0.88

223N 086	6547524	476095	BO	<0.01	1.94	0.03	6.5	<2	<0.1	<0.01	26	0.003	<0.1	<0.01	0.5	<0.01	26.4	<0.01	<0.02	<0.02	<2	0.73
223N 087	6547371	475459	BO	<0.01	2.9	0.17	11.1	<2	0.3	0.02	50	0.012	<0.1	0.02	<0.2	0.02	210.5	<0.01	<0.02	<0.02	<2	1.87
223N 088	6547543	476132	BO	<0.01	2.09	0.1	12.9	<2	<0.1	<0.01	37	0.007	<0.1	0.01	0.3	<0.01	106.5	<0.01	<0.02	<0.02	<2	1.4
223N 089	6547452	475425	VDM	<0.01	2.27	0.03	6.2	<2	<0.1	<0.01	40	<0.001	<0.1	<0.01	0.2	<0.01	120.3	<0.01	<0.02	<0.02	<2	0.83
223N 090	6547600	476233	BO	<0.01	2.56	0.05	10.2	<2	<0.1	<0.01	27	0.003	<0.1	<0.01	<0.2	<0.01	58.6	<0.01	<0.02	<0.02	<2	0.86
223N 091	6547313	475377	BO	<0.01	1.38	0.09	7.6	<2	<0.1	<0.01	26	0.009	<0.1	<0.01	<0.2	0.02	66.7	<0.01	<0.02	<0.02	<2	1.25
223N 092	6547509	476065	VDM	<0.01	1.88	0.06	11.8	<2	<0.1	<0.01	76	<0.001	<0.1	0.02	0.4	<0.01	115.2	<0.01	<0.02	<0.02	<2	1.4
223N 093	6547256	475249	VDM	<0.01	4.04	0.04	15.8	<2	1.4	<0.01	169	0.001	<0.1	0.01	0.3	<0.01	101.2	0.02	<0.02	<0.02	<2	1.57
223N 094	6547580	476151	BO	<0.01	2.19	0.08	9.2	<2	<0.1	<0.01	29	0.003	<0.1	<0.01	0.4	<0.01	68	<0.01	<0.02	<0.02	<2	0.88
223N 095	6547071	475372	BO	<0.01	1.97	0.07	8.1	<2	<0.1	<0.01	24	0.004	<0.1	<0.01	0.2	<0.01	63.2	<0.01	<0.02	<0.02	<2	1.16
223N 096	6547600	476257	VDM	<0.01	2.92	<0.01	10.7	<2	<0.1	0.04	24	<0.001	<0.1	<0.01	<0.2	<0.01	69	<0.01	<0.02	<0.02	<2	0.75
223N 097	6547110	475411	VDM	<0.01	4.49	<0.01	8.3	<2	<0.1	<0.01	36	<0.001	<0.1	<0.01	<0.2	<0.01	52.3	<0.01	<0.02	<0.02	<2	0.57
223N 098	6547658	476299	VDM	<0.01	3.42	0.02	14.5	<2	0.3	<0.01	61	<0.001	<0.1	<0.01	0.4	<0.01	89.4	<0.01	<0.02	<0.02	<2	1.07
223N 099	6547119	475481	VDM	<0.01	3.44	0.02	16.3	<2	0.4	0.03	39	0.001	<0.1	<0.01	0.3	<0.01	62.7	<0.01	<0.02	<0.02	<2	1.1
223N 100	6547674	476357	VDM	<0.01	3.46	0.01	14	<2	0.3	0.02	45	0.001	<0.1	<0.01	0.2	<0.01	41.3	<0.01	<0.02	<0.02	<2	0.93
223N 101	6547488	476380	BO	<0.01	3.05	0.08	8.7	<2	0.3	<0.01	31	0.007	<0.1	<0.01	0.5	0.01	91.4	<0.01	<0.02	<0.02	<2	1.71
223N 102	6547444	476339	VDM	<0.01	3.16	0.02	18.1	<2	0.2	<0.01	52	0.003	<0.1	0.02	0.3	<0.01	80.4	<0.01	<0.02	<0.02	<2	1.52
223N 103	6547356	476157	VDM	<0.01	4.1	0.03	14.9	<2	<0.1	<0.01	51	0.001	<0.1	<0.01	0.3	<0.01	80.1	<0.01	<0.02	<0.02	<2	1.06
223N 104	6547544	476486	VDM	<0.01	3.12	0.02	14.4	<2	1.3	0.08	47	<0.001	<0.1	<0.01	0.2	<0.01	58.9	<0.01	<0.02	<0.02	<2	0.98
223N 105	6547278	476050	BO	<0.01	2.66	0.08	20.3	<2	0.2	<0.01	29	0.006	<0.1	<0.01	0.2	<0.01	64.3	<0.01	<0.02	<0.02	<2	1.36
223N 106	6547404	476297	VDM	<0.01	3.7	<0.01	15	<2	0.6	0.02	39	0.002	<0.1	<0.01	0.5	<0.01	43.2	<0.01	<0.02	<0.02	<2	1.07
223N 107	6547257	476030	BO	0.1	2.5	0.17	9	<2	0.6	0.03	48	0.011	<0.1	0.01	<0.2	0.01	87	<0.01	<0.02	0.03	<2	1.84
223N 108	6547386	476249	VDM	0.03	2.13	0.04	7	<2	1.5	<0.01	35	0.003	<0.1	0.01	0.3	0.01	114	0.01	<0.02	<0.02	<2	2.5
223N 109	6547186	475922	BO	0.02	1.97	0.12	12	3	0.7	0.03	49	0.007	0.1	0.01	0.3	0.01	59.6	<0.01	<0.02	<0.02	<2	1.51
223N 110	6547371	476228	BO	0.1	2.91	0.11	6.7	<2	1.2	0.03	33	0.006	<0.1	<0.01	0.4	<0.01	36.6	<0.01	<0.02	<0.02	<2	1.15
223N 111	6547138	475814	VDM	0.01	4.26	0.15	14.3	<2	0.9	0.06	34	0.001	<0.1	<0.01	<0.2	<0.01	81.4	<0.01	<0.02	<0.02	2	1.1
223N 112	6547348	476148	BO	0.05	3.11	0.12	15.8	<2	0.9	0.03	68	0.011	<0.1	<0.01	0.4	0.01	63.5	<0.01	<0.02	<0.02	<2	1.18
223N 113	6546990	475607	VDM	0.02	3.02	0.03	13.8	<2	1.1	0.02	59	0.002	<0.1	<0.01	0.5	<0.01	57.4	0.01	<0.02	<0.02	<2	0.98
223N 114	6547304	476091	BO	0.03	4.96	0.13	14.2	<2	1.1	0.05	35	0.008	<0.1	0.01	0.3	<0.01	124.3	<0.01	<0.02	<0.02	<2	1.51
223N 115	6546801	475687	BO	0.18	3.64	0.05	9.9	<2	1	0.04	27	0.005	<0.1	<0.01	0.4	<0.01	52.3	<0.01	<0.02	<0.02	<2	1.5

223N 116	6547257	476031	BO	0.07	2.78	0.13	13.1	<2	0.2	0.02	23	0.009	<0.1	<0.01	0.4	<0.01	54	<0.01	<0.02	<0.02	<2	1.53
223N 117	6546864	475786	VDM	0.01	2.98	0.07	13.2	<2	0.8	0.04	47	0.002	<0.1	0.01	0.2	<0.01	126.4	<0.01	<0.02	<0.02	<2	1.62
223N 118	6547205	475954	BO	0.04	4.67	0.02	14.8	2	1.2	0.03	22	0.005	<0.1	<0.01	0.4	<0.01	43.8	<0.01	<0.02	<0.02	<2	0.82
223N 119	6546984	476012	BO	0.19	3.15	0.07	8	<2	1.1	<0.01	23	0.007	<0.1	0.01	0.2	<0.01	56.8	<0.01	<0.02	<0.02	<2	1.46
223N 120	6547200	475949	VDM	0.04	5.08	0.03	10.8	2	0.8	0.04	25	0.005	<0.1	<0.01	<0.2	<0.01	43.3	<0.01	<0.02	<0.02	2	0.52
223N 121	6547058	476095	VDM	0.03	5.77	0.01	15.6	<2	0.9	0.01	31	0.004	<0.1	<0.01	<0.2	<0.01	77.9	<0.01	<0.02	<0.02	<2	1.31
223N 122	6547163	475870	BO	0.2	3.09	0.1	7.7	<2	0.5	0.03	18	0.008	<0.1	<0.01	0.2	<0.01	44.6	<0.01	<0.02	<0.02	<2	1.3
223N 123	6547105	476147	BO	0.07	3.5	0.09	11	<2	1.3	0.03	36	0.007	<0.1	<0.01	0.5	<0.01	68.2	<0.01	<0.02	<0.02	<2	1.33
223N 124	6547144	475854	BO	0.09	2.54	0.15	8.2	<2	0.6	0.05	48	0.011	<0.1	0.01	<0.2	0.01	81.9	<0.01	<0.02	<0.02	2	1.58
223N 125	6547157	476220	VDM	0.03	2.74	0.03	8.4	<2	1	0.09	39	0.012	<0.1	0.01	0.2	<0.01	57	0.01	<0.02	<0.02	2	1.26
223N 126	6547100	475764	VDM	0.05	3.48	0.03	15.2	<2	0.9	0.06	43	0.002	<0.1	<0.01	0.2	<0.01	153.5	0.02	<0.02	<0.02	2	1.64
223N 127	6547166	476277	VDM	0.05	3.85	0.02	9.4	<2	0.7	0.32	29	0.002	<0.1	0.02	0.2	<0.01	35.6	0.02	<0.02	<0.02	<2	0.67
223N 128	6547065	475705	VDM	0.07	3.09	<0.01	12.9	<2	1.1	0.04	59	0.004	<0.1	<0.01	0.2	<0.01	106	<0.01	<0.02	<0.02	2	1.29
223N 129	6547223	476363	VDM	0.07	3.11	0.01	10.8	<2	2.4	0.03	56	0.003	<0.1	<0.01	0.5	<0.01	31.5	0.01	<0.02	<0.02	<2	1.17
223N 130	6547049	475714	BO	0.07	3.65	0.09	11.2	<2	1.1	0.04	31	0.006	<0.1	<0.01	0.3	<0.01	61.9	<0.01	<0.02	<0.02	<2	1.55
223N 131	6547254	476412	VDM	0.09	2.98	0.06	22	<2	1.6	0.03	52	0.005	<0.1	0.02	0.4	<0.01	96.1	<0.01	<0.02	<0.02	<2	2.23
223N 132	6547043	475638	BO	0.16	4.19	0.1	7.6	<2	1.1	0.04	30	0.01	<0.1	<0.01	0.5	<0.01	55.5	<0.01	<0.02	<0.02	2	0.75
223N 133	6547323	476516	VDM	0.08	4.67	0.11	20.3	<2	1.1	0.05	36	0.002	<0.1	<0.01	0.3	<0.01	112.7	<0.01	<0.02	<0.02	2	1.23
223N 134	6546984	475576	VDM	0.15	5.54	0.15	11.3	<2	1.8	0.07	45	0.002	<0.1	<0.01	0.3	<0.01	34.7	0.02	<0.02	0.04	<2	0.8
223N 135	DUP 024			0.19	2.29	0.28	9	<2	1.4	0.04	90	0.012	<0.1	<0.01	0.3	<0.01	57	<0.01	<0.02	0.05	<2	1.32
223N 136	6546945	475536	VDM	0.19	4.79	0.16	10.5	<2	3.2	0.08	75	0.003	<0.1	<0.01	<0.2	<0.01	26.7	0.02	<0.02	0.05	2	0.6
223N 137	6547153	476226	BO	0.24	3.8	0.23	8.8	2	3.4	0.05	33	0.009	<0.1	<0.01	0.2	<0.01	32.4	<0.01	<0.02	0.05	2	0.88
223N 138	6546914	475475	VDM	0.17	4.57	0.11	12.1	<2	2.2	0.05	82	0.004	<0.1	<0.01	<0.2	<0.01	69	0.01	<0.02	0.02	3	0.8
223N 139	6547196	476346	VDM	0.13	4.45	0.13	17.8	<2	1.5	0.04	130	0.003	<0.1	<0.01	0.3	<0.01	79.3	0.02	<0.02	<0.02	<2	1.33
223N 140	6546786	475664	VDM	0.1	6.61	0.13	10.3	<2	2.2	0.08	40	0.002	<0.1	0.02	<0.2	<0.01	66.6	0.02	<0.02	<0.02	2	1.76
223N 141	6547315	476472	VDM	0.13	4.45	0.13	13.3	<2	1.4	0.05	25	0.003	<0.1	<0.01	0.3	<0.01	66.1	<0.01	<0.02	<0.02	<2	1.11
223N 142	6546824	475746	VDM	<0.01	2.76	0.16	11.2	<2	0.2	0.02	44	<0.001	<0.1	<0.01	<0.2	<0.01	66.1	<0.01	<0.02	<0.02	2	1.16
223N 143	6547351	476572	VDM	<0.01	4.33	0.14	15.1	<2	0.8	0.05	50	<0.001	<0.1	<0.01	<0.2	<0.01	51.6	<0.01	<0.02	<0.02	3	0.74
223N 144	6546969	475985	BO	<0.01	2.57	0.14	8.5	<2	<0.1	0.03	40	0.011	<0.1	0.01	<0.2	<0.01	87.1	<0.01	<0.02	<0.02	3	1.9
223N 145	DUP 131			<0.01	2.95	0.17	19.5	<2	0.7	0.05	53	0.004	<0.1	0.02	<0.2	<0.01	96.5	<0.01	<0.02	<0.02	3	2.19

223N 146	6547019	476029	VDM	<0.01	3.42	0.05	12.1	<2	0.2	0.03	20	0.002	<0.1	<0.01	<0.2	<0.01	90.6	<0.01	<0.02	<0.02	4	0.92
223N 147	DUP 102			<0.01	3.4	0.09	19.7	<2	0.6	0.04	58	0.003	<0.1	0.02	<0.2	<0.01	83.8	0.01	<0.02	<0.02	4	1.55
223N 148	6547058	476061	BO	0.03	2.08	0.27	5.6	<2	0.3	0.03	9	0.012	<0.1	<0.01	<0.2	<0.01	47.2	<0.01	<0.02	<0.02	4	1.02
223N 149	DUP 003			0.17	2.68	0.16	10.2	<2	0.8	0.03	38	0.006	<0.1	<0.01	0.3	<0.01	33.9	<0.01	<0.02	<0.02	4	0.9
223N 150	DUP092			<0.01	2.02	0.49	13	<2	0.5	0.04	85	0.002	<0.1	0.02	0.4	<0.01	116.9	<0.01	<0.02	<0.02	4	1.44

P	La	Cr	Mg	Ba	Ti	B	Al	Na	K	W	Sc	Tl	S	Hg	Se	Te	Ga	Cs	Ge	Hf	Nb	Rb	Sn
%	PPM	PPM	%	PPM	PPM	PPM	%	%	%	PPM	PPM	PPM	%	PPB	PPM	PPM	PPM	PPM	PPM	PPM	PPM	PPM	PPM
0.001	0.01	0.1	0.001	0.1	1	1	0.01	0.001	0.01	0.1	0.1	0.02	0.01	1	0.1	0.02	0.1	0.005	0.01	0.001	0.01	0.1	0.02
0.037	0.05	1.2	0.259	7	2	46	<0.01	0.218	0.33	<0.1	<0.1	<0.02	0.1	13	0.4	<0.02	<0.1	0.007	<0.01	0.002	<0.01	1	<0.02
0.049	0.1	1.1	0.131	2.9	2	39	<0.01	0.554	0.6	<0.1	<0.1	<0.02	0.06	1	<0.1	<0.02	<0.1	0.007	<0.01	0.001	<0.01	2	<0.02
0.034	0.05	0.9	0.284	6.3	2	42	<0.01	0.11	0.32	<0.1	0.1	<0.02	0.1	9	0.2	<0.02	<0.1	0.005	<0.01	0.002	<0.01	1	<0.02
0.042	0.06	1.1	0.236	3.7	2	31	<0.01	0.33	0.55	<0.1	<0.1	<0.02	0.12	17	0.3	<0.02	<0.1	0.008	<0.01	0.002	<0.01	1.4	<0.02
0.044	0.22	1.1	0.232	7.7	2	60	<0.01	0.493	0.44	<0.1	0.1	<0.02	0.07	11	0.1	<0.02	<0.1	0.005	<0.01	0.002	<0.01	1	<0.02
0.033	1.03	1.1	0.261	5.3	2	139	0.01	0.29	0.38	<0.1	0.1	<0.02	0.12	26	<0.1	<0.02	<0.1	0.006	0.01	0.001	<0.01	0.8	<0.02
0.035	0.11	1.1	0.303	5.5	3	51	0.02	0.339	0.34	<0.1	0.2	<0.02	0.16	23	0.2	<0.02	<0.1	0.012	<0.01	0.006	<0.01	0.8	<0.02
0.047	0.37	1.1	0.166	5.4	2	68	<0.01	0.493	0.51	<0.1	0.2	<0.02	0.12	8	0.1	<0.02	<0.1	<0.005	<0.01	<0.001	<0.01	1.3	<0.02
0.051	0.37	1	0.218	5.9	2	38	<0.01	0.534	0.55	<0.1	0.1	<0.02	0.13	10	0.1	<0.02	<0.1	<0.005	<0.01	<0.001	<0.01	1.5	<0.02
0.036	0.2	1.1	0.159	9.3	2	81	<0.01	0.395	0.48	<0.1	0.1	<0.02	0.13	14	0.3	<0.02	<0.1	0.005	<0.01	0.004	<0.01	0.9	<0.02
0.031	0.08	1	0.294	4.9	2	50	<0.01	0.115	0.35	<0.1	0.1	<0.02	0.13	12	0.2	<0.02	<0.1	0.007	<0.01	0.002	<0.01	0.7	<0.02
0.043	0.07	0.9	0.134	2.1	2	37	<0.01	0.387	0.71	<0.1	0.1	<0.02	0.09	6	<0.1	<0.02	<0.1	0.006	0.02	0.002	<0.01	1.9	<0.02
0.047	0.1	1.1	0.167	3.1	2	37	<0.01	0.669	0.62	<0.1	0.1	<0.02	0.09	4	<0.1	<0.02	<0.1	0.006	<0.01	<0.001	<0.01	1.7	<0.02
0.05	0.59	1.1	0.178	7.7	2	62	<0.01	0.57	0.66	<0.1	<0.1	<0.02	0.16	16	0.2	<0.02	<0.1	0.007	<0.01	<0.001	<0.01	1.5	<0.02
0.031	0.07	1.3	0.268	8.4	2	58	0.01	0.127	0.33	<0.1	0.2	<0.02	0.13	26	0.2	<0.02	<0.1	0.007	<0.01	0.003	<0.01	0.8	<0.02
0.053	0.19	1.1	0.241	5.9	2	48	<0.01	0.504	0.52	<0.1	<0.1	<0.02	0.14	7	<0.1	<0.02	<0.1	<0.005	<0.01	0.001	<0.01	1.6	<0.02
0.043	0.17	1.1	0.156	7.3	2	50	<0.01	0.57	0.46	<0.1	0.1	<0.02	0.11	8	0.2	<0.02	<0.1	<0.005	<0.01	<0.001	<0.01	1.4	<0.02
0.043	0.05	1.1	0.269	9.5	2	46	<0.01	0.261	0.44	<0.1	0.1	<0.02	0.16	14	0.4	<0.02	<0.1	0.008	<0.01	0.001	<0.01	1	<0.02
0.049	0.03	1	0.12	2.5	2	26	<0.01	0.395	0.64	<0.1	0.2	<0.02	0.12	3	<0.1	<0.02	<0.1	<0.005	0.01	<0.001	<0.01	1	<0.02
0.05	0.02	1.1	0.127	4.8	2	30	<0.01	0.379	0.69	<0.1	0.2	<0.02	0.11	3	<0.1	<0.02	<0.1	<0.005	<0.01	<0.001	<0.01	1.7	<0.02
0.043	0.23	1.1	0.168	5.2	2	38	<0.01	0.403	0.43	<0.1	0.2	<0.02	0.1	9	0.1	<0.02	<0.1	0.006	<0.01	0.001	<0.01	1.4	<0.02
0.044	0.06	1.2	0.169	5.3	2	57	<0.01	0.259	0.46	<0.1	0.2	<0.02	0.13	14	0.1	<0.02	<0.1	<0.005	0.02	<0.001	<0.01	1.1	<0.02
0.044	0.06	1.1	0.169	3	2	26	<0.01	0.576	0.66	<0.1	0.2	<0.02	0.09	5	<0.1	<0.02	<0.1	<0.005	<0.01	0.002	<0.01	2.2	<0.02
0.035	0.08	0.9	0.182	6.7	2	60	0.01	0.14	0.51	<0.1	0.2	<0.02	0.13	21	0.3	<0.02	<0.1	0.009	<0.01	0.004	<0.01	1.1	<0.02
0.041	0.12	1.1	0.137	9.3	2	64	<0.01	0.331	0.44	<0.1	0.1	<0.02	0.11	14	<0.1	<0.02	<0.1	<0.005	<0.01	0.002	<0.01	1.1	<0.02
0.025	0.07	1.1	0.105	8	1	169	0.02	0.3	0.32	<0.1	0.3	<0.02	0.19	33	0.1	<0.02	<0.1	<0.005	<0.01	0.001	<0.01	0.4	<0.02

0.049	0.04	1	0.311	7.9	2	64	<0.01	0.308	0.56	<0.1	0.1	<0.02	0.17	10	0.2	<0.02	<0.1	0.013	0.02	0.002	<0.01	1.8	<0.02
0.04	0.09	1.2	0.289	8.4	3	69	0.01	0.196	0.39	<0.1	0.1	<0.02	0.12	18	0.3	<0.02	<0.1	0.011	0.01	0.003	<0.01	1.1	<0.02
0.044	0.06	1.2	0.255	7.6	3	29	0.01	0.277	0.36	<0.1	0.1	<0.02	0.15	20	0.3	<0.02	<0.1	0.01	0.01	0.004	<0.01	1	<0.02
0.036	0.08	1.1	0.293	4.6	3	64	0.01	0.178	0.41	<0.1	0.2	<0.02	0.16	20	0.2	<0.02	<0.1	0.009	<0.01	0.001	<0.01	1.4	<0.02
0.051	0.04	1.1	0.155	4	2	33	<0.01	0.404	0.53	<0.1	0.1	<0.02	0.13	4	<0.1	<0.02	<0.1	<0.005	0.01	<0.001	<0.01	1.4	<0.02
0.038	0.04	1	0.253	8.7	2	58	<0.01	0.175	0.26	<0.1	0.1	<0.02	0.15	11	0.3	<0.02	<0.1	0.008	0.01	0.002	<0.01	0.7	<0.02
0.035	0.06	1.1	0.277	6.3	2	48	<0.01	0.167	0.42	<0.1	0.1	<0.02	0.16	12	0.3	<0.02	<0.1	0.007	0.02	0.001	<0.01	1.2	<0.02
0.038	0.08	1.1	0.328	3.3	2	90	<0.01	0.179	0.39	<0.1	0.1	<0.02	0.19	17	0.2	<0.02	<0.1	0.007	0.02	0.005	<0.01	0.8	<0.02
0.042	0.12	1	0.186	5	2	37	<0.01	0.529	0.47	<0.1	0.1	<0.02	0.12	3	0.2	<0.02	<0.1	<0.005	<0.01	0.002	<0.01	1.5	<0.02
0.048	0.07	1.2	0.263	7	3	51	0.01	0.305	0.42	<0.1	0.1	<0.02	0.18	19	0.3	<0.02	<0.1	0.011	<0.01	0.003	<0.01	1.1	<0.02
0.05	0.05	0.9	0.14	2.9	2	45	<0.01	0.55	0.69	<0.1	0.1	<0.02	0.15	8	0.2	<0.02	<0.1	<0.005	<0.01	<0.001	<0.01	1.1	<0.02
0.035	0.05	1	0.21	4.7	2	44	<0.01	0.249	0.45	<0.1	0.1	<0.02	0.14	10	0.5	<0.02	<0.1	0.007	<0.01	<0.001	<0.01	1.4	<0.02
0.053	0.02	1.1	0.192	2.1	2	22	<0.01	0.447	0.81	<0.1	0.2	<0.02	0.16	5	0.3	<0.02	<0.1	0.006	<0.01	<0.001	<0.01	2.7	<0.02
0.034	0.27	1.2	0.207	4.2	2	90	<0.01	0.358	0.39	<0.1	0.3	<0.02	0.19	21	0.3	<0.02	<0.1	<0.005	<0.01	0.001	<0.01	0.5	0.02
0.044	0.05	1.2	0.144	5.8	2	63	<0.01	0.355	0.64	<0.1	0.2	<0.02	0.16	10	0.2	<0.02	<0.1	<0.005	0.02	<0.001	<0.01	1.1	<0.02
0.041	0.06	1.1	0.251	6.2	2	52	<0.01	0.188	0.65	<0.1	0.1	<0.02	0.2	14	0.3	<0.02	<0.1	0.009	<0.01	0.002	<0.01	1.7	<0.02
0.032	0.09	1.1	0.365	5.5	2	60	0.01	0.223	0.56	<0.1	<0.1	<0.02	0.17	18	0.5	<0.02	<0.1	0.011	<0.01	0.002	<0.01	1.7	<0.02
0.044	0.52	1.1	0.194	5.3	2	36	<0.01	0.433	0.49	<0.1	<0.1	<0.02	0.13	12	0.2	<0.02	<0.1	<0.005	<0.01	<0.001	<0.01	1.2	<0.02
0.042	0.08	1.1	0.238	6	3	49	0.01	0.443	0.36	<0.1	0.2	<0.02	0.2	26	0.6	<0.02	<0.1	0.011	0.01	0.002	<0.01	1.4	<0.02
0.051	0.64	1.2	0.214	3.2	2	46	<0.01	0.41	0.61	<0.1	<0.1	<0.02	0.16	7	0.3	<0.02	<0.1	<0.005	<0.01	<0.001	<0.01	1.4	<0.02
0.047	0.04	1.2	0.191	4.5	2	69	<0.01	0.333	0.67	<0.1	0.1	<0.02	0.15	10	0.3	<0.02	<0.1	<0.005	<0.01	<0.001	<0.01	1.1	<0.02
0.036	0.31	1.2	0.238	9.3	2	119	<0.01	0.204	0.38	<0.1	0.2	<0.02	0.2	22	0.2	<0.02	<0.1	0.005	<0.01	<0.001	<0.01	0.7	<0.02
0.039	0.07	1.1	0.314	6.6	2	68	<0.01	0.144	0.42	<0.1	0.2	<0.02	0.2	19	0.5	<0.02	<0.1	0.009	<0.01	0.001	<0.01	1.2	<0.02
0.04	0.09	1.1	0.232	4.8	3	63	0.01	0.355	0.65	<0.1	0.2	<0.02	0.19	17	0.5	<0.02	<0.1	0.013	<0.01	0.003	<0.01	2.2	<0.02
0.033	0.06	0.9	0.233	5.5	2	42	<0.01	0.147	0.5	<0.1	<0.1	<0.02	0.19	20	0.3	<0.02	<0.1	0.009	<0.01	<0.001	<0.01	1.4	0.02
0.034	0.09	1.3	0.308	9.5	2	62	<0.01	0.13	0.28	<0.1	0.2	<0.02	0.2	25	0.4	<0.02	<0.1	0.008	<0.01	<0.001	<0.01	0.8	<0.02
0.03	0.07	1.1	0.245	6.4	2	71	<0.01	0.117	0.34	<0.1	0.2	<0.02	0.17	22	0.5	<0.02	<0.1	0.007	<0.01	0.002	<0.01	0.9	<0.02
0.039	0.07	0.9	0.35	10.9	2	53	<0.01	0.088	0.4	<0.1	0.1	<0.02	0.19	15	0.5	<0.02	<0.1	0.01	<0.01	0.002	<0.01	1.3	<0.02
0.036	0.07	1.3	0.328	9.4	2	56	0.01	0.131	0.35	<0.1	0.1	<0.02	0.19	19	0.4	<0.02	<0.1	0.01	<0.01	0.001	<0.01	0.8	<0.02
0.057	0.11	1.1	0.212	6.7	2	51	<0.01	0.591	0.74	<0.1	0.2	<0.02	0.18	10	0.3	<0.02	<0.1	0.006	<0.01	0.001	<0.01	1.5	<0.02

0.067	0.03	1.1	0.188	4.4	3	56	<0.01	0.6	0.63	<0.1	0.2	<0.02	0.2	4	0.3	<0.02	<0.1	<0.005	<0.01	<0.001	<0.01	1.4	<0.02
0.051	0.25	1.3	0.153	5.3	2	39	<0.01	0.613	0.66	<0.1	0.2	<0.02	0.22	10	0.2	<0.02	<0.1	0.008	<0.01	<0.001	<0.01	2	<0.02
0.039	0.09	1.4	0.31	10.2	3	104	0.01	0.097	0.37	<0.1	0.2	<0.02	0.29	27	0.6	<0.02	<0.1	0.012	<0.01	0.006	<0.01	0.9	0.03
0.033	0.09	1	0.393	5.7	2	35	<0.01	0.202	0.47	<0.1	0.1	<0.02	0.25	19	0.5	<0.02	<0.1	0.01	<0.01	0.003	<0.01	1.6	<0.02
0.051	0.03	1.4	0.189	4.1	2	54	<0.01	0.558	0.6	<0.1	0.2	<0.02	0.24	8	0.2	<0.02	<0.1	<0.005	<0.01	<0.001	<0.01	0.7	<0.02
0.024	0.08	1.2	0.297	7	2	47	<0.01	0.118	0.32	<0.1	0.2	<0.02	0.17	15	0.3	<0.02	<0.1	0.008	<0.01	0.002	<0.01	0.8	<0.02
0.037	0.07	1.4	0.284	5	3	63	<0.01	0.19	0.38	<0.1	0.1	<0.02	0.21	19	0.3	<0.02	<0.1	0.008	0.02	0.002	<0.01	0.8	<0.02
0.032	0.08	1.3	0.295	7.1	2	34	<0.01	0.185	0.35	<0.1	0.1	<0.02	0.21	20	0.1	<0.02	<0.1	0.009	<0.01	0.003	<0.01	1.3	<0.02
0.034	0.04	1.3	0.293	27.4	2	55	<0.01	0.165	0.28	<0.1	<0.1	<0.02	0.18	12	1.9	<0.02	<0.1	0.006	<0.01	<0.001	<0.01	0.7	<0.02
0.036	0.07	1.3	0.303	13.2	2	60	0.01	0.277	0.31	<0.1	0.1	<0.02	0.23	17	0.2	<0.02	<0.1	0.011	<0.01	0.002	<0.01	0.7	<0.02
0.073	0.02	1.3	0.203	8.6	3	31	<0.01	0.426	0.73	<0.1	0.1	<0.02	0.23	8	0.3	<0.02	<0.1	<0.005	<0.01	<0.001	<0.01	1.9	<0.02
0.031	0.05	1	0.311	13.6	2	60	<0.01	0.163	0.26	<0.1	0.1	<0.02	0.26	15	0.4	<0.02	<0.1	0.008	<0.01	0.003	<0.01	0.6	<0.02
0.067	0.06	1.2	0.187	5.7	2	37	<0.01	0.569	0.71	<0.1	0.1	<0.02	0.18	9	0.3	<0.02	<0.1	<0.005	<0.01	<0.001	<0.01	2	<0.02
0.047	0.28	1.4	0.26	14.2	2	47	<0.01	0.559	0.6	<0.1	0.2	<0.02	0.21	8	0.4	<0.02	<0.1	<0.005	<0.01	<0.001	<0.01	1.3	<0.02
0.045	0.24	1.5	0.212	7.2	2	58	<0.01	0.187	0.5	<0.1	0.2	<0.02	0.22	19	0.3	<0.02	<0.1	0.005	0.01	0.003	<0.01	0.9	<0.02
0.05	0.13	4.3	0.288	5.5	2	30	<0.01	0.421	0.6	<0.1	0.2	<0.02	0.14	11	0.2	<0.02	<0.1	<0.005	<0.01	<0.001	<0.01	1.3	<0.02
0.055	0.11	4.1	0.152	4.3	2	64	<0.01	0.862	0.78	<0.1	<0.1	<0.02	0.14	7	0.4	<0.02	<0.1	0.005	<0.01	0.001	<0.01	1.4	<0.02
0.044	0.07	4.6	0.233	4	2	39	<0.01	0.376	0.76	<0.1	<0.1	<0.02	0.19	12	0.4	<0.02	<0.1	0.009	<0.01	<0.001	<0.01	3.1	0.02
0.049	0.14	6.4	0.214	10.5	2	65	<0.01	0.356	0.45	<0.1	<0.1	<0.02	0.19	18	0.6	<0.02	<0.1	<0.005	<0.01	0.002	<0.01	0.5	<0.02
0.049	0.05	6.9	0.271	6.5	2	37	<0.01	0.232	0.59	<0.1	0.1	<0.02	0.2	12	0.3	<0.02	<0.1	0.006	<0.01	0.002	<0.01	2	<0.02
0.038	0.08	10.1	0.282	7.1	3	44	<0.01	0.102	0.77	<0.1	<0.1	<0.02	0.16	16	0.5	<0.02	<0.1	0.008	0.01	<0.001	<0.01	2	<0.02
0.043	0.19	12.4	0.276	13.7	2	83	<0.01	0.358	0.46	<0.1	0.1	<0.02	0.17	20	0.4	<0.02	<0.1	0.005	<0.01	<0.001	<0.01	0.6	<0.02
0.042	0.28	13.3	0.15	5.2	2	68	<0.01	0.498	0.49	<0.1	0.2	<0.02	0.16	15	0.3	<0.02	<0.1	0.006	<0.01	0.002	<0.01	0.8	<0.02
0.045	0.32	12.5	0.34	5.4	2	56	<0.01	0.334	0.53	<0.1	0.1	<0.02	0.13	12	0.3	<0.02	<0.1	<0.005	<0.01	0.001	<0.01	0.9	<0.02
0.056	0.11	8.4	0.224	3.1	2	30	<0.01	0.583	0.85	<0.1	<0.1	<0.02	0.16	6	0.3	<0.02	<0.1	0.005	<0.01	<0.001	<0.01	2	<0.02
0.039	0.31	<0.1	0.308	6.8	4	68	0.02	0.203	0.5	<0.1	0.1	<0.02	0.12	18	0.3	<0.02	<0.1	0.009	0.01	0.005	<0.01	1	0.31
0.047	0.15	2.6	0.173	5.9	2	40	<0.01	0.603	0.45	<0.1	<0.1	<0.02	0.1	8	0.3	<0.02	<0.1	<0.005	<0.01	<0.001	<0.01	1	<0.02
0.05	0.28	2.6	0.317	3.6	2	30	<0.01	0.547	0.57	<0.1	0.1	<0.02	0.12	8	0.3	<0.02	<0.1	<0.005	<0.01	<0.001	<0.01	1.2	<0.02
0.056	0.48	1.6	0.17	5.4	2	67	<0.01	0.549	0.54	<0.1	0.2	<0.02	0.17	9	0.2	<0.02	<0.1	0.007	<0.01	<0.001	<0.01	1.6	<0.02
0.043	0.04	0.4	0.237	6.1	2	31	<0.01	0.255	0.8	<0.1	0.1	<0.02	0.21	6	0.3	<0.02	<0.1	0.007	<0.01	0.001	<0.01	2.1	<0.02

0.04	0.21	0.5	0.404	11.5	3	62	0.01	0.206	0.38	<0.1	0.1	<0.02	0.22	32	0.6	<0.02	<0.1	0.014	<0.01	0.004	<0.01	0.9	<0.02
0.046	0.07	0.4	0.347	8.1	3	46	<0.01	0.161	0.39	<0.1	<0.1	<0.02	0.23	18	0.3	<0.02	<0.1	0.009	<0.01	0.005	<0.01	0.9	<0.02
0.061	0.1	<0.1	0.116	15.4	2	58	<0.01	0.65	0.44	<0.1	0.1	<0.02	0.12	8	0.3	<0.02	<0.1	<0.005	<0.01	0.001	<0.01	0.7	<0.02
0.041	0.03	<0.1	0.256	6.5	2	39	<0.01	0.148	0.5	<0.1	<0.1	<0.02	0.17	9	0.4	<0.02	<0.1	<0.005	<0.01	0.002	<0.01	1	<0.02
0.04	0.11	0.3	0.361	10.3	3	53	0.01	0.204	0.4	<0.1	<0.1	<0.02	0.21	22	0.3	<0.02	<0.1	0.011	<0.01	0.003	<0.01	1	0.02
0.053	0.4	0.1	0.295	10.3	2	67	<0.01	0.345	0.7	<0.1	0.1	<0.02	0.16	14	0.3	<0.02	<0.1	0.006	<0.01	<0.001	<0.01	1.3	<0.02
0.043	0.39	0.3	0.245	6.2	2	50	<0.01	0.385	0.35	<0.1	0.1	<0.02	0.16	12	0.4	<0.02	<0.1	<0.005	<0.01	0.003	<0.01	0.8	<0.02
0.044	0.04	<0.1	0.309	6.7	2	64	<0.01	0.306	0.52	<0.1	<0.1	<0.02	0.17	10	0.4	<0.02	<0.1	0.006	<0.01	0.002	<0.01	1.2	<0.02
0.041	0.06	0.2	0.299	5.7	2	49	<0.01	0.284	0.35	<0.1	<0.1	<0.02	0.18	15	0.4	<0.02	<0.1	0.007	<0.01	0.001	<0.01	0.9	<0.02
0.06	0.04	0.3	0.232	5.9	2	30	<0.01	0.598	0.78	<0.1	0.1	<0.02	0.17	5	0.2	<0.02	<0.1	<0.005	<0.01	<0.001	<0.01	1.7	<0.02
0.08	0.12	0.4	0.135	8.8	3	48	<0.01	0.499	0.56	<0.1	0.2	<0.02	0.18	8	0.2	<0.02	<0.1	<0.005	<0.01	<0.001	<0.01	1.3	<0.02
0.055	0.18	0.3	0.2	5.4	2	50	<0.01	0.568	0.5	<0.1	<0.1	<0.02	0.2	13	0.3	<0.02	<0.1	<0.005	<0.01	0.001	<0.01	0.9	<0.02
0.062	0.29	0.4	0.243	9.4	2	87	<0.01	0.62	0.6	<0.1	0.1	<0.02	0.19	15	0.3	<0.02	<0.1	0.006	<0.01	0.002	<0.01	1.4	<0.02
0.046	0.09	0.4	0.153	3.7	2	52	<0.01	0.521	0.59	<0.1	0.2	<0.02	0.18	10	0.4	<0.02	<0.1	<0.005	<0.01	0.002	<0.01	1	<0.02
0.046	0.05	0.2	0.329	9.4	2	60	<0.01	0.178	0.53	<0.1	0.1	<0.02	0.22	19	0.4	<0.02	<0.1	0.008	<0.01	0.003	<0.01	1.4	<0.02
0.044	0.09	0.6	0.169	12.7	2	69	<0.01	0.453	0.52	<0.1	0.2	<0.02	0.16	14	0.3	<0.02	<0.1	<0.005	<0.01	0.002	<0.01	0.7	<0.02
0.069	0.05	0.4	0.233	6.9	2	52	<0.01	0.52	0.57	<0.1	<0.1	<0.02	0.19	6	0.2	<0.02	<0.1	<0.005	<0.01	<0.001	<0.01	1.2	<0.02
0.056	0.36	0.8	0.234	7.4	2	49	<0.01	0.63	0.79	<0.1	0.2	<0.02	0.16	7	0.3	<0.02	<0.1	<0.005	0.01	0.001	<0.01	2.1	<0.02
0.042	0.08	0.4	0.357	9.7	2	62	<0.01	0.267	0.54	<0.1	0.1	<0.02	0.2	12	0.3	<0.02	<0.1	0.008	<0.01	0.003	<0.01	1.1	<0.02
0.061	0.06	0.7	0.28	5.5	2	47	<0.01	0.603	0.79	<0.1	0.1	<0.02	0.2	5	0.2	<0.02	<0.1	<0.005	<0.01	<0.001	<0.01	1.8	<0.02
0.036	0.09	1.2	0.38	15.9	3	78	0.01	0.125	0.52	<0.1	0.2	<0.02	0.21	33	0.1	<0.02	<0.1	0.012	<0.01	0.006	<0.01	1	0.04
0.027	0.15	1.2	0.364	12.4	2	80	<0.01	0.144	0.28	<0.1	0.1	<0.02	0.23	33	0.2	<0.02	<0.1	<0.005	<0.01	<0.001	<0.01	0.5	0.03
0.032	0.06	1.4	0.335	11.3	2	56	<0.01	0.122	0.27	<0.1	0.3	<0.02	0.21	19	0.3	0.03	<0.1	0.01	<0.01	0.004	<0.01	0.9	0.04
0.033	0.05	1.2	0.369	8.4	2	48	<0.01	0.162	0.35	<0.1	0.3	<0.02	0.2	13	0.3	<0.02	<0.1	<0.005	0.02	0.003	<0.01	1.1	0.04
0.05	0.12	1.3	0.18	8.4	2	30	<0.01	0.685	0.89	<0.1	0.2	<0.02	0.2	9	0.1	<0.02	<0.1	0.006	0.02	<0.001	<0.01	2.4	<0.02
0.046	0.08	1.4	0.293	10.4	3	53	0.01	0.249	0.4	<0.1	0.1	<0.02	0.22	23	0.2	<0.02	<0.1	0.011	0.02	0.004	<0.01	1.4	<0.02
0.048	0.09	1.3	0.221	8.9	2	47	<0.01	0.911	0.5	<0.1	0.2	<0.02	0.22	9	0.3	<0.02	<0.1	0.006	0.01	<0.001	<0.01	1.3	<0.02
0.036	0.08	1.2	0.357	10.7	3	40	<0.01	0.263	0.28	<0.1	0.2	<0.02	0.24	16	0.2	<0.02	<0.1	0.008	<0.01	<0.001	<0.01	1.1	0.02
0.044	0.06	1.2	0.304	13.3	3	53	<0.01	0.282	0.44	<0.1	0.2	<0.02	0.2	11	0.3	<0.02	<0.1	0.007	<0.01	0.002	<0.01	1.8	0.03
0.033	0.07	1.2	0.426	10	2	72	0.01	0.203	0.26	<0.1	0.2	<0.02	0.19	22	0.5	<0.02	<0.1	0.008	<0.01	0.001	<0.01	0.6	<0.02

0.053	0.13	1.4	0.348	7.7	3	69	<0.01	0.304	0.5	<0.1	0.2	<0.02	0.2	15	0.1	0.03	<0.1	<0.005	0.01	0.001	<0.01	1.3	<0.02
0.032	0.02	1.2	0.235	8.9	2	37	<0.01	0.134	0.54	<0.1	0.3	<0.02	0.18	11	0.4	0.02	<0.1	0.005	<0.01	0.002	<0.01	1.2	<0.02
0.046	0.06	1.2	0.267	6.9	3	45	<0.01	0.126	0.61	<0.1	0.2	<0.02	0.25	13	0.3	<0.02	<0.1	0.006	0.02	0.001	<0.01	1.2	<0.02
0.059	0.05	1.3	0.265	6.2	3	56	<0.01	0.567	0.49	<0.1	0.3	<0.02	0.23	7	0.2	<0.02	<0.1	<0.005	0.01	0.001	<0.01	1.1	<0.02
0.047	0.02	1.5	0.236	2.4	2	33	<0.01	0.427	0.77	<0.1	0.2	<0.02	0.25	13	0.2	<0.02	<0.1	<0.005	0.01	0.002	<0.01	1.7	<0.02
0.039	0.06	1.2	0.289	7.9	3	40	<0.01	0.212	0.37	<0.1	0.3	<0.02	0.22	17	0.3	<0.02	<0.1	0.007	<0.01	<0.001	<0.01	0.9	<0.02
0.042	0.06	1.3	0.291	10.5	3	45	<0.01	0.312	0.44	<0.1	0.2	<0.02	0.24	15	0.3	<0.02	<0.1	0.008	0.01	<0.001	<0.01	1	0.02
0.031	0.12	1.5	0.424	17.9	3	65	0.01	0.084	0.21	<0.1	0.2	<0.02	0.25	26	0.7	0.02	<0.1	0.01	0.01	0.002	<0.01	0.5	<0.02
0.042	0.18	1.4	0.239	5.2	2	70	<0.01	0.412	0.54	<0.1	0.2	<0.02	0.24	23	0.3	<0.02	<0.1	<0.005	<0.01	<0.001	<0.01	0.8	<0.02
0.049	0.31	1.4	0.246	5.5	3	50	<0.01	0.47	0.76	<0.1	0.2	<0.02	0.21	15	0.2	0.02	<0.1	<0.005	0.01	0.003	<0.01	1.6	<0.02
0.066	0.04	1.4	0.229	7	3	39	<0.01	0.514	0.95	<0.1	0.3	<0.02	0.19	11	0.3	<0.02	<0.1	<0.005	<0.01	<0.001	<0.01	1.6	<0.02
0.063	0.05	1.5	0.236	15.4	3	60	<0.01	0.495	0.62	<0.1	0.2	<0.02	0.23	8	0.3	<0.02	<0.1	<0.005	<0.01	<0.001	<0.01	1.3	<0.02
0.045	0.03	1.8	0.17	2.1	2	63	<0.01	0.662	0.59	<0.1	0.3	<0.02	0.23	24	0.3	<0.02	<0.1	<0.005	<0.01	<0.001	<0.01	1.5	<0.02
0.039	0.03	1.6	0.196	8.9	2	47	<0.01	0.148	0.8	<0.1	0.1	<0.02	0.21	8	0.2	<0.02	<0.1	0.008	<0.01	0.001	<0.01	2.5	<0.02
0.039	0.18	1.8	0.292	10.8	2	72	<0.01	0.347	0.38	<0.1	0.1	<0.02	0.22	20	0.4	<0.02	<0.1	<0.005	<0.01	<0.001	<0.01	0.7	<0.02
0.051	0.05	2.3	0.23	5.9	3	33	<0.01	0.408	0.69	<0.1	0.3	<0.02	0.22	15	0.2	<0.02	<0.1	0.011	<0.01	0.002	<0.01	2.7	<0.02
0.058	0.08	1.9	0.238	5.2	3	36	<0.01	0.623	0.73	<0.1	0.3	<0.02	0.2	9	0.3	<0.02	<0.1	<0.005	<0.01	<0.001	<0.01	1.6	<0.02
0.062	0.07	2.4	0.165	3.3	3	39	<0.01	0.663	0.76	<0.1	0.2	<0.02	0.2	8	0.2	<0.02	<0.1	<0.005	<0.01	<0.001	<0.01	2.7	<0.02
0.036	0.1	2.4	0.221	7.7	3	55	0.01	0.149	0.58	<0.1	0.3	<0.02	0.21	26	0.4	<0.02	<0.1	0.011	0.02	0.003	<0.01	1.5	0.02
0.057	0.09	2.6	0.17	2.8	3	30	<0.01	0.623	0.81	<0.1	0.3	<0.02	0.17	7	0.2	<0.02	<0.1	0.009	<0.01	<0.001	<0.01	3.3	<0.02
0.036	0.07	3.4	0.268	10.5	3	32	<0.01	0.215	0.6	<0.1	0.3	<0.02	0.22	15	0.5	<0.02	<0.1	0.005	<0.01	0.002	<0.01	1.2	<0.02
0.059	0.11	2.2	0.174	10.2	3	47	<0.01	0.671	0.47	<0.1	0.3	<0.02	0.21	11	0.6	<0.02	<0.1	<0.005	<0.01	<0.001	<0.01	1	<0.02
0.071	0.09	2.1	0.234	9.9	3	25	<0.01	0.599	0.78	<0.1	0.2	<0.02	0.21	7	0.4	<0.02	<0.1	<0.005	<0.01	<0.001	<0.01	2	<0.02
0.049	0.8	2.1	0.152	6.4	2	48	<0.01	0.506	0.58	<0.1	0.3	<0.02	0.23	15	0.4	0.03	<0.1	<0.005	0.02	<0.001	<0.01	1.9	<0.02
0.053	0.07	2.1	0.277	5	2	38	<0.01	0.736	0.8	<0.1	0.2	<0.02	0.21	10	0.3	<0.02	<0.1	<0.005	<0.01	<0.001	<0.01	3	<0.02
0.085	0.02	1.2	0.152	3.8	3	48	<0.01	0.598	0.66	<0.1	0.3	<0.02	0.24	8	<0.1	<0.02	<0.1	<0.005	<0.01	<0.001	<0.01	1.9	0.02
0.051	<0.01	1.2	0.185	2.6	2	36	<0.01	0.705	0.97	<0.1	0.2	<0.02	0.2	9	0.2	<0.02	<0.1	<0.005	<0.01	<0.001	<0.01	2.6	<0.02
0.029	<0.01	1.2	0.263	12	2	65	<0.01	0.092	0.29	<0.1	0.2	<0.02	0.24	20	0.5	<0.02	<0.1	<0.005	<0.01	<0.001	<0.01	0.9	<0.02
0.039	0.13	1.3	0.28	10.2	3	73	<0.01	0.348	0.38	<0.1	0.2	<0.02	0.25	20	0.3	0.03	<0.1	0.005	0.01	0.001	<0.01	0.7	<0.02
0.057	<0.01	1.4	0.195	5.6	2	24	<0.01	0.444	0.86	<0.1	0.2	<0.02	0.26	2	<0.1	<0.02	<0.1	<0.005	<0.01	0.002	<0.01	1.9	<0.02

0.041	0.04	1.4	0.189	12.9	2	59	<0.01	0.423	0.52	<0.1	0.2	<0.02	0.23	17	0.2	<0.02	<0.1	<0.005	0.01	0.002	<0.01	0.9	<0.02
0.032	0.05	1.4	0.283	3.2	3	21	0.01	0.24	0.51	<0.1	0.2	<0.02	0.24	23	0.1	<0.02	<0.1	0.009	<0.01	0.002	<0.01	1.2	<0.02
0.035	<0.01	1.4	0.347	6.5	2	46	<0.01	0.124	0.37	<0.1	0.1	<0.02	0.26	11	0.3	<0.02	<0.1	<0.005	<0.01	0.002	<0.01	1.1	<0.02
0.05	0.34	1.4	0.293	10	3	68	<0.01	0.353	0.7	<0.1	0.3	<0.02	0.26	14	0.2	<0.02	<0.1	<0.005	0.02	<0.001	<0.01	1.7	<0.02

Ta	Zr	Y	Ce	In	Re	Be	Li	Pd	Pt
PPM	PPM	PPM	PPM	PPM	PPB	PPM	PPM	PPB	PPB
0.001	0.01	0.001	0.01	0.02	1	0.1	0.01	2	1
<0.001	0.06	0.049	0.1	<0.02	<1	<0.1	1.63	<2	<1
<0.001	<0.01	0.073	0.2	<0.02	<1	<0.1	1.23	<2	<1
<0.001	0.03	0.041	0.08	<0.02	1	<0.1	0.89	<2	<1
<0.001	0.05	0.063	0.13	<0.02	2	<0.1	0.59	<2	<1
<0.001	0.02	0.209	0.55	<0.02	<1	<0.1	2.08	<2	<1
<0.001	0.03	0.958	2.32	<0.02	4	<0.1	4.48	<2	<1
<0.001	0.09	0.095	0.22	<0.02	3	<0.1	1.12	<2	<1
<0.001	0.02	0.366	0.98	<0.02	3	<0.1	2.32	<2	<1
<0.001	0.01	0.301	0.76	<0.02	2	<0.1	1.71	<2	<1
<0.001	0.02	0.288	0.48	<0.02	2	<0.1	3.12	<2	<1
<0.001	0.05	0.07	0.18	<0.02	1	<0.1	1.46	<2	<1
<0.001	0.01	0.099	0.14	<0.02	1	<0.1	0.88	<2	<1
<0.001	0.02	0.082	0.24	<0.02	1	<0.1	1	<2	<1
<0.001	0.03	0.397	2.19	<0.02	2	<0.1	2.72	<2	<1
<0.001	0.06	0.052	0.12	<0.02	2	<0.1	0.87	<2	<1
<0.001	0.01	0.17	0.42	<0.02	2	<0.1	1.18	<2	<1
<0.001	0.01	0.174	0.56	<0.02	<1	<0.1	2.35	<2	<1
<0.001	0.05	0.04	0.13	<0.02	<1	<0.1	0.9	<2	<1
<0.001	0.01	0.062	0.12	<0.02	<1	<0.1	1.35	<2	<1
<0.001	0.01	0.026	0.06	<0.02	<1	<0.1	0.61	<2	<1
<0.001	0.02	0.181	0.58	<0.02	<1	<0.1	1.8	<2	<1
<0.001	0.01	0.111	0.29	<0.02	<1	<0.1	2.32	<2	<1
<0.001	<0.01	0.052	0.1	<0.02	2	<0.1	0.62	<2	<1
<0.001	0.06	0.081	0.19	<0.02	1	<0.1	1.56	<2	<1
<0.001	0.02	0.12	0.24	<0.02	2	<0.1	1.39	<2	<1
<0.001	0.02	0.215	0.21	<0.02	4	<0.1	2.89	<2	<1

<0.001	0.02	0.037	0.11	<0.02	<1	<0.1	2.32	<2	<1
<0.001	0.06	0.059	0.19	<0.02	<1	<0.1	1.16	<2	<1
<0.001	0.08	0.057	0.14	<0.02	<1	<0.1	0.8	<2	<1
<0.001	0.07	0.072	0.18	<0.02	2	<0.1	1.28	<2	<1
<0.001	0.02	0.026	0.06	<0.02	<1	<0.1	0.62	<2	<1
<0.001	0.04	0.048	0.1	<0.02	2	<0.1	0.59	<2	<1
<0.001	0.04	0.046	0.12	<0.02	<1	<0.1	0.85	<2	<1
<0.001	0.04	0.105	0.21	<0.02	<1	<0.1	1.87	<2	<1
<0.001	0.02	0.073	0.31	<0.02	<1	<0.1	1.41	<2	<1
<0.001	0.07	0.054	0.15	<0.02	2	<0.1	1.95	<2	<1
<0.001	0.01	0.053	0.16	<0.02	2	<0.1	1.56	<2	<1
<0.001	0.05	0.034	0.1	<0.02	<1	<0.1	0.75	<2	<1
<0.001	0.01	0.021	0.06	<0.02	<1	<0.1	0.61	<2	<1
<0.001	0.03	0.339	0.9	<0.02	2	<0.1	4.17	<2	<1
<0.001	0.02	0.092	0.14	<0.02	<1	0.1	2.42	<2	<1
<0.001	0.05	0.05	0.14	<0.02	2	<0.1	1.87	<2	<1
<0.001	0.06	0.076	0.2	<0.02	1	<0.1	0.95	<2	<1
<0.001	0.02	0.461	1.28	<0.02	1	<0.1	2.6	<2	<1
<0.001	0.06	0.061	0.2	<0.02	2	<0.1	0.77	<2	<1
<0.001	0.02	0.55	1.66	<0.02	2	<0.1	2.62	<2	<1
<0.001	0.02	0.067	0.12	<0.02	<1	<0.1	1.64	<2	<1
<0.001	0.03	0.353	0.79	<0.02	1	<0.1	3.58	<2	<1
<0.001	0.05	0.053	0.16	<0.02	<1	<0.1	1.22	<2	<1
<0.001	0.08	0.087	0.19	<0.02	1	<0.1	1.72	<2	<1
<0.001	0.06	0.049	0.14	<0.02	1	<0.1	0.68	<2	<1
<0.001	0.06	0.077	0.18	<0.02	2	<0.1	1.01	<2	<1
<0.001	0.05	0.057	0.14	<0.02	1	<0.1	1.2	<2	<1
<0.001	0.05	0.056	0.15	<0.02	<1	<0.1	1.11	<2	<1
<0.001	0.07	0.057	0.16	<0.02	1	<0.1	1.23	<2	<1
<0.001	0.03	0.076	0.19	<0.02	1	<0.1	1.1	<2	<1

<0.001	0.01	0.033	0.06	<0.02	2	<0.1	0.97	<2	<1
<0.001	0.03	0.185	0.78	<0.02	1	<0.1	1.84	<2	<1
<0.001	0.08	0.087	0.21	<0.02	<1	<0.1	1.12	<2	<1
<0.001	0.06	0.072	0.18	<0.02	2	<0.1	0.87	<2	<1
<0.001	0.03	0.055	0.09	<0.02	<1	<0.1	1.95	<2	<1
<0.001	0.06	0.055	0.13	<0.02	<1	<0.1	0.81	<2	<1
<0.001	0.08	0.049	0.13	<0.02	2	<0.1	0.82	<2	<1
<0.001	0.06	0.065	0.18	<0.02	2	<0.1	1.08	<2	<1
<0.001	0.03	0.028	0.06	<0.02	<1	<0.1	0.5	<2	<1
<0.001	0.07	0.057	0.16	<0.02	<1	<0.1	1.25	<2	<1
<0.001	0.02	0.011	0.05	<0.02	<1	<0.1	0.56	<2	<1
<0.001	0.04	0.034	0.1	<0.02	1	<0.1	1.02	<2	<1
<0.001	0.01	0.047	0.12	<0.02	1	<0.1	1.22	<2	<1
<0.001	0.02	0.226	0.7	<0.02	1	<0.1	1.85	<2	<1
<0.001	0.03	0.228	0.53	<0.02	3	<0.1	2.43	<2	<1
<0.001	0.03	0.154	0.3	<0.02	2	<0.1	1.74	<2	<1
<0.001	0.02	0.097	0.23	<0.02	2	<0.1	1.38	<2	<1
<0.001	0.03	0.044	0.14	<0.02	<1	<0.1	1.02	<2	<1
<0.001	0.02	0.144	0.18	<0.02	3	<0.1	2.27	<2	<1
<0.001	0.03	0.054	0.13	<0.02	1	<0.1	1.26	<2	<1
<0.001	0.06	0.069	0.19	<0.02	3	<0.1	1.31	<2	<1
<0.001	0.03	0.178	0.32	<0.02	2	<0.1	2.14	<2	<1
<0.001	0.03	0.322	0.62	<0.02	3	<0.1	2.21	<2	<1
<0.001	0.03	0.307	0.73	<0.02	5	<0.1	2.77	<2	<1
<0.001	0.02	0.175	0.33	<0.02	2	<0.1	1.7	<2	<1
<0.001	0.08	0.048	0.17	<0.02	<1	<0.1	1.45	<2	<1
<0.001	0.02	0.156	0.32	<0.02	1	<0.1	1.32	<2	<1
<0.001	0.02	0.215	0.65	<0.02	1	<0.1	2.21	<2	<1
<0.001	0.01	0.416	1.02	<0.02	<1	<0.1	2.54	<2	<1
<0.001	0.03	0.05	0.11	<0.02	<1	<0.1	1.09	<2	<1

<0.001	0.11	0.16	0.36	<0.02	<1	<0.1	1.93	<2	<1
<0.001	0.06	0.06	0.15	<0.02	<1	<0.1	1.21	<2	<1
<0.001	0.01	0.08	0.17	<0.02	2	<0.1	0.96	<2	<1
<0.001	0.03	0.021	0.06	<0.02	<1	<0.1	0.56	<2	<1
<0.001	0.09	0.082	0.22	<0.02	<1	<0.1	0.83	<2	<1
<0.001	0.02	0.347	0.96	<0.02	2	<0.1	3.2	<2	<1
<0.001	0.03	0.339	1.02	<0.02	<1	<0.1	2.24	<2	<1
<0.001	0.04	0.027	0.08	<0.02	<1	<0.1	1.15	<2	<1
<0.001	0.05	0.048	0.12	<0.02	<1	<0.1	1.11	<2	<1
<0.001	0.01	0.035	0.09	<0.02	<1	<0.1	0.72	<2	<1
<0.001	0.01	0.146	0.35	<0.02	2	<0.1	0.85	<2	<1
<0.001	0.02	0.162	0.42	<0.02	<1	<0.1	1.7	<2	<1
<0.001	0.03	0.279	0.71	<0.02	1	<0.1	2.43	<2	<1
<0.001	0.03	0.077	0.17	<0.02	2	<0.1	1.08	<2	<1
<0.001	0.07	0.039	0.11	<0.02	<1	<0.1	0.88	<2	<1
<0.001	0.03	0.066	0.18	<0.02	2	<0.1	1.2	<2	<1
<0.001	0.02	0.034	0.13	<0.02	2	<0.1	1.16	<2	<1
<0.001	0.02	0.135	0.79	<0.02	2	<0.1	2.29	<2	<1
<0.001	0.05	0.052	0.13	<0.02	<1	<0.1	1.63	<2	<1
<0.001	0.01	0.039	0.16	<0.02	<1	<0.1	1.15	<2	<1
<0.001	0.15	0.08	0.22	<0.02	3	<0.1	1.32	<2	<1
<0.001	0.11	0.21	0.47	<0.02	2	<0.1	3.02	<2	<1
<0.001	0.12	0.062	0.17	<0.02	2	<0.1	0.96	<2	<1
<0.001	0.08	0.049	0.1	<0.02	3	<0.1	0.94	<2	<1
<0.001	0.05	0.069	0.23	<0.02	2	<0.1	1.21	<2	<1
<0.001	0.09	0.062	0.17	<0.02	8	<0.1	1.45	<2	1
<0.001	0.04	0.107	0.17	<0.02	2	<0.1	1.18	<2	<1
<0.001	0.07	0.067	0.22	<0.02	1	<0.1	1.01	<2	<1
<0.001	0.06	0.039	0.1	<0.02	<1	<0.1	0.73	<2	<1
<0.001	0.07	0.068	0.16	<0.02	3	<0.1	1.05	<2	<1

<0.001	0.02	0.125	0.41	<0.02	2	<0.1	2.18	<2	<1
<0.001	0.03	0.015	0.06	<0.02	1	<0.1	0.4	<2	<1
<0.001	0.05	0.046	0.14	<0.02	1	<0.1	2	<2	<1
<0.001	0.04	0.045	0.12	<0.02	2	<0.1	0.66	<2	<1
<0.001	0.03	0.016	0.06	<0.02	5	<0.1	0.16	<2	<1
<0.001	0.07	0.054	0.18	<0.02	<1	<0.1	0.7	<2	<1
<0.001	0.05	0.045	0.17	<0.02	2	<0.1	1.3	<2	<1
<0.001	0.1	0.115	0.27	<0.02	2	<0.1	1.72	<2	<1
<0.001	0.05	0.241	0.4	<0.02	3	<0.1	3.57	<2	<1
<0.001	0.03	0.173	0.73	<0.02	5	<0.1	1.84	<2	<1
<0.001	0.01	0.066	0.14	<0.02	<1	<0.1	1.01	<2	<1
<0.001	0.03	0.059	0.16	<0.02	2	<0.1	1.08	<2	<1
<0.001	0.02	0.037	0.09	<0.02	5	<0.1	1.7	<2	<1
<0.001	0.04	0.035	0.11	<0.02	<1	<0.1	0.75	<2	<1
<0.001	0.04	0.155	0.64	<0.02	4	<0.1	3.15	<2	<1
<0.001	0.05	0.054	0.13	<0.02	<1	<0.1	0.87	<2	<1
<0.001	0.02	0.077	0.27	<0.02	2	<0.1	1.01	<2	<1
<0.001	0.01	0.054	0.21	<0.02	3	<0.1	0.89	<2	<1
<0.001	0.08	0.106	0.25	<0.02	2	<0.1	1.48	<2	<1
<0.001	0.01	0.084	0.4	<0.02	1	<0.1	1.16	<2	<1
<0.001	0.06	0.065	0.14	<0.02	<1	<0.1	0.97	<2	<1
<0.001	0.02	0.118	0.29	<0.02	2	<0.1	1.14	<2	<1
<0.001	0.02	0.083	0.23	<0.02	3	<0.1	1.42	<2	<1
<0.001	<0.01	0.449	1.45	<0.02	2	<0.1	1.95	<2	1
<0.001	<0.01	0.042	0.2	<0.02	<1	<0.1	1.14	<2	<1
<0.001	0.01	0.061	0.18	<0.02	1	<0.1	1.07	<2	<1
<0.001	0.02	0.045	0.12	<0.02	1	<0.1	0.9	<2	<1
<0.001	0.05	0.034	0.14	<0.02	<1	<0.1	1.21	<2	<1
<0.001	0.05	0.171	0.64	<0.02	3	<0.1	3.11	<2	<1
<0.001	0.02	0.023	0.09	<0.02	<1	<0.1	0.77	<2	<1

<0.001	0.03	0.083	0.22	<0.02	3	<0.1	1.18	<2	<1
<0.001	0.1	0.062	0.3	<0.02	1	<0.1	0.14	<2	<1
<0.001	0.04	0.053	0.11	<0.02	<1	<0.1	0.79	<2	<1
<0.001	0.03	0.362	1.2	<0.02	2	<0.1	3.92	<2	<1

Appendix 2: QAQC (Quality Assurance/ Quality Control) Tables: Sample duplicates, standards, and blanks (Elements as listed above)

Pulp Duplicates																								
223N 027	0.07	3.44	0.02	15.1	<2	0.9	0.03	31	0.004	<0.1	<0.01	<0.2	<0.01	75.4	<0.01	<0.02	<0.02	<2	0.92	0.049	0.04	1	0.311	7.9
223N 027	0.08	3.35	0.04	14.6	<2	0.9	0.04	32	0.004	<0.1	<0.01	<0.2	<0.01	82.3	<0.01	<0.02	<0.02	<2	0.98	0.051	0.05	1	0.326	7.5
223N 055	0.03	2.39	0.11	13.9	<2	0.4	0.02	33	0.01	0.1	<0.01	<0.2	<0.01	92.9	<0.01	<0.02	<0.02	<2	1.57	0.036	0.07	1.3	0.328	9.4
223N 055	0.02	2.33	0.13	14.1	2	0.3	0.02	31	0.009	0.2	<0.01	<0.2	<0.01	92.1	<0.01	<0.02	<0.02	<2	1.52	0.036	0.07	1.2	0.288	8.7
223N 084	<0.01	3.01	0.08	13.1	<2	1.6	0.02	44	0.002	<0.1	<0.01	<0.2	<0.01	89	<0.01	<0.02	<0.02	<2	1.42	0.05	0.28	2.6	0.317	3.6
223N 084	<0.01	3.04	0.02	12.6	<2	1.4	0.03	45	<0.001	<0.1	<0.01	<0.2	<0.01	87.7	<0.01	<0.02	<0.02	<2	1.44	0.052	0.28	2.4	0.338	3.5
223N 110	0.1	2.91	0.11	6.7	<2	1.2	0.03	33	0.006	<0.1	<0.01	0.4	<0.01	36.6	<0.01	<0.02	<0.02	<2	1.15	0.033	0.05	1.2	0.369	8.4
223N 110	0.11	2.88	0.06	6.4	<2	1.1	0.03	30	0.006	<0.1	<0.01	<0.2	<0.01	35.9	<0.01	<0.02	<0.02	2	1.16	0.034	0.05	1.2	0.367	7.9
Reference Materials																								
STD V14	0.06	4.64	0.83	14.3	24	1.5	0.74	2049	0.015	11.1	<0.01	4.3	<0.01	6.6	0.21	0.05	0.09	<2	0.64	0.093	0.03	0.9	0.073	1.4
STD V16	1.28	5.62	2.83	36.2	31	6.4	0.83	684	0.325	1.4	<0.01	0.3	<0.01	11.1	0.09	0.06	<0.02	<2	0.28	0.047	0.05	251	0.048	2.1
STD V14	0.06	4.78	0.87	14.4	30	1.5	0.73	2131	0.015	11.1	<0.01	8.4	<0.01	7.2	0.21	0.06	0.09	<2	0.65	0.089	0.03	1	0.076	1.4
STD V16	0.89	4.88	2.81	35.1	31	4.8	0.74	635	0.256	1.3	<0.01	0.9	<0.01	10.7	0.09	0.05	<0.02	<2	0.29	0.047	0.05	196.1	0.048	1.7
STD V14	0.06	4.83	0.84	14.8	26	1.6	0.8	2122	0.016	11.8	<0.01	4.9	<0.01	6.6	0.23	0.06	0.1	<2	0.63	0.098	0.03	1.4	0.082	1.2
STD V16	1.37	7.01	2.83	38.6	36	7.2	1.07	761	0.385	1.6	<0.01	0.6	<0.01	11.8	0.08	0.06	<0.02	<2	0.32	0.055	0.05	310.1	0.052	2
STD V14	0.07	4.8	0.86	14.2	30	1.5	0.69	2124	0.015	11.1	<0.01	7.7	<0.01	6.4	0.21	0.05	0.09	<2	0.63	0.094	0.03	0.8	0.079	1.6
STD V16	1.12	6.18	2.85	37.4	34	5.8	0.89	759	0.313	1.6	<0.01	0.2	<0.01	11.2	0.08	0.06	<0.02	<2	0.31	0.052	0.05	281.2	0.054	1.7
STD V14	0.02	4.31	0.78	13.8	25	1	0.73	2106	0.013	11.7	<0.01	7.4	<0.01	6	0.2	0.05	0.05	<2	0.61	0.098	0.03	0.8	0.066	1.4
STD V16	0.91	5.89	2.92	35.1	31	5.2	0.96	687	0.319	1.5	<0.01	0.8	<0.01	10	0.08	0.06	<0.02	<2	0.31	0.056	0.05	298.9	0.046	1.9
STD V14	0.06	4.71	0.88	14.1	22	1.5	0.7	2109	0.015	10.8	<0.01	4.5	<0.01	6.4	0.19	0.05	0.09	<2	0.62	0.092	0.04	1.2	0.076	1.3
STD V16	1.37	6.36	3.06	40.4	36	7.1	1.16	713	0.38	1.9	<0.01	1	<0.01	11	0.09	0.07	<0.02	<2	0.34	0.053	0.05	310.6	0.052	1.8
STD V14	0.06	5.15	0.84	14.9	24	1.5	0.75	2222	0.016	11.5	<0.01	6.8	<0.01	6.6	0.21	0.05	0.09	<2	0.64	0.093	0.04	1	0.077	1.4
STD V16	2.14	7.22	3.06	40	41	9.6	1.17	771	0.455	1.5	<0.01	1.3	<0.01	12.6	0.09	0.07	0.02	<2	0.32	0.054	0.04	367.2	0.054	1.9

STD V14	0.06	4.06	0.68	14.4	24	1.4	0.7	2003	0.014	11.1	<0.01	4.6	<0.01	6.3	0.21	0.05	0.09	<2	0.61	0.081	0.03	1	0.068	1.3
STD V16	1.34	5.78	3.25	40	42	6.9	1.25	726	0.332	1.7	<0.01	<0.2	<0.01	11.9	0.08	0.08	<0.02	<2	0.32	0.053	0.06	292.6	0.054	2
STD V14	<0.01	4.84	1.17	14.8	28	1.2	0.82	2321	0.016	12.6	<0.01	5.9	<0.01	7.1	0.23	0.06	0.09	<2	0.68	0.101	<0.01	0.7	0.078	1.2
STD V16	1.5	7.45	3.32	40.6	35	8.2	1.12	731	0.433	1.6	<0.01	0.7	0.01	11.4	0.11	0.07	<0.02	<2	0.3	0.052	0.03	338.2	0.05	1.6
STD V14	0.06	4.5	0.73	14.6	23	1.5	0.79	2018	0.014	11.8	<0.01	3.8	<0.01	6.6	0.17	0.06	0.09	<2	0.64	0.085	0.03	1.1	0.071	1.2
STD V16	1.23	6.65	2.99	38.9	35	6.5	1.02	730	0.349	1.5	<0.01	0.6	<0.01	12.3	0.07	0.06	<0.02	<2	0.33	0.051	0.05	286.3	0.057	1.8
STD V14	0.07	4.58	0.89	14.1	25	1.5	0.72	2056	0.016	10.6	<0.01	15.2	<0.01	6.3	0.2	0.05	0.08	<2	0.6	0.083	0.03	1.2	0.076	1.4
STD V16	1.07	5.73	2.94	37.4	30	6.3	0.95	675	0.299	1.5	<0.01	1.1	<0.01	11.2	0.08	0.07	<0.02	<2	0.29	0.047	0.05	244.7	0.053	1.8
FLOUR	0.49	3.09	<0.01	20.6	<2	0.1	<0.01	27	0.003	<0.1	<0.01	<0.2	<0.01	1	0.03	<0.02	0.05	<2	0.02	0.34	<0.01	0.9	0.111	2.6
BLK	<0.01	<0.01	<0.01	<0.1	<2	<0.1	<0.01	<1	<0.001	<0.1	<0.01	<0.2	<0.01	<0.5	<0.01	<0.02	<0.02	<2	<0.01	<0.001	<0.01	<0.1	<0.001	<0.1
FLOUR	0.53	3.17	0.07	25.6	<2	0.2	0.02	28	0.003	<0.1	<0.01	<0.2	<0.01	1.1	0.03	<0.02	0.05	<2	0.03	0.348	<0.01	0.9	0.116	2.5
BLK	<0.01	<0.01	<0.01	<0.1	<2	<0.1	<0.01	<1	<0.001	<0.1	<0.01	<0.2	<0.01	<0.5	<0.01	<0.02	<0.02	<2	<0.01	<0.001	<0.01	<0.1	<0.001	<0.1
FLOUR	0.53	3.17	<0.01	24.6	<2	0.2	<0.01	30	0.003	<0.1	<0.01	<0.2	<0.01	1.1	0.03	<0.02	0.06	<2	0.03	0.364	<0.01	1.2	0.128	2.5
BLK	<0.01	<0.01	<0.01	<0.1	<2	<0.1	<0.01	<1	<0.001	<0.1	<0.01	<0.2	<0.01	<0.5	<0.01	<0.02	<0.02	<2	<0.01	<0.001	<0.01	<0.1	<0.001	<0.1
FLOUR	0.53	3.4	0.07	24.5	<2	0.1	0.01	31	0.004	<0.1	<0.01	<0.2	<0.01	1.1	0.03	<0.02	0.06	<2	0.03	0.38	<0.01	1.5	0.125	2.6
BLK	<0.01	<0.01	<0.01	<0.1	<2	<0.1	<0.01	<1	<0.001	<0.1	<0.01	<0.2	<0.01	<0.5	<0.01	<0.02	<0.02	<2	<0.01	<0.001	<0.01	<0.1	<0.001	<0.1
FLOUR	0.38	3.19	0.05	25.8	2	0.5	<0.01	29	0.002	<0.1	<0.01	<0.2	<0.01	1.2	0.03	<0.02	<0.02	<2	0.03	0.409	<0.01	1.9	0.115	3.3
BLK	<0.01	<0.01	<0.01	<0.1	<2	0.1	<0.01	<1	<0.001	<0.1	<0.01	<0.2	<0.01	<0.5	<0.01	<0.02	<0.02	<2	<0.01	<0.001	<0.01	<0.1	<0.001	<0.1
FLOUR	0.52	3.55	0.11	24.4	<2	0.2	0.02	31	0.004	<0.1	<0.01	<0.2	<0.01	1.2	0.02	<0.02	0.06	<2	0.03	0.347	<0.01	1.3	0.128	2.7
BLK	<0.01	<0.01	<0.01	<0.1	<2	<0.1	<0.01	<1	<0.001	<0.1	<0.01	<0.2	<0.01	<0.5	<0.01	<0.02	<0.02	<2	<0.01	<0.001	<0.01	<0.1	<0.001	<0.1
FLOUR	0.56	3.62	0.09	25.9	<2	0.2	0.02	32	0.003	<0.1	<0.01	0.5	<0.01	1.1	0.03	<0.02	0.05	<2	0.03	0.343	<0.01	1.1	0.112	2.7
BLK	<0.01	<0.01	<0.01	<0.1	<2	<0.1	<0.01	<1	<0.001	<0.1	<0.01	<0.2	<0.01	<0.5	<0.01	<0.02	<0.02	<2	<0.01	<0.001	<0.01	<0.1	<0.001	<0.1
FLOUR	0.6	2.99	0.17	28.6	<2	0.2	<0.01	34	0.006	<0.1	<0.01	<0.2	<0.01	1.1	0.01	<0.02	<0.02	2	0.03	0.396	<0.01	1.3	0.135	3.1
BLK	<0.01	<0.01	<0.01	<0.1	<2	<0.1	<0.01	<1	<0.001	<0.1	<0.01	<0.2	<0.01	<0.5	<0.01	<0.02	<0.02	<2	<0.01	<0.001	<0.01	<0.1	<0.001	<0.1

FLOUR	0.43	3.37	0.23	25.4	<2	<0.1	<0.01	31	0.004	<0.1	<0.01	<0.2	<0.01	1.1	0.03	<0.02	0.03	3	0.03	0.37	<0.01	1.1	0.123	2.5
BLK	<0.01	<0.01	<0.01	<0.1	<2	<0.1	<0.01	<1	<0.001	<0.1	<0.01	<0.2	<0.01	<0.5	<0.01	<0.02	<0.02	<2	<0.01	<0.001	<0.01	<0.1	<0.001	<0.1
FLOUR	0.51	3.22	0.05	24.6	<2	0.2	<0.01	27	<0.001	<0.1	<0.01	<0.2	<0.01	1.1	<0.01	<0.02	0.04	<2	0.03	0.33	0.01	1	0.113	2.7
BLK	<0.01	<0.01	<0.01	<0.1	<2	<0.1	<0.01	<1	<0.001	<0.1	<0.01	<0.2	<0.01	<0.5	<0.01	<0.02	<0.02	<2	<0.01	<0.001	<0.01	<0.1	<0.001	<0.1
FLOUR	0.56	3.37	0.07	23.9	<2	0.2	0.01	32	0.004	<0.1	<0.01	0.7	<0.01	1.2	0.02	<0.02	0.03	<2	0.03	0.317	<0.01	1.3	0.124	2.9
BLK	<0.01	<0.01	<0.01	<0.1	<2	<0.1	<0.01	<1	<0.001	<0.1	<0.01	<0.2	<0.01	<0.5	<0.01	<0.02	<0.02	<2	<0.01	<0.001	<0.01	<0.1	<0.001	<0.1

7.9	2	64	<0.01	0.308	0.56	<0.1	0.1	<0.02	0.17	10	0.2	<0.02	<0.1	0.013	0.02	0.002	<0.01	1.8	<0.02	<0.001	0.02	0.037	0.11
7.5	2	68	<0.01	0.32	0.57	<0.1	0.1	<0.02	0.19	11	0.2	<0.02	<0.1	0.012	<0.01	<0.001	<0.01	1.9	<0.02	<0.001	0.02	0.042	0.11
9.4	2	56	0.01	0.131	0.35	<0.1	0.1	<0.02	0.19	19	0.4	<0.02	<0.1	0.01	<0.01	0.001	<0.01	0.8	<0.02	<0.001	0.07	0.057	0.16
8.7	2	50	<0.01	0.125	0.34	<0.1	0.1	<0.02	0.18	25	0.4	<0.02	<0.1	0.009	<0.01	0.002	<0.01	0.8	<0.02	<0.001	0.06	0.06	0.13
3.6	2	30	<0.01	0.547	0.57	<0.1	0.1	<0.02	0.12	8	0.3	<0.02	<0.1	<0.005	<0.01	<0.001	<0.01	1.2	<0.02	<0.001	0.02	0.215	0.65
3.5	2	31	<0.01	0.612	0.59	<0.1	0.1	<0.02	0.14	12	0.2	<0.02	<0.1	<0.005	<0.01	<0.001	<0.01	1.2	0.02	<0.001	0.02	0.195	0.65
8.4	2	48	<0.01	0.162	0.35	<0.1	0.3	<0.02	0.2	13	0.3	<0.02	<0.1	<0.005	0.02	0.003	<0.01	1.1	0.04	<0.001	0.08	0.049	0.1
7.9	2	45	<0.01	0.161	0.36	<0.1	0.2	<0.02	0.21	14	0.2	<0.02	<0.1	0.006	<0.01	<0.001	<0.01	1	0.03	<0.001	0.08	0.047	0.09
1.4	7	11	0.14	0.003	0.48	<0.1	<0.1	0.03	0.07	49	<0.1	<0.02	<0.1	0.025	0.01	0.001	<0.01	1.7	0.04	<0.001	0.04	0.02	0.07
2.1	11	5	0.04	0.002	0.2	<0.1	0.1	<0.02	0.06	39	<0.1	<0.02	0.1	0.032	0.05	0.005	0.08	1.5	0.18	<0.001	0.16	0.042	0.09
1.4	7	13	0.14	0.001	0.5	<0.1	0.1	0.04	0.09	49	<0.1	<0.02	<0.1	0.028	<0.01	<0.001	<0.01	1.8	0.05	<0.001	0.03	0.017	0.05
1.7	10	4	0.04	0.002	0.2	<0.1	0.2	<0.02	0.08	41	<0.1	<0.02	0.1	0.031	0.03	0.005	0.08	1.4	0.18	<0.001	0.12	0.027	0.09
1.2	7	12	0.16	0.007	0.51	<0.1	<0.1	0.04	0.05	48	0.2	<0.02	<0.1	0.028	0.01	0.002	<0.01	1.8	0.03	<0.001	0.04	0.021	0.06
2	12	6	0.04	0.003	0.23	<0.1	0.2	<0.02	<0.01	38	0.2	<0.02	0.1	0.035	0.03	0.008	0.12	1.6	0.18	<0.001	0.18	0.05	0.09
1.6	7	12	0.14	0.005	0.49	<0.1	0.1	0.04	0.04	45	<0.1	<0.02	<0.1	0.027	<0.01	<0.001	<0.01	1.6	0.04	<0.001	0.04	0.023	0.05
1.7	12	6	0.04	0.007	0.22	<0.1	0.2	<0.02	0.03	41	<0.1	<0.02	<0.1	0.033	0.04	0.004	0.11	1.6	0.19	<0.001	0.18	0.038	0.09
1.4	6	11	0.14	<0.001	0.5	<0.1	<0.1	0.04	0.08	42	0.1	<0.02	<0.1	0.026	<0.01	0.002	<0.01	1.5	0.04	<0.001	0.04	0.021	0.05
1.9	11	6	0.04	0.002	0.23	<0.1	0.1	<0.02	0.1	41	0.2	<0.02	0.1	0.03	0.02	0.004	0.1	1.4	0.21	<0.001	0.16	0.037	0.09
1.3	7	12	0.15	0.008	0.48	<0.1	0.1	0.03	0.07	45	0.2	<0.02	<0.1	0.028	<0.01	0.003	<0.01	1.6	0.04	<0.001	0.19	0.017	0.06
1.8	12	5	0.04	0.003	0.23	<0.1	0.1	<0.02	<0.01	38	<0.1	<0.02	0.1	0.034	0.04	0.008	0.11	1.6	0.23	<0.001	0.19	0.044	0.09

1.4	7	13	0.15	<0.001	0.49	<0.1	<0.1	0.04	0.1	57	<0.1	<0.02	<0.1	0.033	<0.01	0.002	<0.01	1.9	0.05	<0.001	0.04	0.021	0.08
1.9	13	6	0.05	0.002	0.23	<0.1	0.3	<0.02	0.05	44	0.1	0.03	0.2	0.039	0.04	0.005	0.1	1.8	0.23	<0.001	0.25	0.048	0.11
1.3	6	11	0.13	0.008	0.46	<0.1	0.1	0.03	0.04	42	<0.1	<0.02	<0.1	0.028	0.03	<0.001	<0.01	1.7	0.06	<0.001	0.04	0.035	0.06
2	12	5	0.05	0.02	0.23	<0.1	0.1	<0.02	0.04	41	<0.1	<0.02	0.1	0.04	0.07	0.006	0.09	1.6	0.23	0.001	0.18	0.035	0.12
1.2	7	12	0.15	0.007	0.51	<0.1	0.1	0.04	0.09	50	<0.1	<0.02	<0.1	0.03	<0.01	<0.001	<0.01	2	0.03	<0.001	0.04	0.016	0.06
1.6	11	5	0.05	0.011	0.21	<0.1	0.2	<0.02	0.04	42	<0.1	<0.02	0.2	0.033	0.05	0.012	0.12	1.7	0.23	<0.001	0.21	0.059	0.14
1.2	6	10	0.13	<0.001	0.49	<0.1	0.1	0.04	0.09	50	0.2	<0.02	0.1	0.029	0.02	0.003	<0.01	1.8	0.03	<0.001	0.03	0.017	0.05
1.8	12	5	0.05	0.002	0.23	<0.1	0.3	<0.02	0.06	44	0.2	<0.02	0.2	0.038	0.08	0.005	0.1	1.8	0.17	<0.001	0.19	0.048	0.1
1.4	7	10	0.14	0.001	0.47	<0.1	0.2	0.03	0.08	50	0.1	<0.02	<0.1	0.031	<0.01	0.002	<0.01	1.8	0.04	<0.001	0.04	0.021	0.07
1.8	11	5	0.04	0.002	0.21	<0.1	0.3	<0.02	0.03	43	0.1	<0.02	0.1	0.04	0.03	0.007	0.08	1.7	0.19	<0.001	0.16	0.047	0.1
2.6	11	<1	<0.01	0.001	0.26	<0.1	0.1	<0.02	0.09	<1	0.5	<0.02	<0.1	<0.005	<0.01	0.002	<0.01	1.8	<0.02	<0.001	<0.01	<0.001	<0.01
<0.1	<1	<1	<0.01	<0.001	<0.01	<0.1	<0.1	<0.02	<0.01	<1	<0.1	<0.02	<0.1	<0.005	<0.01	<0.001	<0.01	<0.1	<0.02	<0.001	<0.01	<0.001	<0.01
2.5	11	<1	<0.01	0.001	0.3	<0.1	0.1	<0.02	0.19	<1	0.6	<0.02	<0.1	<0.005	<0.01	<0.001	<0.01	2.1	<0.02	<0.001	<0.01	0.003	<0.01
<0.1	<1	<1	<0.01	<0.001	<0.01	<0.1	<0.1	<0.02	0.05	<1	<0.1	<0.02	<0.1	<0.005	<0.01	<0.001	<0.01	<0.1	<0.02	<0.001	<0.01	<0.001	<0.01
2.5	12	<1	<0.01	0.003	0.3	<0.1	0.2	<0.02	0.15	<1	0.7	<0.02	<0.1	<0.005	<0.01	<0.001	<0.01	2.2	<0.02	<0.001	<0.01	0.001	<0.01
<0.1	<1	<1	<0.01	0.018	<0.01	<0.1	<0.1	<0.02	<0.01	<1	<0.1	<0.02	<0.1	<0.005	<0.01	<0.001	<0.01	<0.1	<0.02	<0.001	<0.01	<0.001	<0.01
2.6	13	<1	<0.01	0.002	0.31	<0.1	0.3	<0.02	0.18	<1	0.7	<0.02	<0.1	<0.005	<0.01	0.001	<0.01	2.2	0.03	<0.001	<0.01	0.002	<0.01
<0.1	<1	<1	<0.01	0.007	<0.01	<0.1	<0.1	<0.02	<0.01	<1	<0.1	<0.02	<0.1	<0.005	<0.01	<0.001	<0.01	<0.1	<0.02	<0.001	<0.01	<0.001	<0.01
3.3	13	<1	<0.01	0.002	0.33	<0.1	0.1	<0.02	0.17	<1	0.8	<0.02	<0.1	<0.005	<0.01	<0.001	<0.01	1.9	<0.02	<0.001	0.01	0.002	<0.01
<0.1	<1	<1	<0.01	<0.001	<0.01	<0.1	<0.1	<0.02	<0.01	<1	<0.1	<0.02	<0.1	<0.005	<0.01	<0.001	<0.01	<0.1	<0.02	<0.001	<0.01	<0.001	<0.01
2.7	13	<1	<0.01	0.002	0.31	<0.1	0.3	<0.02	0.16	<1	1	<0.02	<0.1	<0.005	<0.01	<0.001	<0.01	2.1	0.06	<0.001	<0.01	0.003	<0.01
<0.1	<1	<1	<0.01	0.006	<0.01	<0.1	<0.1	<0.02	<0.01	<1	<0.1	<0.02	<0.1	<0.005	<0.01	<0.001	<0.01	<0.1	<0.02	<0.001	<0.01	<0.001	<0.01
2.7	13	<1	<0.01	0.002	0.3	<0.1	0.2	<0.02	0.17	<1	0.6	<0.02	<0.1	<0.005	0.01	<0.001	<0.01	2.3	0.05	<0.001	0.04	0.002	<0.01
<0.1	<1	<1	<0.01	<0.001	<0.01	<0.1	<0.1	<0.02	0.08	<1	<0.1	<0.02	<0.1	<0.005	<0.01	<0.001	<0.01	<0.1	<0.02	<0.001	<0.01	<0.001	<0.01
3.1	15	<1	<0.01	0.003	0.33	<0.1	<0.1	<0.02	0.21	<1	0.5	<0.02	<0.1	<0.005	0.01	<0.001	<0.01	2.3	0.03	<0.001	<0.01	<0.001	<0.01
<0.1	<1	<1	<0.01	0.009	<0.01	<0.1	<0.1	<0.02	<0.01	<1	<0.1	<0.02	<0.1	<0.005	<0.01	<0.001	<0.01	<0.1	<0.02	<0.001	<0.01	<0.001	<0.01
2.5	14	<1	<0.01	0.003	0.31	<0.1	0.2	<0.02	0.22	<1	0.6	<0.02	<0.1	<0.005	<0.01	0.002	<0.01	2.4	0.04	<0.001	0.01	<0.001	<0.01
<0.1	<1	<1	<0.01	0.006	<0.01	<0.1	<0.1	<0.02	<0.01	<1	<0.1	<0.02	<0.1	<0.005	<0.01	<0.001	<0.01	<0.1	<0.02	<0.001	<0.01	<0.001	<0.01
2.7	12	<1	<0.01	<0.001	0.28	<0.1	0.1	<0.02	0.2	2	0.6	<0.02	<0.1	<0.005	<0.01	<0.001	<0.01	2.1	<0.02	<0.001	<0.01	<0.001	<0.01
<0.1	<1	<1	<0.01	<0.001	<0.01	<0.1	<0.1	<0.02	<0.01	<1	<0.1	<0.02	<0.1	<0.005	<0.01	<0.001	<0.01	<0.1	<0.02	<0.001	<0.01	<0.001	<0.01

2.9	15	<1	<0.01	0.001	0.3	<0.1	0.5	<0.02	0.19	2	0.8	<0.02	<0.1	<0.005	<0.01	0.001	<0.01	2.6	<0.02	<0.001	0.02	0.002	0.02
<0.1	<1	<1	<0.01	<0.001	<0.01	<0.1	<0.1	<0.02	<0.01	<1	<0.1	<0.02	<0.1	<0.005	<0.01	<0.001	<0.01	<0.1	<0.02	<0.001	<0.01	<0.001	<0.01

<0.02	<1	<0.1	2.32	<2	<1
<0.02	<1	<0.1	2.25	<2	<1
<0.02	1	<0.1	1.23	<2	<1
<0.02	1	<0.1	1.3	<2	<1
<0.02	1	<0.1	2.21	<2	<1
<0.02	3	<0.1	2.28	<2	<1
<0.02	3	<0.1	0.94	<2	<1
<0.02	1	<0.1	0.81	<2	<1
<0.02	<1	<0.1	0.16	<2	<1
<0.02	<1	<0.1	0.05	<2	<1
<0.02	<1	<0.1	0.11	<2	<1
<0.02	<1	<0.1	0.06	<2	<1
<0.02	<1	<0.1	0.09	<2	<1
<0.02	<1	<0.1	0.09	<2	<1
<0.02	<1	<0.1	0.08	<2	<1
<0.02	<1	<0.1	0.06	<2	<1
<0.02	<1	<0.1	0.07	<2	<1
<0.02	<1	<0.1	0.08	<2	<1
<0.02	<1	<0.1	0.11	<2	<1
<0.02	<1	<0.1	0.06	<2	<1
<0.02	<1	<0.1	0.13	<2	<1
<0.02	1	<0.1	0.06	<2	<1
0.03	<1	<0.1	0.06	<2	<1
<0.02	<1	<0.1	0.07	<2	<1
<0.02	<1	<0.1	0.09	<2	<1
<0.02	2	<0.1	0.1	<2	<1
<0.02	<1	<0.1	0.05	<2	<1
<0.02	<1	<0.1	0.03	<2	<1
<0.02	<1	<0.1	0.07	<2	<1

<0.02	<1	<0.1	0.06	<2	<1
<0.02	<1	<0.1	0.08	<2	<1
<0.02	<1	<0.1	<0.01	<2	<1
<0.02	2	<0.1	0.09	<2	<1
<0.02	<1	<0.1	<0.01	<2	<1
<0.02	1	<0.1	0.07	<2	<1
<0.02	<1	<0.1	<0.01	<2	<1
<0.02	<1	<0.1	0.07	<2	<1
<0.02	<1	<0.1	<0.01	<2	<1
<0.02	1	<0.1	0.27	<2	<1
<0.02	<1	<0.1	<0.01	<2	<1
<0.02	<1	<0.1	0.08	<2	<1
<0.02	<1	<0.1	<0.01	<2	<1
<0.02	1	<0.1	0.05	<2	<1
<0.02	<1	<0.1	<0.01	<2	<1
<0.02	<1	<0.1	0.11	<2	<1
<0.02	<1	<0.1	<0.01	<2	<1
<0.02	<1	<0.1	0.08	<2	<1
<0.02	<1	<0.1	<0.01	<2	<1
<0.02	<1	<0.1	0.09	<2	<1
<0.02	<1	<0.1	<0.01	<2	<1
<0.02	1	<0.1	0.12	<2	<1
<0.02	<1	<0.1	<0.01	<2	<1

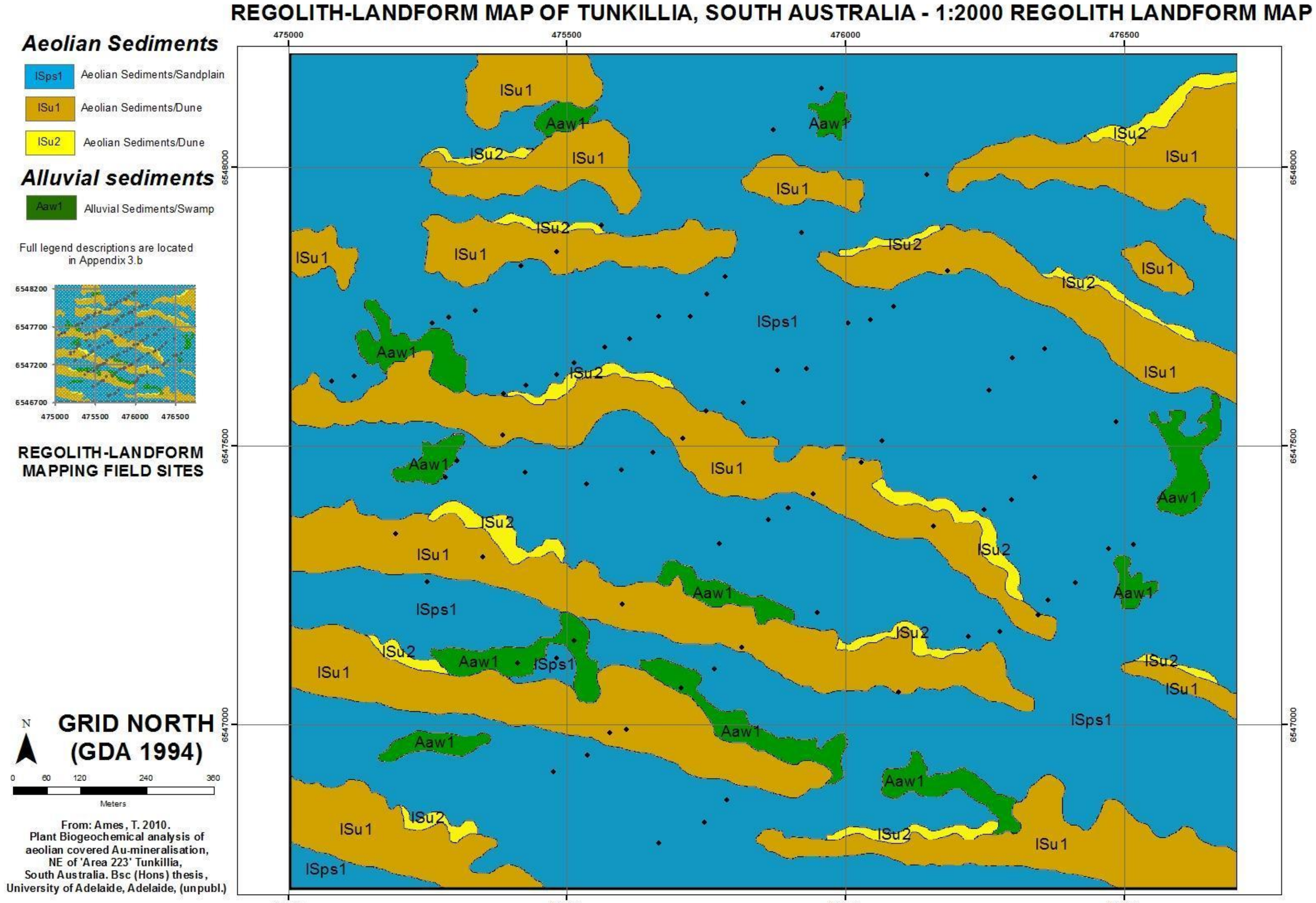
	Mo	Cu	Pb	Zn	Ag	Fe	As	Au	Ca	B	Hg	Se	Ce
223N 027	0.07	3.44	0.02	15.1	0	0.004	0	0	0.92	64	10	0.2	0.11
223N 027D	0.08	3.35	0.04	14.6	0	0.004	0	0	0.98	68	11	0.2	0.11
	-0.01	0.09	-0.02	0.5	0	0	0	0	-0.06	-4	-1	0	0

	Mo	Cu	Pb	Zn	Ag	Fe	As	Au	Ca	B	Hg	Se	Ce
223N 084	0	3.01	0.08	13.1	0	0.002	0	0	1.42	30	8	0.3	0.65
223N 084D	0	3.04	0.02	12.6	0	0	0	0	1.44	31	12	0.2	0.65
	0	-0.03	0.06	0.5	0	0.002	0	0	-0.02	-1	-4	0.1	0

	Mo	Cu	Pb	Zn	Ag	Fe	As	Au	Ca	B	Hg	Se	Ce
223N 055	0.03	2.39	0.11	13.9	0	0.01	0.1	0	1.57	56	19	0.4	0.16
223N 055D	0.02	2.33	0.13	14.1	2	0.009	0.2	0	1.52	50	25	0.4	0.13
	0.01	0.06	-0.02	-0.2	-2	0.001	-0.1	0	0.05	6	-6	0	0.03

	Mo	Cu	Pb	Zn	Ag	Fe	As	Au	Ca	B	Hg	Se	Ce
223N 110	0.1	2.91	0.11	6.7	0	0.006	0	0.4	1.15	48	13	0.3	0.1
223N 110D	0.11	2.88	0.06	6.4	0	0.006	0	0	1.16	45	14	0.2	0.09
	-0.01	0.03	0.05	0.3	0	0	0	0.4	-0.01	3	-1	0.1	0.01

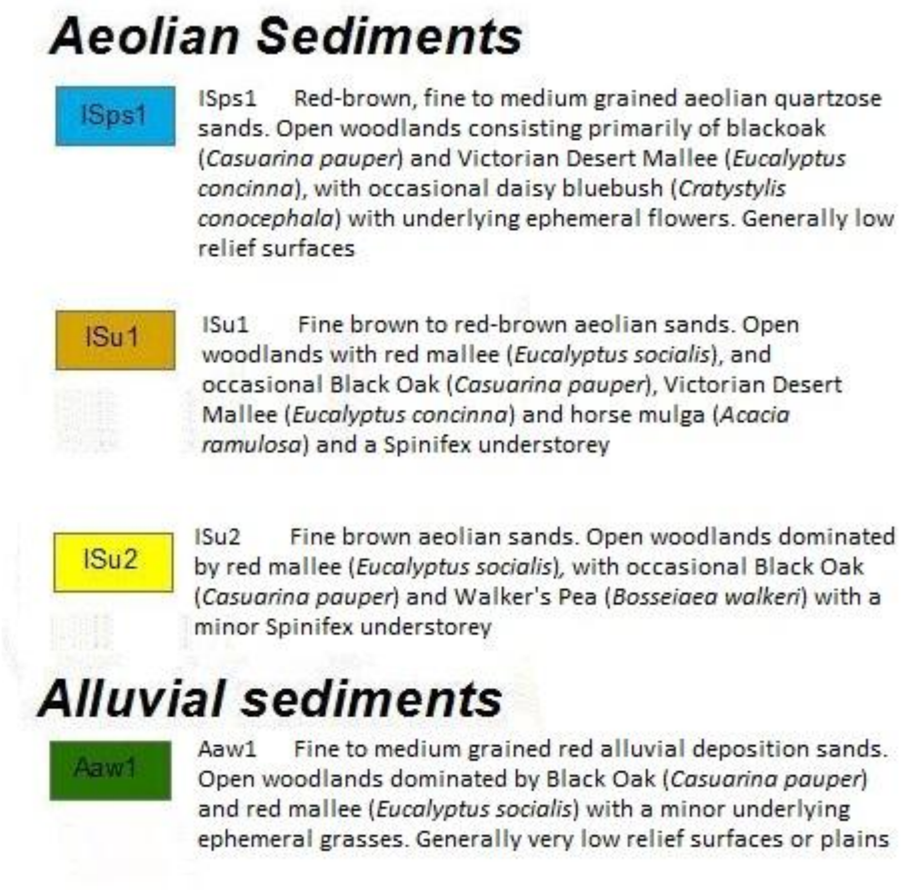
Appendix 3: Regolith Landform Map



REGOLITH-LANDFORM MAP OF TUNKILLIA, SOUTH AUSTRALIA - 1:2000 REGOLITH LANDFORM MAP

From: Ames, T. 2010.
Plant Biogeochemical analysis of
aeolian covered Au-mineralisation,
NE of 'Area 223' Tunkillia,
South Australia. Bsc (Hons) thesis,
University of Adelaide, Adelaide, (unpubl.)

Appendix 3.2: Regolith Map Legend



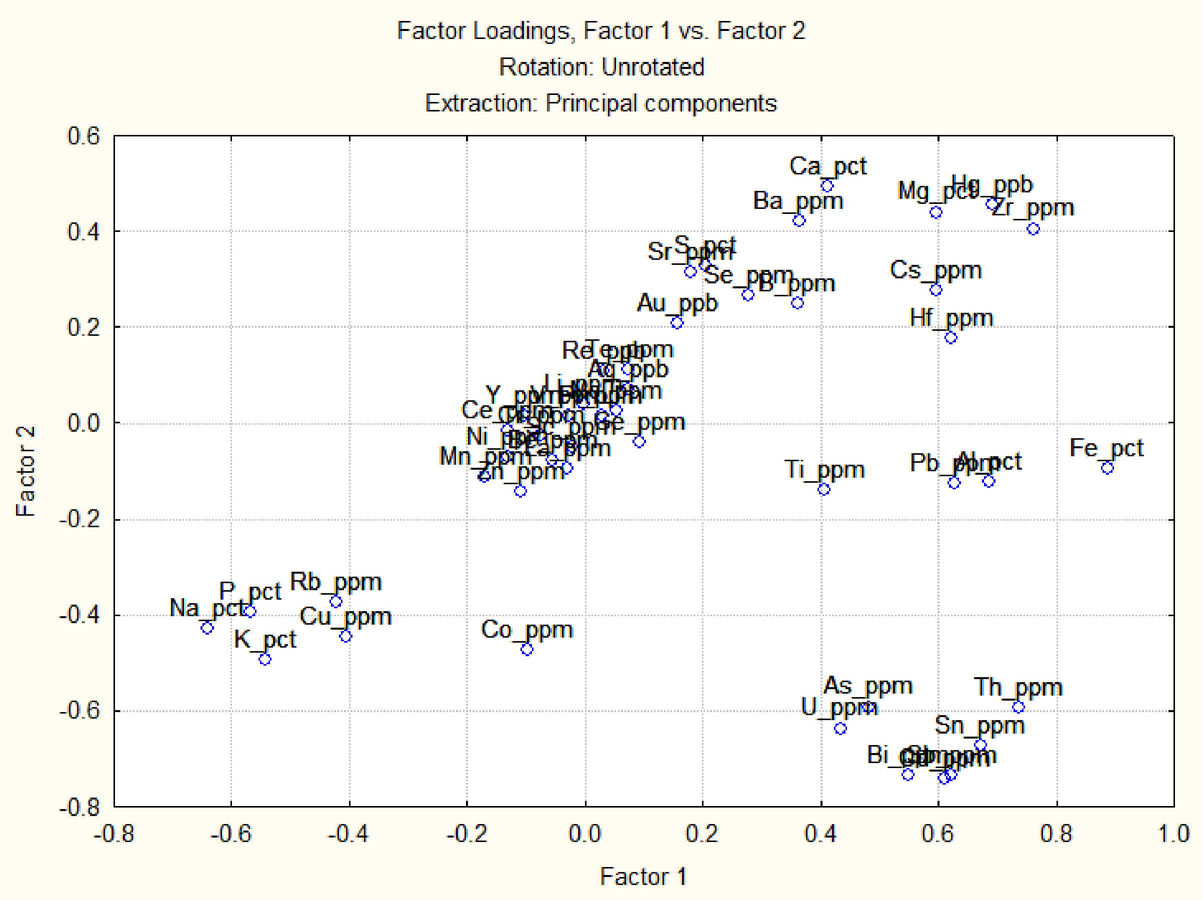
Aeolian Sediments

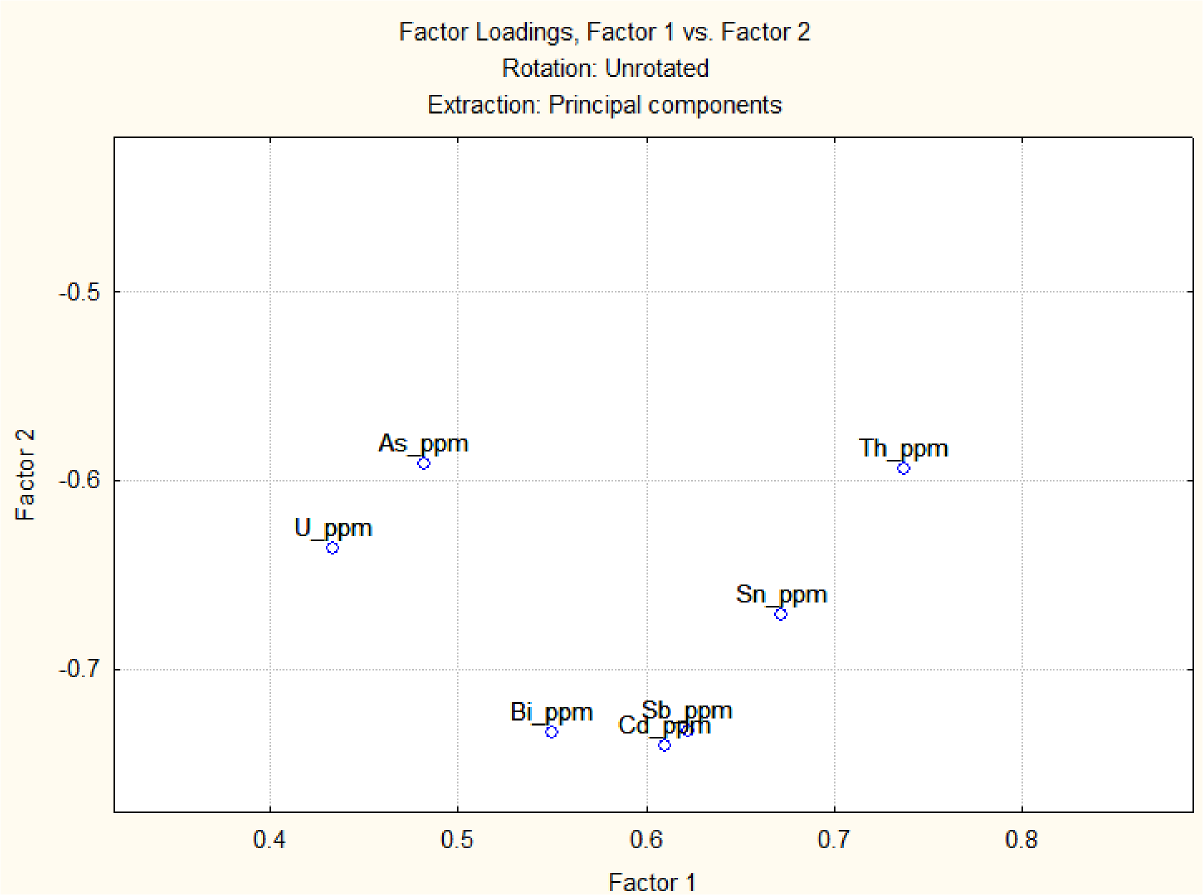
ISps1	ISps1 Red-brown, fine to medium grained aeolian quartzose sands. Open woodlands consisting primarily of blackoak (*Casuarina pauper*) and Victorian Desert Mallee (*Eucalyptus concinna*), with occasional daisy bluebush (*Cratystylis conocephala*) with underlying ephemeral flowers. Generally low relief surfaces
ISu1	ISu1 Fine brown to red-brown aeolian sands. Open woodlands with red mallee (*Eucalyptus socialis*), and occasional Black Oak (*Casuarina pauper*), Victorian Desert Mallee (*Eucalyptus concinna*) and horse mulga (*Acacia ramulosa*) and a Spinifex understorey
ISu2	ISu2 Fine brown aeolian sands. Open woodlands dominated by red mallee (*Eucalyptus socialis*), with occasional Black Oak (*Casuarina pauper*) and Walker's Pea (*Bosseiaea walkeri*) with a minor Spinifex understorey

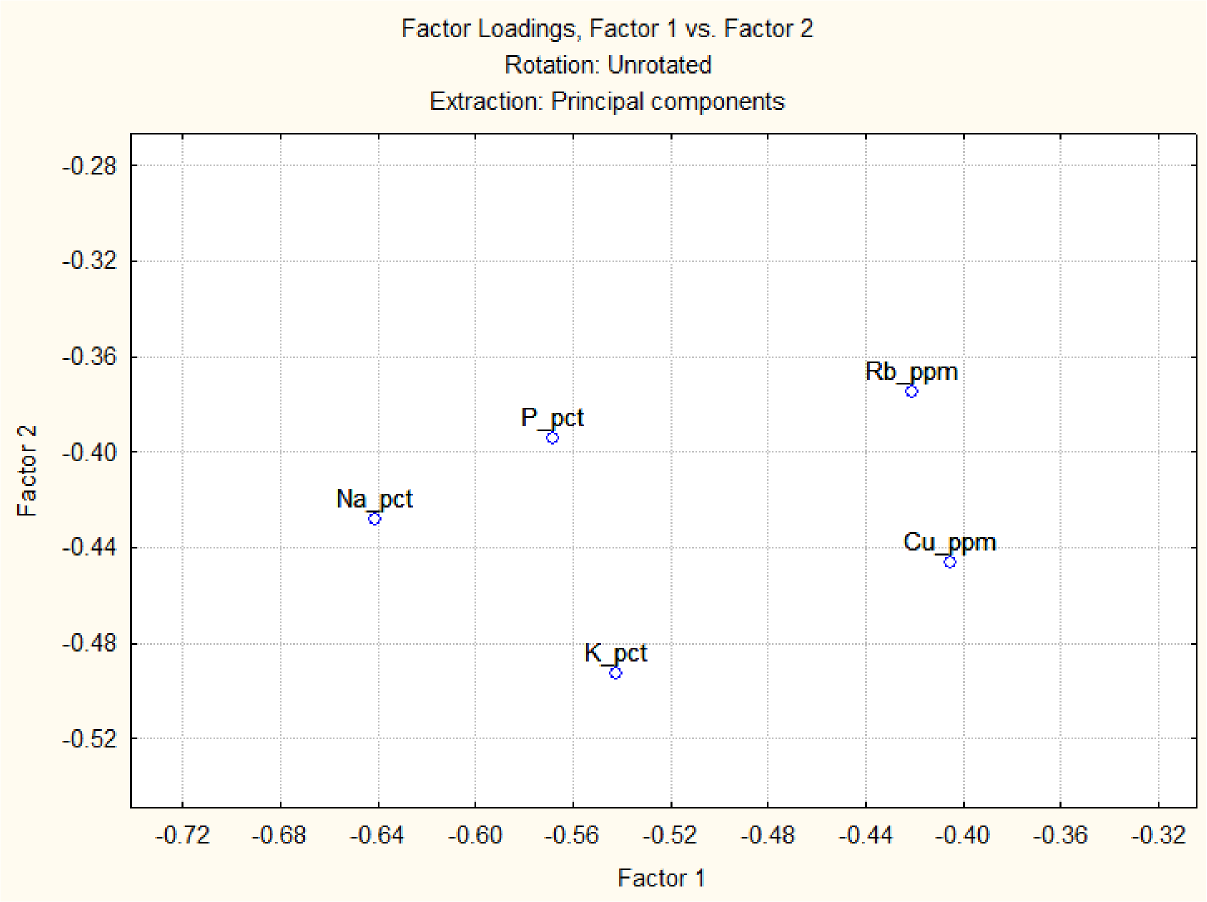
Alluvial sediments

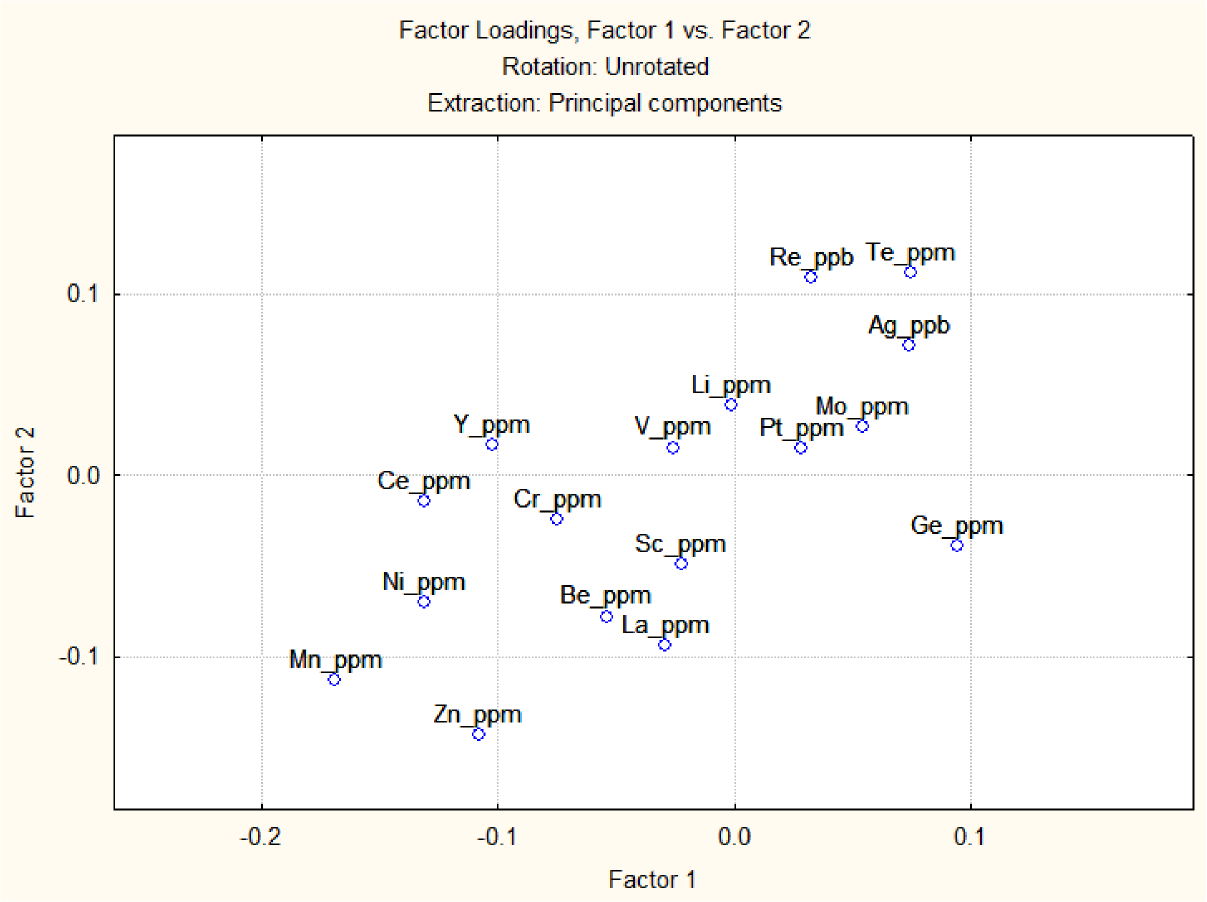
Aaw1	Aaw1 Fine to medium grained red alluvial deposition sands. Open woodlands dominated by Black Oak (*Casuarina pauper*) and red mallee (*Eucalyptus socialis*) with a minor underlying ephemeral grasses. Generally very low relief surfaces or plains

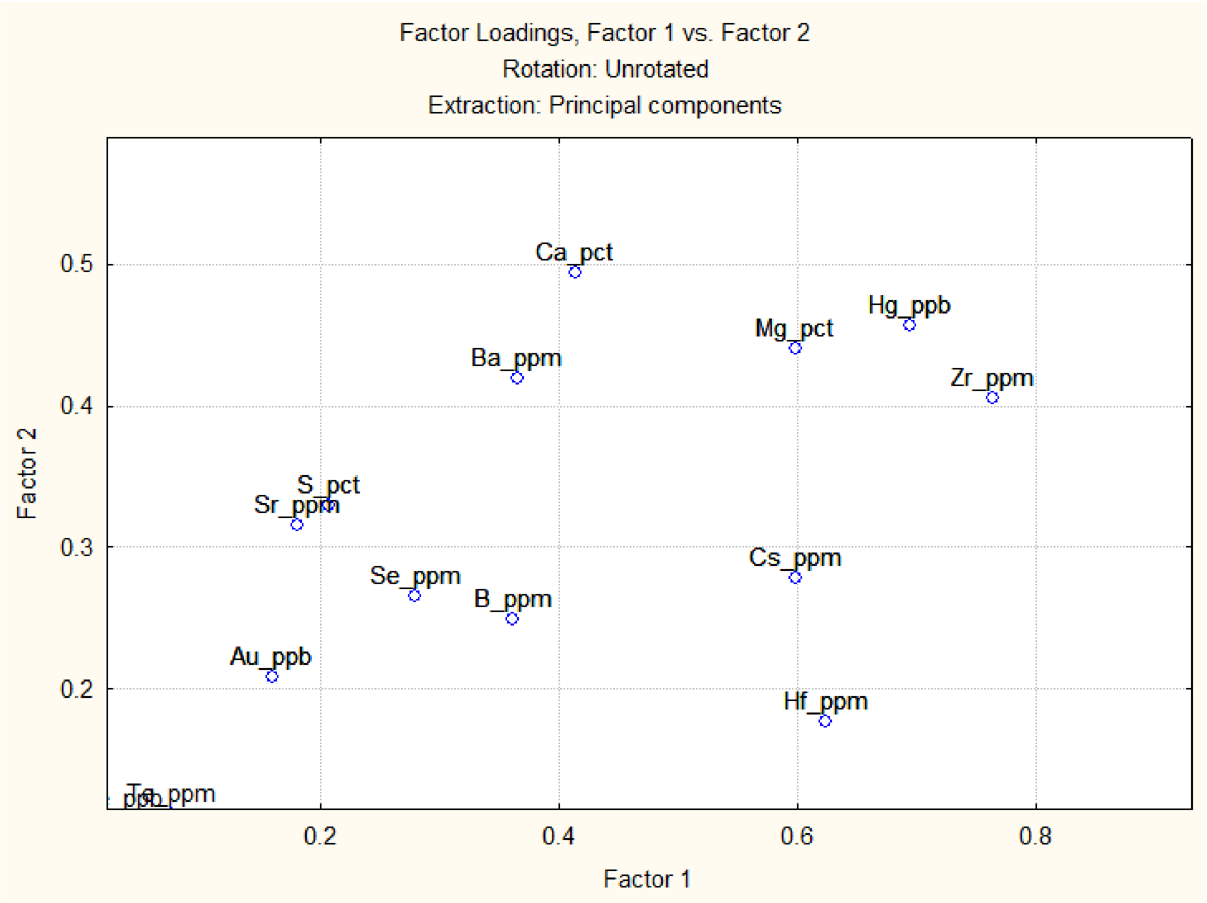
Appendix 4.1: Principal Component Factor Analysis

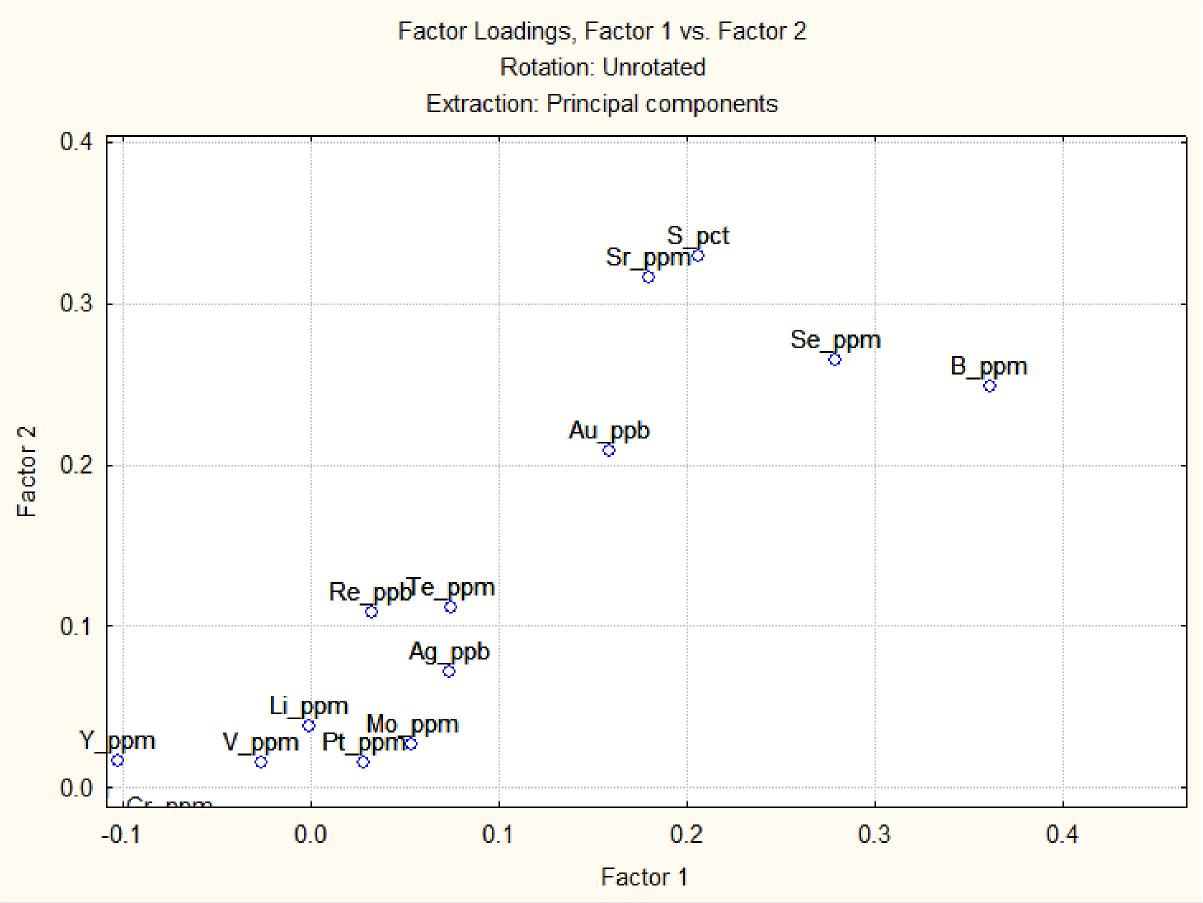



Factor Loadings, Factor 1 vs. Factor 2
Rotation: Unrotated
Extraction: Principal components
Factor 2
-0.5
-0.6
-0.7
0.4
0.5
0.6
0.7
0.8
Factor 1
As_ppm
Th_ppm
U_ppm
Sn_ppm
Bi_ppm
Sb_ppm
Cd_ppm

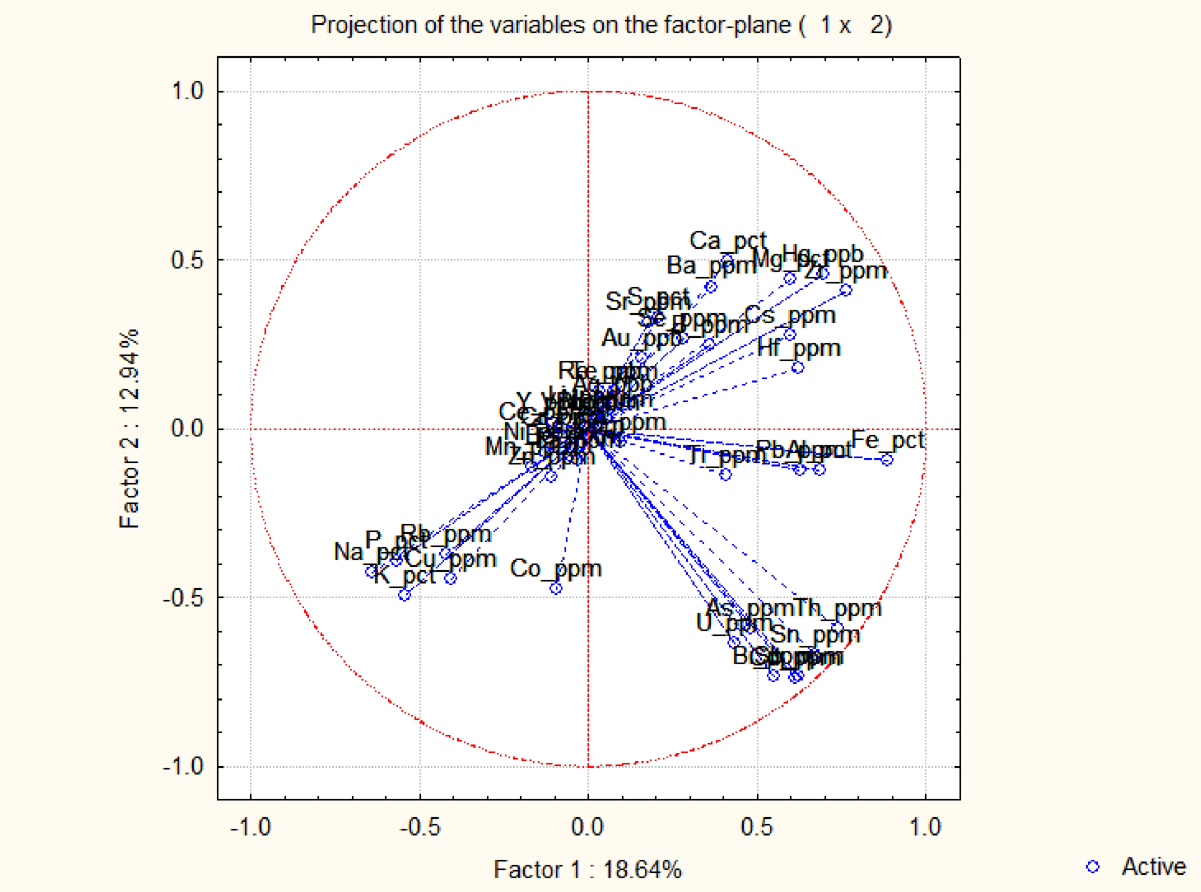

Factor Loadings, Factor 1 vs. Factor 2
Rotation: Unrotated
Extraction: Principal components
Factor 2
-0.28
-0.32
-0.36
-0.40
-0.44
-0.48
-0.52
Factor 1
-0.72
-0.68
-0.64
-0.60
-0.56
-0.52
-0.48
-0.44
-0.40
-0.36
-0.32
Rb_ppm
P_pct
Na_pct
Cu_ppm
K_pct

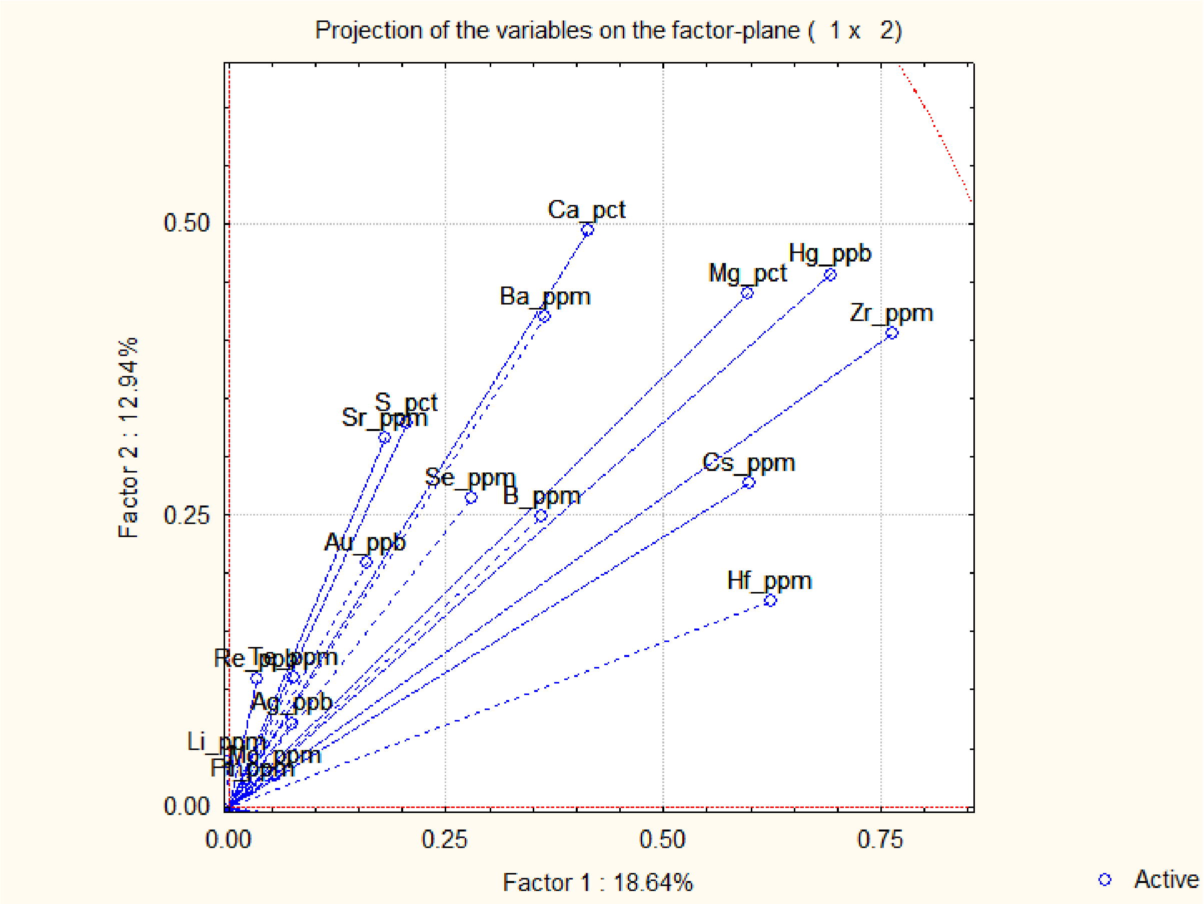

Factor Loadings, Factor 1 vs. Factor 2
Rotation: Unrotated
Extraction: Principal components
Factor 2
Factor 1
0.1
0.0
-0.1
-0.2
-0.1
0.0
0.1
Re_ppb
Te_ppm
Ag_ppb
Li_ppm
Mo_ppm
Y_ppm
V_ppm
Pt_ppm
Ce_ppm
Cr_ppm
Ge_ppm
Sc_ppm
Ni_ppm
Be_ppm
La_ppm
Mn_ppm
Zn_ppm

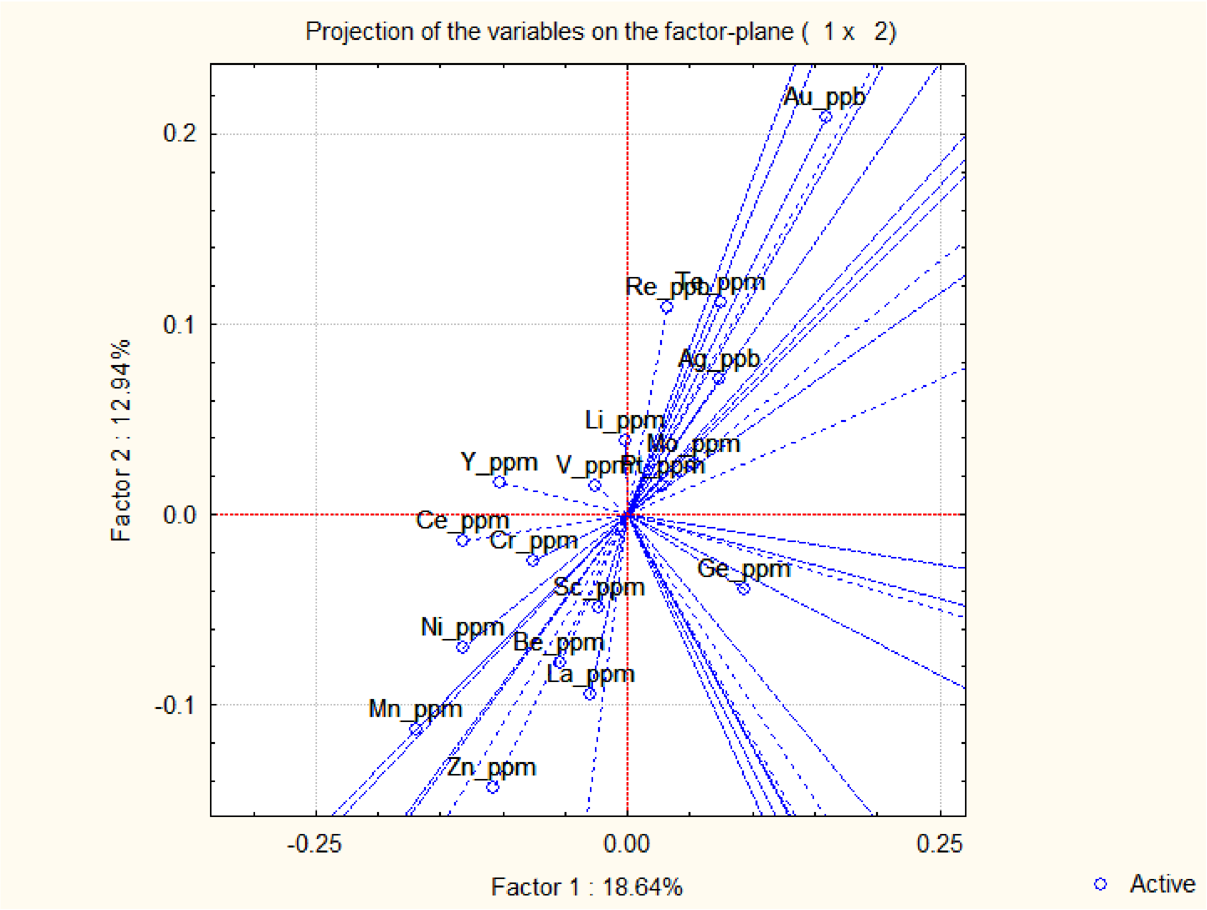

Factor Loadings, Factor 1 vs. Factor 2
Rotation: Unrotated
Extraction: Principal components
Ca_pct
Hg_ppb
Mg_pct
Zr_ppm
Ba_ppm
S_pct
Sr_ppm
Cs_ppm
Se_ppm
B_ppm
Au_ppb
Hf_ppm
Te_ppm
ppb_
0.5
0.4
0.3
0.2
0.2
0.4
0.6
0.8
Factor 2
Factor 1

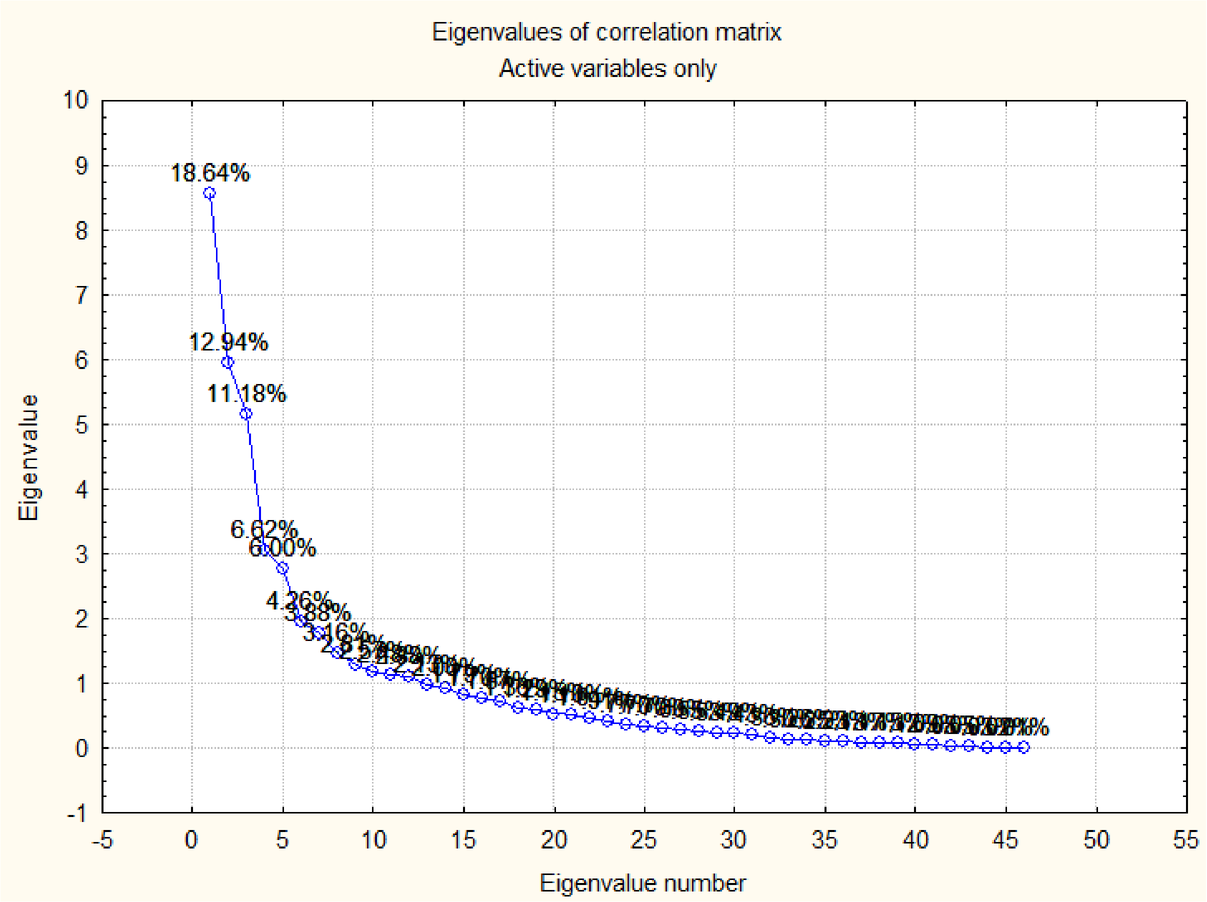

Factor Loadings, Factor 1 vs. Factor 2
Rotation: Unrotated
Extraction: Principal components
Factor 2
Factor 1
0.4
0.3
0.2
0.1
0.0
-0.1
0.0
0.1
0.2
0.3
0.4
S_pct
Sr_ppm
Se_ppm
B_ppm
Au_ppb
Re_ppb
Te_ppm
Ag_ppb
Li_ppm
Mo_ppm
Y_ppm
V_ppm
Pt_ppm
Cr_ppm

Appendix 4.2: Principal Component Analysis: Determining best factors

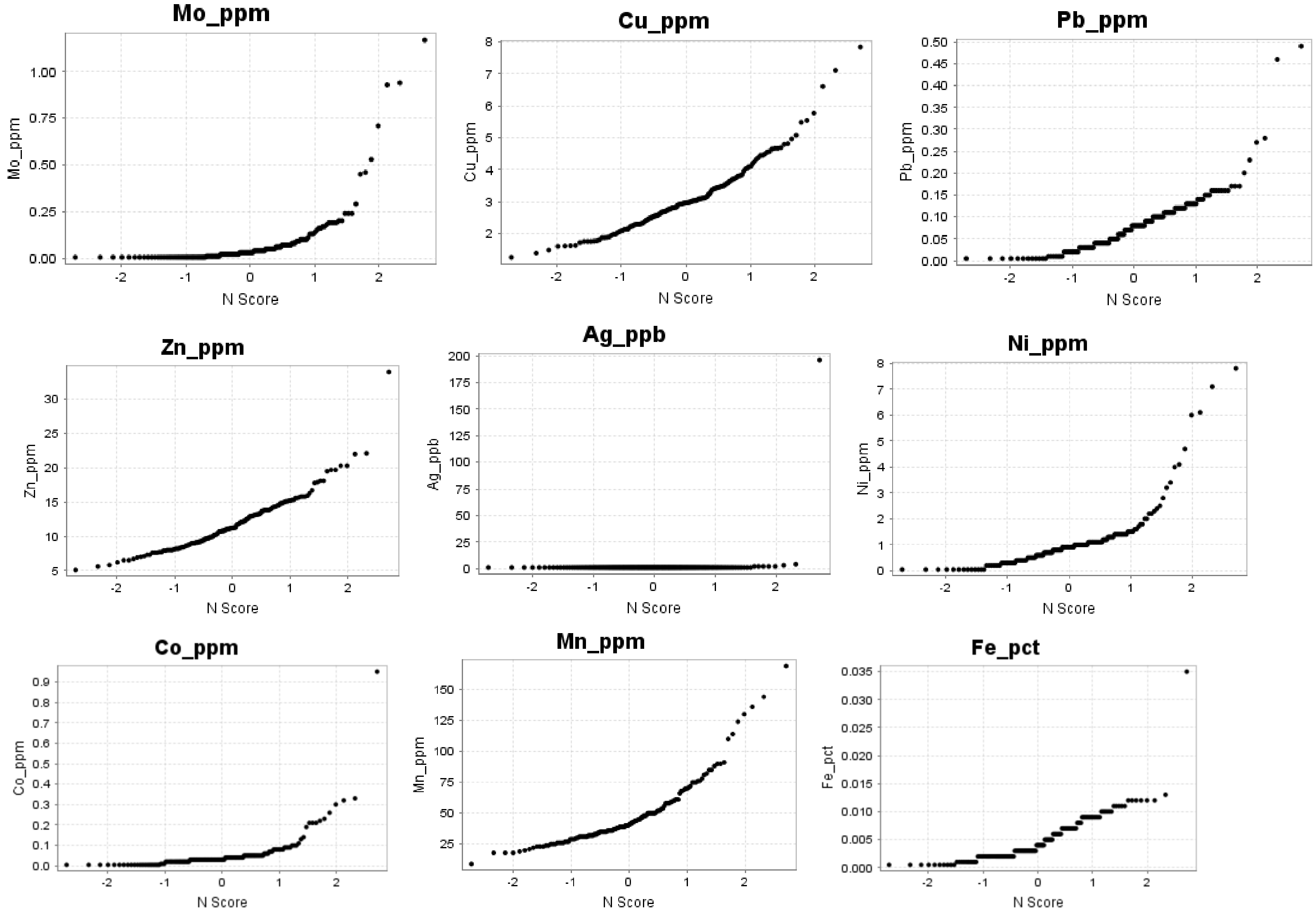


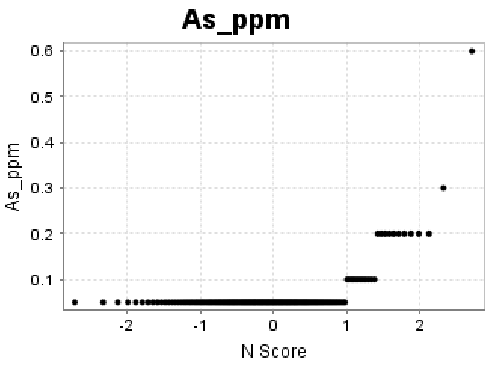

Projection of the variables on the factor-plane (1 x 2)
Ca_pct
Mg_pct
Hg_ppb
Ba_ppm
Zr_ppm
S_pct
Sr_ppm
Se_ppm
B_ppm
Cs_ppm
Au_ppb
Hf_ppm
Re_ppb
Te_ppm
Ag_ppb
Li_ppm
Mo_ppm
0.50
0.25
0.00
0.00
0.25
0.50
0.75
Factor 2 : 12.94%
Factor 1 : 18.64%
○ Active

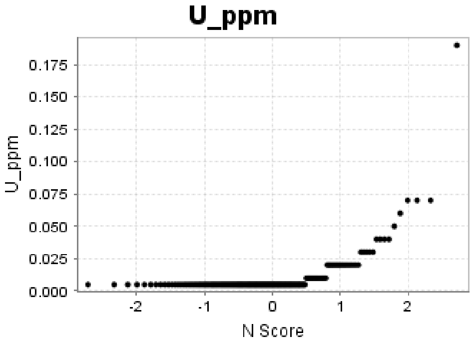

Projection of the variables on the factor-plane (1 x 2)
Au_ppb
Te_ppm
Re_ppb
Ag_ppb
Li_ppm
Mo_ppm
Y_ppm
V_ppm
Pt_ppm
Ce_ppm
Cr_ppm
Ge_ppm
Sc_ppm
Ni_ppm
Be_ppm
La_ppm
Mn_ppm
Zn_ppm
0.2
0.1
0.0
-0.1
-0.25
0.00
0.25
Factor 1 : 18.64%
Factor 2 : 12.94%
Active

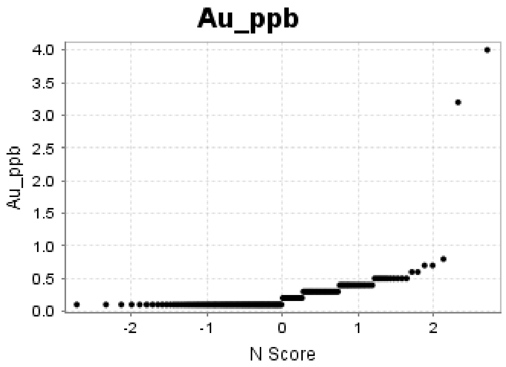

Eigenvalues of correlation matrix
Active variables only
Eigenvalue
Eigenvalue number
10
9
8
7
6
5
4
3
2
1
0
-1
-5
0
5
10
15
20
25
30
35
40
45
50
55
18.64%
12.94%
11.18%
6.62%
6.00%
4.26%
3.88%
3.16%

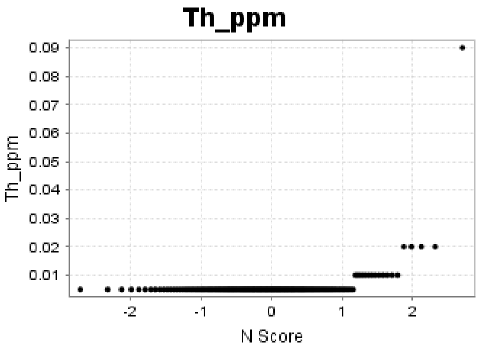
Appendix 4.3: Element Probability Plots

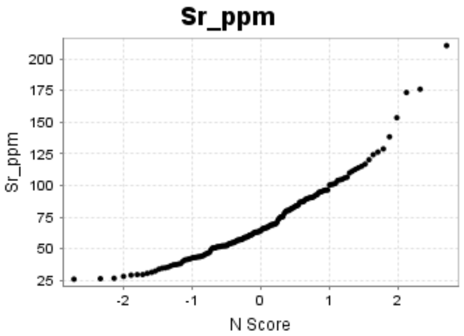


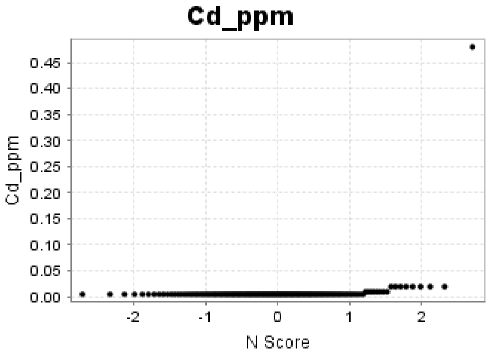

As_ppm
As_ppm
0.6
0.5
0.4
0.3
0.2
0.1
-2
-1
0
1
2
N Score

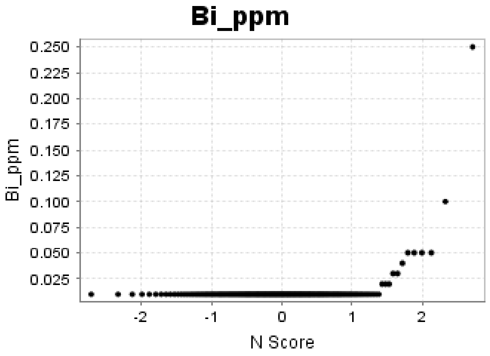

U_ppm
U_ppm
0.175
0.150
0.125
0.100
0.075
0.050
0.025
0.000
-2
-1
0
1
2
N Score

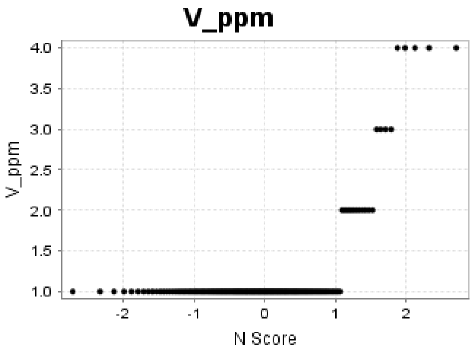

Au_ppb
Au_ppb
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-2
-1
0
1
2
N Score

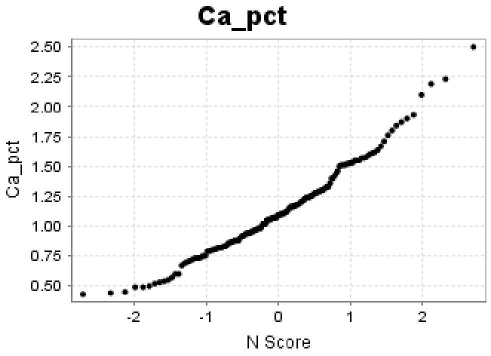

Th_ppm
Th_ppm
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
-2
-1
0
1
2
N Score

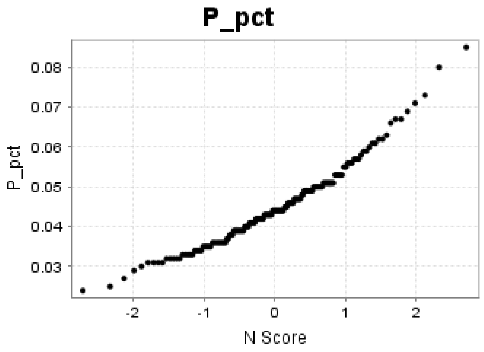

Sr_ppm
Sr_ppm
200
175
150
125
100
75
50
25
-2
-1
0
1
2
N Score

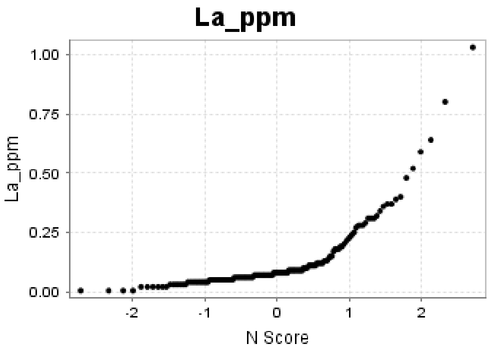

Cd_ppm
Cd_ppm
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
-2
-1
0
1
2
N Score

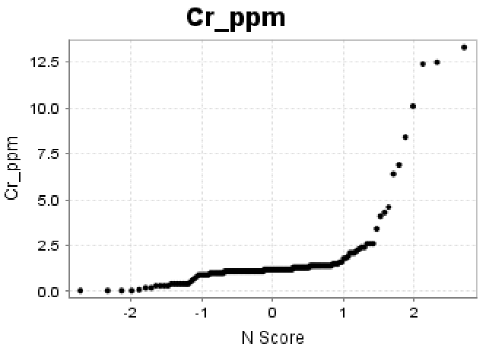

Bi_ppm
Bi_ppm
0.250
0.225
0.200
0.175
0.150
0.125
0.100
0.075
0.050
0.025
-2
-1
0
1
2
N Score

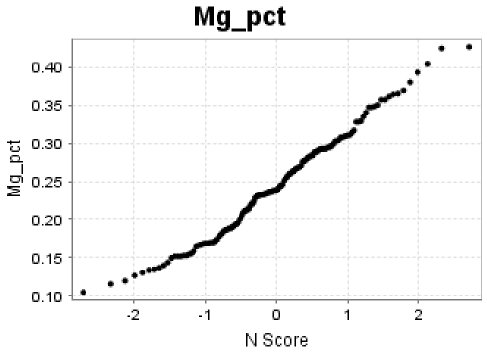

V_ppm
V_ppm
4.0
3.5
3.0
2.5
2.0
1.5
1.0
-2
-1
0
1
2
N Score

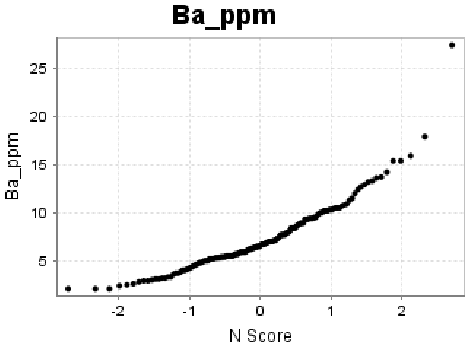

Ca_pct
Ca_pct
2.50
2.25
2.00
1.75
1.50
1.25
1.00
0.75
0.50
-2
-1
0
1
2
N Score

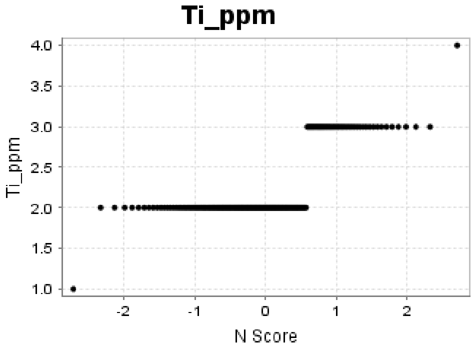

P_pct
P_pct
0.08
0.07
0.06
0.05
0.04
0.03
-2
-1
0
1
2
N Score

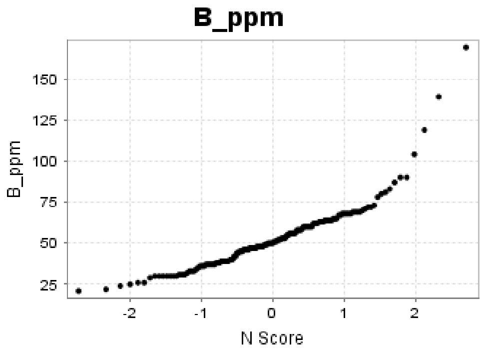

La_ppm
La_ppm
1.00
0.75
0.50
0.25
0.00
-2
-1
0
1
2
N Score

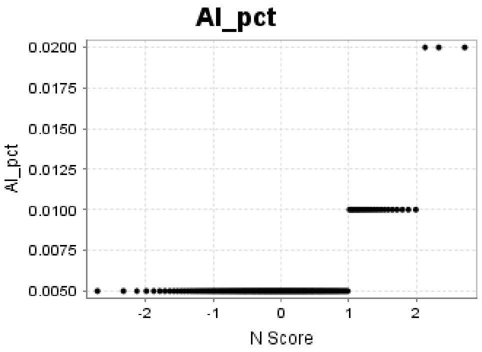

Cr_ppm
Cr_ppm
12.5
10.0
7.5
5.0
2.5
0.0
-2
-1
0
1
2
N Score

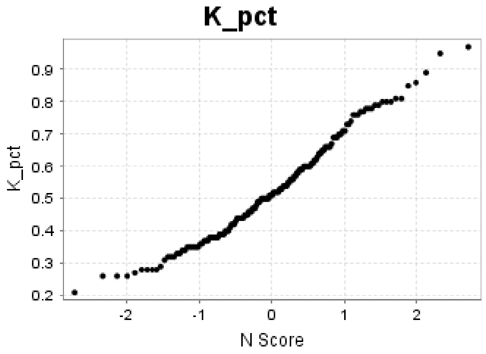

Mg_pct
Mg_pct
0.40
0.35
0.30
0.25
0.20
0.15
0.10
-2
-1
0
1
2
N Score

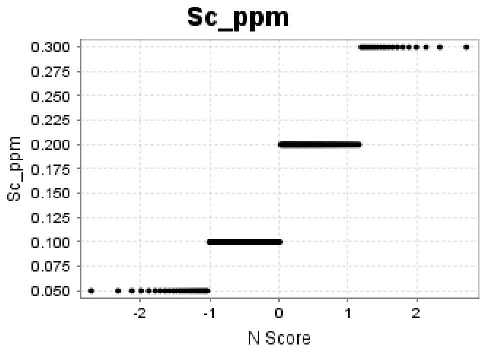

Ba_ppm
Ba_ppm
25
20
15
10
5
-2
-1
0
1
2
N Score

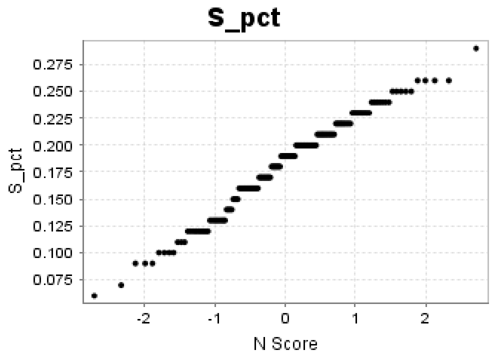

Ti_ppm
Ti_ppm
4.0
3.5
3.0
2.5
2.0
1.5
1.0
-2
-1
0
1
2
N Score

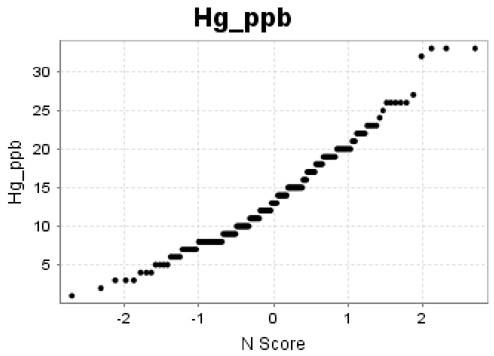

B_ppm
B_ppm
150
125
100
75
50
25
-2
-1
0
1
2
N Score

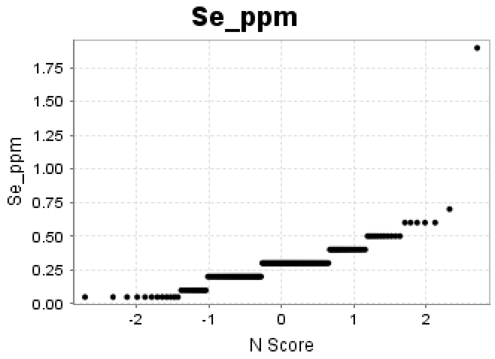

Al_pct
Al_pct
0.0200
0.0175
0.0150
0.0125
0.0100
0.0075
0.0050
-2
-1
0
1
2
N Score

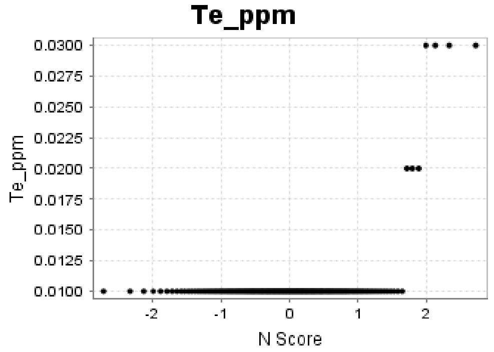

K_pct
K_pct
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
-2
-1
0
1
2
N Score

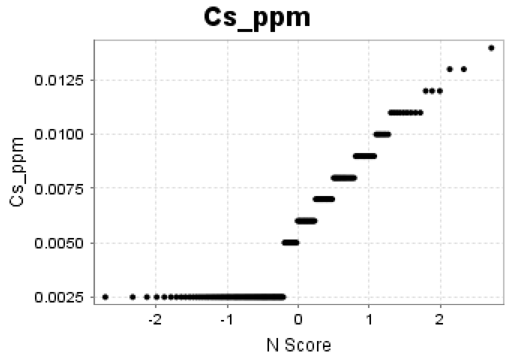

Sc_ppm
Sc_ppm
0.300
0.275
0.250
0.225
0.200
0.175
0.150
0.125
0.100
0.075
0.050
-2
-1
0
1
2
N Score

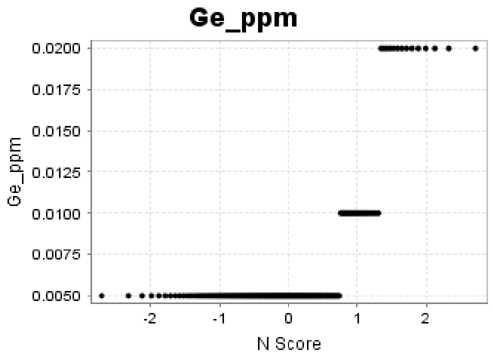

S_pct
S_pct
0.275
0.250
0.225
0.200
0.175
0.150
0.125
0.100
0.075
-2
-1
0
1
2
N Score

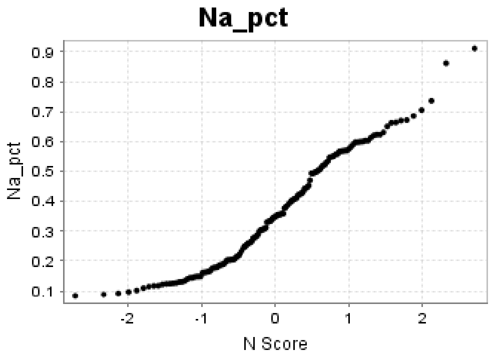

Hg_ppb
Hg_ppb
30
25
20
15
10
5
-2
-1
0
1
2
N Score

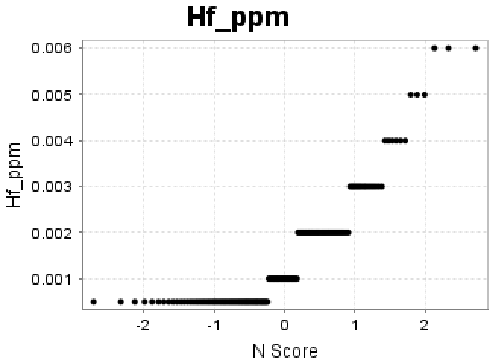

Se_ppm
Se_ppm
1.75
1.50
1.25
1.00
0.75
0.50
0.25
0.00
-2
-1
0
1
2
N Score

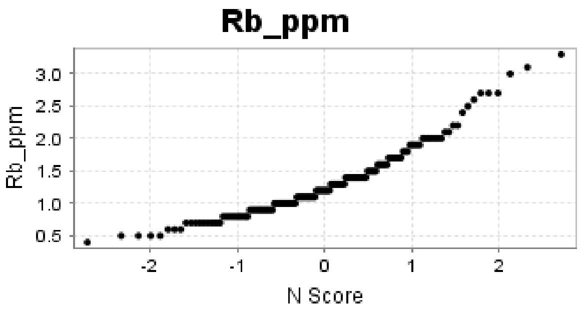

Te_ppm
Te_ppm
0.0300
0.0275
0.0250
0.0225
0.0200
0.0175
0.0150
0.0125
0.0100
-2
-1
0
1
2
N Score

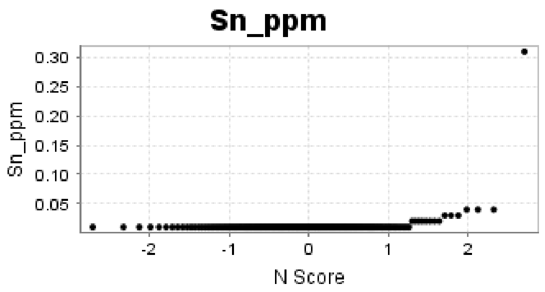

Cs_ppm
Cs_ppm
0.0125
0.0100
0.0075
0.0050
0.0025
-2
-1
0
1
2
N Score

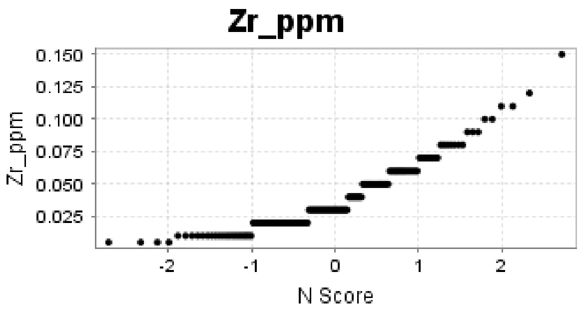

Ge_ppm
Ge_ppm
0.0200
0.0175
0.0150
0.0125
0.0100
0.0075
0.0050
-2
-1
0
1
2
N Score

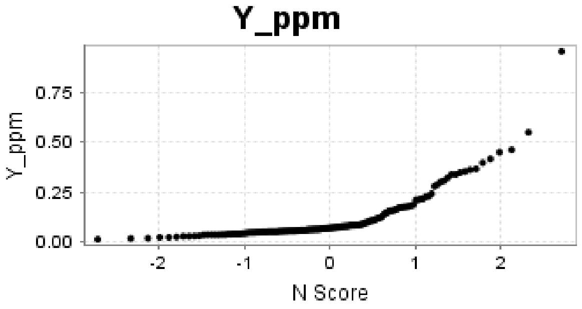

Na_pct
Na_pct
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
-2
-1
0
1
2
N Score

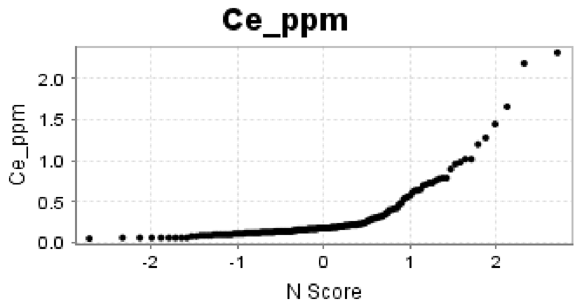

Hf_ppm
Hf_ppm
0.006
0.005
0.004
0.003
0.002
0.001
-2
-1
0
1
2
N Score

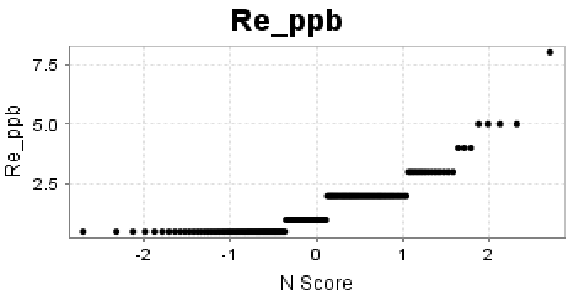

Rb_ppm
Rb_ppm
3.0
2.5
2.0
1.5
1.0
0.5
-2
-1
0
1
2
N Score

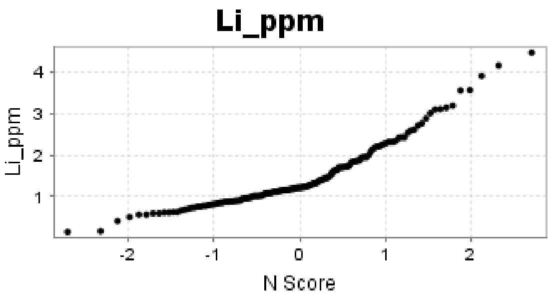

Sn_ppm
Sn_ppm
0.30
0.25
0.20
0.15
0.10
0.05
-2
-1
0
1
2
N Score

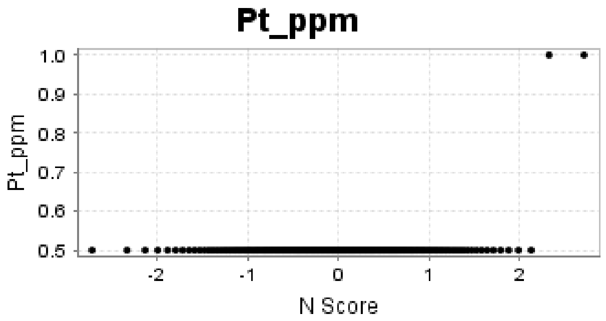

Zr_ppm
Zr_ppm
0.150
0.125
0.100
0.075
0.050
0.025
-2
-1
0
1
2
N Score

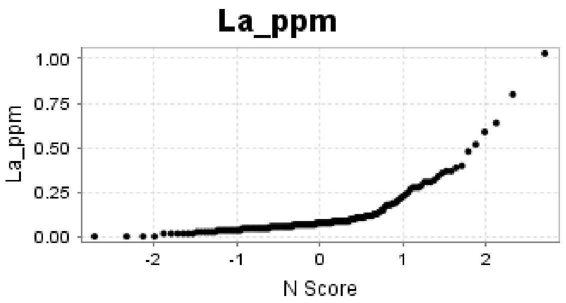

Y_ppm
Y_ppm
0.75
0.50
0.25
0.00
-2
-1
0
1
2
N Score

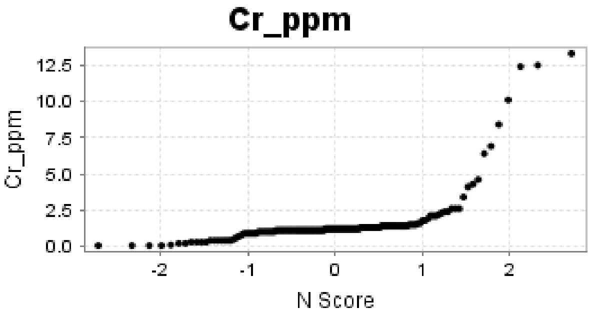

Ce_ppm
Ce_ppm
2.0
1.5
1.0
0.5
0.0
-2
-1
0
1
2
N Score

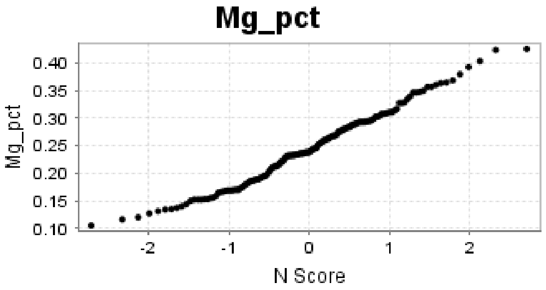

Re_ppb
Re_ppb
7.5
5.0
2.5
-2
-1
0
1
2
N Score

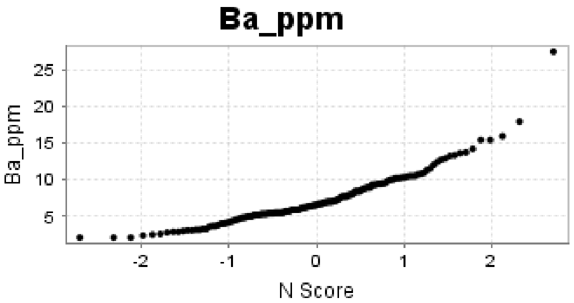

Li_ppm
Li_ppm
4
3
2
1
-2
-1
0
1
2
N Score

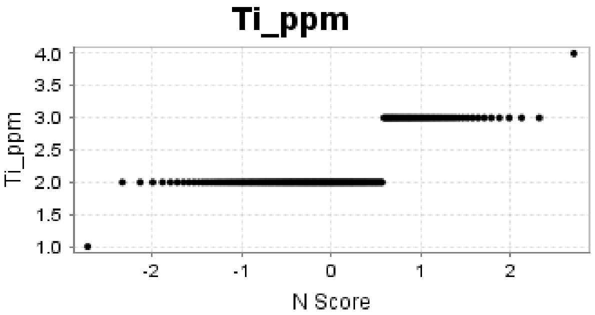

Pt_ppm
Pt_ppm
1.0
0.9
0.8
0.7
0.6
0.5
-2
-1
0
1
2
N Score


La_ppm
La_ppm
1.00
0.75
0.50
0.25
0.00
-2
-1
0
1
2
N Score

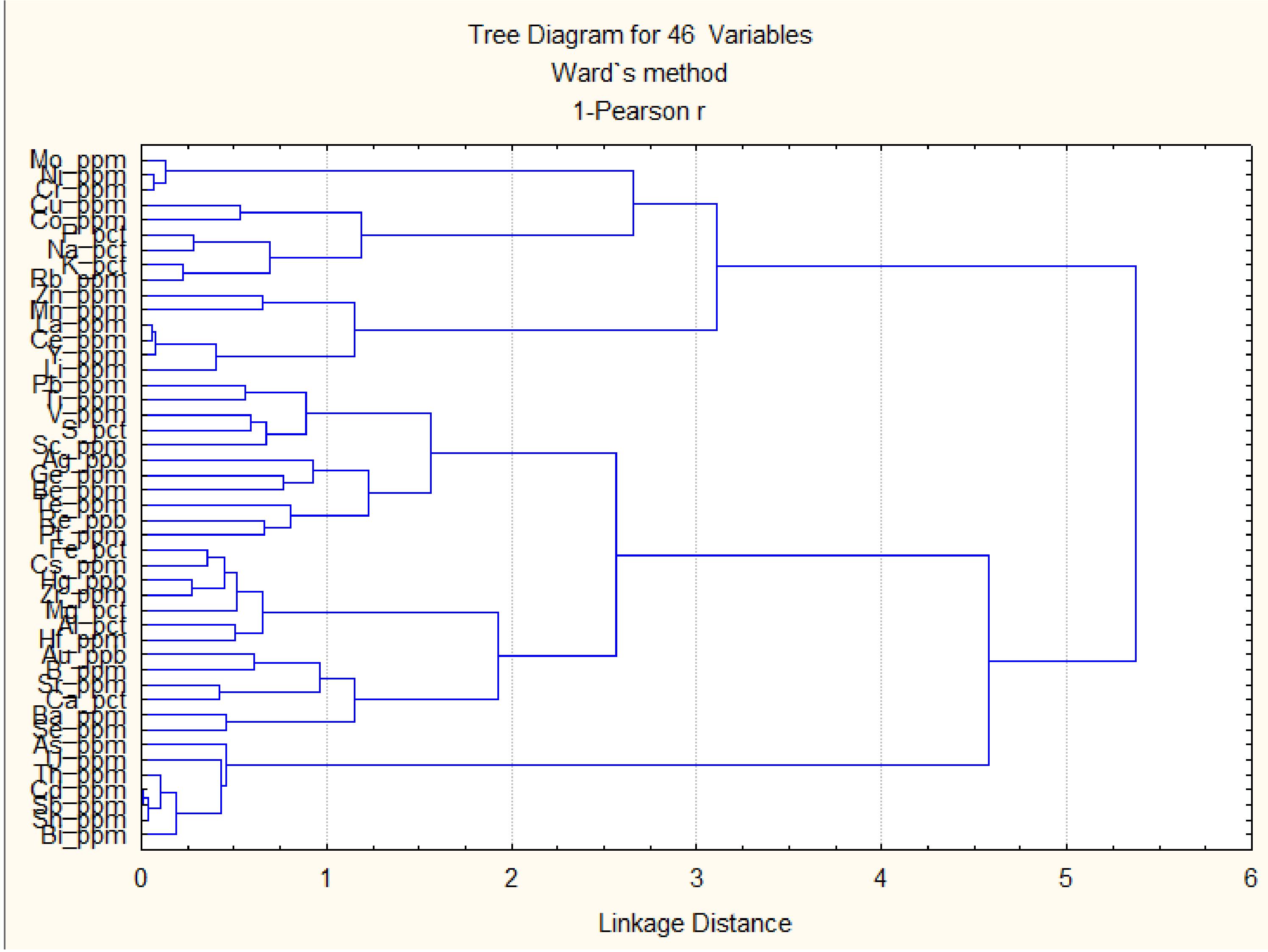

Cr_ppm
Cr_ppm
12.5
10.0
7.5
5.0
2.5
0.0
-2
-1
0
1
2
N Score


Mg_pct
Mg_pct
0.40
0.35
0.30
0.25
0.20
0.15
0.10
-2
-1
0
1
2
N Score


Ba_ppm
Ba_ppm
25
20
15
10
5
-2
-1
0
1
2
N Score


Ti_ppm
Ti_ppm
4.0
3.5
3.0
2.5
2.0
1.5
1.0
-2
-1
0
1
2
N Score

Appendix 4.4: Dendrogram of elements showing how closely they are linked by results



Appendix 4.5: Correlation matrix

	Mo	Cu	Pb	Zn	Ag	Ni	Co	Mn	Fe	As	U	Au	Th	Sr	Cd	Sb	Bi	V	Ca	P	La	Cr	Mg
Mo	1.00	0.01	0.17	0.03	0.01	0.86	0.06	-0.03	0.20	-0.08	-0.01	-0.01	-0.01	0.00	-0.03	-0.04	0.12	-0.05	0.00	-0.08	0.03	0.91	0.09
Cu	0.01	1.00	-0.17	0.28	-0.14	0.18	0.47	0.05	-0.29	0.04	0.17	-0.19	-0.07	-0.14	0.03	0.01	0.11	0.08	-0.25	0.38	0.02	0.09	-0.37
Pb	0.17	-0.17	1.00	-0.06	0.05	0.06	-0.02	-0.07	0.59	0.27	0.31	0.01	0.45	0.08	0.43	0.43	0.47	0.38	0.20	-0.28	-0.02	0.12	0.33
Zn	0.03	0.28	-0.06	1.00	-0.13	0.11	0.00	0.34	-0.13	0.09	0.06	-0.11	0.01	0.14	0.10	0.08	0.08	0.04	0.18	0.14	0.19	0.09	-0.03
Ag	0.01	-0.14	0.05	-0.13	1.00	-0.06	-0.04	-0.04	0.08	-0.02	-0.03	0.06	-0.02	-0.11	-0.01	-0.01	-0.01	-0.03	-0.07	-0.07	-0.03	-0.01	0.05
Ni	0.86	0.18	0.06	0.11	-0.06	1.00	0.14	0.19	0.00	-0.11	0.03	-0.01	-0.09	0.01	-0.06	-0.07	0.10	-0.07	0.00	-0.02	0.20	0.93	-0.09
Co	0.06	0.47	-0.02	0.00	-0.04	0.14	1.00	0.01	-0.03	0.28	0.41	-0.10	0.12	-0.20	0.18	0.17	0.21	-0.05	-0.35	0.08	-0.03	0.10	-0.30
Mn	-0.03	0.05	-0.07	0.34	-0.04	0.19	0.01	1.00	-0.23	0.02	0.12	0.04	-0.05	0.08	0.02	-0.01	0.00	-0.04	0.08	0.11	0.45	0.05	-0.25
Fe	0.20	-0.29	0.59	-0.13	0.08	0.00	-0.03	-0.23	1.00	0.46	0.31	0.03	0.68	-0.03	0.57	0.58	0.54	-0.01	0.20	-0.50	-0.15	0.06	0.51
As	-0.08	0.04	0.27	0.09	-0.02	-0.11	0.28	0.02	0.46	1.00	0.56	-0.05	0.65	-0.11	0.70	0.71	0.71	-0.11	-0.11	-0.11	0.06	-0.11	0.06
U	-0.01	0.17	0.31	0.06	-0.03	0.03	0.41	0.12	0.31	0.56	1.00	0.04	0.68	0.05	0.75	0.75	0.65	-0.05	-0.05	-0.10	0.25	0.02	-0.12
Au	-0.01	-0.19	0.01	-0.11	0.06	-0.01	-0.10	0.04	0.03	-0.05	0.04	1.00	-0.01	0.17	-0.04	-0.04	-0.05	-0.08	0.19	-0.12	0.27	-0.02	0.13
Th	-0.01	-0.07	0.45	0.01	-0.02	-0.09	0.12	-0.05	0.68	0.65	0.68	-0.01	1.00	0.02	0.92	0.93	0.82	-0.06	0.07	-0.11	0.07	-0.08	0.19
Sr	0.00	-0.14	0.08	0.14	-0.11	0.01	-0.20	0.08	-0.03	-0.11	0.05	0.17	0.02	1.00	-0.05	-0.06	-0.10	0.04	0.58	-0.03	0.20	0.08	0.25
Cd	-0.03	0.03	0.43	0.10	-0.01	-0.06	0.18	0.02	0.57	0.70	0.75	-0.04	0.92	-0.05	1.00	0.99	0.89	-0.02	-0.02	-0.03	0.12	-0.06	0.06
Sb	-0.04	0.01	0.43	0.08	-0.01	-0.07	0.17	-0.01	0.58	0.71	0.75	-0.04	0.93	-0.06	0.99	1.00	0.88	-0.03	-0.03	-0.05	0.10	-0.06	0.07
Bi	0.12	0.11	0.47	0.08	-0.01	0.10	0.21	0.00	0.54	0.71	0.65	-0.05	0.82	-0.10	0.89	0.88	1.00	-0.02	-0.09	-0.02	0.07	0.09	0.02
V	-0.05	0.08	0.38	0.04	-0.03	-0.07	-0.05	-0.04	-0.01	-0.11	-0.05	-0.08	-0.06	0.04	-0.02	-0.03	-0.02	1.00	0.08	0.05	-0.05	-0.01	-0.01
Ca	0.00	-0.25	0.20	0.18	-0.07	0.00	-0.35	0.08	0.20	-0.11	-0.05	0.19	0.07	0.58	-0.02	-0.03	-0.09	0.08	1.00	-0.36	0.22	0.01	0.49
P	-0.08	0.38	-0.28	0.14	-0.07	-0.02	0.08	0.11	-0.50	-0.11	-0.10	-0.12	-0.11	-0.03	-0.03	-0.05	-0.02	0.05	-0.36	1.00	0.03	0.02	-0.43
La	0.03	0.02	-0.02	0.19	-0.03	0.20	-0.03	0.45	-0.15	0.06	0.25	0.27	0.07	0.20	0.12	0.10	0.07	-0.05	0.22	0.03	1.00	0.08	-0.09
Cr	0.91	0.09	0.12	0.09	-0.01	0.93	0.10	0.05	0.06	-0.11	0.02	-0.02	-0.08	0.08	-0.06	-0.06	0.09	-0.01	0.01	0.02	0.08	1.00	-0.01
Mg	0.09	-0.37	0.33	-0.03	0.05	-0.09	-0.30	-0.25	0.51	0.06	-0.12	0.13	0.19	0.25	0.06	0.07	0.02	-0.01	0.49	-0.43	-0.09	-0.01	1.00
Ba	0.01	-0.24	0.22	0.01	-0.05	-0.10	-0.22	-0.06	0.17	-0.13	-0.04	0.06	0.06	0.37	-0.02	-0.02	-0.05	0.06	0.48	-0.20	-0.05	-0.03	0.39
Ti	0.06	0.02	0.44	-0.04	0.12	-0.07	-0.05	-0.10	0.45	0.11	0.07	0.05	0.40	0.10	0.31	0.29	0.32	0.20	0.10	0.20	-0.11	-0.02	0.25
B	0.01	-0.29	0.14	-0.04	0.04	0.00	-0.04	0.10	0.11	0.05	0.37	0.40	0.09	0.30	0.05	0.06	0.00	-0.10	0.38	-0.32	0.31	-0.01	0.12
Al	0.02	-0.25	0.47	-0.15	-0.03	-0.11	0.07	-0.06	0.63	0.31	0.39	0.10	0.59	0.02	0.42	0.43	0.38	-0.06	0.10	-0.32	0.03	-0.11	0.21
Na	-0.07	0.42	-0.30	0.18	-0.08	0.12	0.15	0.19	-0.57	-0.12	-0.04	-0.13	-0.15	-0.12	-0.05	-0.07	-0.04	0.07	-0.40	0.72	0.17	0.06	-0.60

K	0.03	0.44	-0.14	0.12	-0.08	0.14	0.25	0.03	-0.38	-0.04	-0.04	-0.14	-0.11	-0.21	0.00	-0.01	0.08	0.14	-0.39	0.64	-0.02	0.13	-0.45
Sc	-0.02	0.30	0.22	0.01	-0.05	-0.01	0.08	-0.04	-0.02	-0.03	0.05	-0.02	-0.08	-0.08	-0.03	-0.06	0.05	0.33	0.00	0.07	-0.06	-0.04	-0.14
S	-0.01	-0.02	0.27	0.03	0.05	-0.14	-0.19	-0.24	0.17	-0.11	-0.17	0.12	-0.06	0.22	-0.10	-0.11	-0.10	0.41	0.38	0.02	-0.18	-0.05	0.38
Hg	0.09	-0.38	0.40	-0.07	0.06	-0.01	-0.16	-0.07	0.55	0.08	0.13	0.21	0.21	0.32	0.05	0.05	0.04	-0.01	0.61	-0.60	0.09	0.01	0.49
Se	0.14	-0.15	0.19	0.00	0.00	0.04	-0.14	-0.11	0.24	0.10	-0.11	0.13	0.04	0.06	0.00	0.01	0.02	-0.06	0.19	-0.21	-0.10	0.10	0.32
Te	-0.06	0.10	0.07	0.09	-0.01	-0.01	-0.02	-0.03	-0.04	-0.04	0.01	-0.04	0.00	0.12	0.00	-0.02	-0.04	0.16	0.29	-0.07	0.17	-0.02	0.12
Cs	0.09	-0.38	0.32	-0.17	0.06	-0.09	-0.18	-0.23	0.65	0.14	-0.12	0.13	0.26	0.03	0.07	0.09	0.11	-0.19	0.17	-0.44	-0.14	-0.06	0.49
Ge	-0.05	0.13	0.20	-0.02	0.24	-0.05	0.07	-0.02	0.07	-0.05	0.13	0.03	0.04	-0.07	0.06	0.05	0.04	0.10	0.01	-0.07	0.06	-0.05	0.02
Hf	0.02	-0.35	0.26	-0.06	0.03	-0.13	-0.16	0.00	0.53	0.13	0.04	0.20	0.38	0.13	0.22	0.22	0.19	-0.08	0.24	-0.38	-0.11	-0.13	0.39
Rb	0.00	0.37	-0.03	0.06	-0.08	0.09	0.06	-0.02	-0.23	-0.02	-0.20	-0.13	-0.11	-0.26	-0.03	-0.03	0.07	0.09	-0.33	0.45	-0.07	0.05	-0.28
Sn	-0.04	-0.02	0.45	0.04	-0.01	-0.08	0.15	-0.02	0.60	0.69	0.73	0.01	0.92	-0.03	0.97	0.98	0.87	-0.05	0.04	-0.09	0.08	-0.07	0.14
Zr	0.05	-0.42	0.44	-0.20	0.13	-0.14	-0.23	-0.25	0.72	0.11	-0.06	0.10	0.32	0.14	0.11	0.12	0.10	0.00	0.45	-0.58	-0.18	-0.08	0.68
Y	0.07	-0.02	-0.05	0.18	-0.05	0.25	-0.02	0.52	-0.24	-0.04	0.23	0.32	-0.07	0.21	-0.03	-0.05	-0.05	-0.01	0.22	-0.01	0.94	0.14	-0.13
Ce	-0.01	0.04	-0.04	0.22	-0.04	0.18	-0.04	0.48	-0.24	-0.03	0.16	0.24	-0.06	0.20	-0.02	-0.04	-0.05	0.04	0.23	0.05	0.95	0.05	-0.12
Re	0.24	0.03	0.04	0.25	0.03	0.32	-0.01	0.23	0.01	-0.12	0.02	0.06	-0.04	0.09	-0.05	-0.07	-0.05	0.03	0.24	-0.01	0.22	0.27	0.00
Be	-0.03	0.12	-0.05	-0.04	-0.01	-0.02	0.14	-0.04	-0.06	-0.03	0.20	0.01	-0.02	0.00	-0.01	-0.01	-0.01	-0.03	-0.09	-0.01	-0.04	-0.02	-0.12
Li	0.05	-0.03	0.01	0.22	-0.07	0.22	0.05	0.43	-0.17	0.00	0.37	0.18	-0.02	0.31	0.01	-0.01	-0.03	-0.02	0.32	-0.07	0.66	0.14	-0.05
Pt	-0.01	0.19	0.07	0.03	-0.01	0.04	0.00	0.02	0.04	-0.04	0.00	-0.01	0.02	-0.02	0.01	-0.01	-0.02	0.05	0.10	0.03	0.25	0.01	-0.04

Appendix 4.5 Cont.

Ba	Ti	B	Al	Na	K	Sc	S	Hg	Se	Te	Cs	Ge	Hf	Rb	Sn	Zr	Y	Ce	Re	Be	Li	Pt
0.01	0.06	0.01	0.02	-0.07	0.03	-0.02	-0.01	0.09	0.14	-0.06	0.09	-0.05	0.02	0.00	-0.04	0.05	0.07	-0.01	0.24	-0.03	0.05	-0.01
-0.24	0.02	-0.29	-0.25	0.42	0.44	0.30	-0.02	-0.38	-0.15	0.10	-0.38	0.13	-0.35	0.37	-0.02	-0.42	-0.02	0.04	0.03	0.12	-0.03	0.19
0.22	0.44	0.14	0.47	-0.30	-0.14	0.22	0.27	0.40	0.19	0.07	0.32	0.20	0.26	-0.03	0.45	0.44	-0.05	-0.04	0.04	-0.05	0.01	0.07
0.01	-0.04	-0.04	-0.15	0.18	0.12	0.01	0.03	-0.07	0.00	0.09	-0.17	-0.02	-0.06	0.06	0.04	-0.20	0.18	0.22	0.25	-0.04	0.22	0.03
-0.05	0.12	0.04	-0.03	-0.08	-0.08	-0.05	0.05	0.06	0.00	-0.01	0.06	0.24	0.03	-0.08	-0.01	0.13	-0.05	-0.04	0.03	-0.01	-0.07	-0.01
-0.10	-0.07	0.00	-0.11	0.12	0.14	-0.01	-0.14	-0.01	0.04	-0.01	-0.09	-0.05	-0.13	0.09	-0.08	-0.14	0.25	0.18	0.32	-0.02	0.22	0.04
-0.22	-0.05	-0.04	0.07	0.15	0.25	0.08	-0.19	-0.16	-0.14	-0.02	-0.18	0.07	-0.16	0.06	0.15	-0.23	-0.02	-0.04	-0.01	0.14	0.05	0.00
-0.06	-0.10	0.10	-0.06	0.19	0.03	-0.04	-0.24	-0.07	-0.11	-0.03	-0.23	-0.02	0.00	-0.02	-0.02	-0.25	0.52	0.48	0.23	-0.04	0.43	0.02
0.17	0.45	0.11	0.63	-0.57	-0.38	-0.02	0.17	0.55	0.24	-0.04	0.65	0.07	0.53	-0.23	0.60	0.72	-0.24	-0.24	0.01	-0.06	-0.17	0.04
-0.13	0.11	0.05	0.31	-0.12	-0.04	-0.03	-0.11	0.08	0.10	-0.04	0.14	-0.05	0.13	-0.02	0.69	0.11	-0.04	-0.03	-0.12	-0.03	0.00	-0.04
-0.04	0.07	0.37	0.39	-0.04	-0.04	0.05	-0.17	0.13	-0.11	0.01	-0.12	0.13	0.04	-0.20	0.73	-0.06	0.23	0.16	0.02	0.20	0.37	0.00
0.06	0.05	0.40	0.10	-0.13	-0.14	-0.02	0.12	0.21	0.13	-0.04	0.13	0.03	0.20	-0.13	0.01	0.10	0.32	0.24	0.06	0.01	0.18	-0.01
0.06	0.40	0.09	0.59	-0.15	-0.11	-0.08	-0.06	0.21	0.04	0.00	0.26	0.04	0.38	-0.11	0.92	0.32	-0.07	-0.06	-0.04	-0.02	-0.02	0.02
0.37	0.10	0.30	0.02	-0.12	-0.21	-0.08	0.22	0.32	0.06	0.12	0.03	-0.07	0.13	-0.26	-0.03	0.14	0.21	0.20	0.09	0.00	0.31	-0.02
-0.02	0.31	0.05	0.42	-0.05	0.00	-0.03	-0.10	0.05	0.00	0.00	0.07	0.06	0.22	-0.03	0.97	0.11	-0.03	-0.02	-0.05	-0.01	0.01	0.01
-0.02	0.29	0.06	0.43	-0.07	-0.01	-0.06	-0.11	0.05	0.01	-0.02	0.09	0.05	0.22	-0.03	0.98	0.12	-0.05	-0.04	-0.07	-0.01	-0.01	-0.01
-0.05	0.32	0.00	0.38	-0.04	0.08	0.05	-0.10	0.04	0.02	-0.04	0.11	0.04	0.19	0.07	0.87	0.10	-0.05	-0.05	-0.05	-0.01	-0.03	-0.02
0.06	0.20	-0.10	-0.06	0.07	0.14	0.33	0.41	-0.01	-0.06	0.16	-0.19	0.10	-0.08	0.09	-0.05	0.00	-0.01	0.04	0.03	-0.03	-0.02	0.05
0.48	0.10	0.38	0.10	-0.40	-0.39	0.00	0.38	0.61	0.19	0.29	0.17	0.01	0.24	-0.33	0.04	0.45	0.22	0.23	0.24	-0.09	0.32	0.10
-0.20	0.20	-0.32	-0.32	0.72	0.64	0.07	0.02	-0.60	-0.21	-0.07	-0.44	-0.07	-0.38	0.45	-0.09	-0.58	-0.01	0.05	-0.01	-0.01	-0.07	0.03
-0.05	-0.11	0.31	0.03	0.17	-0.02	-0.06	-0.18	0.09	-0.10	0.17	-0.14	0.06	-0.11	-0.07	0.08	-0.18	0.94	0.95	0.22	-0.04	0.66	0.25
-0.03	-0.02	-0.01	-0.11	0.06	0.13	-0.04	-0.05	0.01	0.10	-0.02	-0.06	-0.05	-0.13	0.05	-0.07	-0.08	0.14	0.05	0.27	-0.02	0.14	0.01
0.39	0.25	0.12	0.21	-0.60	-0.45	-0.14	0.38	0.49	0.32	0.12	0.49	0.02	0.39	-0.28	0.14	0.68	-0.13	-0.12	0.00	-0.12	-0.05	-0.04
1.00	0.13	0.28	0.09	-0.32	-0.42	-0.01	0.31	0.34	0.54	0.12	0.17	-0.04	0.15	-0.41	0.04	0.35	-0.06	-0.06	0.03	-0.04	0.02	0.04
0.13	1.00	-0.12	0.31	-0.08	0.02	0.29	0.32	0.19	0.07	0.12	0.30	0.15	0.26	0.09	0.32	0.39	-0.18	-0.11	0.07	-0.05	-0.17	0.05
0.28	-0.12	1.00	0.37	-0.24	-0.42	0.06	0.09	0.57	0.07	0.06	0.08	0.05	0.18	-0.51	0.09	0.16	0.43	0.30	0.25	0.04	0.59	-0.01
0.09	0.31	0.37	1.00	-0.26	-0.29	0.06	-0.01	0.54	0.02	-0.04	0.46	0.02	0.49	-0.22	0.44	0.48	0.01	-0.05	0.16	-0.03	0.02	0.07
-0.32	-0.08	-0.24	-0.26	1.00	0.59	0.11	-0.16	-0.57	-0.26	-0.08	-0.51	-0.13	-0.46	0.42	-0.12	-0.64	0.15	0.20	0.11	0.00	0.07	0.01

-0.42	0.02	-0.42	-0.29	0.59	1.00	0.11	-0.01	-0.56	-0.25	-0.10	-0.32	0.01	-0.35	0.77	-0.06	-0.50	-0.06	0.01	-0.03	0.06	-0.08	-0.03
-0.01	0.29	0.06	0.06	0.11	0.11	1.00	0.36	0.12	-0.10	0.25	-0.14	0.16	-0.07	0.09	-0.01	0.03	-0.03	-0.03	0.17	0.05	0.01	0.07
0.31	0.32	0.09	-0.01	-0.16	-0.01	0.36	1.00	0.34	0.23	0.18	0.12	0.09	0.09	-0.01	-0.06	0.34	-0.17	-0.12	0.14	-0.04	-0.05	0.11
0.34	0.19	0.57	0.54	-0.57	-0.56	0.12	0.34	1.00	0.22	0.11	0.50	0.06	0.46	-0.48	0.11	0.72	0.14	0.08	0.31	-0.05	0.25	0.09
0.54	0.07	0.07	0.02	-0.26	-0.25	-0.10	0.23	0.22	1.00	0.03	0.22	-0.11	0.06	-0.20	0.00	0.21	-0.14	-0.14	-0.09	-0.04	-0.13	0.00
0.12	0.12	0.06	-0.04	-0.08	-0.10	0.25	0.18	0.11	0.03	1.00	-0.03	0.16	0.05	-0.05	0.02	0.08	0.10	0.15	0.15	-0.02	0.10	0.31
0.17	0.30	0.08	0.46	-0.51	-0.32	-0.14	0.12	0.50	0.22	-0.03	1.00	0.06	0.56	-0.01	0.12	0.71	-0.20	-0.18	-0.14	-0.08	-0.20	0.04
-0.04	0.15	0.05	0.02	-0.13	0.01	0.16	0.09	0.06	-0.11	0.16	0.06	1.00	0.09	0.02	0.06	0.07	0.02	0.04	0.16	0.24	0.11	0.34
0.15	0.26	0.18	0.49	-0.46	-0.35	-0.07	0.09	0.46	0.06	0.05	0.56	0.09	1.00	-0.26	0.28	0.60	-0.15	-0.18	0.05	-0.07	-0.13	0.06
-0.41	0.09	-0.51	-0.22	0.42	0.77	0.09	-0.01	-0.48	-0.20	-0.05	-0.01	0.02	-0.26	1.00	-0.06	-0.34	-0.16	-0.05	-0.13	-0.03	-0.26	0.07
0.04	0.32	0.09	0.44	-0.12	-0.06	-0.01	-0.06	0.11	0.00	0.02	0.12	0.06	0.28	-0.06	1.00	0.23	-0.06	-0.05	-0.06	-0.01	-0.01	-0.02
0.35	0.39	0.16	0.48	-0.64	-0.50	0.03	0.34	0.72	0.21	0.08	0.71	0.07	0.60	-0.34	0.23	1.00	-0.20	-0.20	0.08	-0.06	-0.14	0.03
-0.06	-0.18	0.43	0.01	0.15	-0.06	-0.03	-0.17	0.14	-0.14	0.10	-0.20	0.02	-0.15	-0.16	-0.06	-0.20	1.00	0.93	0.26	-0.02	0.77	0.13
-0.06	-0.11	0.30	-0.05	0.20	0.01	-0.03	-0.12	0.08	-0.14	0.15	-0.18	0.04	-0.18	-0.05	-0.05	-0.20	0.93	1.00	0.22	-0.04	0.70	0.16
0.03	0.07	0.25	0.16	0.11	-0.03	0.17	0.14	0.31	-0.09	0.15	-0.14	0.16	0.05	-0.13	-0.06	0.08	0.26	0.22	1.00	-0.07	0.28	0.34
-0.04	-0.05	0.04	-0.03	0.00	0.06	0.05	-0.04	-0.05	-0.04	-0.02	-0.08	0.24	-0.07	-0.03	-0.01	-0.06	-0.02	-0.04	-0.07	1.00	0.10	-0.01
0.02	-0.17	0.59	0.02	0.07	-0.08	0.01	-0.05	0.25	-0.13	0.10	-0.20	0.11	-0.13	-0.26	-0.01	-0.14	0.77	0.70	0.28	0.10	1.00	0.03
0.04	0.05	-0.01	0.07	0.01	-0.03	0.07	0.11	0.09	0.00	0.31	0.04	0.34	0.06	0.07	-0.02	0.03	0.13	0.16	0.34	-0.01	0.03	1.00

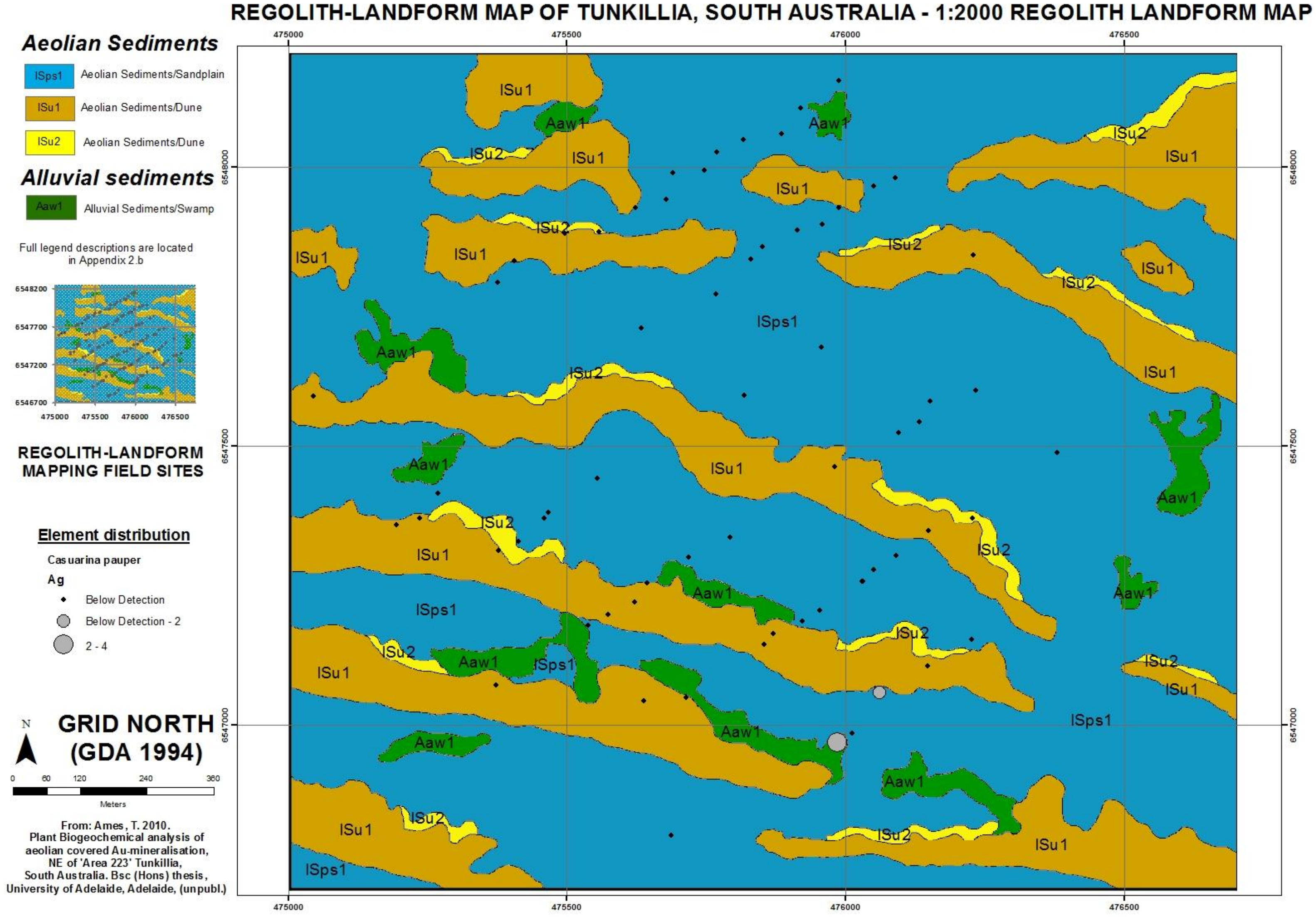
Appendix 5: Bore Hole data tables

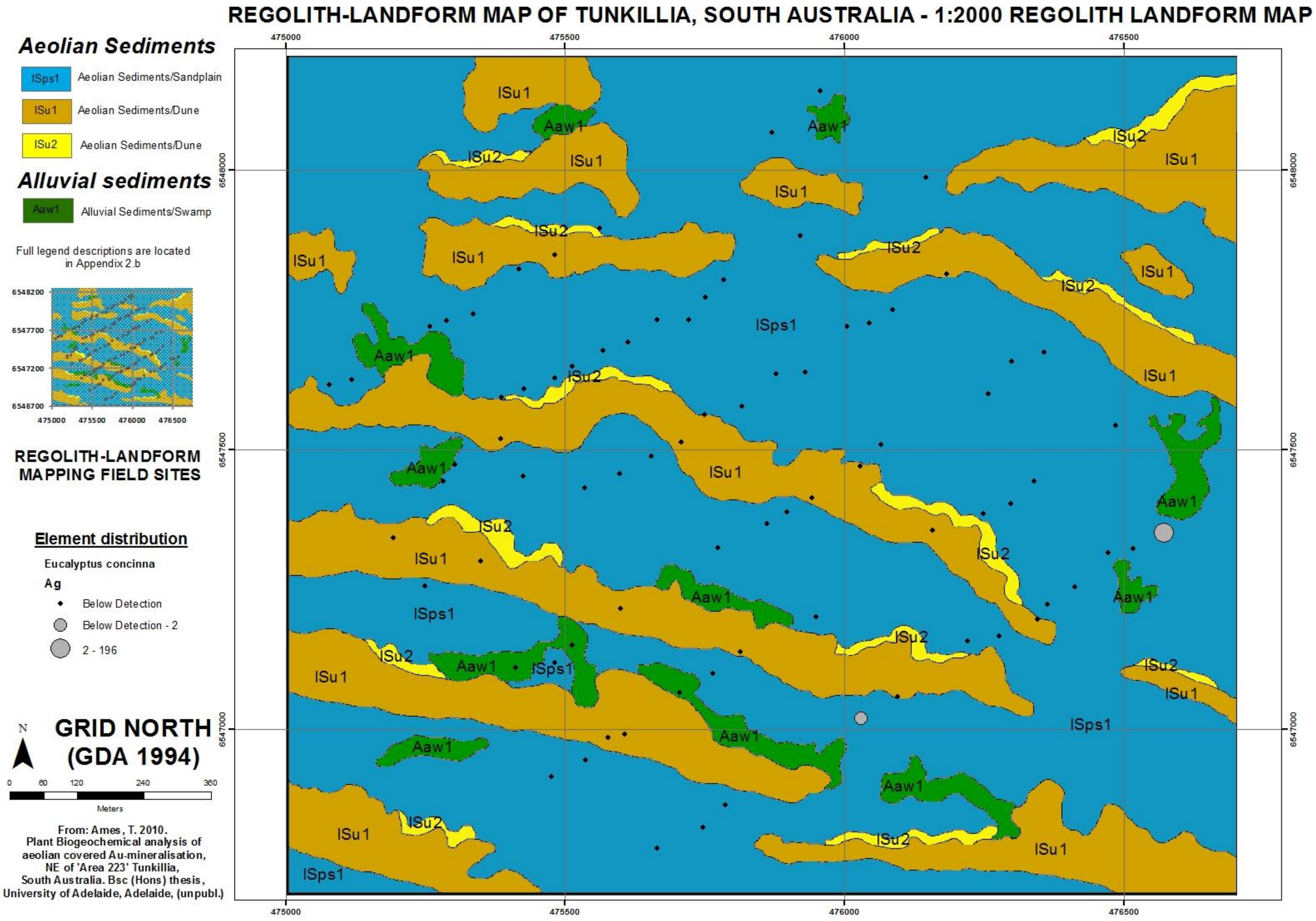
			Fe	Ca	Au	B	Cu	Zn	Mo	Ce	Pb
223N 119	476012	6546984	0.003	0.6	<0.2	30	2.27	8.6	0.03	0.4	0.04
TK73	475994	6547006	0.29	665	0.014	7.5	0.106	0.26	0.0005	0.183	0.008

			Fe	Ca	Au	B	Cu	Zn	Mo	Ce	Pb
223N 121	476095	6547058	0.002	0.98	0.2	48	2.23	8.4	0.03	0.42	0.04
TK74	476099	6547067	0.35	777	0.008	7.5	0.132	0.51	0.0002	0.49	0.02

			Fe	Ca	Au	B	Cu	Zn	Mo	Ce	Pb
223N 119	476012	6546984	0.003	0.6	<0.2	30	2.27	8.6	0.03	0.4	0.04
TK75	476285	6547178	0.77	714	0.012	6.7	0.335	0.72	0.0011	0.053	0.06

Appendix 6: Chemical assay results overlain spatially over Regolith-landform map





From: Ames, T. 2010.
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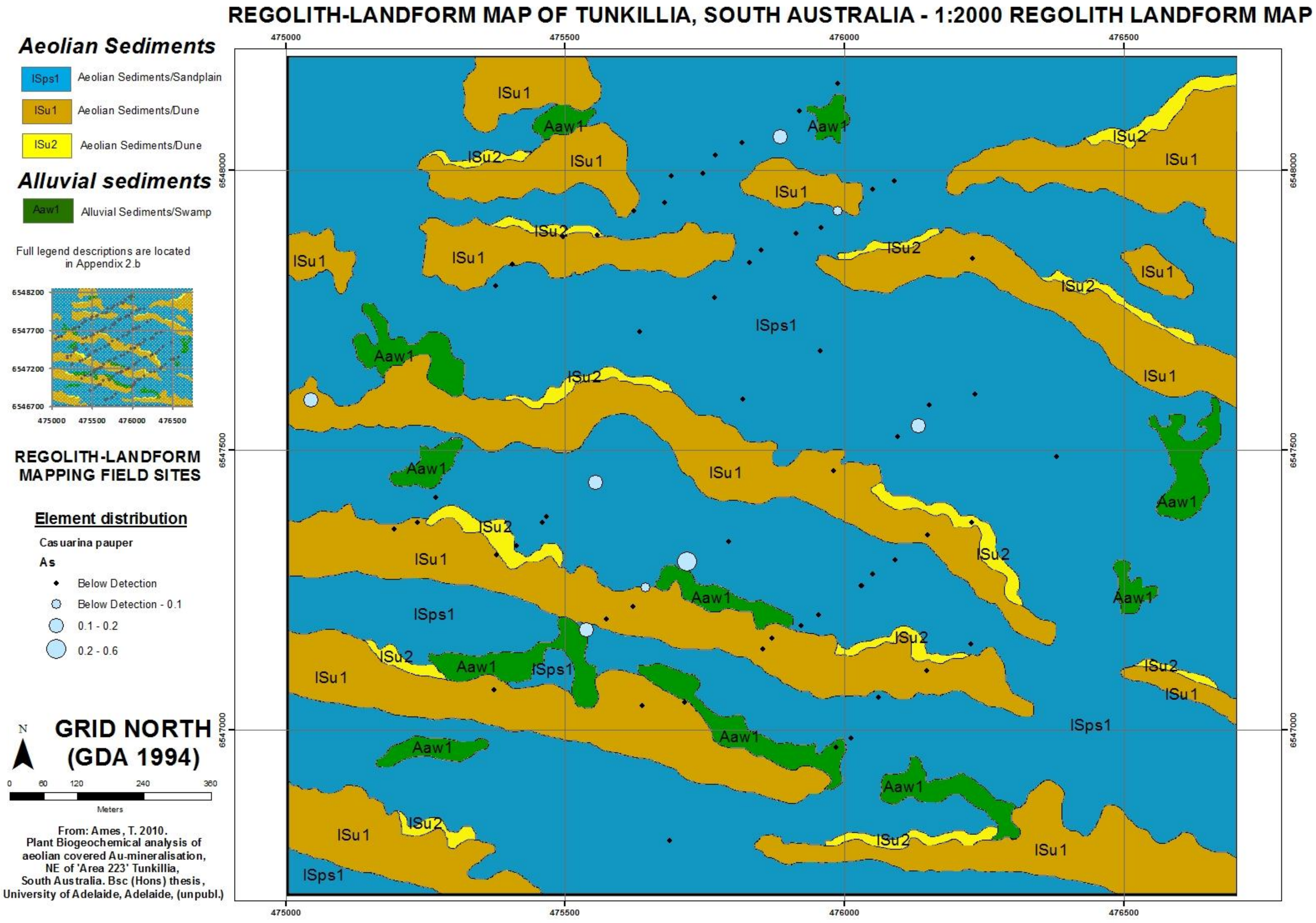
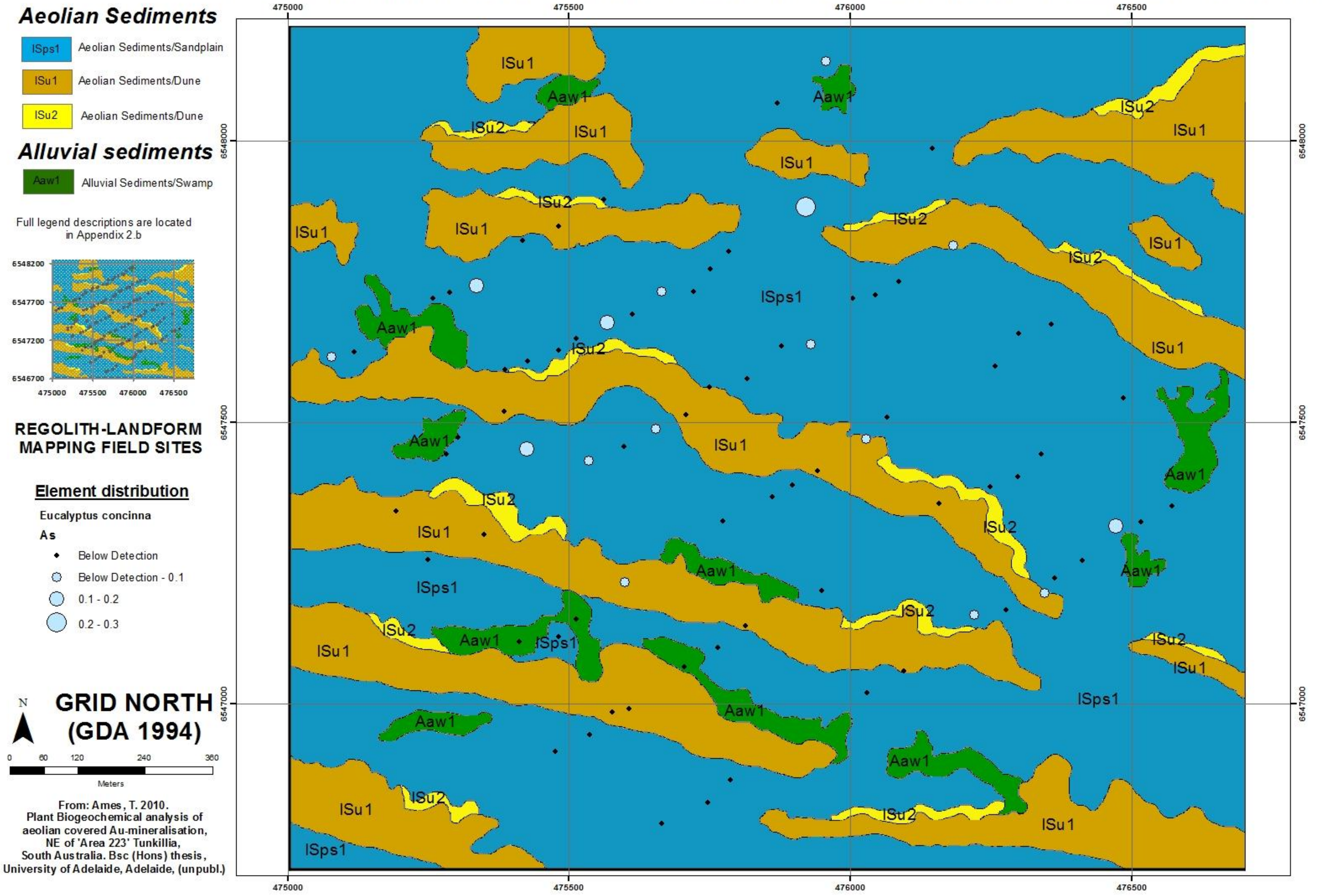


From: Ames, T. 2010.
Plant Biogeochemical analysis of aeolian covered Au-mineralisation, NE of 'Area 223' Tunkillia, South Australia. Bsc (Hons) thesis, University of Adelaide, Adelaide, (unpubl.)

REGOLITH-LANDFORM MAP OF TUNKILLIA, SOUTH AUSTRALIA - 1:2000 REGOLITH LANDFORM MAP



From: Ames, T. 2010.
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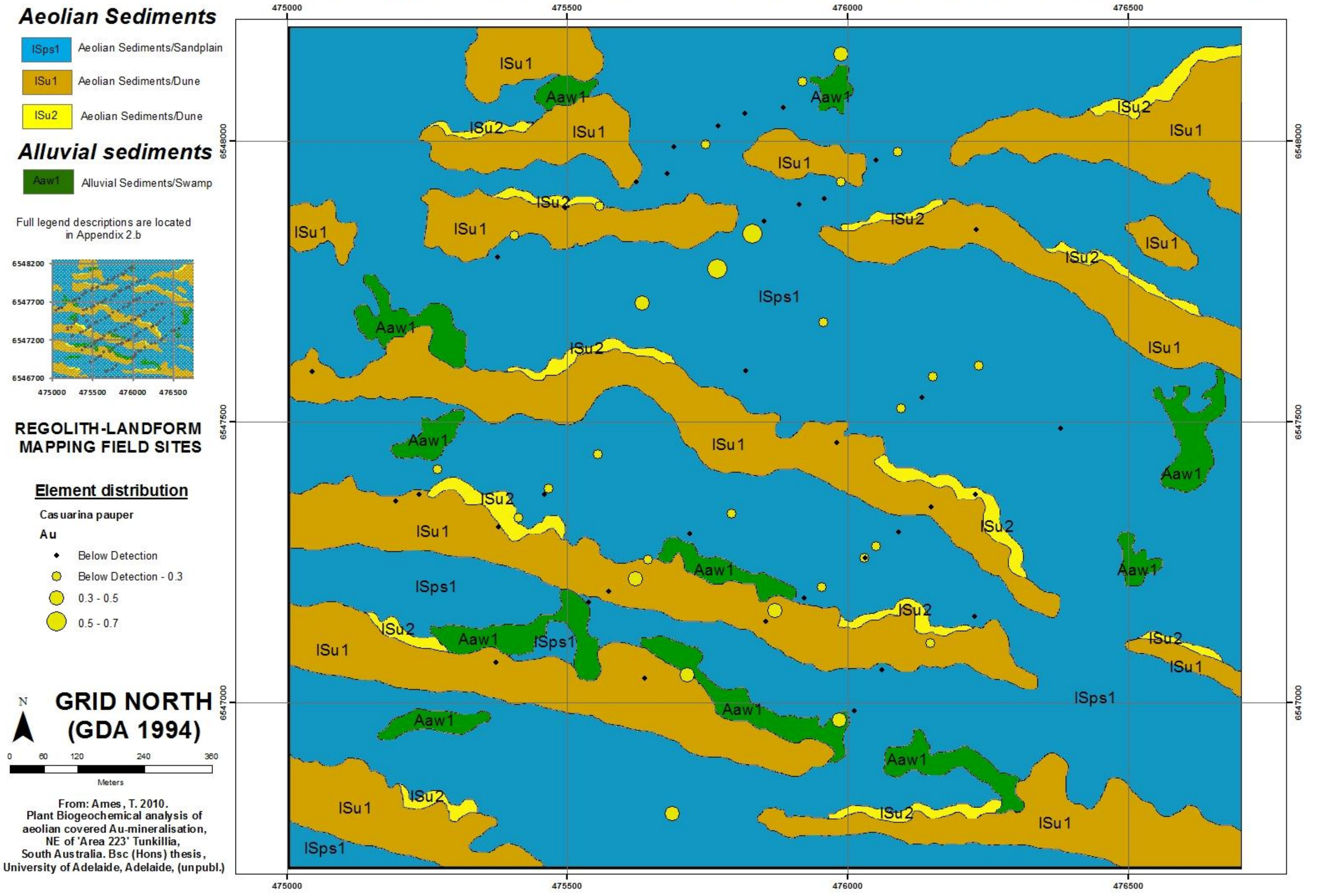
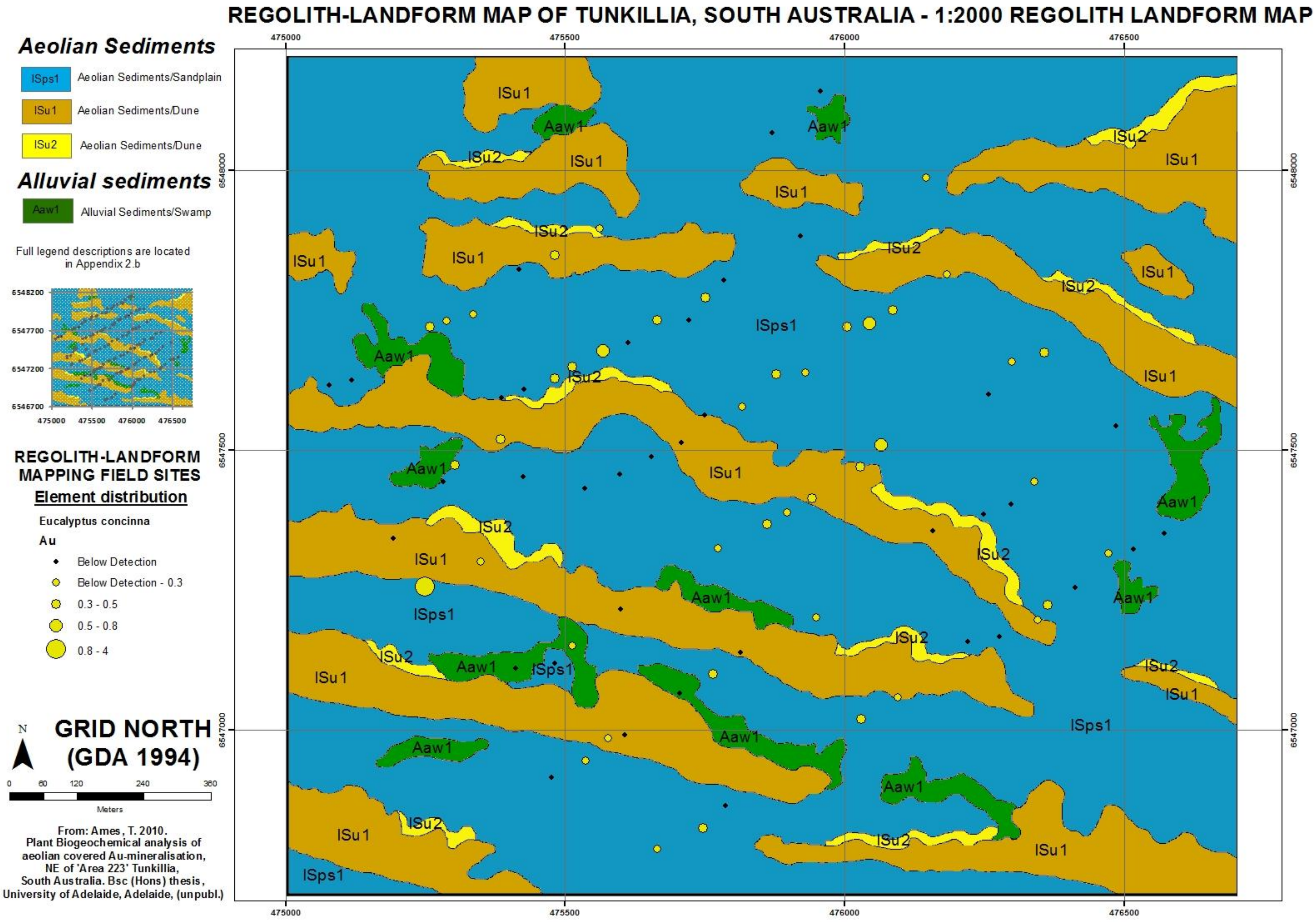
REGOLITH-LANDFORM MAP OF TUNKILLIA, SOUTH AUSTRALIA - 1:2000 REGOLITH LANDFORM MAP



From: Ames, T. 2010.
Plant Biogeochemical analysis of aeolian covered Au-mineralisation, NE of 'Area 223' Tunkillia, South Australia. Bsc (Hons) thesis, University of Adelaide, Adelaide, (unpubl.)



REGOLITH-LANDFORM MAP OF TUNKILLIA, SOUTH AUSTRALIA - 1:2000 REGOLITH LANDFORM MAP

From: Ames, T. 2010.
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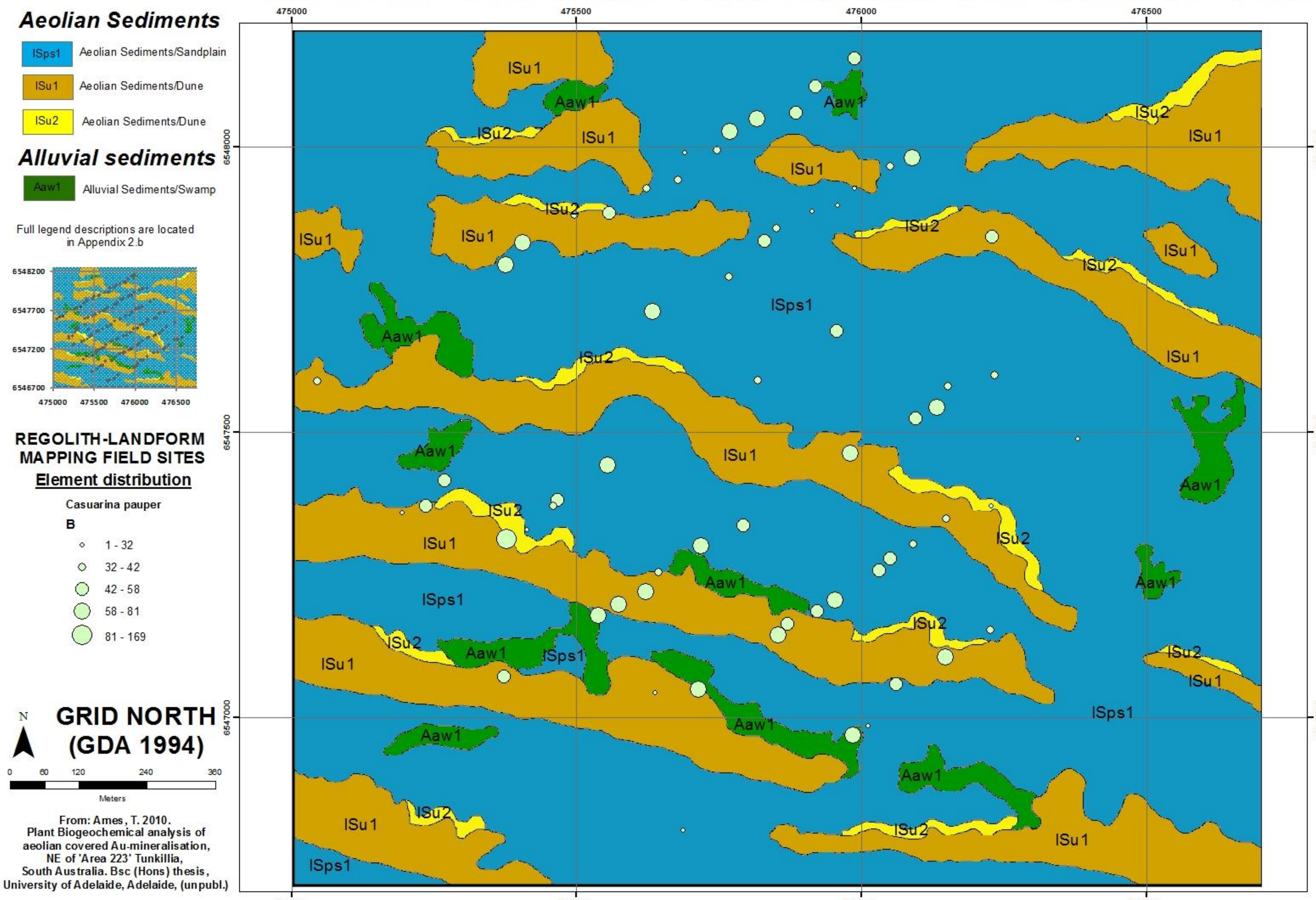
REGOLITH-LANDFORM MAP OF TUNKILLIA, SOUTH AUSTRALIA - 1:2000 REGOLITH LANDFORM MAP



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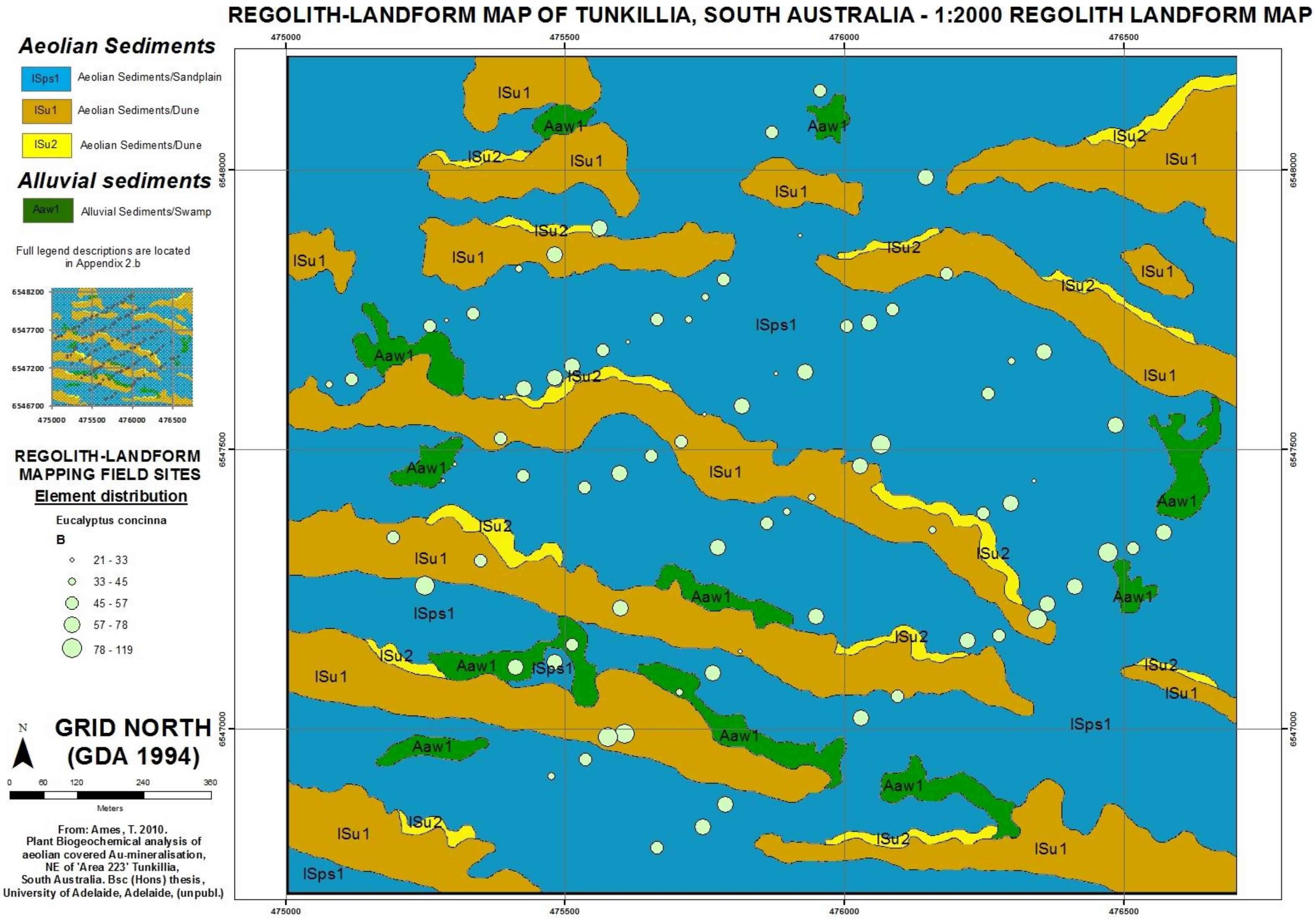
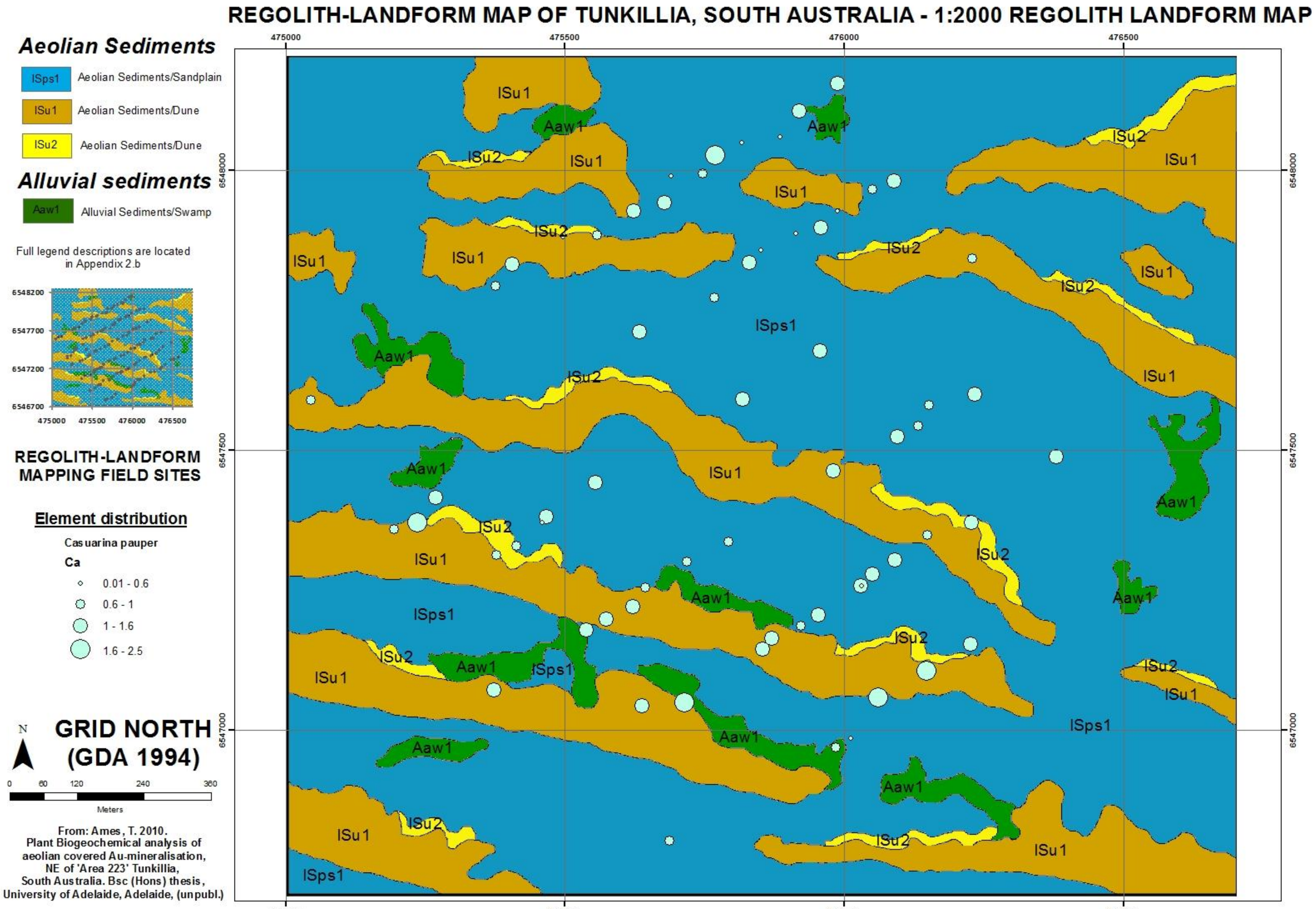
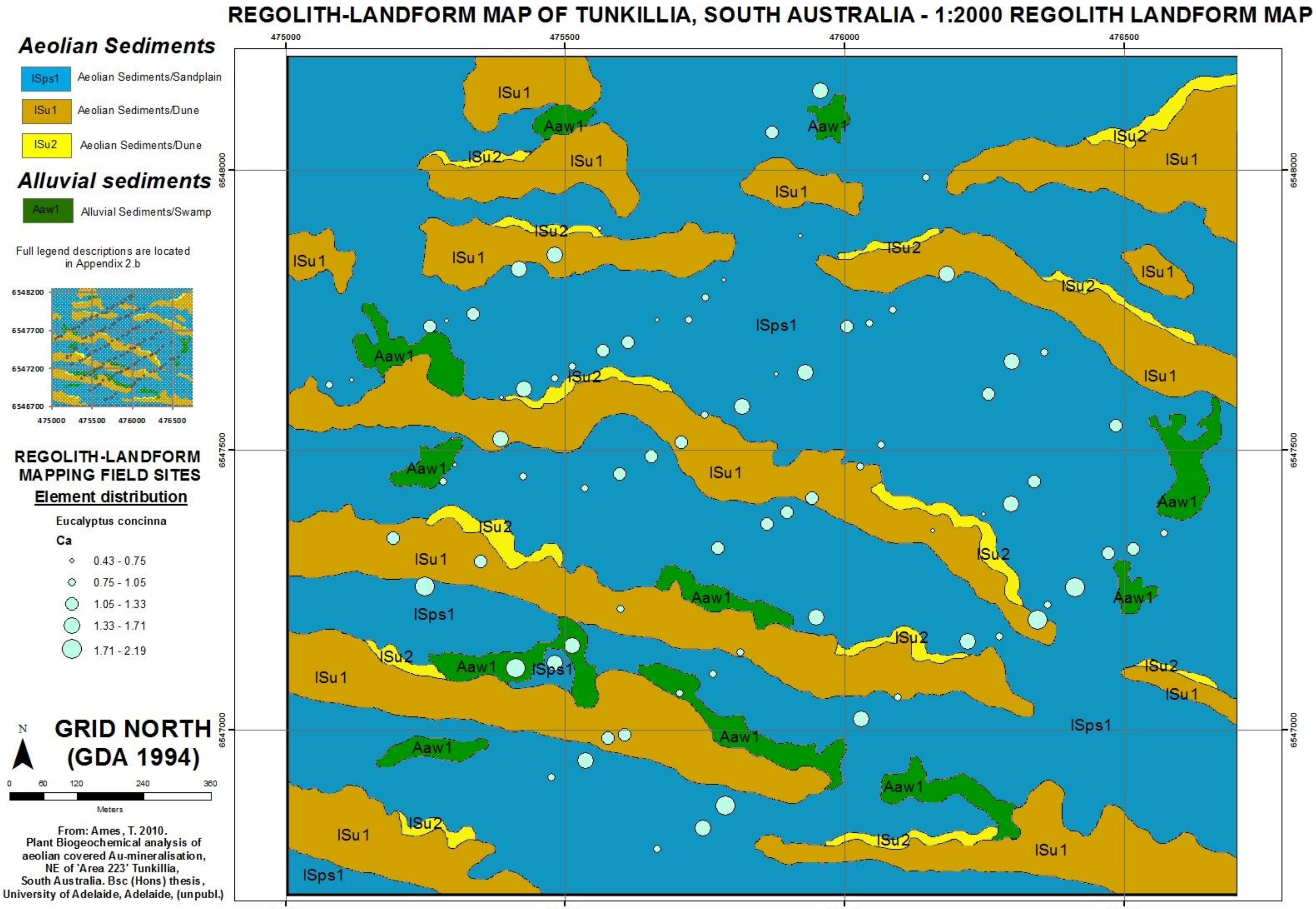

REGOLITH-LANDFORM MAP OF TUNKILLIA, SOUTH AUSTRALIA - 1:2000 REGOLITH LANDFORM MAP
Aeolian Sediments
ISps1 Aeolian Sediments/Sandplain
ISu1 Aeolian Sediments/Dune
ISu2 Aeolian Sediments/Dune
Alluvial sediments
Aaw1 Alluvial Sediments/Swamp
Full legend descriptions are located in Appendix 2.b
6548200
6547700
6547200
6546700
475000 475500 476000 476500
REGOLITH-LANDFORM MAPPING FIELD SITES
Element distribution
Eucalyptus concinna
B
21 - 33
33 - 45
45 - 57
57 - 78
78 - 119
N
GRID NORTH (GDA 1994)
0 60 120 240 360
Meters
From: Ames, T. 2010. Plant Biogeochemical analysis of aeolian covered Au-mineralisation, NE of 'Area 223' Tunkillia, South Australia. Bsc (Hons) thesis, University of Adelaide, Adelaide, (unpubl.)
475000
475500
476000
476500
6548000
6547500
6547000
ISu1
Aaw1
ISu2
ISps1


REGOLITH-LANDFORM MAP OF TUNKILLIA, SOUTH AUSTRALIA - 1:2000 REGOLITH LANDFORM MAP
Aeolian Sediments
ISps1 Aeolian Sediments/Sandplain
ISu1 Aeolian Sediments/Dune
ISu2 Aeolian Sediments/Dune
Alluvial sediments
Aaw1 Alluvial Sediments/Swamp
Full legend descriptions are located in Appendix 2.b
6548200
6547700
6547200
6546700
475000
475500
476000
476500
REGOLITH-LANDFORM MAPPING FIELD SITES
Element distribution
Casuarina pauper
Ca
0.01 - 0.6
0.6 - 1
1 - 1.6
1.6 - 2.5
N
GRID NORTH (GDA 1994)
0
60
120
240
360
Meters
From: Ames, T. 2010. Plant Biogeochemical analysis of aeolian covered Au-mineralisation, NE of 'Area 223' Tunkillia, South Australia. Bsc (Hons) thesis, University of Adelaide, Adelaide, (unpubl.)
475000
475500
476000
476500
6548000
6547500
6547000
ISu1
Aaw1
ISu2
ISps1



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Plant Biogeochemical analysis of
aeolian covered Au-mineralisation,
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South Australia. Bsc (Hons) thesis,
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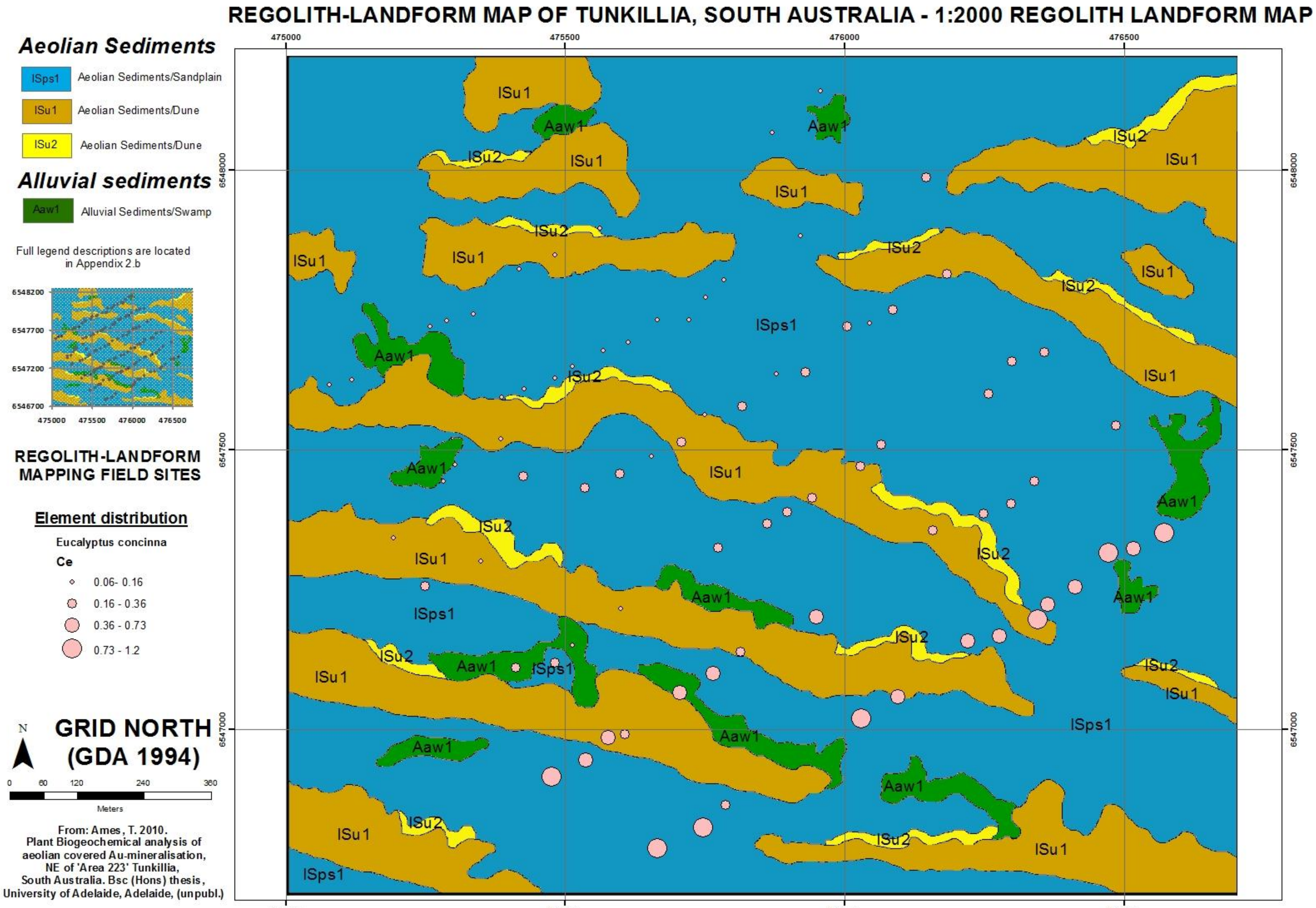

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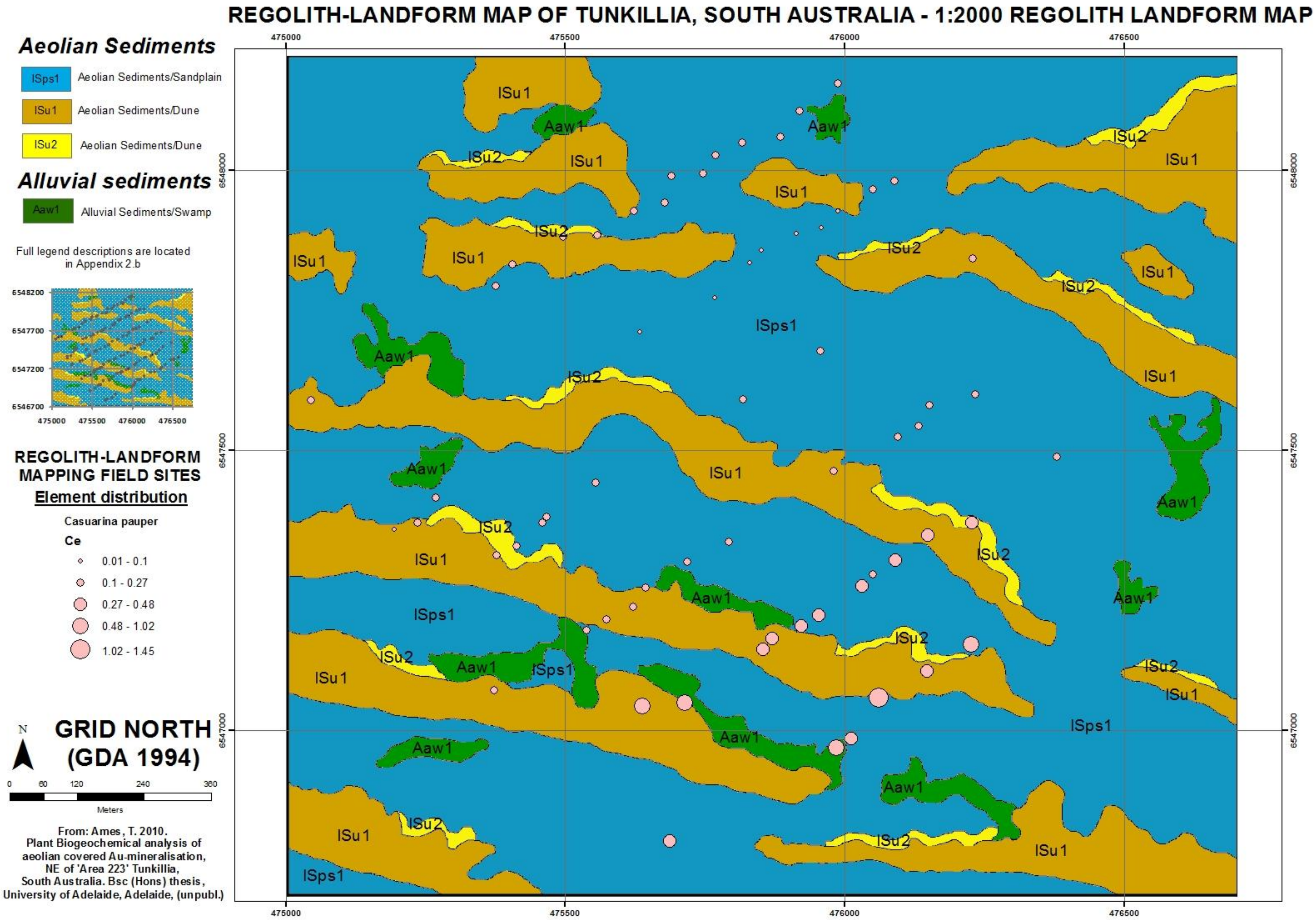
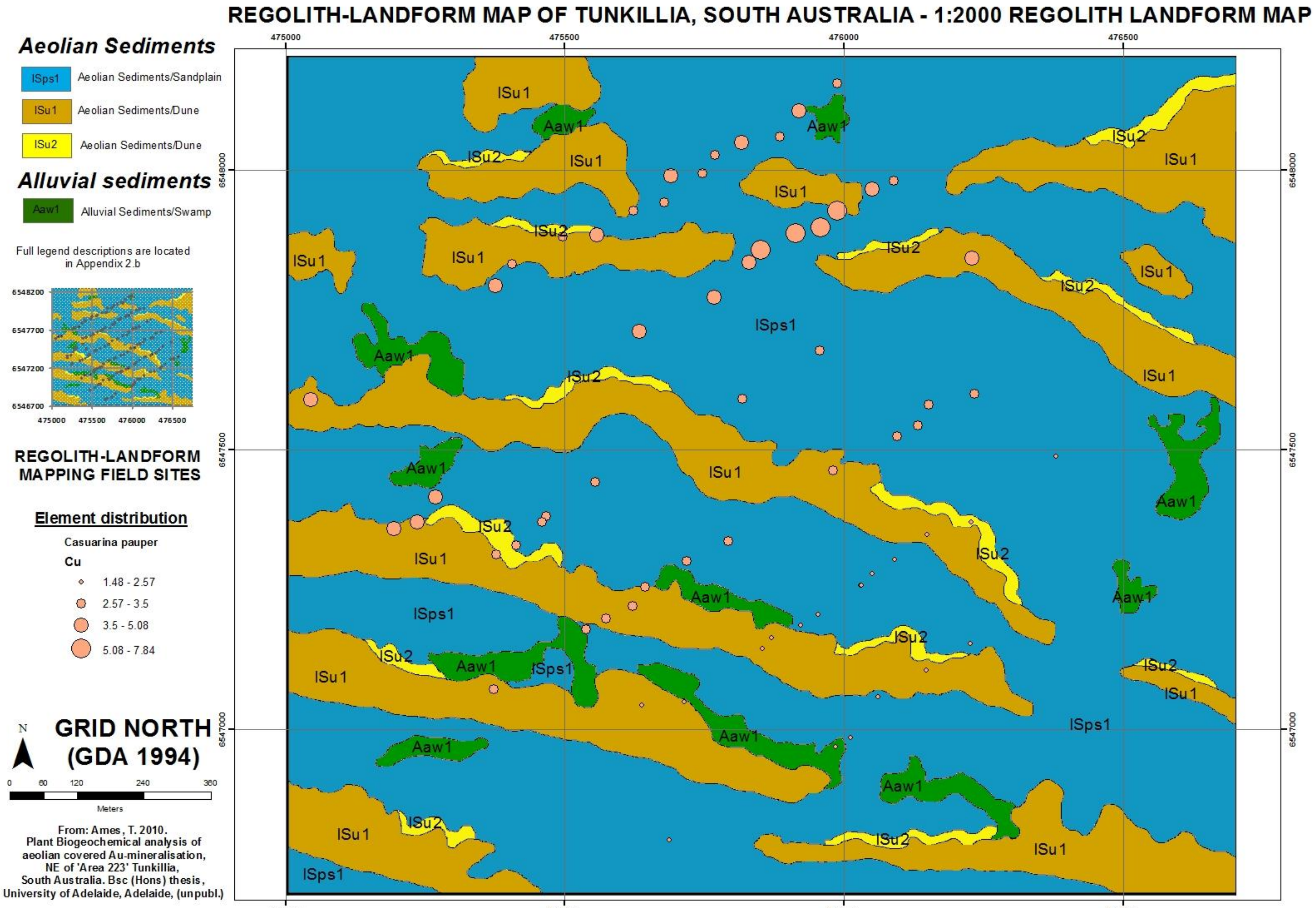
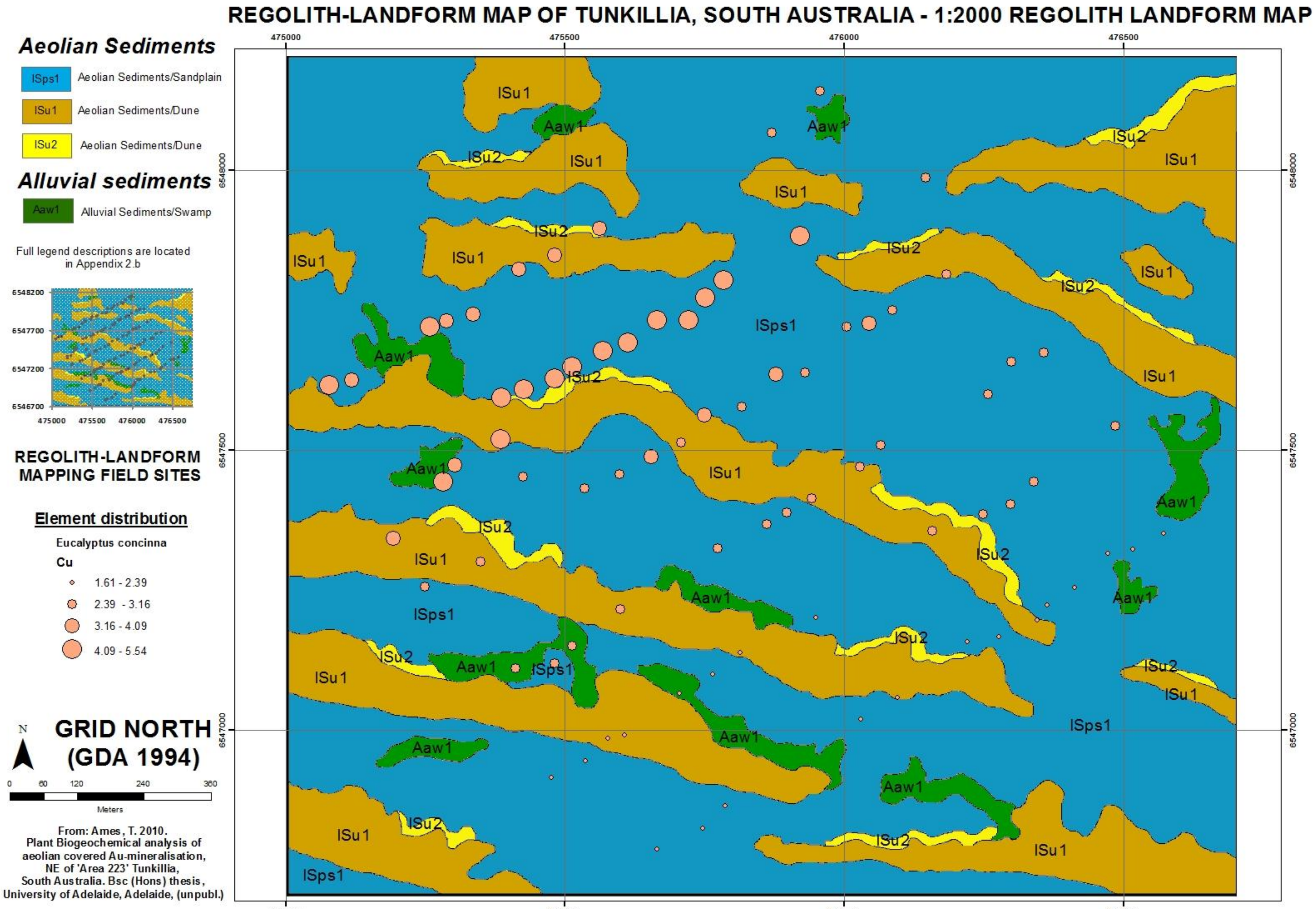

REGOLITH-LANDFORM MAP OF TUNKILLIA, SOUTH AUSTRALIA - 1:2000 REGOLITH LANDFORM MAP
Aeolian Sediments
ISps1 Aeolian Sediments/Sandplain
ISu1 Aeolian Sediments/Dune
ISu2 Aeolian Sediments/Dune
Alluvial sediments
Aaw1 Alluvial Sediments/Swamp
Full legend descriptions are located in Appendix 2.b
6548200
6547700
6547200
6546700
475000
475500
476000
476500
REGOLITH-LANDFORM MAPPING FIELD SITES
Element distribution
Casuarina pauper
Ce
0.01 - 0.1
0.1 - 0.27
0.27 - 0.48
0.48 - 1.02
1.02 - 1.45
N
GRID NORTH (GDA 1994)
0
60
120
240
360
Meters
From: Ames, T. 2010. Plant Biogeochemical analysis of aeolian covered Au-mineralisation, NE of 'Area 223' Tunkillia, South Australia. Bsc (Hons) thesis, University of Adelaide, Adelaide, (unpubl.)
6548000
6547500
6547000
ISu1
ISu2
ISps1
Aaw1


REGOLITH-LANDFORM MAP OF TUNKILLIA, SOUTH AUSTRALIA - 1:2000 REGOLITH LANDFORM MAP
Aeolian Sediments
ISps1 Aeolian Sediments/Sandplain
ISu1 Aeolian Sediments/Dune
ISu2 Aeolian Sediments/Dune
Alluvial sediments
Aaw1 Alluvial Sediments/Swamp
Full legend descriptions are located in Appendix 2.b
6548200
6547700
6547200
6546700
475000
475500
476000
476500
REGOLITH-LANDFORM MAPPING FIELD SITES
Element distribution
Casuarina pauper
Cu
1.48 - 2.57
2.57 - 3.5
3.5 - 5.08
5.08 - 7.84
N
GRID NORTH (GDA 1994)
0
60
120
240
360
Meters
From: Ames, T. 2010. Plant Biogeochemical analysis of aeolian covered Au-mineralisation, NE of 'Area 223' Tunkillia, South Australia. Bsc (Hons) thesis, University of Adelaide, Adelaide, (unpubl.)
6548000
6547500
6547000
ISu1
ISu2
ISps1
Aaw1



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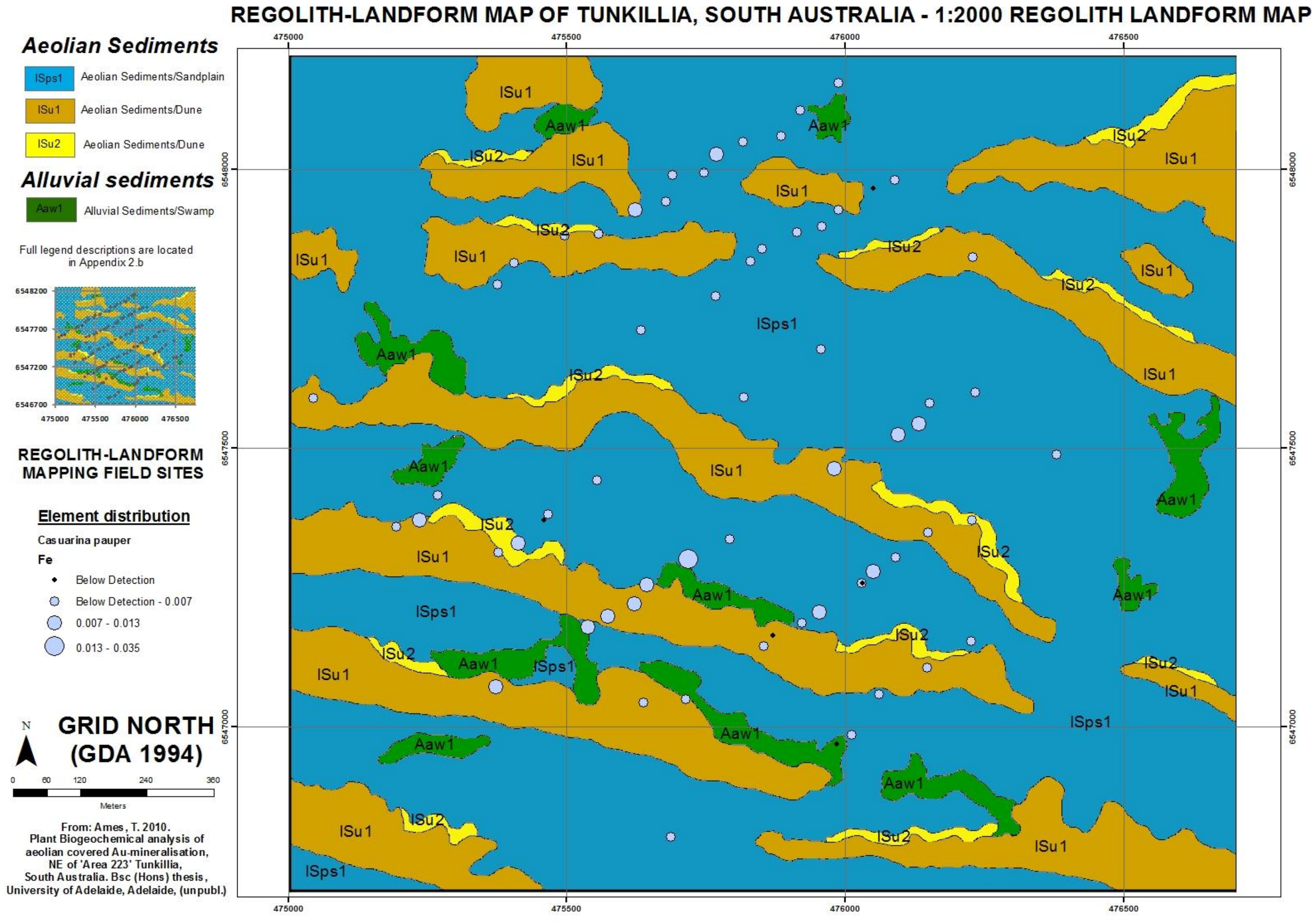
REGOLITH-LANDFORM MAP OF TUNKILLIA, SOUTH AUSTRALIA - 1:2000 REGOLITH LANDFORM MAP

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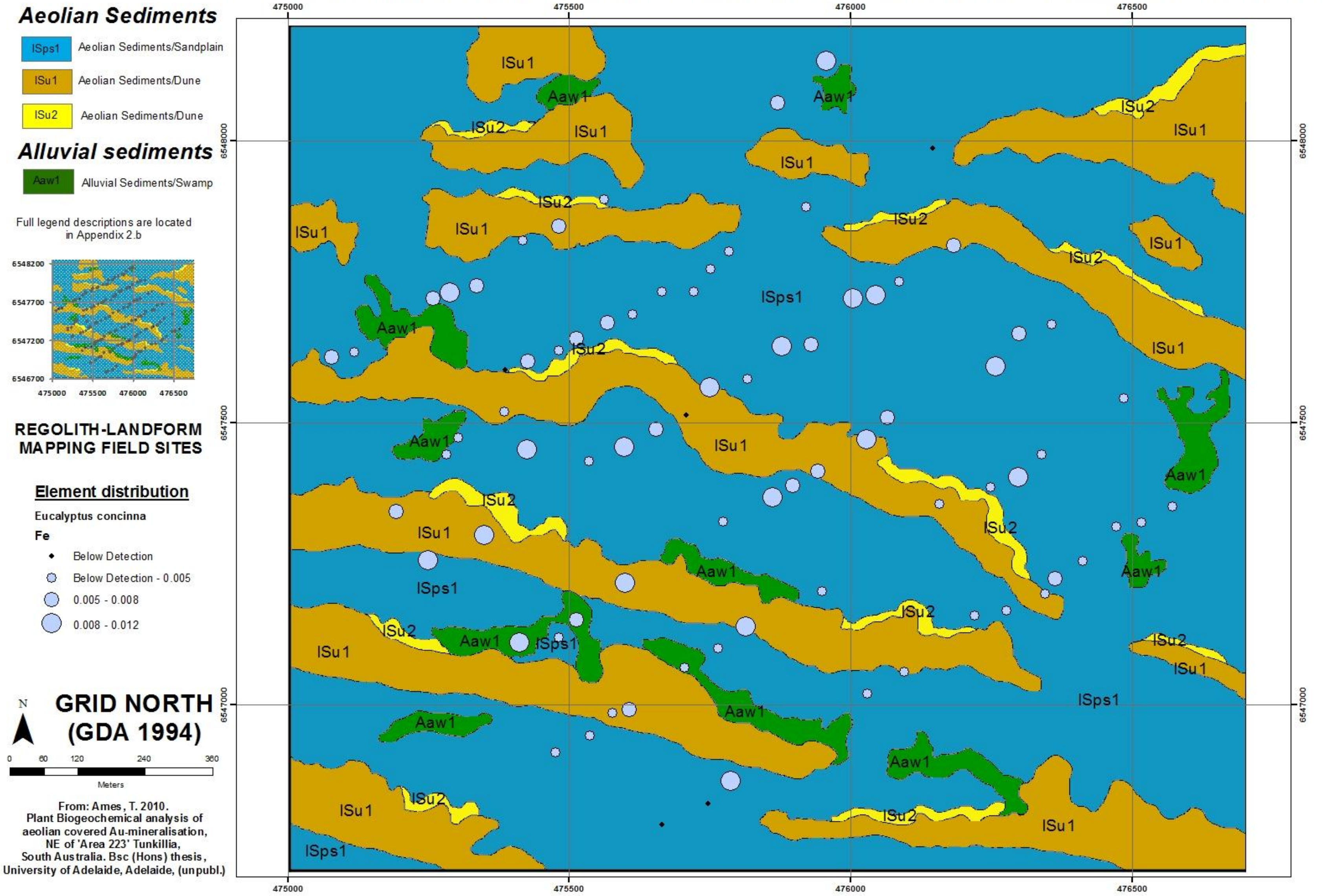
REGOLITH-LANDFORM MAP OF TUNKILLIA, SOUTH AUSTRALIA - 1:2000 REGOLITH LANDFORM MAP



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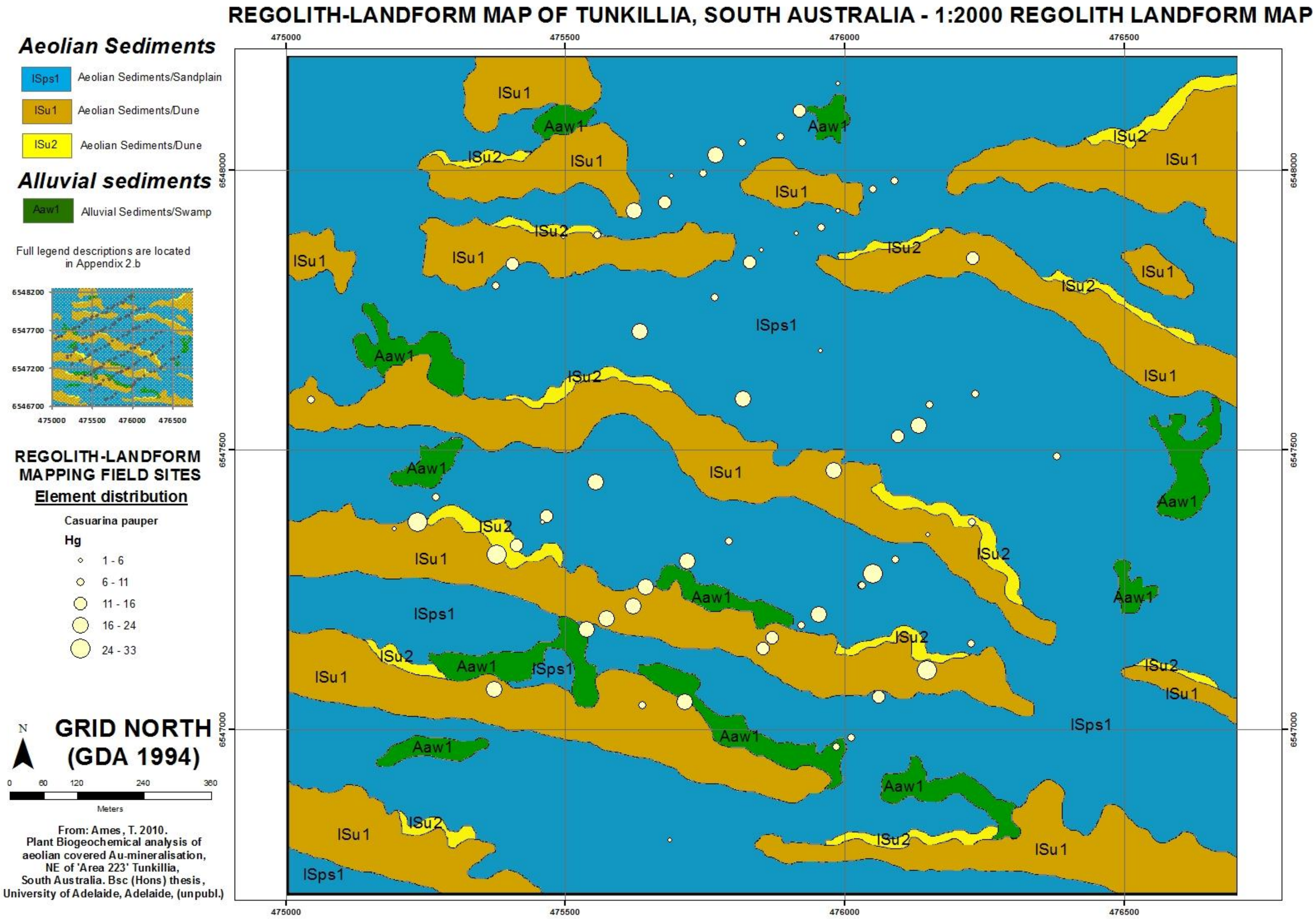

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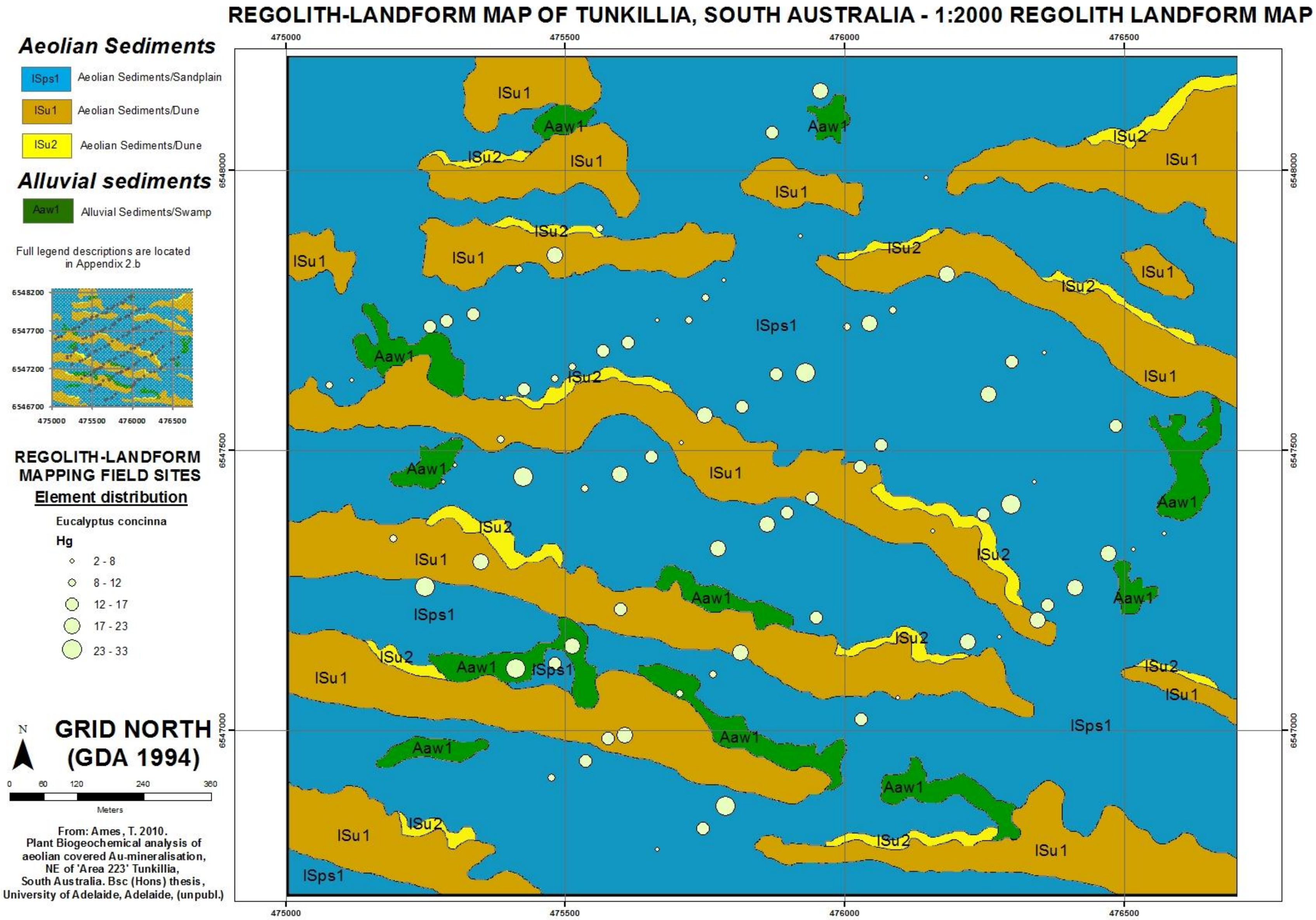

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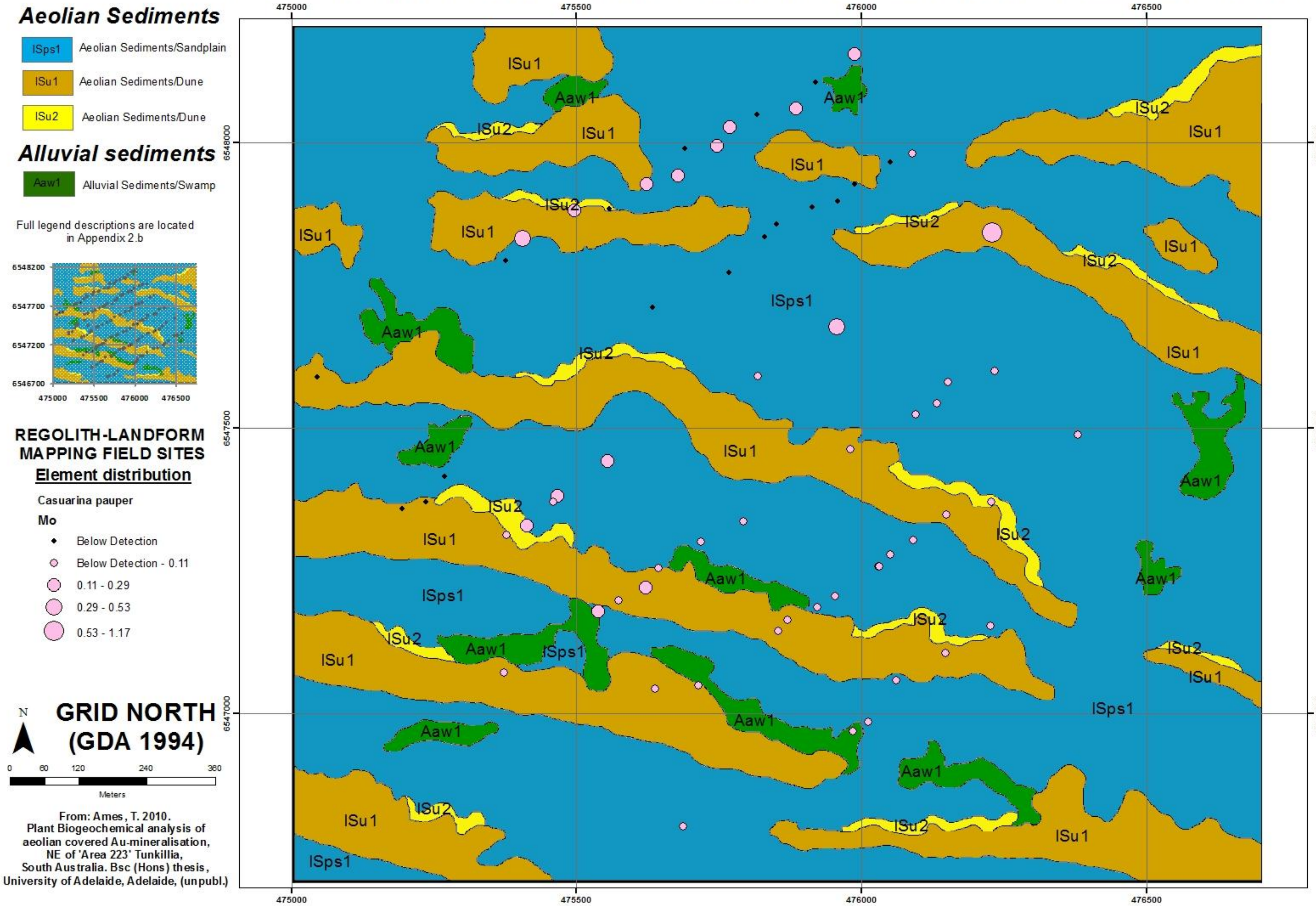
REGOLITH-LANDFORM MAP OF TUNKILLIA, SOUTH AUSTRALIA - 1:2000 REGOLITH LANDFORM MAP



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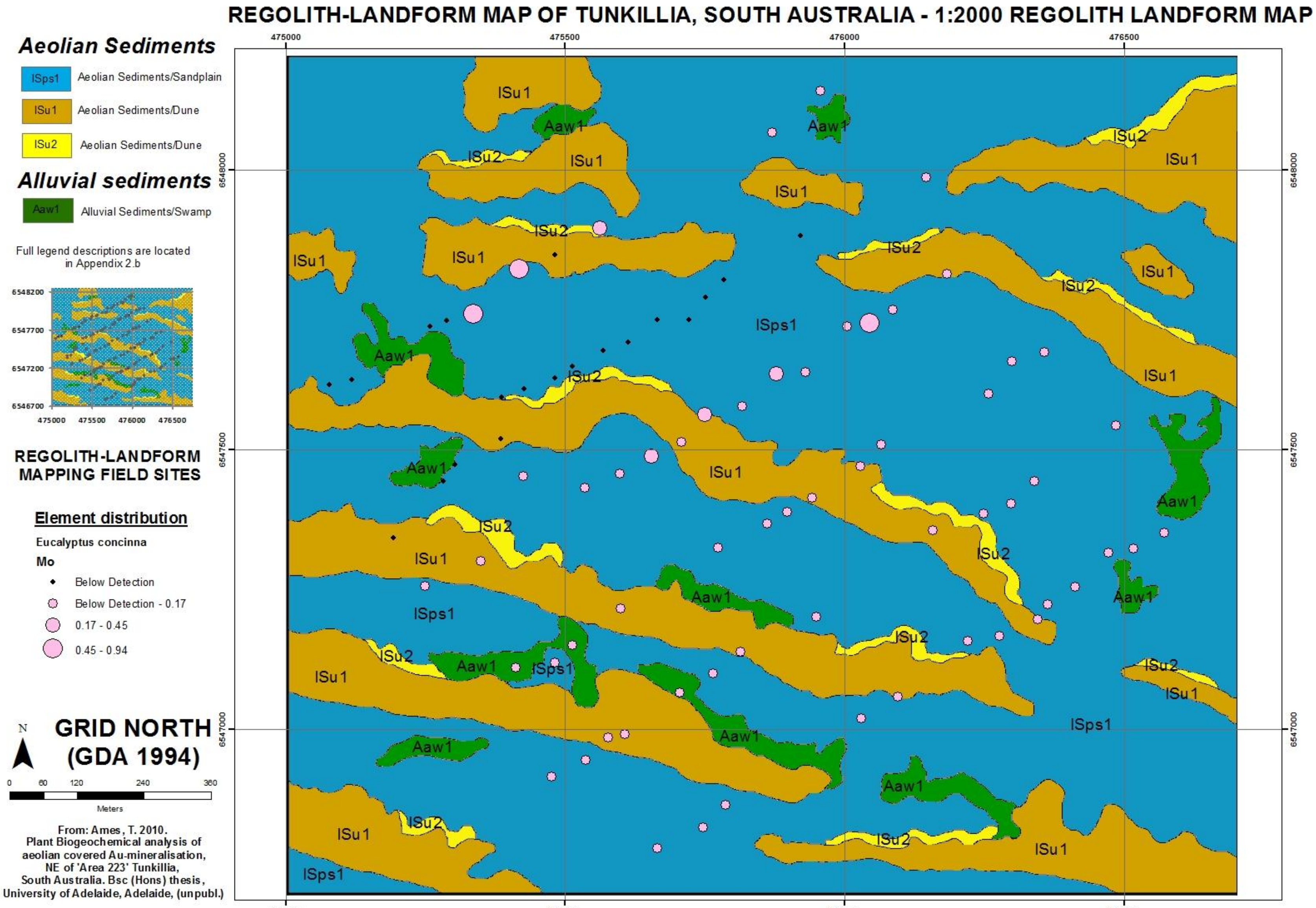
REGOLITH-LANDFORM MAP OF TUNKILLIA, SOUTH AUSTRALIA - 1:2000 REGOLITH LANDFORM MAP

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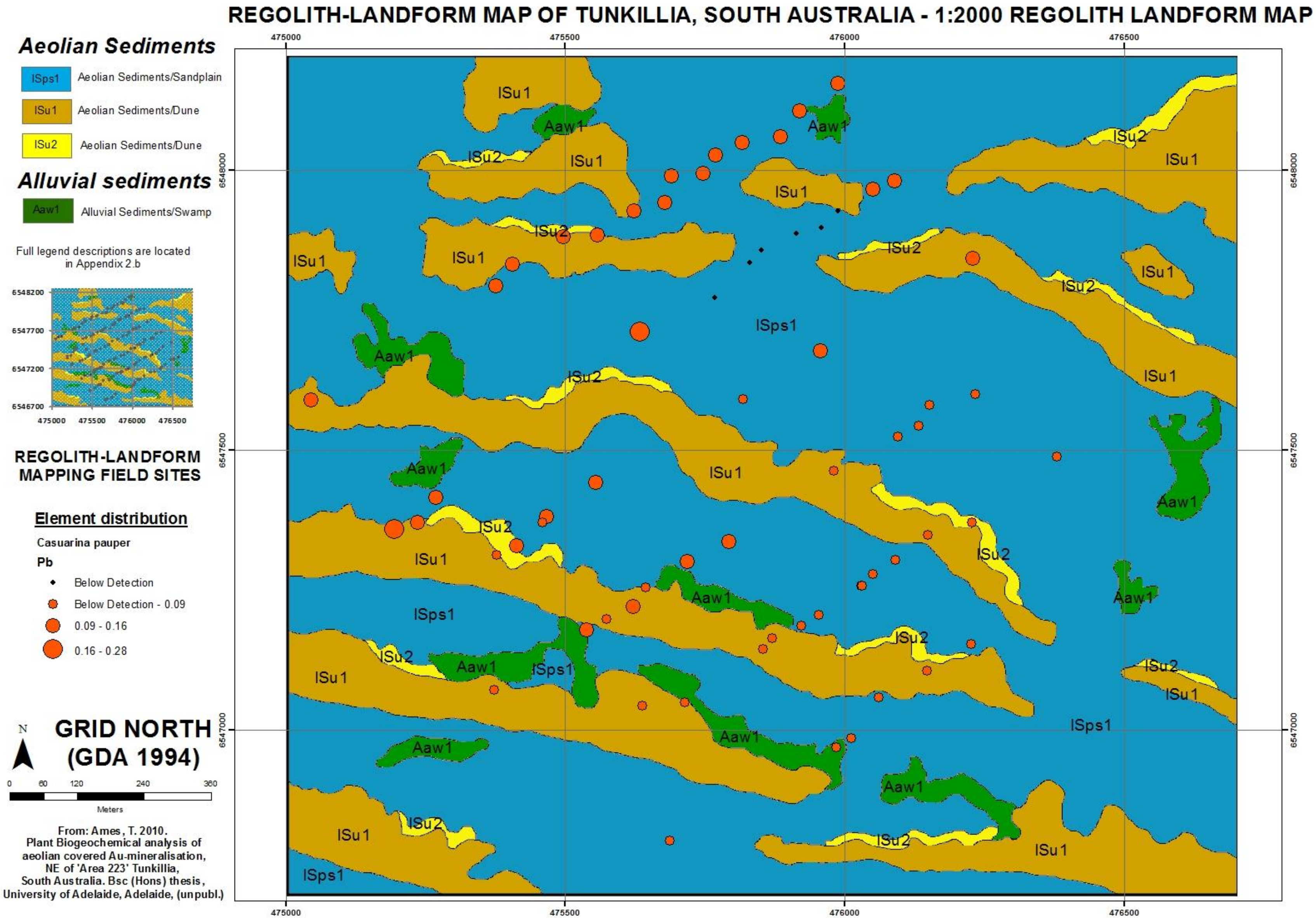

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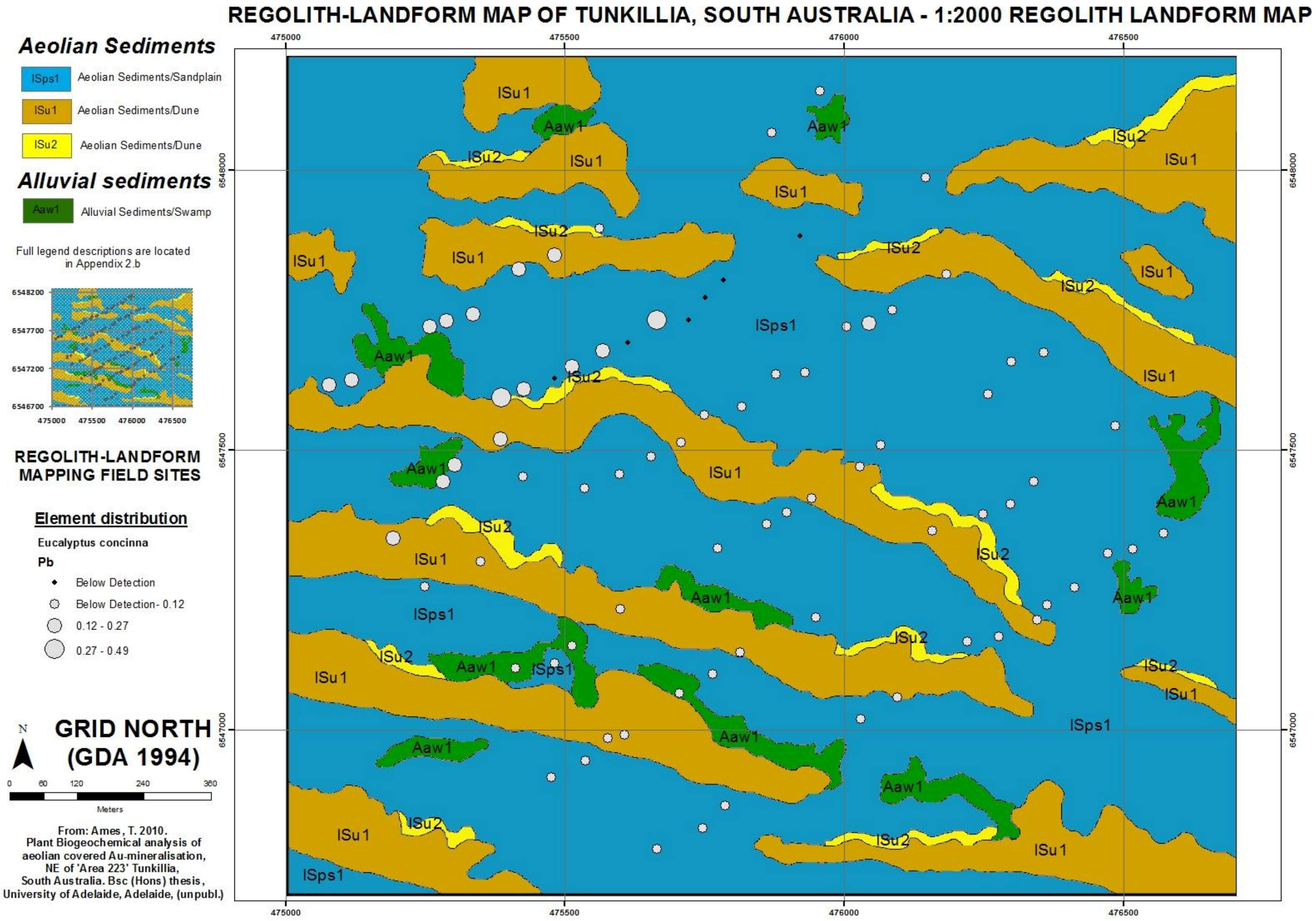

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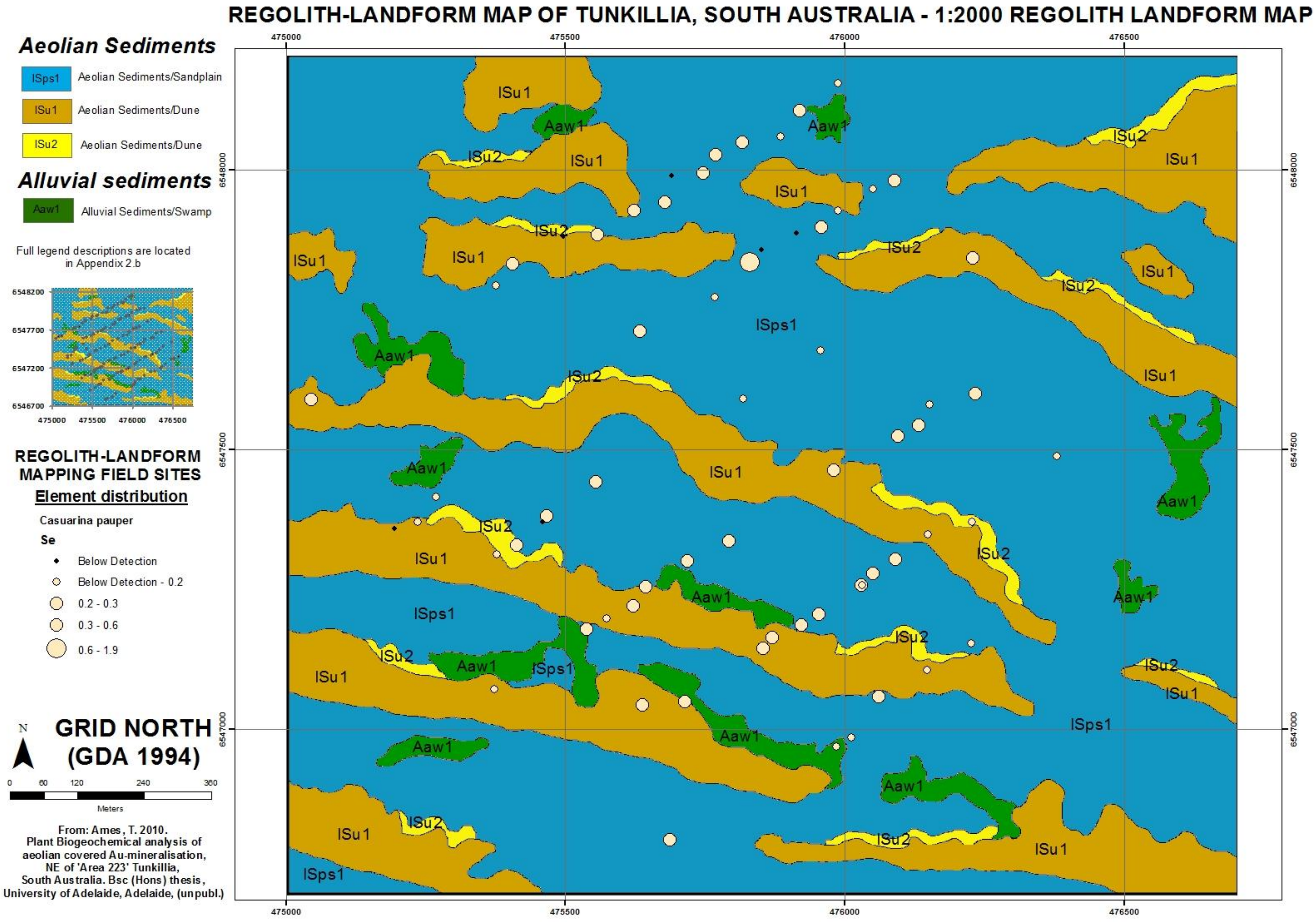
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ISps1 Aeolian Sediments/Sandplain
ISu1 Aeolian Sediments/Dune
ISu2 Aeolian Sediments/Dune
Alluvial sediments
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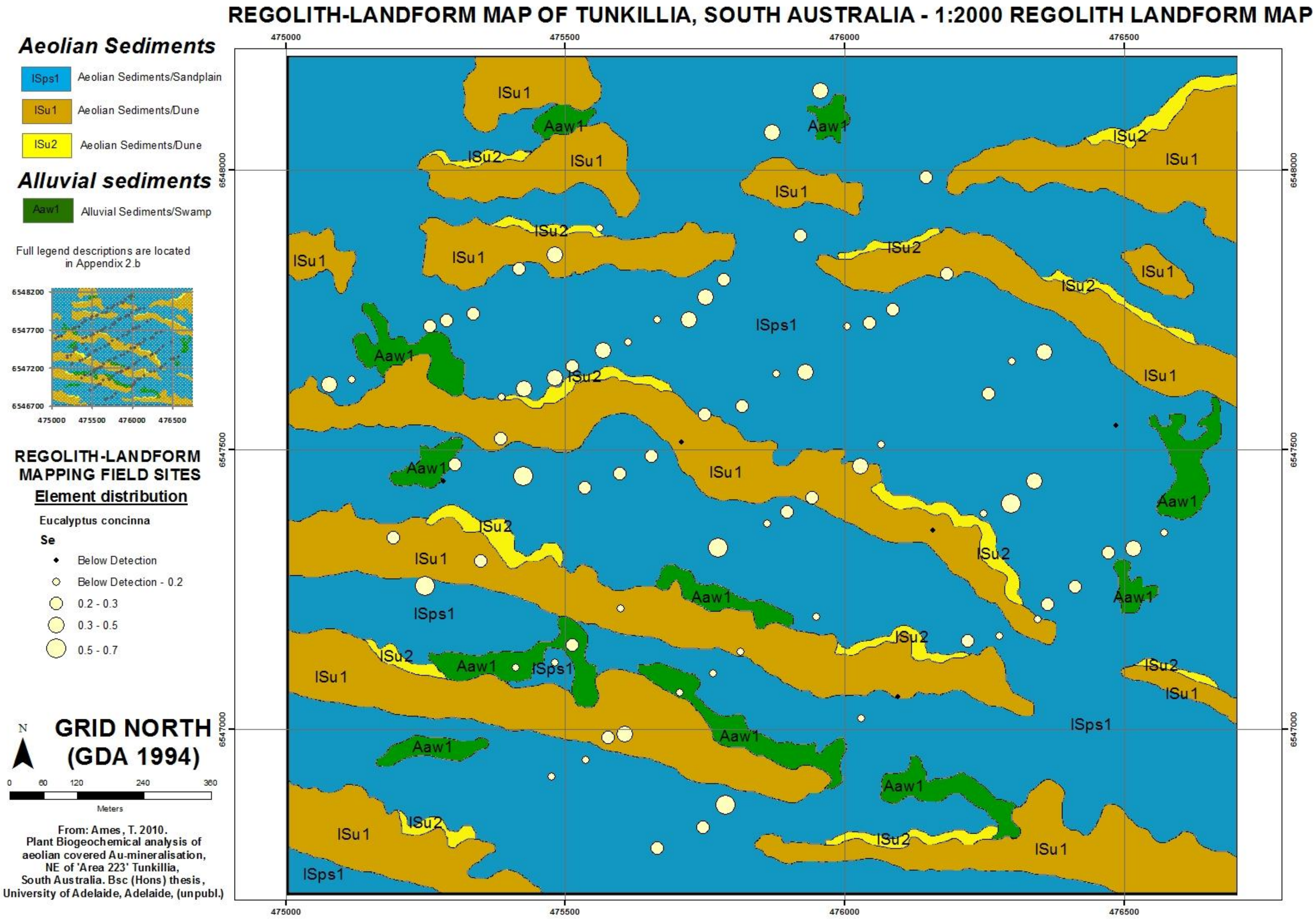
Full legend descriptions are located in Appendix 2.b
6548200
6547700
6547200
6546700
475000
475500
476000
476500
REGOLITH-LANDFORM MAPPING FIELD SITES
Element distribution
Casuarina pauper
Se
Below Detection
Below Detection - 0.2
0.2 - 0.3
0.3 - 0.6
0.6 - 1.9
N
GRID NORTH (GDA 1994)
0
60
120
240
360
Meters
From: Ames, T. 2010. Plant Biogeochemical analysis of aeolian covered Au-mineralisation, NE of 'Area 223' Tunkillia, South Australia. Bsc (Hons) thesis, University of Adelaide, Adelaide, (unpubl.)
6548000
6547500
6547000
ISu1
ISu2
ISps1
Aaw1



From: Ames, T. 2010.
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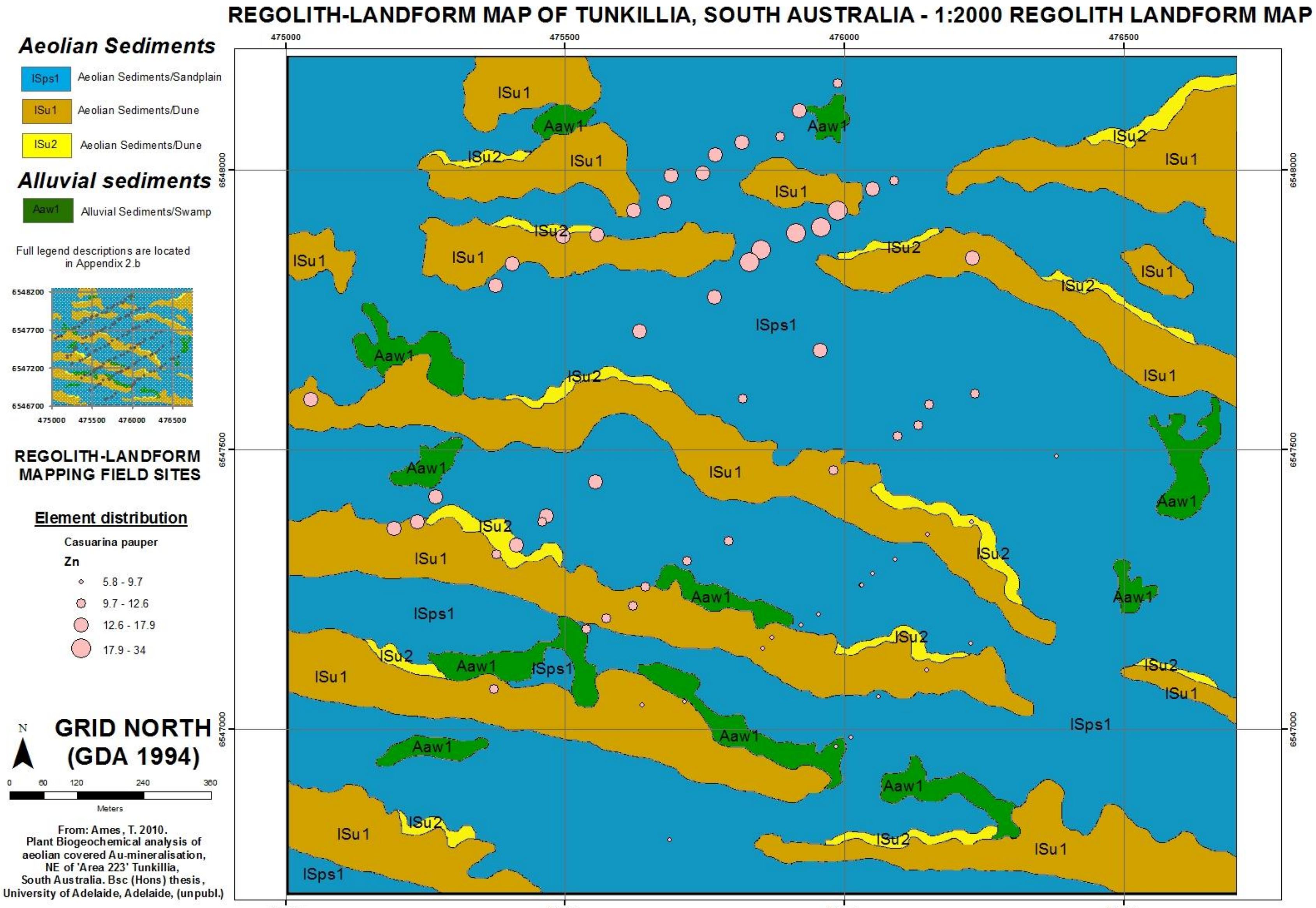
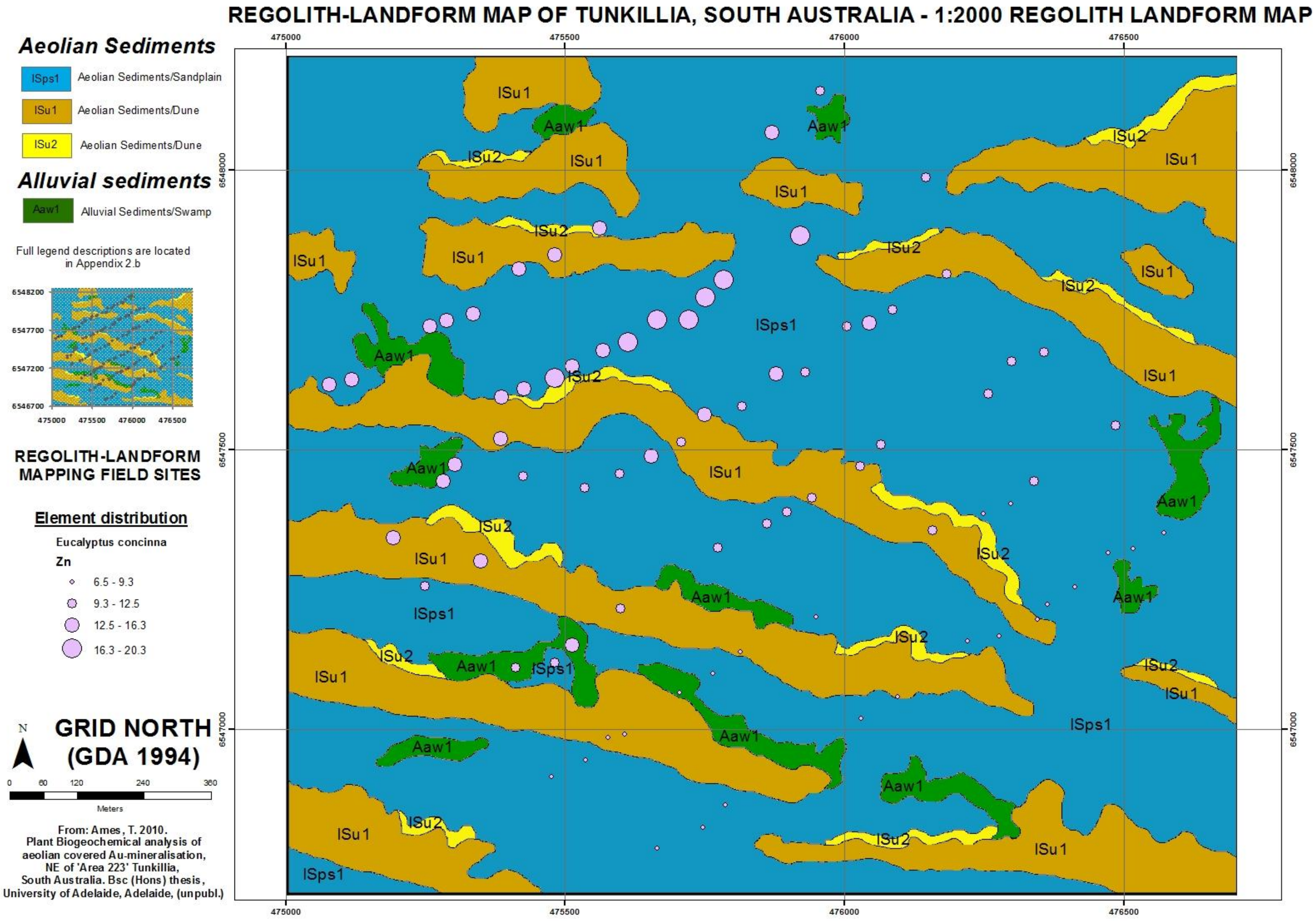
aeolian covered Au-mineralisation,
NE of 'Area 223' Tunkillia,
South Australia. Bsc (Hons) thesis,
University of Adelaide, Adelaide, (unpubl.)



From: Ames, T. 2010.
Plant Biogeochemical analysis of aeolian covered Au-mineralisation, NE of 'Area 223' Tunkillia, South Australia. Bsc (Hons) thesis, University of Adelaide, Adelaide, (unpubl.)

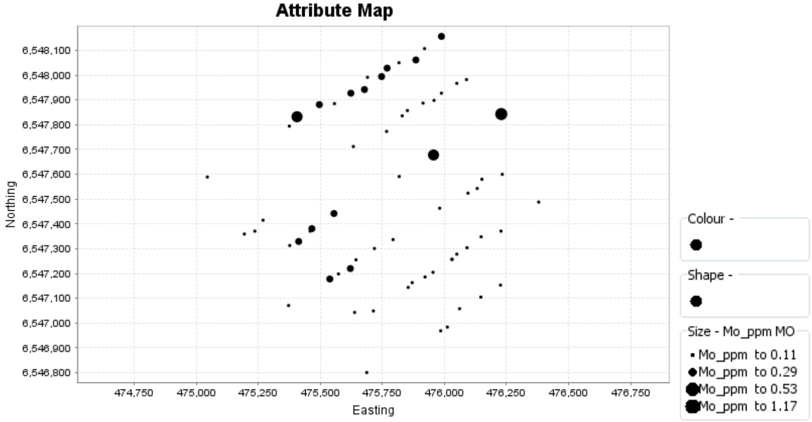


REGOLITH-LANDFORM MAP OF TUNKILLIA, SOUTH AUSTRALIA - 1:2000 REGOLITH LANDFORM MAP

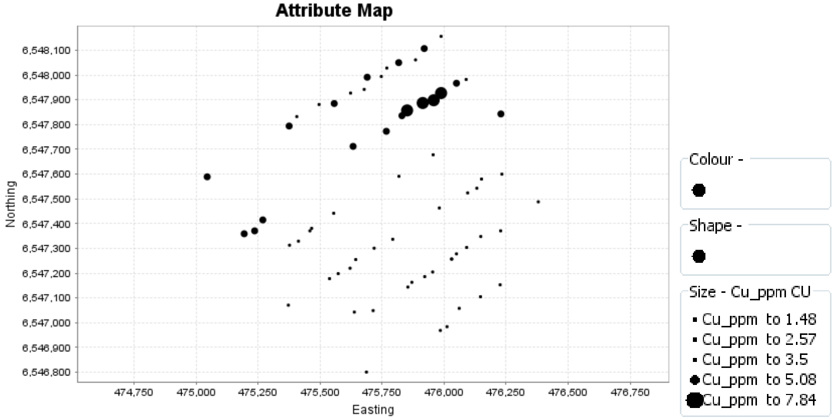
From: Ames, T. 2010.
Plant Biogeochemical analysis of aeolian covered Au-mineralisation, NE of 'Area 223' Tunkillia, South Australia. Bsc (Hons) thesis, University of Adelaide, Adelaide, (unpubl.)

Appendix 7: Distribution plots for *C. pauper*

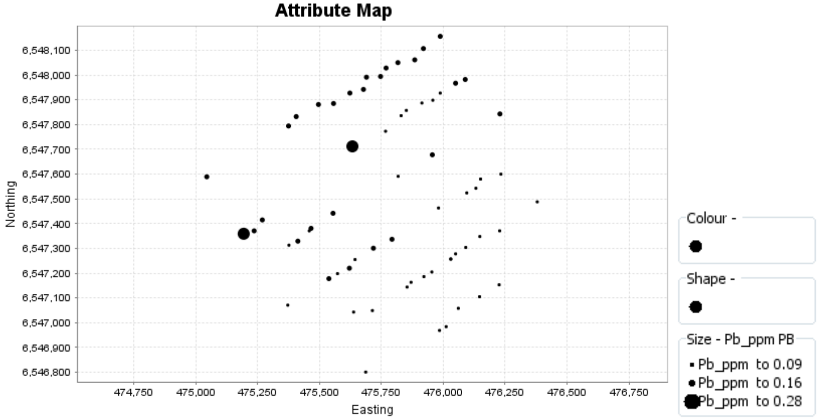
Mo C. pauper Distribution Map: IoGas



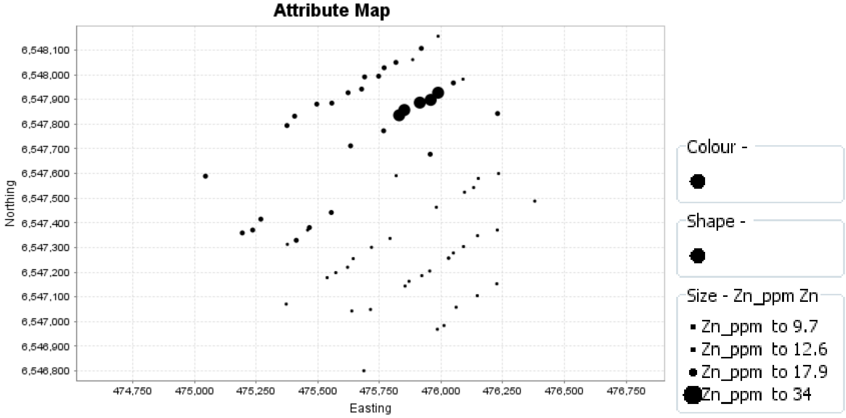
Cu C. Pauper Distribution Map: IoGas



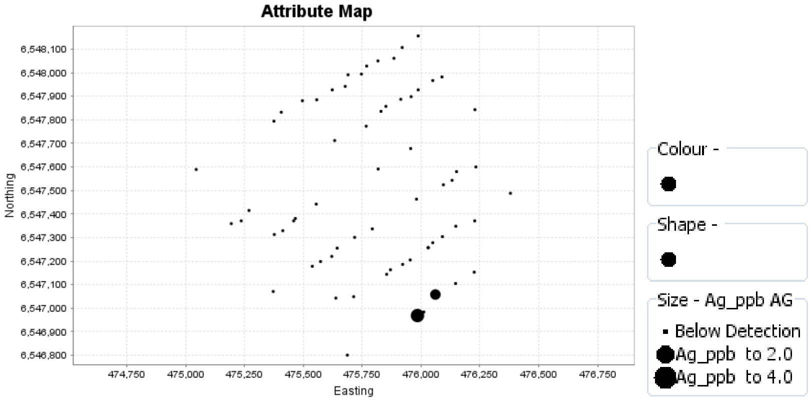
Pb C. Pauper Distribution Map: IoGas



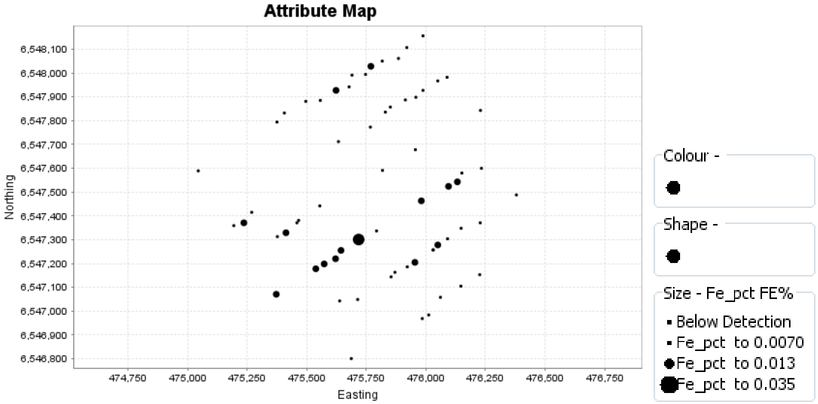
Zn C. Pauper Distribution Map: IoGas



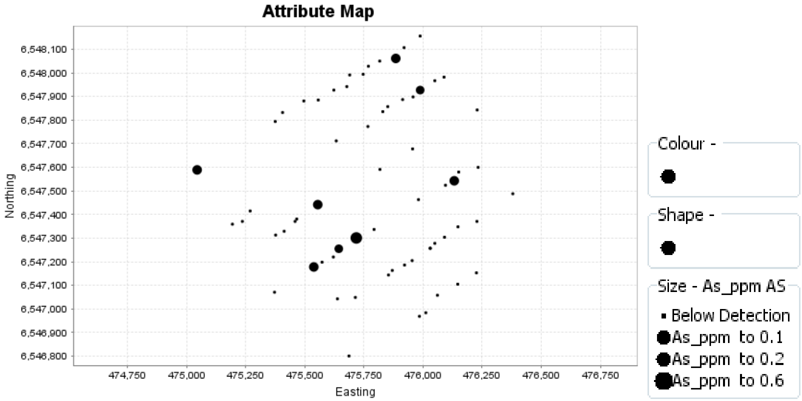
Ag C. Pauper Distribution Map: IoGas



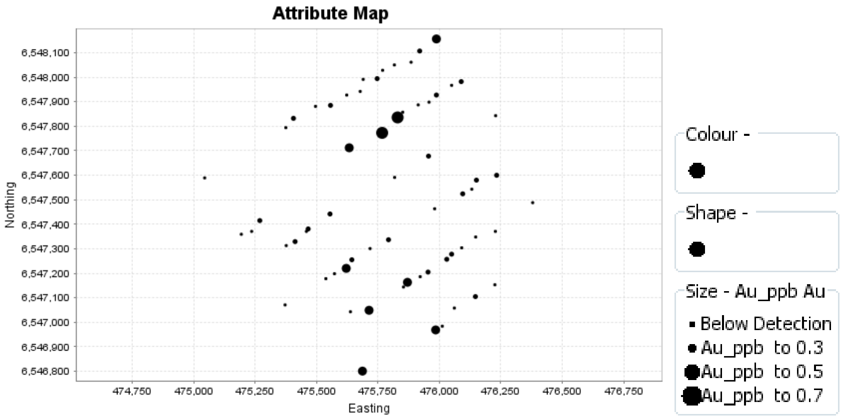
Fe C. Pauper Distribution Map: IoGas



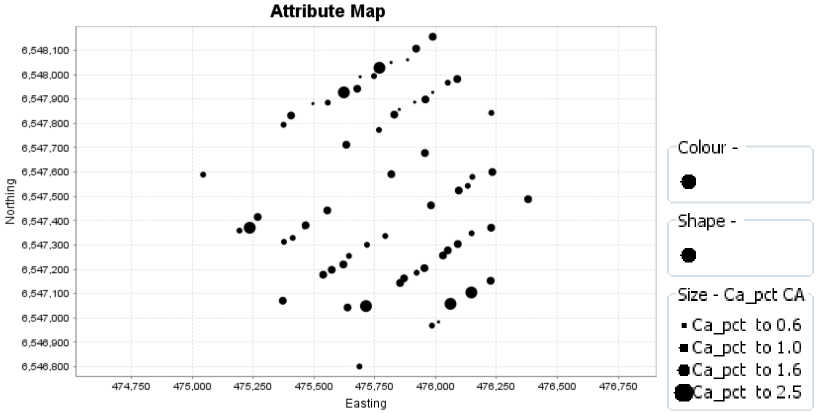
As C. Pauper Distribution Map: IoGas



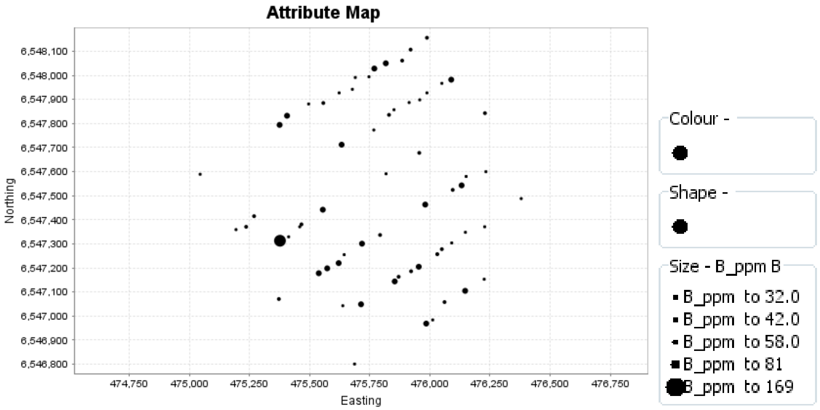
Au C. Pauper Distribution Map: IoGas



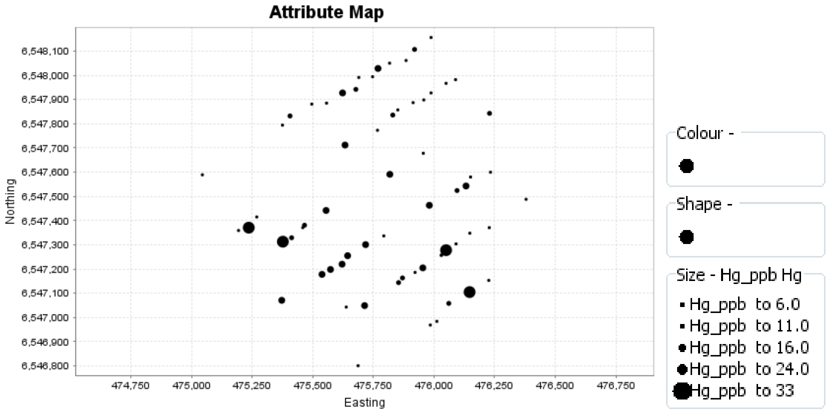
Ca C. Pauper Distribution Map: IoGas



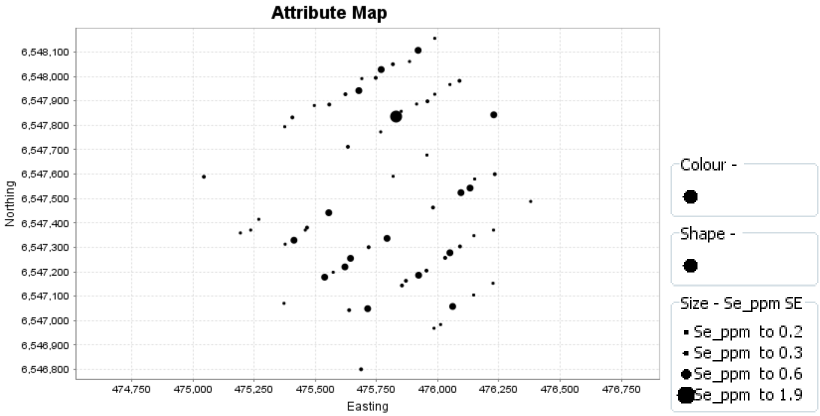
B C. Pauper Distribution Map: IoGas



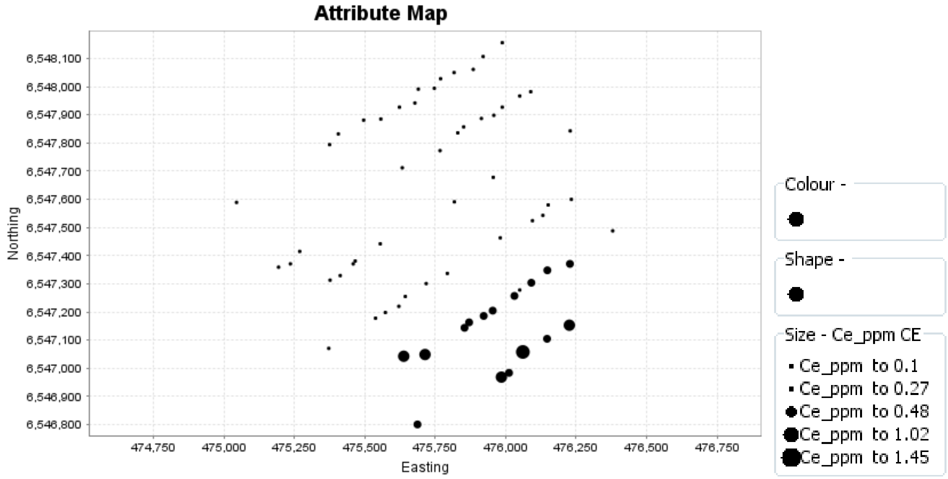
Hg C. Pauper Distribution Map: IoGas



Se C. Pauper Distribution Map: IoGas

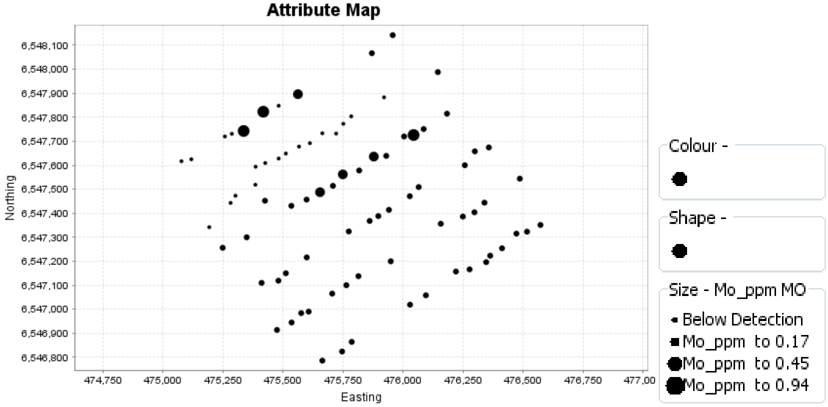


Ce C. Pauper Distribution Map: IoGas

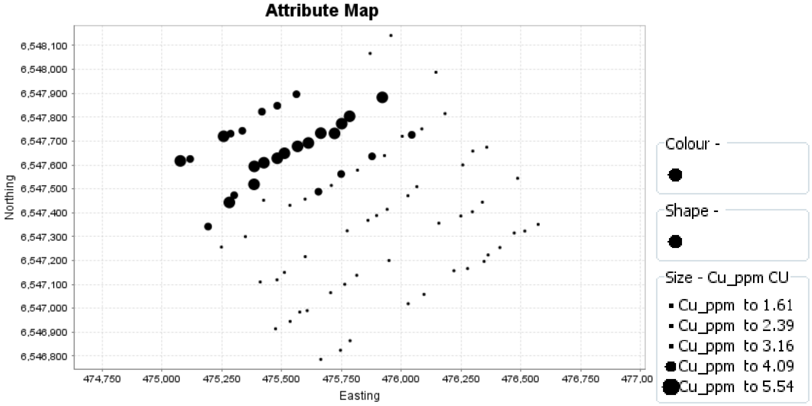


Appendix 8: Distribution Plots for *E. concinna*

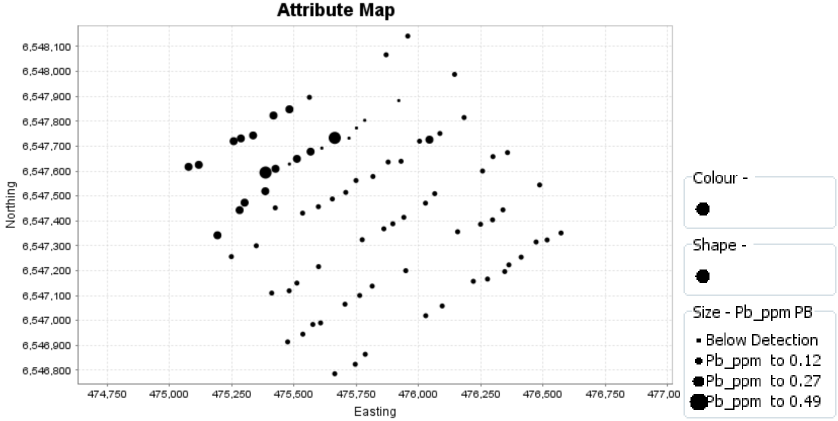
Mo E. Concinna Distribution Map: IoGas



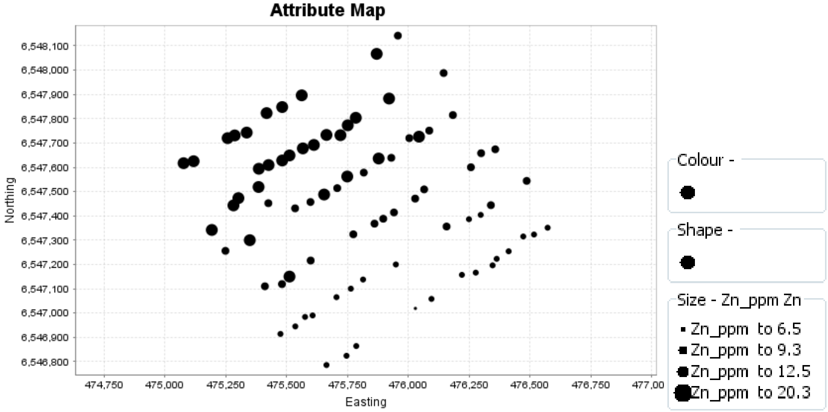
Cu E. Concinna Distribution Map: IoGas



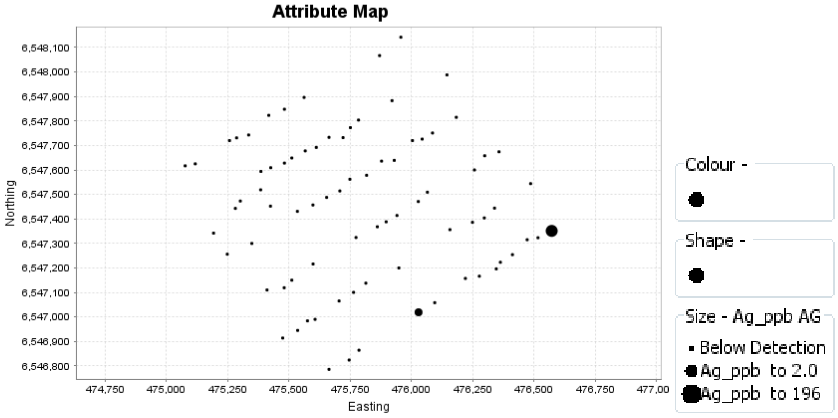
Pb E. Concinna Distribution Map: IoGas



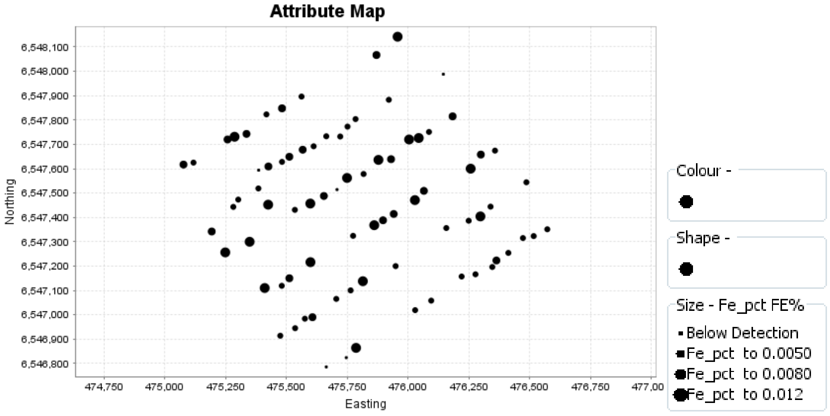
Zn E. Concinna Distribution Map: IoGas



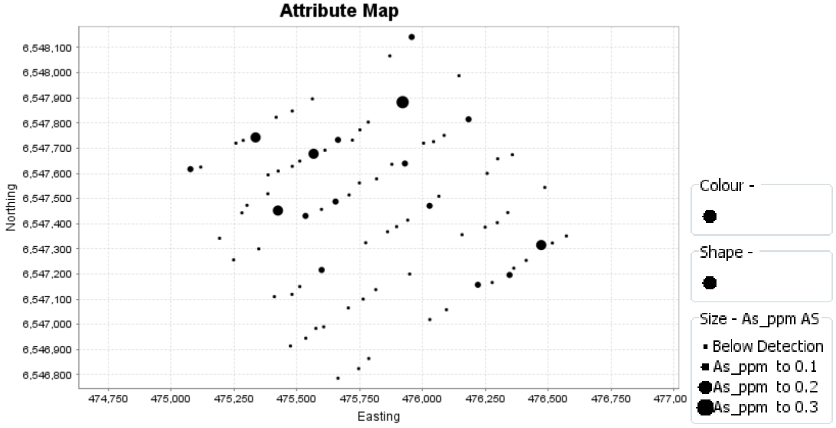
Ag E. Concinna Distribution Map: IoGas



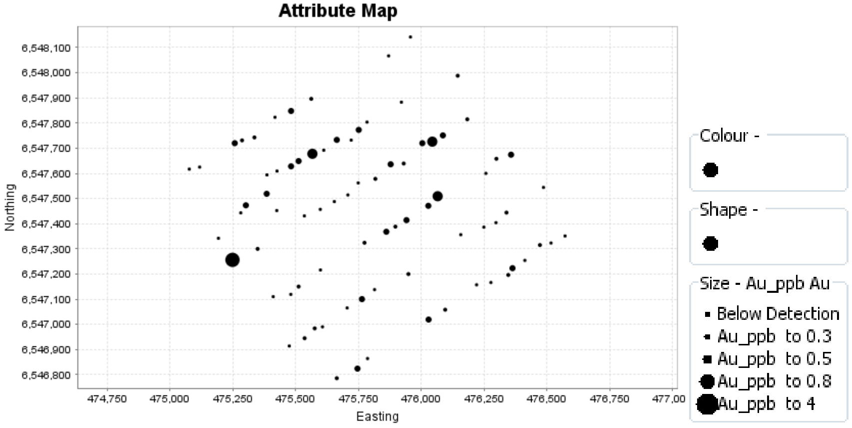
Fe E. Concinna Distribution Map: IoGas



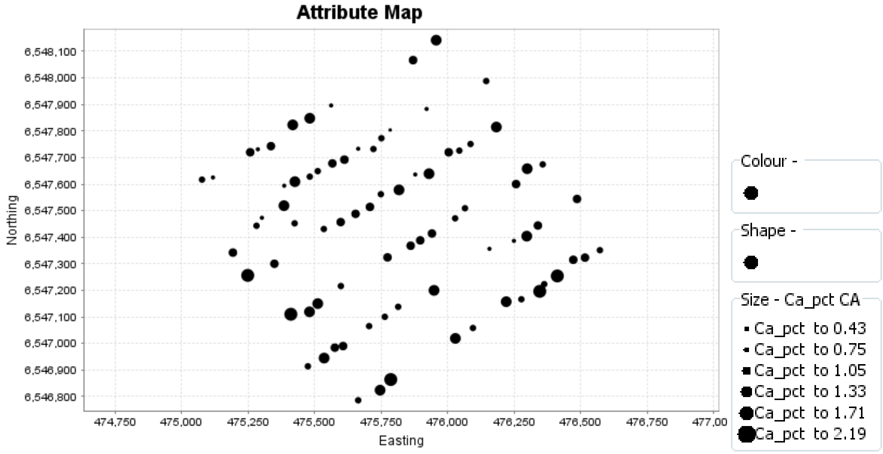
As E. Concinna Distribution Map: IoGas



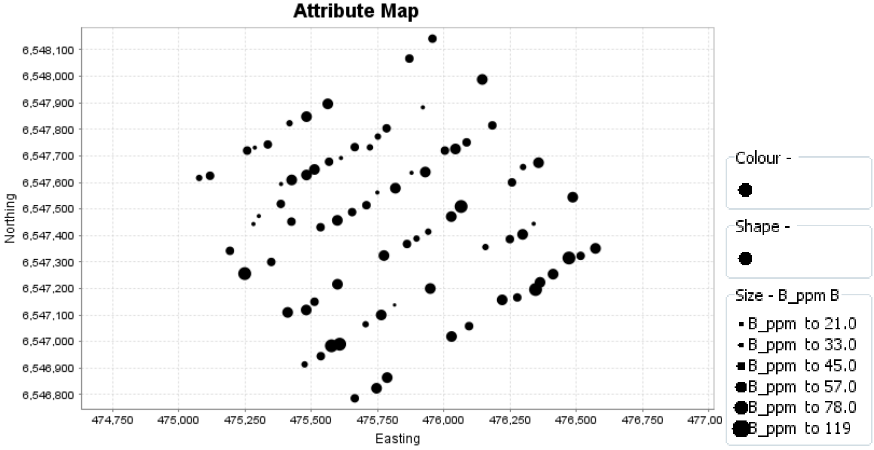
Au E. Concinna Distribution Map: IoGas



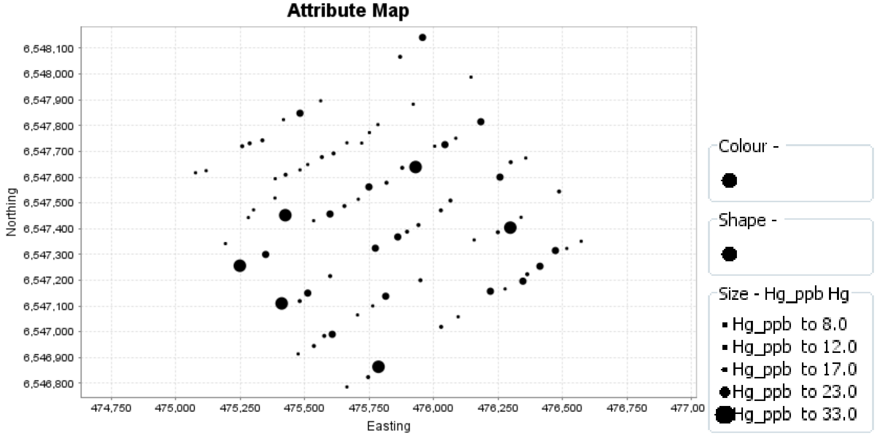
Ca E. Concinna Distribution Map: IoGas



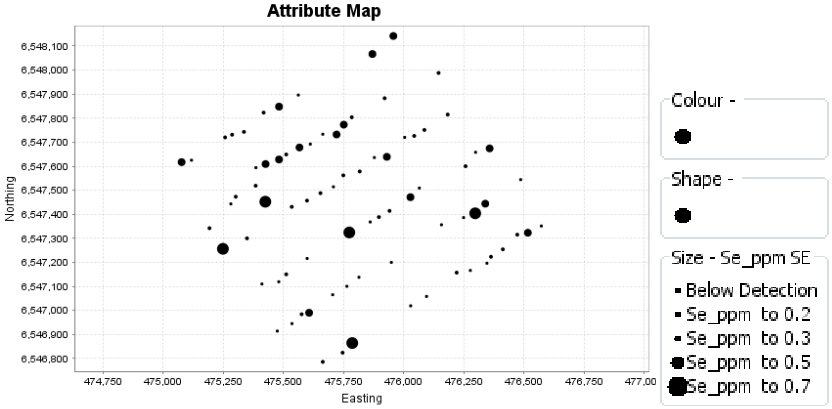
B E. Concinna Distribution Map: IoGas



Hg E. Concinna Distribution Map: IoGas



Se E. Concinna Distribution Map: IoGas



Ce E. Concinna Distribution Map: IoGas