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STUDY OF THE DISTRIBUTION OF GOLD IN SOILS AT MT HOPE, WESTERN AUSTRALIA

M.J. Lintern

CRC LEME OPEN FILE REPORT 65

February 1999

(CSIRO Division of Exploration Geoscience Report 24R, 1989.
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CRC LEME is an unincorporated joint venture between The Australian National University,
University of Canberra, Australian Geological Survey Organisation and CSIRO Exploration and Mining
Headquarters: CRC LEME c/o CSIRO Exploration and Mining, Private Bag, PO Wembley, Western Australia, 6014

RESEARCH ARISING FROM CSIRO/AMIRA REGOLITH GEOCHEMISTRY PROJECTS 1987-1993

In 1987, CSIRO commenced a series of multi-client research projects in regolith geology and geochemistry which were sponsored by companies in the Australian mining industry, through the Australian Mineral Industries Research Association Limited (AMIRA). The initial research program, "Exploration for concealed gold deposits, Yilgarn Block, Western Australia" (1987-1993) had the aim of developing improved geological, geochemical and geophysical methods for mineral exploration that would facilitate the location of blind, buried or deeply weathered gold deposits. The program included the following projects:

P240: Laterite geochemistry for detecting concealed mineral deposits (1987-1991). Leader: Dr R.E. Smith.
Its scope was development of methods for sampling and interpretation of multi-element laterite geochemistry data and application of multi-element techniques to gold and polymetallic mineral exploration in weathered terrain. The project emphasised viewing laterite geochemical dispersion patterns in their regolith-landform context at local and district scales. It was supported by 30 companies.

P241: Gold and associated elements in the regolith - dispersion processes and implications for exploration (1987-1991). Leader: Dr C.R.M. Butt.
The project investigated the distribution of ore and indicator elements in the regolith. It included studies of the mineralogical and geochemical characteristics of weathered ore deposits and wall rocks, and the chemical controls on element dispersion and concentration during regolith evolution. This was to increase the effectiveness of geochemical exploration in weathered terrain through improved understanding of weathering processes. It was supported by 26 companies.

These projects represented "an opportunity for the mineral industry to participate in a multi-disciplinary program of geoscience research aimed at developing new geological, geochemical and geophysical methods for exploration in deeply weathered Archaean terrains". This initiative recognised the unique opportunities, created by exploration and open-cut mining, to conduct detailed studies of the weathered zone, with particular emphasis on the near-surface expression of gold mineralisation. The skills of existing and specially recruited research staff from the Floreat Park and North Ryde laboratories (of the then Divisions of Minerals and Geochemistry, and Mineral Physics and Mineralogy, subsequently Exploration Geoscience and later Exploration and Mining) were integrated to form a task force with expertise in geology, mineralogy, geochemistry and geophysics. Several staff participated in more than one project. Following completion of the original projects, two continuation projects were developed.

P240A: Geochemical exploration in complex lateritic environments of the Yilgarn Craton, Western Australia (1991-1993). Leaders: Drs R.E. Smith and R.R. Anand.
The approach of viewing geochemical dispersion within a well-controlled and well-understood regolith-landform and bedrock framework at detailed and district scales continued. In this extension, focus was particularly on areas of transported cover and on more complex lateritic environments typified by the Kalgoorlie regional study. This was supported by 17 companies.

P241A: Gold and associated elements in the regolith - dispersion processes and implications for exploration. Leader: Dr. C.R.M. Butt.
The significance of gold mobilisation under present-day conditions, particularly the important relationship with pedogenic carbonate, was investigated further. In addition, attention was focussed on the recognition of primary lithologies from their weathered equivalents. This project was supported by 14 companies.

Although the confidentiality periods of the research reports have expired, the last in December 1994, they have not been made public until now. Publishing the reports through the CRC LEME Report Series is seen as an appropriate means of doing this. By making available the results of the research and the authors' interpretations, it is hoped that the reports will provide source data for future research and be useful for teaching. CRC LEME acknowledges the Australian Mineral Industries Research Association and CSIRO Division of Exploration and Mining for authorisation to publish these reports. It is intended that publication of the reports will be a substantial additional factor in transferring technology to aid the Australian Mineral Industry.

This report (CRC LEME Open File Report 65) is a Second impression (second printing) of CSIRO, Division of Exploration Geoscience Restricted Report 024R, first issued in 1989, which formed part of the CSIRO/AMIRA Project P241.

Copies of this publication can be obtained from:
The Publication Officer, c/- CRC LEME, CSIRO Exploration and Mining, PMB, Wembley, WA 6014, Australia. Information on other publications in this series may be obtained from the above or from http://leme.anu.edu.au/

Cataloguing-in-Publication:
Lintern, M.J.
Study of the distribution of gold in soils at Mt Hope, Western Australia
ISBN 0 642 28255 2
1. Soils 2. Gold - Western Australia 3. Geochemistry
I. Title
CRC LEME Open File Report 65.
ISSN 1329-4768

PREFACE

The CSIRO-AMIRA project "Exploration for Concealed Gold Deposits, Yilgarn Block, Western Australia" has as its overall aim the development of improved geological, geochemical and geophysical methods for mineral exploration that will facilitate the location of blind, concealed or deeply weathered gold deposits. This Report presents results of research conducted as part of Module 2 of this project (AMIRA Project 241): "Gold and Associated Elements in the Regolith - Dispersion Processes and Implications for Exploration".

The objectives of this module are, *inter alia,* to suggest improvements in techniques of sampling and data interpretation for gold exploration, and to increase knowledge of the properties and genesis of the regolith. The results of the present study at Mt. Hope contribute strongly to these objectives by establishing (i) the vertical and lateral distribution of gold in soils in the vicinity of mineralization, (ii) the geochemical and mineralogical associations of gold and (iii) the probable dispersion mechanisms. In particular, the results demonstrate the specific association of gold and pedogenic carbonate in certain soils and indicate the importance of sampling the carbonate horizon during geochemical soil surveys. Subsequent work at Mt. Hope and elsewhere is aimed at maximizing the usefulness of this association for gold exploration in regions having similar calcareous soils.

C.R.M. Butt,
Project Leader.
May, 1989.

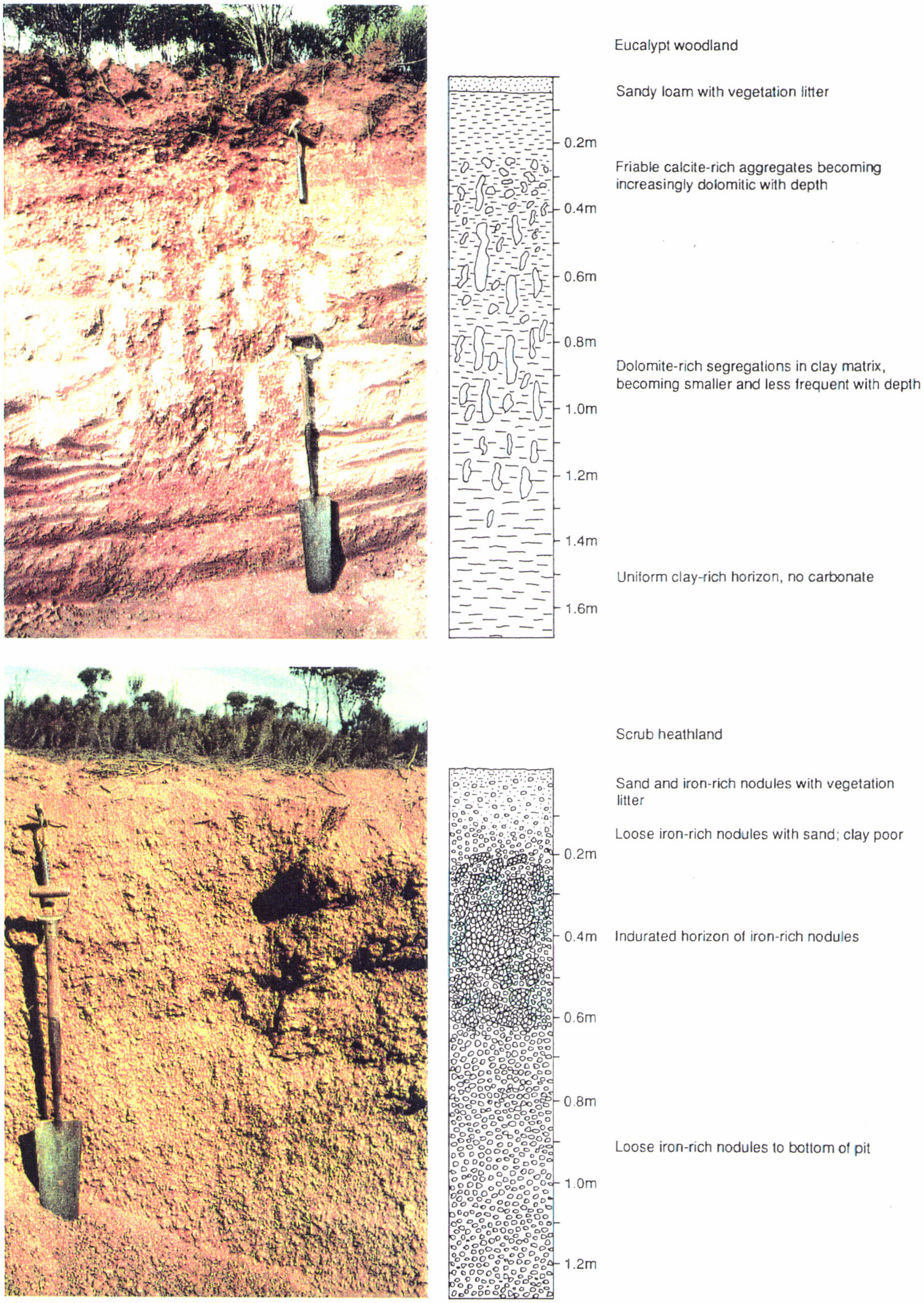

Plate: Photographs and diagrams showing typical examples of (top) a Type 1 profile - Pit 7 and (bottom) a Type 2 profile - Pit 3.

ABSTRACT

The principal objective of the study at Mt. Hope was to determine the location of gold in the surface environment and to determine the mechanism of its emplacement. Mt. Hope provided a near ideal exploration case study area where sampling of soils and vegetation could take place in a relatively undisturbed site.

After an initial orientation survey where a traverse of RAB and RC drilled material was sampled, several small pits (3 x 10 x 2 m deep) were dug. These were situated over, adjacent to and away from mineralization in order to expose various soil profiles. Following photography and description, the profiles were comprehensively sampled. The mineralogical and chemical composition of the samples show strong and highly significant associations especially between gold and the alkaline earth metals, the latter present as carbonates. The associations are widespread and therefore might be used as an exploration tool when looking for gold in areas similar to Mt. Hope. The chemical analysis of samples of vegetation and organic litter indicate the occurrence of gold. Gold values, in the vegetation and litter generally reflect those found within the soil profiles. Experimental work is being undertaken to examine these associations in further detail.

INTRODUCTION

Exploration for gold in the deeply weathered and often transported regolith, overlying much of the Yilgarn Block in Western Australia, has relied upon surface sampling techniques. Most gold mines were initially discovered by panning (loaming) and geochemical soil sampling. Future discoveries must rely more on the follow-up of increasingly subtle surface expression of mineralization, requiring sampling of specific horizons and mineral phases. Lag and pisolith sampling are examples of this approach. However, these materials are not always present and other phases such as pedogenic carbonate, are known to host gold. Pedogenic carbonates are widespread in southern Western Australia, its presence is indicative of climatic change from moist humid-tropical conditions when precipitation exceeded evaporation to the present semi-arid environment. The carbonate can occur in many forms, from massive boulders to paint-like surface coatings (Milnes and Hutton, 1983), but their origin is poorly understood.

Vegetation is another feature of the surface environment that deserves more attention from explorationists. Biogeochemistry has been recognized as an effective exploration technique in other continents although it has not been applied extensively in Western Australia. One notable exception to this has been the work of Smith and Keele (1984) which showed a clear relationship between gold in plants and the underlying mineralization.

It was known from previous soil and auger sampling programmes at Mt. Hope, undertaken by Aztec Exploration Ltd., that there were anomalous surface gold values in the area. The purpose of the present study was to attempt to answer the question - where is the gold? It was therefore considered relevant to concentrate the thrust of the project on investigating the nature of this relationship and whether orientation exploration techniques can be fine-tuned to take advantage of any of the results thus obtained. In addition the relationship between plants and soils was examined.

SITE DESCRIPTION

The Mt. Hope gold prospect is located approximately 95 km ENE of Hyden and 115 km SES of Southern Cross (Figure 1).

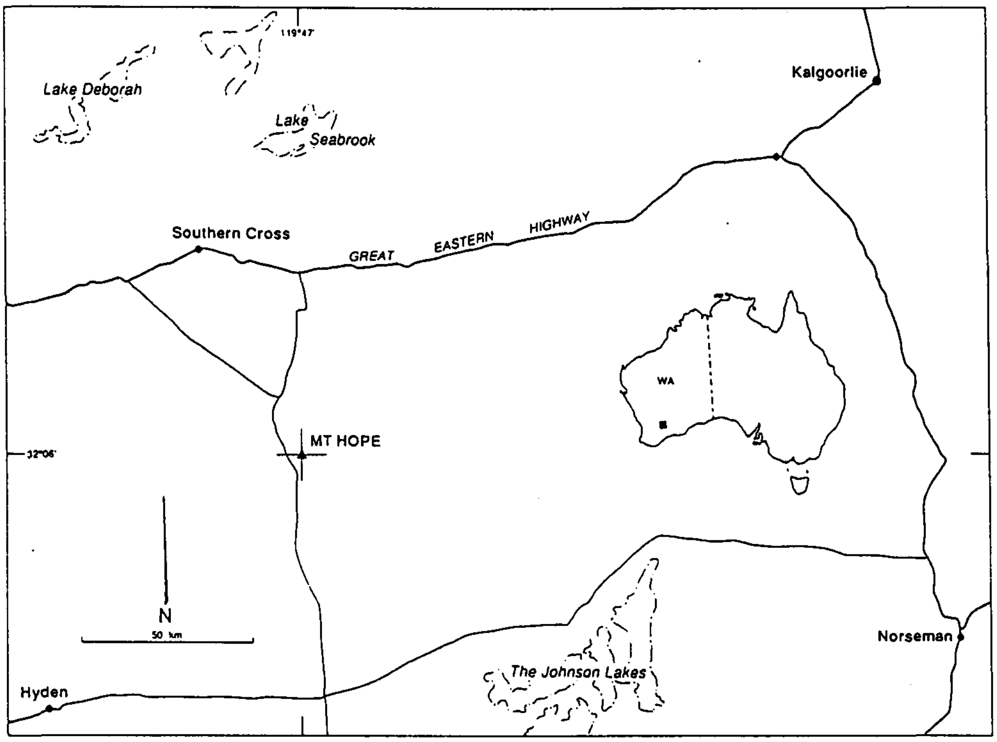

Figure 1. Map showing location of Mt. Hope.

Geologically, the prospect is situated in the Forrestania Greenstone Belt, which is the southern extension of the Southern Cross Greenstone Belt. A more detailed description of the regional geology is found elsewhere (Chin *et al.*, 1984). According to Smith (1986), Au mineralization at Mt. Hope is hosted by a steeply dipping semi-conformable shear system near the contact of a mafic intrusive and a komatiitic flow sequence. The main area of interest, the Bounty Zone, has been calculated to contain a mineable resource of 1.92 mt grading 7.5 g/tonne (Roberts, 1988). Mining of the site commenced in late 1988.

The major landform of the area is an undulating plain averaging about 440 m above sea level with local relief of from 25-50 m. The uplands are often mantled by a deep regolith of lateritic origin. Duricrusts, gravels and deep sandy mantles are common. There has been extensive, though imperfect, stripping of some of this material along some of the valleys and flanking sloped surfaces that are now mantled by calcareous colluvium on deep, non-calcareous, red clay substrates. The Bounty Zone is situated in a broad valley that is a tributary to major systems draining north and east into a large salt lake system at approximately 10 km. The ground surface at this site gently slopes upwards to the west.

Soils in the vicinity of the Bounty Zone are of two broad types; detailed descriptions are given in Appendices 1-9. Type 1 soils are a red clay loam consisting of 2 m of near homogeneous material (both in colour and texture), containing minor ironstone gravels overlying a leached saprolite. Generally, features of the profile include a veneer of organic litter and sheetwash containing minor rock fragments mainly of quartz. Friable calcareous material occurs throughout much of the upper 0.75 m. It continues to about 1.5 m as large pockets in a red plastic clay substrate (see Plate).

Type 2 soils consist of yellow mottled nodular gravels with zones of induration and loosely agglomerated material. The matrix of the friable soil is yellow to reddish-yellow and has a sandy loam to clayey sand texture. It contains nodules which vary in size but are generally less than 30 mm in diameter. Decaying vegetation litter overlies the sandy material (as for Type 1). There is little field evidence of carbonate (lack of effervescence from acid spot tests) in the Type 2 soils (see Plate).

The nature and density of the vegetation is largely controlled by soil type and topographic location and consists of a mosaic of plant communities. Over the calcareous clay soils (Type 1), sclerophyll woodland is dominant, consisting of a eucalypt canopy (up to 10 m in height) with occasional larger salmon gums (*Eucalyptus salmonophloia*) and a lower and semi-continuous shrubby horizon up to 1-2 m in height where tea-tree (*Melaleuca spp.*) is prominent. On the lower lying extensive plain to the north of the Bounty Zone, eucalypts generally have a mallee form (up to 4 m in height) with a sparse understorey. Vegetation over the lateritic Type 2 soils also has two forms. These are scrub heath, consisting of vegetation no more than a metre in height characterizing an area to the north-west of the Bounty Zone, and broombush thicket, consisting of a mixture of very dense acacias, casuarinas, hakeas and occasional mallee eucalypt up to 4 m in height, overlying the southern portion of the Bounty Zone.

SAMPLING AND ANALYSIS

Sample Type and Location

Three sampling visits, from December 1987 to July 1988, were made to Mt. Hope. Sample locations were based, initially, on soil anomalies previously identified by Aztec Exploration Ltd (Figure 2).

Orientation sampling took place along three line traverses consisting of composite RAB and RC drill spoil heaps. Thirty two samples along line 34960N (within mineralization) were collected over a distance of 65 m. To the north of the main mineralized zone, 41 samples were collected over a distance of 330 m along line 35800N, and 87 samples over a distance of 353 m along line 35600N. Predominantly, sampling was of surface and near surface material although some deeper samples were also collected.

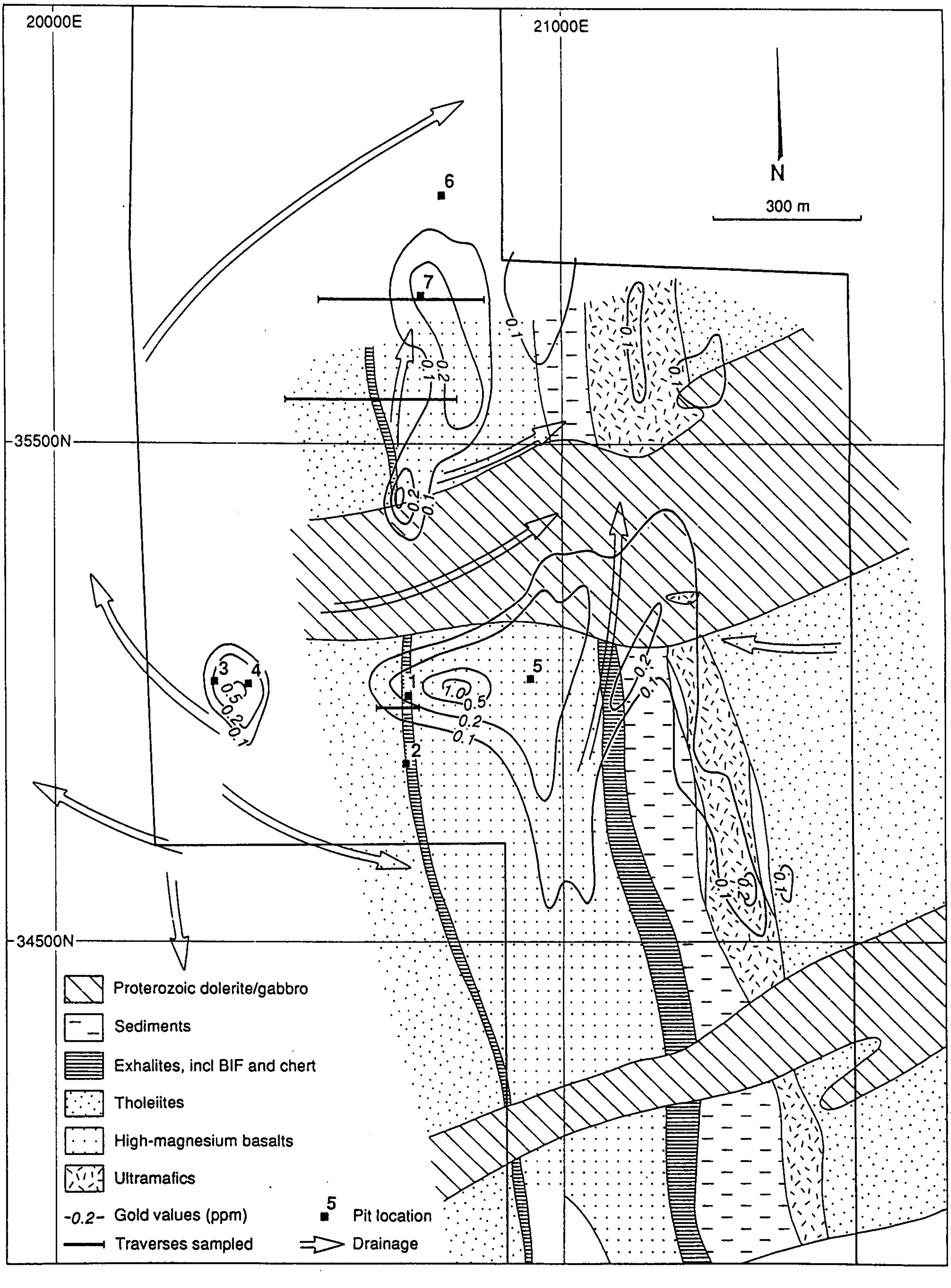

Figure 2. Map showing position of sampling points, geology and soil sampling contour values for gold.

Later visits involved the excavation of seven small pits by Aztec Exploration Ltd, using a bulldozer, away from, adjacent to and within mineralization. The width of the holes (2-3 m) facilitated photography, description and sampling. The length of the pits (up to 5 m) provided information on the degree of variability of soils within a relatively small area. The depth of the pits varied depending on the ease that the bulldozer was able to penetrate but, typically, calcareous profile type 1 soils were easier to dig and therefore deeper than the lateritic type 2 soils. In addition, deep trenches, commissioned for metallurgical test work by Aztec Exploration Ltd., provided profile samples to depths of up to 4 m. These results will be reported upon later.

Profiles chosen for sampling were first "cleaned" to remove foreign material introduced by the bulldozer and backhoe. Profiles were photographed for reference purposes before sampling (see Plate). Sampling of a profile was by "benching" using a geological hammer, rock chisels (when necessary) and collecting into a plastic pan before bagging. The benching technique ensured minimal contamination from material higher up the profile. Samples in excess of 1-2 kilos were collected. Vertical sample intervals were generally 50 mm in the upper horizons and 100-200 mm at depth.

Vegetation samples were collected by breaking off the particular plant organ(s) by hand and transferring it to a plastic bag. Where possible new growth was sampled together with examples of fruiting bodies (e.g. fruit, buds, flowers) to assist in identification. At least 100 g of material was collected from each sample site. Trunk samples were sawn on site.

Organic litter and surface ironstone gravels were swept into plastic dustpan and bagged in polythene.

Sample Preparation

Profile and traverse samples were dried, weighed, homogenized and split into two by cone and quartering on a plastic sheet. Half the sample was retained for reference. The other half was used for analysis. Samples containing fragments greater than 25 mm were jaw crushed prior to cone and quartering. Approximately 60 g was incrementally extracted and ground to a nominal minus 75 μm in an agate ring mill. Pressed discs were prepared and glued with PVA where necessary, for XRF analysis. Sub-samples were also extracted for X-ray diffraction (XRD), inductively coupled plasma (ICP) spectrophotometric and atomic absorption spectrophotometric (AAS) analysis.

Coarse surface ironstone material was collected by wet sieving to plus 2 mm and homogenized before being split into two by cone and quartering on a plastic sheet. Half the sample was retained for reference. Magnetic and non-magnetic fractions, using a hand magnet, from the remaining material. This was facilitated by screening and size sorting ironstones into similar groups prior to magnetic separation. The two fractions were then jaw crushed (if necessary) prior to grinding the entire fraction in a large case-hardened mild steel ring mill. Sub-samples were taken as before, for instrumental analysis.

Vegetation samples were air dried promptly after collection to avoid accumulating moisture within the tied plastic bags. Approximately 30 g of representive material was selected by hand from each sample. The sub-sample was placed in a plastic sieve and rinsed under tap water and then deionised water to remove foreign inorganic material. The sample was then dried in an oven on laminated cardboard trays at 105°C for at least 24 hours to remove moisture. This step was essential to prevent smearing of sample during subsequent milling. The dried material was hand crushed and then introduced into a four-bladed cross-beater mill. Dried wood samples were reduced in size using an hydraulically driven zirconia plate press prior to milling. The vegetation samples were passed twice through the mill - firstly without, and secondly with, a 1 mm mesh screen in place to ensure a suitably homogenized and macerated sample for instrumental analysis. The samples required no further preparation for instrumental neutron activation analysis (INAA). Samples had to be ashed for ICP analysis. After removing the 8 g sample for INAA, the remaining portion was heated in a furnace for 24 hours at 450°C. Samples were weighed before and after ashing so that comparisons could be made with the un-ashed samples sent for INAA.

Organic litter samples required a more thorough washing procedure. Individual samples were screened to plus 2 mm to remove fine inorganic and organic material and then soaked in tap water. Floating material was skimmed off, rinsed with deionized water and prepared for analysis in a similar manner to that used for vegetation.

Sample Analysis

XRF - Pressed discs of profile material were analysed for trace elements on a Phillips PW 1200C XRF analyzer by the method of Norrish and Chappell (1977). Initially samples were analyzed for 28 elements but later this list was reduced to 11.

XRD - Homogenised, powdered samples were smeared onto glass plates using alcohol and determined mineralogically by diffraction of graphite crystal monochromated CuKα radiation at 40kV using a Phillips PW1050 Diffractometer. The traces were interpreted by reference to the JCPDS powder data file for minerals.

ICP - 250 mg of sample were accurately weighed and mixed with 1 g of lithium metaborate. The mix was fused at 1000^{o}C for one hour and the residue dissolved in 1N nitric acid. The solutions were analysed on a Hilger E-100 ICP for the major and some minor elements.

AAS - 25g of sample was shaken with a 50 ml solution of 0.2% potassium cyanide saturated with calcium hydroxide. The bottle, containing the sample was capped and agitated for a minimum of 24 hours. After standing for 24 hours, about 15 ml of solution was extracted by pipette. The solutions were analysed for gold on a Varian 875 AAS. Solutions reading below 100 ppb were either analysed after organic extraction and concentration (Lintern *et al.,* 1988) on the same instrument using a graphite furnace attachment or, alternatively, analysed directly by ICP-MS.

pH - 2 g of dried soil material was shaken with 10 mL of 0.01M $CaCl_2$ in deionised water. The sample was then centrifuged for 10 minutes to separate out a clear liquor. The pH was then measured using an ORION Mk2 Analyser and a glass electrode. A duplicate set of samples was prepared using deionised water containing no calcium chloride. The results of the comparison are tabulated in Appendix 13 .

CSIRO's in-house weathered rock standards were introduced into each analytical run to ensure that results were consistent throughout the study. Satisfactory agreement was also found on selected elements using different analytical techniques on the same sample.

RESULTS

Analyses are tabulated in Appendices 1-9. For comparative purposes, vegetation and soil data are combined according to location. The tables contain information on element concentrations, mineralogy and physical descriptions of the samples, which include vegetation, soils, decayed organic litter and surface gravels.

The object of this investigation is to examine the gold distribution in the surface environment. Thus the discussion will concentrate on soils and plants, with additional results from deeper parts of the profile. When results become available for other profiles and traverses still awaiting instrumental analysis a further report will be prepared.

Correlation coefficients (r) were calculated using standard deviations that were assumed to be samples of the population i.e. the (n-1) method. The α value determined from tables (Rohlf and Sokal, 1981) is a measurement of probability. An α value of <0.001 is equal to a significance of greater than 99.9%, $\alpha <0.01$ greater than 99.0% and $\alpha <0.05$ greater than 95%.

Traverse Data

Detailed results are given in Appendices 1, 2, 3 and 10.

Mineralogy/Field Descriptions: The RAB composite data indicates a surface enrichment of friable calcareous minerals, calcite and dolomite, in quartz and kaolinite for both traverses. Below this horizon, and continuing to 4 m, hematitic and goethitic red clays predominate, generally containing iron-rich nodules. Fresh rock appears at about 20-30 m, containing pyrrhotite, plagioclase and actinolite .

Major Element Distributions: Analytical results confirm the mineralogical findings with significantly correlated high concentrations of calcium and magnesium ($r=0.97$, $\alpha<0.001$) corresponding to the occurrence of dolomite and calcite in the top metre. The alkaline earth metasl, together with sodium and potassium appear to dilute, replace or substitute the silicon and iron minerals. The effect is more pronounced when the lower parts, below to 4 m depth, of the profiles are considered. Soil pH is consistently higher near the surface, in both traverses, and reflects the presence of carbonates. Aluminium, on the other hand, shows no differentiation and is probably present as kaolinite.

Minor Element Distributions: The distribution of Mn, Sr and Ni is enriched within the near surface alkaline or calcareous component of the soil profile. Manganese is also found in high concentrations in unweathered material within mineralization (e.g. sample 04-1158). Chromium, V, As and, to a lesser extent, Pb are strongly correlated with Fe and Si and so have a negative correlation with Ca and Mg. Cerium and La distributions are highly correlated ($r=0.90$, $\alpha<0.001$) as are Zr and Ti ($r=0.94$, $\alpha<0.001$). Other minor and trace elements present occur either in low concentrations or show an erratic distribution pattern e.g. Bi, Mo, Sn, Se and Sb.

Gold distribution: The distribution of Au appears to follow the calcareous components. For the 0-1 m samples of the traverses, there is a highly significant correlation ($\alpha<0.001$) between Au and Mg ($r=0.90$), Ca ($r=0.89$), Sr ($r=0.88$), K ($r=0.88$), Mn ($r=0.89$) and Ni ($r=0.80$). The relationship between the alkaline earth metals and Au is represented in Figure 3.

The correlation is more marked when samples at 3 m depth are included. The vertical relationship is fully investigated in the profile data. Wet sieving of three samples, collected from 35800N, indicate that most of the Au is associated with sub-53 μm particles (Table 1). Furthermore, detailed studies of the fine fraction using scanning electron microscope techniques failed to locate any Au grains suggesting that they are of sub-micron size.

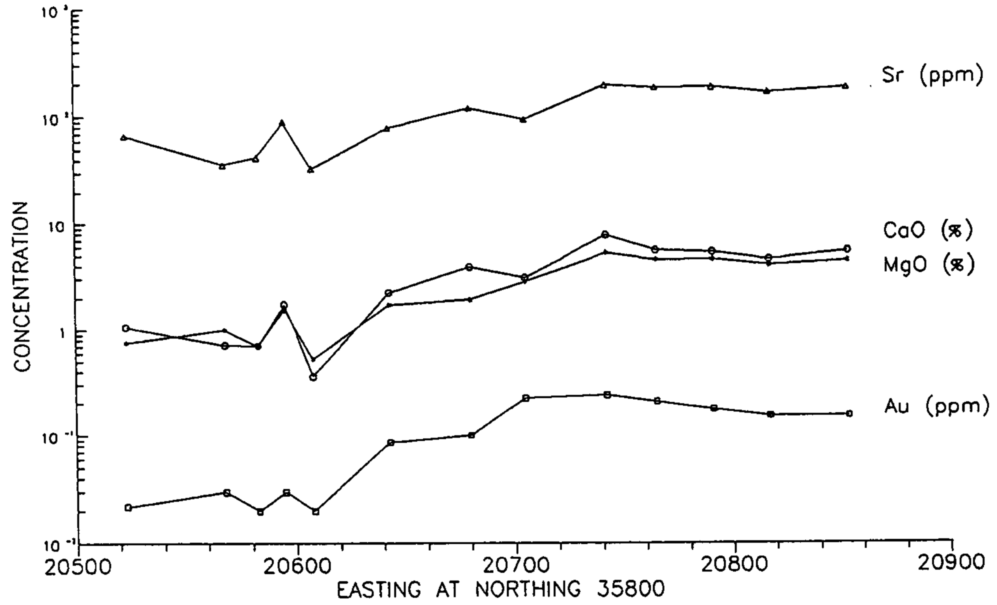

Figure 3. Traverse along 35800N showing the 0-1 m composite analytical results for the alkaline earths and Au.

Table 1. Percentage distribution of size fractions and Au content following wet sieving.

Size	Sample 04-1087		Sample 04-1099		Sample 04-1121	
μm	%wgt	%Au	%wgt	%Au	%wgt	%Au
+800	3.9	1.2	7.0	4.0	6.9	10.1
-800+450	6.3	0.2	7.1	1.5	9.6	9.0
-450+300	16.4	0.5	9.4	0.9	13.4	5.7
-300+210	12.5	0.5	7.1	0.3	16.6	3.0
-210+105	6.4	0.5	10.5	1.2	11.5	4.9
-105+53	3.1	0.2	4.9	0.6	5.6	5.5
-53	51.4	96.8	54.0	91.4	36.4	64.7
TOTALS	100.0	100.0	100.0	100.0	100.0	100.0

Profile Data

Type 1 profiles: Detailed results are given in Appendices 3, 6, 7, 8, 9 and 11. Type 1 profiles occur at pits 1, 4, 5, 6 and 7. They contain significant amounts of calcite and dolomite in quartz and kaolinite. The depth to the top of the calcareous horizon varies. In pits located in the broad valley, the calcereous components occur at about 0.5 m whereas in pits located on the slopes they are closer to the surface (25 mm). There is an overall progressive enrichment of dolomite over calcite with increasing depth in the calcareous horizon. The carbonate generally occurs as a friable or powdery aggregate, commonly concentrated in pockets and indurated in places. Hematite and goethite are present in minor quantities.

Consistent with their mineralogy, Type 1 profiles contain relatively large amounts of Ca and Mg. The maximum Mg concentration for a Type 1 profile sample varies from about 1% (pit 4) to about 5% (pit 1), discounting grab sample 04-1322. For Ca, the maximum concentrations range from 3.2% (pit 6) to 9.4% (pit 1). Gold distribution in Type 1 profiles follows accurately and precisely the Ca and Mg distributions (Figure 4). These highly significant relationships (Ca $r=0.763$, Mg $r=0.734$, $\alpha<0.001$) are consistent for all Type 1 profiles. The Au-Ca or Au-Mg ratios increase towards mineralization, which is to be expected, but do not change markedly within each profile. There is also a high correlation between Au and Mn ($r=0.468$, $\alpha<0.001$), a relationship also seen in the traverse data. Silicon, Fe and Ti are significantly negatively correlated with the alkaline earth metals. Manganese is enriched in the surface horizons (0-0.2 m) and also at about 0.5 m in pits 6 and 7, corresponding to high alkaline earth metal concentrations. Iron is strongly correlated ($\alpha<0.001$) with Cr ($r=0.904$), Cu ($r=0.763$) and V ($r=0.957$).

Type 2 profiles: Detailed results are given in Appendices 4, 5, 6 and 12. The acidic Type 2 profiles occurring at pits 2, 3 and 4 contain little carbonate and, instead, consist of yellow hematitic and goethitic nodules of various sizes, in a quartz-kaolinite matrix. The mineralogical data are supported by chemical analysis, with Fe, Si and Al concentrations reflecting the presence of the nodules. Iron and Ti distribution do not follow an easily recognizable general pattern, but appear to increase slightly with depth in certain profiles, with a resultant loss of Si. Calcium and Mg concentrations are below about 0.1%. The Au concentration range is similar to that found in Type 1 profiles but its distribution here is correlated with Fe ($r=0.566$, $\alpha<0.01$). Copper ($r=0.673$), Cr ($r=0.869$) and V ($r=0.890$) are more strongly correlated with Fe ($\alpha<0.001$). Manganese and Ni are strongly correlated with the alkaline earth metals but at lower concentrations than found in Type 1 profiles.

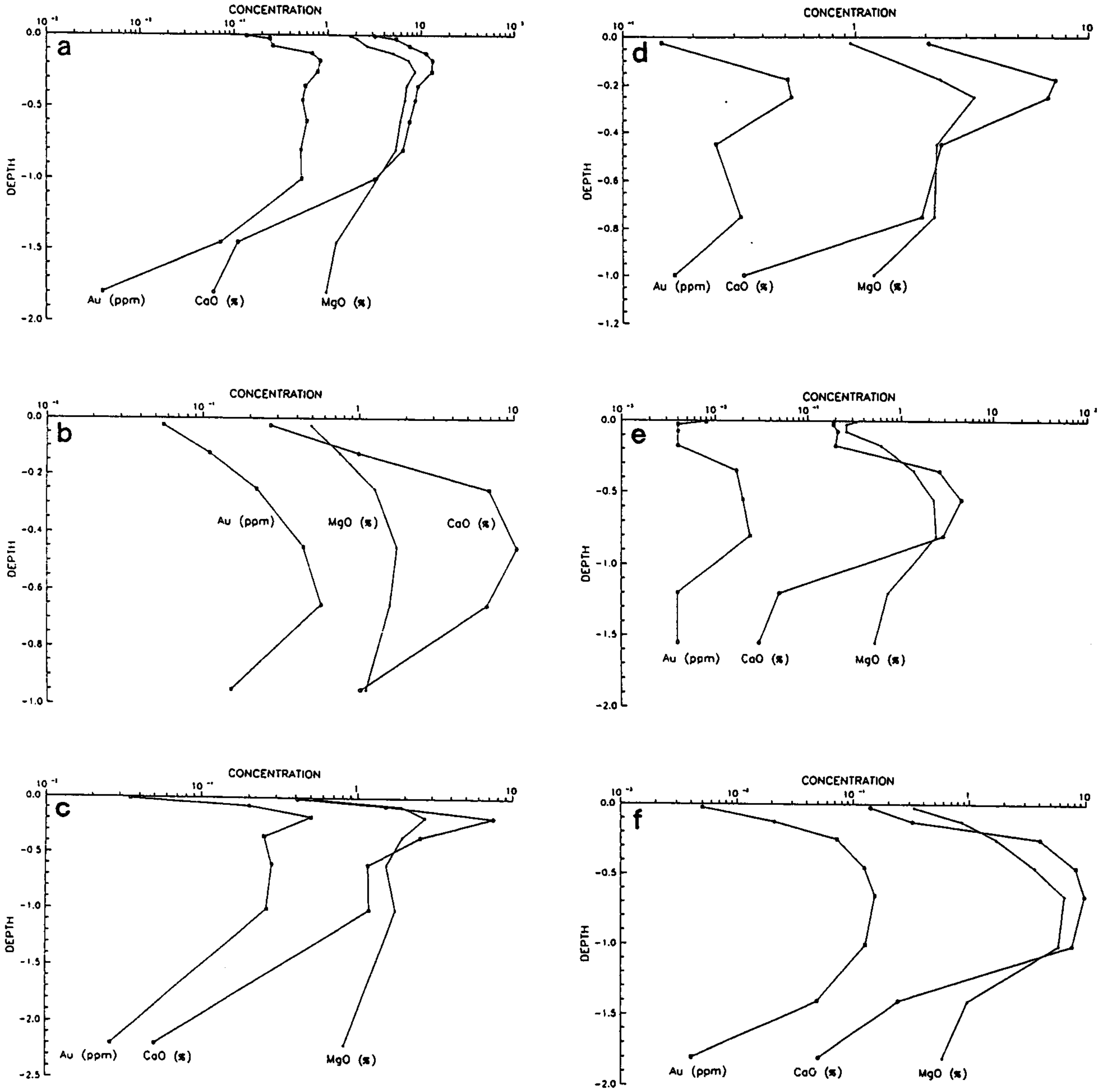

Figure 4. Depth v concentration for calcium, magnesium and gold in Type 1 profiles: a) pit 1; b) pit 4; c) pit 5(a); d) pit 5(b); e) pit 6; f) pit 7.

Biogeochemical Data

From the results received so far only Au, Fe, Cr and Br are present in significant concentrations in vegetation or litter. Concentrations of Ag, As, Ba, Co, Ir, Mo, Sb, Se, Ta, Th, U, W and Zn are either below or near the limits of detection. Values have been expressed in terms of ash content.

The minimum and maximum concentration range for Au in vegetation occurs at the same pits as the minimum and maximum values for soils. The Au concentrations range from below detection (about 0.03 ppm) at pit 6, to 0.312 ppm at pit 3. The Au content of the plant litter varies from below detection (<0.01 ppm) at pit 6, to 0.585 ppm at pit 1 and were generally higher than concentrations found in the vegetation. All of the major plant genera sampled *(Eucalyptus, Melaleuca* and *Daviesia)* contain some Au but no particular genus is outstanding as an Au accumulator. Average Fe and Cr values in the plant litter are about three times higher than vegetation values. Iron concentrations range from below detection (about 0.3%) to 1.74% in the vegetation and 2.17% to 5.33% in the plant litter. Chromium values range from below detection (about 30 ppm) to 126 ppm in the vegetation and 128 ppm to 393 ppm in the plant litter. In contrast, Br concentrations were, generally, considerably higher in vegetation when compared with the plant litter with values ranging from 78 ppm to 1867 ppm in the vegetation and 114 ppm to 394 ppm in the plant litter.

A further detailed study of Au distribution within a single plant was undertaken (Table 2). Samples were taken from various plant organs from the tree *Eucalyptus flocktoniae* (merrit) growing in the vicinity of pit 1. Though the leaves have the greatest concentration of Au, most of the Au in the tree is contained within the trunk, since this has the greatest mass. Further discussion of the biogeochemical data will be included in a later report.

Table 2. Gold distribution in plant organs of *Eucalyptus flocktoniae.*

Sample Type	Au Content (μg/kg) dry weight	Total Weight (g)	Total Au (μg)
LEAF (1)	3.3	323	1.07
LEAF (2)	2.7	249	0.67
BRANCH(1)(<5 mm d)	1.8	190	0.34
BRANCH(2)(<5 mm d)	<0.5	108	<0.11
BRANCH (>5 mm d)	2.2	595	1.30
BARK	1.1	61	0.07
TRUNK	2.0	4175	8.21
ROOT	1.6	864	1.40
TOTALS		6563	13.17

DISCUSSION

The most interesting feature of this study is the correlation that exists between Au and the alkaline earth metals. The correlation exists not only vertically (to two metres) but also horizontally. The relationship appears to be strongest when alkaline earth concentrations in the top metre exceed about 0.1%. Furthermore, the peak concentrations of Au, Ca and Mg coincide.

An understanding of the relationship between the alkaline earths and Au can be obtained by examining the characteristics of the calcareous horizons and assessing the possible models for their formation. The carbonates at Mt. Hope are typical of pedogenic calcretes that occur in the semi-arid regions of southern Western Australia that have a predominantly winter rainfall regime. This is in contrast to the semi-arid regions farther north, with predominantly summer rainfall, where pedogenic calcretes are less common but where groundwater calcretes have formed in valley axes. At Mt. Hope, the carbonates occur principally as a soil horizon, within 3 m of the present surface, in both residual and transported material. The carbonates are generally friable, lack induration and do not preserve relict fabrics. The carbonate horizon is commonly 0.5-1.5 m thick (Ca + Mg > 0.2%), but locally may be thicker (e.g. 3 m over the lode) or absent (e.g. from lateritic Type 2 soils). They are commonly separated from the bedrock by 5-20 m of carbonate-free, dominantly kaolinitic regolith material (usually saprolite). There is thus no immediate and obvious source of the carbonate, except where it occurs as coatings on almost unweathered cobbles of basic rocks.

Pedogenic carbonates, other than those developed on limestones, are characteristically developed in semi-arid climates (rainfall 100-600 mm per annum). In Western Australia, such climates have post-dated the more humid, tropical conditions that were responsible for the formation of the widespread, deeply weathered lateritic regolith. The calcretes are thus considered to be recent additions to the regolith, modifying both its composition and structure.

Several models for the formation of pedogenic calcretes have been proposed (e.g. McKeague and St. Arnaud, 1968; Wetherby and Oades, 1975; Salomons *et al.,* 1978; Milnes and Hutton, 1983; Burvill, 1989). These can be summarized as follows:

1. *In situ* model: Alteration of pre-existing limestone rocks result in the dissolution and reprecipitation of alkaline earth carbonates *in situ.*

2. Ascending model (I): Groundwater containing alkaline earth metals, derived directly from weathering rocks, and dissolved carbon dioxide is drawn to the surface by capillary action and subsequently evaporates. The groundwater then degasses and deposits the metals as carbonates near the surface in an arid environment.

3. Ascending model (II) : Meteoric water percolates predominantly downwards during cool, wet periods leaching alkaline earths from soil horizons, and ascends by capillary action during warm dry periods to redeposit carbonates either by evaporation, degassing or both.

4. Descending model (I): Alkaline earth and carbonate enriched solutions originating at the surface from mechanisms such as rain and dissolution of dust particles (e.g. from salt lakes) percolate downwards and accumulate at depths related to the degree of infiltration.

5. Descending model (II): Alkaline earth solutions are absorbed through plant roots released following leaf/branch fall or plant death, dissolve and accumulate at depths related to the degree of input and infiltration.

The *in situ* model is inappropriate, as there are no limestones present, either in the bedrock or as an unconformable surface unit (e.g. an aeolianite). The ascending (II) model implies the presence of weatherable Ca-Mg minerals in the soil. These are unlikely to be present in an already strongly weathered regolith, unless replenished as aeolian dust, in rainfall or biogenically, as described for the descending models. The accession of alkalis and alkaline earth elements as aerosols with rainfall has been well established (Hingston and Gailitis, 1976), and is largely responsible for the salinization of groundwaters, but cannot alone account for the origin and heterogeneous distribution of carbonates. The aeolian accession of these elements, e.g. by deflation from playas, has long been considered to be the principal source of the carbonates in south west Australia. However, this mechanism similarly cannot readily account for the observed lithodependence of the carbonate distribution, namely being most abundant over calcic rocks such as amphibolites and, at Mt. Hope, the carbonate-altered lode, and being less abundant over Ca-poor rocks such as granites and dunites. Airborne accession, as aerosols or dust, would give a more even distribution. Accordingly, although these may well be minor sources, the ascending (I) and descending (II) models probably have more significance; the latter can also account for the presence of gold. The biogenic input of the descending model (II) is in effect a variant of the ascending model (I), with the transpiration of deep-rooted plants accelerating the capillary/evaporative process through the whole profile and/or shallow-rooted plants causing recycling in the near-surface horizons. Evidence of root penetration to at least 2 m was clearly observed in the pits. The role of plants in both the formation of the carbonates and the association of gold with them is supported by the presence of detectable gold and up to 20% Ca and Mg in the ash of vegetation and litter.

Following defoliation and microbial decomposition of the litter, meteoric water in combination with components of the soil e.g. cyanides, thio complexes or halides re-mobilizes the Au and other elements enabling infiltration of the soil. The source of the carbon dioxide, to complex and later precipitate the Ca and Mg as carbonates is generated by the plant roots themselves during respiration.

The preferential occurrence of pedogenic carbonates in winter rainfall regions is probably due to the longer growing season that, in consequence, results in greater root respiration and evolution of CO_2 and hence higher concentrations of carbonate in soil moisture. Longer term climatic influences could also be of significance in the accumulation process (Milnes and Hutton, 1983). Precipitation occurs at the base of leaching due to the loss of water by evapotranspiration and/or degassing of CO_2 (lower partial pressure due to decline of respiration at the end of the growing season or because water has percolated below the principal root zone). Calcite is precipitated ahead of, and hence on top of, dolomite in the soil profiles owing to its poorer solubility at high pH values (Weatherby and Oades, 1975).

The depth and extent of the carbonate layer is probably due to a combination of many factors including proximity to carbonate source rocks, drainage, infiltration rates, topography, soil type and concealment by transported material. Further re-mobilization of the nutritionally important Ca-Mg horizons by smaller plants with less penetrating root systems will contribute to later lateral dispersion. The extent and shape of this "mushrooming" would be, in part, topographically controlled, consequently, at Mt. Hope, the Au anomaly has become displaced downslope from the source of mineralization.

IMPLICATIONS FOR EXPLORATION

The implications of the results for exploration are significant. Sample type is an important consideration for delineating regional Au anomalies because of the strong Au-carbonate association. A sampling strategy that favours the collection of the carbonate horizon is therefore recommended. It has been shown that the carbonate horizon can vary with depth. Collection of a composite fraction (e.g. 0-1 m or 0-2 m) rather than just the topsoil is a practical solution to this problem. If sampled correctly, the carbonate horizon may well represent an additional medium ranking with pisoliths and other lateritic components , for Au exploration in the arid environment.

Biogeochemical prospecting for Au in Western Australia has not received sufficient attention as an exploration tool. Whether its popularity will increase will depend on case studies which establish that plants can provide better information on the distribution of Au, particularly in relation to other exploration techniques such as soil sampling. Clearly, the results from the present study indicate that Au is being effectively taken up and transported by root systems to the leaves and branches of plants where they are growing on soils and saprolite containing Au. Data from the analysis of the plant and organic litter sample media suggest that it too is suitable material for Au exploration. However, since the survey performed at Mt. Hope was confined to the vicinity of the pits, caution should be exercised in extrapolating the results too far. A regional biogeochemical survey based on a traverse sampling procedure together with collection of the corresponding soil sample is recommended to evaluate biogeochemical techniques fully. The results given here are encouraging and suggest numerous plant genera that would be useful to collect (e.g.*Melaleuca*, *Thryptomene*, *Eucalyptus*, *Daviesia*). Plant leaves regularly report the highest Au concentrations, so these should be sampled where possible.

In areas where Ca and Mg do not occur in significant concentrations, no special soil sampling techniques are indicated. For example, Type 2 profiles containing Au show no difference in their location, profile position, mineralogy or geochemistry when compared with Type 2 profiles that do not contain Au. It however, must be stressed that further work on sampling of additional Type 2 profiles has been undertaken and it is therefore premature to conclude too much based on the limited data in this report. It is also clear that the surface ironstones collected (magnetic or non-magnetic) do not concentrate Au to any great extent. Again, however, conclusions are premature because of insufficient data.

Future work: It is proposed to investigate the relationship between Au and the alkaline earth metals in greater detail e.g. using selective extraction experimental procedures. Long term mobilization and precipitation experiments will also be considered to determine how and which Au chemical species is/are most responsible for dispersion.

ACKNOWLEDGEMENTS

I take this opportunity to thank staff at CSIRO, in particular Max Churchward for instruction on profile sampling and, together with Charles Butt and Ian Robertson, for comments on earlier drafts of this manuscript. Thanks also go to Aztec Exploration Ltd. for allowing access to Mt. Hope and providing welcome hospitality whilst there.

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APPENDICES

CONTENTS

7. Data and descriptions for pit 5, 20930E 35015N:
   a) northings, eastings, depth and major elements (in %),
   b) minor and trace elements (in ppm),
   c) depth, pH, sample weight, mineralogy and descriptions,
   d) biogeochemical and other data.

8 Data and descriptions for pit 6, 20780E 36000N:
   a) northings, eastings, depth and major elements (in %),
   b) minor and trace elements (in ppm),
   c) depth, pH, sample weight, mineralogy and descriptions,
   d) biogeochemical and other data.

9. Data and descriptions for pit 7, 20720E 35800N:
   a) northings, eastings, depth and major elements (in %),
   b) minor and trace elements (in ppm),
   c) depth, pH, sample weight, mineralogy and descriptions,
   d) biogeochemical and other data.

10. Correlation coefficients and significance table for the subset "Traverse 35800N, 0-1 m composites". Concentration ranges are in % for major elements and ppm for minor and trace elements. Subset size is 13 samples.
    Correlation coefficients: $r>0.801, \alpha<0.001$ (99.9%),
    $r>0.684, \alpha<0.01$(99.0%),
    $r>0.553, \alpha<0.05$(95.0%).

11. Correlation coefficients and significance table for the subset "Type 1 profiles". Concentration ranges are in % for major elements and ppm for minor and trace elements. Subset size is 46 samples.
    Correlation coefficients: $r>0.473, \alpha<0.001$ (99.9%),
    $r>0.376, \alpha<0.01$ (99.0%),
    $r>0.291, \alpha<0.05$ (95.0%).

12. Correlation coefficients and significance table for the subset "Type 2 profiles". Concentration ranges are in % for major elements and ppm for minor and trace elements. Subset size is 23 samples.
    Correlation coefficients: $r>0.629, \alpha<0.001$ (99.9%),
    $r>0.515, \alpha<0.01$ (99.0%),
    $r>0.404, \alpha<0.05$ (95.0%).

13. Comparison of pH for a selection of soils using either 0.01M CaCl(2) solution or deionised water.

APPENDIX 1. Data and descriptions for traverse line 34960N:
a) northings, eastings, depth and major elements (in %),
b) minor and trace elements (in ppm),

a)

SAMPLE	EASTING	NORTHING	DEPTH	SiO_2	TiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	Na_2O	K_2O	P	S
04-1128	20645	34960	0.5	53.80	0.42	8.52	8.48	3.23	8.15	0.45	0.96	0.005	0.060
04-1129	20645	34960	1.5	59.20	0.50	9.93	10.50	2.83	3.73	0.97	1.08	0.006	0.068
04-1130	20645	34960	3.5	62.50	0.84	15.10	9.05	0.55	0.79	3.07	0.72	0.002	0.063
04-1131	20645	34960	5.5	58.50	0.91	15.10	11.20	0.50	1.03	4.12	0.72	0.004	0.076
04-1132	20645	34960	35.5	53.30	0.71	14.00	11.30	6.17	9.82	1.87	0.36	0.044	0.064
04-1133	20676	34960	0.5	47.70	0.46	10.40	11.70	3.29	8.81	0.52	0.84	0.004	0.087
04-1134	20676	34960	1.5	56.40	0.59	17.70	10.40	1.52	1.87	0.75	0.24	0.000	0.490
04-1135	20676	34960	3.5	62.70	0.52	15.50	11.00	0.69	0.07	2.77	0.24	0.000	0.076
04-1136	20676	34960	5.5	63.50	0.62	14.90	12.30	0.56	0.04	0.87	0.24	0.001	0.098
04-1137	20676	34960	56.5	55.60	0.05	3.61	24.70	3.11	7.16	1.20	0.12	0.020	8.266
04-1138	20676	34960	57.5	49.70	0.13	4.84	30.60	3.01	5.36	1.87	0.12	0.051	9.860
04-1139	20688	34960	0.5	51.60	0.50	12.70	6.99	3.30	8.82	0.80	1.33	0.002	0.090
04-1140	20688	34960	1.5	46.70	0.54	15.40	8.91	4.83	6.31	1.00	0.96	0.000	0.329
04-1141	20688	34960	2.5	50.30	0.76	21.70	13.50	0.98	1.52	0.53	0.36	0.000	0.111
04-1142	20688	34960	4.5	56.20	0.65	20.60	14.50	0.32	0.11	0.40	0.12	0.000	0.057
04-1143	20688	34960	5.5	59.60	0.60	18.70	12.00	0.35	0.08	0.67	0.24	0.002	0.059
04-1144	20688	34960	7.5	59.50	0.73	18.70	11.30	0.51	0.14	0.87	0.36	0.002	0.061
04-1145	20700	34960	0.5	55.90	0.51	10.70	11.90	2.56	3.92	0.73	0.96	0.007	0.060
04-1146	20700	34960	1.5	62.00	0.63	14.70	7.84	1.92	1.26	0.87	0.84	0.061	0.049
04-1147	20700	34960	3.5	45.40	0.88	22.00	21.50	0.15	0.03	0.60	0.12	0.009	0.196
04-1148	20700	34960	18.5	64.40	0.22	6.42	23.90	0.22	0.07	0.87	0.12	0.022	0.094
04-1149	20700	34960	19.5	52.20	0.53	10.80	28.60	0.47	0.11	2.80	0.24	0.027	0.087
04-1150	20710	34960	0.5	55.60	0.51	12.20	10.90	2.70	6.15	0.53	0.96	0.063	0.054
04-1151	20710	34960	1.5	67.40	0.60	14.60	9.14	1.34	0.86	0.80	0.96	0.003	0.610
04-1152	20710	34960	3.5	38.00	0.99	21.80	28.90	0.13	0.03	0.53	0.12	0.001	0.124
04-1153	20710	34960	7.5	68.40	0.47	12.50	15.50	0.11	0.11	0.40	0.00	0.001	0.088
04-1154	20710	34960	8.5	67.90	0.45	12.40	13.40	0.09	0.02	0.47	0.00	0.002	0.087
04-1155	20688	34960	27.5	56.10	0.77	14.80	10.80	4.89	7.87	3.14	0.60	0.004	0.010
04-1156	20688	34960	28.5	60.50	0.76	15.30	10.00	4.69	6.33	3.94	0.60	0.008	0.023
04-1157	20688	34960	29.5	61.30		16.00	10.10	4.81	6.56	4.61	0.60	0.007	0.047
04-1158	20688	34960	35.5	66.90	0.07	2.09	26.00	2.48	2.67	0.40	0.12	0.050	3.460
04-1159	20688	34960	36.5	58.40	0.15	4.06	24.40	1.80	2.35	0.80	0.12	0.020	8.272

b)

SAMPLE	As	Au	Ba	Be	Bi	Ce	Co	Cr	Cu	Ge	La	Mn
04-1128	9	0.080	115	0.00	1	22	9	282	47	1	12	474
04-1129	12	0.060	154	0.61	1	28	16	355	51	0	13	455
04-1130	9	0.002	250	0.39	1	8	23	89	63	0	5	117
04-1131	7	0.002	332	0.14	0	14	10	42	81	0	1	187
04-1132	0	0.012	154	0.00	1	20	44	61	126	0	8	1331
04-1133	12	0.140	113	0.00	0	26	12	368	78	0	18	430
04-1134	4	0.120	258	0.00	0	9	12	142	121	0	8	215
04-1135	0	0.008	205	0.00	0	3	12	81	91	0	2	112
04-1136	9	0.100	186	0.32	0	4	13	104	100	0	3	111
04-1137	0	65.400	25	0.00	2	6	55	112	265	0	7	3354
04-1138	0	131.800	68	0.00	6	15	77	130	294	0	14	3106
04-1139	6	0.200	246	0.00	1	29	22	220	77	0	11	546
04-1140	7	0.180	166	0.52	0	31	22	206	95	3	13	614
04-1141	8	0.052	50	0.43	0	8	14	131	116	1	2	292
04-1142	7	0.006	27	0.15	0	3	5	105	116	1	0	138
04-1143	5	0.010	72	0.00	1	2	9	103	104	1	2	110
04-1144	4	0.080	107	0.08	0	4	7	122	99	0	5	182
04-1145	6	0.180	127	0.96	1	33	12	387	54	0	17	396
04-1146	10	0.100	165	1.05	0	29	16	324	75	2	12	249
04-1147	10	0.004	35	0.35	1	3	7	189	119	1	2	103
04-1148	67	8.820	690	0.47	1	4	25	322	222	2	14	223
04-1149	50	4.980	158	0.86	0	19	52	233	264	2	28	814
04-1150	10	0.380	130	1.54	0	33	18	310	70	0	17	500
04-1151	9	0.260	167	1.62	2	28	20	274	74	2	13	306
04-1152	13	0.016	24	0.68	1	2	13	216	135	2	3	107
04-1153	35	1.580	19	0.15	0	0	16	369	125	0	0	64
04-1154	31	0.960	29	0.78	1	1	14	559	91	0	0	65
04-1155	5	0.220	155	2.14	0	20	73	57	49	0	10	1234
04-1156	7	0.072	104	1.01	0	20	69	50	49	0	9	1213
04-1157	9	0.104	95	1.76	0	19	n	n	67	0	n	1240
04-1158	20	2.580	13	1.18	3	7	32	49	102	0	13	3949
04-1159	0	0.078	39	0.91	0	5	49	337	239	0	12	2764

APPENDIX 1 cont.

c) minor and trace elements (in ppm) continued,

d) depth, pH, sample weight, mineralogy and descriptions.

c)

SAMPLE	Mo	Nb	Ni	Pb	Sb	Se	Sn	Sr	V	W	Zn	Zr
04-1128	20	3	44	11	3	2	4	276	195	18	25	101
04-1129	9	5	51	9	0	2	3	162	260	16	25	112
04-1130	2	3	19	6	1	3	0	80	221	11	17	123
04-1131	3	4	24	3	0	3	0	112	298	4	14	107
04-1132	4	1	95	2	1	0	1	157	230	15	69	75
04-1133	7	7	56	13	0	1	1	226	266	9	24	99
04-1134	5	1	55	7	0	0	0	71	155	0	32	75
04-1135	2	2	59	1	2	1	0	17	129	3	70	65
04-1136	1	3	35	3	1	5	0	9	179	6	27	73
04-1137	3	0	178	7	0	8	0	46	19	12	164	6
04-1138	3	2	234	11	3	12	3	50	43	7	155	18
04-1139	2	5	62	15	0	1	0	314	159	9	252	107
04-1140	1	7	73	15	1	0	12	255	202	6	151	109
04-1141	2	3	41	9	0	2	4	62	267	9	55	86
04-1142	1	1	27	4	3	3	0	4	256	0	47	91
04-1143	1	4	24	4	1	2	0	4	178	2	45	87
04-1144	5	1	44	12	0	1	0	9	159	6	444	75
04-1145	23	5	75	14	0	0	5	162	277	10	23	122
04-1146	11	6	61	11	0	3	0	71	189	9	28	126
04-1147	4	2	43	6	3	2	0	6	662	3	8	102
04-1148	3	1	147	15	0	4	0	14	340	10	85	28
04-1149	1	5	229	32	1	6	3	73	247	1	118	57
04-1150	84	7	76	13	2	3	5	183	216	9	23	124
04-1151	33	8	76	13	0	1	2	61	177	17	26	127
04-1152	7	6	31	9	0	5	0	1	670	0	1	115
04-1153	1	3	36	9	0	0	0	1	488	14	9	44
04-1154	2	3	31	5	2	3	0	0	399	16	15	41
04-1155	2	1	79	5	0	1	1	224	249	5	68	76
04-1156	3	2	78	5	0	3	0	253	238	7	92	108
04-1157	2	1	76	4	2	2	0	210	n	5	78	95
04-1158	3	1	99	3	0	3	0	17	27	16	195	17
04-1159	1	1	242	15	0	8	0	22	46	18	188	27

d)

SAMPLE	DEPTH	pH	WGT(g)	MINERALOGY					FIELD DESCRIPTIONS
04-1128	0.5	6.9	1502						0-2m silt br.clay loam
04-1129	1.5	7.1	1244						2-3m reddish clays
04-1130	3.5	6.0	4975						3-16m ferr. clays,v. fine clays,some frag. at top
04-1131	5.5	5.4	2112						16m+ saprolitic clays
04-1132	35.5	6.0	1462						
04-1133	0.5	6.5	922						0-2m sl. silt then clay rich red br. calc. loam
04-1134	1.5	6.4	1717						2-3m pale red clays,some Fe fragments
04-1135	3.5	5.0	3172						3-18m red ferr.clays with Fe frag. at top.(powd .samples not logged)
04-1136	5.5	4.5	2334						>18m sap. clays,fresh at 33m
04-1137	56.5	6.1	2206	QTZ	Py	An			KEY:QTZ=quartz,Py=pyrrhotite,An=anorthite,C=calcite,D=dolomite,
04-1138	57.5	6.4	2288	QTZ	Py	An			G=goethite,H=hematite,F=feldspar,Al =albite, Ed=edenite,K=kaolinite.
04-1139	0.5	7.0	792	QTZ	C	K	D		0-5m pale red br.loam,silt top 1m,calc
04-1140	1.5	7.0	1521	QTZ	D	K	G		
04-1141	2.5	6.3	1254	QTZ	K	G	H		
04-1142	4.5	5.4	1397	QTZ	K	G	H		5-6m similar to 0-5m,not calcereous
04-1143	5.5	4.6	1523	QTZ	K	G	H		6-15m red ferr. clays, some Fe frag(?)
04-1144	7.5	4.6	1159	QTZ	K	G			
04-1145	0.5	6.9	1170	QTZ	D	C	K		0-1m pale red br. loam,silt calcereous
04-1146	1.5	6.9	1323	QTZ	K	D			1-11m pale red brown clay,sap. chips
04-1147	3.5	4.9	2369	QTZ	K	H			
04-1148	18.5	4.3	1957	QTZ	G	H	Fe		11-18m red ferr. clays
04-1149	19.5	4.4	1805	QTZ	Fe	H	G		18-22m brown red ferr. clays
04-1150	0.5	7.1	1294	QTZ	D	C			0-2m silt calcareous clay loam, red brown
04-1151	1.5	7.2	1454	QTZ	K	D	C	H	2-3m clays some Fe fragments
04-1152	3.5	4.5	3077	QTZ	G	K	H		3-13m sap clays with siliceous clays and Fe fragments
04-1153	7.5	4.4	1798	QTZ	K	G	H		
04-1154	8.5	4.4	2125	QTZ	K	H	G		9-10m strongly ferr.
04-1155	27.5	6.0	1179						13-20m more ferr. clays,becoming fresh at 20m
04-1156	28.5	6.2	1026	QTZ	Al	Ed			
04-1157	29.5	6.2	1029						
04-1158	35.5	3.4	1616	QTZ	Ed				
04-1159	36.5	3.1	1090						

APPENDIX 2. Data and descriptions for traverse line 35800N:
a) northings, eastings, depth and major elements (in %),
b) minor and trace elements (in ppm),

a)

SAMPLE	EASTING	NORTHING	DEPTH	SiO2	TiO2	Al2O3	Fe2O3	MgO	CaO	Na2O	K2O	P	S
04-1087	20853	35800	0.5	58.30	0.40	9.24	3.88	4.43	5.46	0.46	0.48	0.003	0.047
04-1088	20853	35800	1.5	68.10	0.52	11.90	4.87	0.85	0.14	0.53	0.48	0.003	0.050
04-1089	20853	35800	3.5	58.50	0.55	12.70	17.60	0.40	0.04	0.30	0.24	0.001	0.077
04-1090	20817	35800	0.5	61.30	0.46	10.80	4.34	4.02	4.57	0.46	0.48	0.002	0.050
04-1091	20817	35800	1.5	72.60	0.45	11.00	4.51	1.84	1.42	0.38	0.36	0.004	0.051
04-1092	20817	35800	3.5	52.40	0.65	13.80	27.70	0.35	0.06	0.30	0.24	0.005	0.057
04-1093	20791	35800	0.5	62.80	0.41	10.00	4.00	4.56	5.36	0.30	0.48	0.003	0.044
04-1094	20791	35800	1.5	73.70	0.47	11.80	5.01	1.42	0.63	0.38	0.36	0.002	0.037
04-1095	20791	35800	3.5	55.30	0.60	14.50	27.80	0.34	0.04	0.53	0.12	0.005	0.065
04-1096	20765	35800	0.5	65.70	0.43	10.60	4.78	4.55	5.54	0.53	0.48	0.002	0.035
04-1097	20765	35800	1.5	78.90	0.53	12.80	5.28	1.13	0.41	0.91	0.48	0.004	0.039
04-1098	20765	35800	3.5	64.00	0.53	13.30	24.50	0.36	0.05	0.91	0.24	0.004	0.067
04-1099	20742	35800	0.5	66.00	0.48	12.90	5.04	5.29	7.74	0.46	0.60	0.005	0.068
04-1100	20742	35800	2.5	89.00	0.49	12.90	6.86	0.51	0.05	0.23	0.24	0.001	0.062
04-1101	20742	35800	4.5	59.30	0.74	17.00	31.20	0.35	0.07	0.08	0.12	0.004	0.140
04-1102	20705	35800	0.5	65.80	0.54	12.90	5.06	2.81	3.07	0.30	0.60	0.003	0.036
04-1103	20705	35800	2.5	71.70	0.53	11.60	11.10	0.52	0.07	0.46	0.24	0.002	0.058
04-1104	20705	35800	3.5	61.40	0.57	13.00	19.70	0.40	0.05	0.38	0.24	0.003	0.073
04-1105	20680	35800	0.5	69.00	0.49	11.00	4.72	1.92	3.87	0.38	0.36	0.004	0.028
04-1106	20680	35800	1.5	72.40	0.52	12.20	5.45	1.14	0.83	0.46	0.36	0.003	0.021
04-1107	20680	35800	3.5	39.20	0.79	13.90	32.80	0.26	0.04	0.30	0.12	0.003	0.135
04-1108	20643	35800	0.5	68.00	0.47	10.40	4.28	1.73	2.23	0.30	0.36	0.005	0.045
04-1109	20643	35800	1.5	76.90	0.55	13.60	5.81	0.66	0.11	0.23	0.36	0.002	0.057
04-1110	20643	35800	3.5	65.60	0.56	15.10	16.80	0.35	0.04	0.08	0.24	0.003	0.074
04-1111	20608	35800	0.5	77.60	0.43	11.00	8.83	0.53	0.36	0.00	0.24	0.004	0.018
04-1112	20608	35800	2.5	62.30	0.55	13.30	15.90	0.40	0.05	0.30	0.24	0.004	0.048
04-1113	20595	35800	0.5	63.10	0.50	11.20	4.76	1.56	1.74	0.30	0.48	0.006	0.039
04-1114	20595	35800	2.5	68.60	0.55	13.10	8.21	0.51	0.07	0.45	0.36	0.005	0.024
04-1115	20595	35800	3.5	57.10	0.62	13.20	20.40	0.36	0.12	0.30	0.24	0.002	0.088
04-1116	20583	35800	0.5	70.70	0.54	12.10	9.10	0.70	0.71	0.15	0.36	0.003	0.062
04-1117	20583	35800	1.5	67.50	0.56	13.90	12.20	1.10	0.68	0.22	0.36	0.005	0.043
04-1118	20583	35800	3.5	65.40	0.54	13.60	16.70	0.29	0.03	0.07	0.24	0.005	0.083
04-1119	20583	35800	28.5	82.80	0.07	1.99	14.00	0.26	0.13	0.00	0.00	0.038	0.145
04-1120	20583	35800	31.5	64.20	0.12	3.15	29.20	0.28	0.12	0.45	0.12	0.104	0.080
04-1121	20568	35800	0.5	76.00	0.48	11.40	7.02	1.00	0.72	0.15	0.36	0.004	0.039
04-1122	20568	35800	2.5	58.80	0.56	13.10	20.90	0.33	0.06	0.15	0.24	0.003	0.070
04-1123	20568	35800	3.5	57.40	0.60	13.00	22.50	0.27	0.08	0.22	0.12	0.004	0.087
04-1124	20542	35800	2.5	62.10	0.54	13.10	18.90	0.27	0.05	0.15	0.24	0.004	0.046
04-1125	20523	35800	0.5	69.90	0.63	13.50	5.37	0.76	1.06	0.37	0.36	0.006	0.018
04-1126	20523	35800	1.5	70.70	0.58	13.70	4.62	0.92	3.12	0.30	0.48	0.005	0.025
04-1127	20523	35800	2.5	60.40	0.63	14.70	20.70	0.31	0.04	0.07	0.24	0.004	0.066

b)

SAMPLE	As	Au	Ba	Be	Bi	Ce	Co	Cr	Cu	Ge	La	Mn
04-1087	10	0.152	117	0.74	1	40	16	223	23	0	29	237
04-1088	9	0.012	146	1.99	0	64	23	316	26	2	13	170
04-1089	34	0.004	185	0.60	0	11	20	865	35	0	4	97
04-1090	5	0.152	168	1.93	0	62	17	261	33	1	38	285
04-1091	11	0.076	157	0.67	0	50	17	240	20	1	29	259
04-1092	67	0.060	181	0.95	0	22	50	1055	46	1	6	138
04-1093	6	0.176	124	1.01	1	40	15	246	28	1	27	265
04-1094	10	0.060	112	1.18	0	52	16	293	29	1	26	352
04-1095	42	0.004	173	1.95	0	27	35	1050	49	3	11	161
04-1096	7	0.208	135	0.44	0	44	13	301	26	1	26	295
04-1097	6	0.020	129	1.97	0	76	34	333	27	0	21	295
04-1098	54	0.016	158	2.13	0	9	20	922	37	2	9	106
04-1099	12	0.240	167	1.40	0	50	6	268	40	2	30	296
04-1100	20	0.016	86	0.00	0	11	3	306	20	1	4	104
04-1101	144	0.004	238	0.54	0	6	23	1592	102	1	2	45
04-1102	14	0.224	156	1.19	1	66	20	314	33	1	40	312
04-1103	22	0.008	151	0.06	0	9	16	505	21	1	6	97
04-1104	43	0.012	143	0.00	0	10	16	916	40	2	2	86
04-1105	12	0.100	105	0.00	0	46	10	263	23	1	27	252
04-1106	6	0.038	121	0.00	1	56	23	287	27	1	21	215
04-1107	122	0.004	125	0.00	0	5	23	1996	95	1	5	55
04-1108	4	0.086	106	0.00	0	48	15	216	21	0	28	195
04-1109	8	0.012	153	0.00	0	43	13	265	32	1	10	106
04-1110	24	0.004	110	0.00	0	9	10	676	37	2	5	80
04-1111	12	0.020	48	0.00	0	37	11	329	22	0	21	137
04-1112	38	0.004	173	1.51	0	36	13	576	45	3	11	98
04-1113	11	0.030	79	0.37	0	46	5	230	26	1	27	218
04-1114	14	0.004	75	1.13	1	40	11	306	33	1	5	75
04-1115	52	0.004	221	0.73	0	6	21	753	33	1	6	86
04-1116	19	0.020	173	1.53	1	21	10	364	28	2	22	169
04-1117	25	0.014	88	0.17	0	42	19	445	35	0	29	203
04-1118	38	0.004	186	0.00	0	8	8	585	24	1	6	93
04-1119	26	3.600	119	3.21	3	16	11	85	99	1	14	166
04-1120	65	3.200	107	7.31	1	25	42	183	217	0	16	659
04-1121	17	0.030	68	0.40	0	36	17	311	18	1	22	228
04-1122	44	0.004	124	0.20	2	12	11	784	30	0	7	97
04-1123	57	0.060	202	0.00	0	4	23	834	33	2	5	99
04-1124	52	0.002	102	1.30	3	21	12	659	50	1	14	99
04-1125	11	0.022	65	1.51	2	55	8	246	36	2	31	183
04-1126	8	0.022	118	1.61	0	48	14	217	26	1	30	179
04-1127	50	0.002	107	1.16	0	10	16	756	33	0	6	93

APPENDIX 2 cont.

c) minor and trace elements (in ppm) continued,
d) depth, pH, sample weight, mineralogy and descriptions.

c)

SAMPLE	Mo	Nb	Ni	Pb	Sb	Se	Sn	Sr	V	W	Zn	Zr
04-1087	3	2	131	11	5	2	4	186	89	25	24	103
04-1088	5	5	150	17	0	2	4	18	102	38	63	135
04-1089	3	5	100	18	0	0	24	8	453	20	19	116
04-1090	2	5	168	16	1	0	6	169	93	24	132	127
04-1091	2	6	125	11	0	0	2	64	108	17	16	117
04-1092	5	6	116	34	0	3	16	9	744	8	20	130
04-1093	2	5	146	13	0	0	2	187	93	20	20	107
04-1094	4	7	149	13	1	1	5	31	107	29	19	122
04-1095	2	5	116	32	0	0	20	7	686	19	12	112
04-1096	2	4	120	14	3	0	0	186	97	22	21	118
04-1097	3	8	124	17	0	0	3	26	119	18	17	125
04-1098	4	4	81	18	1	3	8	5	489	13	14	108
04-1099	2	5	110	17	0	0	5	195	104	11	84	121
04-1100	4	7	51	10	3	1	1	9	144	23	14	128
04-1101	3	8	85	13	0	3	9	8	945	10	2	143
04-1102	1	9	122	18	2	0	1	95	113	18	35	138
04-1103	4	6	65	11	3	3	9	13	265	26	18	130
04-1104	4	6	62	17	0	3	11	6	497	16	12	122
04-1105	1	6	79	16	0	0	4	120	110	19	22	137
04-1106	2	5	84	21	1	0	5	34	133	13	18	139
04-1107	4	7	97	23	7	9	2	6	870	7	2	122
04-1108	4	3	58	18	0	1	1	79	105	16	23	139
04-1109	1	8	56	17	2	1	5	18	137	14	20	149
04-1110	5	4	61	14	0	2	8	8	430	16	13	116
04-1111	2	4	51	19	0	0	6	33	219	18	14	117
04-1112	3	4	56	31	0	2	11	12	468	12	15	128
04-1113	12	4	60	16	0	0	3	90	119	19	16	138
04-1114	3	9	48	16	2	3	3	15	215	13	13	136
04-1115	9	7	60	21	4	2	10	11	554	15	13	129
04-1116	5	6	59	22	2	1	3	42	233	19	18	141
04-1117	6	4	67	24	2	1	2	27	313	21	14	137
04-1118	7	6	44	19	0	2	13	8	436	16	75	123
04-1119	5	1	52	6	0	4	5	24	83	23	86	23
04-1120	5	1	126	40	1	3	4	49	183	17	230	45
04-1121	23	6	65	18	2	1	4	36	148	21	20	122
04-1122	5	8	55	24	0	3	3	7	568	21	13	125
04-1123	11	7	50	18	3	3	13	9	615	24	11	120
04-1124	3	2	53	33	0	2	18	10	559	21	13	121
04-1125	4	8	54	19	0	0	4	67	132	15	19	170
04-1126	3	6	41	15	0	1	4	108	116	12	19	163
04-1127	3	7	55	23	0	2	11	10	566	13	19	132

d)

SAMPLE	DEPTH	pH	WGT(g)	MINERALOGY					FIELD DESCRIPTONS
04-1087	0.5	6.5	1608						Silty clay loam ,pale red brown ,calcereous(calc.)
04-1088	1.5		1459						Silty clay loam ,sl. redder.Some Fe fragment
04-1089	3.5		1145						Ferruginous(ferr.) clays.Fe frag.5m+ pale green (gr)sap. clay
04-1090	0.5	6.7	961						Silty pale brown clay loam,calcereous
04-1091	1.5		1512						Silty pale red brown clay,not calcereous
04-1092	3.5		1811						3-5m pale red br. clay,Fe nods.5m+ gr.sap. clay,indur. ,ochre
04-1093	0.5	6.8	1064						Silty clay loam,carbonate
04-1094	1.5		1127						2-3m silty clay loam.3-6m silty clay loam +Fe fragments
04-1095	3.5		1589						KEY:QTZ=quartz.D=dolomite.C=calcite.K=kaolinite.H=hematite.G=goethite.
04-1096	0.5	6.3	620	QTZ	D	K			Silty clay loam,calcareous Ru=rutile
04-1097	1.5		905	QTZ	K				1-3m silty clay loam,not calcereous
04-1098	3.5		990	QTZ	K	H			3-4m silt clay loam,ferr.+Fe frag.4-5msilt clay.5m+pale gr.sap.clay
04-1099	0.5	6.6	840	QTZ	D	C	K	Ru	Silt clay loam,calcereous
04-1100	2.5		974						4-6m reddish clay with Fe fragments.5-6m qtz present
04-1101	4.5		1352						6m+ pale green sap clay
04-1102	0.5	6.7	798						Clay loam,calcereous
04-1103	2.5		1123						2-5m clays reddish,increasingly Fe pisolitic with depth
04-1104	3.5		1305						5-6m pink/red clays ,qtz.6m+pale green sap clay
04-1105	0.5	6.7	589						Silty loam,calcareous
04-1106	1.5		1143						1-3m silty clay loam,Fe frag.esp 2-3m.3-5m ferr. clay,Fe frag.
04-1107	3.5		1569						6m+pale green sap clay
04-1108	0.5	6.2	973						Silt clay loam,calcareous.1-2m silt clay loam ,not calc.
04-1109	1.5		1103						2-6m brown (br)red clays,ferruginous frag.(few at 4-5m)
04-1110	3.5		1681						5-6m sap clays.6m+ pale green sap clays
04-1111	0.5	6.4	687						0-1m ferr.silt clay loam,Fe frag.,calc.1-2m ferr.silt clay loam (?)
04-1112	2.5		925						2-4m ferr.clay +Fe nods.5m+pale clays sl. ferr.at top,sap silicified
04-1113	0.5	6.7	893						0-1m ferr.silt clay loam,red br.,fine Fe frag.,calc.,(rock frag.?)
04-1114	2.5		976						1-3m red clay loam+ Fe frag.3-6m red clay+fine Fe frag.(br.4-6m)
04-1115	3.5		1568						6-20m pale sl.silicified clays,occ.Fe stain,Fe frag. only in 6-7m
04-1116	0.5	6.8	1143						0-1m red clay loam,calcareous
04-1117	1.5		1184						1-2m red clay loam,Fe frag.
04-1118	3.5		3608						2-6mred clay + fine Fe frag.
04-1119	28.5		3027	QTZ	H	G			7-27m bleached hard clays,some Fe frag.
04-1120	31.5		2521	QTZ	H	G			27m+ferrug. oxidized (part weathered) rock
04-1121	0.5	6.4	1659						Silt clay loam not calcareous
04-1122	2.5		1454						2-4m ferrug. clays +Fe frag.
04-1123	3.5		2111						4m+ bleached sl. silicified clays
04-1124	2.5		1103						0-2m?2-8m sl. Fe clays +Fe frag.8m+bleached sap .clays
04-1125	0.5	6.9	430						0-2m silt red brown loam,calcareous
04-1126	1.5		837						2-5m red br. clays +Fe frag.5-7m pale clays+red Fe stain,some Fe frag.
04-1127	2.5	4.9	1571						7m bleached sap(?)silicified clays

APPENDIX 3. Data and descriptions for pit 1, 20708E 34990N:

a) northings, eastings, depth and major elements (in %),
b) minor and trace elements (in ppm),
c) depth, pH, sample weight, mineralogy and descriptions,
d) biogeochemical and other data.

a)

SAMPLE	EASTING	NORTHING	DEPTH	SiO2	TiO2	Al2O3	Fe2O3	MgO	CaO
04-1214	20708	34990	0.005	70.1	0.40	8.78	6.23	1.72	3.15
04-1202	20708	34990	0.025	66.7	0.39	8.94	5.98	2.04	5.33
04-1203	20708	34990	0.075	60.9	0.39	9.05	5.72	2.60	7.47
04-1204	20708	34990	0.125	50.6	0.32	7.88	4.04	4.97	11.20
04-1205	20708	34990	0.175	42.2	0.30	7.68	4.28	7.25	13.20
04-1206	20708	34990	0.250	41.7	0.32	8.32	4.07	8.46	13.00
04-1207	20708	34990	0.350	45.4	0.37	9.31	4.93	6.91	9.13
04-1208	20708	34990	0.450	49.2	0.41	10.30	5.27	6.62	8.58
04-1209	20708	34990	0.600	53.1	0.44	11.30	5.49	5.90	7.42
04-1210	20708	34990	0.800	55.9	0.46	11.80	5.50	5.29	6.33
04-1211	20708	34990	1.000	63.4	0.52	13.20	6.07	3.36	3.15
04-1212	20708	34990	1.450	70.9	0.55	14.00	6.49	1.23	0.11
04-1213	20708	34990	1.800	72.6	0.52	14.30	5.92	0.95	0.06

b)

SAMPLE	Au	Ba	Be	Cr	Cu	Mn	Ni	V	Zr
04-1214	0.136	103	1.20	268	23	848	66	102	83
04-1202	0.240	105	0.00	213	30	652	68	102	97
04-1203	0.260	106	0.00	294	50	629	76	103	100
04-1204	0.680	108	0.00	160	40	488	63	71	76
04-1205	0.830	140	0.00	167	54	428	59	94	65
04-1206	0.780	258	0.00	172	47	458	66	131	70
04-1207	0.580	218	0.00	198	48	439	70	154	85
04-1208	0.540	273	0.00	217	51	478	75	141	89
04-1209	0.600	212	0.00	238	54	437	74	110	95
04-1210	0.520	177	0.00	241	53	439	77	107	103
04-1211	0.530	181	0.00	279	62	490	87	115	112
04-1212	0.072	182	0.00	331	76	415	104	123	116
04-1213	0.004	157	0.00	342	60	114	66	109	102

c)

SAMPLE	DEPTH	pH	WGT(g)	MINERALOGY				FIELD DESCRIPTIONS	
04-1214	0.005								
04-1202	0.025	6.8	1164	QTZ	K	C	D	Organic rich	KEY:QTZ=quartz
04-1203	0.075	6.9	1207	QTZ	K	C	D	Organic-carbonate transition	K=kaolinite
04-1204	0.125	7.0	2240	QTZ	K	D	C	Carbonate clay	C=calcite
04-1205	0.175	6.9	2153	QTZ	K	D	C	Carbonate clay	D=dolomite
04-1206	0.250	6.5	2611	QTZ	K	D	C	Carbonate clay	G=goethite
04-1207	0.350	6.5	2723	QTZ	K	D		Carbonate clay	
04-1208	0.450	6.6	2311	QTZ	K	D		Clay carbonate	
04-1209	0.600	7.0	2147	QTZ	K	D		Clay carbonate	
04-1210	0.800	7.1	2286	QTZ	K	D		Clay	
04-1211	1.000	6.7	2368	QTZ	K	D		Clay	
04-1212	1.450	6.2	1904	QTZ	K	G		Clay	
04-1213	1.800	6.1	2016	QTZ	K	G		Clay- gypsum nodules(?),plant roots (3mm)	

d)

SAMPLE	SAMPLE TYPE OR SPECIES	FORM	SAMPLE SUB-TYPE	% ASH	As	Au	Br	Co	Cr	%Fe	Sb	Ta	Th	Zn
1340B	*Eucalyptus annulata*	Tree	leaves	3.94	<12.7	<0.030	1041	<5.0	48	0.79	2.79	<5.8	<2.5	3302
1341B	*Eucalyptus flocktoniae*	Tree	leaves	3.45	<14.5	0.064	1015	6.7	32	0.64	<1.5	3.48	1.45	3481
1343B	*Melaleuca sp.*	Shrub	leaves											
1344B	*Melaleuca sp.*	Shrub	leaves	6.30	<8.0	0.175	1139	7.5	90	15.24	<0.8	<1.6	3.17	1746
1201V	Surface plant litter			8.63	15.2	0.585	394	29.0	255	3.25	0.70	<2.3	9.97	1391

APPENDIX 4. Data and descriptions for pit 2, 20704E 34860N:
a) northings, eastings, depth and major elements (in %),
b) minor and trace elements (in ppm),
c) depth, pH, sample weight, mineralogy and descriptions,
d) biogeochemical and other data.

a)

SAMPLE	EASTING	NORTHING	DEPTH	SiO2	TiO2	Al2O3	Fe2O3	MgO	CaO
04-1216	20704	34860	0.025	60.0	0.59	12.80	21.50	0.16	0.15
04-1218	20704	34860	0.125	52.9	0.60	13.80	30.00	0.13	0.09
04-1220	20704	34860	0.250	42.2	0.64	14.00	44.40	0.11	0.07
04-1222	20704	34860	0.525	46.2	0.75	20.80	33.90	0.14	0.06

b)

SAMPLE	Au	Ba	Be	Cr	Cu	Mn	Ni	V	Zr
04-1216	0.017	37	0.00	902	38	101	58	484	186
04-1218	0.055	26	0.00	1231	40	81	66	705	199
04-1220	0.036	9	0.00	1578	48	96	71	857	220
04-1222	0.040	14	0.00	1545	74	60	81	774	214

c)

SAMPLE	DEPTH	pH	WGT(g)	MINERALOGY				FIELD DESCRIPTIONS	
04-1216	0.025	4.8	3799	QTZ	K	H	G	Organic material,litter,gravels	KEY:QTZ=quartz
04-1218	0.125	4.7	4770	QTZ	K	H		Fine,sandy clay loam, loose,friable.Duricrust at	K=kaolinite
04-1220	0.250	4.4	4085	QTZ	K	H		about 0.45m.Sample chiselled out.Large pieces	H=hematite
04-1222	0.525	4.2	3944	QTZ	K	H	G	of conglomerated gravels	G=goethite

d)

SAMPLE	SAMPLE TYPE OR SPECIES	FORM	SAMPLE SUB-TYPE	% ASH	As	Au	Br	Co	Cr	%Fe	Sb	Ta	Th	Zn
1345B	*Thryptomene sp.*	Shrub	leaves	4.08	<12.2	0.149	115	14.9	73	1.74	<1.2	<2.44	3.18	3183
1346A	*Eucalyptus hypochlamydea*	Mallee	leaves	3.30	<15.2	<0.030	1393	8.8	61	0.70	<1.5	<3.02	<3.02	3634
1347	*Melaleuca uncinata*	Shrub	fruit, leaves and small branches	3.89	<12.8	0.051	488	<5.2	54	0.67	1.54	<2.57	2.83	3598
1348A	*Eucalyptus sp.*	Mallee	leaves	4.19	<12.0	0.081	1074	<4.8	55	0.88	<1.2	<4.76	3.58	2864
1349B	*Hakea coriacea*		leaves	1.72	<29.0	0.151	929	<11.6	110	1.51	<2.9	<5.8	<5.8	6971
1224V	Surface plant litter			12.44	9.6	0.169	121	16.1	321	4.82	<0.4	2.25	19.29	964
1224NM	Surface gravels		non-magnetic fraction			<0.080			2316					
1224 M	Surface gravels		magnetic fraction			<0.080			2898					

APPENDIX 5. Data and descriptions for pit 3, 20320E 35010N:

a) northings, eastings, depth and major elements (in %),
b) minor and trace elements (in ppm),
c) depth, pH, sample weight, mineralogy and descriptions,
d) biogeochemical and other data.

a)

SAMPLE	EASTING	NORTHING	DEPTH	SiO2	TiO2	Al2O3	Fe2O3	MgO	CaO
04-1239	20320	35010	0.025	59.4	0.44	11.40	20.40	0.08	0.06
04-1241	20320	35010	0.125	47.4	0.47	12.90	32.10	0.07	0.06
04-1243	20320	35010	0.250	38.5	0.50	19.90	30.60	0.06	0.05
04-1245	20320	35010	0.450	31.0	0.55	19.90	36.30	0.06	0.04
04-1247	20320	35010	0.650	32.4	0.53	20.50	37.50	0.07	0.05
04-1249	20320	35010	0.850	34.4	0.57	17.60	36.30	0.06	0.04
04-1251	20320	35010	1.300	24.3	0.45	13.70	48.90	0.05	0.05

b)

SAMPLE	Au	Ba	Be	Cr	Cu	Mn	Ni	V	Zr
04-1239	0.170	24	0.00	921	51	43	44	353	139
04-1241	0.240	11	0.00	1156	74	59	57	434	161
04-1243	0.160	9	0.00	1506	137	42	65	480	180
04-1245	0.221	3	0.00	1617	193	48	69	702	180
04-1247	0.170	0	0.00	1352	208	51	68	571	168
04-1249	0.490	1	0.00	1417	205	67	62	830	156
04-1251	0.990	0	0.00	1079	265	73	74	597	146

c)

SAMPLE	DEPTH	pH	WGT(g)	MINERALOGY			
04-1239	0.025	4.6	3565	QTZ	K	H	G
04-1241	0.125	4.6	3143	QTZ	K	H	G
04-1243	0.250	4.4	4101	QTZ	K	G	H
04-1245	0.450	4.3	4044	QTZ	K	G	H
04-1247	0.650	4.2	3451	QTZ	K	G	H
04-1249	0.850	4.3	3623	QTZ	K	G	H
04-1251	1.300	4.4	4275	QTZ	K	G	H

FIELD DESCRIPTIONS

Yellow gravels throughout profile. Texture-loosely conglomerated,duricrust in patches.Sampling made difficult due to avalanching of material.Fine roots penetrate entire horizon

KEY:QTZ=quartz
K=kaolinite
H=hematite
G=goethite

d)

SAMPLE	SAMPLE TYPE OR SPECIES	FORM	SAMPLE SUB-TYPE	% ASH	As	Au	Br	Co	Cr	%Fe	Sb	Ta	Th	Zn
1359	*Hakea subsulcata*	Shrub	fruit, leaves and small branches	2.36	<21.2	0.131	1867	<8.4	<42	0.85	<2.12	<4.24	<4.24	5091
1360B	*Melaleuca cordata*	Shrub	leaves	4.37	<11.4	0.087	1431	14.2	<22	<0.22	<1.14	<2.28	<2.28	2748
1362B	*Thryptomene sp.*	Shrub	leaves	3.07	<16.2	0.062	78	<6.6	<32	0.78	<1.62	<3.26	<3.06	4236
1361	*Alocasuarina sp.*	Shrub	fruit, leaves and small branches	1.95	<25.6	0.312	973	<10.2	<52	0.26	<2.56	<12.24	<5.12	6147
1238V	Surface plant litter			12.25	15.5	0.237	114	9.8	277	4.00	0.49	<1.62	11.43	979
1238NM	Surface gravels		non-magnetic fraction			<0.080			2040					
1238M	Surface gravels		magnetic fraction			<0.080			2794					

APPENDIX 6. Data and descriptions for pit 4, 20380E 35010N:

a) northings, eastings, depth and major elements (in %),
b) minor and trace elements (in ppm),
c) depth, pH, sample weight, mineralogy and descriptions,
d) biogeochemical and other data.

a)

SAMPLE	EASTING	NORTHING	DEPTH	SiO_2	TiO_2	Al_2O_3	Fe_2O_3	MgO	CaO
04-1252	20380	35010	0.025	62.9	0.51	15.10	14.70	0.49	0.27
04-1254	20380	35010	0.125	60.4	0.53	16.60	13.70	0.75	0.99
04-1256	20380	35010	0.250	50.6	0.47	16.10	8.37	1.26	6.88
04-1258	20380	35010	0.450	40.4	0.47	16.20	9.18	1.74	10.40
04-1260	20380	35010	0.650	37.6	0.58	18.20	17.00	1.57	6.67
04-1262	20380	35010	0.950	44.6	0.73	23.60	14.30	1.10	1.01
04-1264	20380	35010	0.025	56.9	0.51	14.30	19.40	0.18	0.17
04-1266	20380	35010	0.125	58.7	0.45	13.70	19.30	0.16	0.09
04-1268	20380	35010	0.250	57.9	0.62	21.40	10.10	0.28	0.09
04-1270	20380	35010	0.450	50.9	0.64	25.60	9.85	0.36	0.08
04-1272	20380	35010	0.650	65.7	0.36	19.50	5.48	0.13	0.04
04-1274	20380	35010	0.025	59.3	0.50	14.70	16.40	0.11	0.05
04-1276	20380	35010	0.125	54.5	0.53	14.90	21.40	0.10	0.05
04-1278	20380	35010	0.250	48.0	0.56	17.00	26.40	0.09	0.05
04-1280	20380	35010	0.450	46.9	0.62	21.50	19.70	0.10	0.04
04-1282	20380	35010	0.650	46.5	0.71	25.60	16.40	0.13	0.03
04-1284	20380	35010	0.850	55.9	0.57	22.40	13.10	0.16	0.03

b)

SAMPLE	Au	Ba	Be	Cr	Cu	Mn	Ni	V	Zr
04-1252	0.056	48	0.00	612	64	146	51	266	137
04-1254	0.110	74	0.00	576	70	200	59	254	122
04-1256	0.220	170	0.00	380	77	215	56	155	92
04-1258	0.440	266	0.00	398	97	154	55	179	81
04-1260	0.570	134	0.00	677	203	184	65	422	92
04-1262	0.150	81	0.00	606	148	193	59	306	81
04-1264	0.071	35	0.00	757	60	113	52	339	155
04-1266	0.046	25	0.00	737	61	60	45	366	141
04-1268	0.096	38	0.00	429	67	57	58	182	147
04-1270	0.058	35	0.04	407	75	51	65	175	129
04-1272	0.006	1399	0.00	166	44	37	40	101	173
04-1274	0.142	33	0.00	643	52	64	47	287	144
04-1276	0.092	25	0.53	820	66	69	46	382	154
04-1278	0.061	19	0.27	1030	94	69	51	553	164
04-1280	0.082	22	0.01	779	104	52	51	387	153
04-1282	0.290	27	0.00	525	69	44	56	289	153
04-1284	0.020	25	0.00	347	39	42	42	223	162

c)

SAMPLE	DEPTH	pH	WGT(g)	MINERALOGY	FIELD DESCRIPTIONS
04-1252	0.025	6.6	2622		Fungal hyphae present.
04-1254	0.125	6.3	2331		General desciption-carbonate rich clay
04-1256	0.250	6.9	2670		0.2-0.3m hard carbonate layer
04-1258	0.450	6.9	2217		0.6-0.9m carbonate nodules present
04-1260	0.650	6.5	2117		1.0-1.1m indurated mottled clay
04-1262	0.950	6.7	2057		
04-1264	0.025	6.4	2576		Clay present 0-0.5m.
04-1266	0.125	6.1	3183		0.5m+ samples chiselled out,hardpan
04-1268	0.250	4.6	2265		Profile type not found elsewhere
04-1270	0.450	4.2	1902		
04-1272	0.650	4.6	2328		
04-1274	0.025	4.1	2684		General description-yellow gravels.
04-1276	0.125	4.0	2803		Difficult sampling owing to unconsolidated
04-1278	0.250	3.9	4000		nature of upper horizons.
04-1280	0.450	3.9	3354		0.5m+ samples chiselled- duricrust.
04-1282	0.650	4.2	2846		
04-1284	0.850	4.6	2680		Sample chiselled from floor of pit.

d)

SAMPLE	SAMPLE TYPE OR SPECIES	FORM	SAMPLE SUB-TYPE	% ASH	As	Au	Br	Co	Cr	%Fe	Sb	Ta	Th	Zn
1355	*Melaleuca uncinata*	Shrub	fruit, leaves and small branches	4.96	<10.0	<0.020	886	6.8	<20	0.26	2.22	<2.02	<2.02	2216
1357B	*Thryptomene sp.*	Shrub	leaves	5.43	<9.2	<0.010	85	5.9	76	1.09	<0.92	<1.84	2.21	2211
1273V	Surface plant litter			12.20	12.3	0.584	205	15.6	336	5.33	<0.4	<1.62	21.32	984
1273NM	Surface gravels		non-magnetic fraction			0.340			1820					
1273M	Surface gravels		magnetic fraction			0.240			2380					

APPENDIX 7. Data and descriptions for pit 5, 20930E 35015N:

a) northings, eastings, depth and major elements (in %),
b) minor and trace elements (in ppm),
c) depth, pH, sample weight, mineralogy and descriptions,
d) biogeochemical and other data.

a)

SAMPLE	EASTING	NORTHING	DEPTH	SiO2	TiO2	Al2O3	Fe2O3	MgO	CaO
04-1225	20930	35015	0.010	83.3	0.40	7.79	11.90	0.52	0.41
04-1227	20930	35015	0.075	75.0	0.50	12.90	8.58	1.88	1.50
04-1229	20930	35015	0.175	67.4	0.49	11.90	7.01	2.70	7.45
04-1231	20930	35015	0.350	67.1	0.52	12.50	7.17	1.92	2.52
04-1233	20930	35015	0.600	72.4	0.53	12.70	6.99	1.52	1.16
04-1235	20930	35015	1.000	71.6	0.57	14.10	6.62	1.74	1.18
04-1237	20930	35015	2.200	75.0	0.53	11.80	6.63	0.82	0.05
04-1323	20927	35015	0.025	53.5	0.46	9.71	23.60	0.95	2.06
04-1325	20927	35015	0.175	53.2	0.38	8.78	13.50	2.32	7.22
04-1327	20927	35015	0.250	52.9	0.40	9.28	12.60	3.24	6.71
04-1329	20927	35015	0.450	61.8	0.47	10.60	14.40	2.23	2.34
04-1331	20927	35015	0.750	63.0	0.47	11.00	13.40	2.18	1.92
04-1333	20927	35015	1.000	68.9	0.49	12.50	10.20	1.19	0.33

b)

SAMPLE	Au	Ba	Be	Cr	Cu	Mn	Ni	V	Zr
04-1225	0.035	96	0.00	839	25	348	104	215	141
04-1227	0.200	106	0.68	627	35	342	157	149	130
04-1229	0.500	264	0.77	486	41	353	144	141	134
04-1231	0.250	174	1.30	495	58	327	150	134	156
04-1233	0.280	183	0.94	479	43	266	140	130	150
04-1235	0.260	173	0.60	455	44	269	145	121	158
04-1237	0.026	122	0.00	460	46	96	99	120	141
04-1323	0.146	147	0.00	1920	43	616	172	406	157
04-1325	0.510	125	0.00	941	39	445	132	226	124
04-1327	0.530	156	0.00	909	37	435	136	213	133
04-1329	0.250	179	0.00	1052	38	480	161	252	159
04-1331	0.320	157	0.00	921	41	450	159	231	159
04-1333	0.166	157	0.00	707	42	286	150	185	150

c)

SAMPLE	DEPTH	pH	WGT(g)	MINERALOGY	FIELD DESCRIPTIONS
04-1225	0.010	6.1	2663		Rootlets present,lag,red earth
04-1227	0.075	7.0	1727		General description-little carbonate ,clay dominant
04-1229	0.175	7.5	2364		throughout depth,yellow coated gravels in base
04-1231	0.350	7.9	2179		of pit.In surface horizons presence of black areas
04-1233	0.600	6.6	1889		(coatings)which mark presence of old/new tree
04-1235	1.000	6.9	1536		roots
04-1237	2.200	6.2	1688		Occurance of yellow gravels sporadic
04-1323	0.025	6.4	3314		Carbonate prominent in upper horizons.
04-1325	0.175	6.9	2102		Black gravels extensive on surface- evidence
04-1327	0.250	7.4	1887		of transportation as concentrated on "windward"
04-1329	0.450	7.0	2312		side of protruding tree root stumps.
04-1331	0.750	6.4	1580		
04-1333	1.000	6.5	1773		

d)

SAMPLE	SAMPLE TYPE OR SPECIES	FORM	SAMPLE SUB-TYPE	% ASH	As	Au	Br	Co	Cr	%Fe	Sb	Ta	Th	Zn
1350A	*Melaleuca sp.*	Shrub	fruit and leaves	6.30	8.0	0.027	1141	<3.2	<16	0.22	10.47	<3.96	1.90	1904
1351A	*Eucalyptus salubris*	Tree	leaves											
1352A	*Eucalyptus sp.*	Tree	leaves											
1353A	*Daviesia sp.*	Shrub	leaves	2.82	<17.8	0.231	1667	3.5	<7.0	1.10	4.26	<3.54	<3.54	4965
1353B	*Daviesia sp.*		small branches	2.30	10.9	0.096	1002	26.6	57	1.18	3.05	<4.36	<4.36	5662
1215V	Surface plant litter			11.52	8.7	0.200	130	26.0	373	3.47	0.22	<1.74	13.02	1041
1215NM	Surface gravels		non-magnetic fraction			<0.080			4697					
1215M	Surface gravels		magnetic fraction			<0.080			6456					

APPENDIX 8. Data and descriptions for pit 6, 20780E 36000N:

a) northings, eastings, depth and major elements (in %),
b) minor and trace elements (in ppm),
c) depth, pH, sample weight, mineralogy and descriptions,
d) biogeochemical and other data.

a)

SAMPLE	EASTING	NORTHING	DEPTH	SiO2	TiO2	Al2O3	Fe2O3	MgO	CaO
04-1304	20780	36000	0.025	83.7	0.35	7.36	2.80	0.26	0.19
04-1308	20780	36000	0.075	88.1	0.34	6.55	2.43	0.26	0.21
04-1310	20780	36000	0.175	79.5	0.46	11.20	3.77	0.61	0.20
04-1312	20780	36000	0.350	68.4	0.52	14.30	4.83	1.37	2.61
04-1314	20780	36000	0.550	63.2	0.51	14.20	4.99	2.25	4.52
04-1316	20780	36000	0.800	64.7	0.54	14.70	5.56	2.39	2.86
04-1322	20780	36000	0.950	22.3	0.18	4.91	2.02	12.20	22.60
04-1318	20780	36000	1.200	72.0	0.54	14.90	4.93	0.72	0.05
04-1320	20780	36000	1.550	73.3	0.50	13.70	4.95	0.52	0.03

b)

SAMPLE	Au	Ba	Be	Cr	Cu	Mn	Ni	V	Zr
04-1304	0.004	49	0.00	131	8	148	36	63	102
04-1308	0.004	49	0.00	118	6	113	31	57	103
04-1310	0.004	56	0.00	170	16	92	59	79	122
04-1312	0.017	73	0.00	204	31	181	78	100	130
04-1314	0.020	105	0.00	223	34	192	79	115	116
04-1316	0.024	127	0.00	242	32	209	80	122	125
04-1322	0.020	191	0.00	95	12	61	40	47	40
04-1318	0.004	158	0.00	216	33	152	86	107	131
04-1320	0.004	135	0.00	220	22	46	57	112	115

c)

SAMPLE	DEPTH	pH	WGT(g)	MINERALOGY						FIELD DESCRIPTIONS	
04-1304	0.025	5.4		QTZ	K	H				Very few gravels present on surface.	KEY:QTZ=quartz
04-1308	0.075	5.7	1578							Carbonate localized and consolidated in clay	K=kaolinite
04-1310	0.175	5.8	1525	QTZ	K	H	G			matrix.	H=hematite
04-1312	0.350	7.4	1907							Duplex soil(sand -yellow on clay-red)	G=goethite
04-1314	0.550	6.4	2114	QTZ	K	C	D	H	G	Clay throughout profile- elastic	C=calcite
04-1316	0.800	7.5	2301							Carbonate lining relic root channels.	D=dolomite
04-1322	0.950	7.0	77							Sample of carbonate pod.	An=anatase
04-1318	1.200	6.0	1880	QTZ	K	H	G	An	Ru		Ru=rutile
04-1320	1.550	4.7	1873								

d)

SAMPLE	SAMPLE TYPE OR SPECIES	FORM	SAMPLE SUB-TYPE	% ASH	As	Au	Br	Co	Cr	%Fe	Sb	Ta	Th	Zn
1370A	*Eucalyptus pileata*	Mallee	leaves	3.03	<16.4	<0.032	1583	8.6	<32	0.56	0.82	<3.30	3.63	3957
1370B	*Eucalyptus pileata*	Mallee	fruit and small branches	3.77	<13.2	<0.026	1062	<5.4	<26	<0.26	2.12	<2.66	<2.66	3185
1371A	*Melaleuca sp.*	Shrub	leaves	3.54	<14.2	<0.032	1488	8.5	37	0.79	<1.42	5.08	4.24	3389
1371B	*Melaleuca sp.*	Shrub	fruit and small branches	4.65	10.7	<0.028	1274	<4.2	26	0.47	8.17	<2.14	<2.14	3009
1372A	*Daviesia sp.*	Shrub	leaves	2.25	<22.2	<0.022	1601	37.8	85	1.47	<2.22	<4.44	8.89	5782
1372B	*Daviesia sp.*	Shrub	small branches	1.34	<37.4	<0.038	749	50.2	<74	1.20	<3.74	<7.48	<7.48	9734
1302V	Surface plant litter			5.07	<9.8	<0.010	375	21.7	128	2.17	<0.98	4.34	13.01	2169

APPENDIX 9. Data and descriptions for pit 7, 20720E 35800N:

a) northings, eastings, depth and major elements (in %),
b) minor and trace elements (in ppm),
c) depth, pH, sample weight, mineralogy and descriptions,
d) biogeochemical and other data.

a)

SAMPLE	EASTING	NORTHING	DEPTH	SiO2	TiO2	Al2O3	Fe2O3	MgO	CaO
04-1301	20720	35800	0.005	84.4	0.36	7.56	3.10	0.33	0.19
04-1285	20720	35800	0.025	87.6	0.32	7.13	3.05	0.33	0.14
04-1287	20720	35800	0.125	74.3	0.41	10.70	4.16	0.87	0.32
04-1289	20720	35800	0.250	62.3	0.41	11.40	4.18	1.71	4.06
04-1291	20720	35800	0.450	59.9	0.42	12.20	4.40	3.64	8.20
04-1293	20720	35800	0.650	53.2	0.38	11.20	4.03	6.55	9.72
04-1295	20720	35800	1.000	56.7	0.40	11.50	4.34	5.83	7.60
04-1297	20720	35800	1.400	72.4	0.48	13.30	7.59	0.96	0.24
04-1299	20720	35800	1.800	66.6	0.50	13.50	13.70	0.58	0.05

b)

SAMPLE	Au	Ba	Be	Cr	Cu	Mn	Ni	V	Zr
04-1301	0.008	57	1.06	156	3	320	57	57	104
04-1285	0.005	58	0.47	150	11	122	48	72	106
04-1287	0.021	62	0.70	203	19	192	89	86	113
04-1289	0.073	81	1.12	202	35	210	101	87	110
04-1291	0.124	184	0.00	212	33	221	102	87	95
04-1293	0.152	300	0.00	205	30	242	98	80	89
04-1295	0.126	189	0.00	229	38	261	98	88	86
04-1297	0.049	180	0.00	315	38	283	108	182	116
04-1299	0.004	298	0.00	476	63	63	87	303	114

c)

SAMPLE	DEPTH	pH	WGT(g)	MINERALOGY					FIELD DESCRIPTIONS	
04-1301	0.005								Few gravels mainly sand	KEY:OTZ=quartz
04-1285	0.025	5.2	1797	OTZ	K	H	G		Duplex soil - sharp transition from sand to clay.	K=kaolinite
04-1287	0.125	6.2	2105						General description - carbonate prominent	H=hematite
04-1289	0.250	6.8	1934	OTZ	K	C	H	G	throughout profile in clay matrix.Micro ironstones	G=goethite
04-1291	0.450	6.6	2199	OTZ	K	D	C		present throughout together with black coloured	C=calcite
04-1293	0.650	6.8	1886	OTZ	K	D			nodules(sporadic) of carbonate(esp.0.6m to 1.1m)	D=dolomite
04-1295	1.000	7.0	2255	OTZ	K	D			1.5m gravels cemented with plastic clay,qtz	
04-1297	1.400	5.8	1894	OTZ	K	H	G	D	present.	
04-1299	1.800	5.4	1854							

d)

SAMPLE	SAMPLE TYPE OR SPECIES	FORM	SAMPLE SUB-TYPE	% ASH	As	Au	Br	Co	Cr	%Fe	Sb	Ta	Th	Zn
1363A	*Acacia sp.*	Shrub	leaves	2.54	<19.6	<0.020	1456	<7.8	98	0.63	<1.96	<7.86	<3.94	4327
1364A	*Daviesia sp.*	Shrub	leaves	2.19	<22.8	0.183	1735	34.2	91	1.05	3.20	<4.56	<4.56	6847
1364B	*Daviesia sp.*	Shrub	small branches	1.99	<25.2	0.065	804	34.2	126	1.06	<2.52	<5.02	<5.02	6536
1365A	*Eucalyptus pileata*	Mallee	fruit	4.03	<12.4	0.032	1433	<5.0	<24	0.12	<1.24	5.71	<2.48	2732
1365B	*Eucalyptus pileata*	Mallee	leaves	3.33	<15.0	0.180	1561	<6.0	48	<0.30	8.12	<3.0	<3.00	3609
1365C	*Eucalyptus pileata*	Mallee	small branches	3.46	<14.4	<0.014	462	<5.8	<28	<0.28	<1.44	<2.88	<2.88	3466
1366A	*Melaleuca sp.*	Shrub	leaves	4.95	12.1	0.030	1276	<4.0	<20	0.36	7.27	<2.02	2.22	2423
1366B	*Melaleuca sp.*	Shrub	fruit and small branches	7.81	<6.4	<0.020	1092	5.8	35	0.23	<0.64	<3.08	<1.28	1537
1300V	Surface plant litter			7.31	10.3	0.031	233	31.5	233	2.60	<0.68	<2.74	13.68	1641

APPENDIX 10. Correlation coefficients and significance table for the subset "Traverse 35800N, 0-1 m composites". Concentration ranges are in % for major elements and ppm for minor and trace elements. Subset size is 13 samples.

Correlation coefficients: $r > 0.801, \alpha < 0.001$ (99.9%),
$r > 0.684, \alpha < 0.01$ (99.0%),
$r > 0.553, \alpha < 0.05$ (95.0%).

	SiO2	TiO2	Al2O3	Fe2O3	MgO	CaO	Na2O	K2O	P	S	As	Au	Ba	Be	Bi	Ce	Co	Cr	Cu	Ge	La	Mn	Mo	Nb	Ni	Pb	Sb	Se	Sn	Sr	V	W	Zn	Zr
SiO2	1.00																																	
TiO2	0.28	1.00																																
Al2O3	0.36	0.86	1.00																															
Fe2O3	0.79	0.22	0.31	1.00																														
MgO	-0.73	-0.54	-0.30	-0.66	1.00																													
CaO	-0.68	-0.47	-0.23	-0.66	0.97	1.00																												
Na2O	-0.76	-0.09	-0.10	-0.80	0.75	0.79	1.00																											
K2O	-0.71	-0.06	0.15	-0.59	0.77	0.73	0.64	1.00																										
P	0.26	0.50	0.42	0.01	-0.45	-0.34	-0.19	-0.20	1.00																									
S	-0.40	-0.19	-0.04	-0.08	0.49	0.48	0.26	0.52	-0.21	1.00																								
As	0.52	0.43	0.51	0.71	-0.49	-0.45	-0.52	-0.15	0.12	0.07	1.00																							
Au	-0.59	-0.36	-0.07	-0.59	0.90	0.89	0.67	0.83	-0.47	0.39	-0.37	1.00																						
Ba	-0.51	-0.06	0.09	-0.19	0.60	0.58	0.46	0.66	-0.56	0.77	-0.04	0.66	1.00																					
Be	-0.35	0.38	0.46	-0.04	0.30	0.24	0.30	0.46	-0.23	0.45	0.08	0.27	0.63	1.00																				
Bi	-0.14	0.53	0.35	-0.01	-0.12	-0.15	0.03	0.04	0.09	-0.16	0.18	-0.09	0.01	0.50	1.00																			
Ce	-0.37	0.25	0.30	-0.61	0.31	0.30	0.50	0.52	0.06	-0.19	-0.44	0.48	0.16	0.28	0.05	1.00																		
Co	-0.13	-0.31	-0.34	-0.18	0.20	0.05	0.00	0.14	-0.66	-0.02	-0.18	0.33	0.21	0.05	0.05	0.24	1.00																	
Cr	0.61	0.16	0.36	0.83	-0.33	-0.36	-0.53	-0.22	-0.39	0.02	0.69	-0.15	0.18	0.13	-0.03	-0.39	0.10	1.00																
Cu	-0.32	0.45	0.66	-0.20	0.39	0.42	0.44	0.60	0.10	0.30	-0.04	0.46	0.52	0.80	0.38	0.52	-0.28	-0.03	1.00															
Ge	0.06	0.66	0.75	0.17	0.00	0.07	0.17	0.27	0.18	0.30	0.42	0.03	0.37	0.66	0.36	0.01	-0.46	0.29	0.70	1.00														
La	-0.58	0.24	0.26	-0.59	0.42	0.38	0.55	0.67	-0.17	0.09	-0.33	0.58	0.48	0.55	0.23	0.90	0.37	-0.30	0.61	0.10	1.00													
Mn	-0.58	-0.20	0.01	-0.64	0.80	0.78	0.71	0.86	-0.43	0.33	-0.26	0.89	0.61	0.30	-0.16	0.57	0.34	-0.15	0.41	0.17	0.64	1.00												
Mo	0.37	0.10	0.03	0.26	-0.41	-0.47	-0.37	-0.21	0.29	0.00	0.42	-0.50	-0.43	-0.22	-0.21	-0.31	0.01	0.10	-0.45	0.04	-0.40	-0.21	1.00											
Nb	0.29	0.77	0.80	0.19	-0.29	-0.27	-0.13	0.14	0.07	-0.23	0.47	0.00	0.11	0.43	0.47	0.37	0.08	0.41	0.47	0.62	0.39	0.18	0.02	1.00										
Ni	-0.73	-0.47	-0.33	-0.58	0.86	0.77	0.62	0.68	-0.69	0.36	-0.47	0.80	0.63	0.47	0.00	0.42	0.50	-0.20	0.35	-0.05	0.60	0.78	-0.40	-0.08	1.00									
Pb	0.72	0.68	0.69	0.75	-0.73	-0.69	-0.61	-0.42	0.31	-0.03	0.56	-0.54	-0.05	0.15	0.08	-0.16	-0.23	0.60	0.13	0.41	-0.18	-0.51	0.18	0.51	-0.66	1.00								
Sb	-0.32	-0.30	-0.35	-0.05	0.30	0.19	0.26	0.23	-0.58	0.19	0.17	0.25	0.26	0.08	0.17	-0.19	0.48	0.16	-0.23	-0.22	0.04	0.22	0.07	-0.23	0.35	-0.39	1.00							
Se	-0.11	-0.24	-0.43	0.06	-0.05	-0.10	-0.07	-0.16	-0.12	0.32	0.18	-0.19	0.00	-0.12	0.13	-0.46	0.31	-0.10	-0.48	-0.36	-0.26	-0.27	0.29	-0.45	-0.08	-0.15	0.67	1.00						
Sn	0.20	-0.01	0.10	0.30	-0.14	-0.08	-0.21	-0.28	0.15	-0.01	0.19	-0.30	-0.19	0.22	-0.12	-0.03	-0.26	0.04	0.15	0.06	-0.06	-0.28	0.07	-0.06	-0.04	0.14	-0.21	-0.04	1.00					
Sr	-0.79	-0.51	-0.36	-0.73	0.97	0.96	0.83	0.69	-0.40	0.40	-0.57	0.83	0.53	0.26	-0.08	0.30	0.08	-0.45	0.37	0.01	0.39	0.74	-0.47	-0.33	0.83	-0.80	0.24	-0.09	-0.10	1.00				
V	0.74	0.26	0.28	0.98	-0.72	-0.72	-0.83	-0.64	0.08	-0.11	0.67	-0.66	-0.22	-0.05	0.08	-0.63	-0.24	0.75	-0.20	0.14	-0.59	-0.74	0.18	0.16	-0.63	0.76	-0.10	0.08	0.28	-0.76	1.00			
W	-0.35	-0.49	-0.69	-0.14	0.17	0.03	0.13	-0.05	-0.68	-0.07	-0.16	0.01	0.05	-0.04	-0.07	-0.14	0.55	0.00	-0.48	-0.44	0.02	0.13	0.13	-0.33	0.46	-0.52	0.66	0.38	-0.02	0.21	-0.16	1.00		
Zn	-0.37	-0.08	0.11	-0.28	0.50	0.48	0.44	0.45	-0.28	0.47	-0.31	0.45	0.58	0.62	-0.26	0.52	0.14	-0.11	0.56	0.21	0.61	0.50	-0.23	0.02	0.62	-0.07	-0.09	-0.24	0.45	0.46	-0.34	0.04	1.00	
Zr	0.26	0.94	0.70	0.13	-0.60	-0.52	-0.06	-0.21	0.55	-0.30	0.20	-0.44	-0.15	0.21	0.39	0.28	-0.34	0.00	0.32	0.49	0.21	-0.30	0.03	0.61	-0.54	0.65	-0.42	-0.27	-0.06	-0.53	0.20	-0.46	-0.10	1.00

APPENDIX 10 cont. Correlation coefficients and significance table for the subset "Traverse 35800N, 0-1 m composites". Concentration ranges are in % for major elements and ppm for minor and trace elements. Subset size is 13 samples.

Correlation coefficients: $r>0.801, \alpha<0.001$ (99.9%),
$r>0.684, \alpha<0.01$ (99.0%),
$r>0.553, \alpha<0.05$ (95.0%).

ELEMENT	CONCENTRATION RANGE		LEVEL OF SIGNIFICANCE					
			99.9%		99.0 %		95.0%	
	MINIMUM	MAXIMUM	POSITIVE	NEGATIVE	POSITIVE	NEGATIVE	POSITIVE	NEGATIVE
SiO2	58.3	77.6			Fe,Pb,V	Mg,Na,K,Ni,Sr	Cr	Au,La,Mn
TiO2	0.4	0.63	Al,Zr		Nb		Ge,Pb	
Al2O3	9.24	13.5	Nb,Ti		Ge,Pb	W,Zr	Cu	
Fe2O3	3.88	9.1	Cr,V	Na	Si,As,Pb	Sr		Mg,Ca,K,Au,Ce,La,Mn,Ni
MgO	0.53	5.29	Ca,Au,Ni,Sr		Na,K,Mn	Si,V,Pb	Ba	Fe,Zr
CaO	0.363	7.74	Mg,Au,Sr		Na,K,Mn,Ni	V,Pb		Fe,Si
Na2O	0	0.53	Sr	Fe,V	Ca,Mg,Mn	Si	K,Au,Ni	Pb
K2O	0.241	0.602	Au,Mn		Ca,Mg,Sr	Si	Ba,Ce,Cu,La,Ni	V
P	0.002	0.006				Ni,W	Zr	Ba,Co,Sb
S	0.018	0.068			Ba		K	
As	4	19			Fe,Cr			Sr
Au	0.02	0.24	Mg,Ca,K,Mn,Ni,Sr				Na,Ba,La	Si,Fe,V
Ba	48	173			S		Mg,Ca,K,Au,Be,Mn,Ni,Zn	P
Be	0	1.93			Cu		Ba,Ge,Zn	
Bi	0	2						
Ce	21	66	La				Mn	Fe,V
Co	5	20						P
Cr	216	364	Fe		As,V		Si,Pb	
Cu	18	40			Be,Ge		Al,K,La,Zn	
Ge	0	2			Al,Cu		Ti,Be,Nb	
La	21	40	Ce				K,Au,Cu,Mn,Ni,Zn	Si,Fe,V
Mn	137	312	K,Au		Mg,Ca,Na,Ni,Sr	V	Ba,Ce,La	Si,Fe
Mo	1	23						
Nb	2	9	Al		Ti		Ge,Zr	
Ni	51	168	Mg,Au,Sr		Ca,Ni	Si,P	Na,K,Ba,La,Zn	Fe,Pb,V
Pb	11	22			Si,Al,Fe,V	Ca,Mg,Sr	Ti,As,Cr,Zr	Na,Ni
Sb	0	5					Se,W	P
Se	0	2					Sb	
Sn	0	6						
Sr	33	195	Mg,Ca,Na,Au,Ni		K,Mn	Si,Fe,Pb,V		As
V	89	233	Fe	Na	Si,Pb,Cr	Ca,Mg,Mn,Sr	As	K,Au,Ce,La,Ni
W	11	25				Al,P	Sb	
Zn	14	132					Ba,Be,Cu,La,Ni	
Zr	103	170	Ti		Al		Nb,Pb	Mg

APPENDIX 11. Correlation coefficients and significance table for the subset "Type 1 carbonate-rich profiles". Concentration ranges are in % for major elements and ppm for minor and trace elements. Subset size is 46 samples.

Correlation coefficients: $r>0.473, \alpha<0.001$ (99.9%),
$r>0.376, \alpha<0.01$ (99.0%),
$r>0.291, \alpha<0.05$ (95.0%).

SiO2	1.000																
TiO2	-0.016	1.000															
Al2O3	-0.280	0.892	1.000														
Fe2O3	-0.278	0.418	0.350	1.000													
MgO	-0.630	-0.431	-0.277	-0.331	1.000												
CaO	-0.772	-0.474	-0.212	-0.218	0.834	1.000											
Na2O	0.010	0.482	0.275	-0.146	0.176	-0.100	1.000										
P2O5	-0.197	0.292	0.280	0.025	0.055	0.124	0.264	1.000									
Au	-0.710	-0.280	-0.180	0.007	0.734	0.783	0.155	0.297	1.000								
Ba	-0.461	0.007	0.068	0.017	0.552	0.483	0.450	-0.002	0.439	1.000							
Be	0.289	0.060	-0.065	-0.177	-0.179	-0.181	0.273	0.519	-0.103	-0.083	1.000						
Cr	-0.128	0.263	0.093	0.904	-0.290	-0.226	-0.071	-0.071	-0.002	0.011	-0.074	1.000					
Cu	-0.601	0.580	0.726	0.477	-0.018	0.145	0.159	0.348	0.292	0.171	-0.171	0.187	1.000				
Mn	-0.275	-0.308	-0.411	0.113	0.397	0.367	0.052	0.256	0.488	0.151	0.108	0.231	-0.118	1.000			
Ni	0.071	0.232	-0.029	0.417	-0.068	-0.164	0.410	-0.035	0.030	0.270	0.312	0.656	-0.132	0.265	1.000		
V	-0.372	0.450	0.432	0.957	-0.257	-0.153	-0.129	0.045	0.068	0.088	-0.218	0.787	0.626	0.024	0.290	1.000	
Zr	0.467	0.398	0.054	0.438	-0.523	-0.625	0.276	-0.100	-0.356	-0.143	0.233	0.609	-0.216	-0.080	0.739	0.297	1.00
	SiO2	TiO2	Al2O3	Fe2O3	MgO	CaO	Na2O	P2O5	Au	Ba	Be	Cr	Cu	Mn	Ni	V	Zr

ELEMENT	CONCENTRATION RANGE		LEVEL OF SIGNIFICANCE					
			99.9%		99.0%		95.0%	
	MINIMUM	MAXIMUM	POSITIVE	NEGATIVE	POSITIVE	NEGATIVE	POSITIVE	NEGATIVE
SiO2	37.6	88.1		Mg,Ca,Au,Ba,Cu	Zr	V		
TiO2	0.295	0.727	Al,Na,Cu	Ca	Fe,V,Zr	Mg	P	Mn
Al2O3	6.550	23.6	Ti,Cu		V	Mn	Fe	
Fe2O3	2.430	23.6	Cr,Cu,V		Ti,Ni,Zr		Al	
MgO	0.256	8.46	Ca,Au,Ba	Si,Zr	Mn	Ti		Fe
CaO	0.046	13.2	Mg,Au,Ba	Si,Ti,Zr	Mn			
Na2O	0	0.95			Ti,Ba,Ni			
P2O5	0	0.04	Be				Ti,Au,Cu	
Au	0.004	0.83	Mg,Ca,Mn	Si	Ba		Cu,P	Zr
Ba	48	300	Mg,Ca		Na,Au	Si		
Be	0	1.3	P					
Cr	118	1920	Fe,Ni,V,Zr					
Cu	5.83	203	Ti,Al,Fe,V	Si			Au	
Mn	63.3	848	Au		Mg,Ca	Al		Ti
Ni	31	172	Cr,Zr		Fe,Na,Be			
V	56.8	422	Fe,Cr,Cu,Zr		Ti,Al	Si		
Zr	65.4	159	Cr,Ni	Mg,Ca	Si,Ti,Fe		V	Au

APPENDIX 12. Correlation coefficients and significance table for the subset "Type 2 carbonate-poor profiles". Concentration ranges are in % for major elements and ppm for minor and trace elements. Subset size is 23 samples.

Correlation coefficients: $r>0.629, \alpha<0.001$ (99.9%),
$r>0.515, \alpha<0.01$ (99.0%),
$r>0.404, \alpha<0.05$ (95.0%).

SiO2	1.000															
TiO2	-0.303	1.000														
Al2O3	-0.359	0.578	1.000													
Fe2O3	-0.797	0.138	-0.194	1.000												
MgO	0.682	-0.035	-0.082	-0.584	1.000											
CaO	0.639	-0.302	-0.561	-0.263	0.792	1.000										
Na2O	-0.086	-0.204	-0.257	0.177	-0.354	-0.126	1.000									
P2O5	0.547	0.309	0.375	-0.758	0.636	0.216	-0.358	1.000								
Au	-0.630	-0.153	-0.065	0.566	-0.354	-0.231	-0.032	-0.478	1.000							
Ba	0.322	-0.435	0.085	-0.401	0.037	-0.045	-0.162	0.159	-0.183	1.000						
Be	0.050	0.004	-0.074	-0.053	-0.105	-0.114	0.044	0.108	-0.112	-0.066	1.000					
Cr	-0.604	0.186	-0.220	0.869	-0.431	-0.078	0.374	-0.670	0.232	-0.433	-0.059	1.000				
Cu	-0.847	-0.054	0.185	0.673	-0.460	-0.344	0.022	-0.557	0.778	-0.201	-0.071	0.486	1.000			
Mn	0.545	-0.281	-0.582	-0.132	0.719	0.959	-0.192	0.106	-0.121	-0.076	-0.036	0.018	-0.252	1.000		
Ni	-0.079	0.120	-0.207	0.376	0.460	0.602	-0.083	-0.079	0.185	-0.271	-0.236	0.499	0.225	0.675	1.000	
V	-0.655	0.354	-0.151	0.890	-0.513	-0.224	0.124	-0.611	0.293	-0.384	-0.029	0.904	0.471	-0.103	0.362	1.000
Zr	-0.255	0.400	0.001	0.494	-0.332	-0.152	0.126	-0.220	-0.238	0.061	-0.102	0.604	-0.061	-0.104	0.247	0.670	1.000
	SiO2	TiO2	Al2O3	Fe2O3	MgO	CaO	Na2O	P2O5	Au	Ba	Be	Cr	Cu	Mn	Ni	V	Zr

ELEMENT	CONCENTRATION RANGE		LEVEL OF SIGNIFICANCE					
			99.9%		99.0%		95.0%	
	MINIMUM	MAXIMUM	POSITIVE	NEGATIVE	POSITIVE	NEGATIVE	POSITIVE	NEGATIVE
SiO2	24.3	83.3	Mg	Fe,V	Ca,P,Mn	Au,Cr,Cu		
TiO2	0.36	0.745			Al			Ba
Al2O3	7.79	25.6			Ti	Ca,Mn		Ba
Fe2O3	5.48	48.9	Cr,Cu,V	Si,P	Au	Mg	Zr	
MgO	0.052	0.516	Si,Ca,Mn		P	Fe	Ni	Cr,Cu,V
CaO	0.027	0.414	Mg,Mn		Ni,Si	Al		
Na2O	0	0.3						
P2O5	0	0.04		Fe,Cr	Mg,Si	Cu,V		
Au	0.006	0.99	Cu		Fe	Si		P
Ba	0	1399						Ti,Cr
Be	0	0.528						
Cr	166	1617	Fe,V	P	Zr	Si	Cu,Ni	Mg,Ba
Cu	24.5	265	Fe,Au	Si		P	Cr,V	Mg
Mn	37.4	348	Mg,Ca,Ni		Si	Al		
Ni	40	104	Mn		Ca		Mg,Cr	
V	101.000	857.000	Fe,Cr,Zr	Si		P	Cu	Mg
Zr	129.000	220.000	V		Cr		Fe	

APPENDIX 13. Comparison of pH for a selection of soils using either 0.01M CaCl(2) solution or deionised water.

Sample	pH-0.01M CaCl	pH-deionised water only
04-1274	4.1	5.6
04-1280	3.9	4.8
04-1284	4.6	5.9
04-1252	6.6	6.3
04-1258	6.9	8.6
04-1262	6.7	8.3
04-1204	7.0	8.0
04-1205	6.9	8.5
04-1247	4.2	6.1
04-1249	4.3	5.2