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REGOLITH STUDIES RELATED TO THE CHALLENGER GOLD DEPOSIT, GAWLER CRATON, SOUTH AUSTRALIA

Geochemistry and stratigraphy of the Challenger Gold Deposit
Volume 1: Text

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This report presents outcomes of a collaborative research project between the Gawler Joint Venture, CRC LEME and PIRSA that commenced in April 1998. The agreement between the parties allowed the regolith mapping module of the project to be publicly released on completion and the geochemical module to remain confidential for twelve months. Reports on both modules were issued to the Gawler Joint Venture in March 1998. Under the terms of the agreement, the maps were immediately available on open file. The confidentiality restrictions on the outcomes of the geochemical module expired in March 1999 and the research results are presented herein.

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PREFACE

In the late 1980s and 1990s, CSIRO-AMIRA Projects (P240, P240A, P241, P241A, P409 and others) in the Yilgarn Craton in WA investigated the geochemical expression of primary and supergene Au mineralisation in the regolith and its relationship with regolith landforms. These studies demonstrated that in relict (laterite-dominated) and erosional (saprolite-dominated) landform regimes, carefully directed, shallow sampling is usually more cost- and technically-effective than routine drilling to the lower regolith in regional- and prospect-scale exploration. In some locations, it was found that there was a surface expression of mineralisation concealed by up to 40 m of barren sediments and/or apparently leached saprolite.

Two groups of sample media were found to have particular value for mineral exploration in the Yilgarn Craton; these were:

(i) ferruginous materials, particularly lateritic residuum and lag;

(ii) calcareous soil horizons, which are widespread in the semi-arid parts of the southern Yilgarn. Gold concentrations are often much greater in pedogenic carbonate, compared with immediately adjacent horizons. These are termed gold-in-calcrete anomalies.

The research was highly successful with at least three large Au deposits (Plutonic, Bronzewing and Challenger) and numerous smaller deposits being found using methods attributable to the CSIRO-AMIRA jointly-funded projects.

Remote sensing applications have grown rapidly over the past decade. Initially, the major use of imagery was in structural analysis but more recently the spectral properties of surficial materials have been analysed to assist in regional geological and regolith landform mapping, and hence for regional geochemical analysis of regolith. Broad-band, space-borne multi-spectral instruments such as Landsat Thematic Mapper allow appraisals of the geology and geomorphology of an area to be made quickly, efficiently and cheaply. For more detailed local work, better results can be obtained from aircraft-mounted high-spectral resolution instruments, such as the Geoscan and HYMAP systems that are capable of locating alteration minerals and discriminating between different types of alteration products. Remotely-sensed images have significance in providing synoptic views of large areas, thereby allowing broad-scale variations of land properties to be more readily detectable, and of having spatial comprehensiveness when compared with field data. This latter point does not mean that field data can be eliminated. Rather, the efficiency and effectiveness of field data collection can be improved when using remotely-sensed images.

One of the principal outcomes of the success of the regolith research projects has been the formation of the Cooperative Research Centre for Mineral Exploration and Landscape Evolution (CRC LEME) in 1995, and with it a new impetus to extend similar research in other parts of Australia. The South Australian Node of CRC LEME was established in late 1996 and has successfully teamed up with the Regolith Terranes Team in PIRSA (Primary Industry and Resources, South Australia, formerly MESA, Mines and Energy Department of South Australia). The principal objective of the CRC LEME Shields Program and PIRSA Regolith Terranes Team in South Australia is to develop technically efficient procedures for mineral exploration through a comprehensive understanding of the processes of regolith development and landscape evolution and their effects on the surface expression of concealed mineralisation.

The specific objectives in South Australia are to:

- Establish broad spatial relationships between regolith, landforms and bedrock lithotypes.
- Establish mineralogical and geochemical characteristics of regoliths in different geological, geomorphological and climatic environments.
- Characterise the surface and sub-surface geochemical expression of major ore systems in the regolith.

- Establish relationships between geochemical dispersion patterns, weathering processes and evolution of regolith and landform development.
- Develop appropriate exploration procedures for the different landscapes of the Cratons and Provinces.

CRC LEME and PIRSA commenced joint regolith studies in South Australia to assist the exploration industry with precious and base metal exploration over areas of variably-covered basement terranes. The initial focus has been on the Gawler Craton since it is a region well suited to research activities due to the current high level of exploration activity. The enormous interest in the Gawler Craton of late, particularly with respect to Au exploration, has been the result of a combination of several key factors including:

- Pioneering of calcrete sampling for Au exploration in Western Australia by CSIRO in the late 1980s.
- Discovery of Au by drilling by MESA in the early 1990s.
- Availability of high-quality airborne geophysical data from the state government's South Australian Exploration Initiative (SAEI).
- The application of calcrete sampling to South Australia by Dominion Mining in 1993.
- The discovery of the Challenger Gold Deposit in 1995.

Initially some of the preliminary "in-house" studies have involved comparisons between calcretes in Western Australia and South Australia. However, the study of the regolith goes far beyond an appraisal of calcrete as a sample medium even though it is believed that considerably more use and application of calcrete sampling can be made for exploration purposes. The regolith is a complex subject that requires the study of several inter-related research topics, including regolith mapping, regolith geochemistry and surficial geochemistry. Individually, these topics provide useful information, but when combined, they provide a powerful understanding of the processes involved in regolith formation and development.

Since late 1996, the CRC LEME - PIRSA groups have been approached by several companies offering research sites for pilot regolith studies. All sites were visited and assessed using various criteria for suitability including style and tenor of mineralisation, presence of known surficial anomalies and regolith setting. In March 1997, the Gawler Joint Venture (GJV) were presented with a project proposal for regolith investigations in the Gawler Craton. Agreement was reached in April 1997 to commence the research centred on the Challenger Gold Deposit. The geochemical data generated from the project will remain confidential for a period of twelve months whereas the regolith mapping data will be open file.

Preliminary investigations were based on research methods that have been successfully applied in the deeply weathered environments of Western Australian and Queensland. As investigations progressed, they were tailored to suit the specific requirements of the South Australian regolith as they become apparent. In addition, some knowledge was already available in the published literature. Accordingly the agreed objectives of the project are:

- Construction of a detailed regolith landform map of a central, core area, and a reconnaissance map of the surrounding region (Wilford et al, 1998).
- Determination of the mineralogical and geochemical characteristics of one or more calcrete anomalies.
- Determination of the mineralogical and geochemical characteristics of the regolith at one area of mineralisation.
- Assist with the interpretation of calcrete anomalies.

The research project was undertaken as part of a broad CRC LEME-PIRSA Regolith Program that consists of a series of Research Modules, four of which were proposed for this project: Regolith Mapping, Regolith Geochemistry, Surface Geochemistry and Biogeochemistry. The four Modules will assist the GJV in its exploration endeavours in the Challenger area and provide fundamental data for increasing knowledge about regolith processes and landscape evolution within this important region.

The Challenger Gold Deposit and surrounding area provide an excellent opportunity to examine, map and sample regolith units, and to investigate geochemical dispersion of Au and associated elements in *one of the few areas of significant Au mineralisation* currently outlined in the Gawler Craton.

M.J. Lintern
I.T. Tapley
(Project Leaders)

March 1998

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EXECUTIVE SUMMARY

The Challenger Au Deposit lies in the northern Gawler Craton, South Australia, 750 km NW of Adelaide, and 140 km NW of Tarcoola. A 1.5 km traverse (the regolith line) was chosen for the study of geochemical dispersion and regolith stratigraphy across three zones of mineralisation (Zones 1, 2 and 3) and various landforms in the Challenger area. The principal mineralisation (Challenger I or Zone 1) outcrops on the flank of a low rise, referred to as Mt Challenger. Zone 2 mineralisation (Challenger SE) occurs about 400 m to the south east of Zone 1. Kelpie, or Challenger II (Zone 3), is located beneath about 20 m of sediments, presumed to be mostly Tertiary in age, about 800 m to the SE of Zone 1. Other zones of mineralisation occur in the area, but were not studied. Mineralisation is associated with silica and arsenopyrite alteration in the Christie Gneiss, a garnet-rich paragneiss consisting of plagioclase, perthitic K-feldspar, quartz, cordierite, garnet and biotite.

Deep weathering of the Christie Gneiss has led to the development of a clay-dominated saprolite of variable thickness (but averaging about 30 m) that contains abundant relict quartz. The upper regolith (designated as 0–6 m) is dominated by silicification (silcrete) and calcrete development, with comparatively small quantities of ferruginous material occurring mainly as ferruginous granules (lag) on the surface. The area is of low relief and dominated by a shrubland of bluebush (*Maireana sedifolia*), with pockets of mulga (*Acacia* sp.) flourishing in thin (< 2 m) aeolian dunes.

Thirty holes were specially drilled along the regolith line in order to study the upper regolith in detail. The lower regolith was sampled to about 60 m, using cuttings from pre-existing drill holes, at intervals along the regolith line that correspond with the upper regolith samples. A series of eight, 3 m deep pits were excavated along the regolith line to enable detailed examination of the relationship (i) between silcrete and calcrete, and (ii) between silcrete/calcrete and mineralised saprolite. In addition to the drill cuttings and pits, sampling and analyses of calcrete, silcrete, lag and vegetation was undertaken using a suite of 50 major and minor elements, XRD and SEM.

Results and recommendations are summarised below.

1. The geochemical study was undertaken along the 1.5 km "regolith line" that traversed mineralisation at Challenger. Mineralisation virtually outcrops in two Zones (1 and 2) along the regolith line. A geochemically anomalous area at the far western end of the line requires more investigation. Further investigations are also required at Zone 3, located beneath approximately 20 m of palaeochannel sediments, to test whether anomalous geochemistry in drill cuttings of Au, Bi, W, Mo and Fe-normalised elements (e.g. Cu and As) in the upper regolith are related to mineralisation.

2. The regolith line can be divided into two units, *in situ* and transported. The *in situ* unit consists of Archaean basement rocks deeply weathered to saprolite. The transported unit consists of mainly fluvial deposits (up to 25 m thick) of presumed Tertiary age. Exploration strategies should be different for each unit due to their quite dissimilar genesis, mineralogy and geochemical signatures.

3. Calcrete is ubiquitous and is recommended by far as the best sample medium for Au exploration in the *in situ* unit providing broad, high-contrast anomalies. Gold is by far the superior element to analyse for in calcrete but Cu and As are also useful. Drill cuttings, silcrete, soil, lag, and vegetation are alternative sample media that could be used in transported units with caution, but further investigations are required to test the limits of their effectiveness.

4. Silcrete lag was demonstrated for the first time to be an alternative sample medium for Au. In areas where calcrete is absent, silcrete or soil are recommended as surficial sampling media.

5. The elements in the regolith associated with mineralisation at the Challenger Gold Deposit are in two broad groups: sulphide-related (Ag, As, Bi, Cd, Cr, Cu, Fe, Mo, S, Se, ?W and Zn) and alteration-related (Ba, Cs, K, Rb, Tl). The use of these elements as pathfinders depends on the sample medium to be used and the regolith setting.

6. Distinguishing between transported and *in situ* regolith has been demonstrated to be important from the geochemical sampling perspective. The light REE (Ce, La, Pr, Sm and Nd) appear to be able to discriminate between transported and *in situ* regolith. Further investigations are required to test whether calcretes can be used *in lieu* of drill cuttings. To further assist in the discrimination between transported and *in situ* regoliths, the use of the Portable Infra-red Mineral Analyzer (PIMA) should be appraised.

7. Gypsum was associated with mineralisation in the weathered *in situ* upper regolith. Isotope studies are underway to determine the origin of the S.

8. Surficial ferruginous materials, although not common, require further investigation as sample media since some are highly concentrated in Au.

9. It is recommended that samples are analysed using a detection limit technique at least an order of magnitude lower than the concentration of interest. For example, when using 5 ppb data for contouring geochemical data, then a technique with a detection limit <0.5 ppb is required.

10. Induration of the upper regolith by silica and carbonate cements has yielded silcrete, calcrete and calcreted silcrete to depths of 2–3 m in the Challenger area. These materials now carry the geochemical signatures of mineralisation that so many explorers are now using.

11. Non-precious opal (potch) was identified in siliceous palaeochannel materials. Although precious opal was not encountered, there is a high potential for precious opal to occur in this environment. It is recommended that appropriate regolith settings similar to those found at Challenger are explored for opal. To avoid any problems with uninvited opal miners prospecting in an uncontrolled way over the Challenger area, steps to alter the conditions of the EL and MLs should be made as this area is outside of any of the Proclaimed Precious Stones Fields.

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1. INTRODUCTION

1.1 Previous work

There is relatively little information available about research or orientation studies undertaken on geochemical dispersion in the Gawler Craton (e.g. Edgecombe, 1997). The limited number of company reports on the subject are mostly closed file (e.g. Wills, 1994). Wills (1994), while working for Dominion Mining Ltd, examined geochemical dispersion of Au and other elements in several exploration leases now currently owned by the Gawler Joint Venture (GJV). In summary, he noted that:

i) calcrete in SA is normally cemented into laminated, nodular or massive varieties and occurs close to the surface (<0.5 m) whereas in WA, it is generally friable and often located deeper in the profile;
ii) ferruginous lag sampled at the South Hilga prospect (~30 km SSE of Challenger) was generally ineffective as a sample medium for Au;
iii) calcrete was very effective for Au exploration at the South Hilga prospect, with higher Au concentrations near the surface associated with mineralisation at depth;
iv) calcrete was easily sampled from the surface by digging a small pit;
v) the Au in calcrete was ultrafine since good reproducibility was obtained with 2 g repeat samples; and
vi) appropriate regolith mapping should be undertaken before surface geochemical methods are utilised.

Gillman (1997) summarises more recent exploration using calcrete by the GJV in their tenement to the NW of Tarcoola (including the Challenger Gold Deposit):

i) the tenement can be broadly divided into areas dominated by either colluvium or sand dunes;
ii) calcrete can be collected by hand from shallow pits in areas of colluvium and by auger drill from the dune areas;
iii) 296 Au in calcrete anomalies have been identified from which 39 have been drill tested; significant Au mineralisation has been found at 80% of these sites;
iv) 1.6 km by 1.6 km grid calcrete sampling was followed up locally to 100 m by 50 m with a maximum over the Challenger Gold Deposit of 620 ppb Au, 37 ppm As and 36 ppm Cu; and
v) an initial sample spacing of at least 400 m by 400 m is recommended in order not to miss significant Au mineralisation.

New Au-in-calcrete anomalies from various tenements in the Gawler Craton are being generated at a phenomenal rate. Vast databases are evolving within individual companies that will potentially be of enormous value once collated and then combined with other data sets, such as regolith landform maps, digital terrain models, radiometrics, aeromagnetics, gravity and Landsat imagery. At present, however, the databases largely remain confidential to individual companies.

1.2 Objectives and scope of this study

The objectives of the Geochemistry Modules (regolith, surficial and biogeochemistry) of this study were to:

1. Determine the mineralogical and geochemical characteristics of one or more calcrete anomalies.
2. Determine the mineralogical and geochemical characteristics of the regolith at one area of mineralisation.
3. Assist the GJV with the interpretation of calcrete anomalies.

The objectives were to be achieved through a work program organised as follows:

1. Determine suitable traverse (1–2 km) after detailed inspection of existing data, field evaluation and after consultation with GJV personnel.
2. Undertake preliminary field sampling. Site suitability further assessed and adjustments made (if required) after consultation with GJV personnel.
3. Determine the coordinates of a “regolith line” for the investigation.
4. Supervision of RC drill rig operator to ensure collection of high quality surficial samples (0–6 m).
5. Supervision of back-hoe contractor for excavation and rehabilitation of small “soil” pits; sample collection from profiles.
6. Collection of other surficial material and biogeochemical samples.
7. Collection of selected material from other anomalous sites.
8. Transportation and submission of samples for analytical work.
9. Appraisal of data. Follow-up sampling and analysis if required.
10. Presentation of results.
11. Production of a Final Report.

2. SITE CHARACTERISTICS

2.1 Regional geology

The Challenger Gold Deposit lies in the northern Gawler Craton and is located 750 km NW of Adelaide (South Australia) and 140 km NW of Tarcoola and is centred at 363500E 6693700N (Figure 1 and Figure 2). The information following in this section has been largely taken from Daly *et al*. (1998) and describes the tectonic evolution of the Mulgathing Complex.

According to Daly *et al*. (1998), although the northern Gawler Craton has been affected by extensive and prolonged tectonism, a significant proportion of the region retains Archaean to earliest Proterozoic radiometric ages. Archaean metasediments of the Mulgathing Complex (Daly, 1985) were derived at least in part from a pre-existing continental basement, and included BIF, chert, carbonate, calcsilicate, quartzite and aluminous sediments. Komatiite and tholeiitic basalt flows, and pyroxenite and peridotite sills are inferred to be contemporaneous with sedimentation. Together with abundant other mafic rocks intersected in the subsurface (Robertson *et al*., 1992; Daly and Van der Stelt, 1992; Morris *et al*., 1994) these metabasic and ultramafic rocks are inferred to represent regional attenuation of the Archaean crust and may indicate the presence of oceanic crust during sedimentation. Peak regional granulite-facies metamorphism during the Sleafordian Orogeny (9 Kb at 860°C) and associated extensive syntectonic granites, tonalites and norite have been dated at ~2450 Ma from both Rb-Sr whole rock and U-Pb zircon geochronology (Fanning, pers. comm).

Aeromagnetic data and field/drilling observations show that the dominant regional structures for the Mulgathing Complex, developed during the Sleafordian, are tight to isoclinal folds (SF_3) up to 40 km long, refolding earlier macro- and micro-isoclinal folds SF_2. In some areas, limbs of SF_3 folds become increasingly attenuated and grade into mylonite. These shear zones are interpreted to be Archaean in age (developed during peak metamorphism) and were reworked during Proterozoic tectonism. Progressive rotation of Archaean SF_3 axial surfaces and parallel shear zones, from (i) predominantly north trending (and immediately south of the Karari Fault Zone and near Mount Christie) to (ii) easterly near Lake Harris, may be explained by strike-slip fault drag along portions of Proterozoic ductile shear zones (Daly *et al.*, 1998).

A range of prograde Sleafordian metamorphic conditions are recorded within the Mulgathing Complex. Granulite-facies at Mount Christie and to the north-west are in distinct contrast to the much lower metamorphic grade komatiite flows, that contain relict cumulus olivine near Lake Harris, and the mildly deformed acid volcanic rocks north of Kingoonya. The original crustal architecture of the Mulgathing Complex during the late Archaean through the Palaeoproterozoic is not as well defined as in the southern Eyre Peninsula. Major structures controlling the juxtaposition of differing crustal levels are suspected to be high strain zones parallel to SF_3 axial planes, subsequently rotated in part by the ductile Proterozoic shear zones (Daly *et al.*, 1998).

2.2 Local geology and mineralisation

The information in this section has been mostly taken from Bonwick (1997) and describes the exploration history for the Challenger deposit.

The lack of a definitive marker unit in the gneissic basement hampered exploration in the early stages and, apart from the mineralisation itself, no units were observed in the percussion drilling to determine the basement structural controls. Continued drilling showed that the mineralisation in the near surface had a 060° (AMG) strike, and not the NNW strike as originally thought. As a consequence, drilling was re-orientated onto new traverse lines with most holes angled along grid at 60° toward 152° (AMG).

Follow-up drilling continued and further bonanza Au grades were intersected associated with a supergene zone overlying silica and arsenopyrite altered Christie Gneiss. Further RC drilling extended significant oxide and primary mineralisation over a 250 m strike length and to a 100 m vertical depth. It was noted that mineralisation at Challenger is associated with a zone of deeper weathering, possibly due to the breakdown of sulphide minerals. The clay in the saprolite typically reaches a depth of 40–50 m around the ore zones, in contrast to depths of 10 m in the surrounding country rock.

Although the “hit-rate” had improved dramatically with the new drilling orientation, the higher grade shoots kept cutting-out down dip. Construction of a Conolly diagram by Jon Standing, Resolute’s Senior Structural Geologist, pointed out that although the mineralised ‘horizon’ does strike approximately 060°, the high grade shoots plunge approximately 30° toward 030° (AMG). Structural studies indicated that this plunge is defined by a megascopic fold closure in the gneissic foliation. It also appeared that at least 5 mineralised surfaces are present (two in the hanging wall, the main zone and two in the footwall), further complicating the interpretation.

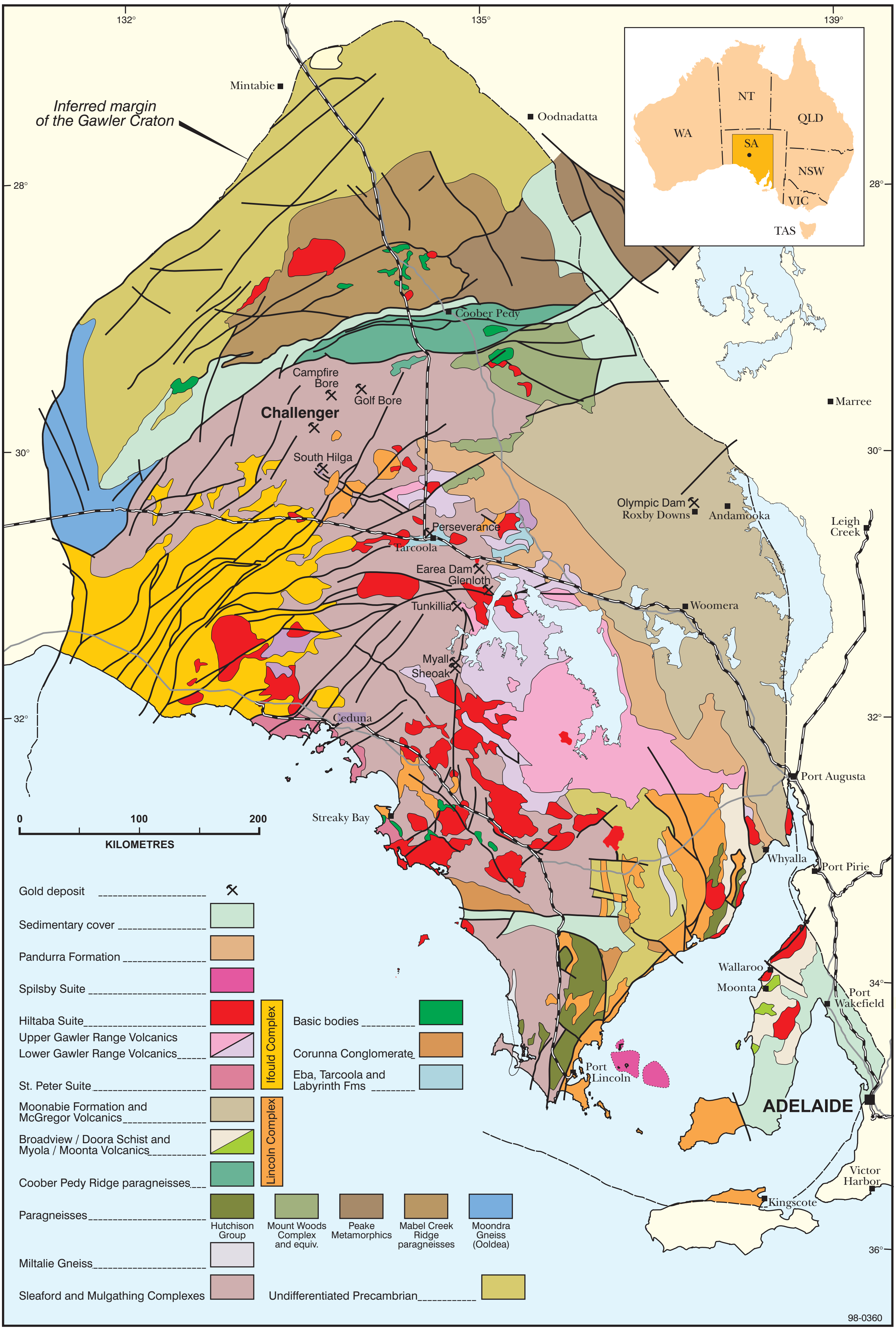


Fig. 1 *Regional geology of the Gawler Craton showing location of Challenger and other Au deposits. (After Daly et al., 1998).*

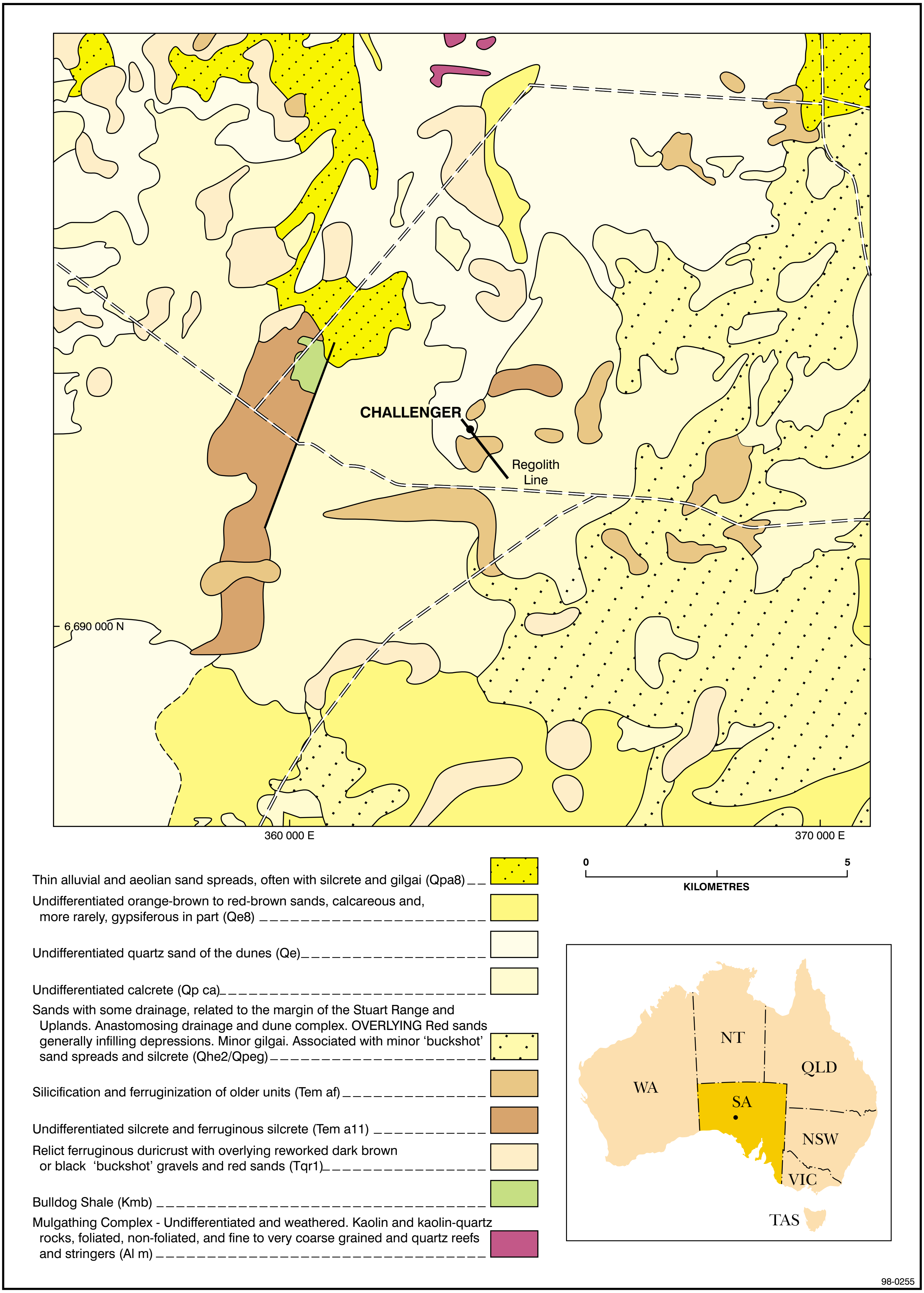


Fig. 2 Local geology of the Challenger area showing the location of the "regolith line" used in this study. (From Benbow, 1996).

With this new interpretation the drilling "hit-rate" targeting the high grade shoots improved to almost 100% resulting in the identification of four high grade Au shoots along the main zone. The high grade shoots are straight and have been defined continuously over 900 m down plunge to a vertical depth of 400 m. Other high grade shoots have been identified along footwall and hanging wall surfaces. All shoots remain open at depth. The deposit is currently being drilled out to define ore reserves, and additional drilling is being undertaken to locate new blind shoots.

Challenger-style mineralisation appears to be unique in Australia, although it may have some characteristics similar to the Renco Au deposits in Zimbabwe (Blenkinsop and Frei, 1996). Mineralisation is hosted by the Christie Gneiss, a garnet-rich paragneiss consisting of plagioclase, perthitic K-feldspar, quartz, cordierite, garnet and biotite. The Christie Gneiss reached peak metamorphism during the granulite facies Sleafordian Orogeny (Thomson, 1980; 2640–2300 Ma), however, the protolith ages are as old as 3070–2680 Ma on the basis of Sm-Nd data (Daly and Fanning, 1990). Retrograde metamorphism during the 1850–1700 Ma Kimban Orogen resulted in the replacement of pyroxenes with biotite and amphibole, and cordierite by sillimanite plus biotite.

High grade Au mineralisation is associated with coarse-grained quartz veins containing minor feldspar, garnet and biotite. Wallrock alteration consists of quartz, K-feldspar and biotite haloes to the veins. A late, low-temperature alteration assemblage of sericite, chlorite, carbonate and leucoxene is spatially related to a post-mineralisation intrusive suite of mafic and ultramafic dykes of lamprophyric affinity, and concordant fracture zones.

Gold mineralisation is associated with arsenopyrite (cored by löllingite - $FeAs_2$), pyrrhotite, pyrite and rare graphite. Chalcopyrite and bismuth compounds are also noted. Gold occurs as single grains or aggregates in arsenopyrite and inclusions in quartz, K-feldspar and plagioclase. Preliminary dating undertaken by Mark Fanning (unpublished data, 1997) suggests Au mineralisation was contemporaneous with a prograde metamorphic event with an age of ca 2435 Ma (monazite, $^{207}Pb/^{206}Pb$). Metamorphic ages cluster around 2445±32 Ma (U-Pb zircon).

Although not confirming an Archaean age, the data suggest that Au mineralisation at Challenger is much older than Meso-Proterozoic Au mineralisation associated with the 1600 Ma Hiltaba Suite granites at Olympic Dam and Helix Resource's Tunkillia discovery, south east of Tarcoola (Figure 1).

For this study (centred on the regolith line, Figure 2), three zones of mineralisation were studied:
(i) the main Challenger I ore body mineralisation is termed Zone 1 and sub-crops beneath a veneer of calcareous and siliceous material and is continuous to depths in excess of 80 m;
(ii) at Challenger South-east, termed Zone 2, mineralisation sub-crops but overlays a 14 m thick saprolite where Au is poorly concentrated;
(iii) at Challenger II or Kelpie, termed Zone 3, mineralisation is concealed beneath about 20 m of principally barren transported overburden.

This study indicates that the Christie Gneiss at the Challenger Gold Deposit consists of a foliated felsic granulite with a mineral assemblage of plagioclase, quartz, K-feldspar, garnet, cordierite, biotite, orthopyroxene and minor opaques (Fe-Ti oxides and graphite, Plate 1). The mineral assemblage suggests that this gneiss had a pelitic sedimentary precursor that has undergone high-grade regional metamorphism. Later quartz veining (often bluish) with concomitant sericitic and chloritic alteration is associated with the Au mineralisation at Challenger (Plate 1).

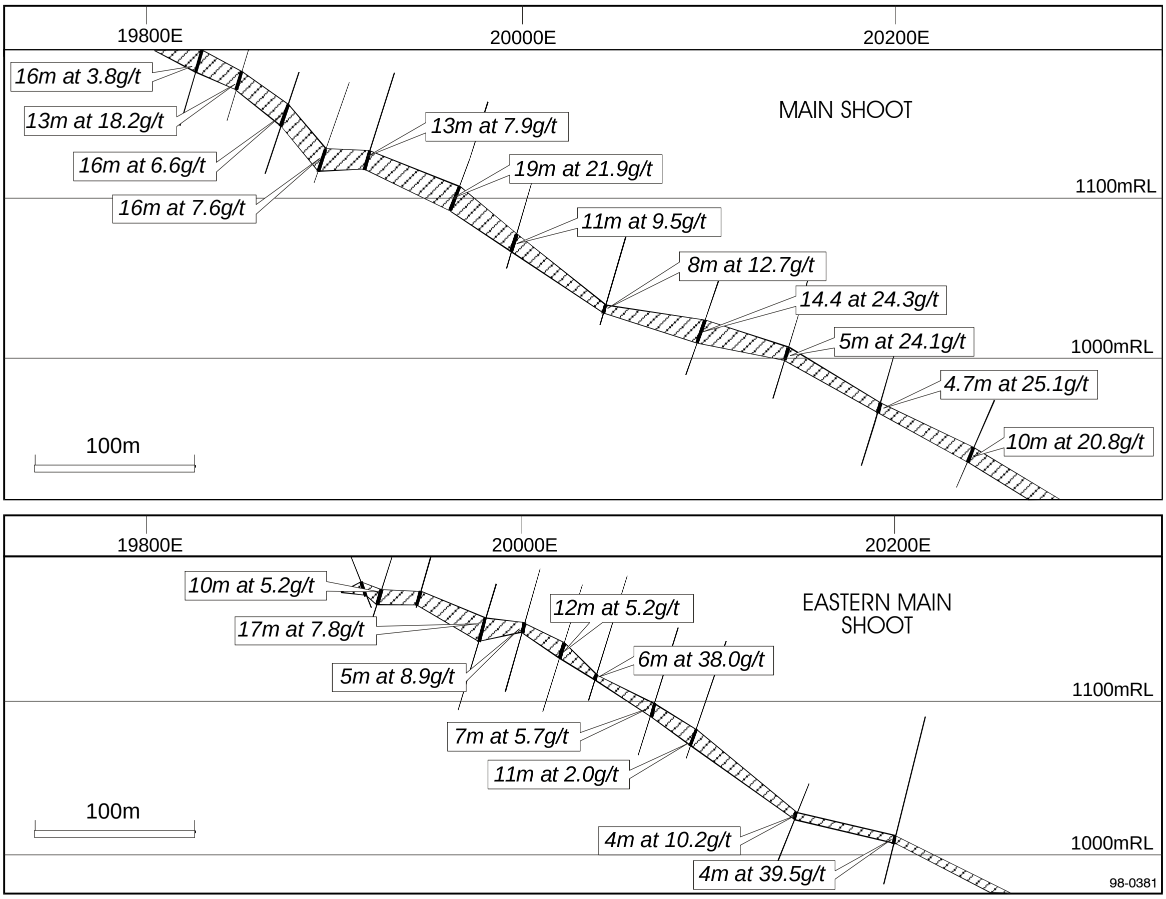


Fig. 3 *Section showing mineralisation with depth. Both the main shoot and Eastern Main Shoot are located in Zone 1 referred to in this study. (after Bonwick, 1997).*

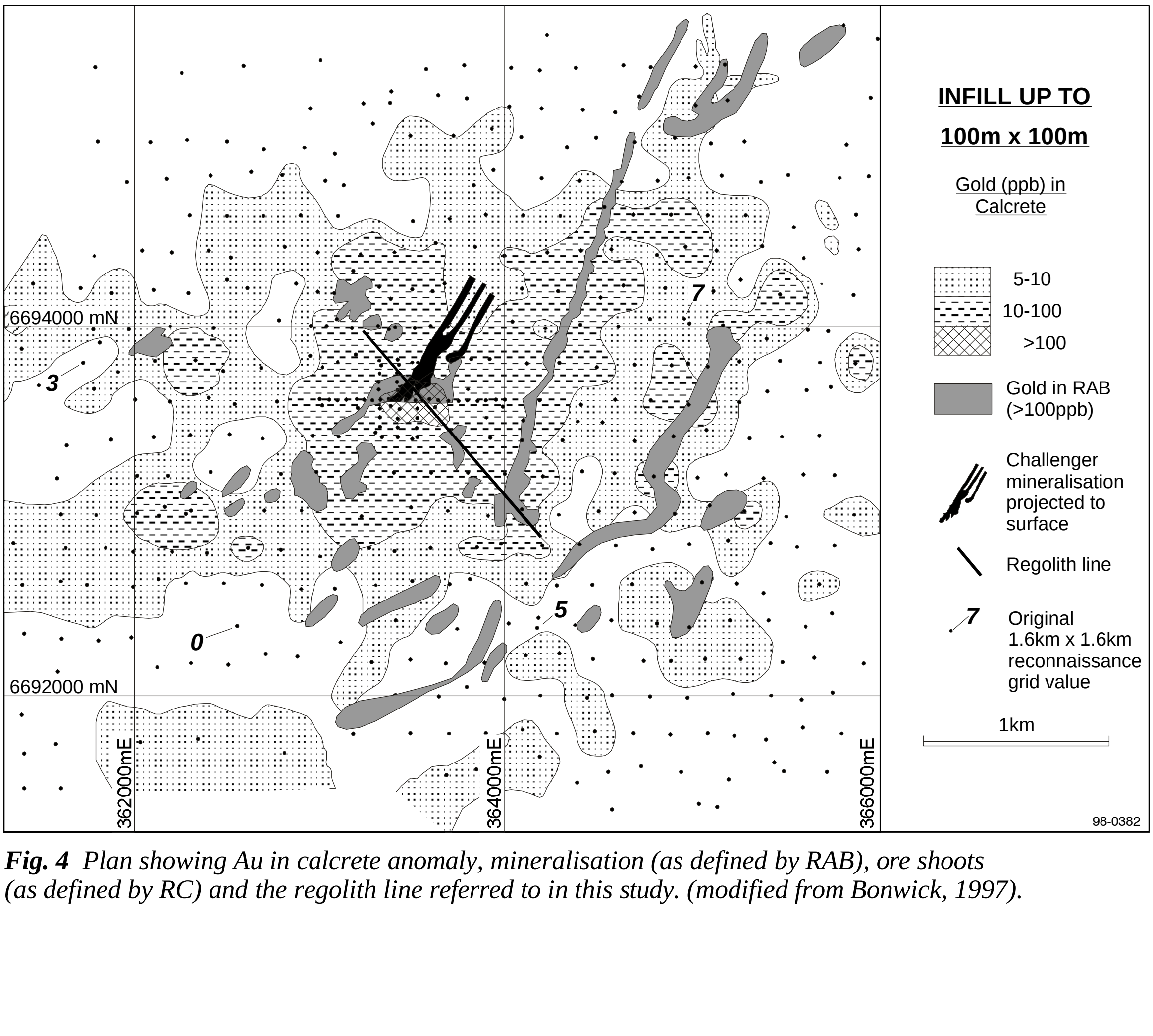
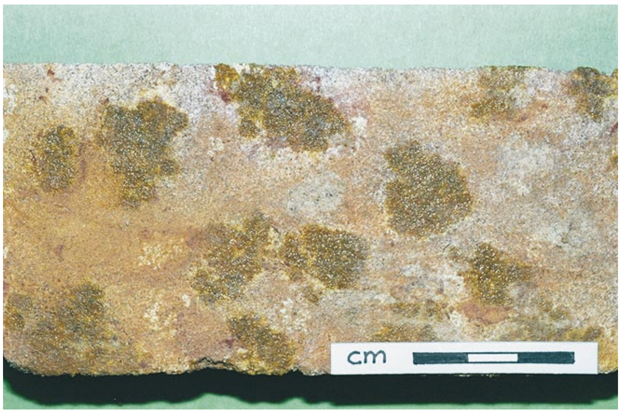
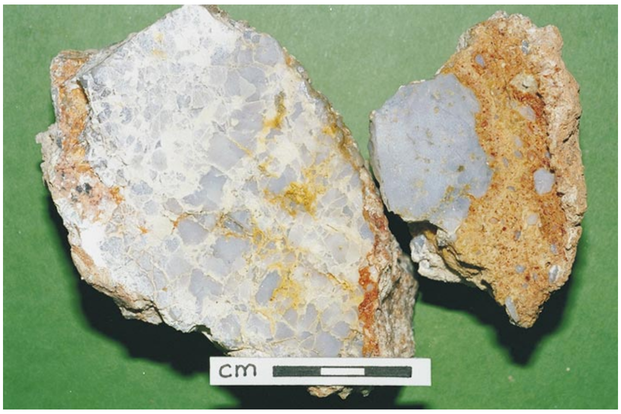


Fig. 4 *Plan showing Au in calcrete anomaly, mineralisation (as defined by RAB), ore shoots (as defined by RC) and the regolith line referred to in this study. (modified from Bonwick, 1997).*

(a) *Diamond drill 1/4 core (hole 97CDH1361, depth 40.43-40.51 m) Christie Gneiss felsic garnet-orthopyroxene-cordierite gneiss, Sample R367481.* *(Photo 45689)*



(d) *Diamond drill 1/2 core (hole 97CHDH1361, depth ~20 m) weathered garnets in saprolite expressed as ferruginous mottles, Sample R367484.* *(Photo 45691)*



(b) *Bluish quartz, mostly as vein relicts in saprolite (weathered felsic gneiss) pit GCP122 (depth ~0.75 m) Sample R214063.* *(Photo 45620)*

(e) *Diamond drill 1/4 core (hole 97CHDH1361, depth 4.77-4.85 m) kaolinitic bleached upper saprolite, Sample R367486.* *(Photo 45694)*

(c) *Diamond drill 1/2 core (hole 97CHDH1361, depth 26.62-26.72) weakly weathered Christie Gneiss felsic garnet gneiss, Sample R367484.* *(Photo 45690)*

(f) *Saprolite, weathered lineated felsic gneiss, pit GCP122 (depth ~3 m) Sample R214050.* *(Photo 45625)*

Plate 1: Drill core and quartz.

2.3 Landforms

A 1450 m long "regolith line" of shallow (6 m) RC holes was drilled to investigate the upper regolith over the Challenger Gold Deposit (Figure 15). The line runs from hole GC100 (SE) to hole 129 (NW) and transects a limited number of subtle landforms on a relatively flat landscape (Figure 2). At the SE end, there are two bouldery silcrete outcrops (holes GC100–101 and GC104 to near 105); these have sparse shrub and low tree vegetation and are separated by a flat, non-vegetated clay pan occurring at holes GC102–103. From hole GC105 to 116 there is a very gradually-rising alluvial surface with scattered shrubs, dominated by bluebush *Maireana sedifolia*, and a sparse to conspicuous surface gibber consisting of pebbles to cobbles of silcrete, quartz and minor exotic lithotypes. Low profile (<1–1.5 m) dune-spreads of red sand occur between (i) GC116 to near 120 and (ii) GC127–129. The vegetation growing on the dune-spreads is more substantive in stature and density than on surrounding areas, consisting mostly of mulga (*Acacia* spp.) and several tall (1–4 m) shrubby genera (section 2.7, Plate 2). The dune-spread to the west has developed near the western flank of a low erosional rise that forms what is referred to locally and herein as “Mt Challenger” (holes GC123–126). Dune-spreads of this type form in response to subtle topographic affects on the velocity of air, hence sand-carrying capacity, of near-surface prevailing winds. The erosional high of Mt Challenger, a subtle local feature, has contributed clastic material as very coarse- to very fine-grained colluvial, alluvial and possible aeolian sediment over a considerable time span to the present. Some of the landscape forms are presented in Plate 2.

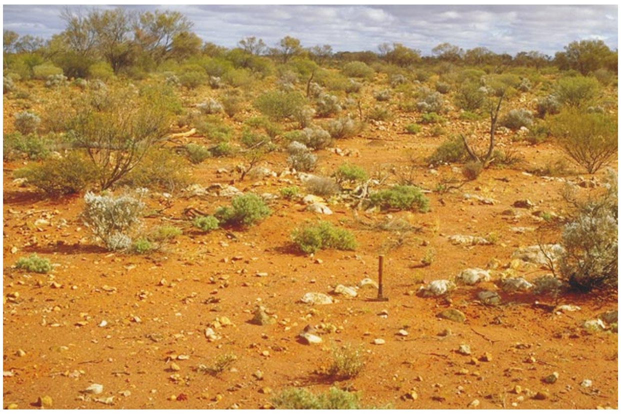
There is no obvious active drainage within the regolith line area although in the sub-surface there is evidence for small (<1 m) to wide (>1000 m) palaeochannels. Most erosion-transport activity today would appear to be limited to fluvial sheet flow, aeolian dust, and a general lowering of the landscape highs yielding aprons of colluvium and remnant gibber lag.

2.4 Regolith stratigraphy

2.4.1 Introduction

The regolith line traverses two major regolith units: the *in situ* unit consisting of Archaean Christie Gneiss, highly weathered in its upper part, and the transported unit consisting of fluvial deposits of presumed Tertiary age. These two units are displayed on the cross-sections of Figure 5 and Figure 6 with pink colours representing the *in situ*, and blues representing the transported separated by a red unconformity line. As one of the principal objectives of the study was to investigate the Au-in-calcrete anomalies occurring at the Challenger Gold Deposit, the upper regolith (defined as 0–6 m) was studied in detail.

(a) *A view from Mt Challenger towards the southeast.* *(Photo 45447)*



(c) *Bouldery silcrete outcrop area at the E end of the regolith line.* *(Photo 45452)*

(b) *Low vegetated dune east of Mt Challenger, view west.* *(Photo 45453)*

(d) *View S, one of several small clay pans, left mid-ground.* *(Photo 45455)*

Plate 2: Landform.

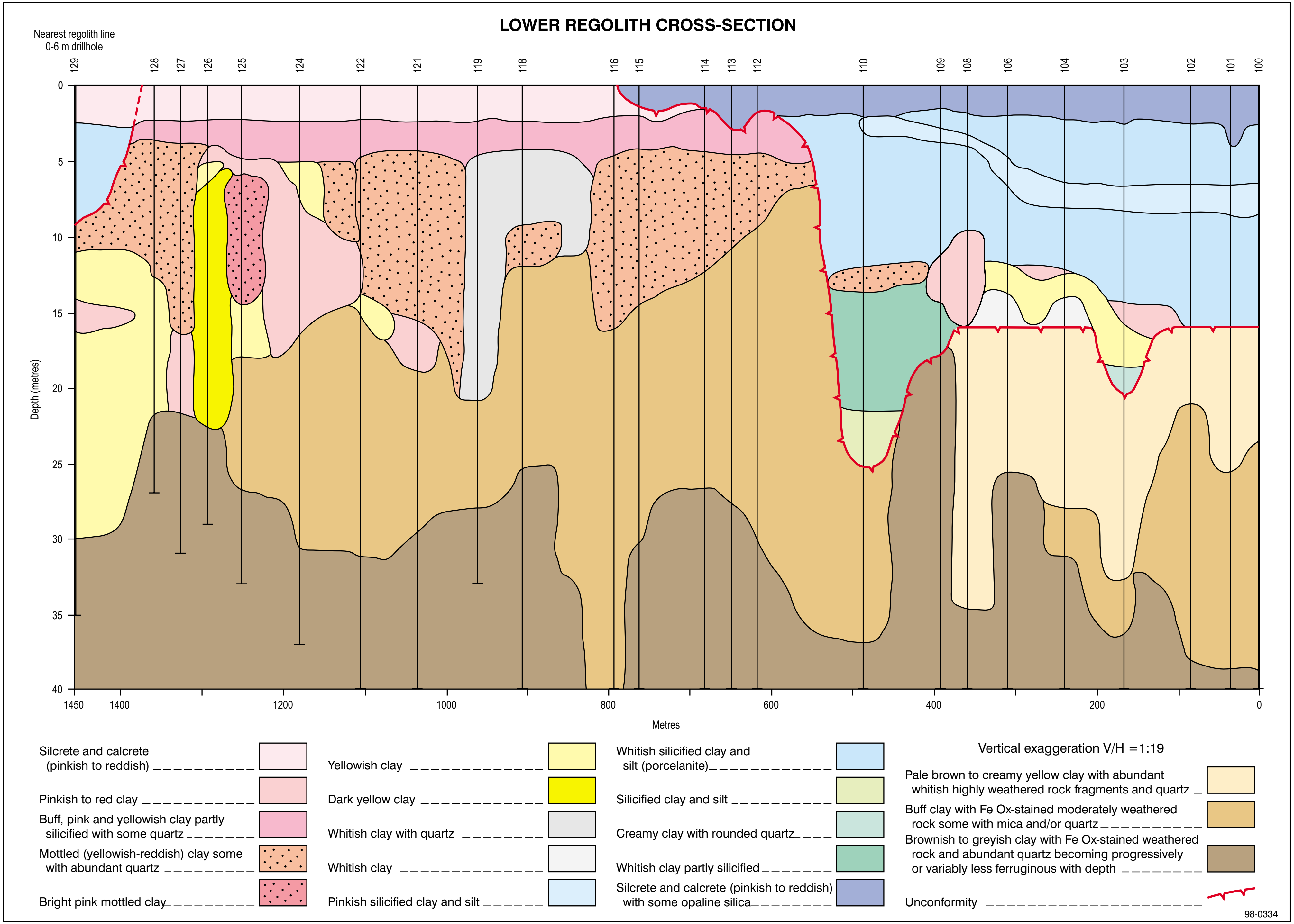


Fig. 5 *Lower regolith cross-section at Challenger. See Figure 6 for upper regolith detail.*

CHALLENGER GOLD DEPOSIT – SOUTH AUSTRALIA

UPPER REGOLITH CROSS-SECTION AND PIT PROFILES

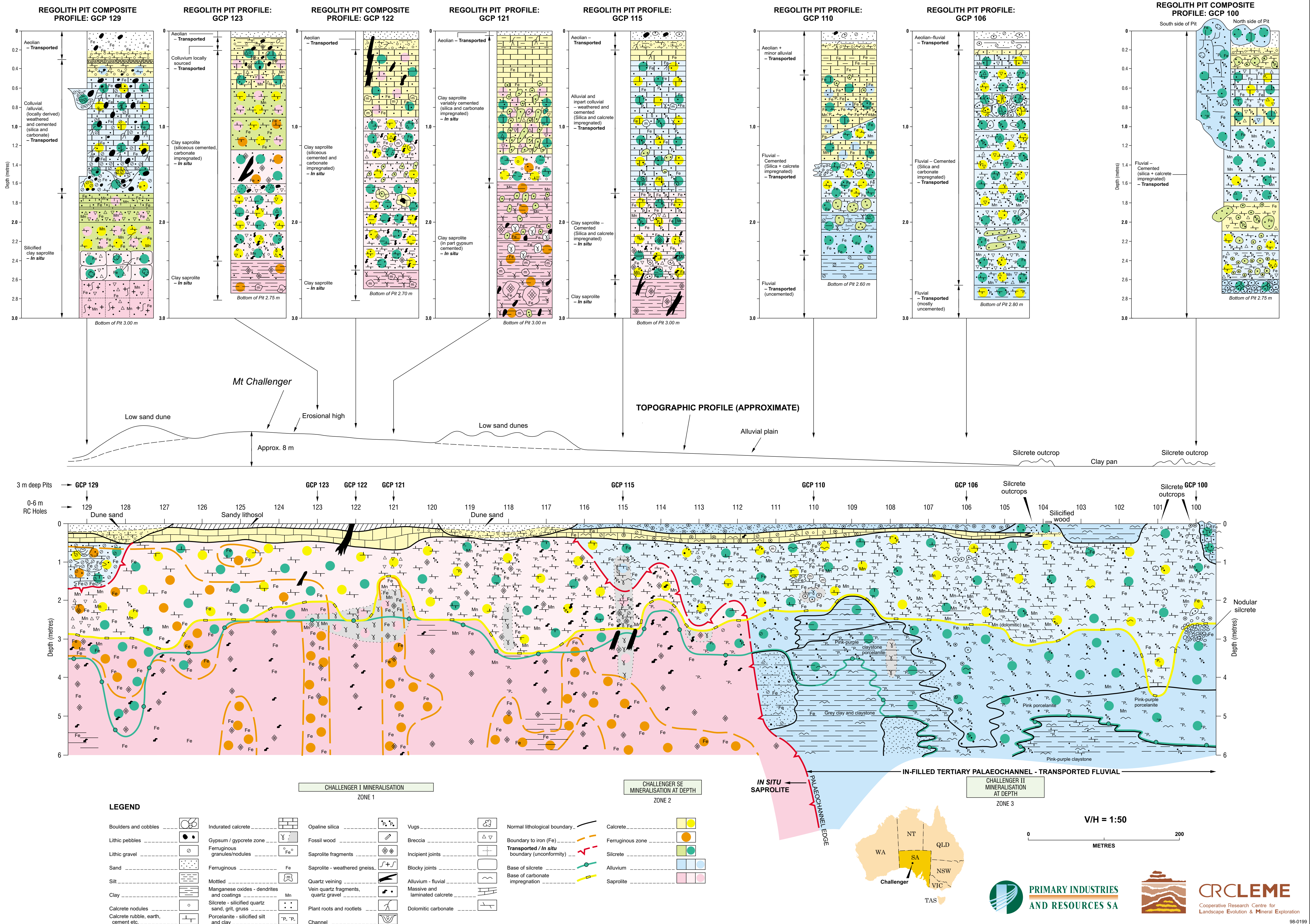


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Figure 6

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Figure 6: Upper regolith cross-section and pit profiles at Challenger (located in back pocket).

2.4.2 *In situ regolith unit*

The *in situ* regolith broadly consists of a calcareous and siliceous upper few metres (0–3 m) underlain by either (i) mottled clays, overlying variably coloured clays (mainly yellows and reds) and partly ferruginous weathered rocks and abundant quartz grading to less ferruginous weathered rock and abundant quartz with depth or (ii) as above but with mottled clays absent. Micas are common throughout and are associated with both the highly weathered and moderately weathered rock. The boundary between highly weathered (mostly clay) and moderately weathered (containing appreciable quantities of partly weathered rock) is variable but lies between 20–40 m.

In the upper regolith (0–6 m), deep weathering of the crystalline basement rocks in the Challenger region has yielded a generally pale coloured clay-rich saprolite. The clays are predominantly kaolinite, illite and smectite with residual quartz fragments and clasts. This weathered profile (saprolite) has been over printed by a series of staining minerals of Fe and Mn and variably cemented by silica, carbonate and gypsum. Within the top 6 m there is saprolitic material of relict weathered crystalline basement gneiss. (Plate 1). More resistant minerals such as quartz, zircon, ilmenite, graphite, tourmaline, rare garnet and some biotite can be observed in these saprolite fragments. Where diamond coring from the surface through the saprolite to fresh basement gneiss has taken place, the core reveals that the garnets (possibly almandine) present in the gneiss are gradually weathering to ferruginous mottle-like brownish features (Plate 1). X-ray diffraction analysis on selected samples has demonstrated the presence of dominantly quartz, kaolinite and sericite, with accessory graphite, rutile, ilmenite and smectite minerals. The rutile and sericite are secondary alteration minerals as are the clays. Some of the clay-rich saprolite displays features consistent with surficial mechanical break up and dislodgment, to form locally derived slope scree-talus breccias. These can contain resistate mineral grains that exhibit a low to moderate degree of transportation rounding, some of these have been incorporated, via surficial shrinkage cracks, deeper into the *in situ* profile.

One of the few natural exposures of the regolith stratigraphy is within an erosional amphitheatre located about 20 km to the north of the regolith line at a break-away escarpment known as "Cockatoo Ridge" (380722E, 6708193N). The section reveals a kaolinitic quartz grit-rich material with cross-cutting relict quartz veins, and a capping of younger silicified fluvial sandstone rests unconformably on the saprolite. Ferruginous staining and mottling occur within this saprolite section (Plate 3).

(a) *Cockatoo Ridge - 19 km NE of the Challenger Gold Deposit. A breakaway exposing a section (~4 m thick) of bleached kaolinitic-quartz saprolite displaying brown ferruginous mottles and stains; the saprolite is capped by silicified sandstone (post Paleozoic). (Photo 45454)*

(b) *Cockatoo Ridge - NE of the Challenger Gold Deposit. Brown ferruginous mottles and stains within the saprolite of (a.); hammer scale 30 cm. (Photo 45467)*

(c) *Cockatoo Ridge - NE of the Challenger Gold Deposit. The crudely bedded silicified sandstone (post Paleozoic) overlying saprolite, the hammer head marks the irregular unconformity surface. (Photo 45452)*

Plate 3: Cockatoo Ridge - a breakaway.

2.4.3 Transported regolith unit

The transported regolith occurs principally in the eastern part of the section and consists, from the surface down to ~3 m, of calcrete and silcrete; from ~3 to ~16 m, white and pink coloured, variably silicified clays and silt (porcelanitic) mostly dominate. Underlying some of the lower portions of the silicified unit are brightly-coloured yellow and red clays of up to 3 m in thickness. In the transported regolith, there are two palaeochannels, one extending down to ~25 m and the other to ~21 m, incising the base of the saprolite. The western (deeper) palaeochannel is filled with partly silicified white clay becoming silcrete with depth; this silcrete differs from that found near and on the surface because it contains few quartz clasts. The location of the silcrete at the base of the palaeochannel suggests it to be of groundwater origin. The eastern (shallower) palaeochannel is mostly filled with clay. The unconformity between the transported and *in situ* regolith is usually characterized by the presence of rounded quartz grains a few millimetres in diameter. In the far western part of the section, transported material occurs to a depth of ~9 m and consists of silicified clay and silt. However, the eastern edge to this palaeochannel is irregular and the depth to the palaeolandsurface varies significantly over a short lateral distance. The closely located upper regolith hole (GC129) and soil pit (GCP129) have only ~1 to 2 m of transported material.

Sediments within the upper part of the palaeochannel (0–6 m) consist of interdigitating lenses of gravel, sand, silt and clay. The coarser-grained clasts are characteristically subrounded to well rounded, in contrast to the quartz fragments present within saprolitic material which are angular. Sedimentary structures including, planar bedding and cross-bedding, are preserved in outcrop where silicification has occurred (near holes GC100, 101 and 104). Similar features are preserved in sub-surface silcrete blocks and corestones. Grains are dominantly quartz with rare polycrystalline aggregates, rare relict feldspars, rare dark brownish ferruginous granules to sand in some lenses, rare white mica, rare black heavy mineral grains, and occasional lithic grains. The quartz grains are dominantly well-rounded to subangular, are clear-white-milky-grey-bluish coloured, and many of them also occur in the weathered basement. Clast morphology and mineralogy taken together may be interpreted as a relatively mature sediment with a moderate to long transportation history. However, some of the sedimentary materials may have been locally derived, evidenced by the presence of rare feldspar and mica grains. Rare silicified wood, consisting of branch and twig fragments, occurs within this palaeochannel sand sequence. A palaeobotanical analysis of one of these fragments appears in Appendix 10 (Plate 4). Evidence from the RC drilling to 6 m suggests that the boundaries of the western bank to this palaeochannel are complex, and relatively steep (Figure 5, Figure 6). Chemical over-printing of this fluvial sequence in several cycles has occurred with the introduction of: silica, as silcrete, porcelanite and opaline forms; carbonate; minor gypsum; and minor Fe and Mn oxide-oxyhydroxides. These overprinting minerals and/or cements are discussed in more detail in sections below in approximate chronological order from oldest to youngest.

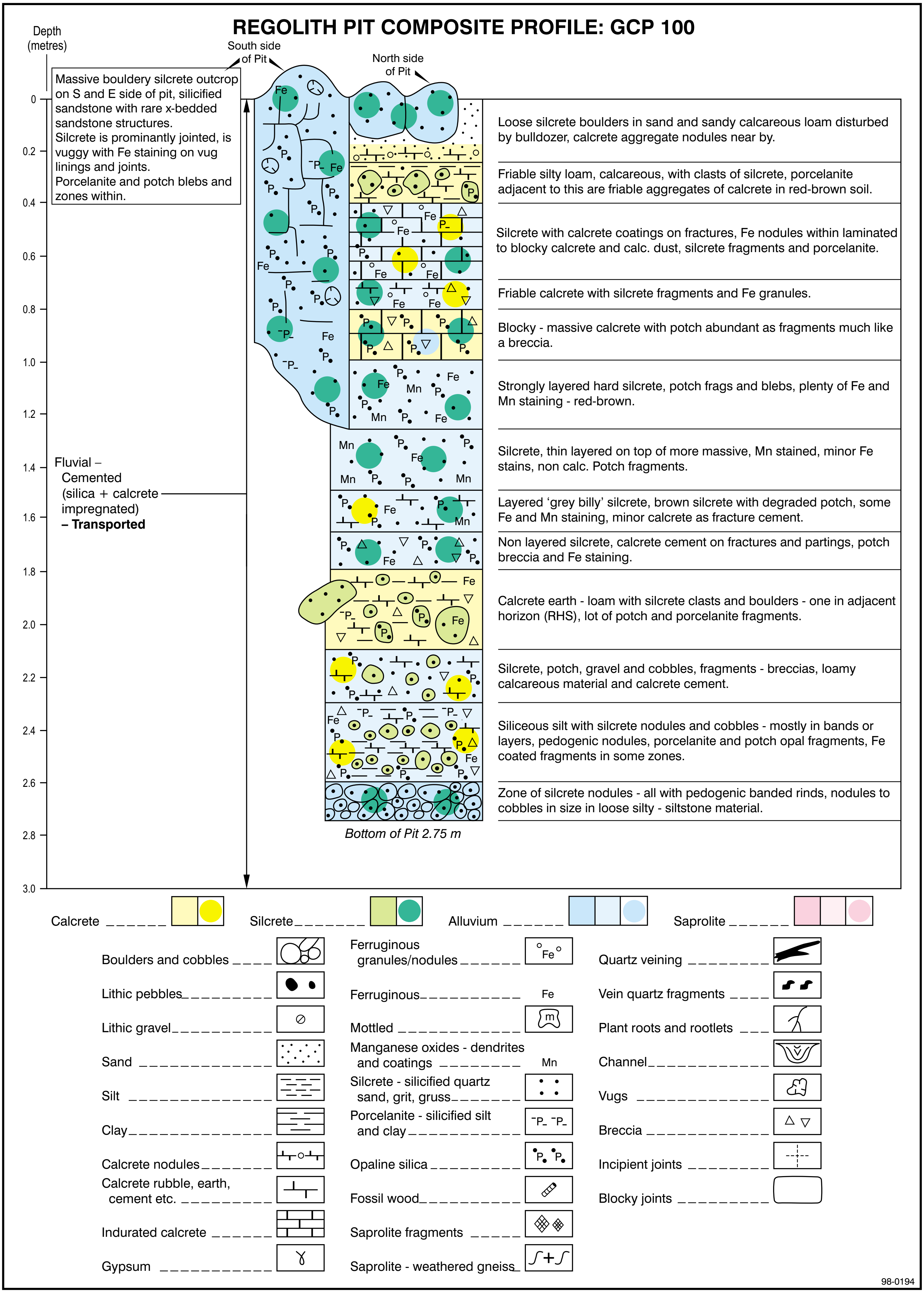


Fig. 7 Regolith pit profile GCP 100.

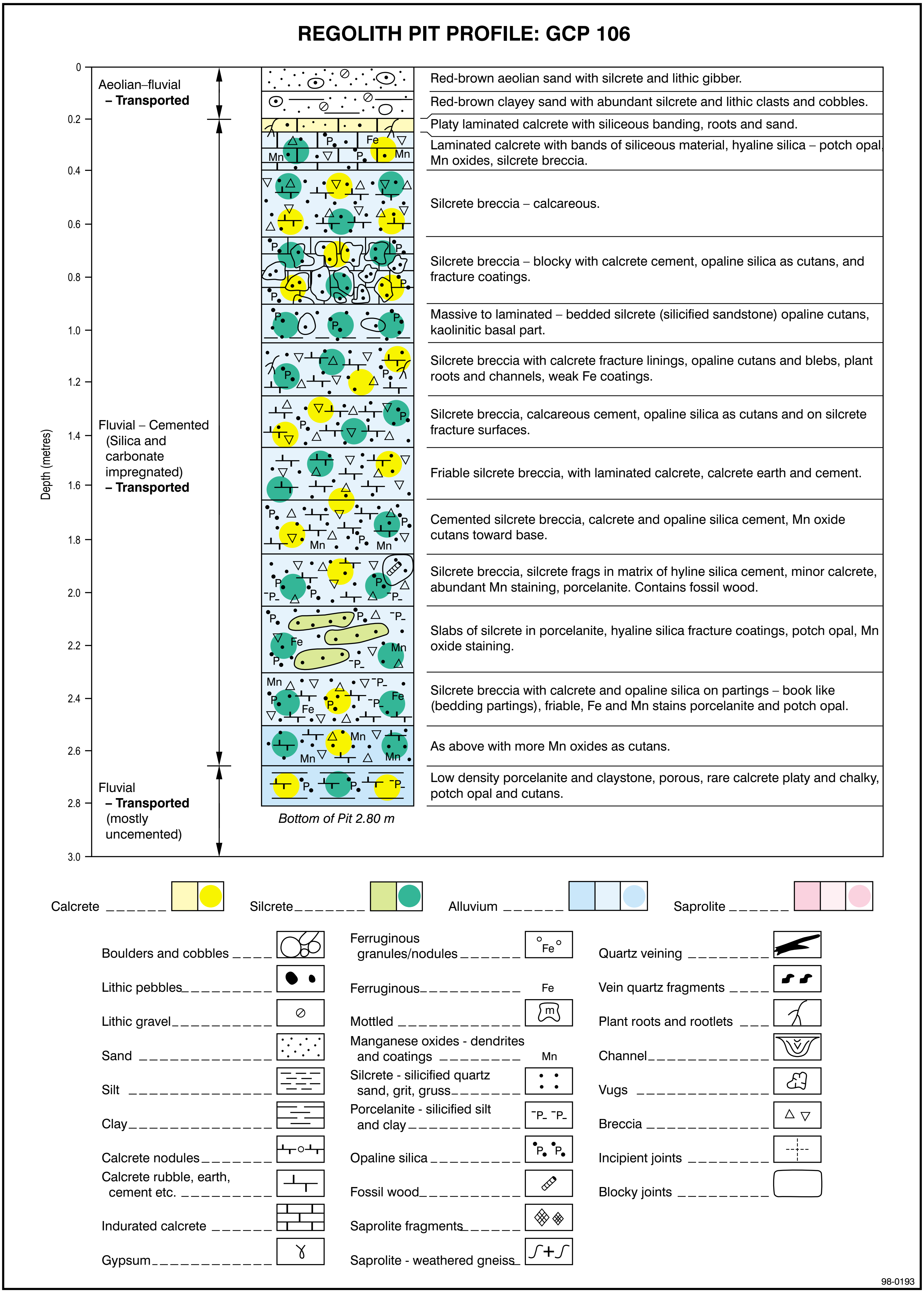


Fig. 8 Regolith pit profile GCP 106.

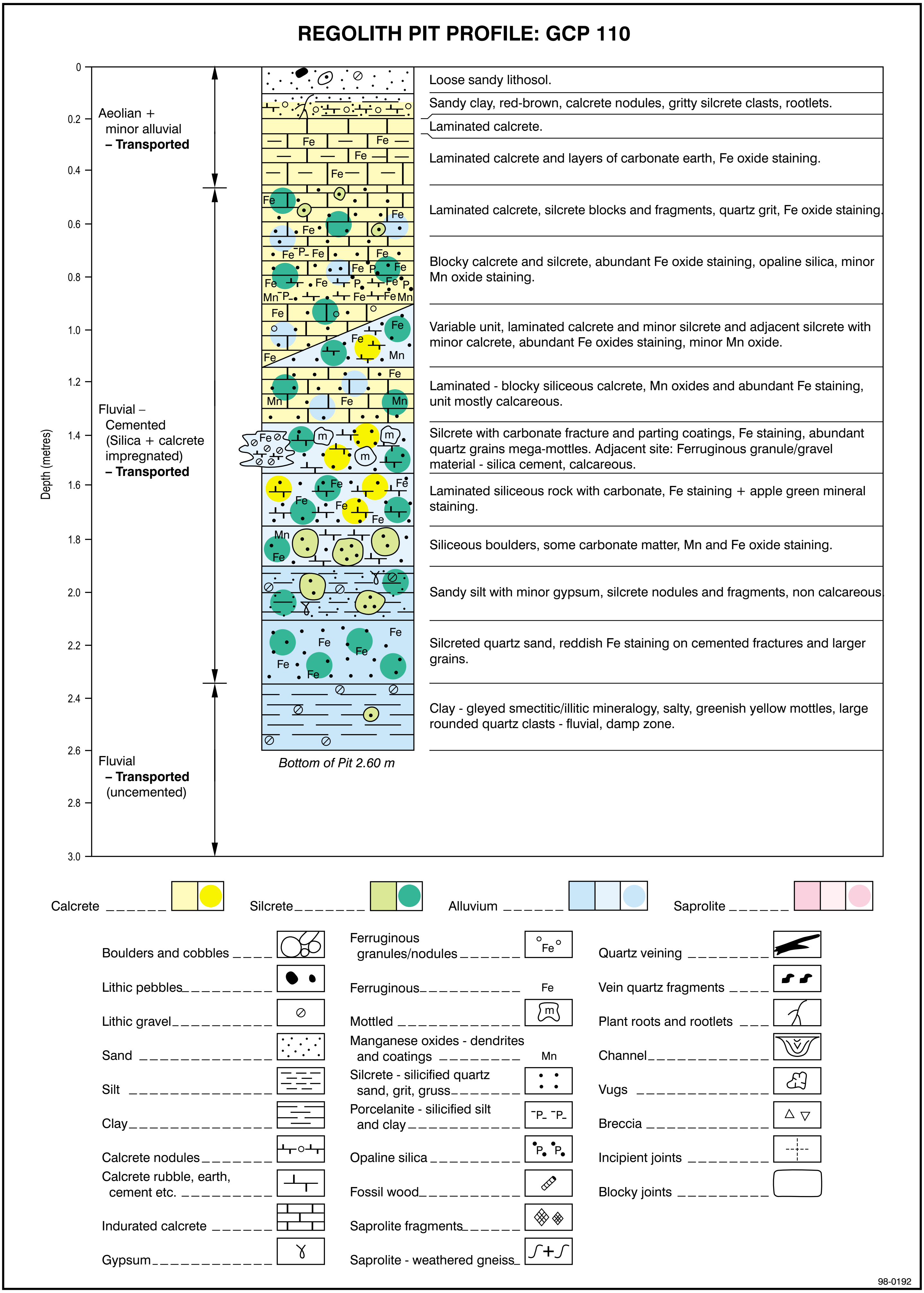


Fig. 9 Regolith pit profile GCP 110.

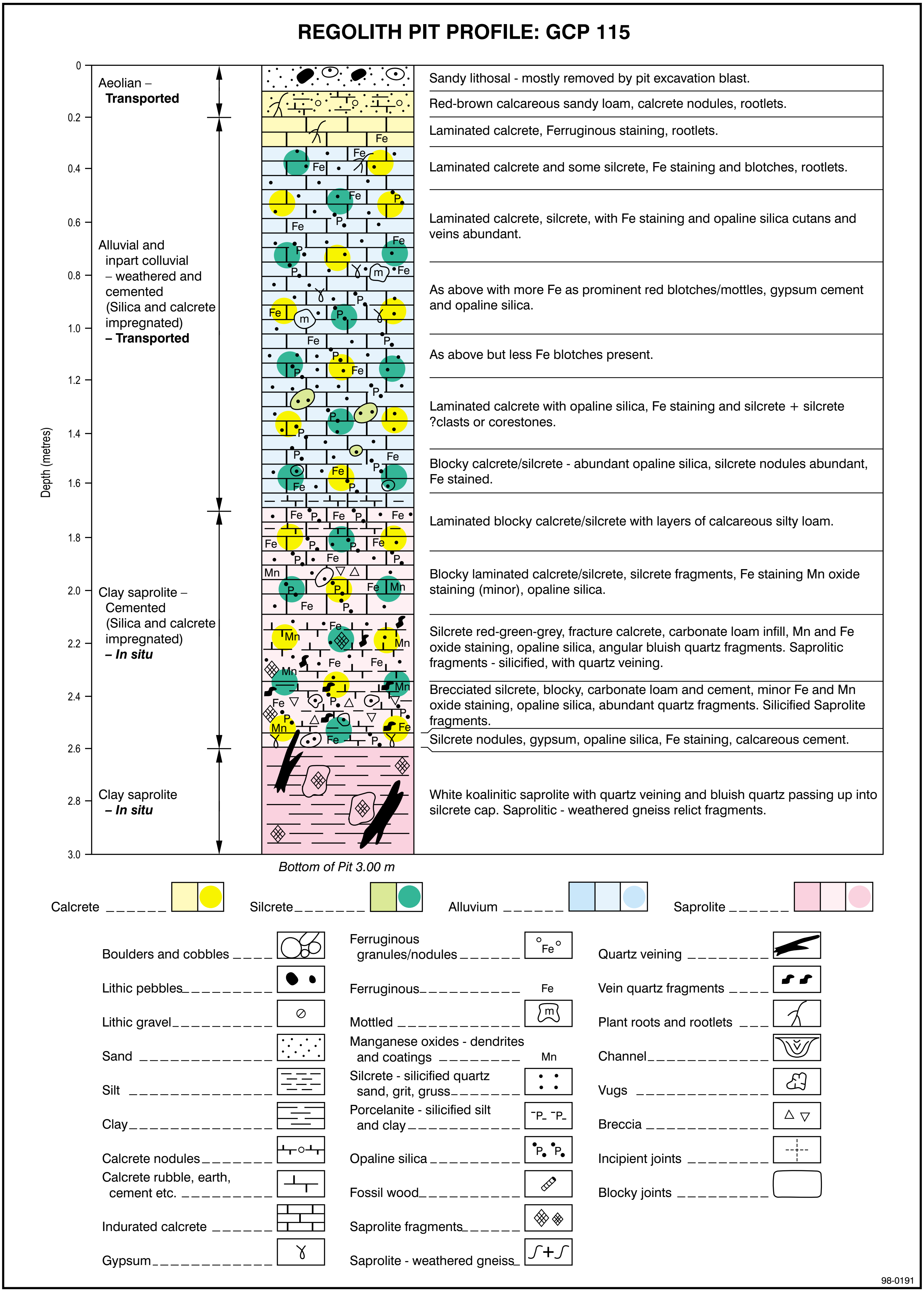


Fig. 10 *Regolith pit profile GCP 115.*

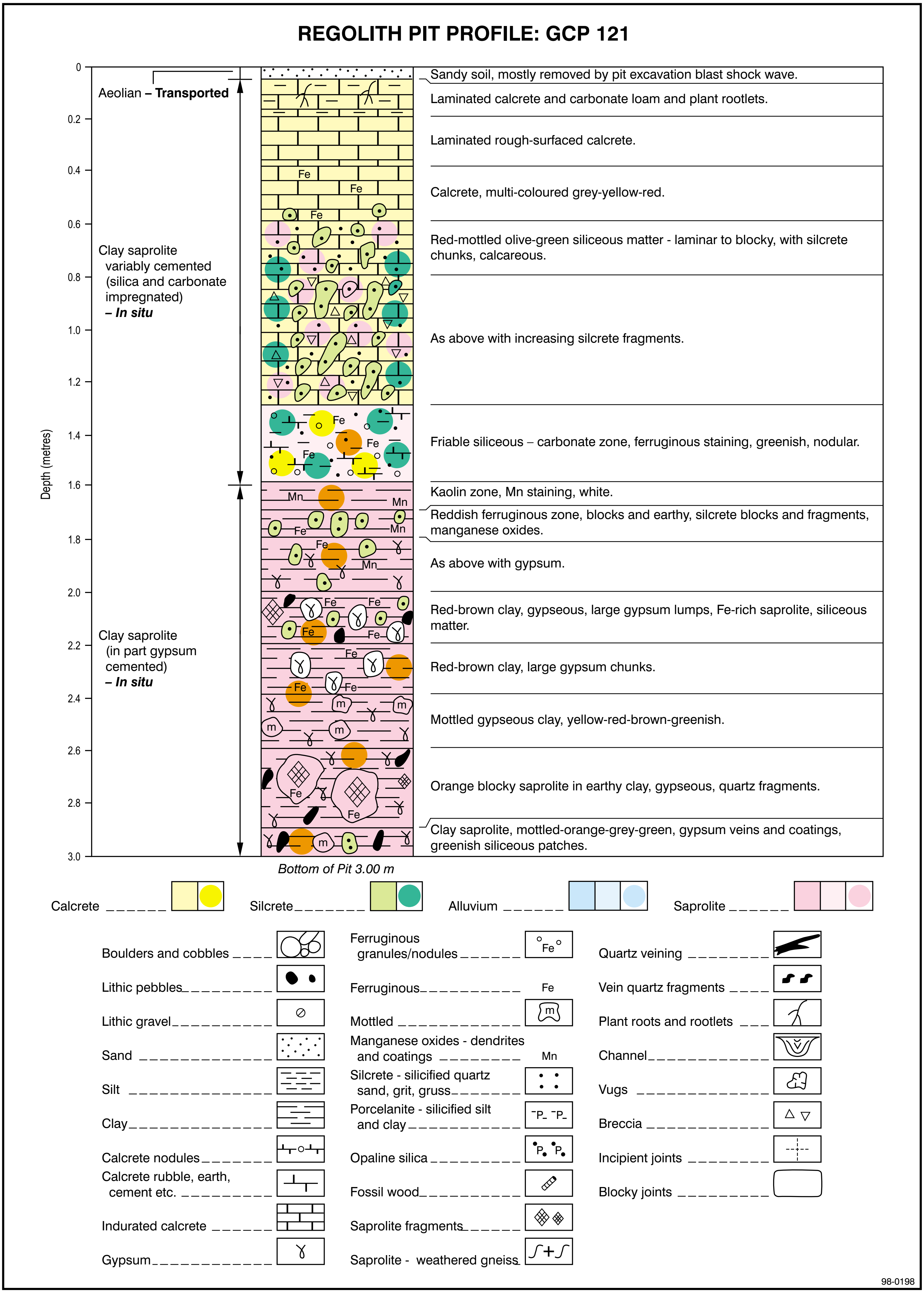


Fig. 11 Regolith pit profile GCP 121.

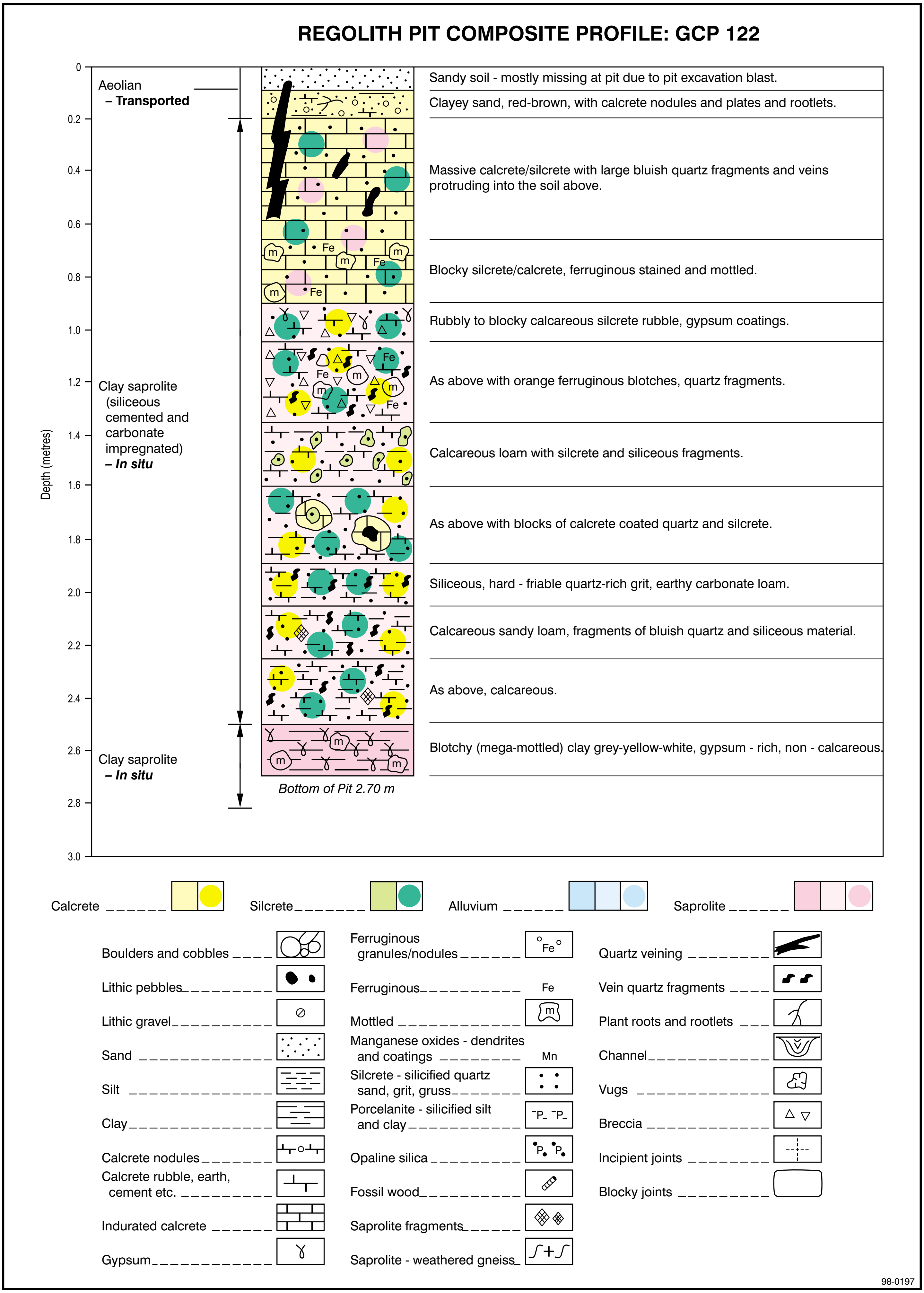


Fig. 12 Regolith pit profile GCP 122.

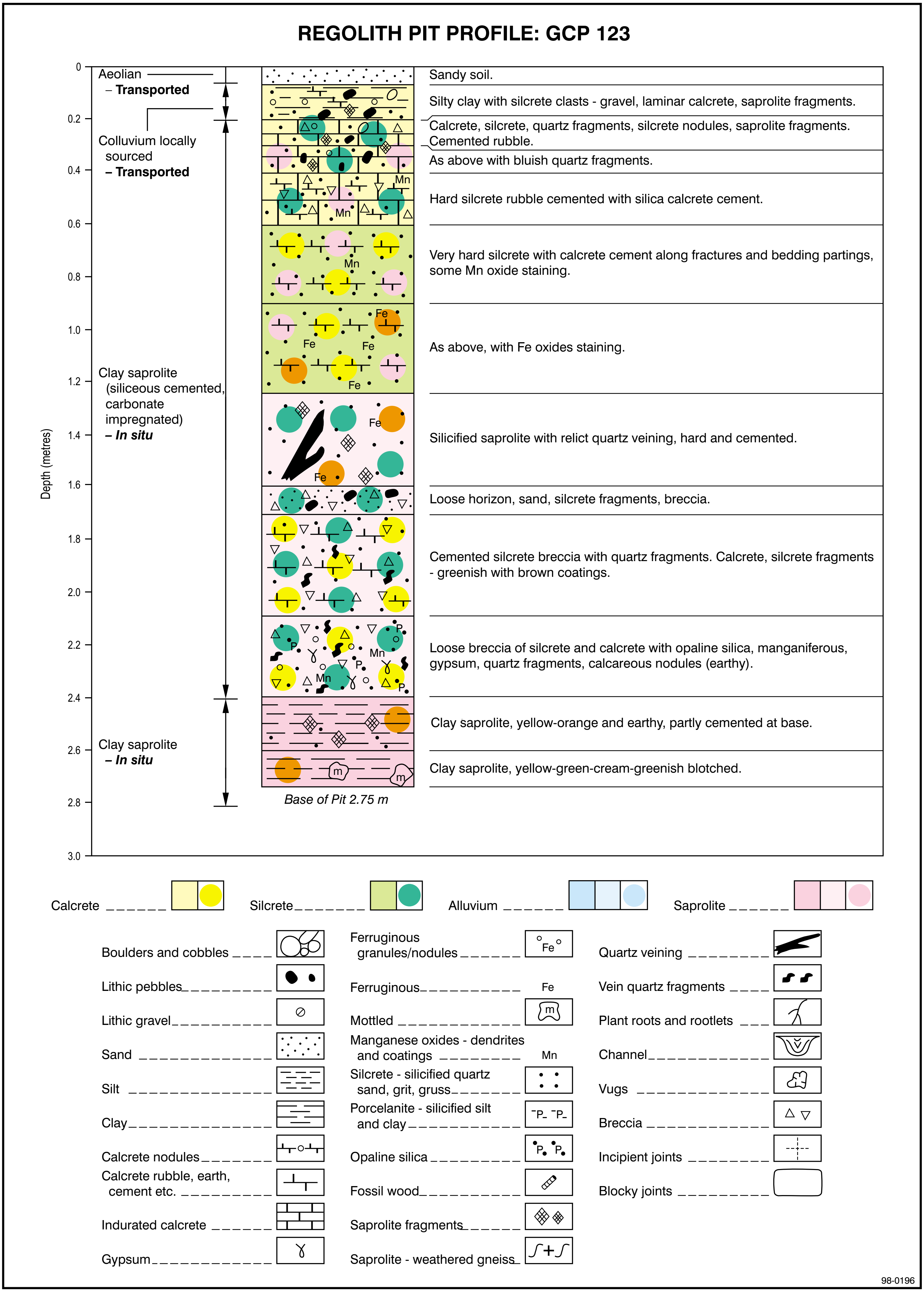


Fig. 13 *Regolith pit profile GCP 123.*

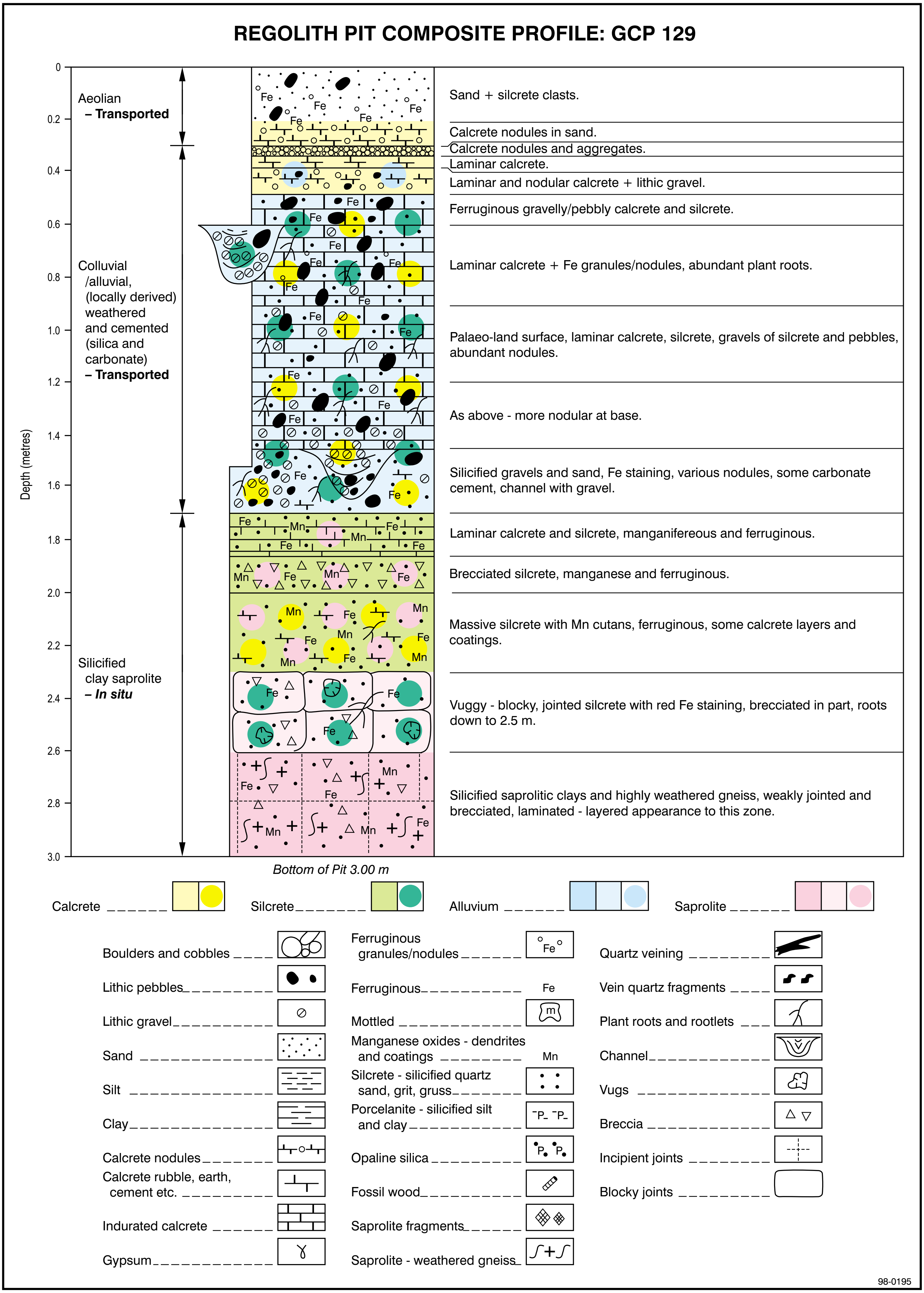


Fig. 14 Regolith pit profile GCP 129.

2.5 Overprinting cements and mineral impregnations

2.5.1 Siliceous materials

A pervasive silcrete covers much of the area as either outcrop or subcrop. Silcrete is a secondary cementation feature imposed on existing sediments or weathered rocks. There are two broad classes of silcretes; those that form within the soil profile by silica (± TiO_2) precipitation with pedogenic processes (pedogenic silcrete) and those that form due to silica deposition from groundwater (groundwater silcrete). Silcretes are silicified host materials that retain the properties of the precursor, diluted by added silica and modified by the processes that accompanied the silica (± TiO_2) precipitation.

Most, if not all, silcrete in the upper regolith at Challenger is of a pedogenic origin, however, there are examples of groundwater derived silcrete deeper in the lower regolith profile within palaeochannel deposits (section 2.4.3). Silcretes are usually very hard, but extremely brittle and break with a conchoidal fracture where the fracture propagates across the cemented grains rather than around them. Freshly broken silcrete shards commonly have a pungent odour, have a vitreous sheen and are very sharp.

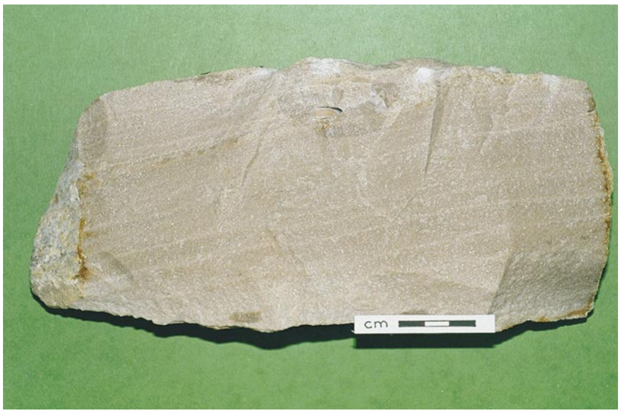
A variety of *in situ* and transported regolith materials have been affected by silcrete forming processes in this area. Some of the resultant silcrete forms are displayed in Plate 4 and Plate 5. Figure 6 displays the extent of the silcrete profile using an overprint large dot pattern (green) and the silcrete base line or silicification front (green line). The silcrete base line averages ~2.5 m within the saprolitic material but increases to >6 m within the palaeochannel deposits, other local variations can also be seen. This feature probably reflects primary porosity-permeability differences with the sandier palaeochannel sediments being more amenable to silicification than the silts and clays of saprolite.

At Challenger, silicification of highly sandy transported to gritty saprolitic materials have mostly yielded massive ‘grey billy’ silcretes; whereas, silty to clayey materials have yielded porcelanites and siliceous claycretes (Plate 4 and Plate 5); claycrete is cemented weathered argillaceous material (Bates and Jackson, 1980). Under the hand-lens, the grain characteristics of the coarser varieties are easily observed but thin-sections are required to examine the fine-grained varieties, any grain cement characteristics, grain replacement or invasion textures. Sedimentary structures were observed in the silcrete outcrop areas around holes GC100–101 and 104, these included cross-bedding and planar lamellae. Silicified wood fragment fossils were also observed as float at hole GC104 and within silicified sandstone at pit GCP 106 (Plate 4, Appendix 10).

Pit exposures revealed a high degree of complexity of siliceous cementing, brecciation, re-cementing and textural variability that was not evident from the silcrete outcrop. To gain an appreciation of this variability, in excess of 200 block and bulk samples for laboratory work and analysis were collected. In addition to the siliceous variations, the first 2–3 m of the upper regolith is strongly overprinted by pedogenic carbonates (section 2.5.6). Carbonate coatings mask much of the complexity in hand specimens and the pit-face exposures (Figure 6 to Figure 14). Opal (as potch or non-precious opal) and porcelanite dominate the profile below 1 m in palaeochannel sediments (under the massive ‘grey billy’ silcrete), whereas opaline silica is subdominant to minor within silicified saprolite (Figure 7 to Figure 14, Appendix 8). Second generation and later silica cementation is mostly isotropic opaline to hyaline in nature and occurs as cutans, layered overgrowths, veinlets and commonly as a clast-cement in breccias (Plate 5). A petrographic study is required to investigate these materials and their relationships more fully. Generally much of the massive silcrete is coloured grey to greenish grey to pale yellow-brown but ferruginous inclusions and staining can yield strong yellows, reds and browns. The porcelanite can be white, cream, pale to strong yellow and brown, while the potch opal can be translucent-greyish, white, cream, pale yellow to strong yellow and multi-coloured in wisps to zones.

Manganese oxides occur as black, three dimensional dendrite inclusions in some of the opaline silica (section 2.5.4).

In the Challenger area there are no readily observable stratigraphic separating sequences between the various silicification events. However, there is macroscopic evidence that the first generation silcrete has been in-part disrupted by surface processes, mostly mechanical, but also including some minor fluvial-colluvial activity in its upper portions (Figure 7 to Figure 14). The second generation silcreting event has then re-cemented the silcrete scree-talus and colluvium that derived from the earlier forms into complex breccias (Plate 5). It is possible that a third - even older silcrete exists in some parts of South Australia; Sheard (in prep) has discovered evidence for this on CALLABONNA within the Mulligan Dam Regolith. This silcrete may be of Latest Cretaceous or Early Palaeocene age. Thus, it is possible that the siliceous cementation of the Challenger upper regolith (particularly the saprolite) is even more complex than is immediately obvious.



(a) *Silcrete - silicified bedded sandstone with twig fossil (top centre) age ?Tertiary, from pit GCP106 (depth of ~1.70 m) Sample R367477.* *(Photo 45545)*

(c) *Silcrete nodules and nodule aggregates, some cut open to reveal banded rinds on massive cores, pedogenic, from pit GCP100 (depth of ~2.75 m).* *(Photo 45517)*

(b) *Common silcrete, (grey billy) silcrete-mantled sandy silcrete, pedogenic, from pit GCP100 (depth of ~2.75 m) Sample R367478.* *(Photo 45519)*

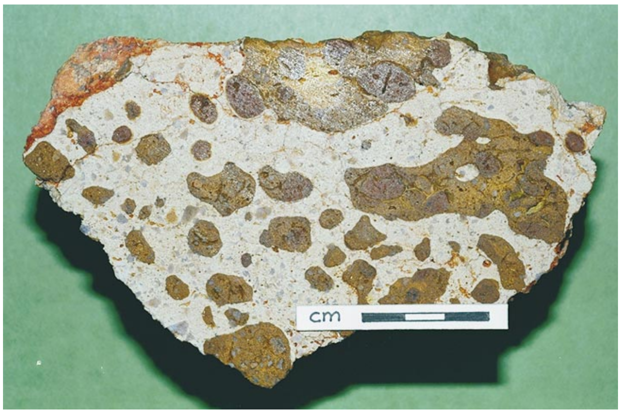
(d) *Petrified wood, silicified tree branch, from silcrete outcrop near RC drillhole GC104, Sample R213958, palaeobotanical age ?Early Tertiary (Appendix 10).* *(Photo 45558)*

Plate 4: Silcretes.

(a) *Porcelanite - silicified siltstone (pale grey) exhibiting manganese oxyhydroxide dendrites (black) and some pale yellow ferruginous stains on fractures and partings. From pit GCP106 (depth ~2.7 m) Sample R214134. (Photo 45550)*

(c) *A silica breccia, calcrete-cemented, generated from a surficial detritus accumulation (talus breccia). Components: large porcelanite fragments, ferruginous claycrete fragments, and quartz - all cemented by calcrete with minor hyaline silica, from pit GCP100 (grab h, depth ~1 m) Sample R367482. (Photo 45527)*

(b) *Common opal-potch, exhibiting vitreous conchoidal fractures, a variety of colours and colour mixes, from pit GCP100 (depth ~1 m) Sample R367481. (Photo 45530)*



(d) *Silicified sandy claycrete containing ferruginous material exhibiting a replacement texture, from a drillhole sump N of Mt Challenger (depth ~1 m, Field No. GC034)) Sample R213520. (Photo 45675)*

Plate 5: Silcretes (cont).

2.5.2 Claycrete

Clay cementation occurs at both the macroscopic and microscopic level mostly within saprolitic materials. It presents as dense hard mats and cutans and is probably associated with cryptocrystalline and isotropic silica. Clay minerals appear to have either deposited from soil water solutions and/or suspensions to form a pervasive cement or cappings to larger clasts. The latter structures provide a facing in some specimens. Hard clay balls (3-15 mm) occur in some gravel and colluvial lenses. Many of these claycretes are almost as hard and tough as silcrete suggesting silica cements also play a major role in this lithotype. Colours range from cream to yellows and browns. Petrographic and XRD work is required to further investigate these materials.

2.5.3 Ferruginous materials

A variety of ferruginous materials occur in the Challenger area but they are not abundant. These materials include: ferruginous lag, gravel, granules, fracture linings, rock surface coatings, cutans, minor cements and staining. On the ground surface, the most obvious ferruginous materials are in the form of (i) dark brown to black buck-shot gravel lag (ferruginous granules), (ii) dark brown to near black ferruginous nodules (up to several cm), and (iii) as a ‘desert varnish’ and/or a pervasive stain on lags of silcrete and lithic clasts. Subsurface ferruginous materials comprise yellow, brown and red staining, mottles, brown to dark brown gravels, pisoliths and granules as isolated grains/granules or in lens-like aggregates, and as incipient nodules (yellow-brown to brown). Generally most ferruginous materials have low Fe contents (<10% and commonly <5%) although some ferruginous granules and nodules have higher Fe contents (up to 43% as Fe) (Plate 6).

(a) *Coarse lag (>2 mm) from near RC drillhole GC100. Components: quartz (bluish grey, white), ferruginous granules (black, dark brown), normal silcrete (pale brown), ferruginous silcrete (brown) and calcrete (orange, cream), Sample R213825.* *(Photo 45538)*

(b) *Ferruginous silcrete lag, individual pebble with a sawn face displaying large and small bluish grey quartz clasts cemented by cryptocrystalline silica and goethite (2% Fe), Sample R213527.* *(Photo 45679)*

(c) *Ferruginous silcrete pebble lag, from Mt Challenger, Sample R214160.* *(Photo 45687)*

(d) *Common silcrete lag, from Mt Challenger, Sample R213526.* *(Photo 45676)*

(e) *Quartz pebble lag, from Mt Challenger, displaying a variety of quartz types, Sample R213530.* *(Photo 45682)*

(f) *Exotic clasts as lag from Mt Challenger, metasedimentary lithotypes similar to rocks from the Tarcoola area, Sample R213529.* *(Photo 45681)*

Plate 6: Lags.

Along the regolith line, ferruginous gravels and granules are present in colluvium (hole GC129, Figure 14) and ferruginous fragments and/or grains are common in some saprolitic materials. Ferruginous staining of silcrete is present throughout the silicified zone of both the *in situ* and transported regolith. Little Fe oxide is present in the fluvial sands below the silcrete, suggesting that the silicification and ferruginising processes and/or events are partly related.

Within the saprolite above mineralisation (especially Zone 1) a pronounced yellow to orange staining of the clay saprolite occurs as an irregular halo (indicated by an orange overprint, large dot pattern and line on Figure 6). The core to this halo (Pit GCP122) is white to pale grey suggesting a possible outward movement of Fe from a central area.

2.5.4 Manganiferous materials

Small quantities of Mn oxides occur within the silcrete and sometimes in saprolite materials as black cutans, coatings, dendrites and stains. Most coatings (<1 mm thick) occur on smectite clay fractures or pod surfaces, staining silcrete, and cutans on peds, granules and nodules. Black dendrites formed as planar features on silcrete fractures but also as microscopic to ~ 3 mm sized three dimensional forms within creamy to yellow potch opal and porcelanite. Some botryoidal hyaline silica has overgrown dusty, black Mn mineral coatings on silcrete and relict saprolite. Precipitates of Mn and Fe oxides appear to have been contemporaneous (Plate 7).

2.5.5 Gypsiferous materials

Gypsum occurs in discrete parts of the regolith line, predominantly above deeper mineralised zones. The largest discrete pod occurs between holes GC121–123 above the main Challenger I mineralisation (Zone 1, Figure 6, Plate 8, and Figure 11 to Figure 13). There it forms a well crystallised mat of gypcrete cementing minor clay saprolite in a zone between 1.8–3 m (Plate 8). A second smaller pod of gypsum occurs between 2–3 m in hole GC118. Other occurrences of gypsum are in holes GC115 between 1–4 m and at ~3 m in GC113, both almost directly overlying the deeper Challenger SE mineralisation of Zone 2 (Figure 6). Small pockets of sparse crystalline gypsum occur within the palaeochannel sediments in holes GC108 at 3–4 m and GC110 at ~1.5–3 m. Although these are close to the Challenger II mineralisation (Zone 3, Figure 6), they are laterally displaced to the west. The origin of this gypsum is intriguing and is currently being investigated by S isotope analysis.

Black Mn oxide coating and orange Fe oxide staining on a block of clay-cemented conglomerate from pit GCP129 (depth 2.6-3.0 m), Sample R213974. *(Photo 45655)*

Plate 7: Manganiferous and gypsiferous material.

Massive gypsum with minor anhydrite and trace lithic fragments from pit GCP122 (depth 2.7 m), Sample R214049. *(Photo 45614)*

Plate 8: Gypsum.

2.5.6 Calcrete

A wide variation in calcrete morphology was encountered in the vicinity of the Challenger regolith line and nearby areas. Loose and aggregated nodules and pisoliths, earthy segregations, and powders, laminated and massive forms occurred within the soil profile. Many of the indurated forms have complex internal fabrics and structures that are interpreted to mean cyclic carbonate deposition, dissolution, disruption and re-cementation (Plate 9). In general, the morphology reflects the texture, porosity and properties of the host material diluted by added carbonate and modified by the precipitation process. Colours ranged from creams to pale pink and pale grey to rich reds and browns.

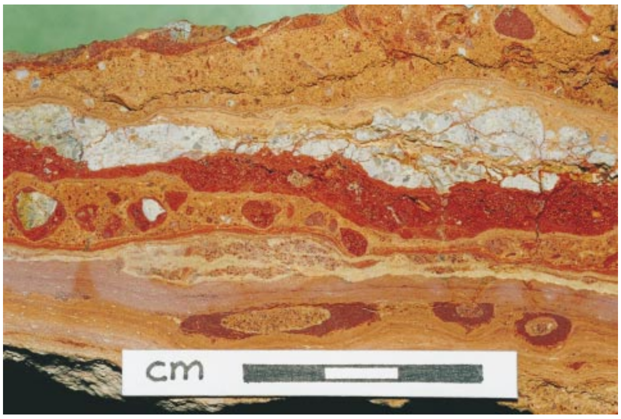
Calcretes occurring within the Quaternary red sand spreads (between holes GC116–120, 127–129) are exclusively nodular to pisolitic in form, with some degree of incipient aggregation. Dune calcrete was restricted to a zone 10–30 cm thick and approximately 25–50 cm below the surface.

Elsewhere, soil calcretes are more complex, usually with some nodules and/or pisoliths in the upper B_{Ca} horizon and aggregations or platy to laminar to massive forms below. The most indurated forms occurred at the base of the soil profile and on top of the underlying silcrete indicating a permeability barrier deposit. Indurated sheet forms ranged from 10–40 cm in thickness and ranged from book-like friable plate stacks to hard sheets. Commonly the thicker units have horizontal partings and vertical fractures where plant roots are present. The partings generally have smooth upper surfaces, rough under sides and dusty to loamy carbonate in between the plates. An exception to these observations is in the clay pan between holes GC102–104 Plate 2. Below the pan, at the clay-silcrete interface, an earthy carbonate powder formed a thin layer 5–15 mm thick, with no carbonate in the clay profile above (~50 cm thick). This suggests leaching of carbonate from the clay by ephemeral ponded water.

Calcrete and similar micro- to cryptocrystalline carbonate has also impregnated the silcrete to a depth of ~1.5 to >4.0 m (average ~2.7 m), (yellow overprint, large dot pattern on Figure 6). Most of the indurated morphologies and the dusty to loamy forms expressed in the soil profile above are repeated within the silcrete. To accommodate the added carbonate, the silcrete has been forced apart along partings, joints and fractures. The result is a complex rock having the overall appearance of a cemented jigsaw fit mega breccia or a pseudo-bedded siliceous rock that has a strong calcareous nature (Plate 10). The thickness of carbonate impregnation and the base of the carbonate infiltration front has been established using 10% HCl acid on samples from the regolith pits and RC hole cuttings and is indicated on Figure 6 as a bright yellow line. This front roughly parallels that of the silcrete infiltration front (green line on Figure 6) within the silicified saprolitic material. However, this observation is not true of the silicified palaeochannel deposits in which the calcrete front remains at about 2–3 m where as the silcrete front descends from about 3 m in hole GC111 to >6 m by hole GC107.

Possibly dolomitic calcrete occurs in the cuttings from holes GC103–105 between 2–3 m. The powdered material reacted to acid but this was not the case with the larger cuttings unless scratched. Further analysis with XRD is required to confirm this. This type of calcrete appears to be rare along this section but its location at the base of the calcrete zone is consistent with observations from elsewhere (Phillips, 1988; Phillips and Milnes, 1988; Milnes and Hutton, 1983; Lintern, 1989).

Carbonate cementation of palaeochannel materials and equivalents below the main calcrete front was observed at the eastern end of the regolith line (holes GC103–104 at 4–5 m). The carbonate was not visible even with the aid of a binocular microscope, but there is a vigorous response to acid. Very thin colourless calcite fracture coatings within the claystone are inferred. This carbonate appears to be similar to a thicker form of fracture in-fill calcite occurring within silcrete at the Birthday Prospect ~30 km east of Challenger (Lintern and Sheard, 1997, figure 4). Calcite of this type is interpreted to predate the calcretes located higher in the profile but its time of formation is uncertain.



***(a)** Laminated silica-bearing calcrete from pit GCP110 (depth 1.0 m) sawn face (wet) revealing a complex multi-coloured interior, Sample R214109.* *(Photo 45566)*

***(b)** Laminated calcrete aggregate from pit GCP129 (depth 15-25 cm) sawn face (wet), Sample R213981.* *(Photo 45665)*

***(c)** Saprolite-bearing calcrete boulder with laminated calcrete rind, from pit GCP122 (depth 20-65 cm) sawn face (wet), Sample R214038.* *(Photo 45608)*

***(d)** Exterior view of boulder in Plate c, Sample R214038.* *(Photo 45607)*

(a) *A laminar mega-breccia of calcrete impregnated silcrete in pit GCP106.* *(Photo 45444)*

(b) *A jig-saw fit breccia of porcelanite fragments cemented by calcrete, sawn face (wet) from pit GCP106 (depth 185-205 cm), Sample R214130.* *(Photo 45548)*

Plate 10: Breccias.

2.6 Soils

Soil terminology used herein follows that of Northcote (1979) and Stace *et al.* (1968). A detailed pedological examination of the study area was beyond the scope of this project: the following descriptions provide a general framework only.

Soils in the vicinity of the regolith line are predominantly modern, i.e. Late Quaternary. Following Northcote (1979) the soils cover the range: medium-textured Uniform soils (Um1, Um2) - sands; Uniformly fine-textured soils (Uf1) - light clays; weakly Gradational soils (Gn, Gc) - not calcareous throughout and calcareous throughout; and some Duplex soils (Dr2, Db1) - hard setting A horizon and whole coloured (red and brown) B horizon. Sandy textured soils dominate and have only a small to moderate horizonal texture contrast, minimal pedogenic differentiation, occurring mostly with the Pleistocene sand spreads. However, the older and more pedogenically-organised soils are developed on or near weathering substrates or clay pans. Many soils away from the sand spreads and dunes are gibber-clad primitive lithic-rich 'stony lithosols' that are related to erosional areas or alluvial deposits (Northcote *et al*., 1960–68; Northcote *et al.*, 1975). Clay-rich soils are of limited extent along the regolith line and they tend to be restricted to drainage sinks (clay pans). These soils appear to be lacking carbonate segregations in their B horizons possibly due to leaching by ephemeral ponded water.

Almost all soils have an alkaline trend (i.e. from neutral at the surface to pH≥8.6 within ~15–30 cm depth) and relate directly to the presence of carbonate in the B or B_{Ca} horizons.

Soil surface colours were within quite a narrow range, from the reddest (moderate reddish brown, 10R 4/5) to the yellowest (light brown, 5YR 6/6), and are typical of this region (Munsell, 1975; Kelly and Judd, 1976 as modified by Sheard and Bowman, 1996; Lintern and Sheard, 1997). All of these colours fall within the strongly coloured Value-Chroma Rating Groups of VC4–VC5 of Northcote (1979), suggesting that they have all developed under a similar climatic regime (Arid Temperate). All soils in this area are within the AS2 unit described as alkaline, strongly sodic and sodic with sandy to loamy textures (Northcote and Skene, 1972). Due to this soil and subsoil sodicity, and, by implication, high dispersivities by water, there is potential for human-induced fluvial erosion during rain events where soils are disturbed by removal of gibber armouring and/or down slope linear or sheet excavation.

2.7 Vegetation

The vegetation consists of chenopod-dominated shrublands, with open woodland groves of *Acacia* spp (mostly *aneura*) restricted to the sandy areas. The shrubland is represented by members of the Chenopodiaceae (*Maireana sedifolia*, *Sclerolaena divaricata*, *Salsola kali*, ?*Enchylaena tomentosa*), Myoporaceae (*Eremophila* spp. including *latrobei*, *glabra* and ?*serrulata*), Amaranthaceae (*Ptilotus obovatus*), Caesalpiniaceae (*Senna* spp. including *cardiosperma* ssp *gawlerensis*, *artemisioides* and *helmsii*), Mimosaceae (*Acacia tetragonophylla*), Sapindaceae (*Dodonaea microzyga*), Loranthaceae (*Lysiana murrayi*) and Poaceae (*Aristida contorta*).

3. SAMPLING AND ANALYSIS

3.1 Sample collection

Sampling at approximately 50 m intervals was undertaken to within about 10 m of the 1.45 km regolith line starting at drill hole GC100 (364195E 6692845N) and running NW to drill hole GC129 (363216E 6693969N). This line is close to existing RAB and RC drilling holes undertaken by GJV prior to our visit. Its position was chosen for three principal reasons:

i) it crossed 3 zones of mineralisation namely Challenger I (Zone 1), Challenger South-east (Zone 2) and Challenger II (Zone 3);
ii) it included both *in situ* and transported regolith types, and
iii) surface drilling contamination was at minimal levels to permit detailed geochemical work.

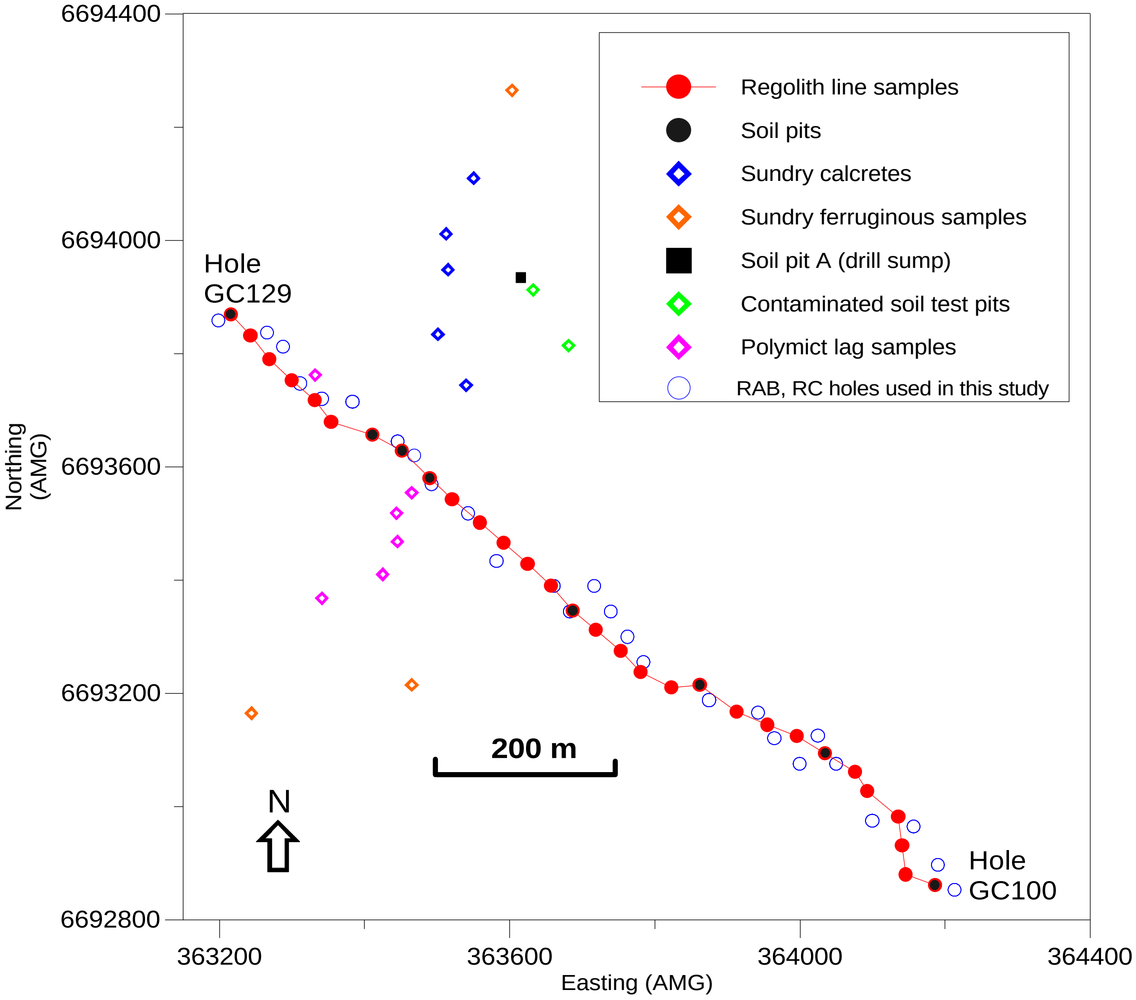


Figure 15: Plan showing general sample location and the regolith line along which most samples were taken. See Figure 2 for location.

One hundred and eighty (1–3 kg) drill cutting samples were collected from the first six metres (sample numbers suffixed A to F), using a reverse circulation drill rig, with holes spaced at 50 m intervals along the regolith line. The drilling rig enabled accurate upper regolith sampling to be undertaken with minimal down hole contamination. The first 5 cm (approximately) was removed prior to drilling to (i) reduce the possibility of aeolian/fluvial contamination, albeit remote, caused by previous drilling activity and (ii) be sampled separately (cf. next paragraph). Reverse circulation RC drilling was used as it provides samples with minimal up-hole contamination. Hole-to-hole contamination was minimised by cleaning the drilling pipe-rod-bit system prior to commencing this job, and then drilling a set of test holes at the beginning of the regolith line. Then between each of the regolith holes a system clean out was achieved by drilling a 1 m deep hole adjacent to the sampling hole.

A series of 8 strategically-sited pits were excavated along the regolith line. The ubiquitous presence of thick (2–>6 m) calcrete and silcrete duricrust made excavation by bulldozer difficult, hence it was decided to use drilling and explosives. The Department of Industrial Affairs – Explosives Inspectorate was engaged to carry out this part of the work. At each site, a RAB rig drilled eight 3.5 m deep by 75 mm diameter holes, in two parallel sets 2 m apart. Ammonium nitrate and diesel fuel mix formed the explosive (ANFO, mixed on site) with standard linked fuse-detonator-primer triggering systems employed at each site. Once blown, the pits were cleaned out (as much as practical) with an on-site bulldozer, then completed by hand with GJV field staff and the investigating team. Blasting was effective, creating pits of about 12 x 8 x 3 m (Plate 11). Pits were constructed at the following drill hole sites: (GCP) 100, 106, 110, 115, 121, 122, 123 and 129. Each regolith pit was examined, photographed (Appendix 8), a central vertical profile was described/logged, and, finally, sampled (~2–>10 kg/sample). At pit sites GCP122 and 129 additional laterally-spaced vertical profiles were described and sampled to check for site variability. The spoil heaps were also examined to enable hand specimens of materials not seen in the exposed pit faces, to be collected as grab samples. Regolith pit logs are provided in Appendix 8 with graphic interpretive logs displayed in Figure 6 to Figure 14. One potentially problematic aspect of working on an area with substantial exploration activity such as at Challenger (as opposed to an unexplored area) is the level of surficial anthropogenic disturbance and mineral/geochemical contamination by deep drilling activities. Sampling to determine the magnitude of this effect was also carried out during the first visit, the results from this work are displayed in Appendices 8 and 9 (Plate 11). Comparative analysis of undisturbed vs disturbed sites demonstrated that the potential geochemical problem was minor probably due to a combination of the local aridity and insufficient time for significant vertical geochemical leaching to take place (Appendix 5). Early in the project, 2 shallow pits were shovel-dug and sampled to test for element contamination down profile from drill spoil. Lastly, 1 set of samples was taken from an existing drill sump (soil pit A, Appendix 8). Pit faces were cleaned prior to sample collection using a geological hammer and plastic dust pan, and vertically "channel-sampled" using a benching technique to minimise cross-contamination. In total, 186 samples from 11 pits were collected.

(a) Grey surface contamination by exploration drill spray and cuttings of mineralised Christie Gneiss from below the saprolite. *(Photo 45896)*

(b) Blasting through the massive calcrete-silcrete with ANFO explosives to excavate pit GCP110, August 1997, view southwest, blast at ~400 m distance. *(Photo 45489)*

(c) Cleaning out the blast mullock from pit GCP129 with bulldozer to expose the wall sections, August 1997, view southwest. *(Photo 45895)*

(d) Regolith line single metre composite samples in chip trays (from 6 m RC hole GC121) the left tray contains unwashed sample, the right tray contains washed chips. The yellow and brown colour is due to Fe oxides in the saprolite. *(Photo 45685)*

Thirty "topsoils" (0–10 cm, sample numbers suffixed S) each weighing 1–2 kg were collected, using a geological pick and plastic dustpan, from uncontaminated ground within the vicinity of the drill hole samples, at 50 m spacing along the regolith line.

Thirty "lag" samples (1–2 kg, sample numbers initially suffixed L) were collected from the surface using a plastic dustpan and brush within the vicinity of the drill hole samples, at 50 m spacing along the regolith line. These were further sub-divided into silcrete (LVC, plus 4 mesh or >6 mm), coarse (LC, plus 9 mesh or >2 mm) and fine (LF, plus 40 mesh or >475 µm).

Thirty calcrete samples (sample numbers suffixed N) were collected from drill spoil and the sides of the open drill holes.

Thirty samples of bluebush *Maireana sedifolia* leaf and outer branches (sample numbers suffixed V) were collected from one to several bushes per site by hand in calico bags from adjacent to the drill holes.

Two hundred and nine RAB and RC drill cutting samples from 0 to up to 83 m from 27 holes were incorporated into the study to examine the dispersion and geochemical characteristics of elements closely associated with Au within the deeper regolith. The holes had been drilled by the GJV prior to this study. Chip trays were made up from drill cuttings in the field, and pulps were used for geochemical analyses.

In addition, 118 other sundry near-surface samples were collected and analysed including calcretes, lag, ferruginous materials, soil and chip tray samples to make a substantial total collection for the project in excess of 1400 samples.

3.2 Sample preparation and analyses

3.2.1 Mineral samples

The preparation regime for each sample type varied. Soil (S) and 0–6 m (A–F) samples were pre-prepared in the laboratory by weighing, mixing the sample on a plastic sheet, then incrementally extracting approximately 200 g of material to be sent to the sample preparation and analytical laboratory for pulverising. Carbonate (N) samples were washed in a coarse sieve, retaining the >2 m fraction. Lag samples (L) were washed through a coarse then fine sieve retaining the >2 mm (LC) and >475 µm (LF) size fractions. Very coarse silcretes (LVC, >6 mm) were hand picked from the >2 mm size fraction and comprised a separate sample. Approximately 60 g of pulverised RAB and RC material from the GJV drilling programme was re-sampled and re-analysed for the identical suite of elements as for the other samples.

Well-characterised standards were submitted "blind" with each sample set sent to the laboratory at the rate of approximately 1 per 30 samples to check for analytical precision and accuracy. All samples and standards were analysed by AMDEL Laboratories Ltd as follows (detection limits in ppm):

(i) approximately 0.25 g of sample was analysed by ICP-OES after mixed acid digest ($HF+HCl+HNO_3$) for Ba (10), Ca (10), Cr (2), Fe (100), K (10), Mg (10), Mn (5), Na (10), Ni (2), P (5), S (500), Ti (10), V (2), and Zn (2);

(ii) approximately 0.25g of sample was analysed by ICP-MS after mixed acid digest ($HF+HCl+HNO_3$) for Ag (0.1), As (0.5), Bi (0.1), Cd (0.1), Cs (0.1), Ce (0.2), Cu (0.5), Ga (0.1), In (0.05), Mo (0.1), Nb (0.5), Pb (0.5), Rb (0.1), Sb (0.5), Se (0.5), Sr (0.1), Te (0.2), Th (0.02), Tl (0.1), U (0.02), W (0.1), Y (0.05), Zn (0.5) and the REEs Ce (0.05), La (0.05), Dy (0.02), Er (0.05), Eu (0.02), Gd (0.05), Ho (0.02), Lu (0.02), Nd (0.02), Pr (0.05), Sm (0.02), Tb (0.02), Tm (0.05) and Yb (0.05);

(iii) 25 g of sample was analysed by graphite furnace AAS after aqua regia digest for Au (0.001).

3.2.2 Vegetation samples

Vegetation samples (V) were returned to the laboratory within two days of collection to prevent mould growth. Samples were vigorously washed with hot then cold water in individual fine mesh, nylon, zippered bags to remove as much aeolian contamination as possible before air drying. Samples were weighed then dried at approximately 80°C for at least 24 hours, to prevent smearing during grinding. Samples were then ground using a blender. The samples were then re-weighed and step-wise ashed using the following programme: 4 hours at 200°C, 4 hours at 400°C and then 15 hours at 550°C before being re-weighed and sent for analysis as for the mineral samples.

3.3 Partial extractions

Three in-house partial extraction solutions, discussed in detail in Gray and Lintern (1993), were used to test the solubility of Au; solubility is an indication of potential mobility. However, the procedure was modified in two ways. Firstly, pulverised material was used in place of unpulverised material and, secondly, the iodide solution was unbuffered. Pulverised material was used because much of the sample material was finely ground to varying degrees by the RC drilling process; samples appeared to be siliceous and grinding would help free encapsulated Au (fine or coarse). Unbuffered samples were used as it has been found that buffering the samples to pH 7.4 (Gray and Lintern, 1993) has little effect on the extractability of Au (Lintern, unpublished data). In all cases, a 25 g portion of sample material was mixed with 50 mL of extractant in a screw-cap polyethylene plastic bottle, and then gently agitated for one week, after which the total Au extracted was determined. Total Au was measured by adding a 1 g carbon sachet with the sample and analysing the carbon using INAA (Becquerel Laboratories Ltd); in-house experiments have shown that the carbon sachet procedure reduces re-adsorption of the dissolved Au on components within the sample. The three solutions are:

(i) deionised water: dissolves the most soluble Au;

(ii) iodide: a 0.1 M KI solution dissolves more Au than water alone;

(iii) cyanide: 0.2% KCN / 0.2 M NaOH solution dissolves all but the most refractory Au such as large particles of Au and that encapsulated within resistant material such as quartz.

The partial extraction tests were performed as a sequential extraction using 3 different carbon sachets, commencing with deionised water and finishing with cyanide.

3.4 X-ray diffraction analysis

X-Ray diffraction of selected samples was performed by CSIRO (Floreat Park, WA) using a Philips PW1050 diffractometer, fitted with a graphite crystal diffracted beam monochromator. CuK$\propto$ radiation was used. Each sample was scanned over the range 2–65° 2θ at a speed of 1° 2θ a per minute and data were collected at 0.02°2θ intervals. Mineralogical compositions were determined by comparison with JCPDS files and laboratory standard traces.

4. GEOCHEMICAL RESULTS

4.1 Introduction

The geochemical results for the 50 elements analysed for the lower regolith (up to 80 m depth), upper regolith (0–6 m depth), lag, silcrete, calcrete, topsoil, and vegetation are graphically displayed by element in composite figures in Appendix 2, tabulated in Appendix 9 and electronically stored

(Appendix 11). Other graphical represented data (including scatter plots) are found in Appendices 1, 5, 6 and 7. It is suggested that readers refer to the Appendices while browsing the text. In this section and others that follow, the terms "anomalies" and "anomalous" have been used in their broadest sense and refer to element concentrations that are clearly greater in concentration than the majority of samples of that same type. This has been done deliberately so as to (i) avoid assigning a particular value due to the statistically small sample population used, and (ii) for text flow. Exceptions exist where a particularly important element is discussed.

4.2 Mineralogy

X-ray diffraction was performed on 57 samples including samples from the upper regolith, lower regolith and from the three zones of mineralisation (Appendix 4). Minerals present in the upper regolith include quartz, calcite, opal, gypsum, hematite, mica, feldspar, halite, goethite, "smectites", graphite, anatase and rutile. Quartz is either dominant, or co-dominant with calcite, in all upper regolith samples. Kaolinite is the major clay mineral present with some samples having additional smectite minerals.

The lower regolith, including the mineralised zones, is dominated throughout by quartz with kaolinite present in major amounts. Feldspars were detected in the top 12 m and variably increase in abundance with depth depending on the drill hole. For example, in Zone 1, feldspars are only a major component below 50 m, whereas in Zone 2 they are abundant at 20 m. Micas are present in minor quantities, particularly in Zone 1, where they are consistently present below 2 m. Chlorite is abundant in the deeper regolith.

4.3 Lower regolith

There are three zones of high grade Au mineralisation visible on the cross section (Figure 16) all contained within Christie Gneiss. The highest grades (>1 ppm) are found in Zone 1 and locate the main Challenger ore body. The high grades of Au are continuous with depth with little evidence for a depletion zone or supergene dispersion within the regolith. In Zone 2, high Au grades are found at about 20 m with weak grades (0.1–1 ppm) found above. Whether this is evidence (i) for a depletion zone, (ii) that reflects the original Au distribution, or (iii) for a sampling artefact due to the orientation of the ore body, cannot be determined from this data. A similar Au distribution to that of Zone 2 is found in Zone 3. However, the lower grades of Au in the top ~20 m in Zone 3 are interpreted to be due to the material being of transported origin.

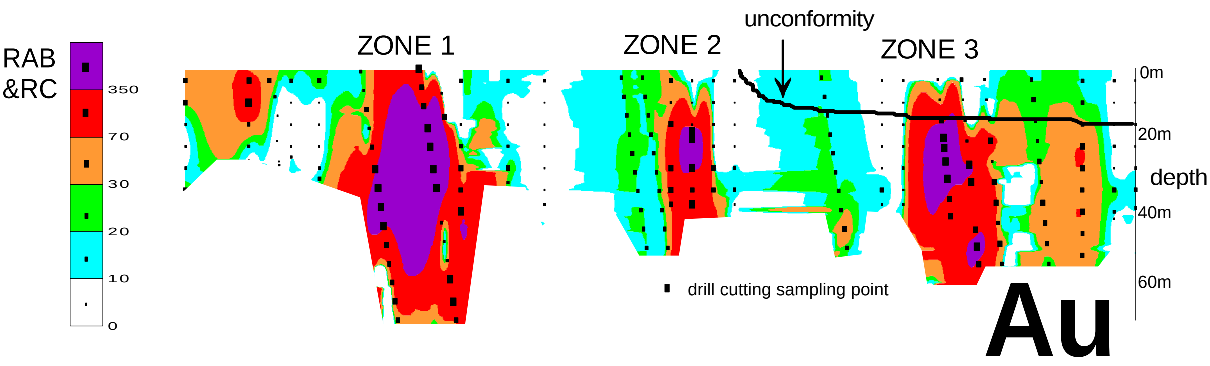


Figure 16: Distribution of Au (ppb) in the lower regolith showing the three zones of mineralisation and the approximate position of the unconformity between the Archaean and Mesozoic/Tertiary. Width of section approximately 1500 m.

In broad terms, the elements associated with mineralisation at Challenger are in two groups: sulphide-related (Ag, As, Bi, Cd, Cr, Cu, Fe, Mo, S, Se, ?W and Zn) and alteration-related (Ba, Cs, K, Rb, Tl) (see Figure 21 and Appendices). Of these, As, K (Rb) and possibly Mo, may provide broader anomalous zones (500 m) in the lower regolith compared with the distribution of Au (300 m, Figure 17, Figure 18, and Figure 19); and would be useful pathfinder or indicator elements in drill cuttings. The distribution of Bi is particularly interesting since elevated concentrations (>0.3 ppm) are not only found associated with Zone 1, and, to a lesser extent, Zone 2 but also in the transported regolith in the eastern part of the section (Figure 20). The origin of Bi in the transported material is not readily understood but may be from Zones 1, 2 or a more distant source.

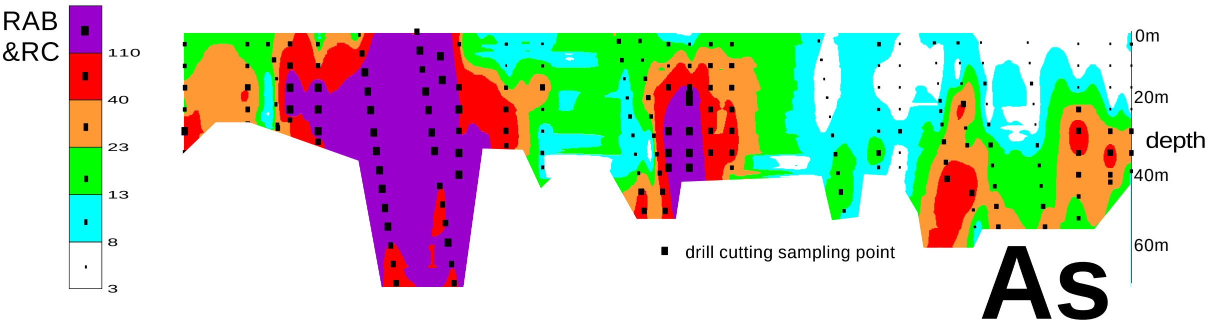


Figure 17: The distribution of As (ppm) in the lower regolith. Width of section approximately 1500 m.

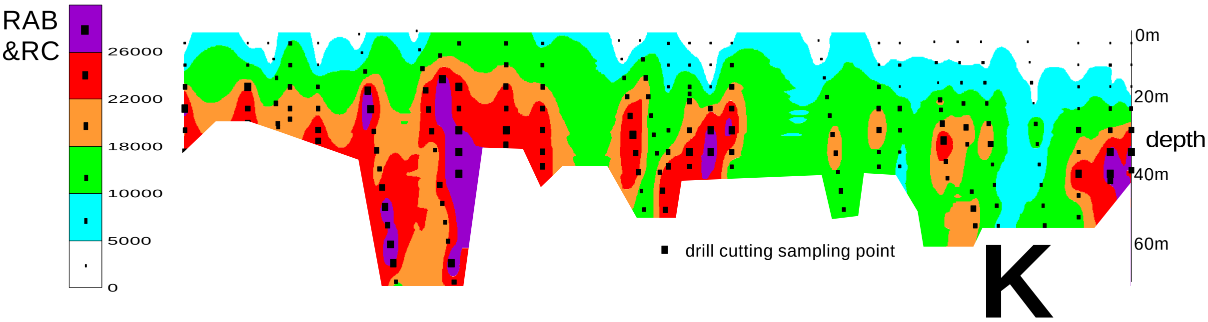


Figure 18: The distribution of K (ppm) in the lower regolith. Width of section approximately 1500 m.

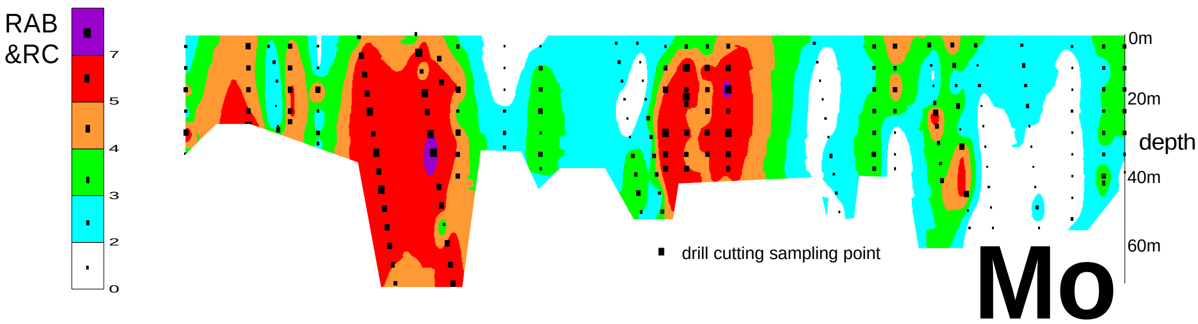


Figure 19: The distribution of Mo (ppm) in the lower regolith. Width of section approximately 1500 m.

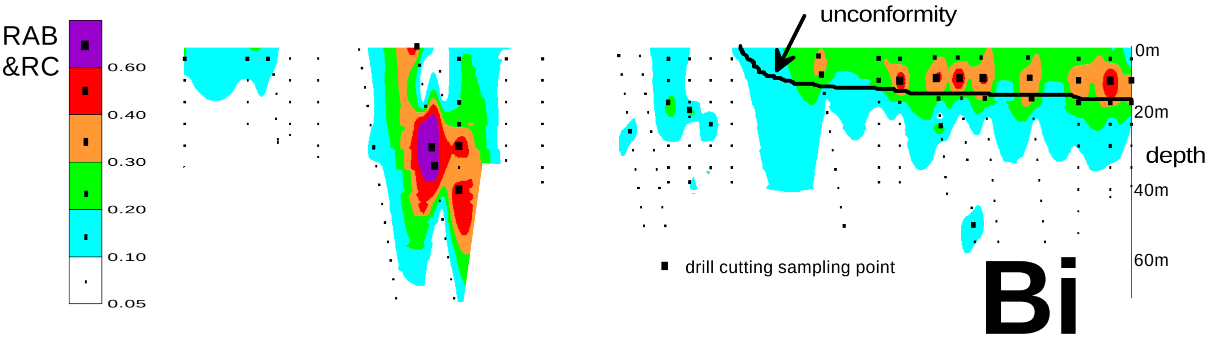


Figure 20: Distribution of Bi (ppm) in the lower regolith. Bismuth appears to be more concentrated in Zone 1 and in the palaeochannel. Width of section approximately 1500 m.

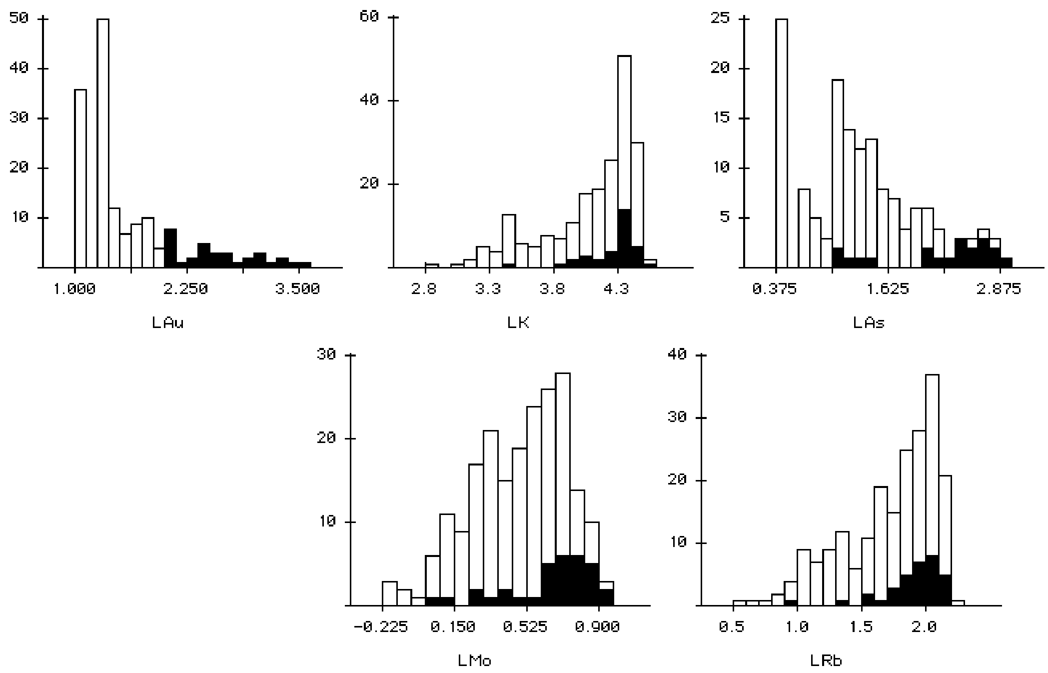


Figure 21: Histograms of lower regolith data (Au in ppb, other elements in ppm, log transformed) of selected elements with samples >100 ppb Au in black. Data ranked according to Au concentration.

4.4 Upper regolith

Elemental concentrations in the top 6 m of the regolith give strong indications of the high grade mineralisation associated with Zone 1 (Figure 22). Gold appears to be continuous with depth in (hole) GC122 immediately above Zone 1 with the highest concentration (5600 ppb) occurring from 1–2 m. Quartz veining was observed in soil pit GCP122 excavated adjacent to this hole. For Zone 2, the highest Au concentration (42 ppb) is for the 0–1 m sample and then concentration decreases with depth. As with Zone 1, quartz veining was observed in the adjacent soil pit (GCP115). The interpretation is less clear for Zone 3 which is located beneath the palaeochannel. There may be a very weak (5–10 ppb) and broad Au response in silcretes and calcretes in the top 3 m above mineralisation but from 3–6 m, the response appears to be not only broad but offset to eastern part of the regolith line. The origin of these minor concentrations of Au in the channel sediments may be the underlying mineralisation or, like Bi, be derived from elsewhere. Further work on adjacent sections is required to determine this. At the far western end of the regolith line (GC129 and 128), some relatively high concentrations (up to 290 ppb) of Au are present throughout the top 6 m. Deeper drilling is not extensive in this area. It is recommended that more drilling is undertaken in order to gain more data and perhaps explain the origin(s) of these higher concentrations.

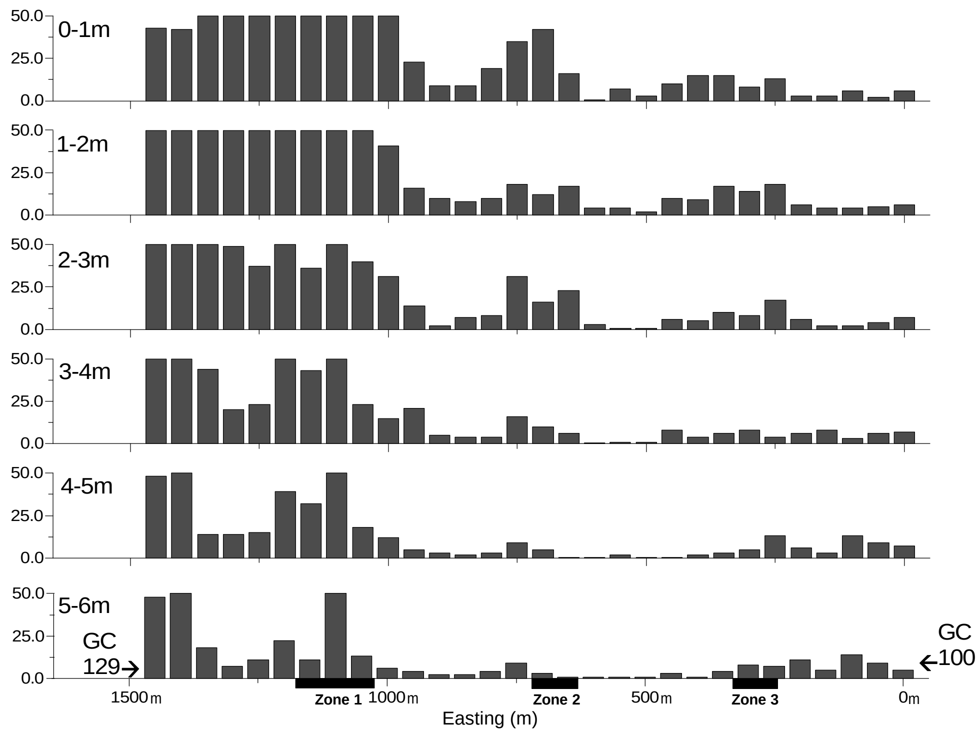


Figure 22: Distribution of Au in the upper regolith. Data truncated at 50 ppb. Y axes show concentration (ppb).

Calcrete is generally confined to the top 2 or 3 m of the profile. There is a general association between Au and Ca (Figure 23). The major exceptions appear to be when the Ca concentrations are relatively low (<10%), as occurs at the eastern end of the regolith traverse, or directly overlie outcropping mineralisation where there is probably detrital Au present (Zone 1 and 2).

Arsenic concentrations are anomalous (>~20 ppm) in the upper regolith above Zones 1 and 2. Over Zone 1, they do not precisely follow Au concentrations (which peak at GC122), but are anomalous on the adjacent GC123 and GC121. However, after normalising with respect to Fe content, a closer agreement with the underlying mineralisation at Zone 1 is obtained, although the anomaly over Zone 2 becomes much weaker by this procedure (Figure 24). In addition, Bi, Ba, Cd, Cr, Cs, Cu, Fe, K, Mo, Rb, S, Se, Tl, V and Zn demonstrate weak to strong anomalism over Zone 1 mineralisation, and As, Cr, Cu, Fe, Mo, S, Se and V are anomalous over Zone 2 mineralisation. Copper and As demonstrate interesting broad anomalism over Zone 3 *once normalised with respect to Fe* and require further investigation (Figure 25). Tungsten also has concentrations above background (~2 ppm) in some upper regolith samples.

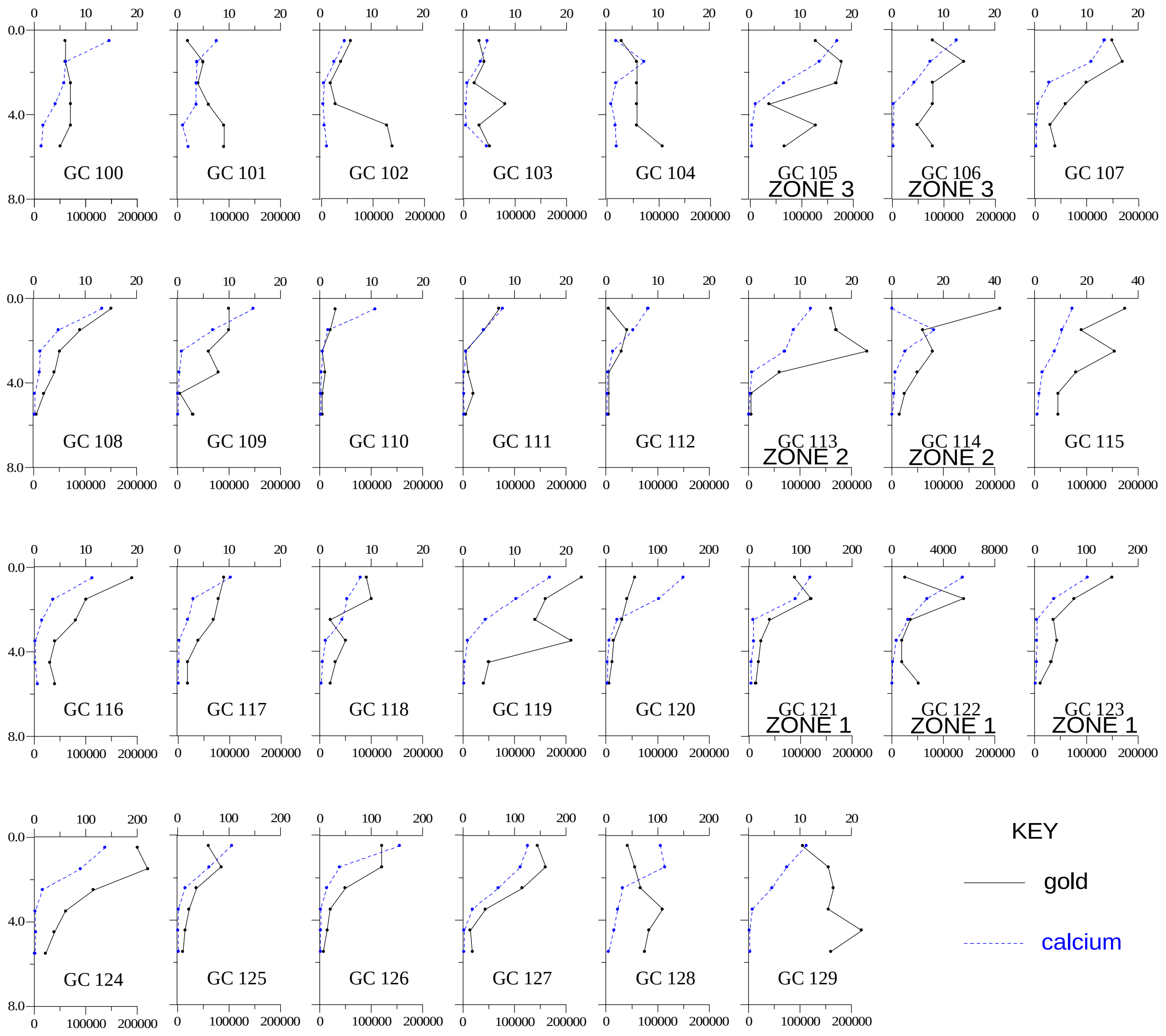


Figure 23: Gold and Ca concentrations for 0–6 m samples from Challenger. Y axes are depth (m). Top axes show Au (ppb), bottom axes show Ca (ppm).

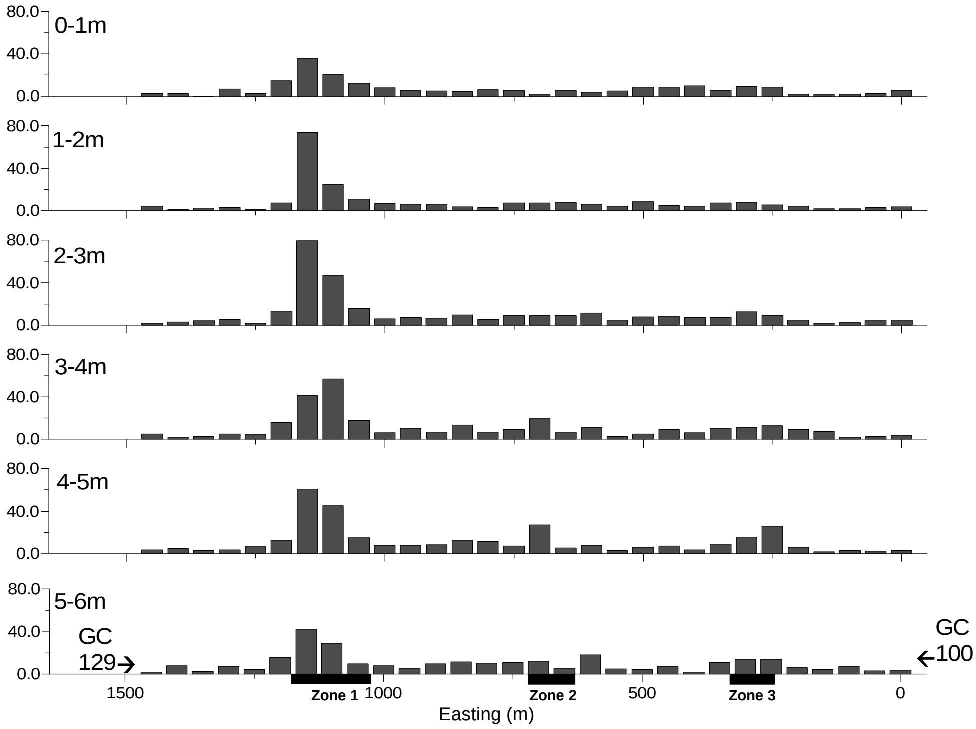


Figure 24: Arsenic concentrations in the upper regolith normalised with respect to Fe content (As/Fe). Y axes show concentration (in ppm/%).

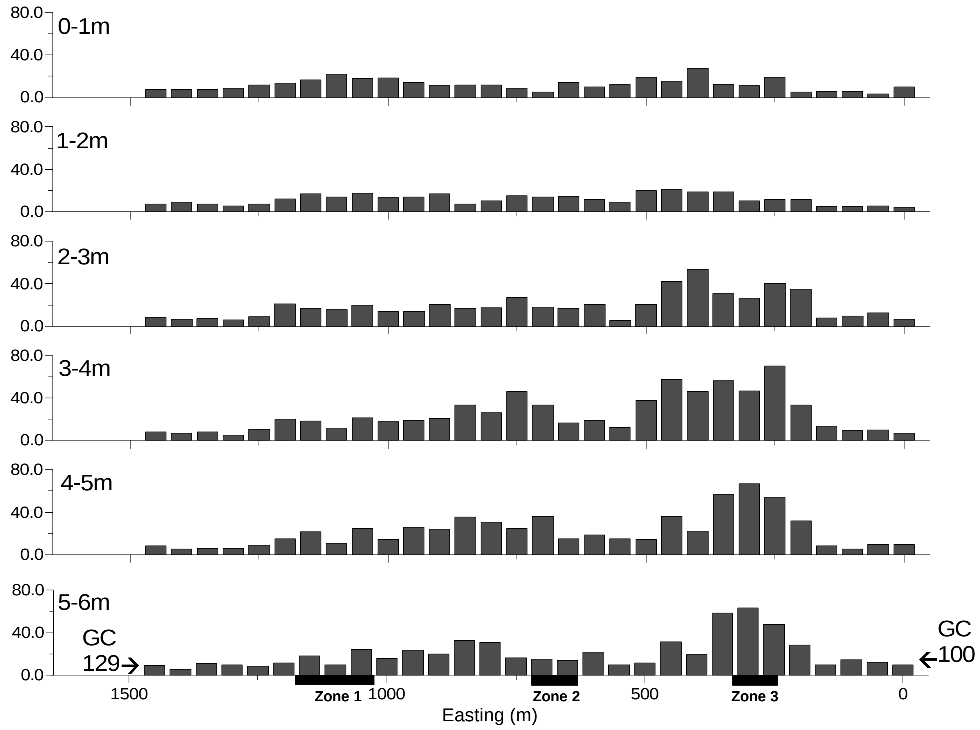


Figure 25: Copper concentrations in the upper regolith normalised with respect to Fe content (Cu/Fe). Y axes show concentration (in ppm/%).

4.5 Silcrete lag

A preliminary survey of siliceous lags from the Challenger area showed a number of different types including (i) uncommon “exotic” rounded clasts with sedimentary features that may be derived from areas of outcrop in the Tarcoola area and possibly transported to this site during the Permian glaciation (verb. comm. Edgecombe), (ii) grey “normal” silcrete, (iii) ferruginous silcrete and (iv) silcrete containing coarse-grained quartz (Plate 4 and Plate 5). Gold concentrations are highly variable with a sub-sample containing over 10 ppm (Appendix 6, Figure 26). Four samples with high Au concentrations (>1 ppm) were sectioned and examined under the SEM (using a nominal detection scale of view of 1 µm Au particle); samples were rich in barite but no visible Au was detected. The variability of the Au content suggests that some of it is coarse grained and that part of the silcrete lag (containing high Au concentrations) must have been locally derived from the re-working of quartz and/or silicification associated with the kaolinisation of mineralised Christie Gneiss; its appearance overlying mineralisation suggests it to be a “true” deflation (let-down) lag. Further evidence of the variable concentrations of Au in silcrete can be found in Section 4.5.

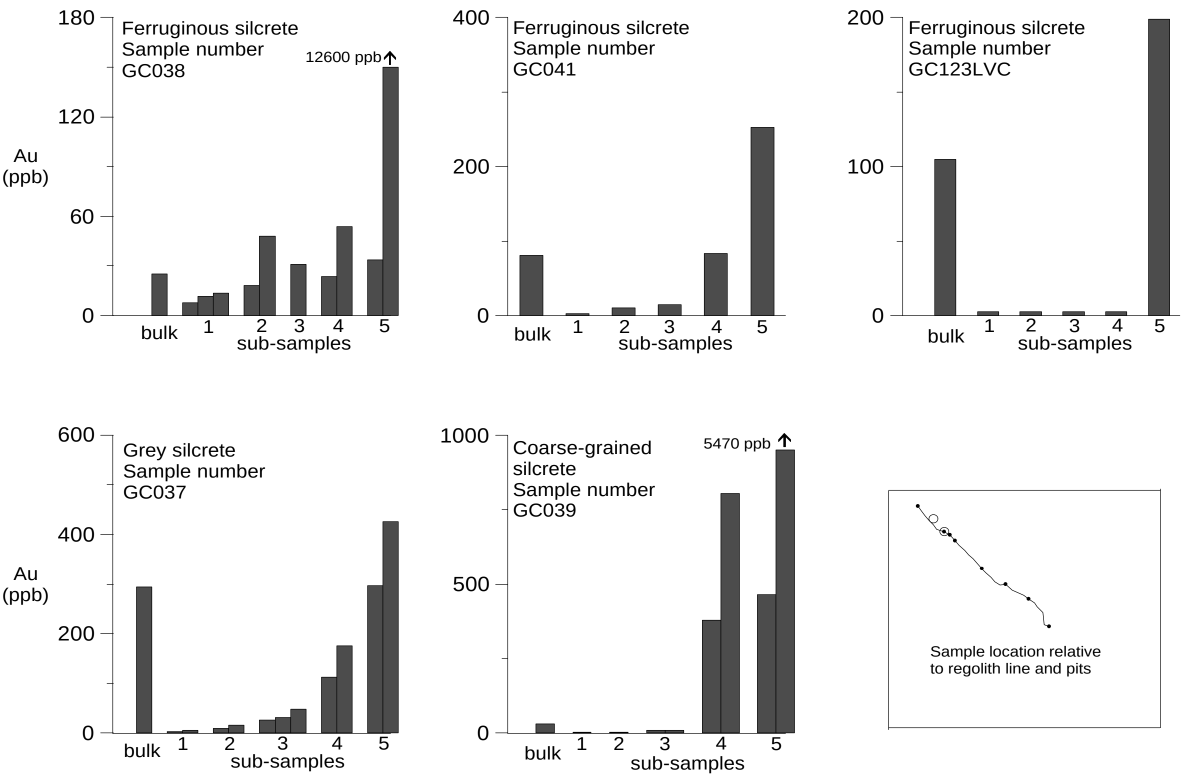


Figure 26: Variation in Au content (in ppb) of silcrete (3 types, 5 samples). Individual clasts (1–5) were randomly sub-sampled and analysed separately from the bulk sample. In some cases, large individual clasts were themselves broken into 2 or 3 pieces represented by multiple bars for the one sub-sample number.

Very coarse (>6 mm) silcrete (all types) were sorted in the laboratory from bulk lag samples collected from the regolith line and analysed separately for Au and other element contents (Figure 27). Gold concentrations were found to be highly anomalous over Zone 1 mineralisation (105 ppb maximum) but were not anomalous (<1 ppb) at Zones 2 or 3. Silcrete lag was absent near the middle of the regolith line due to the presence of aeolian dunes.

The results suggest that other elements are anomalous in silcrete lag over mineralisation. In particular, Cu (and Cd) concentrations over and adjacent to Zone 2 appear to be highly anomalous (>~10 ppm for Cu, >0.1 ppm for Cd). However, for other elements, it is not clear whether they are anomalous over mineralisation or are merely elevated due to their derivation from (mineralogical) peculiarities associated with outcropping weathered Christie Gneiss; this is most obvious for Ce (and other rare earth elements (REE)) whose concentration gradually tails off from west to east without specifically peaking over the mineralised zones, and which may provide a useful indicator of *in situ* regolith (see Section 5.4).

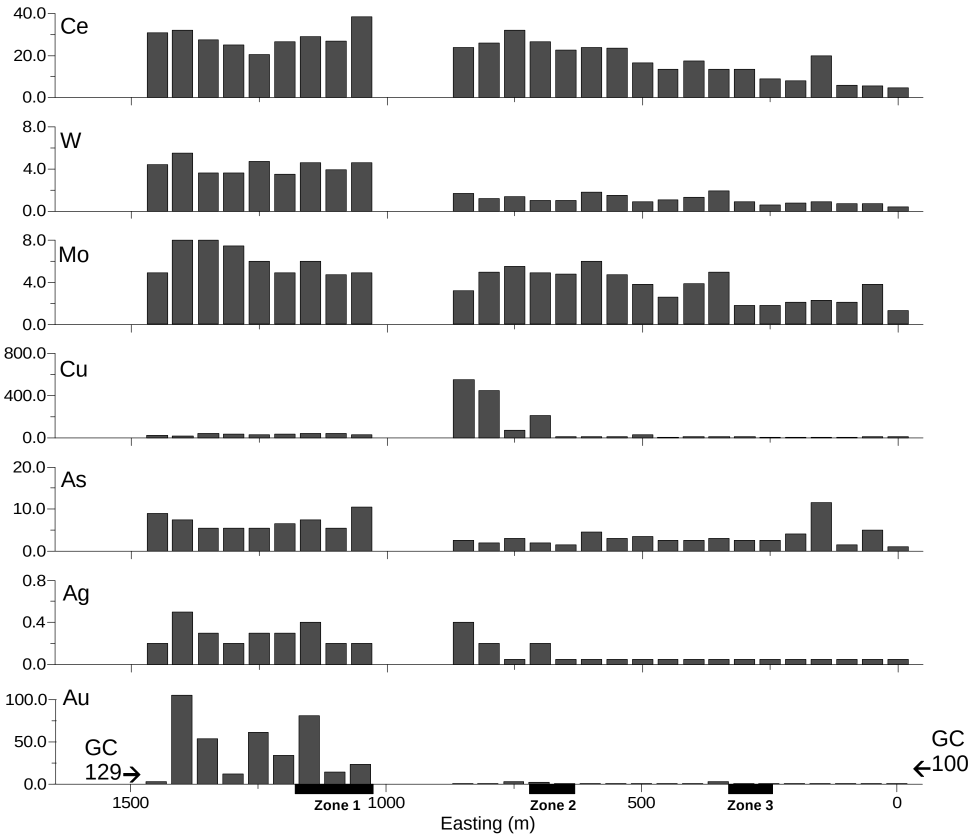


Figure 27: Selected elemental abundances in coarse (>6 mm) silcrete lag from the regolith line at Challenger. Y axes show concentration (in ppb).

4.6 Calcrete

Calcrete nodules were collected along the regolith line from drill spoil and from the sides of the drill holes. Examination of the calcrete both in the field and sectioned in the laboratory indicate that it is complex in character. Multiple generations of calcrete were observed consisting of several different forms (e.g., nodular, laminar and massive) and inclusions including silcrete, ferruginous granules, saprolite, opal and vein quartz (Plate 9). It is not surprising, therefore, that the geochemical signature of the calcretes is also complex.

There is a strong and broad response for Au in the calcrete over mineralisation, particularly Zone 1 where a maximum of 2370 ppb was recorded (Figure 28). Anomalous values (~>10 ppb) extend for about 500 m over Zone 1 and about 200 m over Zone 2 (maximum of 52 ppb); no anomaly was detected over Zone 3. For other elements, the response over Zone 1 was more subdued and erratic with As and Cu, and, possibly, Ce, Cr, Fe, K, Mg, Rb, S, Th and V exhibiting one or two point anomalies. A response was not detected over Zone 2 mineralisation except perhaps for Cu and Zn. Some smoothing of the data can be achieved after normalising the chalcophile elements with respect to Fe.

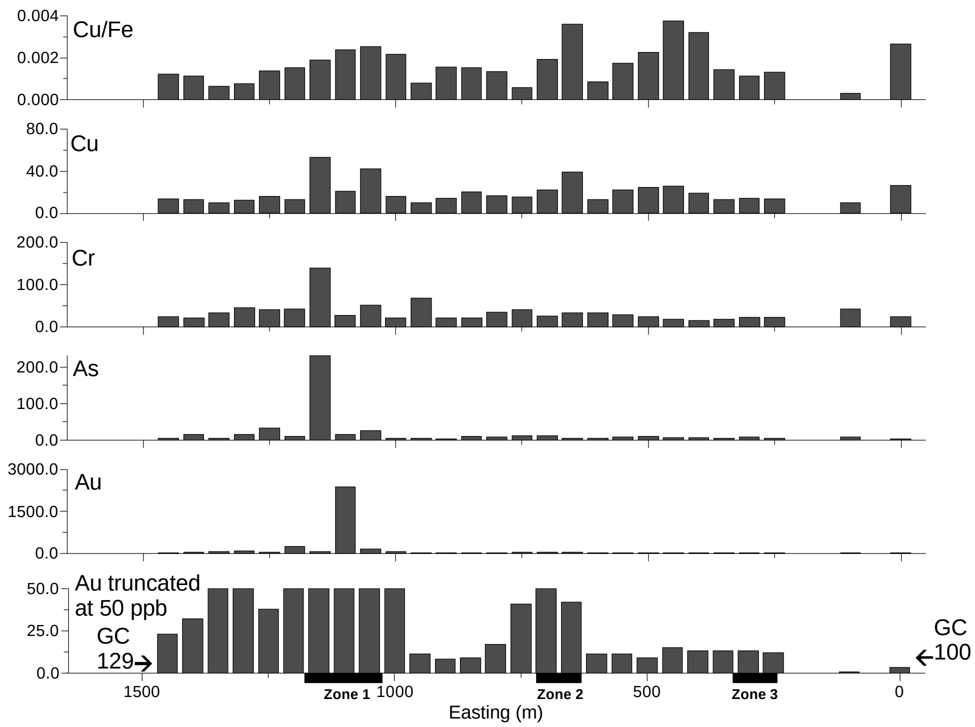


Figure 28: Selected elemental abundances for calcrete from the regolith line at Challenger. Y axes are for concentration (in ppm and for Au in ppb).

4.7 Sorted lag (quartz, silcrete, calcrete and ferricrete)

Ten to twenty kilos of bulk lag were collected and sorted from 7 sites (a-f, close to pit GCP122, and site m from Mt Challenger) to examine element dispersion and the relative merits of different lag types for exploration (Figure 29). The data indicate a wide variation in Au content (i) between sites and (ii) within different materials at the same site (<1 to 1300 ppb, Figure 29). The highest Au concentration was recorded for nodular ferruginous saprolite (1.3 ppm, sample R214180, graphitic gneiss) from site e (Plate 12).

Elements associated with mineralisation (Ag, As, Bi, Cd, Cr, Cs, Cu, K, Mo, Rb, S, Se, Tl, and possibly W and Zn) also show variable behaviours in silcrete as with Au (Appendix 6). However, some of these elements (As, Cr, Cu, Mo, Se) show medium to strong association with Fe and it is recommended that any future lag collection, and multi-element data generated from them, are normalised with respect to Fe.

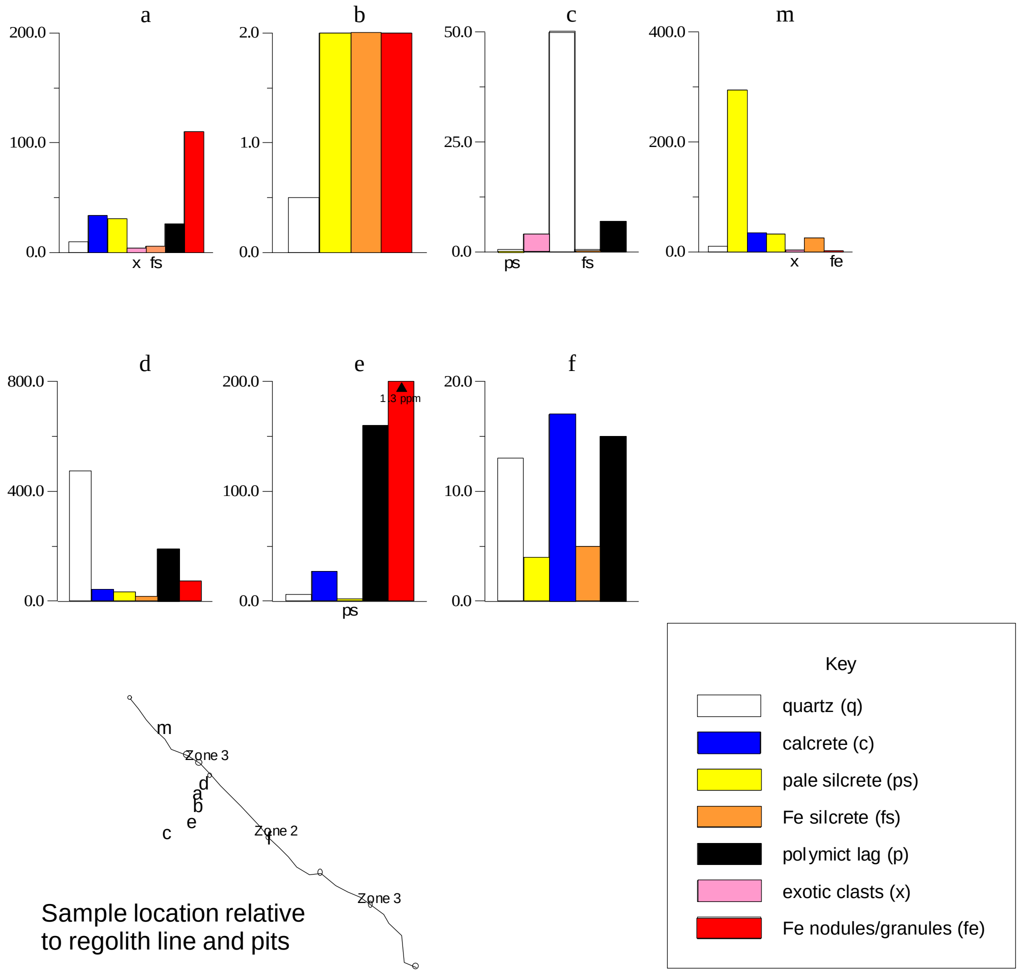


Figure 29: Gold content (ppb) of sorted lags from the Challenger area.

4.8 Unsorted coarse and fine lag from the regolith line

Coarse (>2 mm to <6 mm) and fine (>0.475 mm to < 2 mm) lag was collected from the regolith line and from near (<1 km) the Challenger area. The samples consisted of varying quantities of coarse sand, ferruginous, calcareous and siliceous materials. It was noted that there was an irregular distribution of the various components across the regolith line and in adjacent areas, although their boundaries beyond the line were not specifically mapped except at the 1:50000 scale (see Regolith-Landform Report). Fine ferruginous components, for example, were observed to be particularly numerous on a low rise south of the regolith line on 6693200N (Figure 15) and may represent the last vestiges of a lateritic weathering surface. For many coarse samples, the data suggest a generally antipathetic relationship between Fe and Ca, and, by closure, Si. Care should be taken, therefore, with interpretation, particularly when considering the distribution of trace elements. Many trace elements, such as As, concentrate in Fe oxides and oxy-hydroxides. For example, As data for coarse lag between Zones 1 and 2 are both anomalous and variable but when normalised with respect to Fe, the anomaly is enhanced and the data are smoothed (Figure 30, Figure 31); for fine lag, the anomaly over Zone 1 mineralisation is enhanced by normalising with respect to Fe and the spurious anomaly between Zones 1 and 2 is no longer apparent.

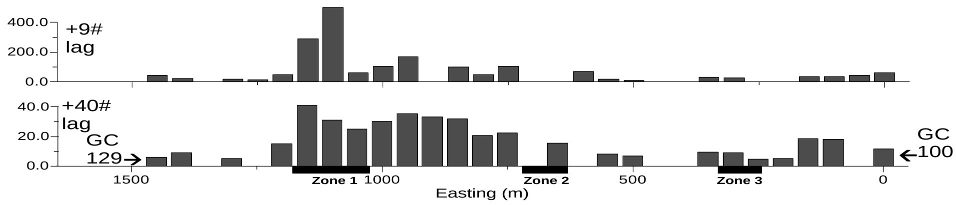


Figure 30: Arsenic concentrations in unsorted fine and coarse lag BEFORE normalising with respect to Fe content. Y axes show concentration (in ppm).

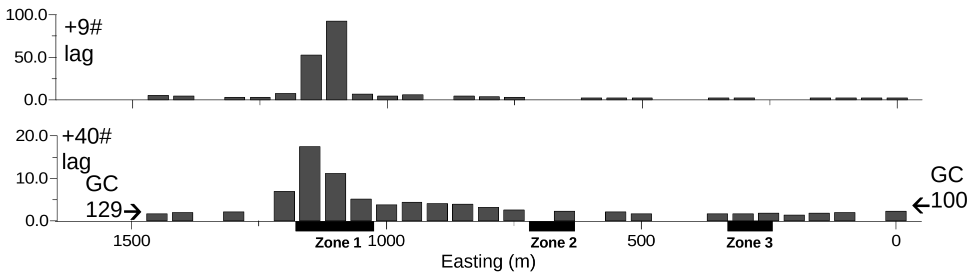


Figure 31: Arsenic concentrations in unsorted fine and coarse lag AFTER normalising with respect to Fe content (As/Fe). Y axes show concentration (in nominal units).

High Au concentrations (82–285 ppb) were recorded in unsorted fine and coarse lag over Zone 1 mineralisation at Challenger (Figure 32). This is not surprising since it has already been shown that high Au concentrations occur in silcrete, which is a major component of the unsorted lag. No anomalism was observed over Zone 2 or Zone 3. As with the upper regolith (0–6 m) data, a high Au concentration (320 ppb) was recorded at the far western end of the line (GC129). This may be due to transported material but it is more likely to be derived from a local source, possibly from quartz veining noted in the detailed drill hole and pit logs.

Normalised Cu, and K (Rb), Na and W also show anomalism over Zone 1 mineralisation (Figure 33, Figure 34, Figure 35). The K and Na may be present due to weathering of relict primary feldspars now as clay.

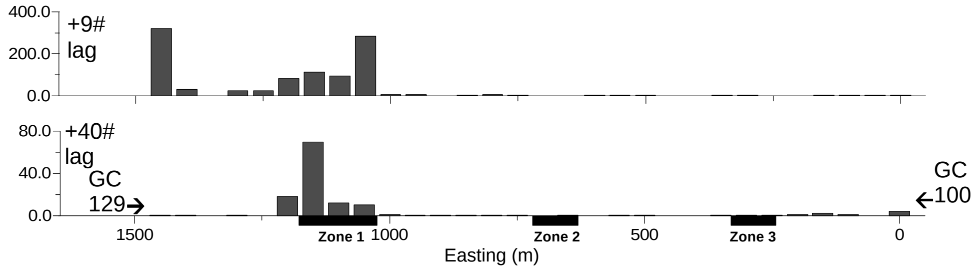


Figure 32: Gold concentrations in unsorted fine and coarse lag. Y axes show concentration (in ppb)

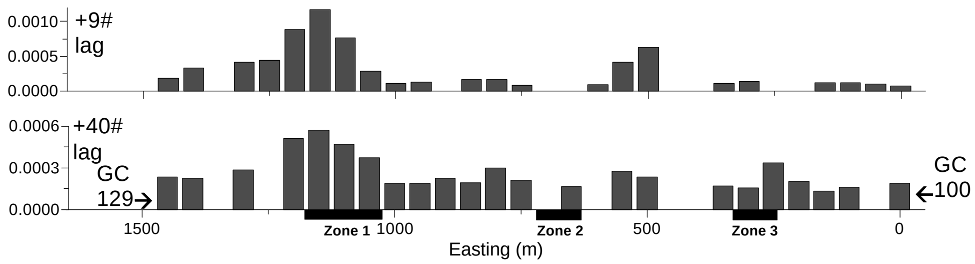


Figure 33: Normalised Cu concentrations in unsorted fine and coarse lag. Data normalised with respect to Fe content (Cu/Fe). Y axes show concentration (in ppm).

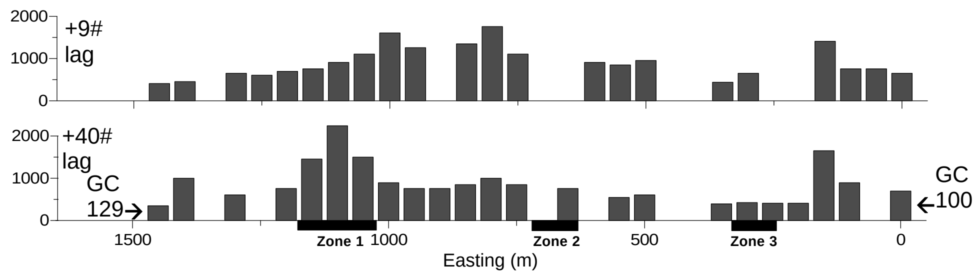


Figure 34: Potassium concentrations (ppm) in unsorted fine and coarse lag. Y axes show concentration.

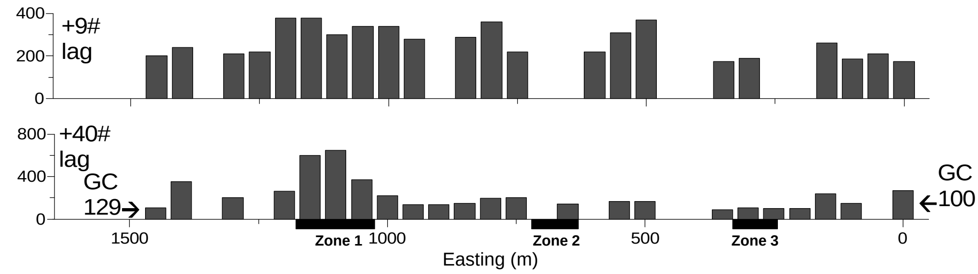


Figure 35: Sodium concentrations (ppm) in unsorted fine and coarse lag. Y axes show concentration.

4.9 Soil (0–10 cm)

The soil consists mainly of clayey sand and includes breakdown products from the lag and regolith together with aeolian and fluvially transported materials; some soil is calcareous. High concentrations of Au (25–73 ppb) were recorded directly over Zone 1 mineralisation (Figure 36), some of which is accounted for by the higher Ca contents (Figure 37). The anomaly tails off to the west but ends abruptly to the east (GC120) presumably due to the presence of exotic windblown material associated with the dune. Over Zone 2, significant concentrations of Au up to 4 ppb were recorded. Concentrations over Zone 3 are below detection (<1 ppb). Due to the poor precision of Au determinations below 10 ppb, we recommended that a technique with lower detection limits, such as a cyanide leach, is used for soils (Figure 60). As with upper regolith and lag material, an unusually high concentration of Au (22 ppb) was recorded at the far western end of the line that requires further investigation.

Arsenic, Cu, and Na are anomalous over Zone 1 mineralisation (Figure 38, Figure 39 and Figure 42). The data for As and Cu are consistent with that from upper regolith drill cuttings from Zone 1. Sodium is not associated with mineralisation, but elevated concentrations were found in unsorted lag from Zone 1; the Na anomaly is partly reduced when normalised with respect to Ca (calcrete). Potassium, Mo, Na, P and W are weakly anomalous over Zone 2 mineralisation (Figure 40, Figure 41 and Figure 42). For Mo and W there are also displaced anomalies to the west of Zone 1. Molybdenum is associated with mineralisation in Zone 1 and 2. Detection limits for S (currently 500 ppm) and Se (0.5 ppm) need to be lower as these elements may also be anomalous in soils over mineralised areas.

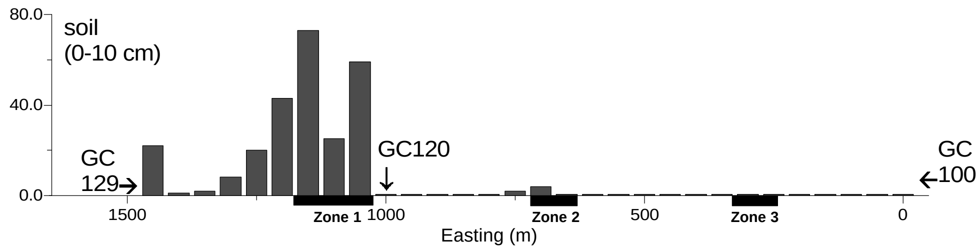


Figure 36: Gold distribution in soil (0–10 cm). Y axis shows concentration (ppb).

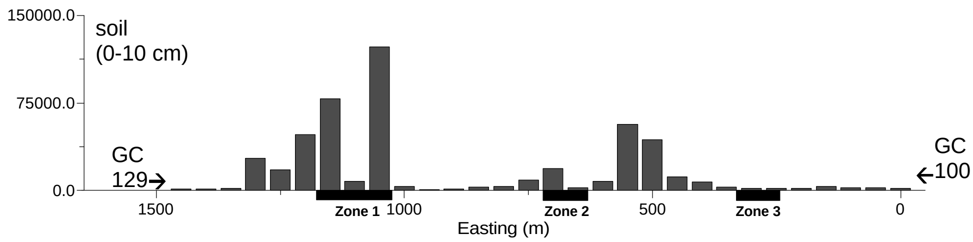


Figure 37: Calcium distribution in soil (0–10 cm). Y axis shows concentration (ppm).

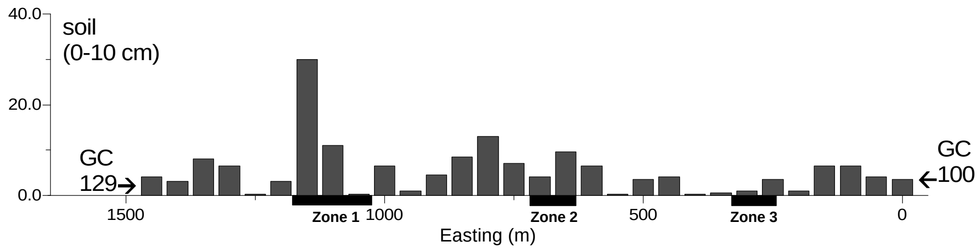


Figure 38: Arsenic distribution in soil (0–10 cm). Y axis shows concentration (ppm).

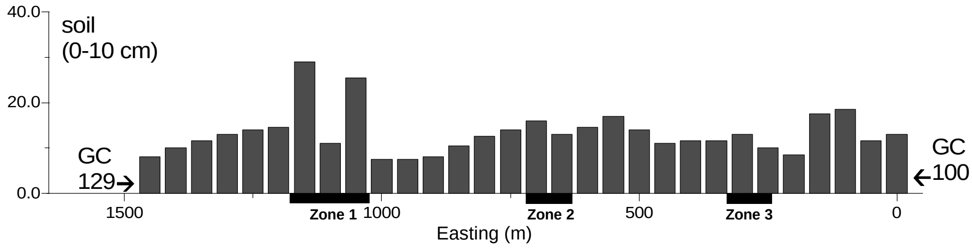


Figure 39: Copper distribution in soil (0–10 cm). Y axis shows concentration (ppm).

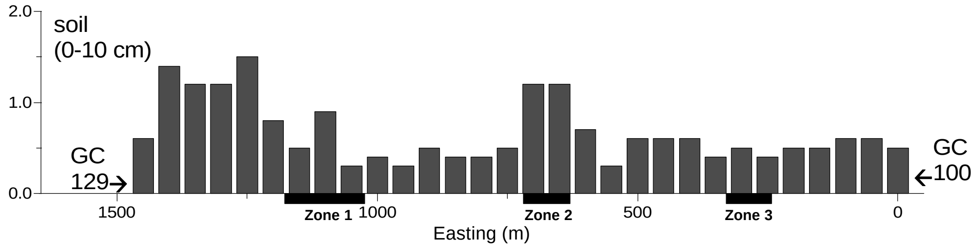


Figure 40: Molybdenum distribution in soil (0–10 cm). Y axis shows concentration (ppm).

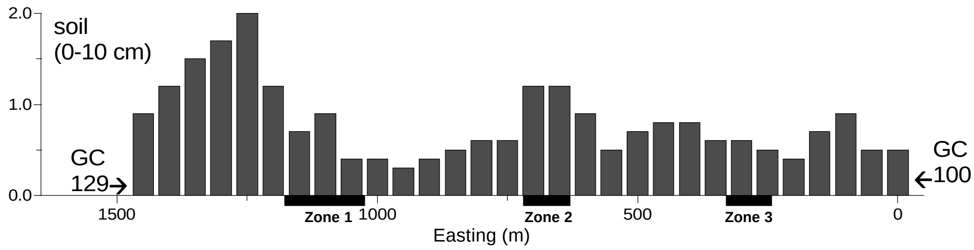


Figure 41: Tungsten distribution in soil (0–10 cm). Y axis shows concentration (ppm).

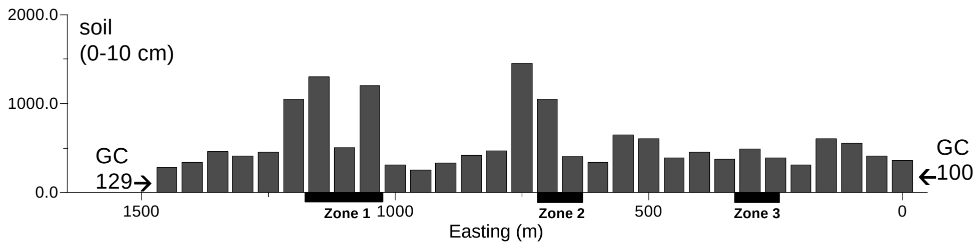


Figure 42: Sodium distribution in soil (0–10 cm). Y axis shows concentration (ppm).

4.10 "Soil" pits

"Soil" pits enabled (i) detailed sampling of upper regolith profiles including specific horizons and units which are not easily identified in drill cuttings and (ii) the spatial relationship between saprolite, silcrete and calcrete to be investigated in some detail. The geochemistry provided important information on the distribution of elements close to the surface and on the suitability of sampling techniques and media. All geochemical data are graphed in Appendix 5.

Gold contents of the profiles are extremely variable (Figure 44). The highest Au concentration (~100 ppm, Plate 12) was recorded at 2.0 m in pit GCP122, over Zone 1, although the Au concentration at the surface was only 250 ppb. For adjacent profiles from the same pit located within 5 m of each other, near surface sample concentrations of 250, 380 ppb, 35 ppb and 900 ppb were recorded indicating the extreme variability close to mineralisation (Figure 43). Gold is statistically significantly correlated with Ca in 4 of the profiles (Table 1, pits GCP123, 110, 106, 100 and A). However, in nearly all profiles there appears to be a general association between Au and calcrete. The exception is for pit GCP122 where low Au extractability (cf. Section 3.3) implies relatively coarse grained Au is present in significant quantities beneath the calcrete horizon. The high Ca concentration (15%) at the base of pit GCP122 (Sample R214049) is almost entirely due to the presence of gypsum; the Au concentration here is 760 ppb. Calcrete is generally confined to the top 2–3 m of the profile and decreases in abundance with increasing depth.

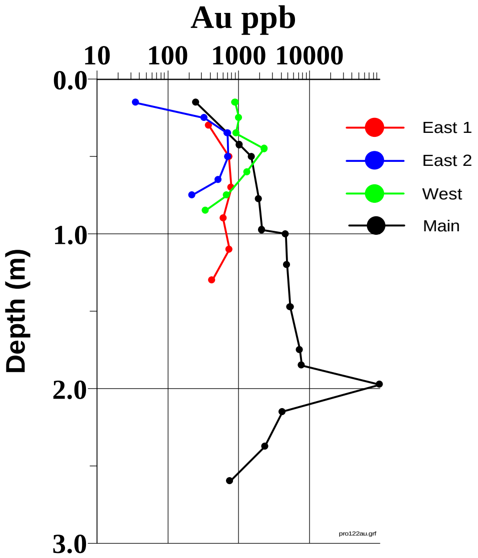


Figure 43: Variability of Au concentrations from 4 profiles sampled in pit GCP122.

Arsenic is significantly (99.9%) correlated with Fe in most of the profiles. Arsenic is generally associated with mineralisation (cf. Sections 4.3 and 4.4); however, in pit GCP122 where Au concentrations are at their highest, As and Fe are neither correlated nor present in high concentrations. The reason(s) for this are unclear but the distribution of As and Fe suggest an annulus of ferruginisation surrounding a unit of less ferruginised material which is quartz-rich and auriferous. The highest Fe concentration (Sample R213976, 16%) is from a grab sample taken from the spoil heap at pit GCP129 (Plate 12). The sharp Fe maximum (9.1%, sample R214118) for pit GCP110 is also due to a similar "pod" of ferruginous materials as found in pit GCP129 (Plate 12). The generally low Fe concentrations (< 16%) and the lack of visual evidence in the pits suggest that a lateritic duricrust was either never prevalent, mostly absent or has been completely stripped from the Challenger site. However, about 1.1 km to the east of Zone 1 at 364514E 6693445N, a relict lateritic duricrust or ferruginous saprolite is present capping a local topographic high (higher than Mt Challenger) that suggests weathering conditions were conducive for this type of material to form in this area in the past.

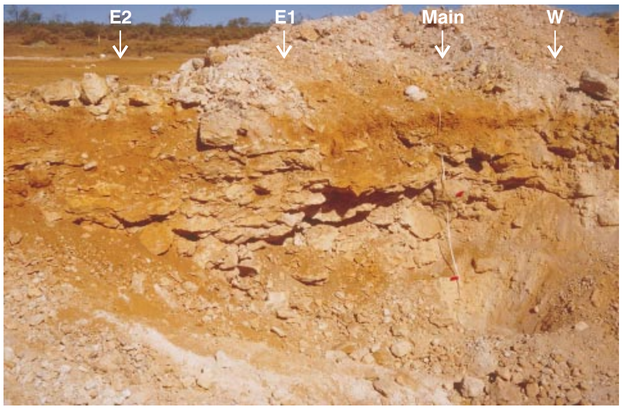
Molybdenum distribution is related to that of Fe (Figure 47). As with As, Mo is associated with mineralisation but where Au is most concentrated, there is poor agreement between Mo and Fe. The highest Mo concentration (6 ppm) is recorded for the surface sample at pit GCP129.

The association of Ga with Th is of note because understanding the distribution of the latter will assist in the interpretation of the radiometrics data. The chemistry of Ga is often closely related to that of Al and sometimes Fe. However, due to the low concentrations of Fe oxides at Challenger, most of the Ga (and Th) are probably associated with clay minerals, although if high Fe concentrations are present there will almost certainly be an increase in Th (Figure 46).

Table 1: Selected highly significant (99.9%) element associations for the pit profiles at Challenger.

Profile	**Fe (Fe oxides and oxy-hydroxides)**	**Ca (calcretes, gypsum)**	**Ga (clay minerals, Fe oxides and oxyhydroxides)**
GCP129	As, Cr, Ni, V	K, Mg, S, Sr	Bi, Ce, Th
GCP123 – Zone 1	As, Cr, Cu, Mo, Zn	Au, Mg, Sr	Ce, K, Th, Ti, V
GCP122–Zone 1	Ni, Cu, Mn	Sr	Ag, Bi, Ce, Mo, Th, V
GCP121–Zone 1	As, Ce, Cr, Cu, Mo, Pb, Th, V, Zn	-----	Ce, Cr, K, Mo, Th, Ti, V, Zn
GCP115–Zone 2	As, Bi, Mn, Sr	As, Mg, Sr	Ce, Cr, Th, Ti, V
GCP110	As, Ce, Cr, Mn, Sb	As, Au, Mn, S, Sr, U	------
GCP106–Zone 3	Ba, Cr, K, V, Zn	Au, Mg, S, Sr	K
GCP100	As, Ba, Ce, K, Mg, Ni, Th, V	As, Au, Cr, K, Mg, Ni, Sr, V	As, Ce, Cr, Fe, K, Mg, Ni, Th, V
PIT A	Ce, Cu, Ni, S, Sr, Th	Au, Mg, Sr	Ce, Cu, Fe, Ni

(a) *Gold-bearing saprolite (100 ppm, weathered felsic gneiss) from pit GCP122 (depth 190-205 cm) directly above Challenger 1 mineralisation, sawn face (wet), Sample R214046.* *(Photo 45613)*



(d) *Location of the sub-profiles in pit GCP122.* *(Photo 45432)*

(b) *Iron-rich grab sample consisting of siliceous, cutanous ferruginous nodules and quartz. Sample R213976 from pit GCP129 spoil heap.* *(Photo 45666)*

(e) *Surface lag of ferruginised, strongly weathered rock with 1.3 ppm Au from near GCP122, Sample R214180.* *(Photo 45686)*

(c) *Polymictic 'pod' of ferruginous nodules, quartz and silcrete. Sample R214118 from pit GCP110.* *(Photo 45567)*

Plate 12: Regolith materials and sub-profile location.

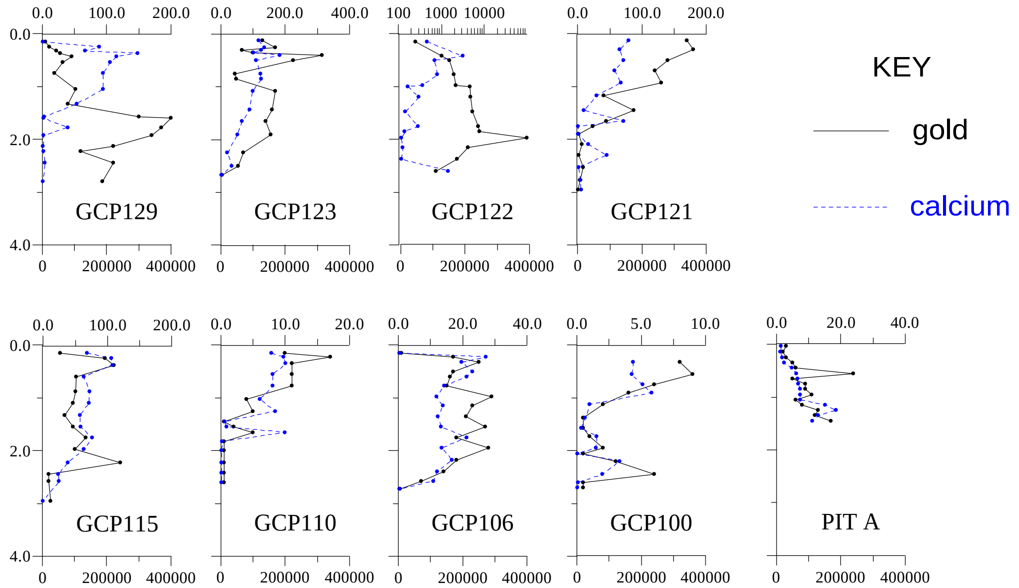


Figure 44: Gold and Ca distributions in pit samples from Challenger. Y axes show depth (m). Top axes show Au (ppb), bottom axes show Ca (ppm).

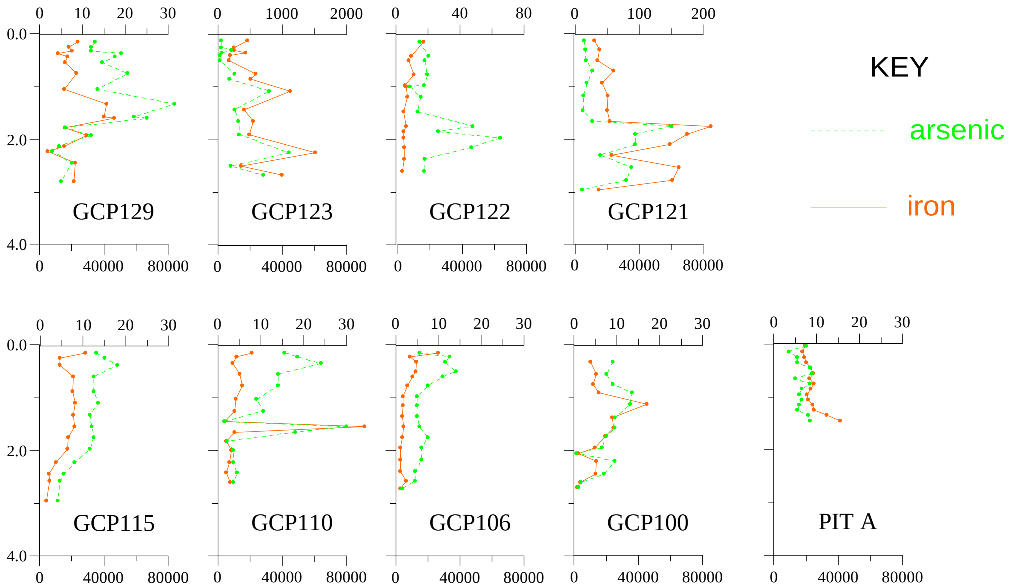


Figure 45: Arsenic and Fe distributions in pit samples from Challenger. Y axes show depth (m). Top axes show As (ppm), bottom axes show Fe (ppm).

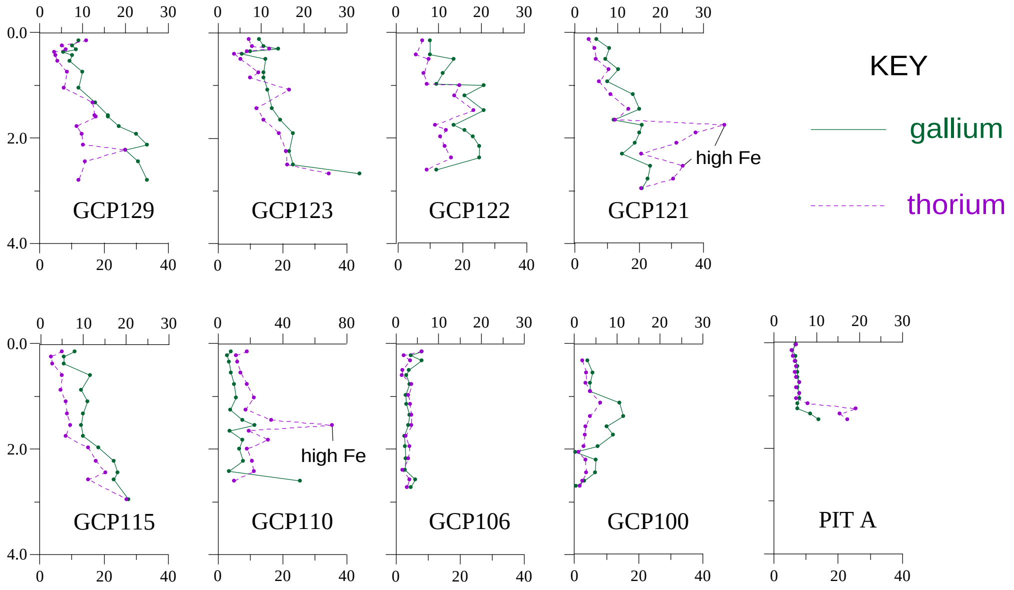


Figure 46: Gallium and Th distributions in pit samples from Challenger. Y axes show depth (m). Top axes show Ga (ppm), bottom axes show Th (ppm).

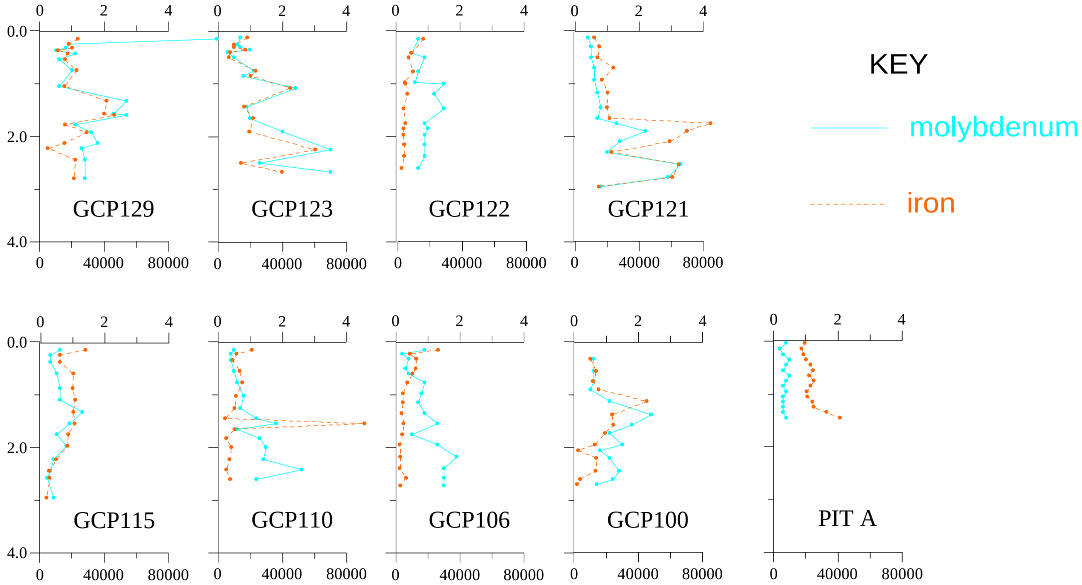


Figure 47: Molybdenum and Fe distributions in pit samples from Challenger. Y axes show depth (m). Top axes show Mo (ppm), bottom axes show Fe (ppm).

4.11 Vegetation

Bluebush (*Maireana sedifolia*) was chosen as the type sample medium for vegetation because, firstly, it is ubiquitous in the Challenger area and secondly, it has been investigated at several sites in Western Australia. In Western Australia, concentrations in excess of ~2 ppb have been estimated to be anomalous, although there may be locally higher thresholds (unpublished data, Lintern; Lintern *et al.*, 1997). No other plant species was represented at all drill hole sample locations for the entire regolith line.

Gold concentrations in bluebush are generally low (all <0.7 ppb) even over Zone 1 mineralisation, indicating that little Au is being absorbed by plant roots even though high concentrations are present in surficial materials (Figure 48). This suggests that Au is less mobile under the current climatic conditions compared with WA. Nevertheless, the highest Au concentration (0.7 ppb) was recorded over Zone 1. Zone 2 had anomalous samples averaging ~0.5 ppb, against a background of ~0.1–0.2 ppb.

Arsenic, W and Ni concentrations are all anomalous in bluebush over Zone 1, suggesting that these elements are mobile and absorbed by plants under the prevailing climate and soil conditions. Arsenic provides a broad anomaly over Zone 1 (>1 ppm), although the background concentrations of As, W and Ni (or other elements except Au) over Zone 2 and Zone 3 lessens the usefulness of bluebush as a sample medium.

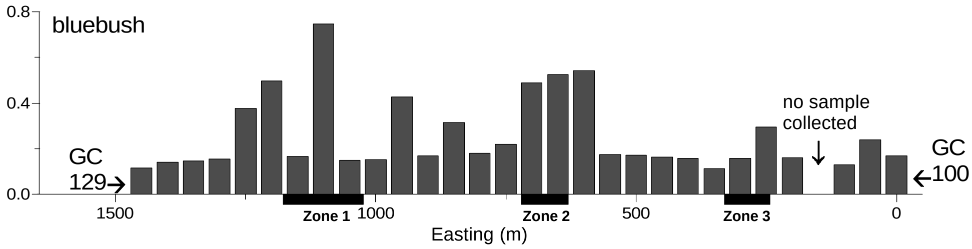


Figure 48: Gold concentrations (ppb) in bluebush. Y axis is for concentration.

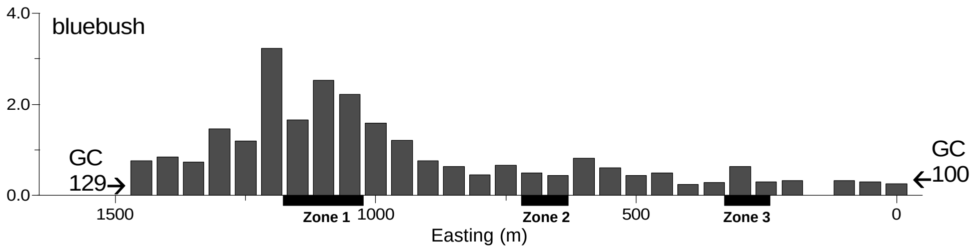


Figure 49: Arsenic concentrations (ppm) in bluebush. Y axis is for concentration.

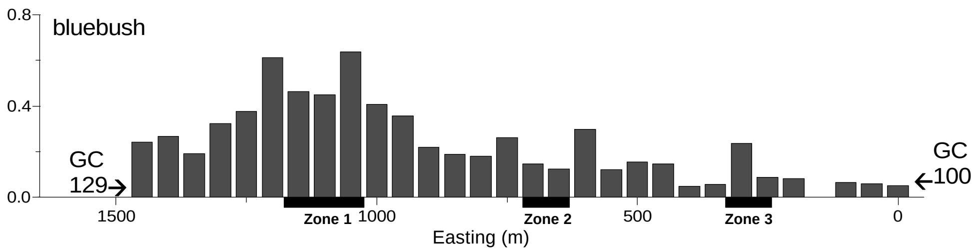


Figure 50: Tungsten concentrations (ppm) in bluebush. Y axis is for concentration.

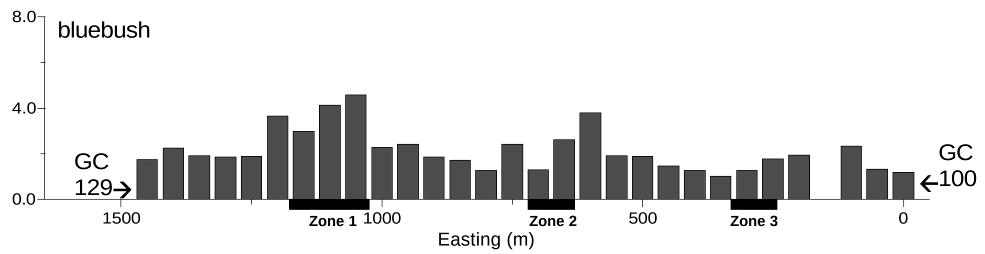


Figure 51: Nickel concentrations (ppm) in bluebush. Y axis is for concentration.

4.12 Partial extractions

The sequential partial extraction data provide information on the relative solubility of Au in the surficial environment and, by inference, the potential mobility of Au. The data indicate important differences occur (i) due to proximity to mineralisation, (ii) with depth and (iii) between different regolith materials (Figure 52, Figure 53). The main features are summarised below:

(1) Calcrete has a significantly higher proportion of water-soluble Au (15%) compared with other materials investigated (<10% for upper regolith and silcrete). The calcrete sample directly overlying Zone 1 contains the least water- and iodide-soluble Au (2% and 29%, respectively). Samples immediately adjacent to Zone 1 have the most water- and iodide-soluble Au (24% and 85%, respectively).
(2) Silcrete and drill cutting samples overlying the transported regolith in the eastern part of the line have higher water (11%) and iodide (42%) solubilities compared with the weathered Archaean regolith (3% and 34%, respectively).
(3) The mean proportion of iodide-soluble Au decreases from ~60% at the surface to ~3 m and then remains constant at ~40%.

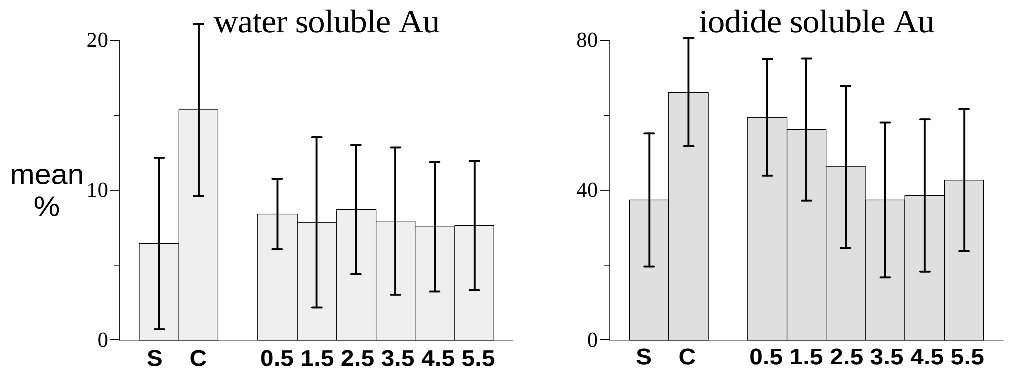


Figure 52: Comparison of mean extractable Au in water and iodide for silcrete (s), calcrete (c) and drill cuttings (0–6 m). Standard deviations are as error bars.

The results suggest that coarse-grained Au (low water solubility) dominates the upper regolith in the vicinity of Zone 1 mineralisation. They also confirm field observations from the soil pits where quartz veins were noted virtually at the surface. The water- and iodide-soluble Au in silcrete concentrations show similar trends and suggest that the silcrete is silicified upper saprolite. The top three metres of the regolith contain, on the average, more iodide-soluble Au (>40%) than the lower part of the upper regolith (<40%) which suggests that pedogenic processes are involved in the mobilisation of Au, and that these processes decrease with depth. The greatest proportion of water-soluble occurs in calcrete suggesting that the mobilisation process is at a maximum in the evaporative zone (highest carbonate concentration) of the soil profile.

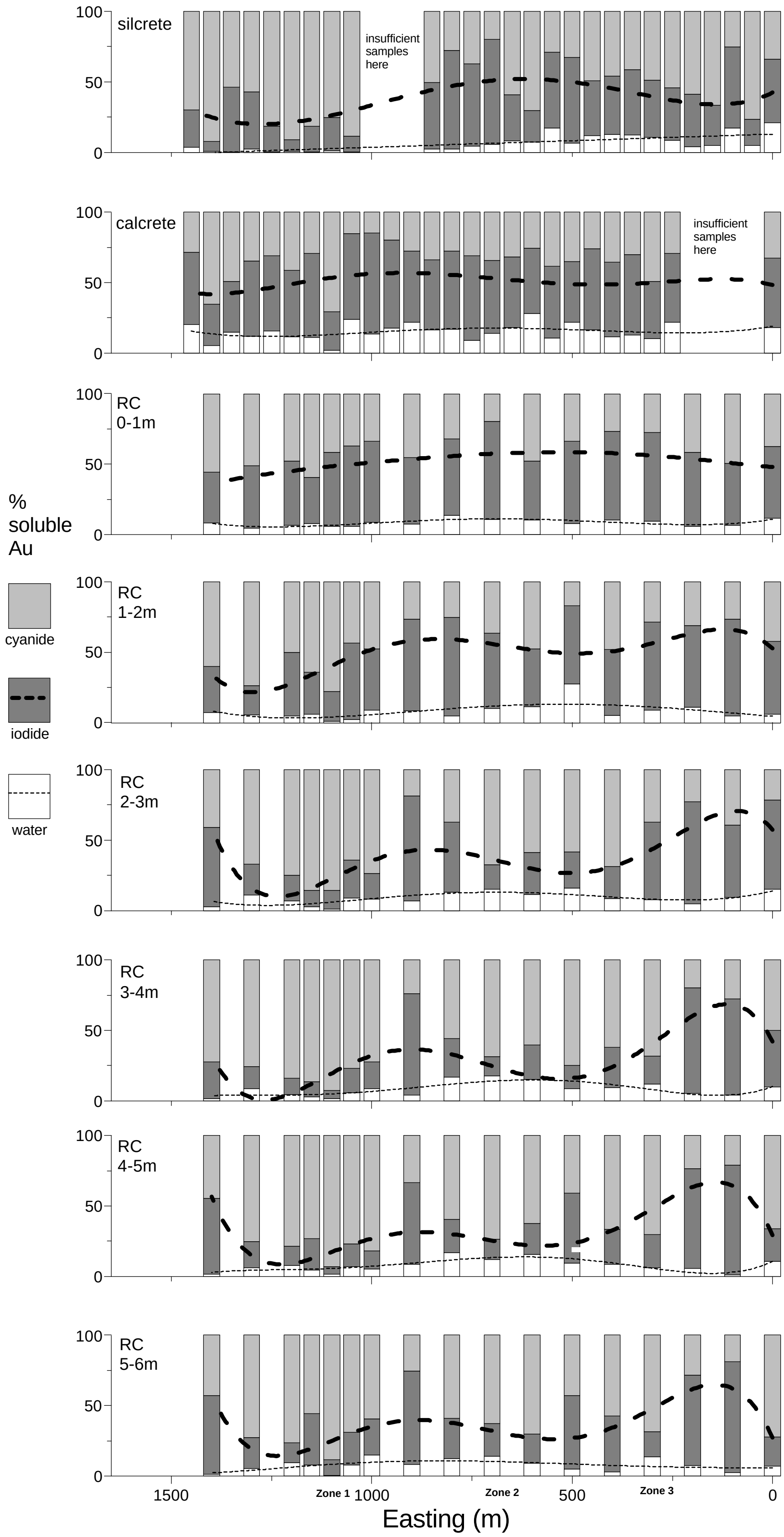


Figure 53: Sequential extraction (water, iodide then cyanide) of selected drill cutting samples. Shaded areas (Zones 1–3) locate mineralisation. Dashed lines are polynomial fit (smoothing trend) curves for iodide- and water-soluble Au data sets expressed as a % of total extractable Au.

5. REGOLITH GEOCHEMISTRY

5.1 Introduction

Three zones of mineralisation were identified along the regolith line:

(i) Zone 1 (Challenger I) mineralisation virtually outcrops in weathered Christie Gneiss on the flank of a low rise and appears to be continuous from the surface to several hundred metres depth;

(ii) Zone 2 (Challenger South-east) mineralisation virtually outcrops in weathered Christie Gneiss but has a ~14 m zone of low Au concentrations below 6 m in the regolith section studied; it is located on a very gently sloping to flat plain near a shallow dune; and

(iii) Zone 3 (Challenger II or Kelpie) is located in weathered Christie Gneiss immediately beneath about 18 m of transported sediments on a very gently sloping to flat plain.

The different mineralised Zones and their associated regolith settings appear to be important for the distribution and concentration of certain metals which are summarised in Table 2. These distributions are discussed in sections 4.3–4.11 but will be discussed in more detail in this section with an emphasis on the upper regolith and surficial materials.

Table 2: Elements associated with mineralisation in different regolith components.

Regolith component	Zone 1	Zone 2	Zone 3
Lower regolith	**Au Ag As Bi Cd Cr Cs** Cu **K Mo** Rb **S Se Tl W** Zn	**Au Ag As Bi** Cd Cr Cu **K Mo Rb S Tl** Fe Zn	**Au** Ag **As** K Mo Rb W
Upper regolith (0–6 m)	**Au As** Bi Ba *Cd* **Cr** Cs **Cu Fe K Mo Rb S Se Tl** V Zn	**Au As Cr Cu Fe Mo S Se V** Zn	As* Cu* Au Mo W
Silcrete	**Au** *As Ag* Bi Cd Tl *Th* Fe *W*	Au Cd **Cu**	
Calcrete	**Au As** Ba Cr Ce **Cu** Fe K Mg Rb S Th V	**Au** Cu Zn	
Ferricrete**	Au As Cr Cu Mo Se		
Lag (coarse and fine)	**Au As Cu K Na Rb W**	Bi Cu	
Soil	**Au** Ag As **Cu** Na *Mo* P **S** Se *W*	Au K Mo Na W	
Vegetation	**Au As** Cr **W**	**Au**	

Cu*, As* - anomalous once normalised with respect to Fe

Ferricrete** - not systematically collected since it does not comprise a major surface component.

Bold - strongly anomalous and/or showing more than a single peak maximum.

Italics - having a broad anomaly in the western end of the regolith line without being specifically associated with Zone 1.

Lower case - not associated with mineralisation in lower regolith.

Unlike environments commonly found in the Yilgarn Craton, evidence of ferruginisation of the regolith at Challenger is minimal. This has considerable implications for exploration in such a deeply weathered environment. Iron oxides and oxy-hydroxides are important in concentrating Au and associated elements such as as, Cu, Sb, Bi, Se, Zn and W so that ferruginous materials are important exploration sample media. Their low abundance at Challenger, and in the Gawler Craton in general, demands reliance on other regolith components.

Calcrete is abundant at Challenger and is expected to play a major role in the distribution of Au and the alkaline earth metals. It is interpreted to be a late addition to landscape as found in other parts of southern Australia. The distribution of Ca was critically examined in relation to the distribution of Au; some Ca occurs as gypsum, rather than calcite, and this was calculated using the S data.

The relatively low relief and monotonous nature of the landscape at Challenger belies a complex regolith that lies beneath. One of the more important criteria for exploration is to determine whether a particular sampling programme is being undertaken in *in situ* or transported units. Geochemical signatures and anomaly thresholds will vary considerably depending on the regime. Examination of the element distribution plots (Appendix 2), principal component analyses (Appendix 7) and other data visualisation and statistical techniques suggested that light REEs may be important in this regard. Therefore, the concentration and distribution of light REEs was examined critically with the aim of using these to discriminate between transported and *in situ* regolith.

5.2 Gold

In Zone 1, Au concentrations were generally >100 ppb in the lower and upper regolith and extend to the near surface where spectacular grades (e.g. 100 ppm at ~2 m) were recorded. There is little evidence for a supergene enrichment zone surrounding any of the Zones. Gold is confined to narrow zones of quartz veining near the surface and has highly variable concentration (nugget effect). The presence of some remnant ferruginous material (nodules and granules) suggests that either a very thin lateritic cover was present or a thicker Fe-rich duricrust was present but it has been all but eroded away. Gold is detectable in some ferruginous material (ferruginous saprolite) but not in all (e.g. some ferruginous granules). The silcrete lag and siliceous components within the upper regolith suggests that dispersion of some elements associated with leaching and re-distribution of silica (or Si) has occurred in the past. Some of the Au is present in the silcrete as coarse particles, as suggested by the observed "nugget effect". This indicates that the formation of some of the silcrete may be as a result of the silicification of weathered Christie Gneiss containing auriferous quartz and that, once encapsulated, any dispersion of Au in the silcrete would probably be mechanical. In contrast, the soluble nature of some of the Au associated with calcrete present within the top 2 or 3 metres, suggests that there has been some re-working and chemical dispersion of Au during relatively recent times. The "supply" of Au to the calcrete has been, and still is, continuous since mineralisation extends to the surface. The process by which the Au is mobilised is poorly understood, but it is thought to involve the effects and presence of biota (including microbes, organic ligands and/or higher plants). Some of the Au in calcrete close to mineralisation is probably as coarse-grained particles (as in silcrete) as suggested by its low solubility and concentrations in excess of 1 ppm.

In Zone 2, Au is concentrated in surficial material (>100 ppb) and appears to be related to quartz veining as identified in the soil pits at Zone 1 and 2. However, the evidence to date suggests that beneath the upper regolith (6 m) Au appears to be depleted or leached in a zone ~14 m thick. This interpretation may change as more drilling information becomes available as Au may still be confined to, as yet, unidentified quartz veining. As with Zone 1, Au in calcrete has been, and is, partly mobile and provides a larger target area for exploration than would be present without the calcrete.

In Zone 3, mineralisation occurs at about 20 m depth beneath transported sediments of presumed Tertiary age. Gold concentrations in the lower transported units are <10 ppb and it is uncertain whether this represents vertically upward dispersion from the mineralisation, or merely lateral dispersion from another source, as seen for Bi (Figure 20). Individual metre composite data for the upper regolith suggests there may be some potential for detecting mineralisation at depth (Figure 54); even the most easily-collected interval (0–1 m) appears to locate mineralisation. To be confident of whether vertical or horizontal processes are occurring and to understand fully the anomalous trend indicated in Figure 54 more data are required (i.e. more careful drilling to 6 m) using analyses with a detection limit of 1 ppb or better. Earlier studies from Higginsville (Lintern *et al.*, 1996) and Steinway (Lintern and Craig, 1996), caution against assuming an upward migration of Au from buried mineralisation.

5.3 Elements associated with mineralisation

The elements associated with mineralisation at Challenger are in two broad groups: sulphide-related (Ag, As, Bi, Cd, Cr, Cu, Fe, Mo, S, Se, ?W and Zn) and alteration-related (Ba, Cs, K, Rb, Tl) (Table 2). Of these only Ag, As, K, Mo and Rb are common to all 3 Zones. The absence of Cs and Se from Zones 2 and 3, and Bi, Cd, S, Tl and Zn from Zone 3 are probably due to the overall low concentrations of these elements present, and inadequate detection limits. Mineralisation is associated with arsenopyrite, pyrite and pyrrhotite, and alteration to a low-temperature, post-mineralisation assemblage of micaceous minerals associated with an intrusive suite of mafic and ultramafic dykes (Bonwick, 1997).

Ag, As, Bi, Cd, Cr, Cu, Fe, Mo, S, Se, and Zn. Gold mineralisation at Challenger is associated with sulphides that contain a wide range of chalcophile elements. Arsenic is particularly stable in the weathering profile and therefore, when it occurs, is a useful element for exploration. In Zone 1, As has a broad dispersion halo of high contrast in the saprolite (larger than Au itself) and continues to the surface. It is present in highly anomalous concentrations compared with background in the upper regolith (>~10 ppm), silcrete (5), calcrete (10), coarse lag (40), fine lag (10) soil (5) and vegetation (1). Normalising data with respect to Fe, with which As is commonly associated in the regolith (in Fe oxides and oxy-hydroxides), appears to increase contrasts and produce a better-defined target. In Zone 2, throughout the regolith profile, concentrations of As are generally lower compared with Zone 1, and are lower or absent in the upper regolith and surficial materials. Samples from 3 to 6 m (>~40 ppm) provide the best indicators of underlying mineralisation. In Zone 3, where As concentrations in saprolite are lower again (<10 ppm), anomalism is absent in the upper regolith. However, there appears to be weak evidence of mineralisation in some upper regolith samples after normalising for Fe, possibly indicating the presence of the buried mineralisation although further data are required from this area to substantiate this suggestion (cf. Au in section 5.2).

The presence of large quantities of gypsum in the upper regolith over Zone 1 and 2 mineralisation is intriguing; here S concentrations peak at 2.6% for a 3–4 m composite sample. The presence of gypsum is commonly indicative of proximity to evaporite deposits e.g. salt lakes, either in aeolian gypsum dunes or in evaporites generated by re-circulating groundwaters. However, there are no such deposits or landforms in the Challenger area. Furthermore, at Zone 1, S is also present in the lower regolith. Given the degree and depth of weathering, S, generated from the weathering of sulphides, would be expected to have been readily leached. The isotopic signature of the S should be determined to establish the origin of the gypsum (Chivas *et al*., 1991; Andrew *et al*., 1998). If, indeed, the S is derived from sulphides associated with mineralisation, then it indicates that sulphide minerals, or their derivatives, have survived the intense weathering of the humid early Tertiary, and that their presence in drill cuttings in the upper regolith may be used as an indicator of sulphides at depth in certain circumstances.

Of the other elements, Bi provides a narrow dispersion halo (detection limit of 0.1 ppm) in the lower regolith over Zone 1 (>~0.3 ppm) and was close to or below detection in Zone 2 and 3. It is not anomalous in calcrete, soil, lag and only weakly anomalous in bluebush and silcrete. However, over Zone 1, there is a narrow (150 m), high contrast anomaly in lower regolith samples (maximum of 1 ppm). The higher concentrations of Bi noted earlier in the transported regolith (>0.3 ppm) may be related to the anomalous concentrations of Au, W, Mo and (Fe-normalised) As and Cu occurring here.

Silver is associated with mineralisation in Zone 1 and 2 (lower regolith maximum of 15 ppm) but is not particularly useful for Au exploration since the dispersion halo is narrow and Ag is not anomalous in any regolith materials located in the top 6 m. Zinc and Cd are weakly anomalous in the upper regolith at Zones 1 and 2. Copper and Cr behave similarly to Zn and Cd but contrasts are marginally greater. Of note are weak anomalies in calcrete (>~20 ppm in Cu, 50 ppm in Cr) , coarse lag (30, 200), silcrete (50, 50) and soil (>~30 ppm for Cu only). Selenium provides a dispersion halo in the lower regolith which appears to broaden and intensify progressively to the surface. Selenite ions, derived from oxidising sulphides, are very stable and able to migrate until they are adsorbed on Fe hydroxides and oxy-hydroxides (Leutwin, 1972). Anomalies occur in upper regolith samples over Zones 1 and 2 (>~0.5 ppm). Molybdenum forms particularly broad anomalies in the lower regolith in all Zones (>200 m). Whereas no Mo anomalies occur in bluebush and lag, weakly contrasting anomalies occur in soil (>~0.5 ppm), calcrete (1 ppm), silcrete (4 ppm) and some upper regolith samples for Zones 1 and/or 2 (up to 6 ppm). The data also indicate that, like As and Cu, a weak Mo anomaly (maximum of 4 ppm) appears to be present in the upper regolith above Zone 3 that requires further investigation.

Potassium, Rb, Cs, Ba and Tl. The presence of highly anomalous K concentrations in the lower regolith in all three Zones are presumably due to the presence of mica and feldspar. Over Zone 1, anomalous K continues through the upper regolith (in sericite) to the surface, and persists in calcrete and lag but not in silcrete, soil or bluebush. Caesium, Rb and Tl substitute for K in crystal lattices and have similar distributions in the regolith. Barium is not abundant in the regolith but due to its ability to substitute for K, is also weakly anomalous in the upper regolith above Zone 1. Barium tends to persist in the regolith as relatively insoluble barite. Its presence was noted in silcrete and calcrete samples by SEM.

Tungsten. Tungsten is associated with Zone 1 mineralisation but not Zone 2 or 3. It forms a broad anomaly in silcrete (>3 ppm) and soil (>1 ppm) in the western part of the traverse, and is more specifically located over Zone 1 for bluebush (>0.4 ppm). In Zone 2, only soil is weakly anomalous. As with Au, Mo, and Fe-normalised As and Cu, a weak and displaced W anomaly occurs over Zone 3 mineralisation.

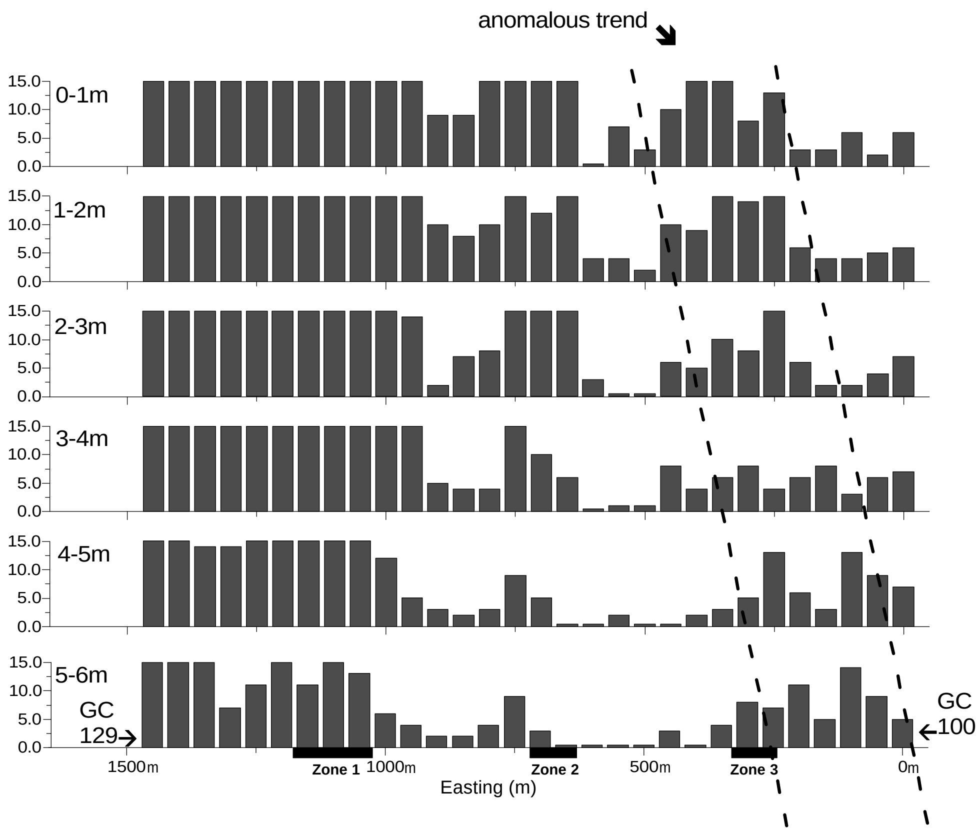


Figure 54: Gold concentrations in the upper regolith. Y axes are for concentration (ppb). Data truncated to 15 ppb. Detection limit of 1 ppb.

5.4 Distinguishing transported from *in situ* regolith using REE distributions.

Of particular importance during exploration, and evident for this study, is the need to distinguish between transported (Tertiary and/or Mesozoic) and *in situ* regolith units. The dispersion of ore-related elements from mineralisation to form dispersion haloes in the *in situ* regolith contrasts sharply with dispersion in the transported units, where the ore-related elements are orders of magnitude lower or undetectable. Consequently, it is imperative to establish the geomorphic processes, landscape regimes and/or units in order to apply the correct geochemical thresholds for the elements being sought. This is difficult to establish by field observation or by regolith landform mapping even by experienced personnel, and commonly requires stratigraphic drilling. Even then, the identification of regolith material using drill cuttings can be difficult. At Challenger, identification of the eastern transported regolith was possible to some degree after examination and logging of drill cuttings in the field and laboratory for lithorelics, rounded quartz grains and (less often) colour changes. Care was taken to be aware of the possibility of down-hole contamination. For this study, the logging procedure was assisted by the age of the drill cuttings, the fines of which had been partly removed by winnowing or rainfall.

Once the stratigraphy had been visually determined, the geochemical composition of the regolith was examined to determine whether characteristics could be used to distinguish between transported and *in situ* units. Inspection of the upper and lower regolith data indicates that the light REE (La, Ce, Eu, Nd, Pr and Sm) generally have much higher concentrations in the *in situ* regolith e.g. Ce in Figure 55, Figure 58, and Table 3. For the heavy REE (Y, Gd, Tb, Dy, Ho, Er, Tm, Yb and Lu), the contrast is present although much weaker. For the light REE, the weakest contrast between *in situ* and transported data was for the 0–1 m drill sample and suggests that this interval:

(i) contains material derived from weathered basement;
(ii) has not undergone the same weathering processes as lower intervals; or
(iii) has components that are better at concentrating the light REE compared with the deeper intervals.

The intermediate section of the regolith line (GC116 to GC112), where the sediment cover is <2 m thick, appears to be geochemically indistinct from the mainly *in situ* regolith (GC117 to GC129); this suggests that the veneer of transported material is largely derived from *in situ* units.

The light REE content of surficial regolith materials (lag, silcrete, calcrete, soil and bluebush) were examined to see whether they too could be used to discriminate *in situ* from transported material. Although the contrasts are not as great as with the upper regolith materials, the data suggest that probably silcrete and possibly calcrete could be used but that soil, vegetation and unsorted lag (fine and coarse) could not (Figure 56, Table 3). Clearly, a larger data set is required to test these observations over a broader area and establish the appropriate thresholds. There is also a possibility that Fe and Mn may play a role in concentrating a portion of these elements within oxides and oxy-hydroxides.

The analysis of Ce or other light REE in material such as calcrete could be probably performed on an aliquot of the digest liquor (*aqua regia*) currently used by exploration companies for the analysis of Au, since it may not be necessary to analyse for the total element concentration in the sample. This would reduce costs considerably but requires testing.

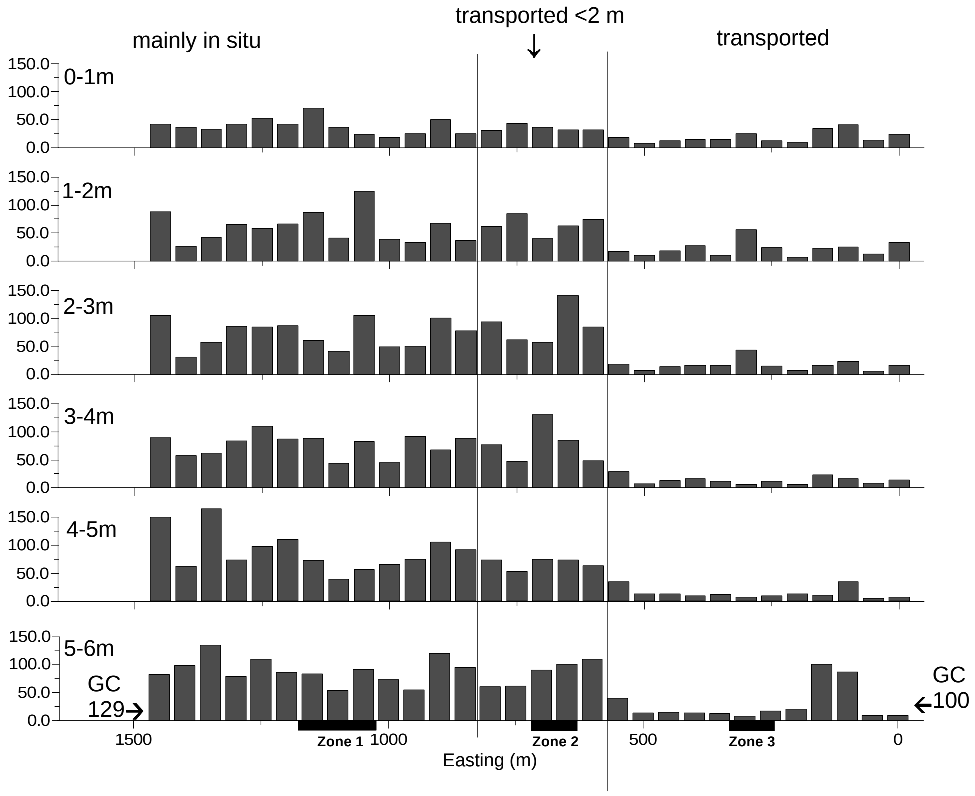


Figure 55: Cerium concentrations in the upper regolith. Y axes are for concentration (ppm).

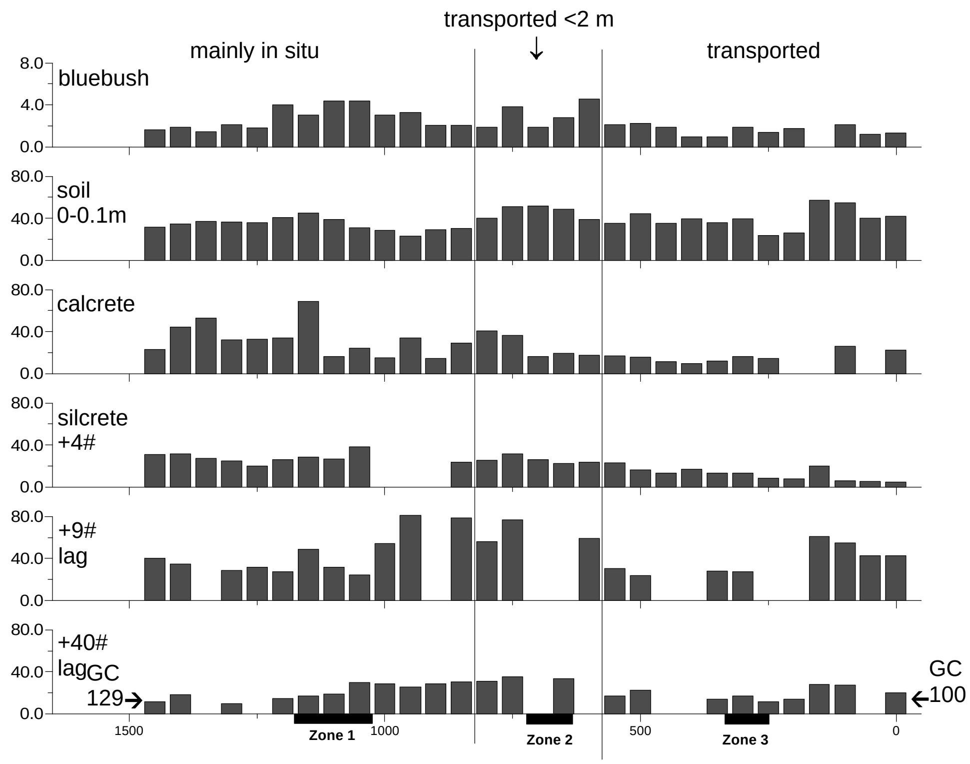


Figure 56: Cerium concentrations in surficial regolith materials. Y axes are for concentration (ppm).

Table 3: Medians of Ce data in ppm for sub-sets of *in situ*, intermediate (<2 m transported) and wholly transported units of the regolith line. Sample media in italics are not suitable as discriminators.

Regolith unit/material	*In situ*	Intermediate	Transported
0–1 m	37	32	15
1–2 m	59	63	21
2–3 m	78	84	16
3–4 m	84	77	12
4–5 m	75	73	11
5–6 m	85	90	14
calcrete	33	20	16
silcrete	27	26	14
soil (0–10 cm)	*35*	*49*	*40*
bluebush	*2.1*	*2.8*	*1.8*
coarse lag (plus 9#)	*35*	*59*	*37*
fine lag (plus 40#)	*19*	*34*	*17*

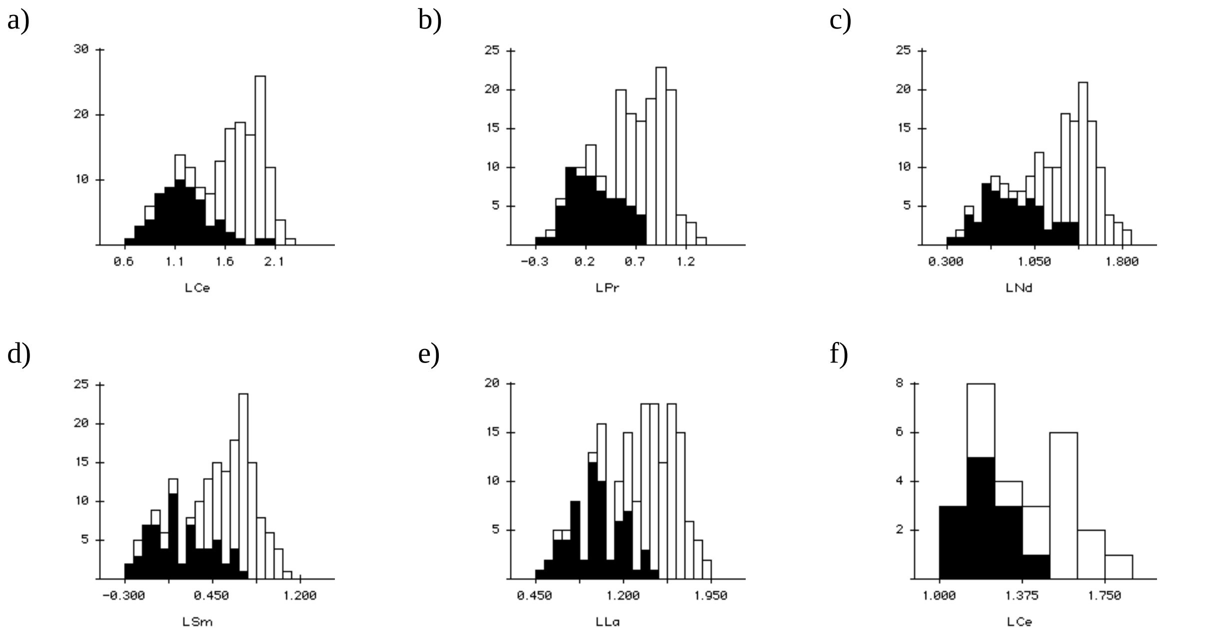


Figure 57: Histograms (log transformed data) of selected light REE for upper regolith (a–e) and calcrete (f) samples: a) Ce (06 m); b) Pr; c) Nd; d) Sm; e) La; and f) Ce (calcrete). Blacked data are for transported material.

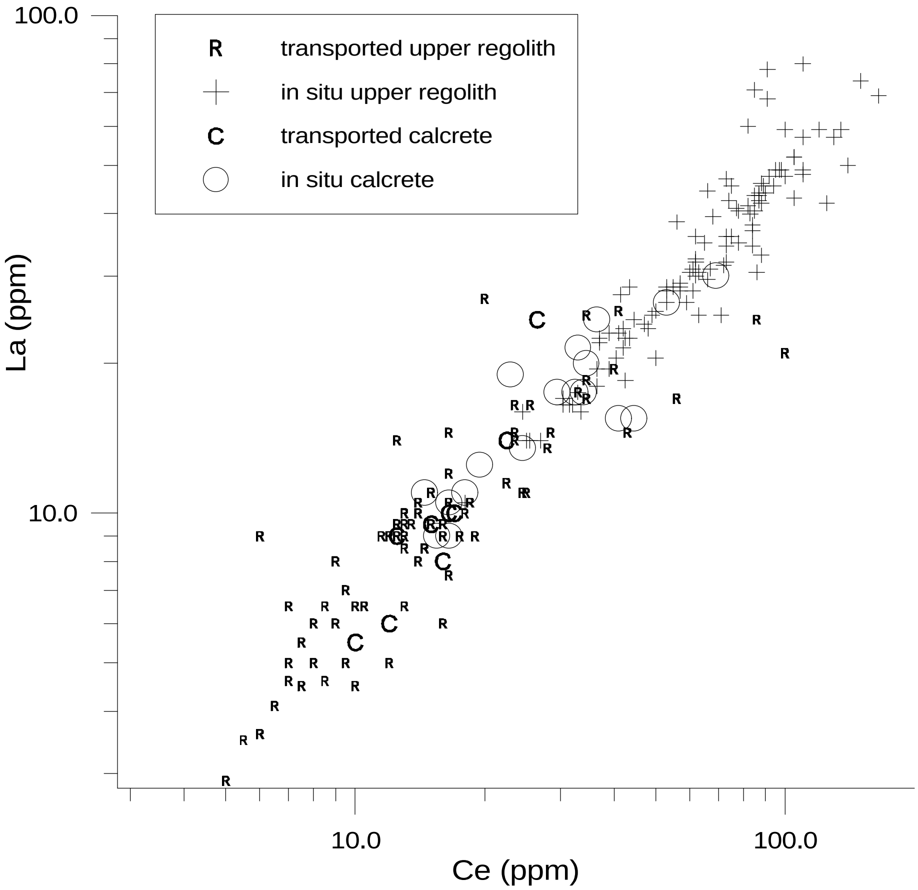


Figure 58: Cerium vs La in calcretes and upper regolith materials for transported and *in situ* regolith.

6. REGOLITH SAMPLE MEDIA

6.1 Calcrete

6.1.1 Introduction

The Challenger Gold Deposit was the first of the "new generation" discoveries (i.e. post "South Australian Exploration Initiative" (SAEI) initiated by the South Australian Government) to be located with a combination of MESA's bedrock drilling, the new SAEI aeromagnetic data and application of the "calcrete-Au association". The latter had been earlier recognised by CSIRO in Western Australia (Lintern, 1989; Lintern and Butt, 1993; Edgecombe, 1997). Calcrete has been routinely used as a sample medium by companies within the Au exploration industry for about 7 years in WA and, 4 years in SA. During this time, several Au deposits have been discovered and several have been mined in Western Australia. As Au-in-calcrete sampling has now been (i) adopted as a standard technique in southern Australia and in other parts of the world (Lintern, 1997), and (ii) shown to be very effective at delineating mineralisation at Challenger, it is useful to treat it as an industry benchmark and review how it compares against the other industry standard techniques of lag, drill cutting, soil and vegetation sampling used in this study.

6.1.2 Calcrete at Challenger

Comparison of Au data from calcretes with 0–1 m drill cuttings indicate that there is good agreement and similar concentrations between the two sample media (Figure 59). Normalising the data with respect to Ca has little effect on improving the relationship but does highlight a 0–1 m sample at Zone 2 which intersects mineralisation but is relatively poor in Ca. Gold contents in other sample media demonstrate some agreement with those in calcrete, but are generally an order of magnitude lower, with many analyses below detection (Figure 59).

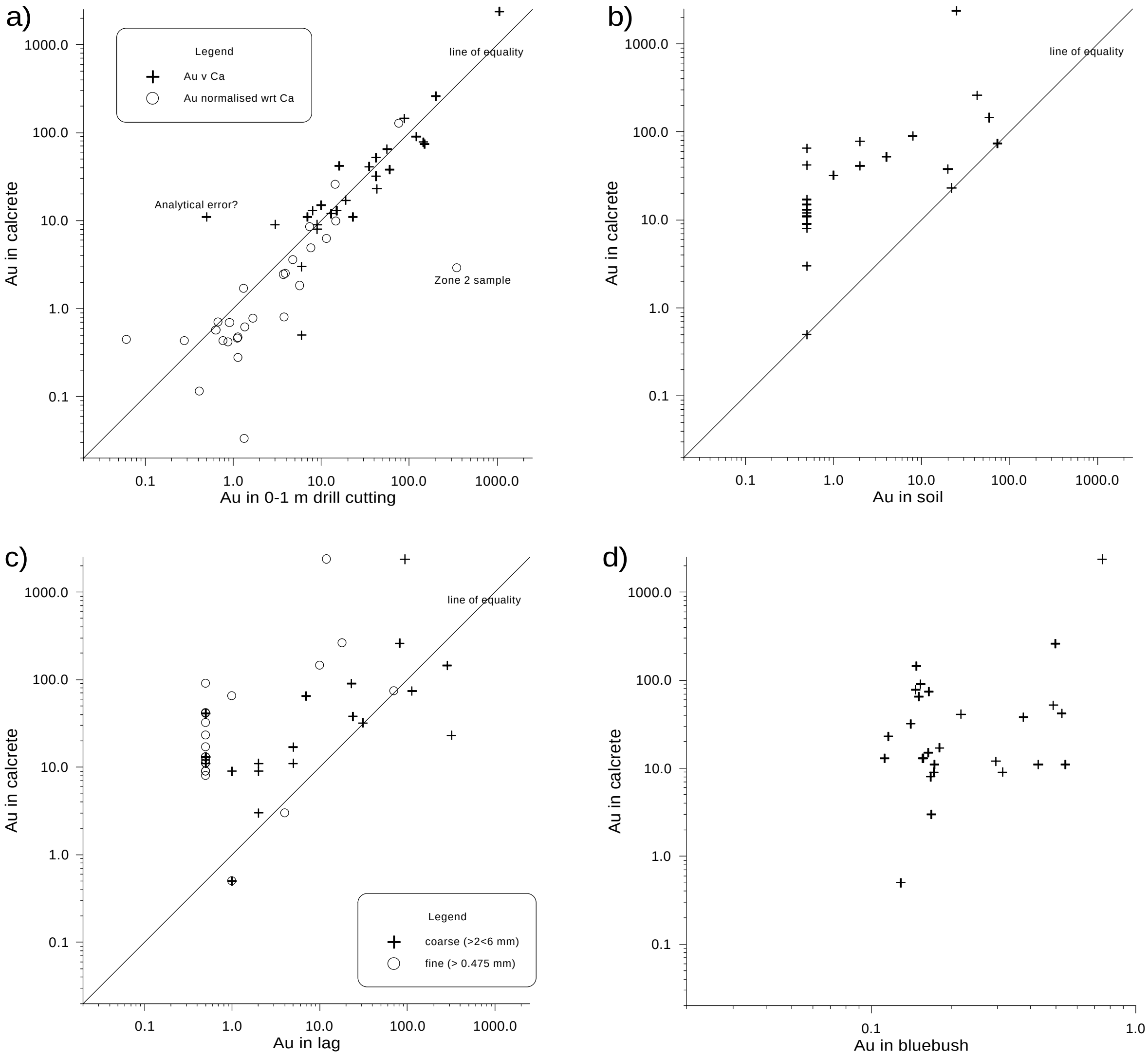


Figure 59: Gold in calcrete versus a) 0–1 m drill cuttings (normalised and un-normalised with respect to Ca), b) soil, c) lag and d) bluebush. Concentrations in ppb.

The large variation in Au content in lag and soil probably reflect the size and randomness of the Au particles contained therein (nugget effect). Calcrete and 0–1 m samples are both carbonate-rich media and some of the Au here is undoubtedly present as a mobile chemical species that has been locally dispersed and then encapsulated within the calcrete, thus providing anomalies that are both coherent and sourced to mineralisation. Subtle effects of the topography will presumably determine local transportation routes and sinks for both the chemically re-worked and mechanically-dispersed Au. Mapping the regolith landforms and determining position within the landscape is extremely important since it will determine the usefulness of, and the application of appropriate thresholds for, sample media. The comparisons here suggest that after calcrete, drill cuttings, soil, lag, and then vegetation should be used for *in situ* regolith as the preferred sample medium.

6.1.3 Calcrete analysis

As with any analytical technique, variation of precision for an element determination increases the closer to the theoretical detection limit. There may be large analytical errors associated with low concentrations of Au (say <10 ppb) if analysed by the standard 1 ppb detection limit procedure rather than a lower detection method (Figure 60; Table 4). We recommended that calcrete samples are analysed using a technique with a detection limit at least an order of magnitude lower than the concentration of interest e.g. if using a 5 ppb lower contour interval for visualising geochemical data then this element should be analysed by a technique with a detection limit <0.5 ppb. Techniques such as graphite furnace AAS (following *aqua regia* digest and solvent extraction) and ICP-MS (following cyanide or diluted acid digest) would provide suitable data.

We recommended that calcrete analyses should include Au, Cu and As. This study indicates that Au is by far the best indicator for mineralisation for the "mine scale". Other elements may be determined, as listed in Table 2. Anomaly thresholds are not given because a larger data set is required. In addition, thresholds should be calculated and adjusted to suit a number of factors including regolith setting (including slope), mineralisation style, depth of transported material and proximity to known mineralisation. Light REEs concentrations in calcrete may be useful in regolith landform classification but requires further testing.

6.1.4 Terminology, forms and occurrence

The definition of calcrete (pedogenic carbonate) follows that of Goudie (1972), Milnes and Hutton (1983), Lintern (1997) and Anand *et al*. (1997, 1998). Calcrete represents a range of carbonate accumulations that have developed either in soil profiles or directly over and within subsoil materials. The mineralogy is dominantly calcite-rich with dolomitic forms usually subordinate with variations both laterally and vertically occurring. Pedogenic carbonate may precipitate in regoliths where the average annual rainfall is less than about 600 mm and forms in unsaturated (vadose) soil horizons. It occurs in many forms (e.g. massive duricrusts, laminated duricrusts, nodules, pisoliths, coatings, rhizomorphs and earthy segregations) within soils, transported materials and saprolite. Its formation arises from a source of carbonate (proximal or distal) in combination with specific geological, pedological, geomorphological and environmental conditions. It is wide spread in southern semi-arid to arid parts of Australia including the Gawler Craton. Controversy still surrounds the source of calcrete in the Gawler Craton, with some believing it is principally of marine origin via meteoric or aeolian mechanisms, while others believe it is locally sourced from the weathering of Ca-rich rocks. Future isotope work that PIRSA and CRC LEME have planned may help to resolve this question. Around Kalgoorlie, calcrete is dispersed within the top 2 metres of the profile where it is commonly present in a powdery form and as thin coatings on country rock and other components of the soil. A power auger has been found to be the most economically viable method for sampling this type of material. In SA, where calcretes are more prevalent and are usually indurated and present as nodules and blocks close to the surface, a technique whereby this material is hand-collected using a spade then sieved has been developed by exploration companies (Wills, 1997).

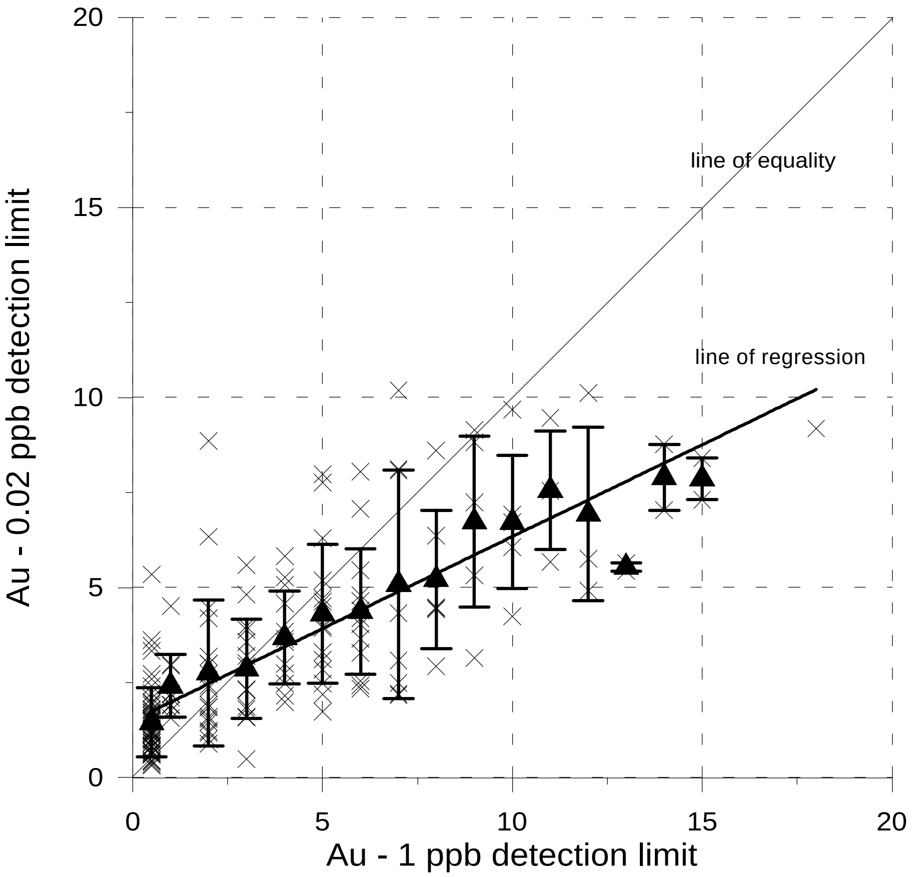


Figure 60: Duplicate samples analysed by two Au analysis methods. Gold at 1 ppb detection analysed by GFAAS after aqua regia digest. Gold at 0.02 ppb detection analysed by INAA after preconcentration on to carbon after cyanide digest. Standard deviations are as error bars.

Table 4: Tabulated data of sets of duplicate samples analysed by two Au analysis methods. Data displayed graphically in Figure 60.

	number of duplicates (n)	mean	standard deviation	% relative standard deviation	minimum	maximum
Au (1 ppb detection)	Au (0.02 ppb detection)					
<1	57	1.4	0.9	62.8	0.3	5.3
1	10	2.4	0.8	34.3	1.6	4.5
2	20	2.8	1.9	69.8	0.9	8.8
3	15	2.9	1.3	45.7	0.5	5.6
4	12	3.7	1.2	33.2	2.0	5.8
5	15	4.3	1.8	42.2	1.7	8.0
6	14	4.8	2.2	46.7	2.3	10.6
7	9	5.9	3.6	61.8	2.2	12.3
8	7	6.2	2.9	47.4	2.9	12.1
9	5	6.7	2.2	33.4	3.1	9.1
10	6	7.7	2.7	34.8	4.2	12.4

6.2 Silcrete

6.2.1 Silcrete at Challenger

This research has documented for the first time that silcrete can be used as an exploration sample medium for Au. Examination of the samples from the soil pits shows a probable genetic relationship between quartz-rich silcrete lag, saprolite and quartz veining associated with mineralisation, and explains the occurrence of Au and other elements in silcrete associated with mineralisation (e.g. As, Ag and Bi). However, although the Challenger area is liberally covered in silcrete lag, it is still not as an effective sample medium as calcrete, since contrasts and absolute concentrations are lower and, as shown at Zone 2, are often close to detection limits. In this respect, it is probably no better than soil as a sample medium. Our results suggest that where calcrete is absent, silcrete lag or soil may be used, with caution, as an alternative surficial sample medium although the sampling density needs to be further tested.

In the transported unit, non-precious opal (potch) is present. Common opal may be considered as a pathfinder or indicator of precious opal hence it is suggested that the exploration license conditions for the Challenger area EL be changed to include precious opal. Notification was made to the Adelaide management of GJV about this discovery (June 1997) and its implications (verbal communication, M.J. Sheard, August 1997), as this matter relates to the South Australian State Mining Legislation and tenement activities. Action should be taken to minimise any problems with uninvited opal miners prospecting in an uncontrolled way over the Challenger area which is outside of any of the Proclaimed Precious Stones Fields. The potential for precious opal in this area has not been investigated. The study suggests that either Tertiary cover sequences or their margins may be important for the development of conditions suitable for opal formation. The presence of opaline material could be easily detected in drill cuttings and it is recommended that appropriate regolith settings similar to those found at Challenger are explored for opal.

6.2.2 Terminology

There is a wide divergence of opinions on what is meant by the term silcrete, the varieties and their genesis. Silcrete has been widely mapped in South Australia since the 1960s and appears with a lithotype designation or as a host rock overprint symbol on many state geological maps. The following discussion is provided as a guide to terminology, occurrence and genesis.

The term silcrete was coined by Lamplugh (1902, British occurrences) and later refined by Lamplugh (1907, for African occurrences) - "silicified rocks of the greywether type; *i.e*. silicified sandstones and conglomerates" - mostly of a surficial nature, and later to include "extensive bands of ... hard sandstone or quartzite ... knit together by chalcedonic cement". Williamson (1957) first used silcrete terminology for Australian equivalents to African silcretes and numerous authors have since refined its definition and application here, including use of the interchangeable term 'siliceous duricrust' (Langford-Smith, 1978; Thiry and Milnes, 1991; Benbow *et al*., 1995). There are two broad classes of silcretes; those that form within the soil profile by silica ($\pm$ TiO_2) precipitation with pedogenic processes (pedogenic silcrete) and those that form due to silica deposition from groundwater (groundwater silcrete). Silcretes are silicified host materials that retain the properties of the precursor (c.f. calcrete), diluted by added silica and modified by the processes that accompanied the silica ($\pm$ TiO_2) precipitation.

6.2.3 Pedogenic silcrete

Pedogenic silcrete forms at or near the land surface, within the soil profile by chemical leaching, mineral modification and geopetal processes. In general, pedogenic silcretes may display diagnostic features in their upper portions that are consistent with slope and soil leaching processes. These include: nodules (3-30 cm), pisoliths (5-30 mm), concretions or concretionary-laminated over growths, forms like dripping candle wax, and columnar bodies with internal structures (draped banding), silica-cemented rounded silcrete clasts, silcrete breccias, hyaline silica and/or opal overgrowths, cutans, veins and blobs-patches; strongly segregated silica-titania (anatase or leucoxene) and resistate, non-quartz minerals such as zircon and monazite. Many pedogenic silcretes have high values of Ti (1-15%), Zr (>2,000 ppm), Nb (>25 ppm) and Y (>5 ppm); some pedogenic silcretes can contain titania in excess of 50% Ti (Hutton *et al.*, 1978; Thiry and Milnes, 1991). A complex silica deposition scenario is advanced by Thiry and Milnes (1991) whose model is driven by cyclic seasonal wet and dry periods, leaching silica in low concentrations (SiO_2 ≅6 ppm) with deposition by evaporative concentration. Silica varieties found within these rocks include isotropic banded to non-banded chalcedony and opal, porcelanite (turbid non-vitreous opal and silicified silt/clay), microcrystalline chalcedony and microcrystalline-lined voids (micro- and macro-sized).

Pedogenic silcretes indicate that a strong vertical leaching of silica has occurred through the profile. Commonly the resultant silcrete segregations and concretions (nodules, pisoliths etc) exhibit similar analogues to those observed in calcrete and lateritic profiles. It is common to find the more isotropic opaline silica forms deeper in the profile nearer the silica leach front than the more crystalline chalcedonic forms (Thiry and Milnes, 1991). Colours range from pale to dark grey to pale yellowish to pale brown. Other brighter or stronger colours and mottling occur where oxides/oxyhydroxides of Fe are significant (e.g. red, yellow, rich brown) or when mottled palaeosols have been silicified (Wopfner, 1978; Preiss *et al.*, in prep). Where thick enough and on exposure these silcrete profiles can form bouldery to blocky outcrop and cappings to breakaways, plateaus, mesas and buttes. Thick silcrete profiles may also be strongly block-jointed.

6.2.4 Groundwater silcrete

Groundwater silcretes are massive and tend to form in clast-supported granular to sandy materials. Silica cements the intergrain voids and forms grain overgrowths with cryptocrystalline quartz that binds the grains well enough to form a very hard, but extremely brittle rock. This usually breaks on impact or by point applied pressure with a conchoidal fracture where the fractures propagate across cemented grains rather than around them. According to Hutton *et al.*, (1978) and Thiry and Milnes (1991) these silcretes are usually dominantly SiO_2 and have low values of Ti (<1%), Zr (<1,000 ppm) and Nb (<20 ppm). They also demonstrate that silica mobility in the groundwater can be promoted by an acid environment (low pH) leading to leaching out of aluminous fines and the deposition of silica cutans when silica saturation was achieved (SiO_2 ≅120 ppm). Further evidence for acidic solutions comes from the extremely detailed silicified plant leaf impression assemblages e.g., Stuart Creek (Rowett, 1997a, b; White, 1994). The entrapped sand grains usually appear to be unaltered by silicification, which has commonly preserved sedimentary structures and fossils, including trace fossils. Groundwater silcrete horizons appear to reflect palaeo-groundwater tables and/or porosity barriers (Krieg *et al*., 1991, page 40 and figure 9). Callen (1983, p. 395) and (Benbow *et al*., 1995, p. 206 and figure 10.40) demonstrate gradational transition between pedogenic and groundwater silcrete forms with palaeo-landscape catena and depth. On exposure to weathering these massive rocks can become jointed and slab-blocky.

6.2.5 Silcreting events in South Australia

There are two major silicification events recognised in South Australia, both yielded significant and wide spread thick siliceous duricrusts or silcretes (Benbow *et al*., 1995). The older silcrete known and mapped as the Cordillo Silcrete (Wopfner, 1974, 1978) has affected mid-Eocene to ?Oligocene and older sediments, the younger silcrete has affected mid- to late Miocene to Pliocene and older sediments (Benbow *et al*., 1995). Radiometric dating by Bird and Chivas (1989) using K/Ar methods on silcrete from the Coober Pedy area, has provided an age range of mid- to late Miocene. These two major silicification events can only be easily observed where separated by fortuitous sedimentary processes. Where no such sedimentation intervenes then repeated silicification events can overprint the landsurface profile and usually make it more difficult to distinguish between single events.

6.3 Ferruginous materials

That there are only small quantities of ferruginous surface material in the form of granules, saprolite or nodules reflect the low Fe content of the regolith or bedrock from which they were derived. Ferruginous material was not specifically collected along the regolith line, but was included as part of the unsorted lag sample. The richest area for Fe nodules was from near the centre of the line, where Fe concentrations averaging 24% suggest that Fe oxide materials comprise about a third of the total mass of lag collected. However, over mineralisation, and for most of the regolith line, Fe oxide contents were <10% of the sample. Normalising with respect to Fe for lag had a strong positive effect on anomaly definition for elements such as As and Cu. Coarse ferruginous material (some as lithic nodules) was sorted from bulk lag and analysed separately; the maximum Au concentration was 1300 ppb. Clearly, there is some scope for further investigation of the different types of Fe-rich materials and their pathfinder element contents although, as with silcrete, calcrete appears to provide a far better sample medium for Au in this area. We recommended that ferruginous materials are investigated in greater detail as an exploration sample medium.

6.4 Gypsum

Gypsum was identified in several drill cutting samples and appears to be associated with mineralisation possibly derived from sulphide weathering processes. Two factors reduce the usefulness of gypsum as a sample medium. Firstly, surface materials are not particularly anomalous in S and secondly, gypsum is a common mineral associated with evaporite deposits. We recommended that isotopic studies be conducted on samples containing gypsum to ascertain whether they are related to sulphide weathering.

7. REGOLITH EVOLUTION

Regional mapping and drilling programs by MESA over the last 25 years have established a stratigraphic framework for this area which is now being refined by detailed company exploration and drilling. Evidence to date indicates that following Archaean to Proterozoic deformation and intrusion, this area was exhumed by erosion during the Neoproterozoic to late Palaeozoic. Permian glaciation stripped away any pre-existing weathering profiles (Drexel *et al*., 1993, Drexel and Preiss, 1995). Thus, all weathering profiles preserved in the area will post date that glaciation.

A widely occurring deep weathering event that probably equates to the deeply weathered basement profile at Challenger is the Bopeechee Regolith - a palaeo-landsurface of deep (kaolinitic) weathering, mapped by and defined by Krieg *et al*. (1991), Sheard (1996), Sheard, Reid and White (1996), Preiss *et al*. (in prep.) and Sheard (in prep.). The Bopeechee Regolith weathering event has been shown by Rogers and Freeman (1996) to have affected the Latest Permian sediments in the Peake and Denison Ranges on WARRINA. Additional stratigraphic relationships from the edge of the Eromanga Basin at the northern end of the Flinders Ranges indicate that this deep weathering continued into the latest Jurassic and even possibly into the earliest Cretaceous (Sheard, in prep; Sheard *et al.*, 1996; Preiss *et al*., in prep.). Observations during 1996-97 of deeply weathered profiles (outcrop and excavation) at several widely spaced Western Gawler Craton sites supports this hypothesis. Therefore a significant period of landscape stability occurred throughout most of the continental Australian Mesozoic, where deep chemical weathering predominated, yielding leached kaolinitic profiles to depths of >50 m. Thick sedimentary units like the kaolin-rich Jurassic Algebuckina Sandstone are derived for their most part from this regionally weathered landscape. The Jurassic was largely a cool arid time, Australia and Antarctica were then near latitudes 75-50^{o} S (White, 1993, page 159; Krieg, 1995, figure 9.3) and the derived terrigenous sediments were dominated by aeolian and subordinate fluvial processes. Cretaceous times were cool, wetter and dominated by fluvial-paludal sedimentation (Sheard, 1990; Frakes and Francis, 1988), culminating with the marine transgression of the Early Cretaceous Cadna-Owie Formation (Klc) and later Bulldog Shale (Kmb). The latter formation has been mapped in outcrop only 3.5 km west of the Challenger Deposit (Figure 2).

Early Tertiary times were warmer and initially wet, with (i) terrigenous fluvial deposits dominating and (ii) with the establishment of large palaeochannels transecting large parts the continent including South Australia (Alley and Lindsay, 1995; White, 1994). Australia was then separating or had separated from Antarctica and was moving north to latitudes ~60–40^{o}S. A characteristic of these deposits is mature quartz-rich gravels and sands with minimal silt and clay fines. These deposits range in time from Palaeocene to Pliocene. At Challenger, near regolith hole GC104, a piece of silicified tree branch was collected by V. Stamoulis (MESA) as float from an outcrop of silicified palaeochannel sands (Plate 4). Rowett (1997b, and Appendix 10) has identified the wood as deriving from a conifer, a member of the Podocarpaceae, with a possible affinity to the genus *Phyllocladus*. A time range for this genus along with other palynological evidence in this region would suggest a latest Eocene to Late Miocene age.

As previously stated there are two major silicification events recognised in South Australia. The older Cordillo Silcrete has affected Eocene and older sediments and the younger silcrete has affected Miocene to Pliocene and older sediments. At Challenger, there is evidence that the first silcrete has been disrupted by mostly mechanical (colluvial) surface processes and some minor fluvial activity. The second (Miocene to Pliocene) silicification event then re-cemented the first generation silcrete scree-talus and colluvium into complex breccias. A consequence of this event may have been to promote further weathering and leaching of the regolith and deepen the silicification front of the Cordillo Silcrete.

Low level erosion with limited colluvial to alluvial deposition followed Tertiary silicification, and this has continued sporadically through to today. Deposits relating to this activity form stony alluvial plains that consist of thin surficial to near-surface pebbly clays and pebbly sandy clays. During the Mid- to Late Quaternary, orange siliceous sand was blown eastwards from the Eucla Basin to form a large dune field containing a myriad of ~E-W oriented linear dunes. Some of these cross the Challenger area where they form thin sand spreads.

The introduction of carbonate, leading to the development of calcretes, appears to be a late feature in the Gawler Craton although there is some carbonate cementation of palaeochannel materials and silicified equivalents below the main Quaternary calcrete front at the eastern end of the regolith line. These carbonates have been recognised nearby at the Birthday Prospect (Lintern and Sheard, 1997) and are probably Late Tertiary or Early Quaternary. Stratigraphic evidence from elsewhere in South Australia suggests that the latest introduction of carbonate has occurred in cycles relating to a series of glacial maxima during the Late Quaternary (Belperio, 1995; Sheard, 1995). Calcrete development within the dune sands is more subdued than in the substrate on which they sit. This could be ascribed to porosity-texture contrasts, or to the Late Quaternary carbonate flux being swamped by aeolian sand, or cyclic carbonate influx with the last cycle being relatively weak, or simply that the dunes are relatively young.

8. SUMMARY AND RECOMMENDATIONS

1. The geochemical study was undertaken along a 1.5 km “regolith line” that traversed mineralisation at Challenger. Mineralisation virtually outcrops in two Zones (1 and 2) along the regolith line. A geochemically anomalous area at the far western end of the line requires more investigation. Further investigations are also required at Zone 3, located beneath approximately 20 m of palaeochannel sediments, to test whether anomalous geochemistry in drill cuttings of Au, Bi, W, Mo and Fe-normalised elements (e.g. Cu and As) in the upper regolith are related to mineralisation.

2. The regolith line can be divided into two units, *in situ* and transported. The *in situ* unit consists of Archaean basement rocks deeply weathered to saprolite. The transported unit consists of mainly fluvial deposits (up to 25 m thick) of presumed Tertiary age. Exploration strategies should be different for each unit due to their quite dissimilar genesis, mineralogy and geochemical signatures.

3. Calcrete is recommended by far as the best sample medium for Au exploration in the *in situ* unit providing broad, high-contrast anomalies. Gold is by far the superior element to analyse for in calcrete but Cu and As are also useful. Drill cuttings, silcrete, soil, lag and vegetation are alternative sample media that could be used in transported units with caution and more research.

4. Silcrete lag has been demonstrated for the first time to be an alternative sample medium for Au for *in situ* regolith. In areas where calcrete is absent, silcrete or soil are recommended as possible surficial sampling media.

5. The following elements were shown to be associated with mineralisation: Ag, As, Bi, Cd, Cr, Cs, Cu, Fe, K, Mo, Rb, S, Se, Tl, W and Zn. The use of these elements as pathfinders depends on the sample medium to be used and the regolith setting.

6. Distinguishing between transported and *in situ* regolith has been demonstrated to be important from the geochemical sampling perspective. The light REE (Ce, La, Pr, Sm and Nd) appear to be able to discriminate between transported and *in situ* regolith. Further investigations are required to test whether calcretes can be used *in lieu* of drill cuttings. To further assist in the discrimination between transported and *in situ* regoliths, the use of the Portable Infra-red Mineral Analyzer (PIMA) should be appraised.

7. Gypsum is associated with mineralisation in the weathered *in situ* upper regolith. Isotope studies are underway to determine the origin of the S.

8. Surficial ferruginous materials, although not common, require further investigation as sample media since some contain high concentrations of Au.

9. It is recommended that samples are analysed using a detection limit technique at least an order of magnitude lower than the concentration of interest. For example, when using 5 ppb data for contouring geochemical data, then a technique with a detection limit <0.5 ppb is required.

10. Induration of the upper regolith by silica and carbonate cements has yielded silcrete, calcrete and calcreted silcrete to depths of 2–3 m in the Challenger area. These materials carry the geochemical signatures of mineralisation that so many explorers are now using.

11. Non-precious opal (potch) was identified in siliceous palaeochannel materials. Although precious opal was not encountered, there is a high potential for precious opal to occur in this environment. It is recommended that appropriate regolith settings similar to those found at Challenger are explored for opal. To avoid any problems with uninvited opal miners prospecting in an uncontrolled way over the Challenger area, steps to alter the conditions of the EL and MLs should be made as this area is outside of any of the Proclaimed Precious Stones Fields.

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REGOLITH STUDIES RELATED TO THE CHALLENGER GOLD DEPOSIT, GAWLER CRATON, SOUTH AUSTRALIA

Geochemistry and stratigraphy of the Challenger Gold Deposit
Volume 2: Appendices

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LIST OF APPENDICES

APPENDIX 1

Appendix 1: Graphed elemental abundances for upper regolith (0–6 m)

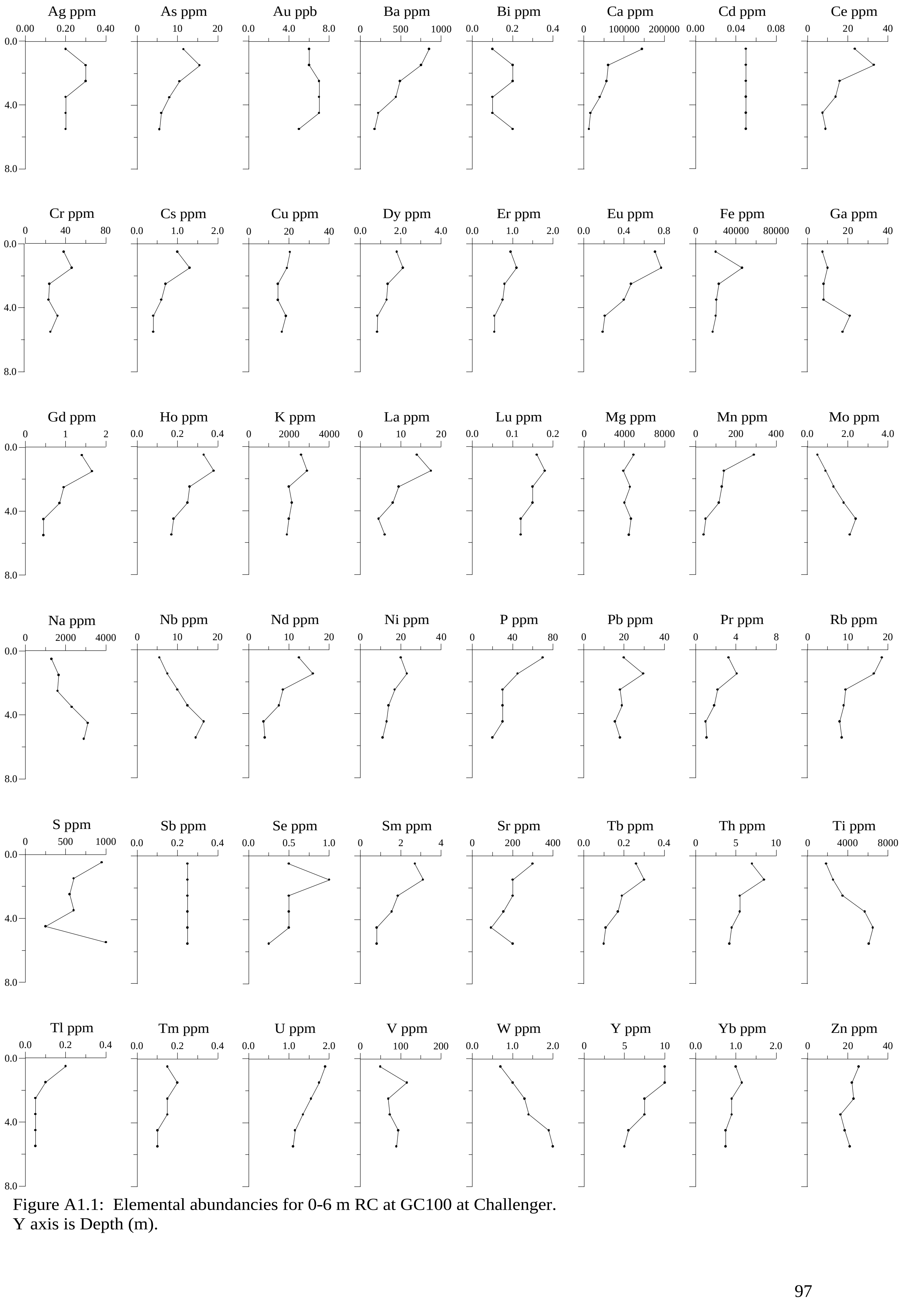

Figure A1.1: Elemental abundancies for 0-6 m RC at GC100 at Challenger.
Y axis is Depth (m).

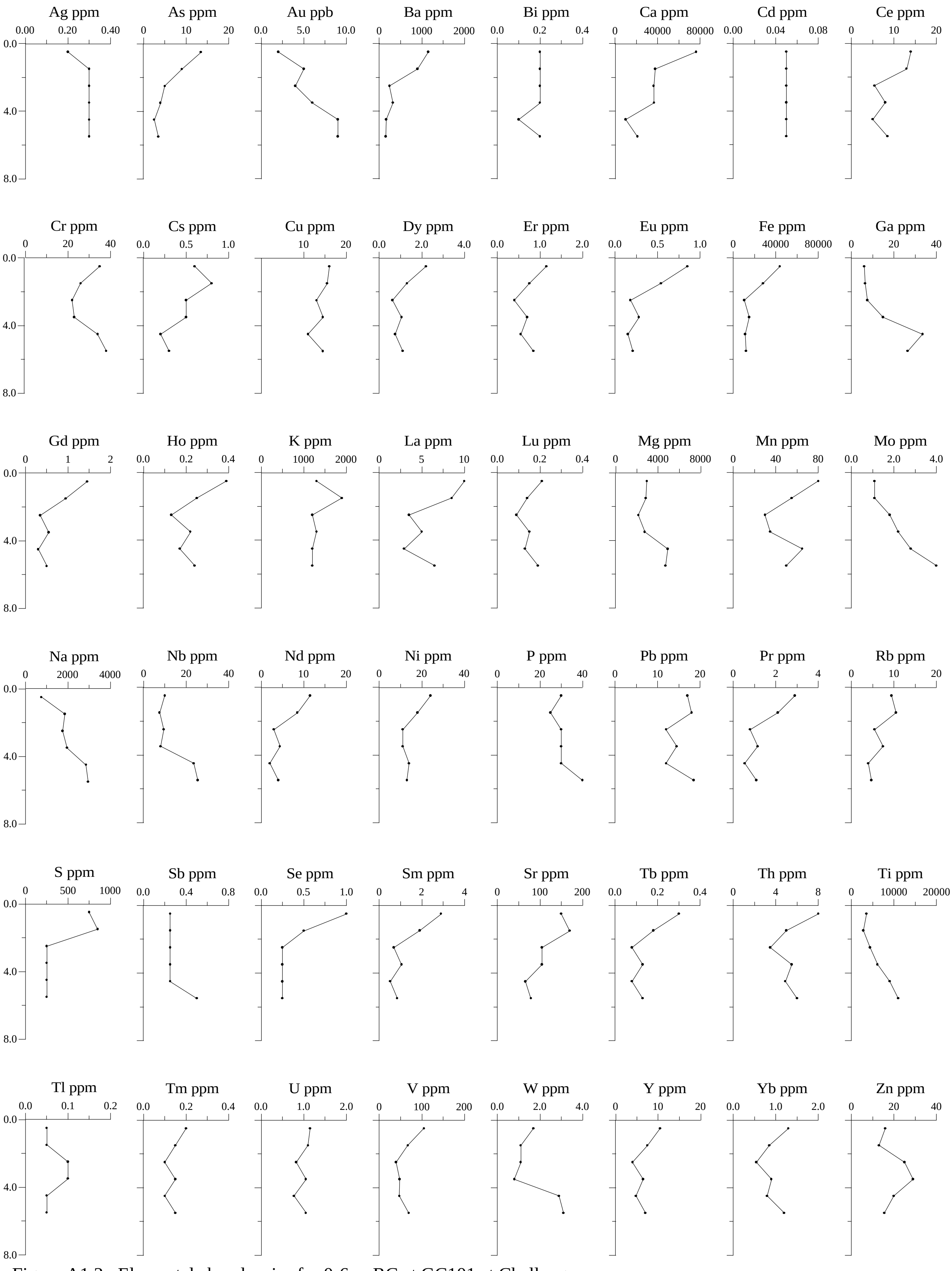

Figure A1.2: Elemental abundancies for 0-6 m RC at GC101 at Challenger.
Y axis is Depth (m).

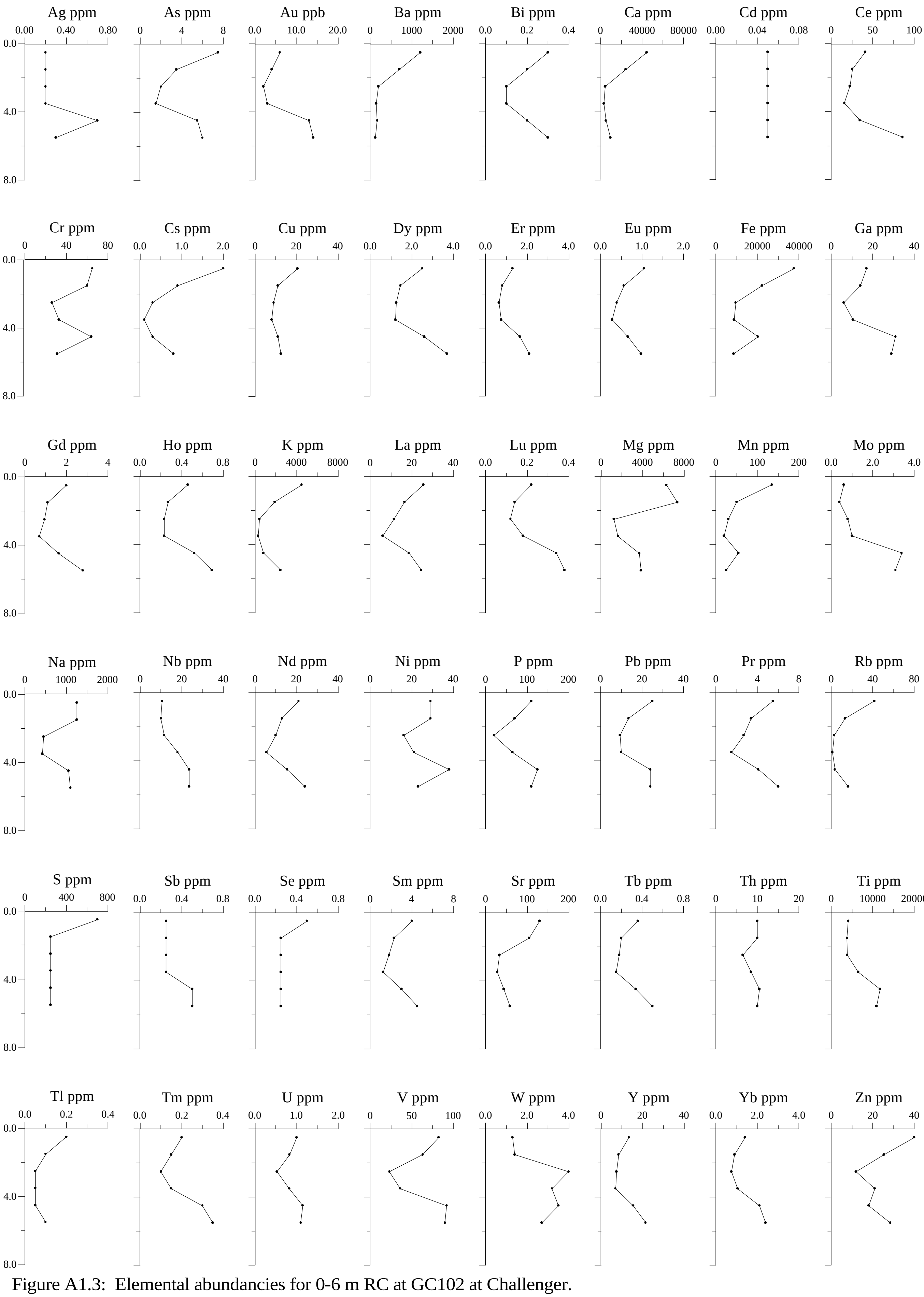

Figure A1.3: Elemental abundancies for 0-6 m RC at GC102 at Challenger.
Y axis is Depth (m).

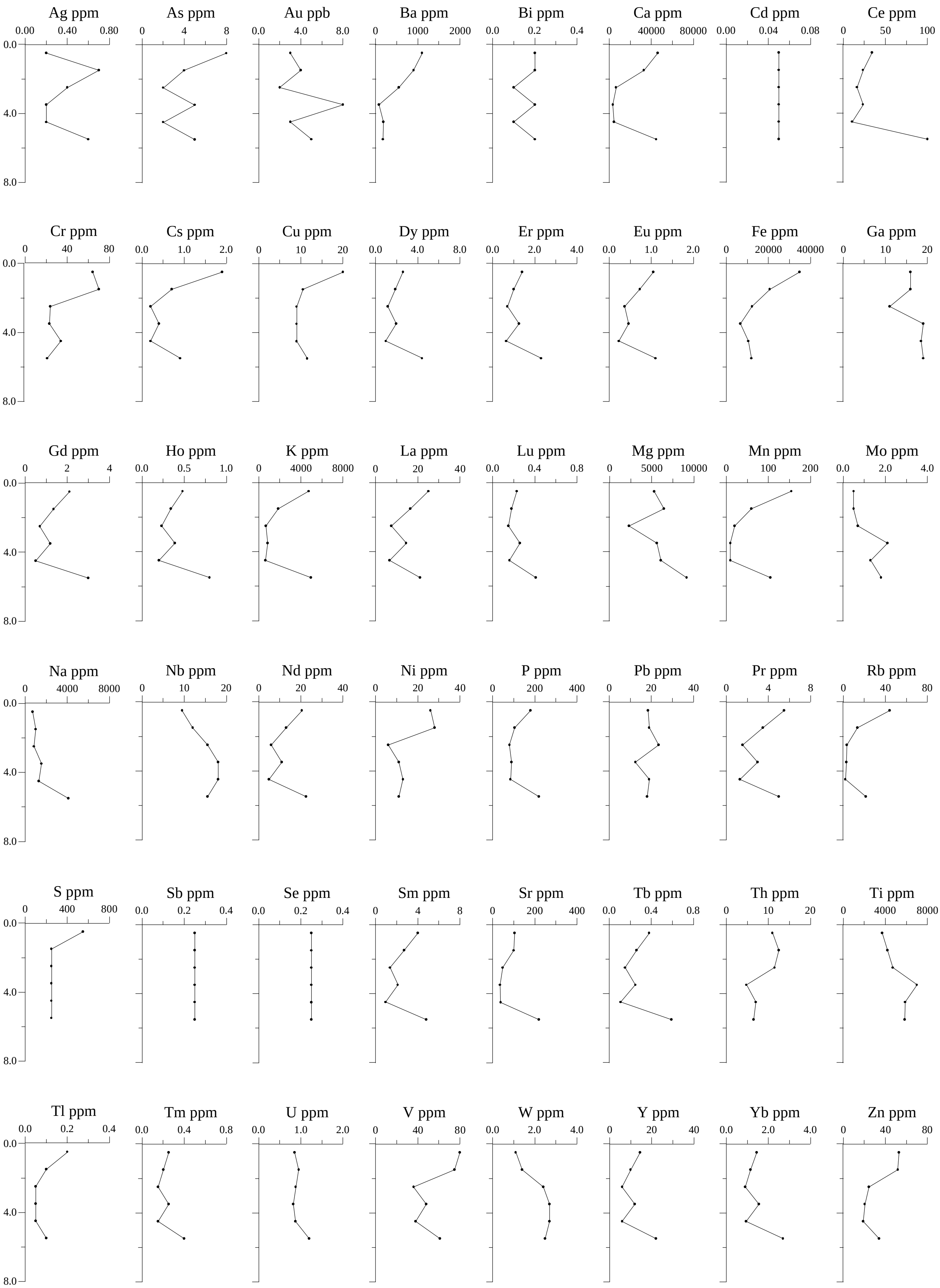

Figure A1.4: Elemental abundancies for 0-6 m RC at GC103 at Challenger.
Y axis is Depth (m).

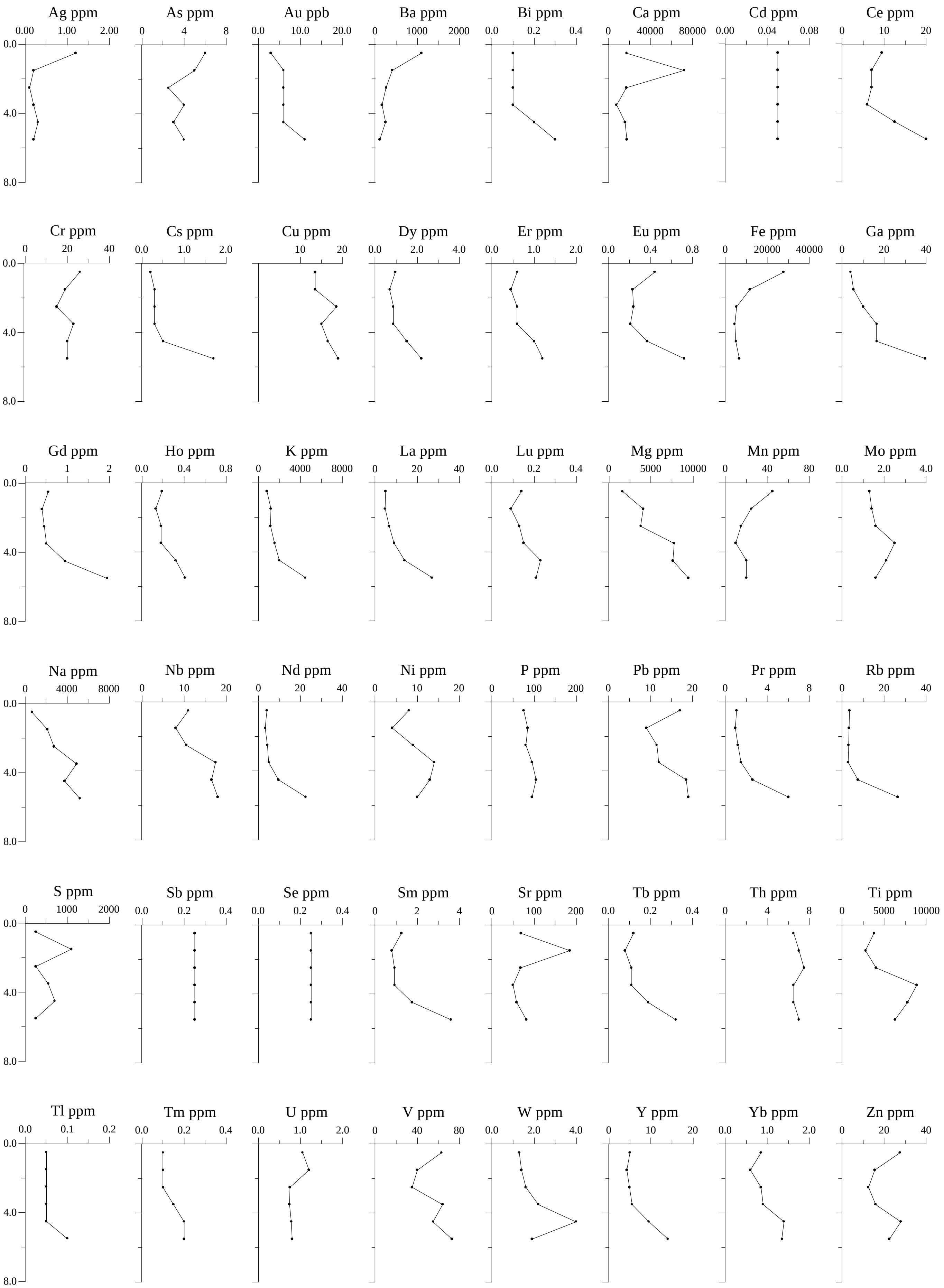

Figure A1.5: Elemental abundancies for 0-6 m RC at GC104 at Challenger.
Y axis is Depth (m).

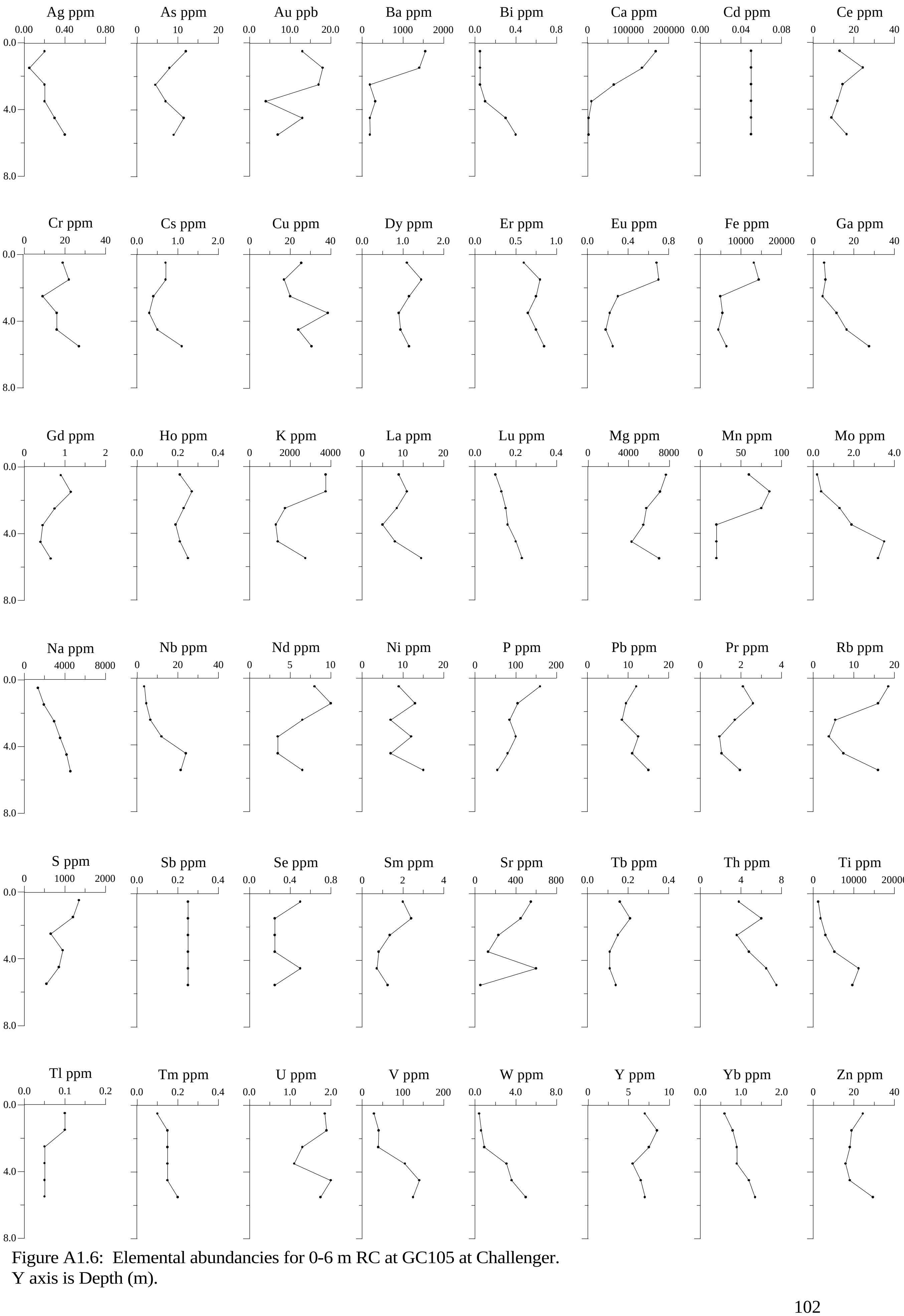

Figure A1.6: Elemental abundancies for 0-6 m RC at GC105 at Challenger.
Y axis is Depth (m).

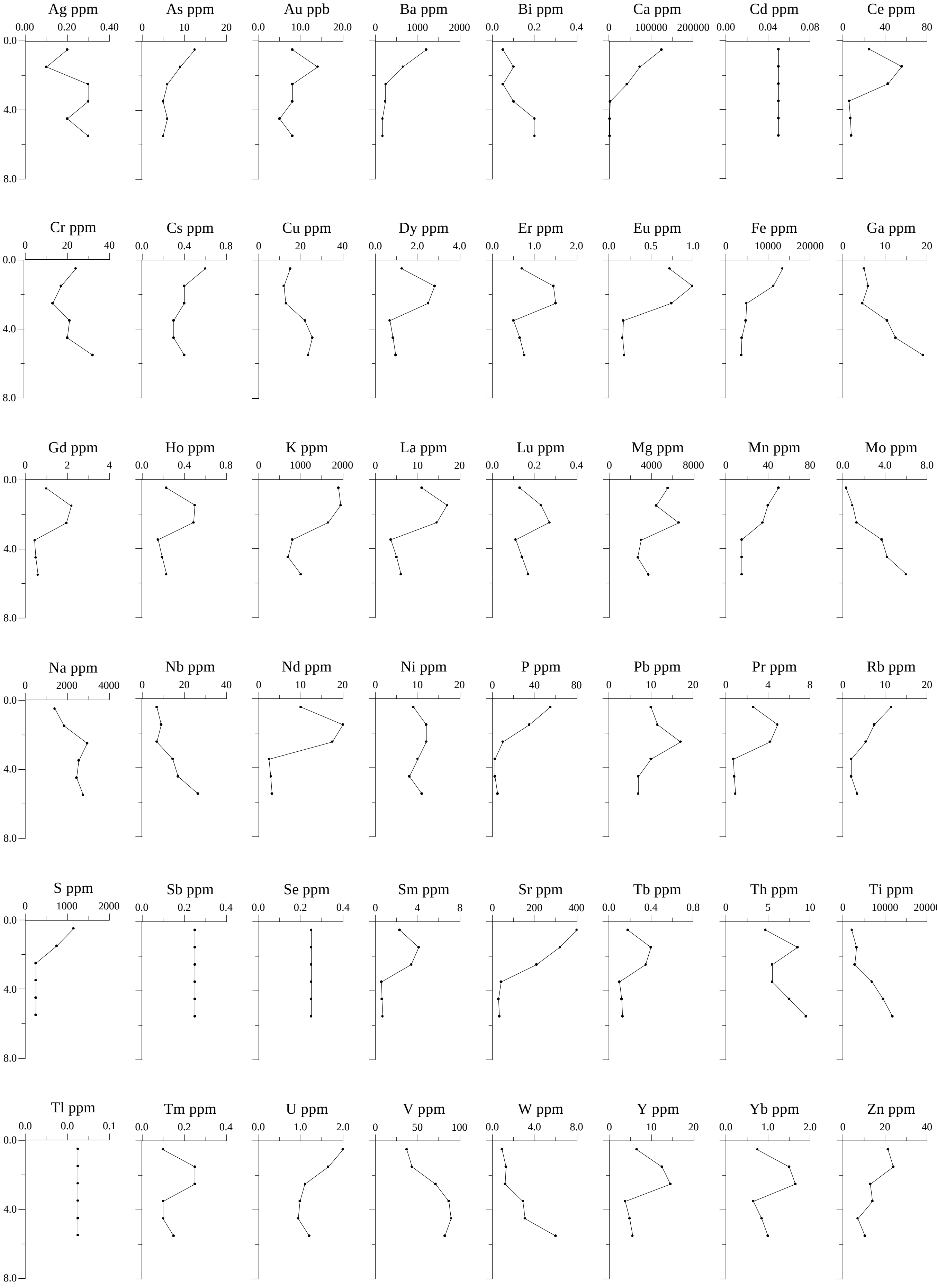

Figure A1.7: Elemental abundancies for 0-6 m RC at GC106 at Challenger.
Y axis is Depth (m).

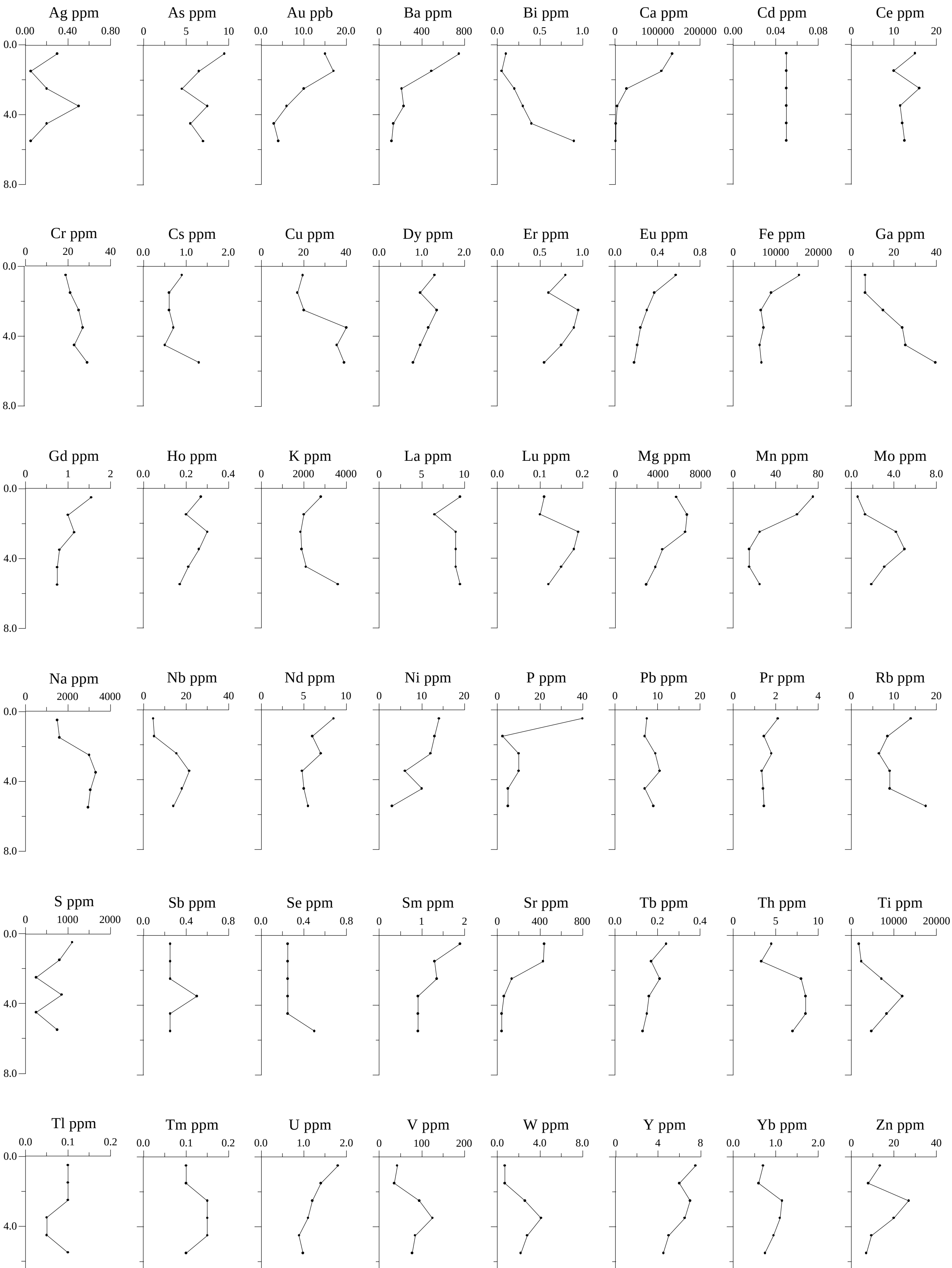

Figure A1.8: Elemental abundancies for 0-6 m RC at GC107 at Challenger.
Y axis is Depth (m).

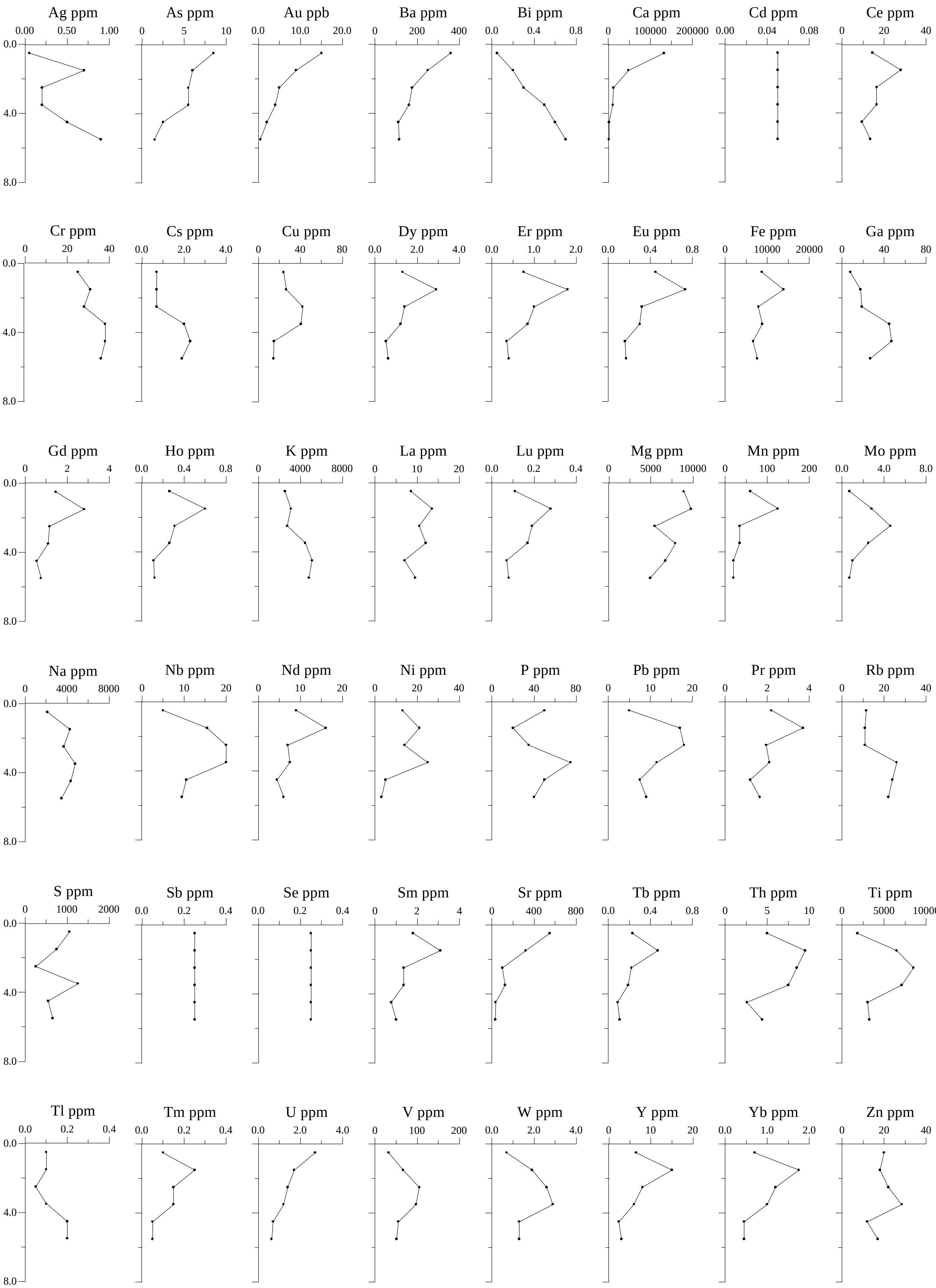

Figure A1.9: Elemental abundancies for 0-6 m RC at GC108 at Challenger.
Y axis is Depth (m).

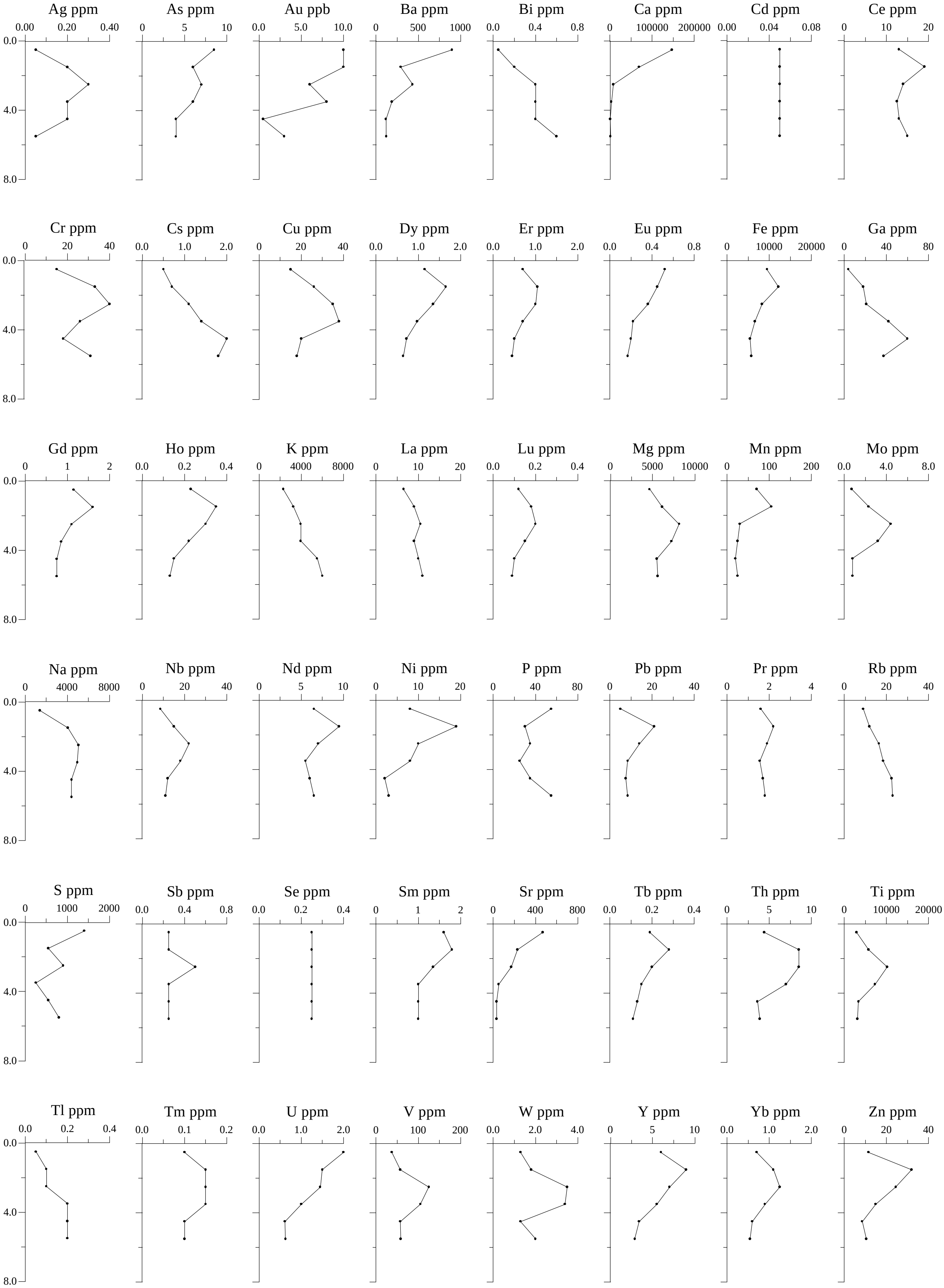

Figure A1.10: Elemental abundancies for 0-6 m RC at GC109 at Challenger.
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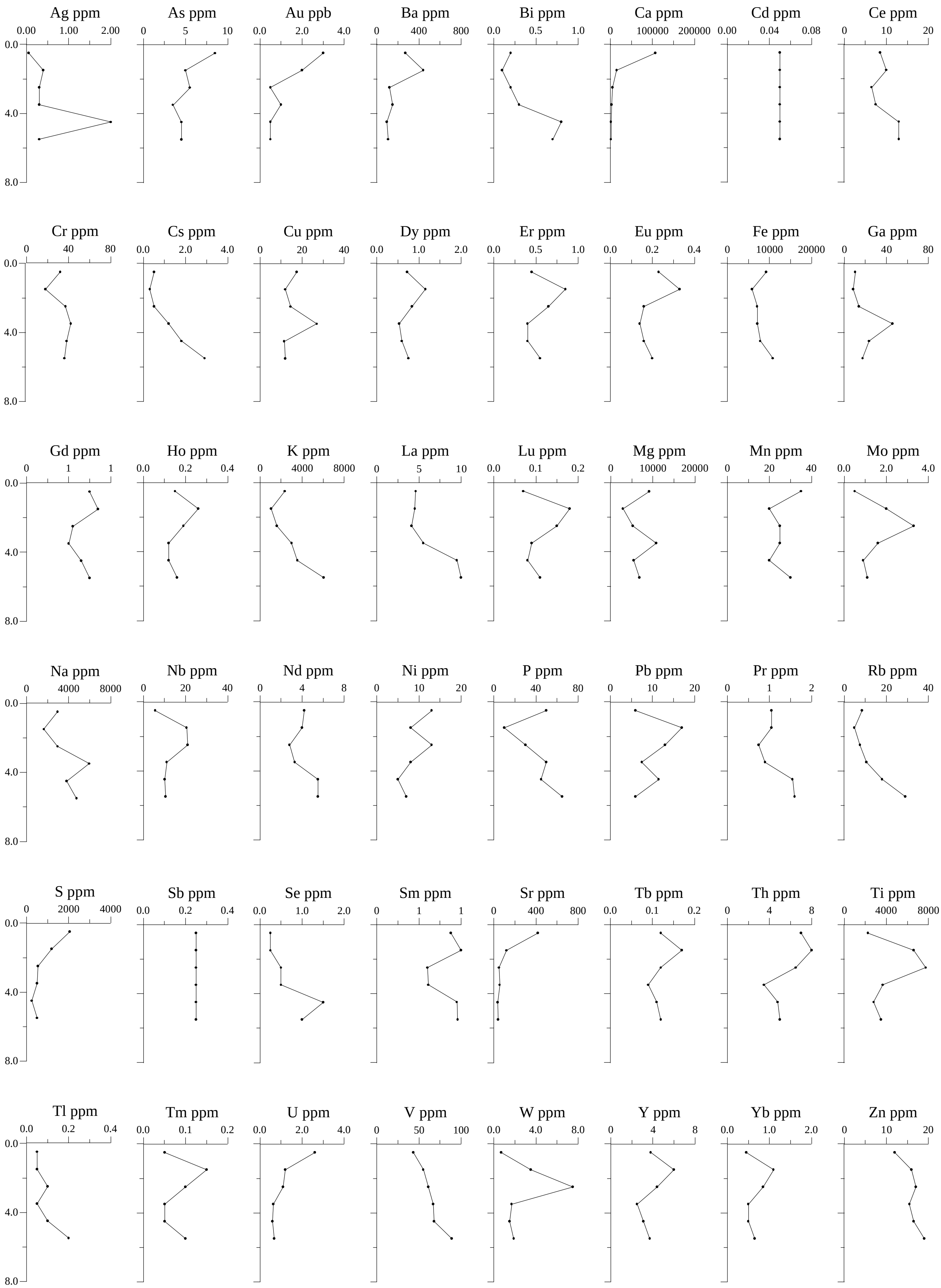

Figure A1.11: Elemental abundancies for 0-6 m RC at GC110 at Challenger.
Y axis is Depth (m).

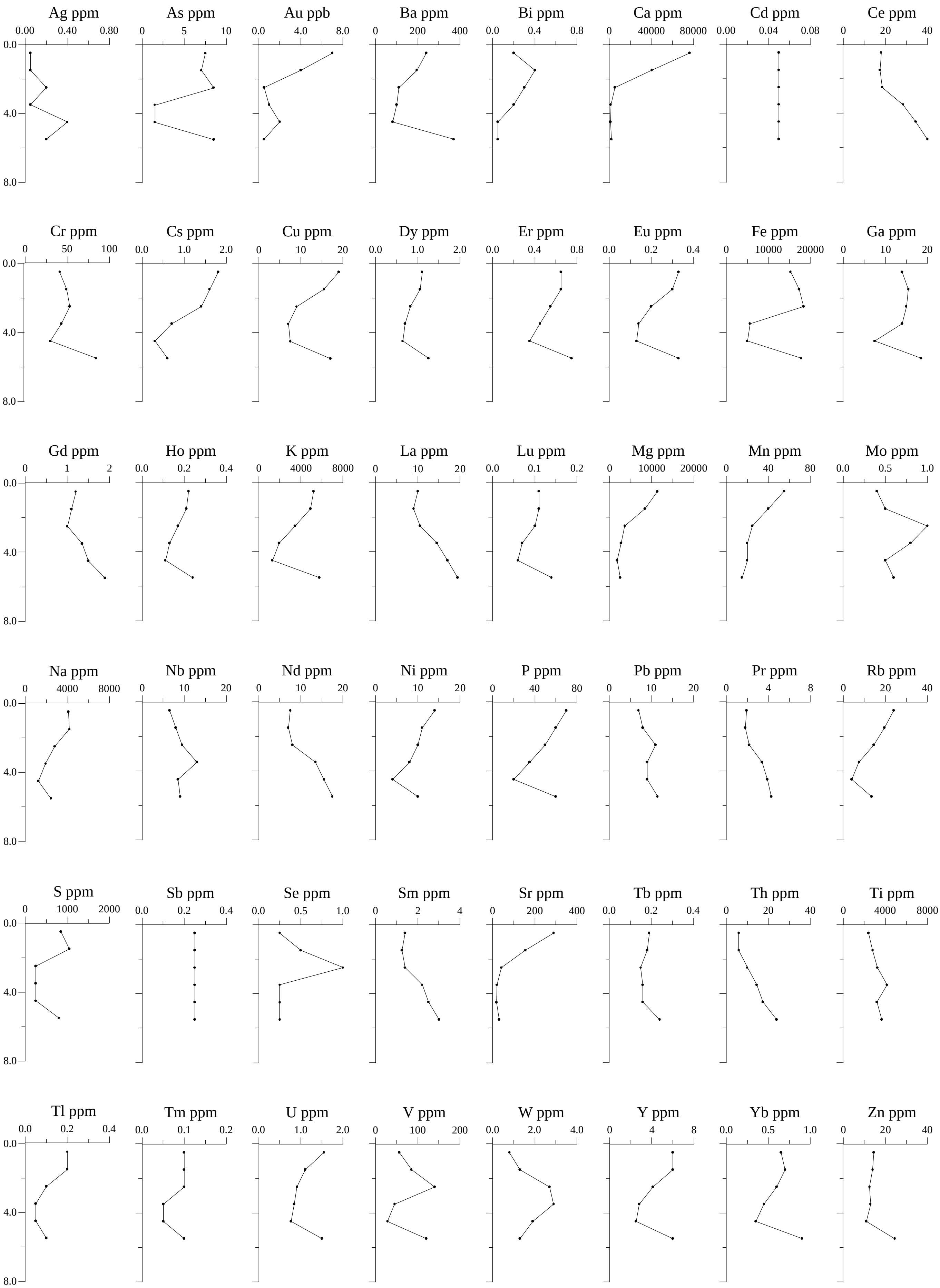

Figure A1.12: Elemental abundancies for 0-6 m RC at GC111 at Challenger.
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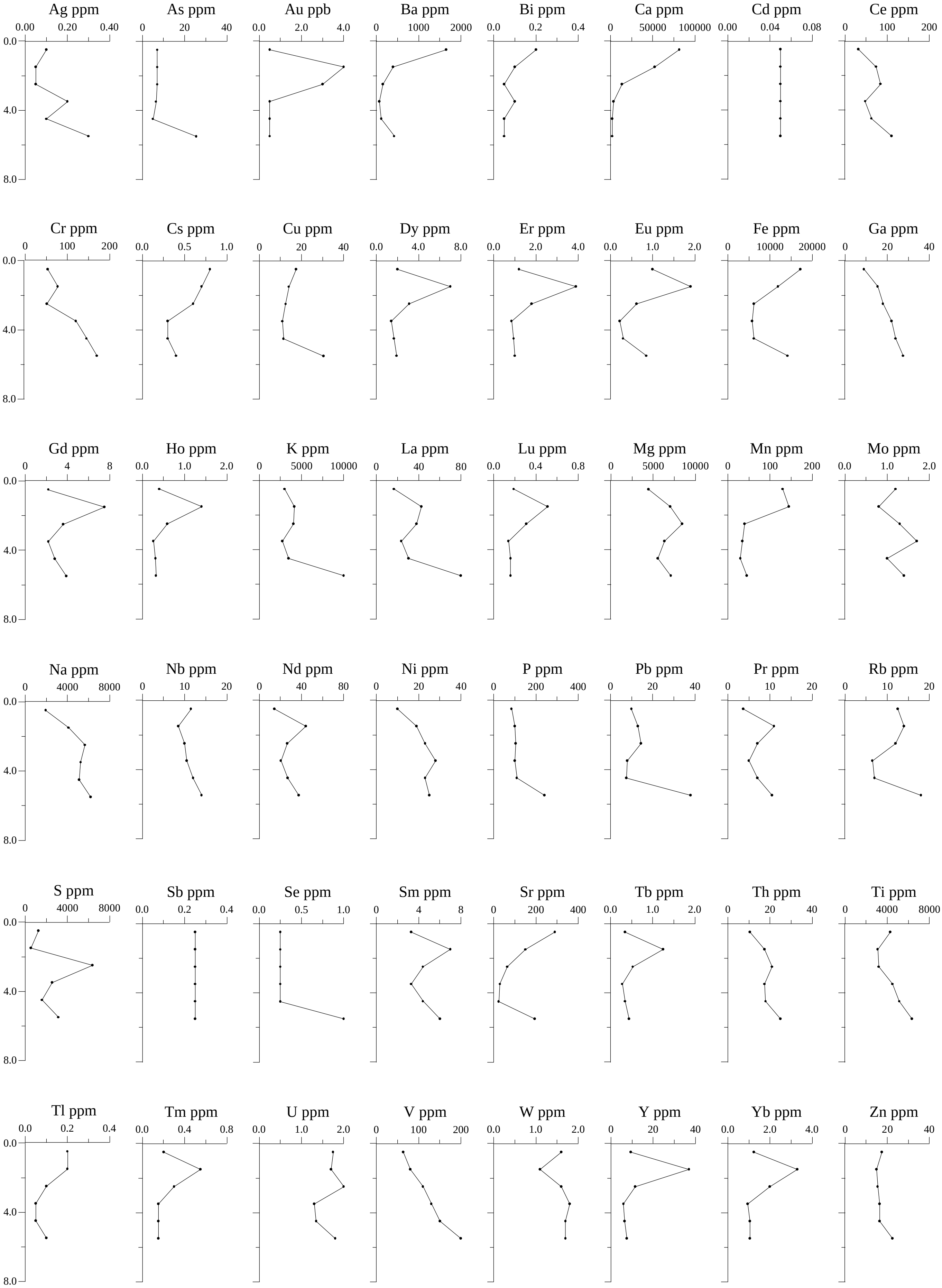

Figure A1.13: Elemental abundancies for 0-6 m RC at GC112 at Challenger.
Y axis is Depth (m).

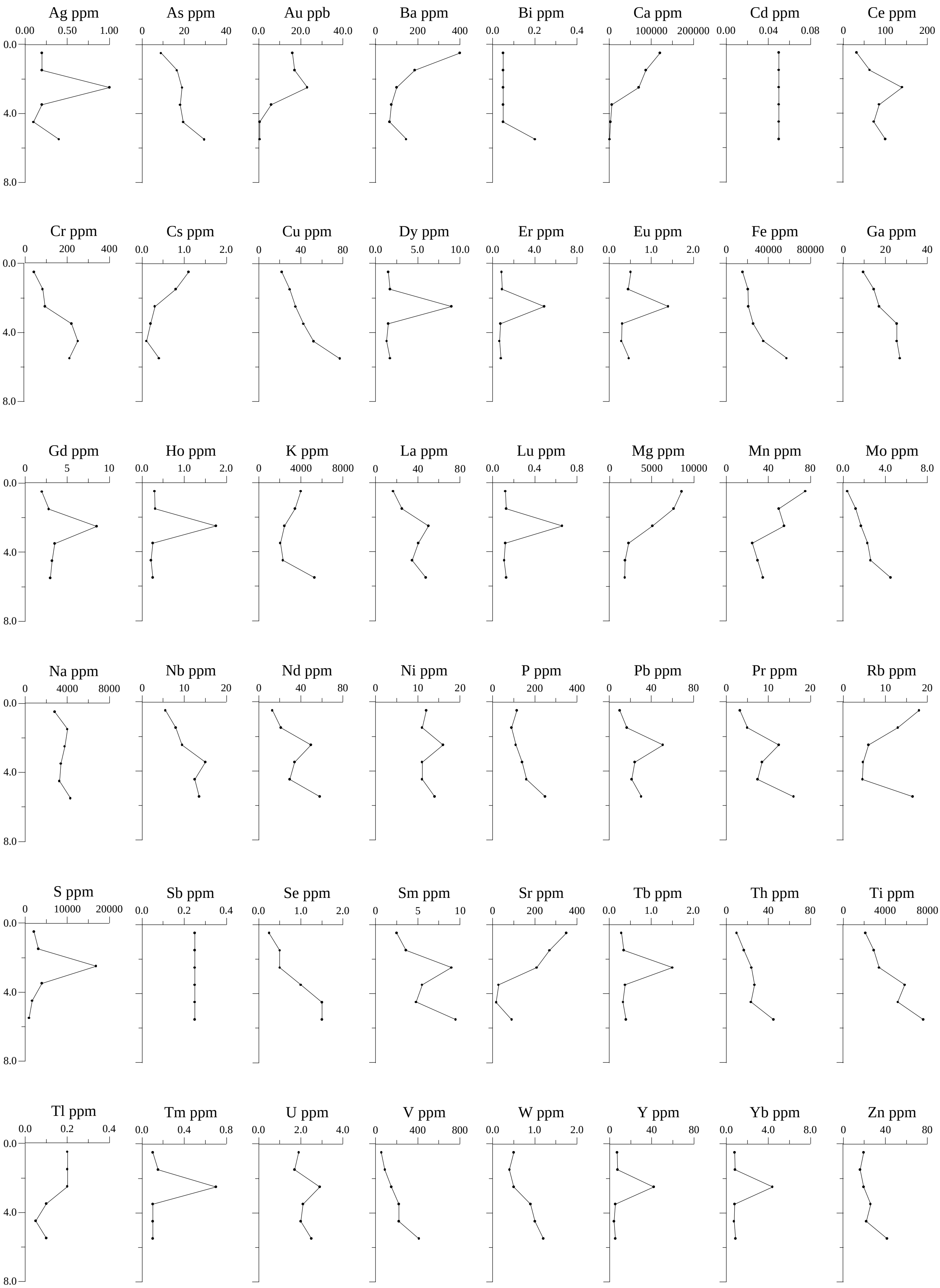

Figure A1.14: Elemental abundancies for 0-6 m RC at GC113 at Challenger.
Y axis is Depth (m).

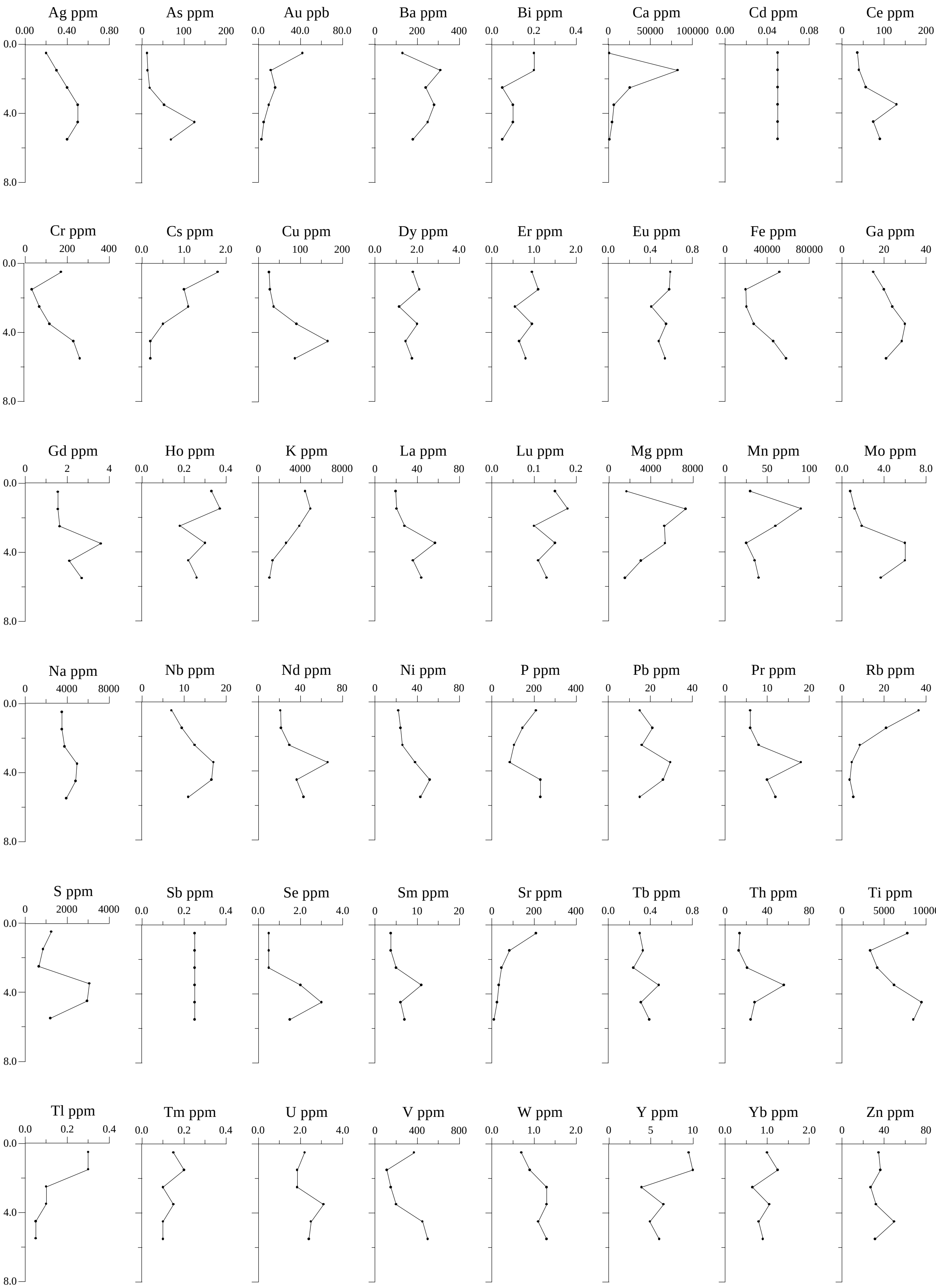

Figure A1.15: Elemental abundancies for 0-6 m RC at GC114 at Challenger.
Y axis is Depth (m).

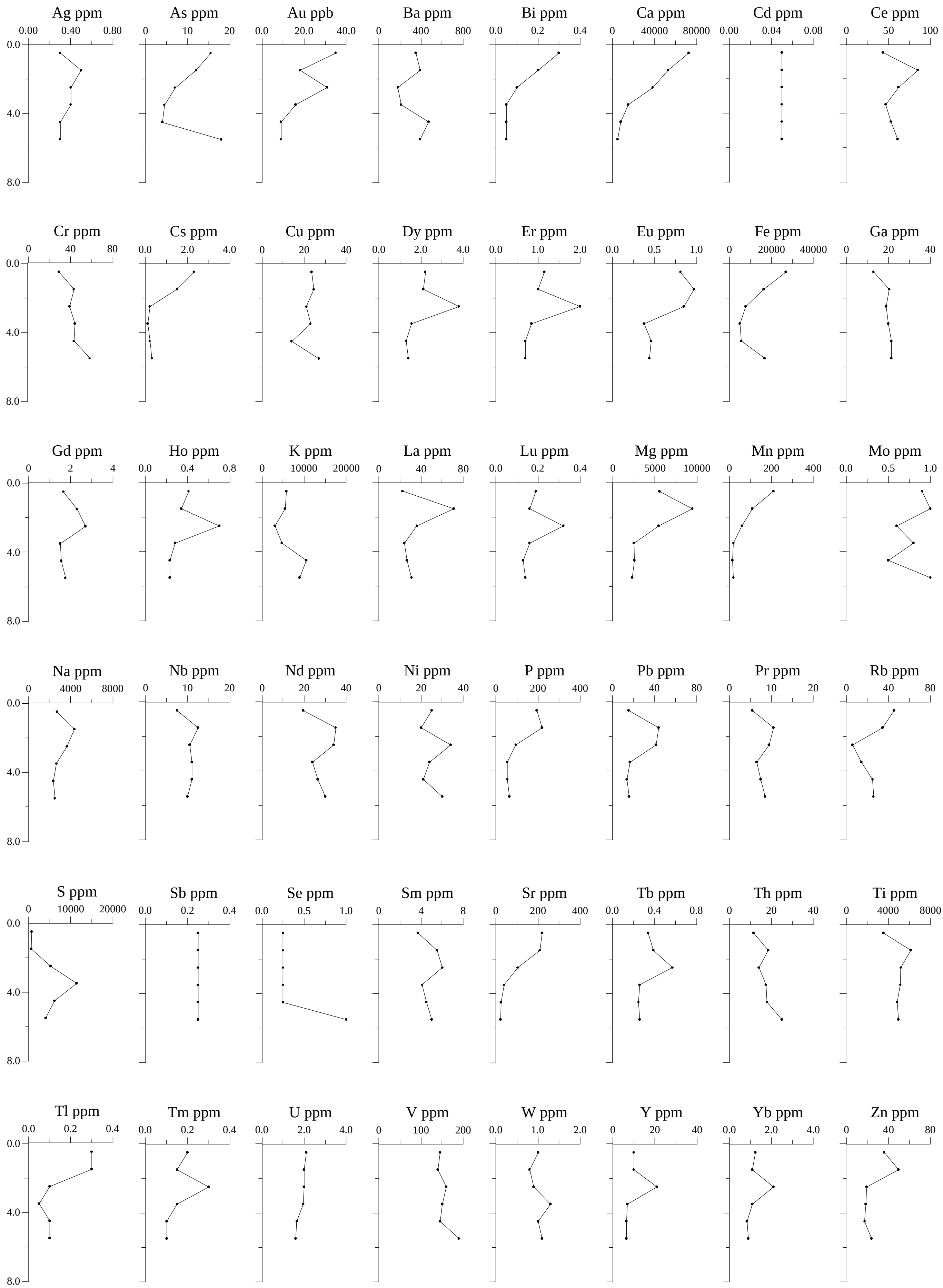

Figure A1.16: Elemental abundancies for 0-6 m RC at GC115 at Challenger.
Y axis is Depth (m).

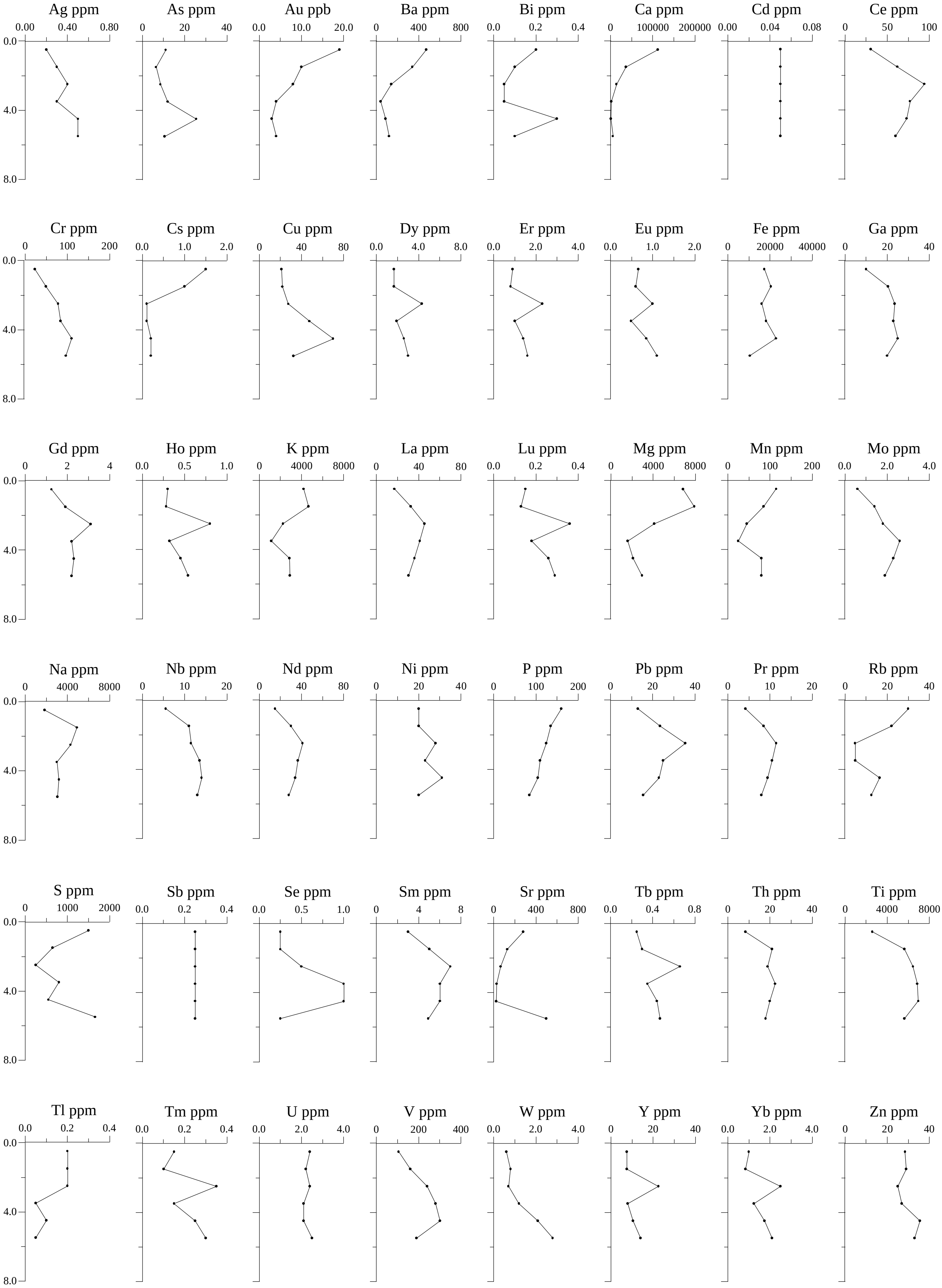

Figure A1.17: Elemental abundancies for 0-6 m RC at GC116 at Challenger.
Y axis is Depth (m).

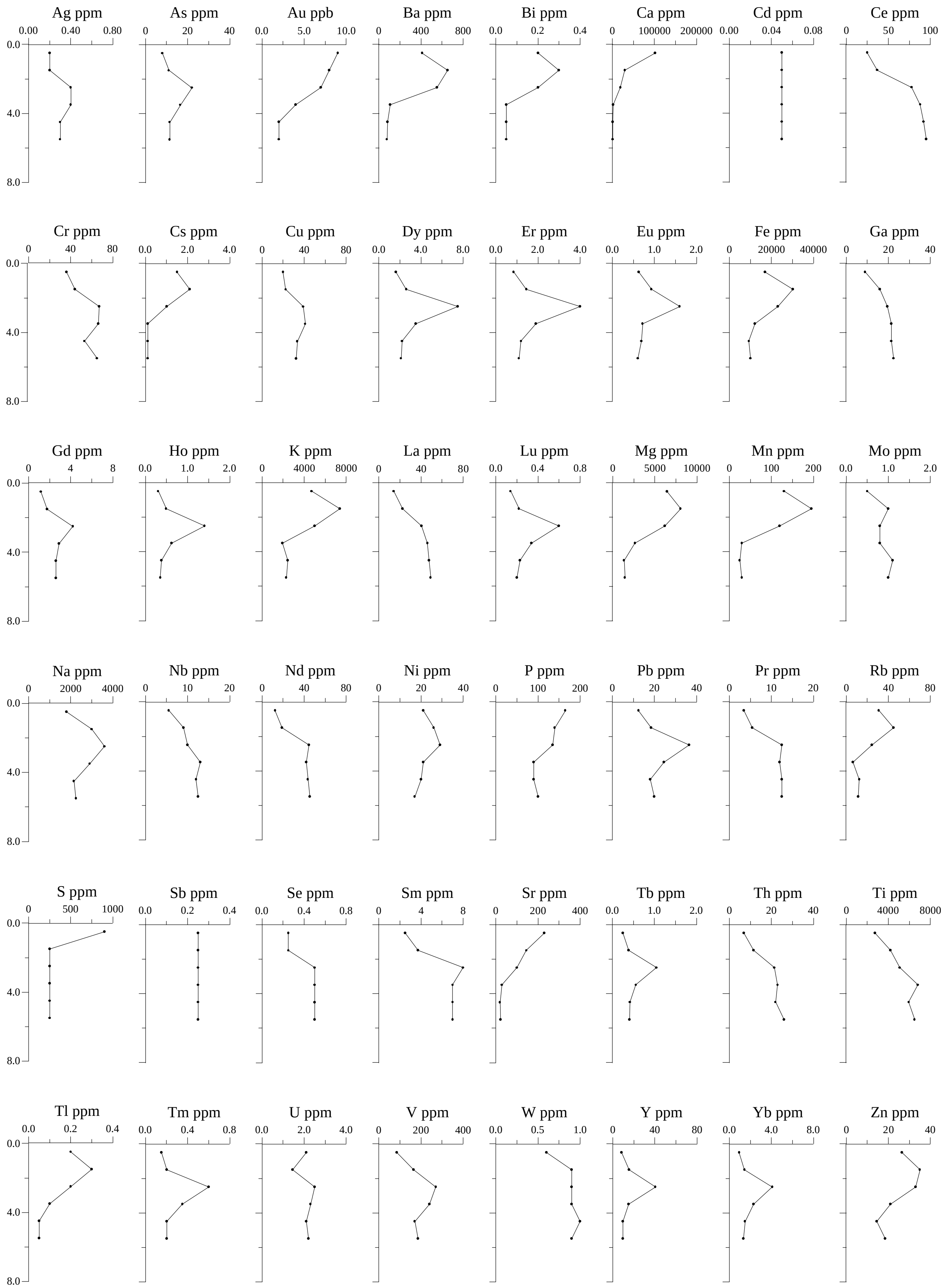

Figure A1.18: Elemental abundancies for 0-6 m RC at GC117 at Challenger.
Y axis is Depth (m).

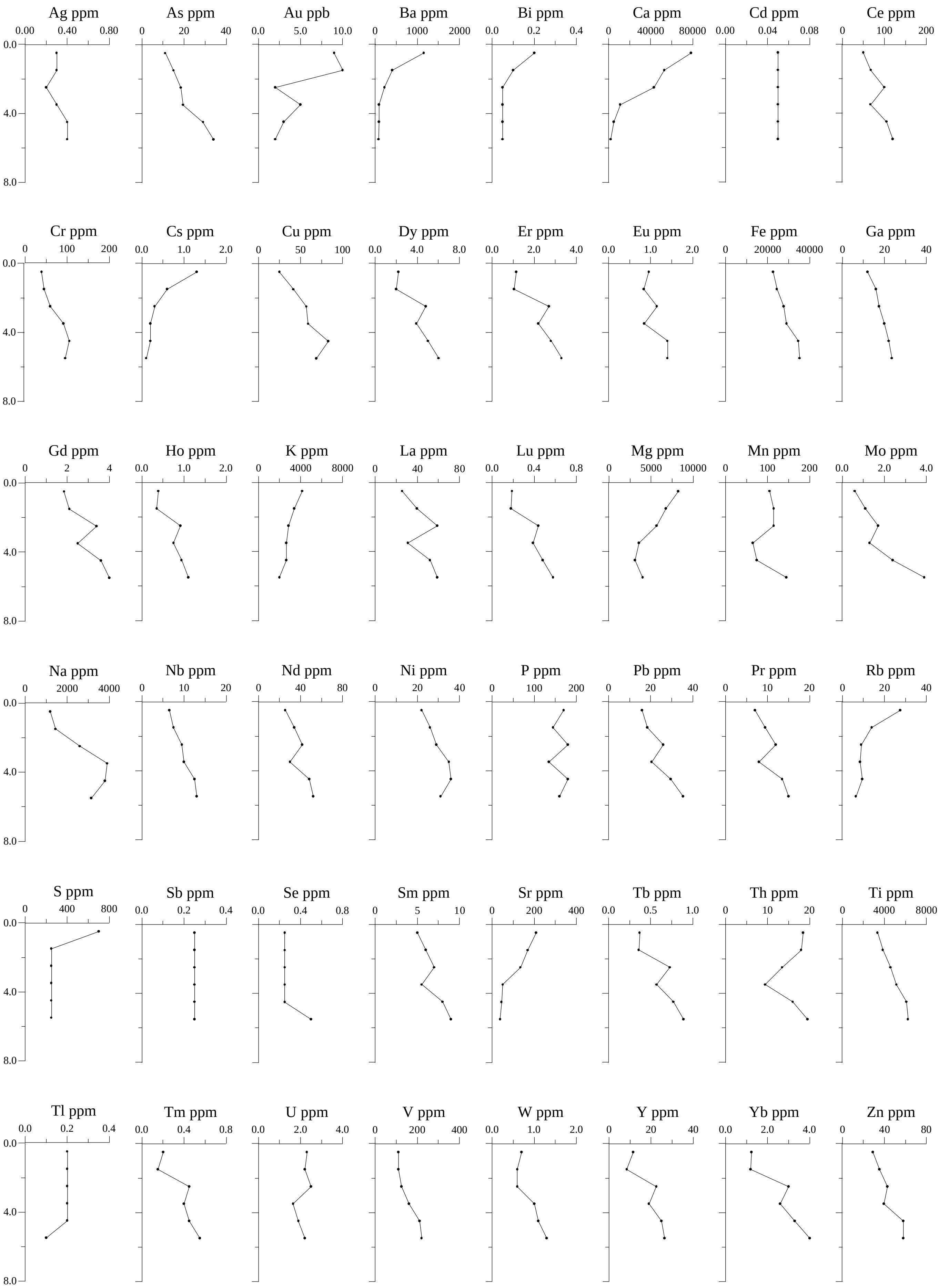

Figure A1.19: Elemental abundancies for 0-6 m RC at GC118 at Challenger. Y axis is Depth (m).

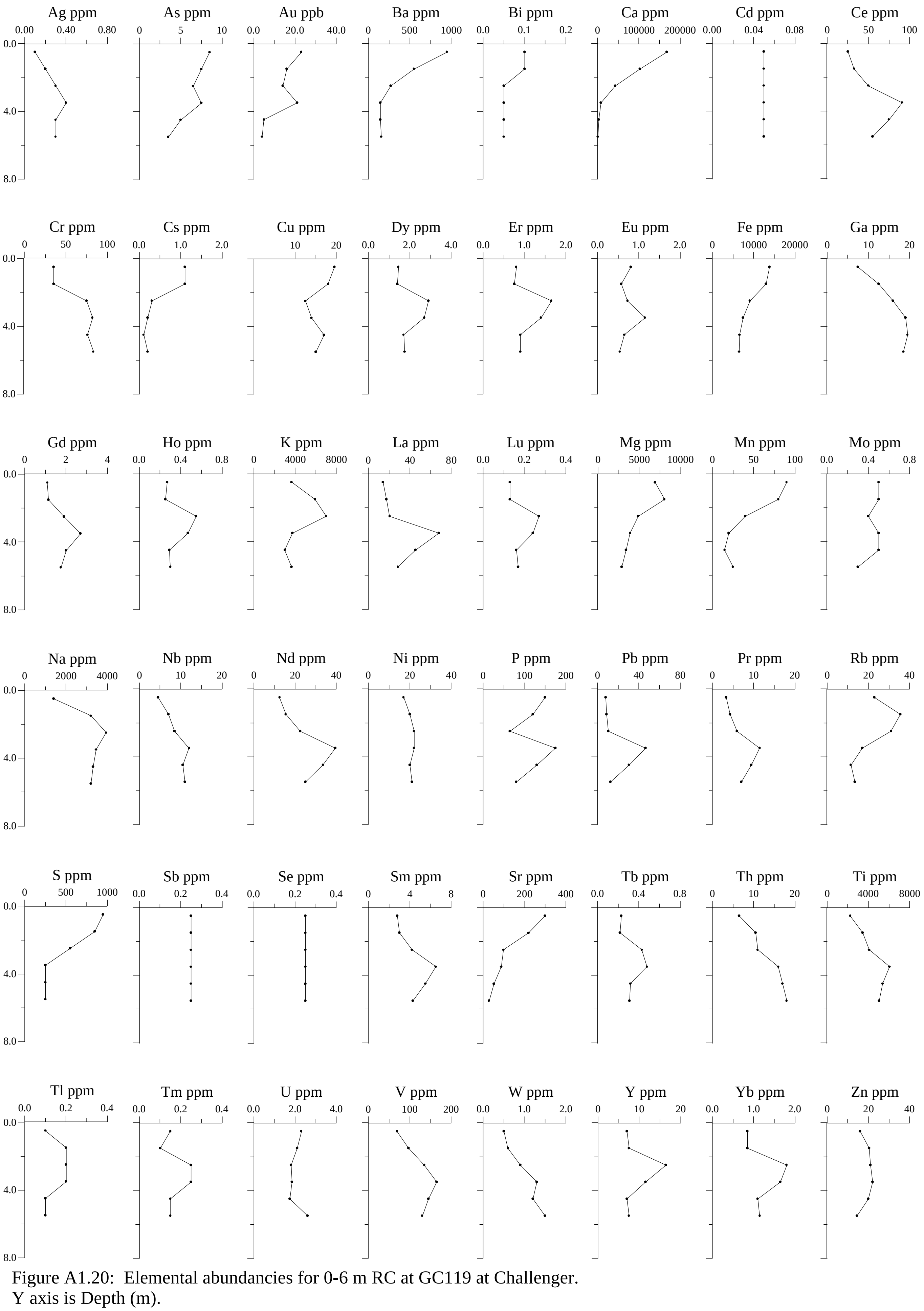

Figure A1.20: Elemental abundancies for 0-6 m RC at GC119 at Challenger.
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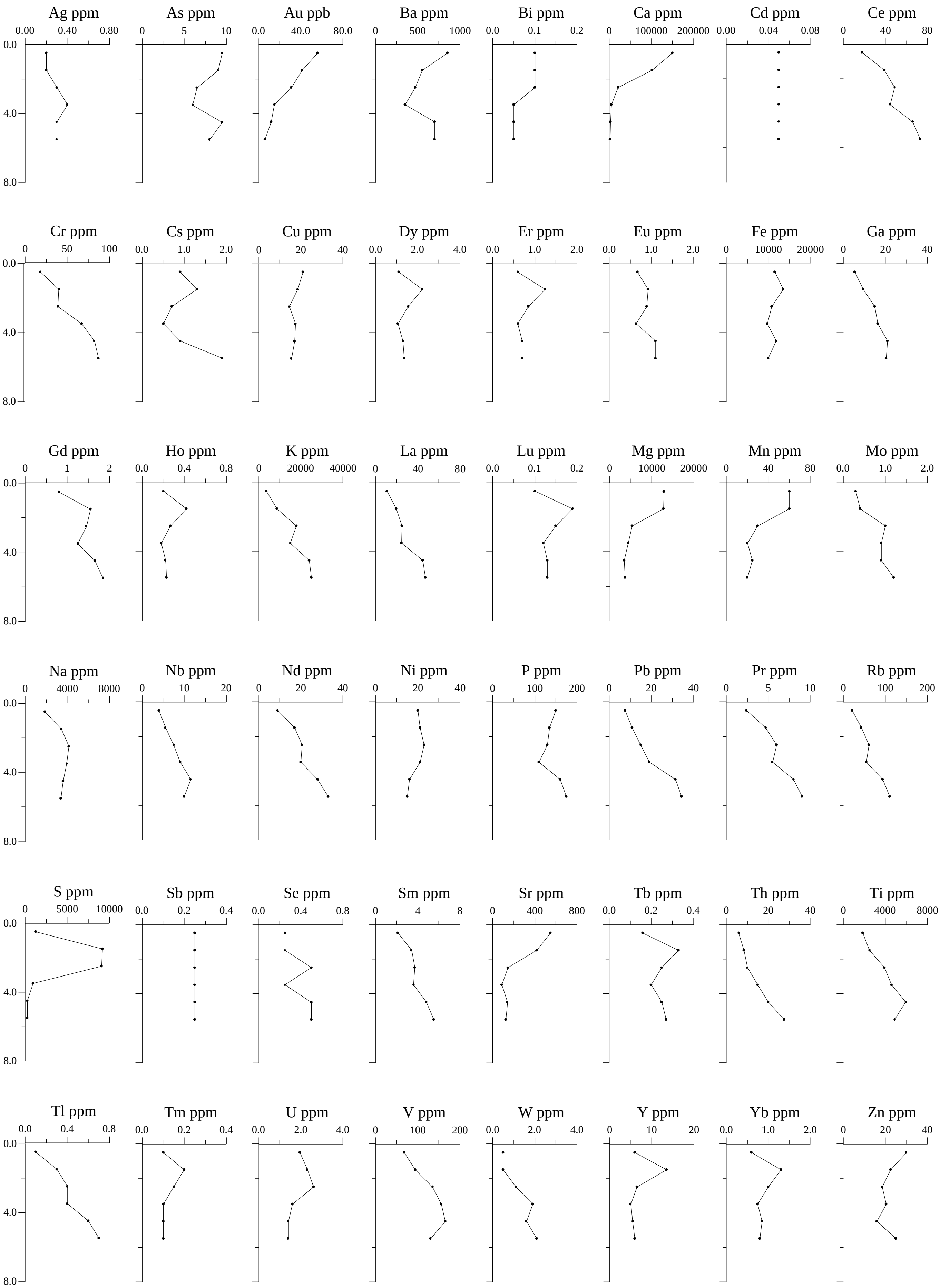

Figure A1.21: Elemental abundancies for 0-6 m RC at GC120 at Challenger.
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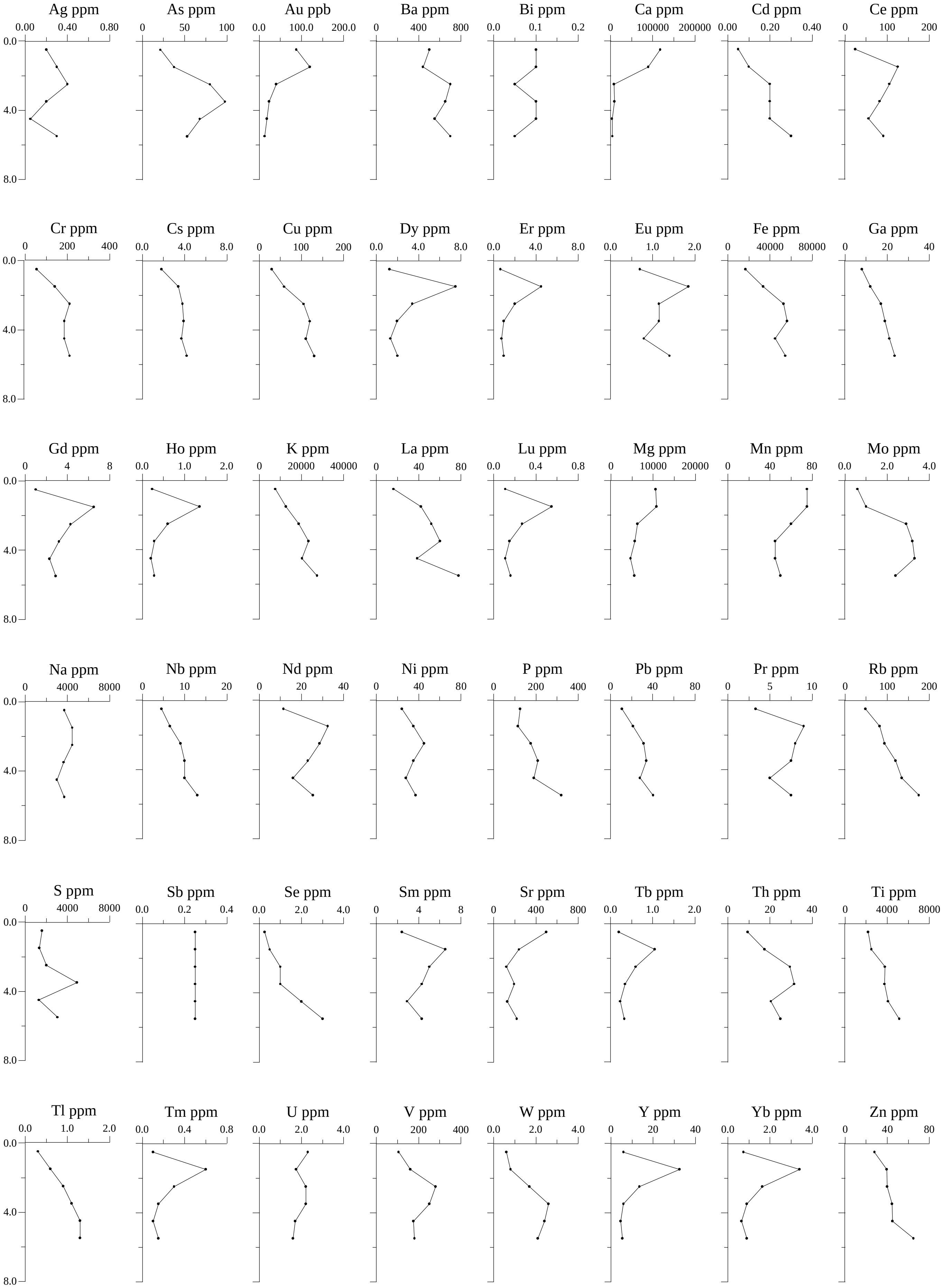

Figure A1.22: Elemental abundancies for 0-6 m RC at GC121 at Challenger.
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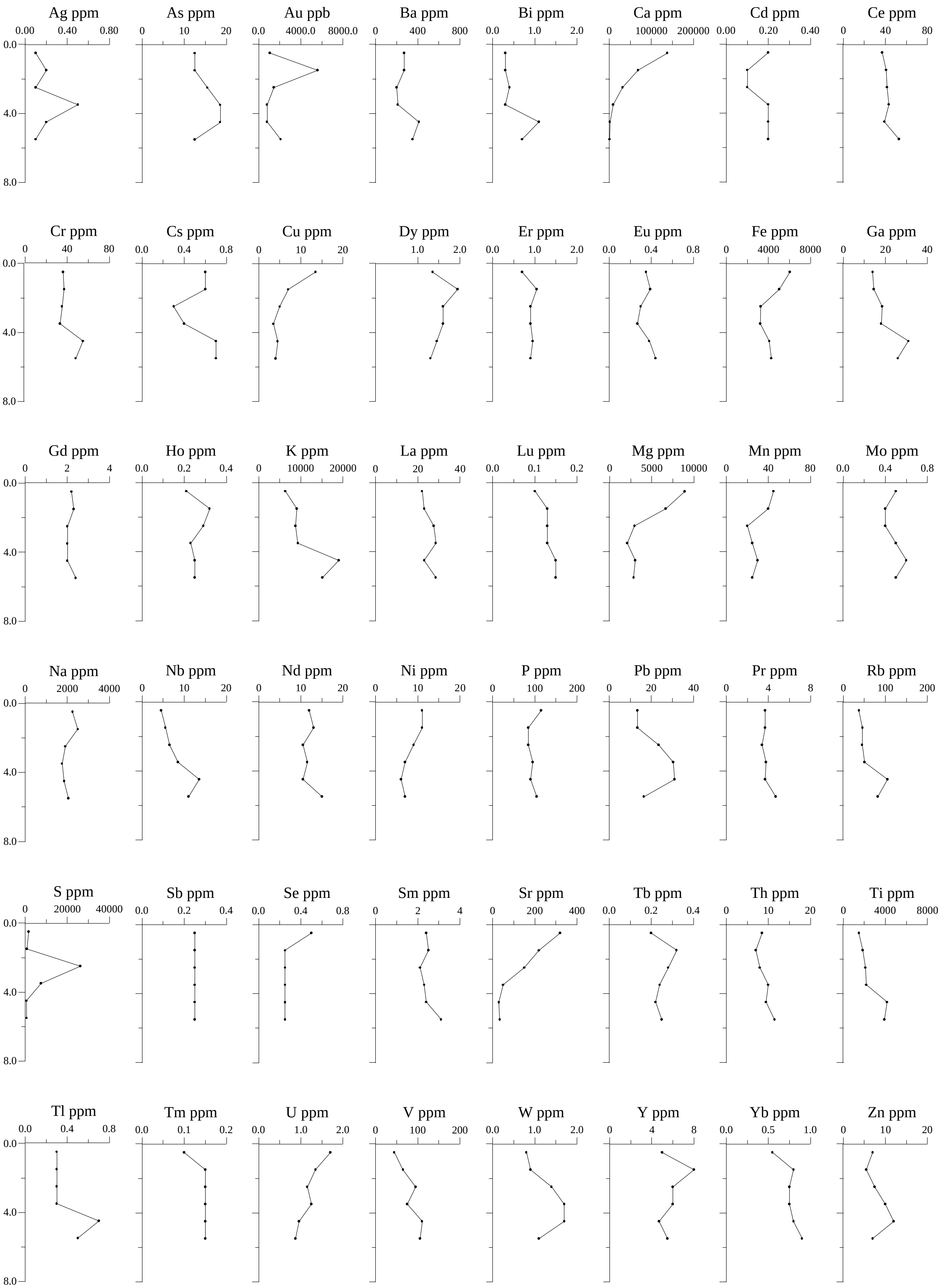

Figure A1.23: Elemental abundancies for 0-6 m RC at GC122 at Challenger.
Y axis is Depth (m).

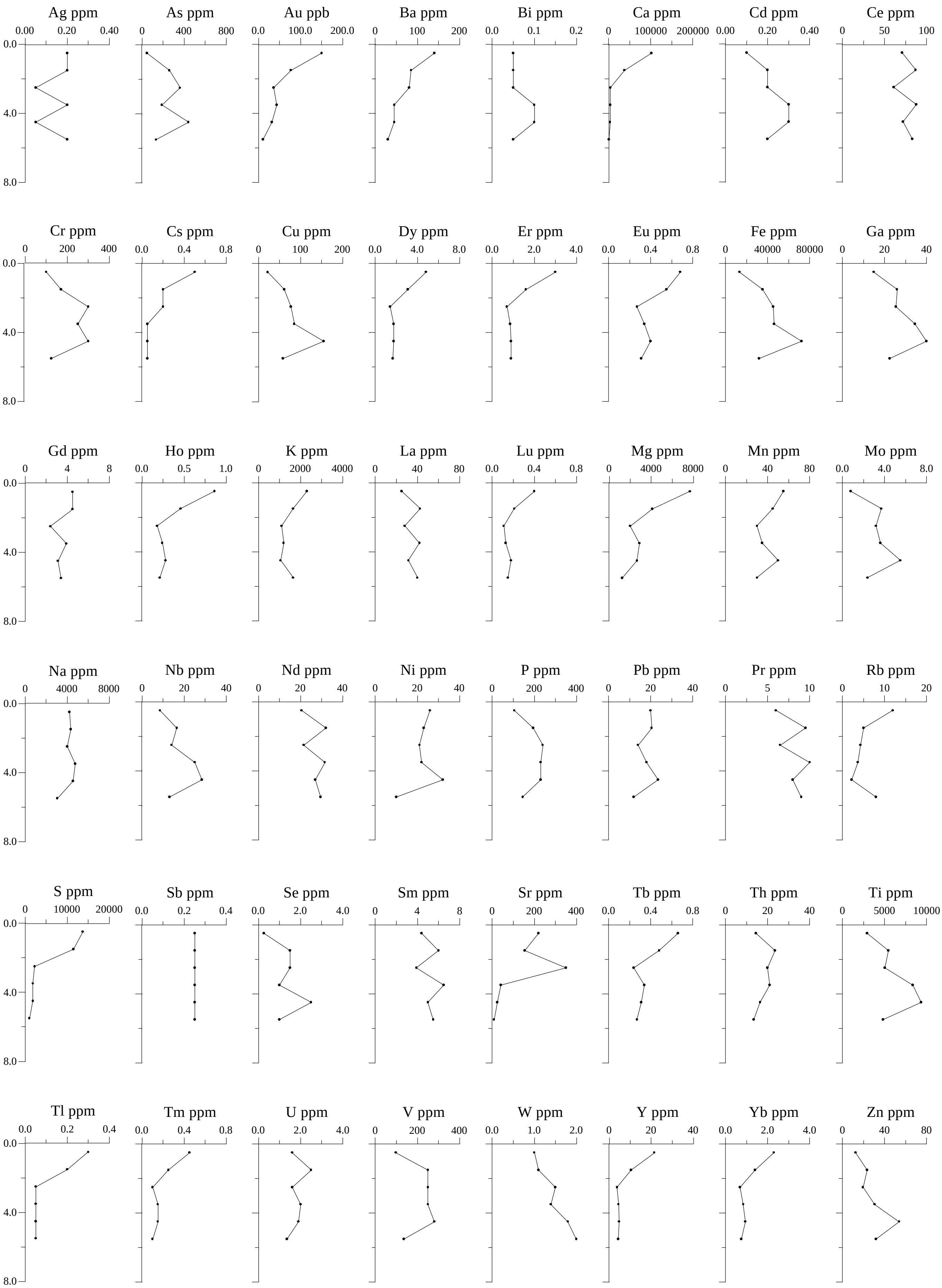

Figure A1.24: Elemental abundancies for 0-6 m RC at GC123 at Challenger.
Y axis is Depth (m).

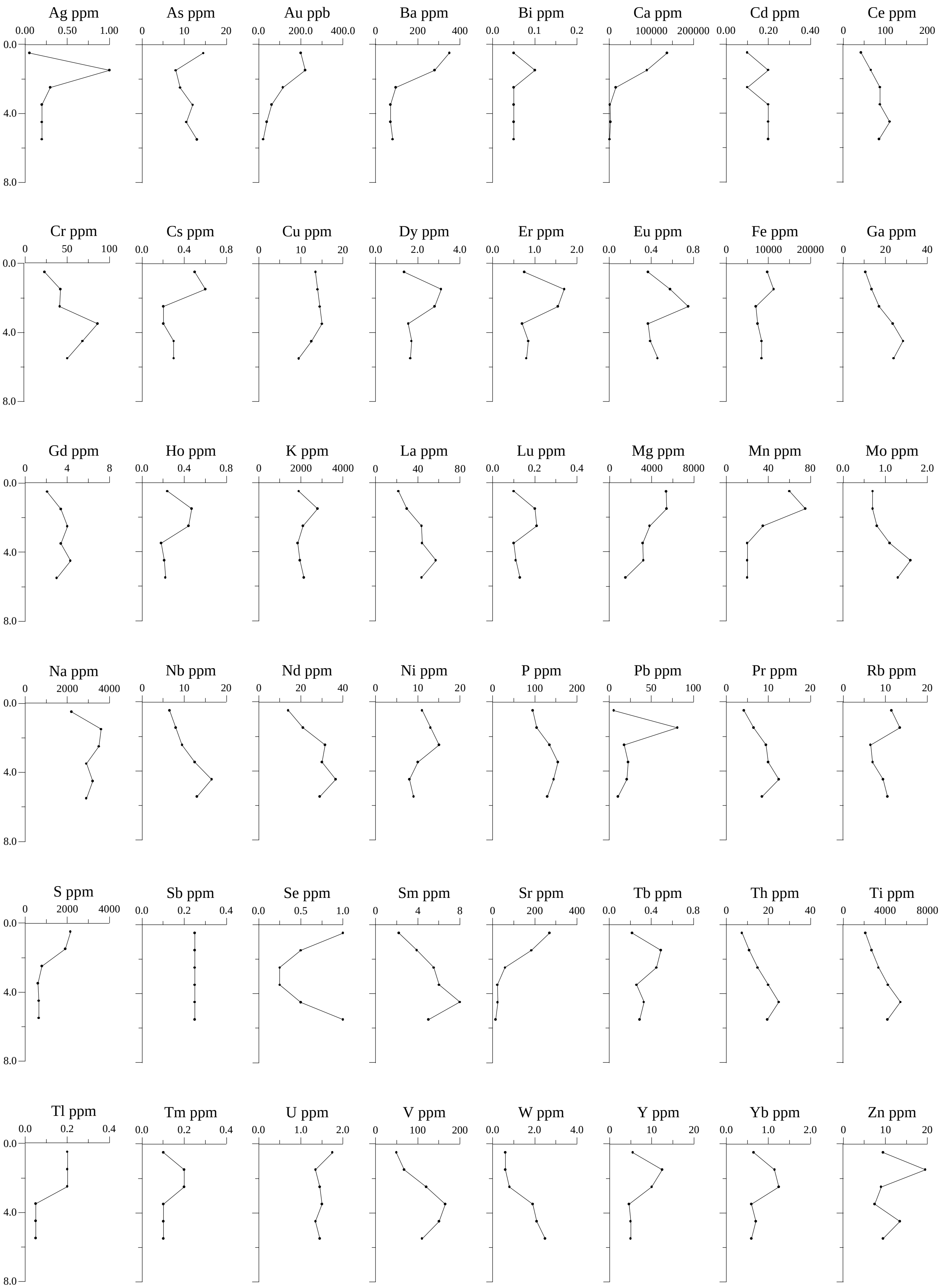

Figure A1.25: Elemental abundancies for 0-6 m RC at GC124 at Challenger.
Y axis is Depth (m).

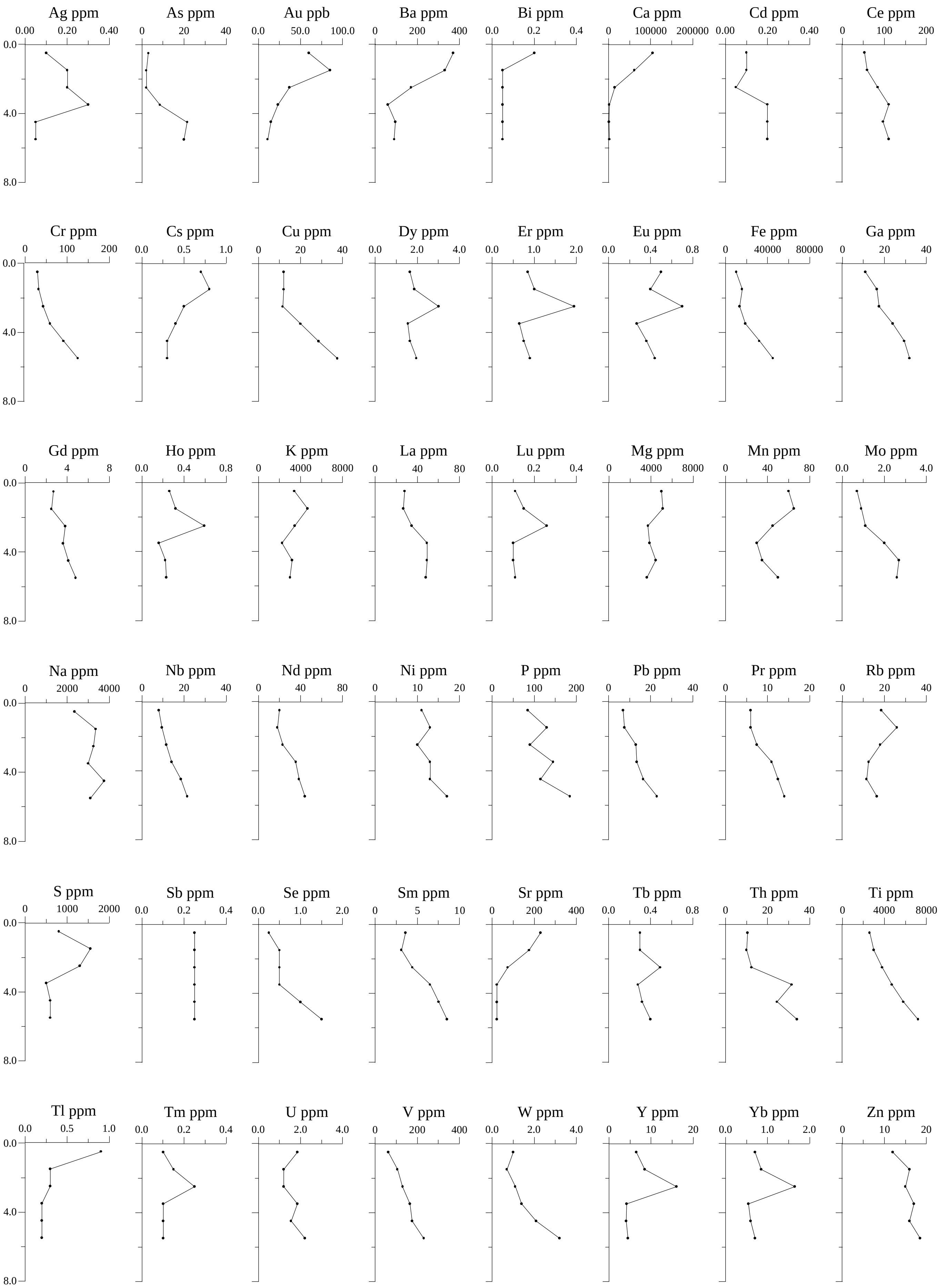

Figure A1.26: Elemental abundancies for 0-6 m RC at GC125 at Challenger.
Y axis is Depth (m).

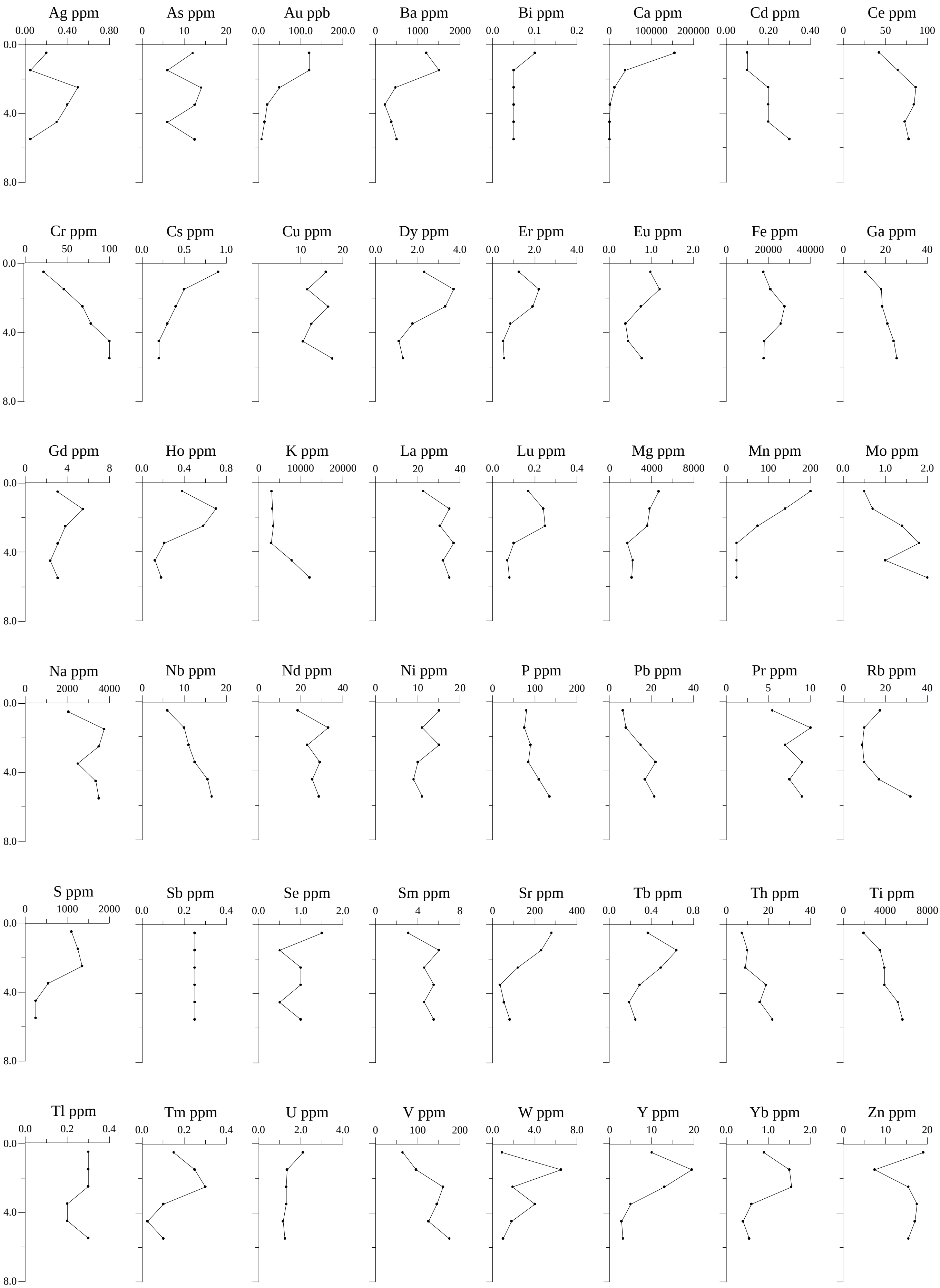

Figure A1.27: Elemental abundancies for 0-6 m RC at GC126 at Challenger.
Y axis is Depth (m).

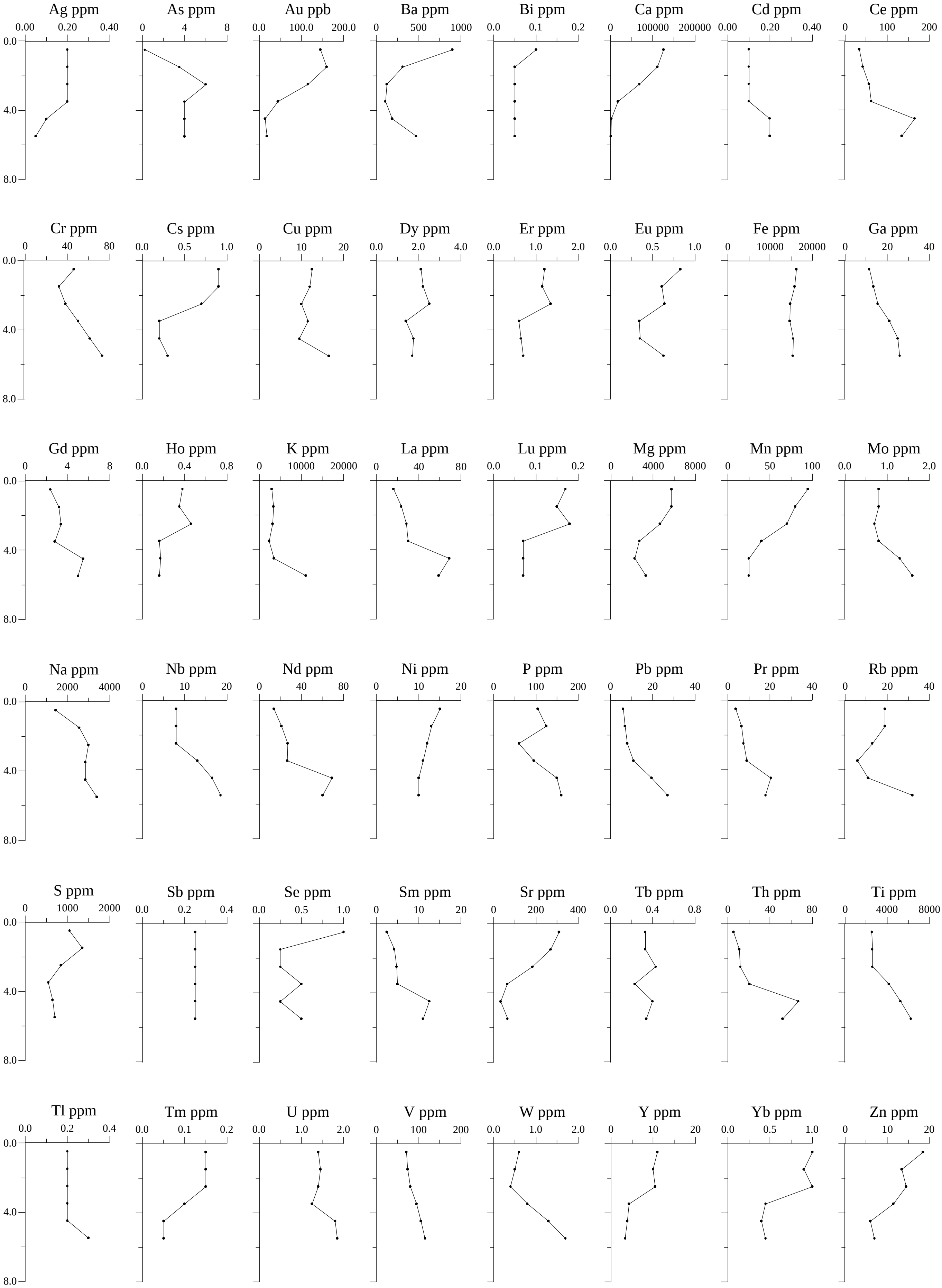

Figure A1.28: Elemental abundancies for 0-6 m RC at GC127 at Challenger.
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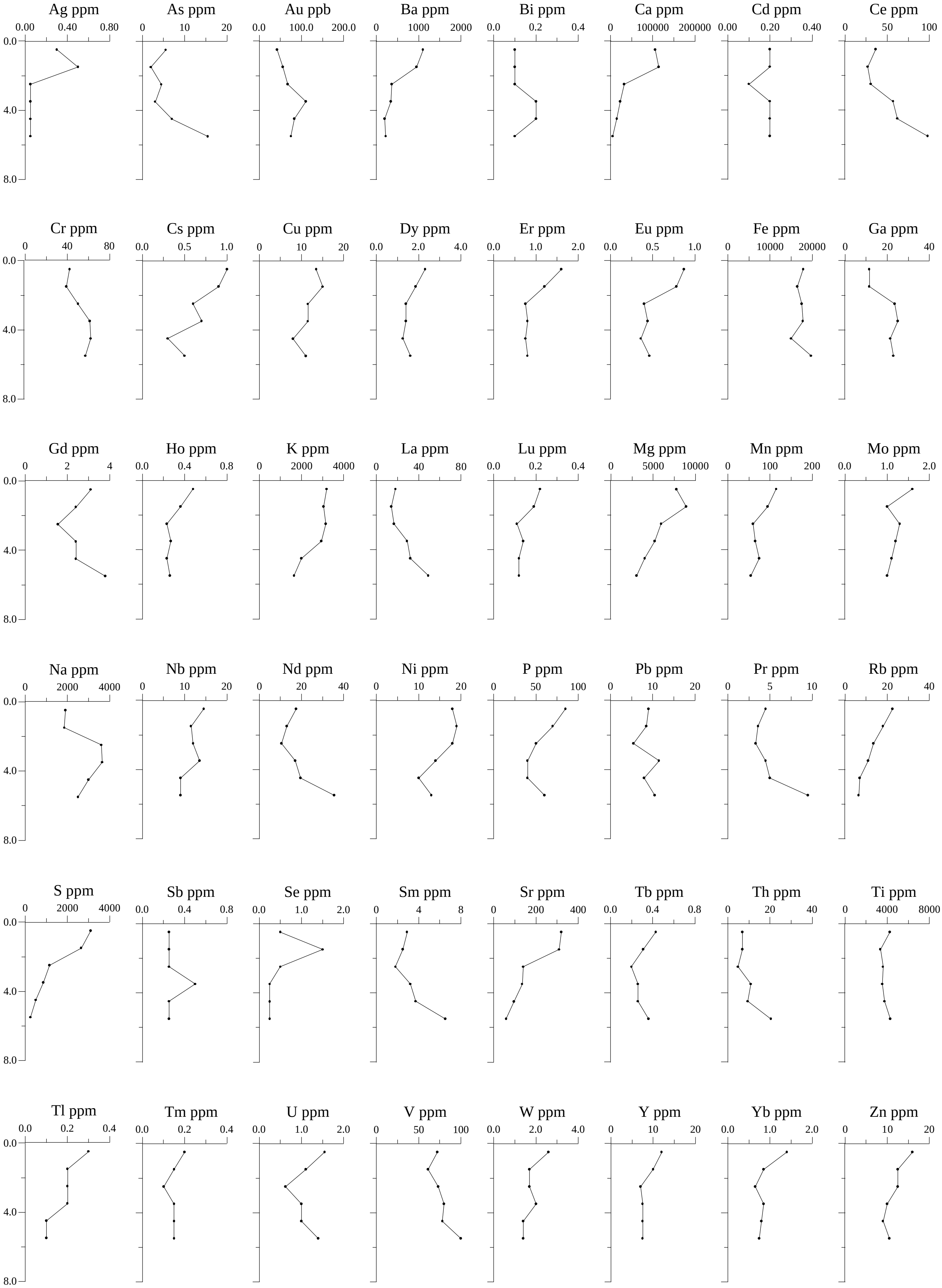

Figure A1.29: Elemental abundancies for 0-6 m RC at GC128 at Challenger.
Y axis is Depth (m).

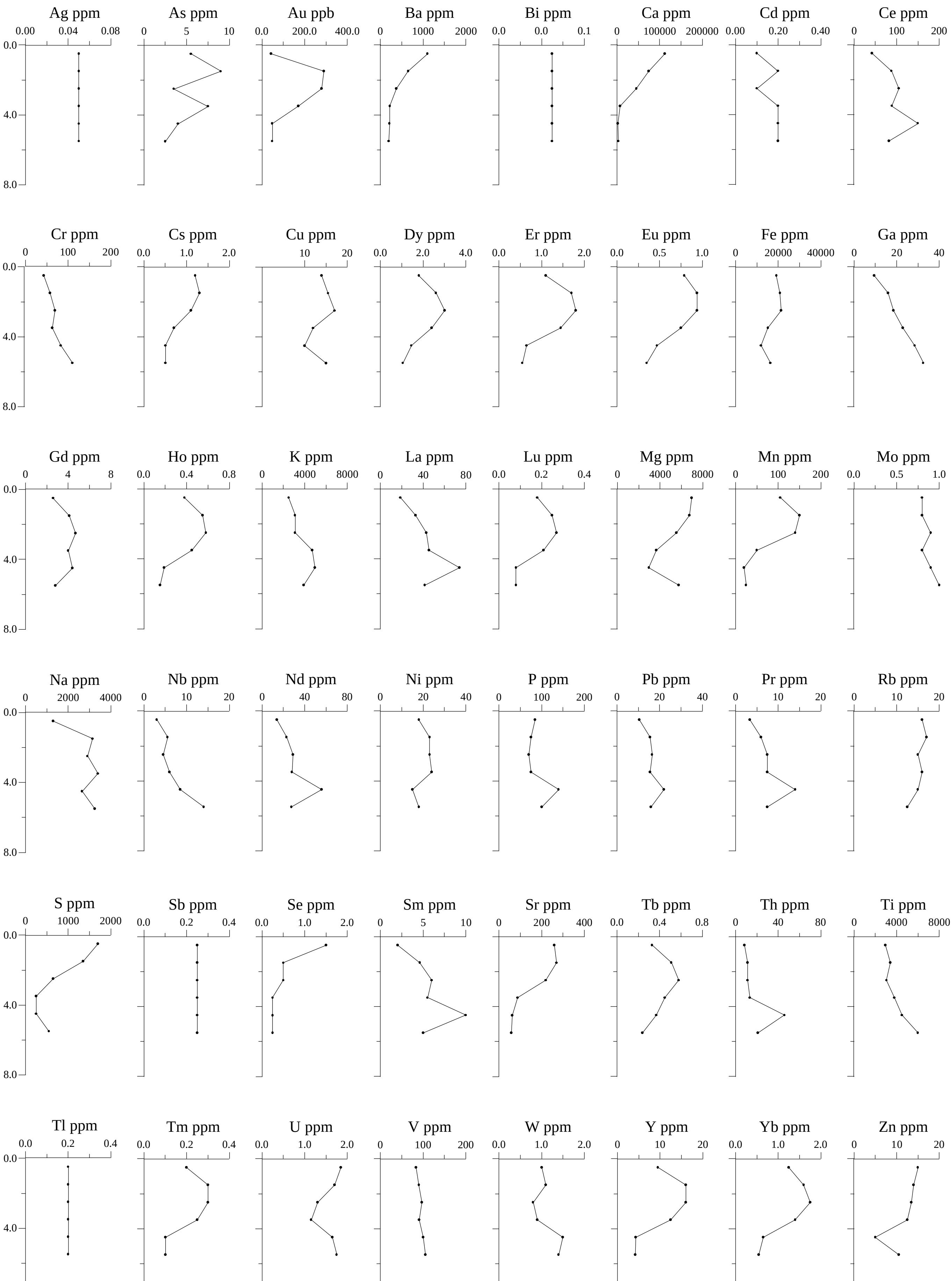

Figure A1.30: Elemental abundancies for 0-6 m RC at GC129 at Challenger.
Y axis is Depth (m).

APPENDIX 2

Appendix 2: Graphed elemental data for all regolith line samples plotted by element.

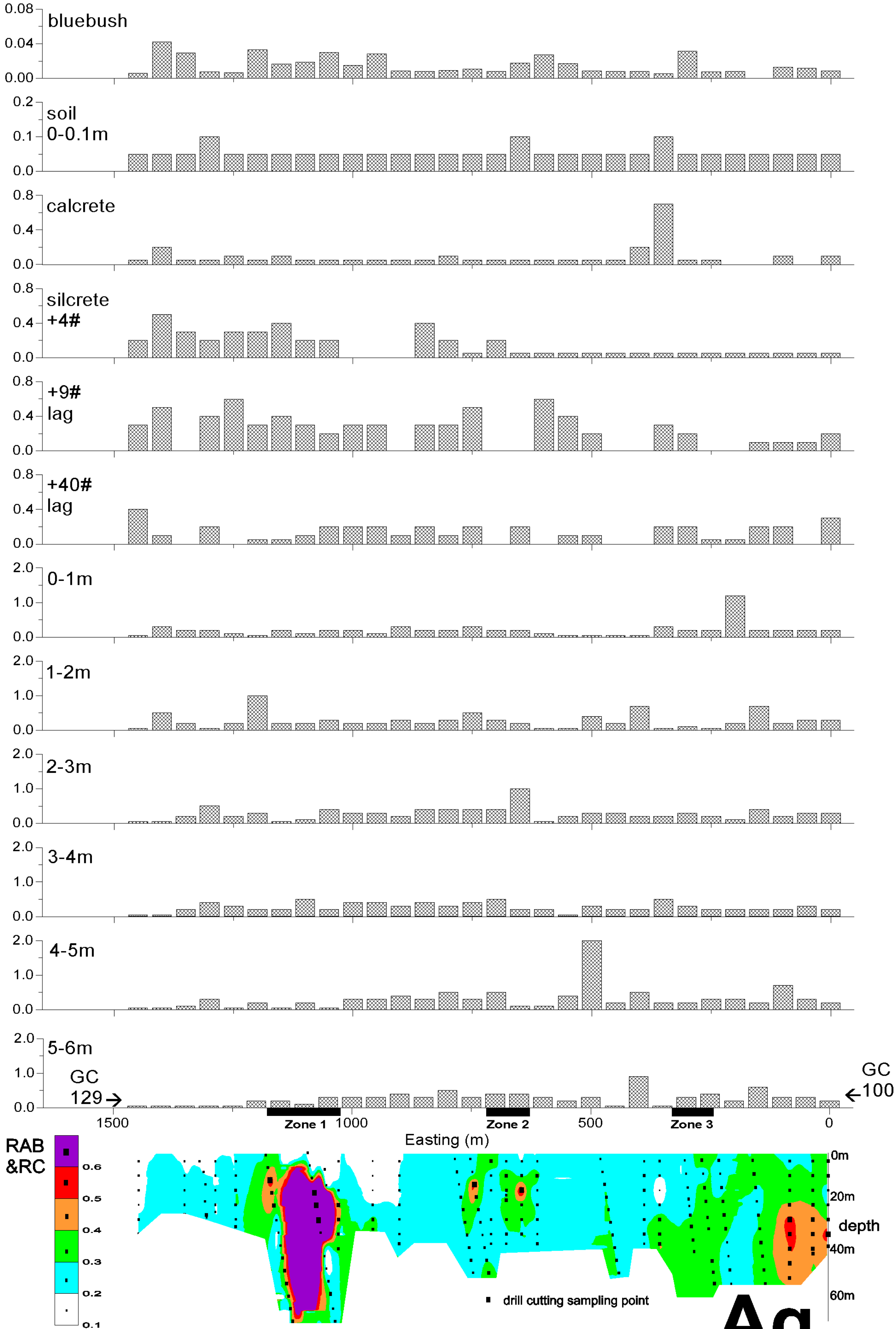

Figure A2.1: Ag distributions in vegetation and regolith components.
Data in ppm. Black rectangles (Zones 1-3) locate mineralisation.

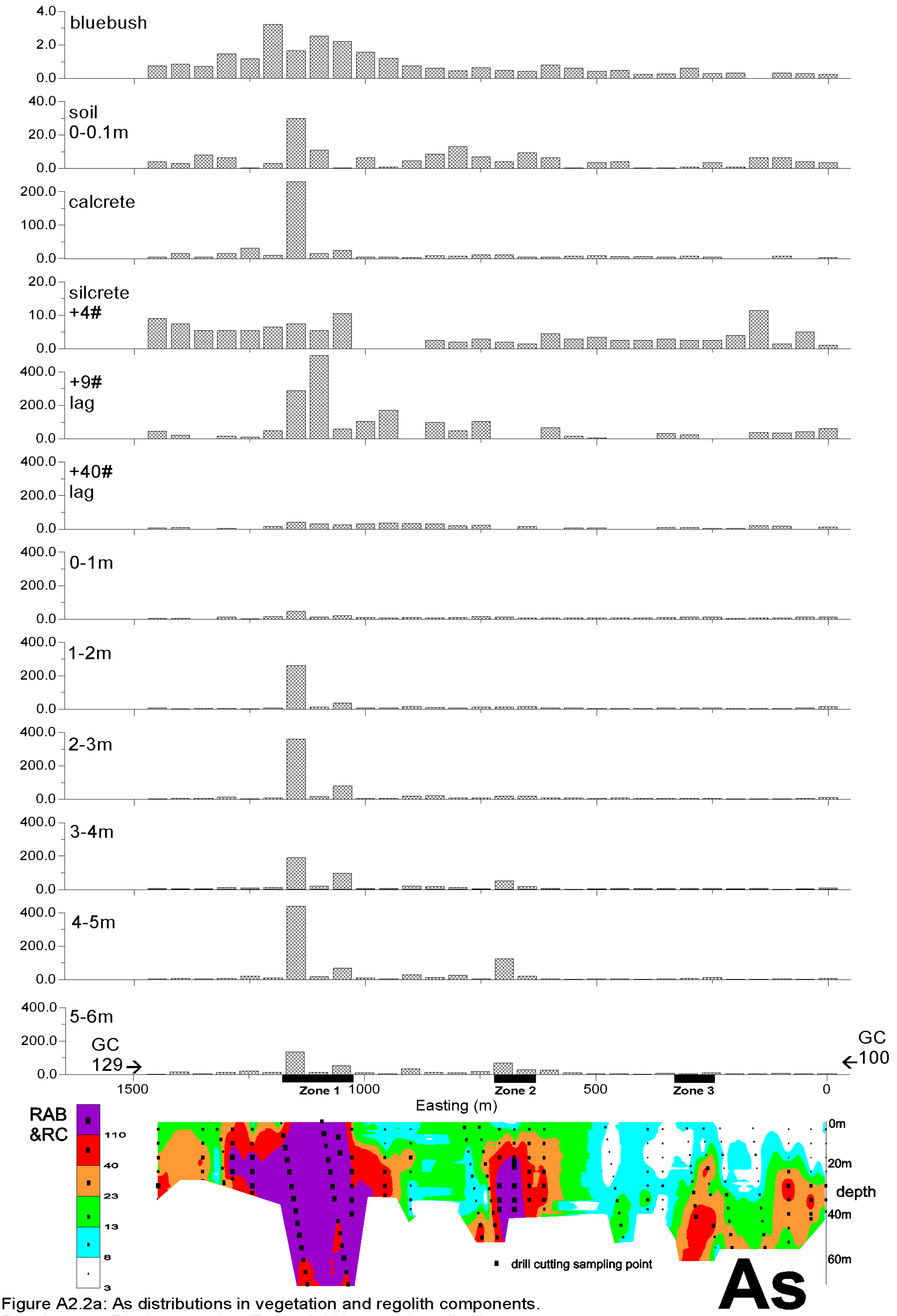

Figure A2.2a: As distributions in vegetation and regolith components. Data in ppm. Black rectangles (Zones 1-3) locate mineralisation.

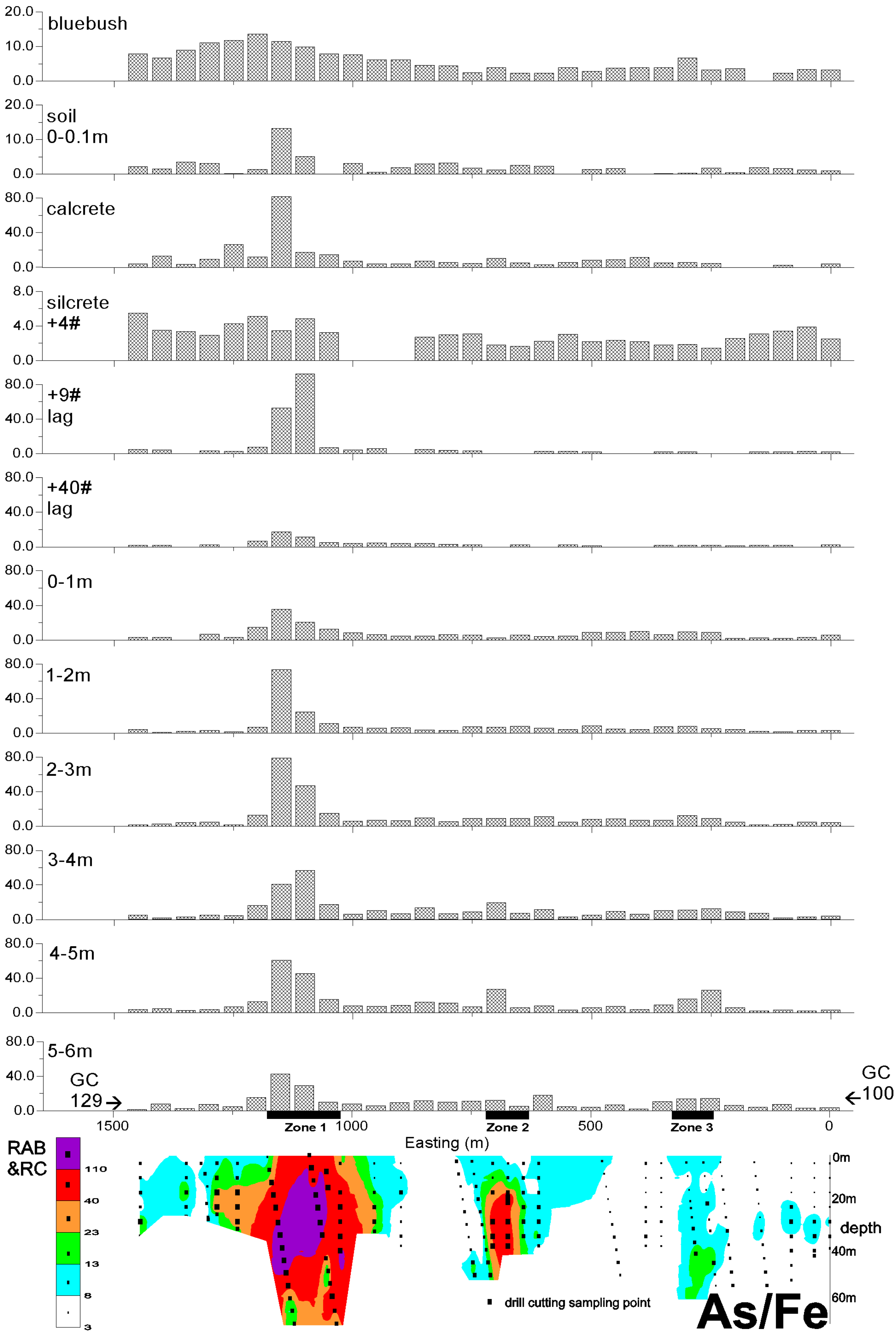

Figure A2.2b: As/Fe distributions in vegetation and regolith components.
Data in %. Black rectangles (Zones 1-3) locate mineralisation.

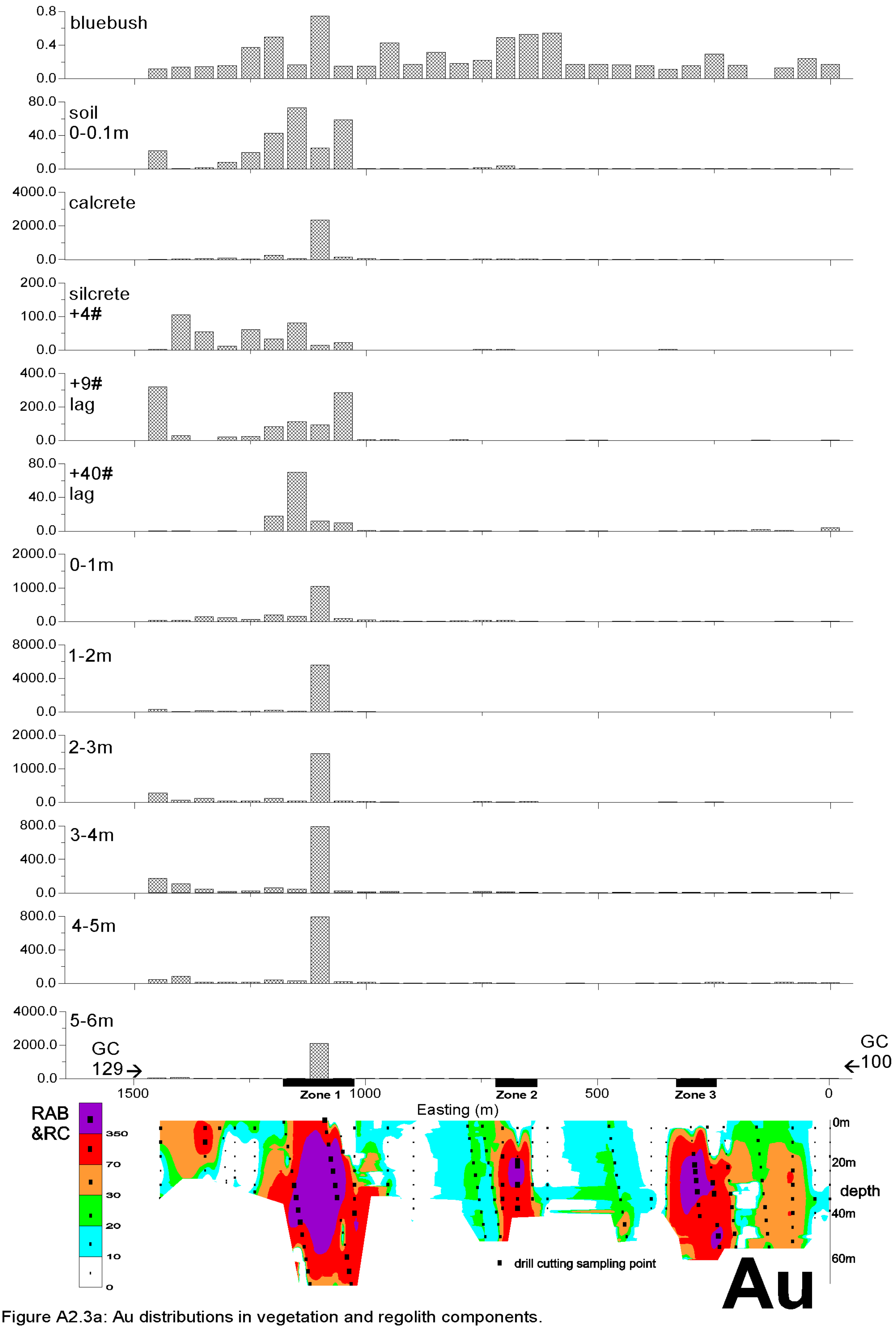

Figure A2.3a: Au distributions in vegetation and regolith components.
Data in ppb. Black rectangles (Zones 1-3) locate mineralisation.

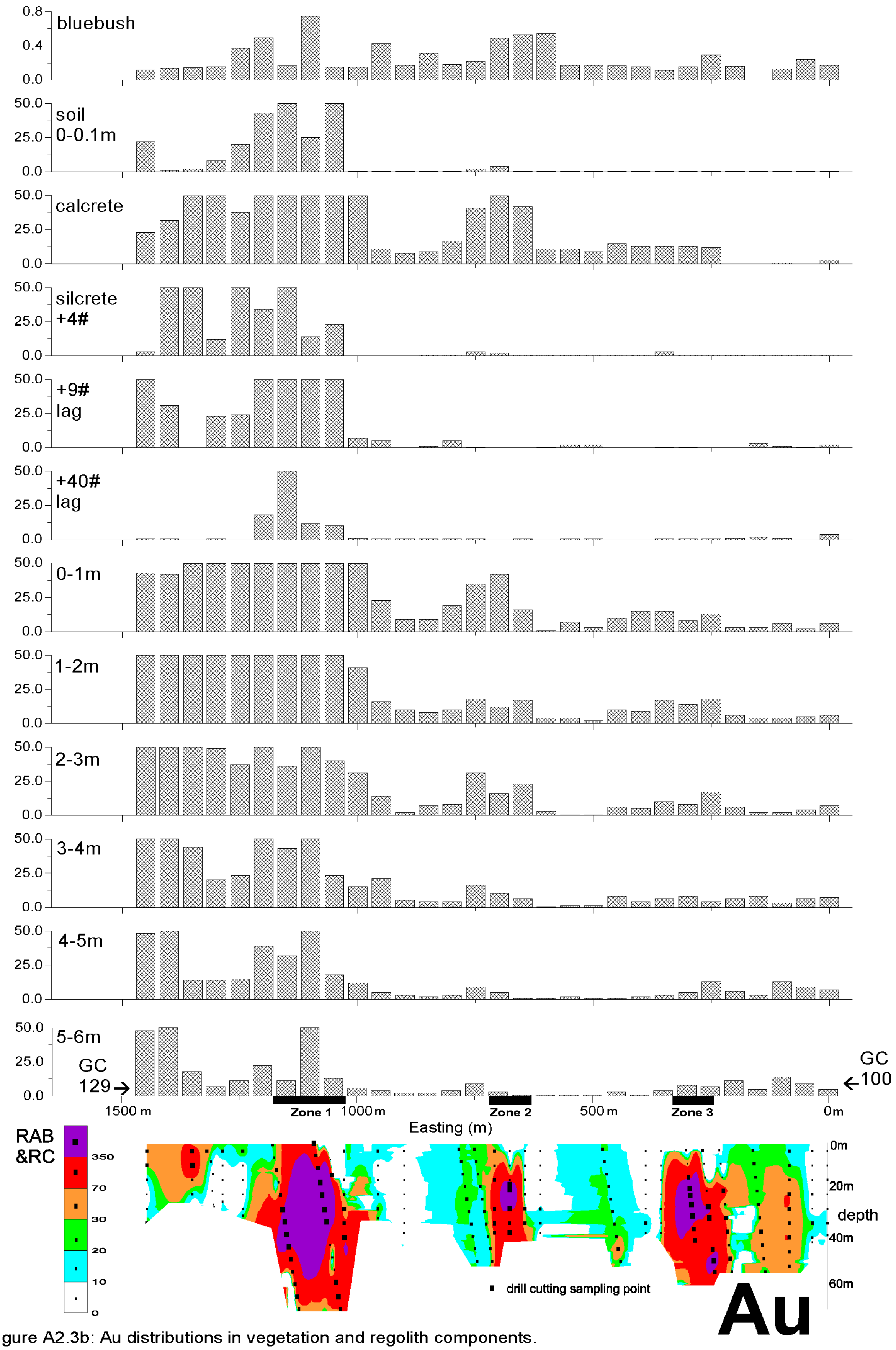

Figure A2.3b: Au distributions in vegetation and regolith components.
Data in ppb and truncated to 50 ppb. Black rectangles (Zones 1-3) locate mineralisation.

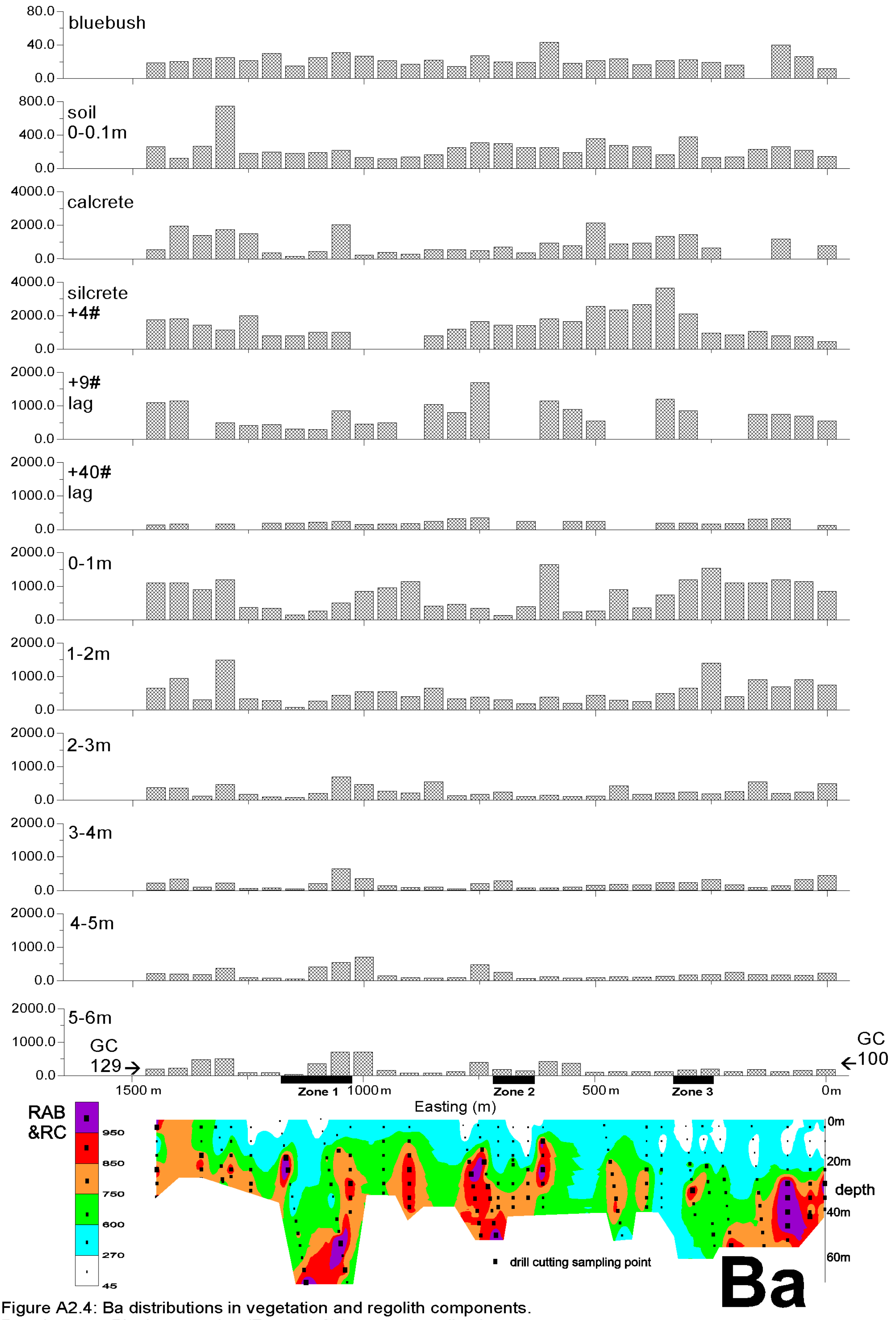

Figure A2.4: Ba distributions in vegetation and regolith components.
Data in ppm. Black rectangles (Zones 1-3) locate mineralisation.

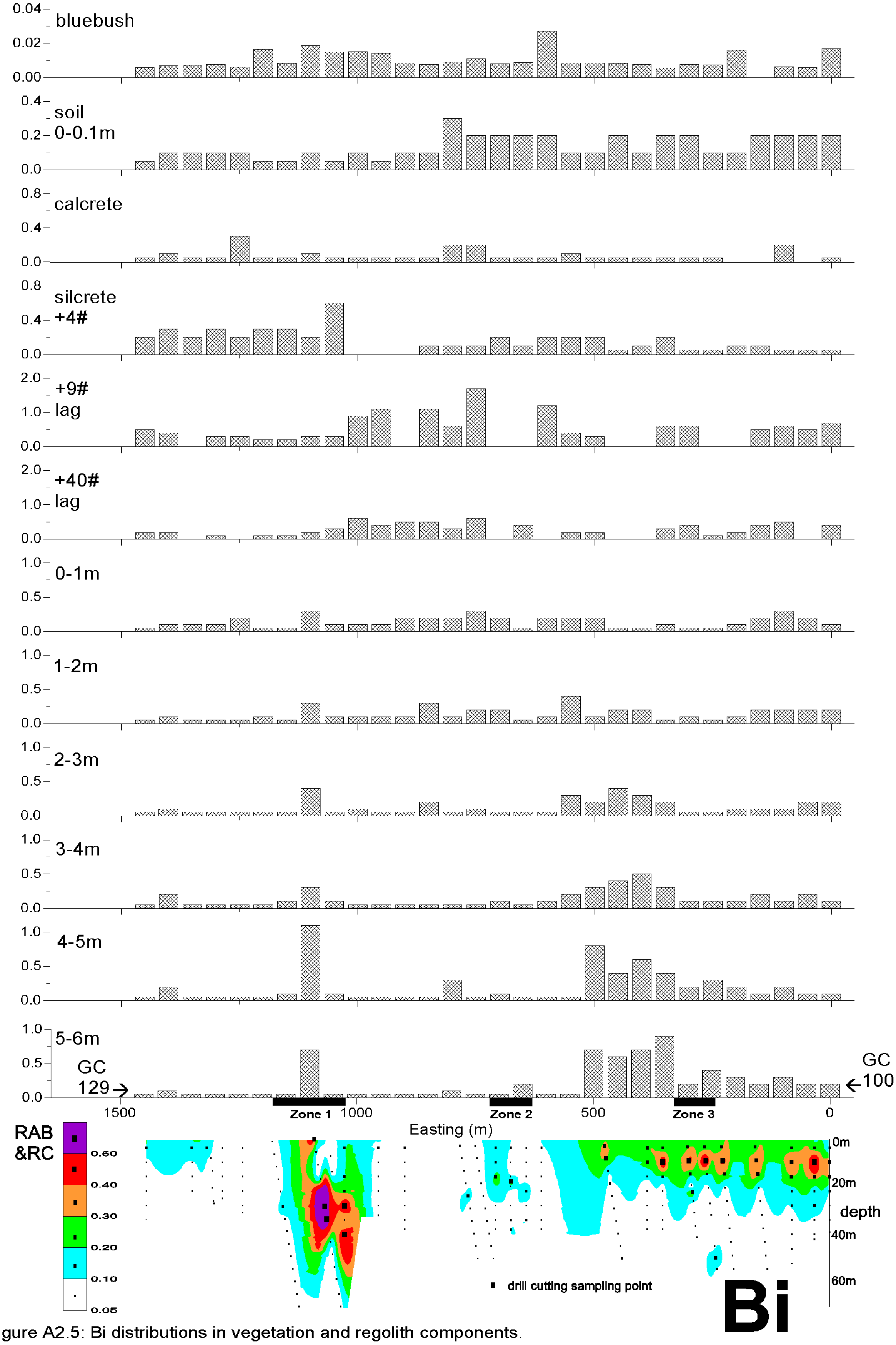

Figure A2.5: Bi distributions in vegetation and regolith components.
Data in ppm. Black rectangles (Zones 1-3) locate mineralisation.

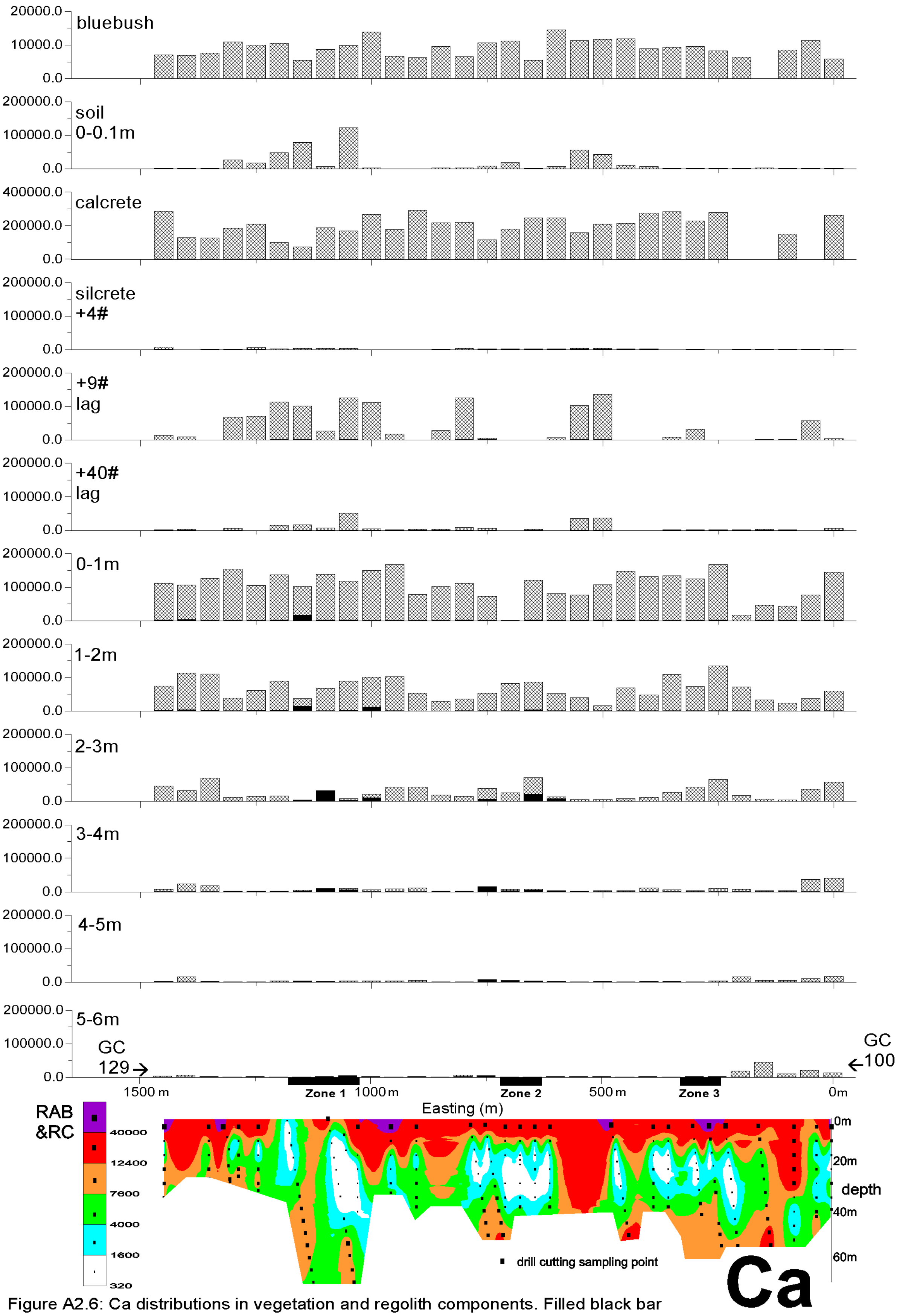

Figure A2.6: Ca distributions in vegetation and regolith components. Filled black bar graphs are estimated gypsum present calculated from S data. Data in ppm.

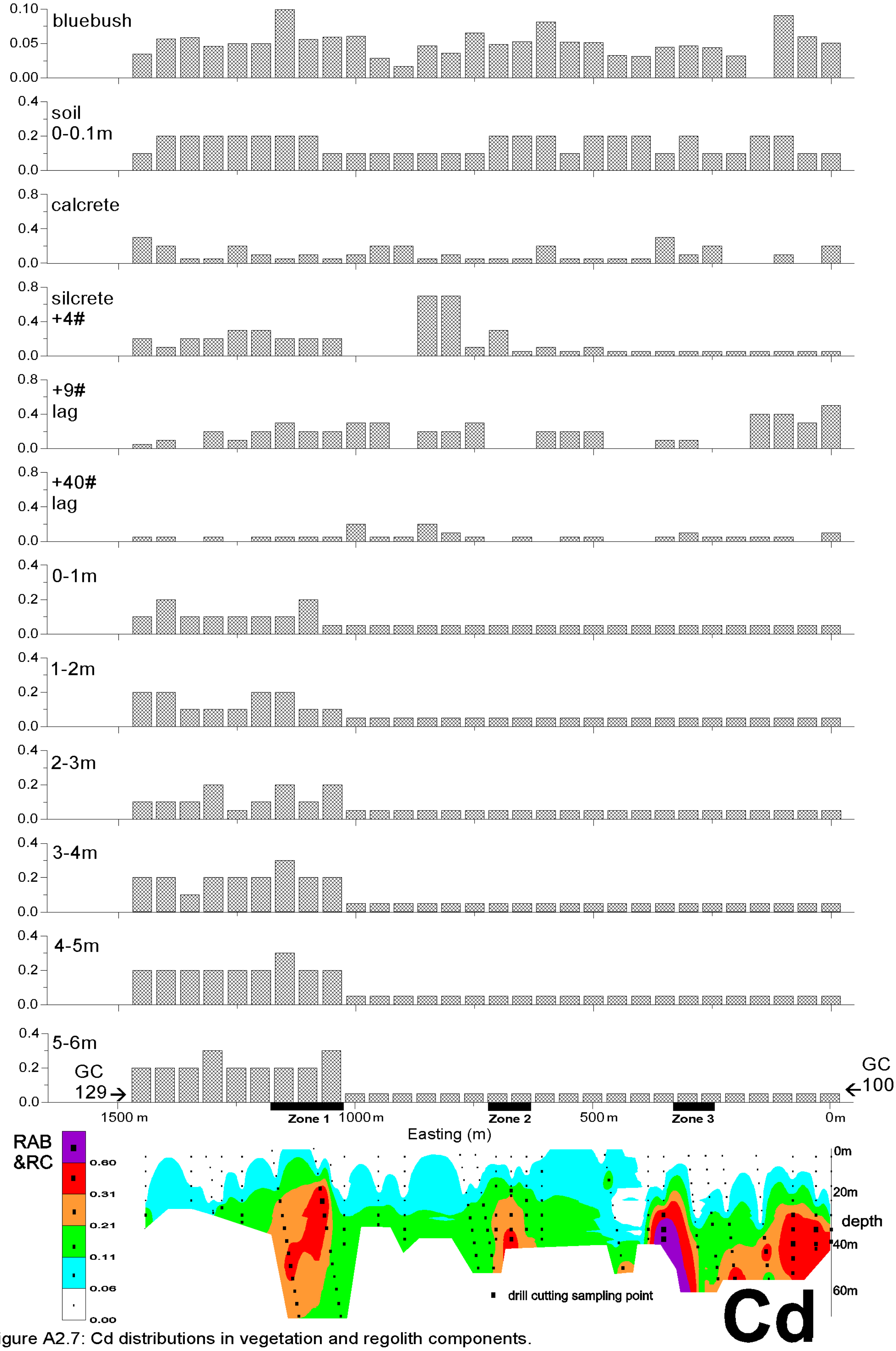

Figure A2.7: Cd distributions in vegetation and regolith components.
Data in ppm. Black rectangles (Zones 1-3) locate mineralisation.

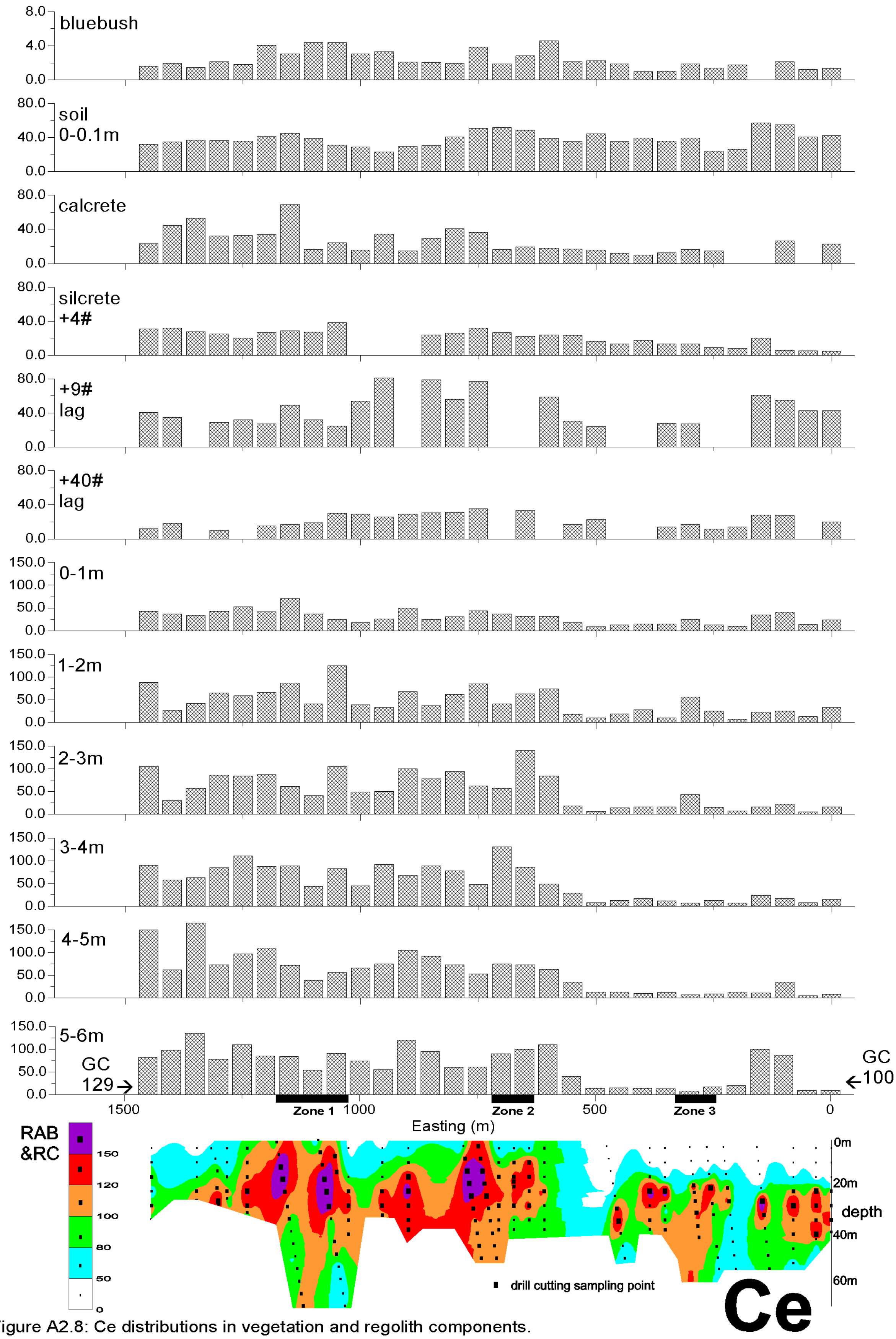

Figure A2.8: Ce distributions in vegetation and regolith components. Data in ppm. Black rectangles (Zones 1-3) locate mineralisation.

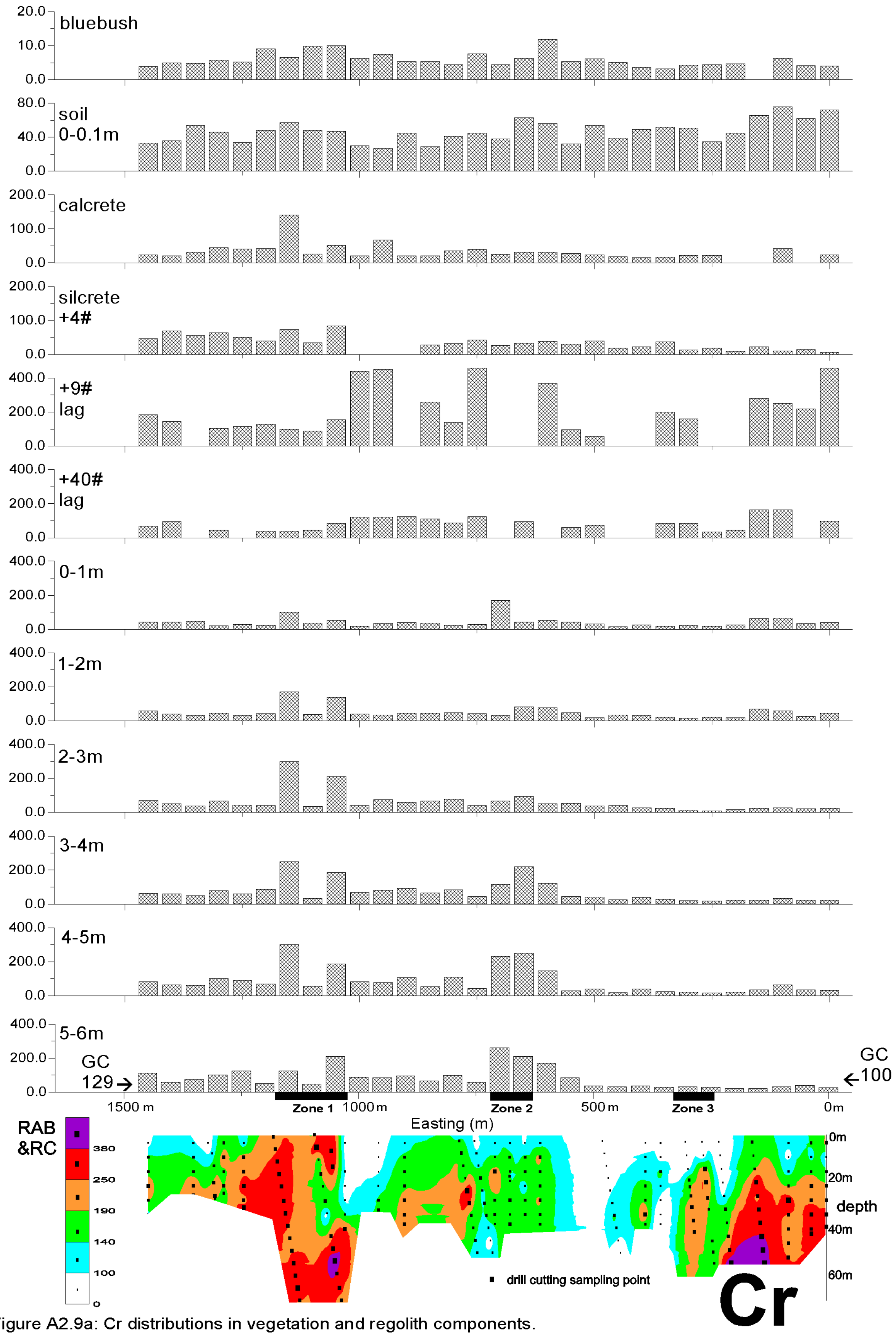

Figure A2.9a: Cr distributions in vegetation and regolith components.
Data in ppm. Black rectangles (Zones 1-3) locate mineralisation.

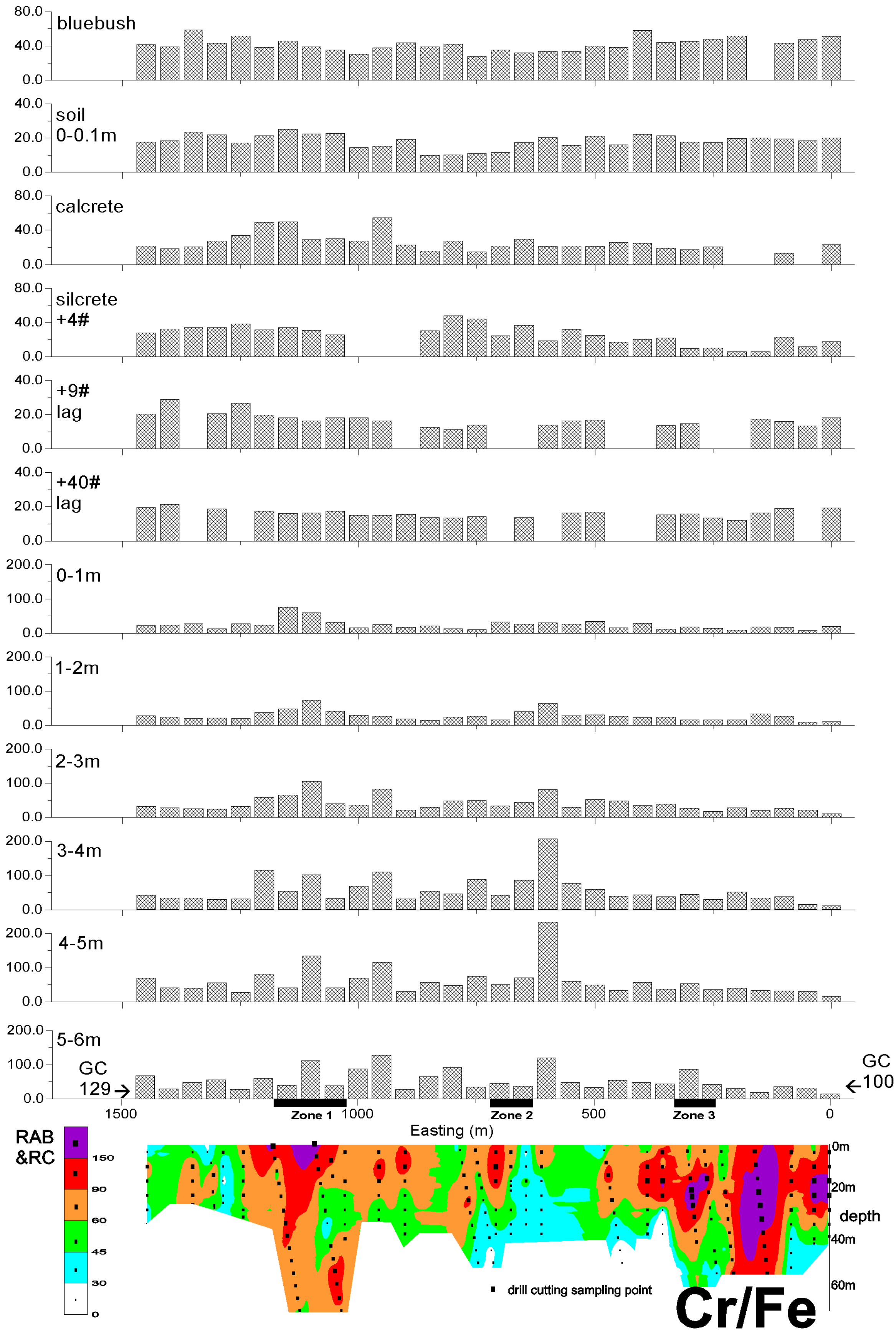

Figure A2.9b: Cr/Fe normalised distributions in vegetation and regolith components. Data in %. Black rectangles (Zones 1-3) locate mineralisation.

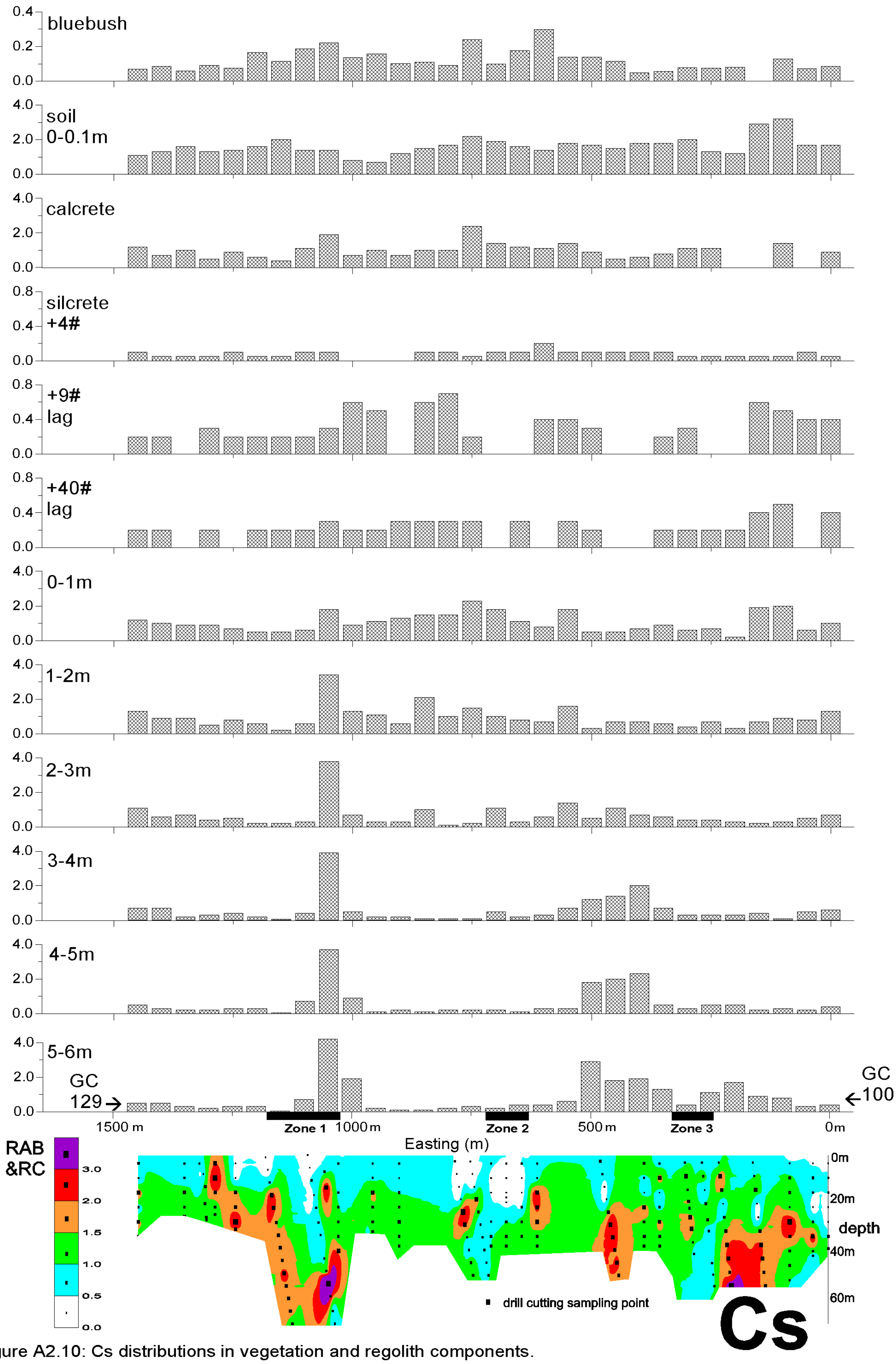

Figure A2.10: Cs distributions in vegetation and regolith components. Data in ppm. Black rectangles (Zones 1-3) locate mineralisation.

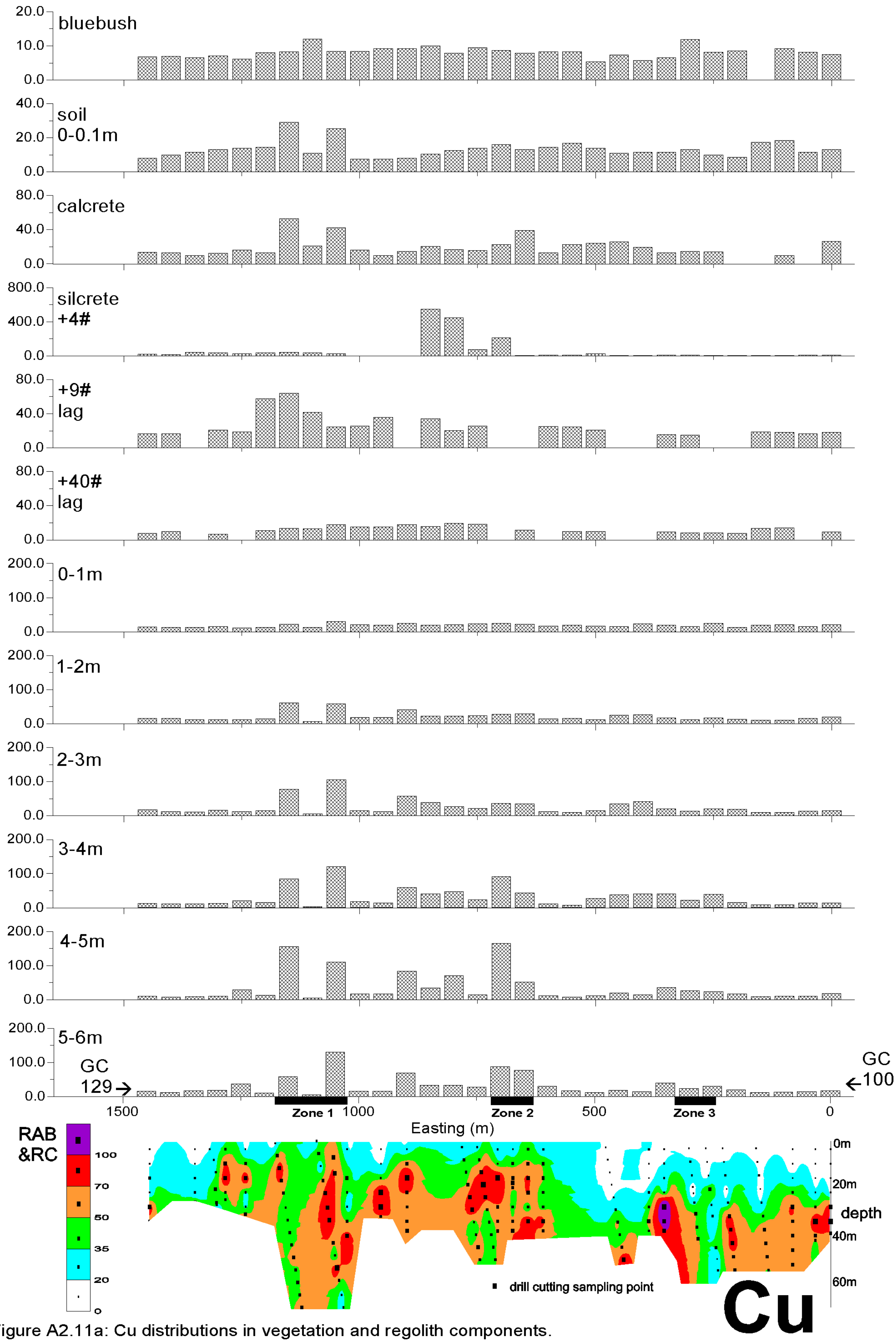

Figure A2.11a: Cu distributions in vegetation and regolith components.
Data in ppm. Black rectangles (Zones 1-3) locate mineralisation.

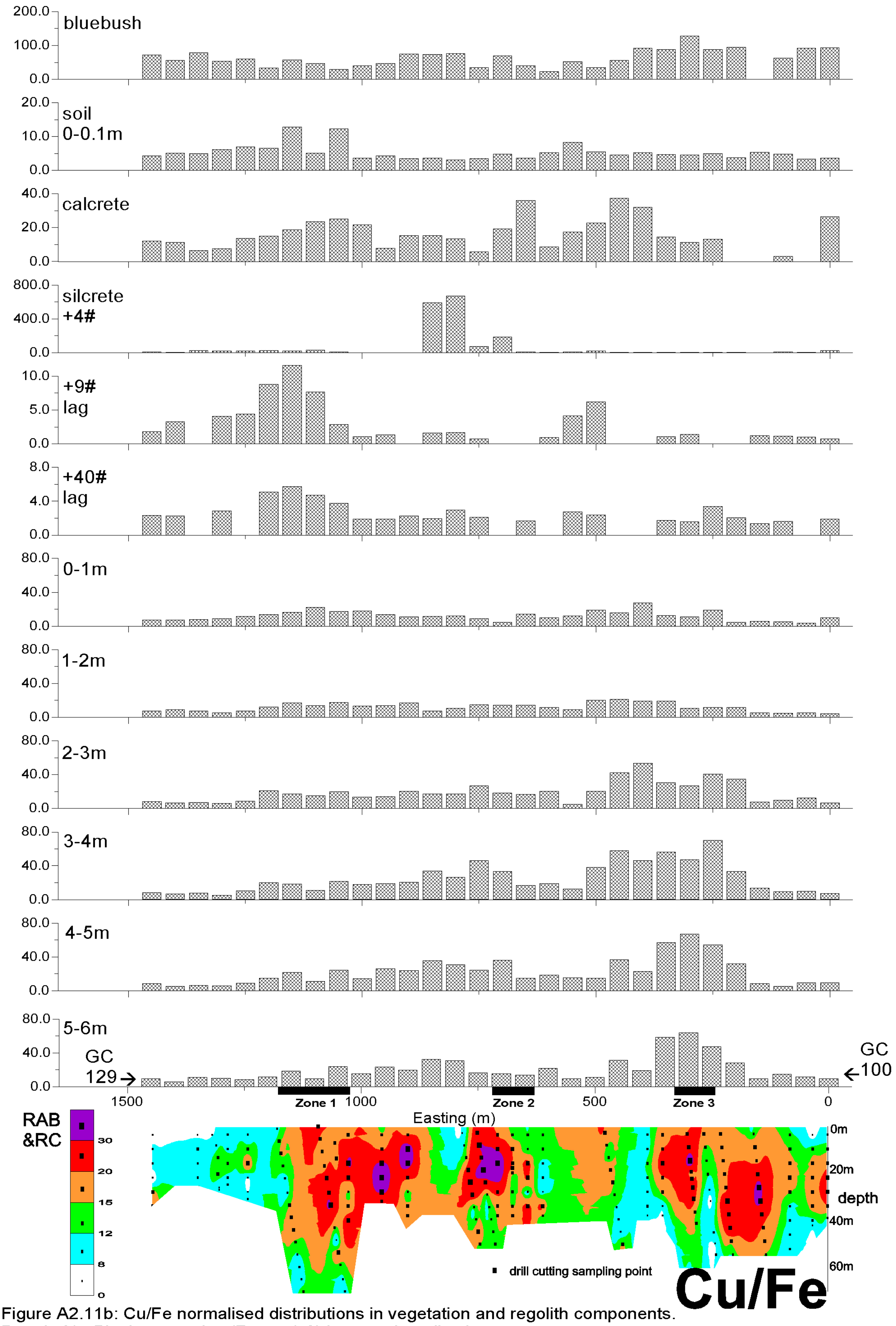

Figure A2.11b: Cu/Fe normalised distributions in vegetation and regolith components. Data in %. Black rectangles (Zones 1-3) locate mineralisation.

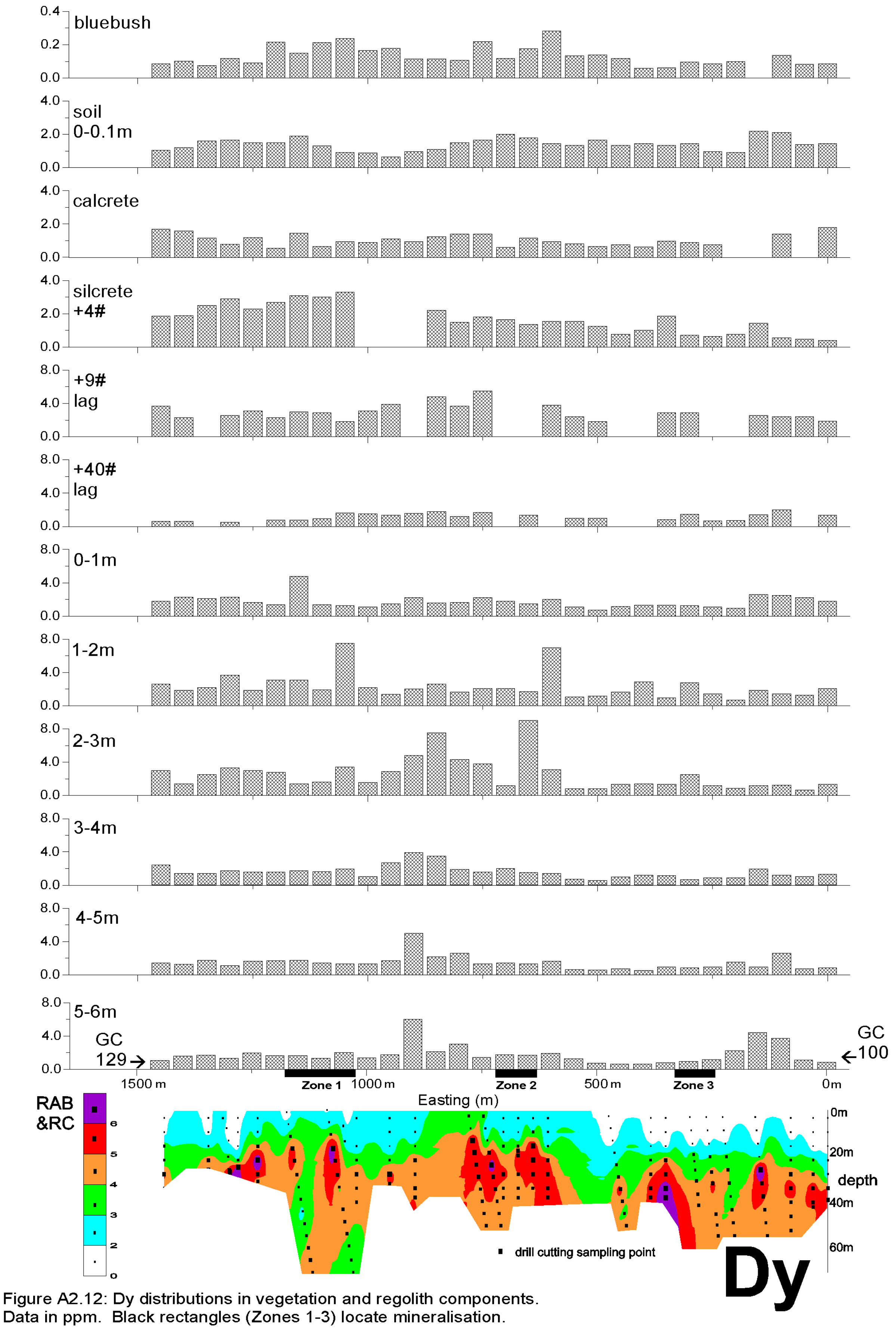

Figure A2.12: Dy distributions in vegetation and regolith components. Data in ppm. Black rectangles (Zones 1-3) locate mineralisation.

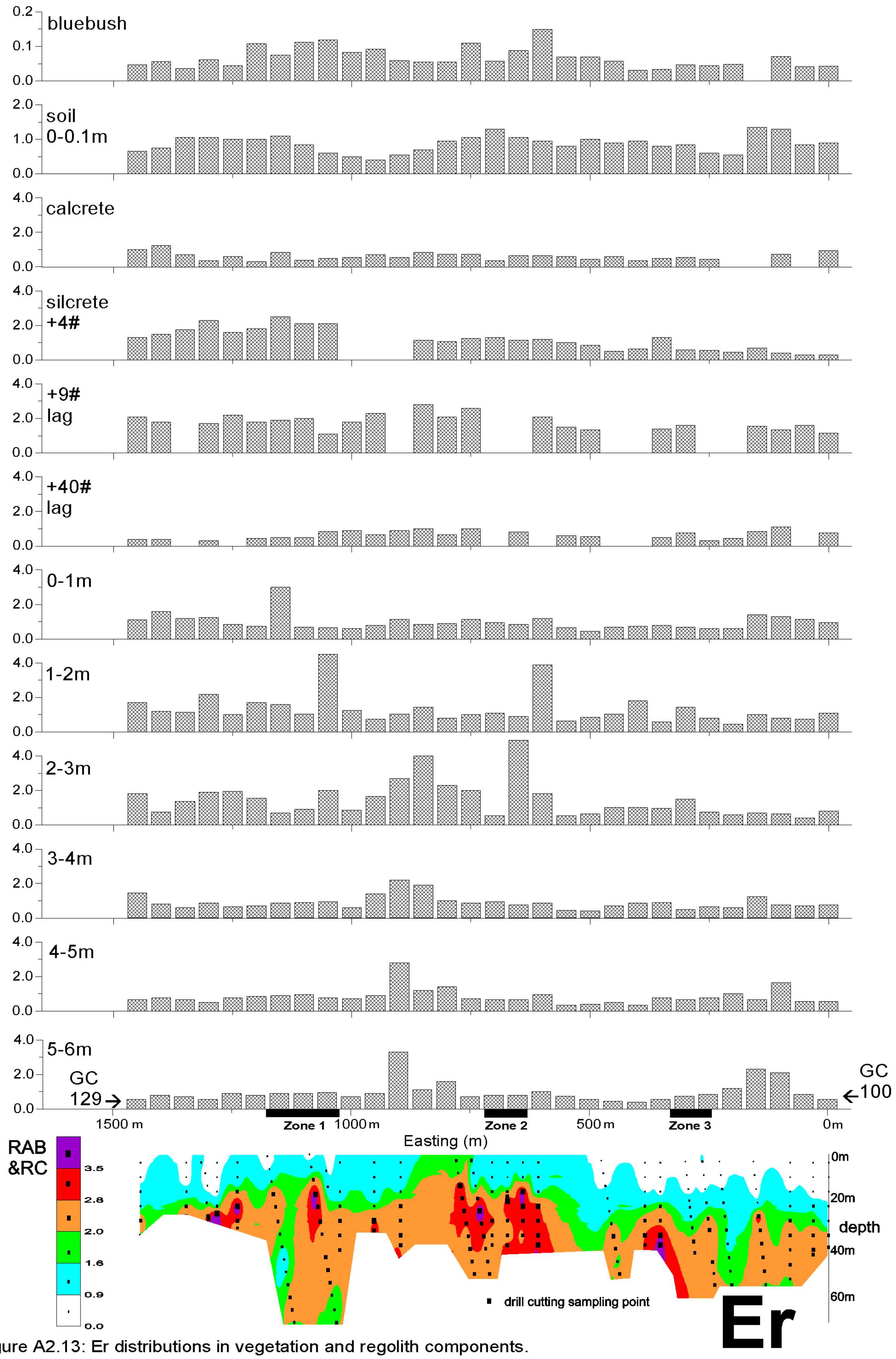

Figure A2.13: Er distributions in vegetation and regolith components.
Data in ppm. Black rectangles (Zones 1-3) locate mineralisation.

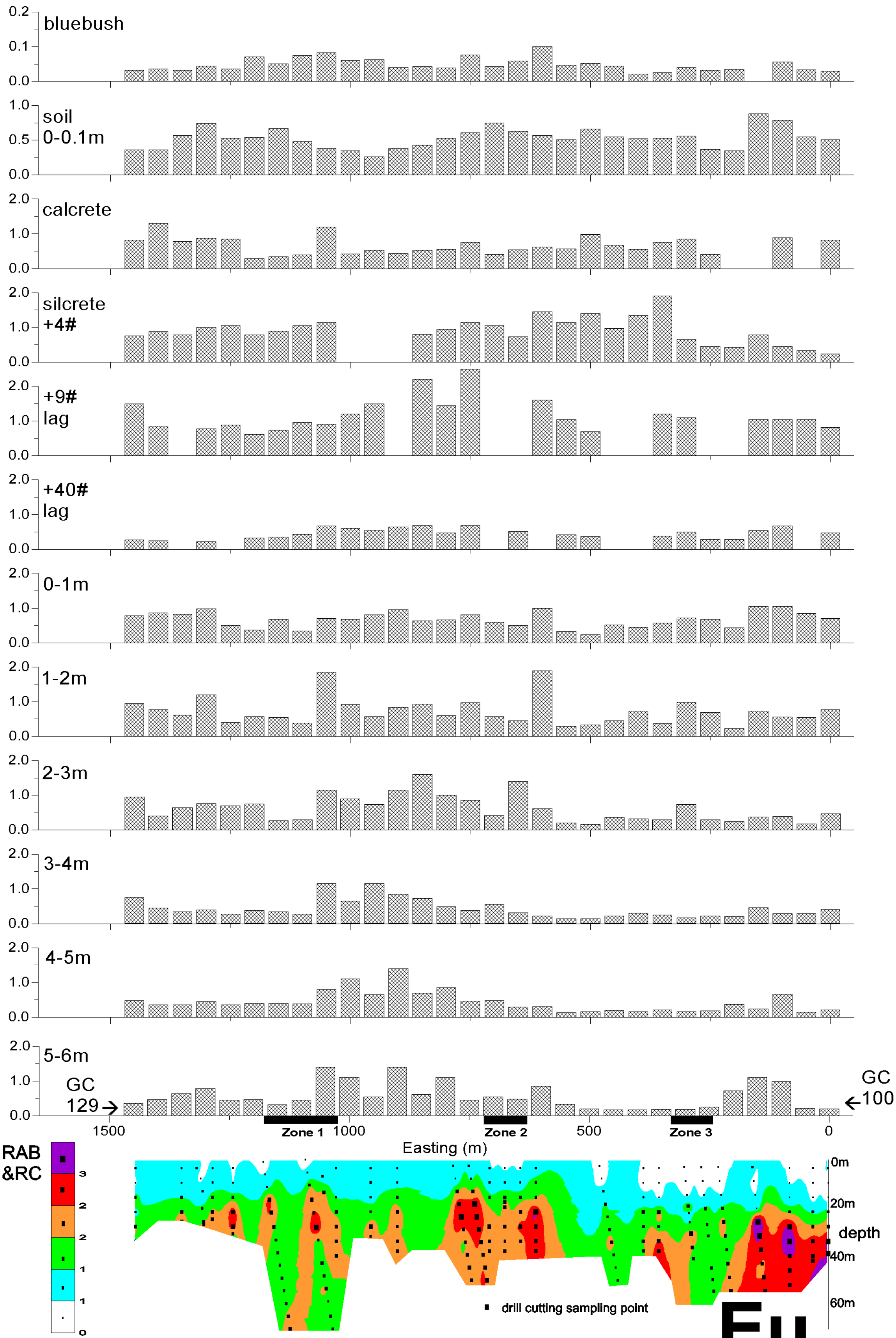

Figure A2.14: Eu distributions in vegetation and regolith components.
Data in ppm. Black rectangles (Zones 1-3) locate mineralisation.

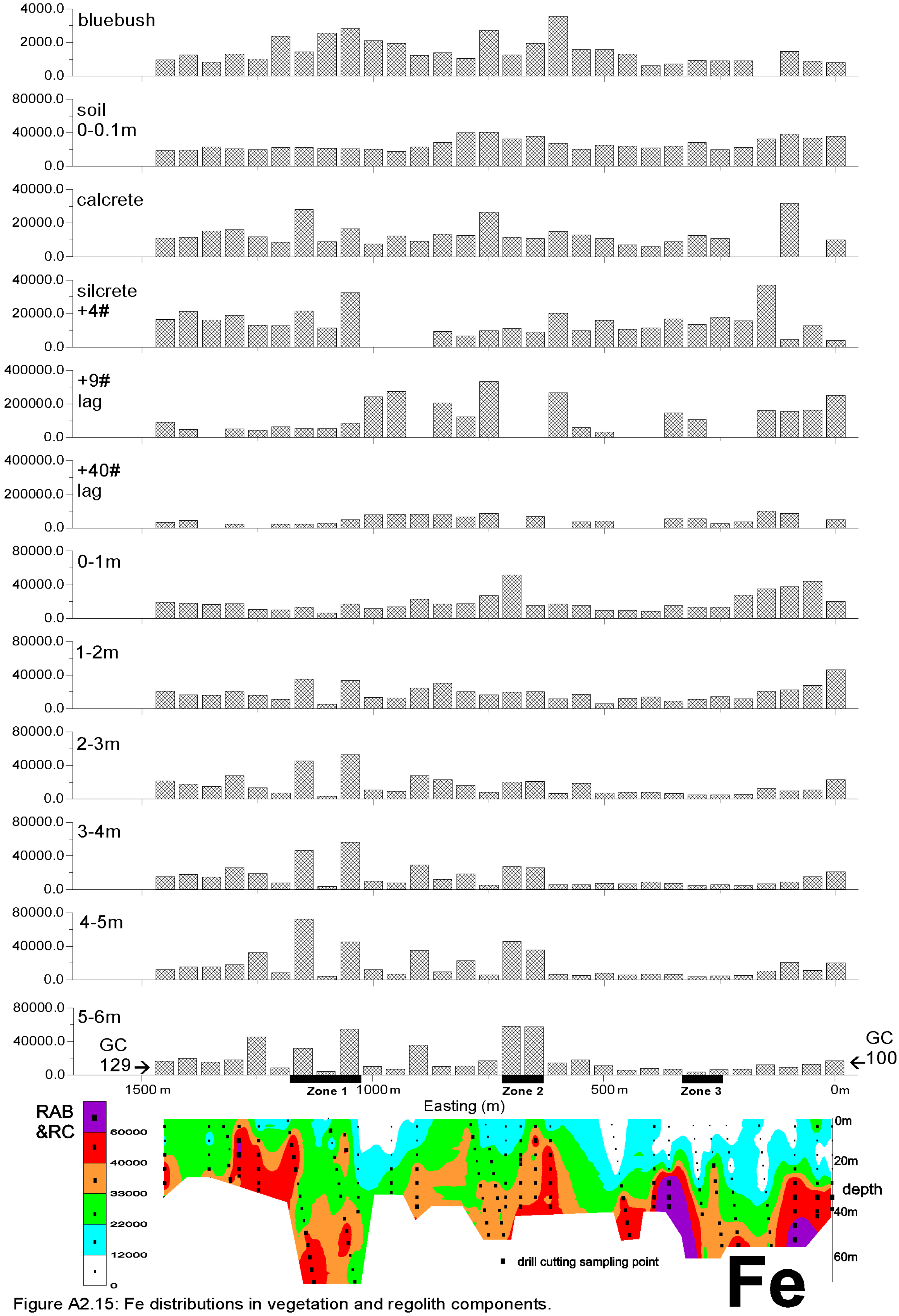

Figure A2.15: Fe distributions in vegetation and regolith components.
Data in ppm. Black rectangles (Zones 1-3) locate mineralisation.

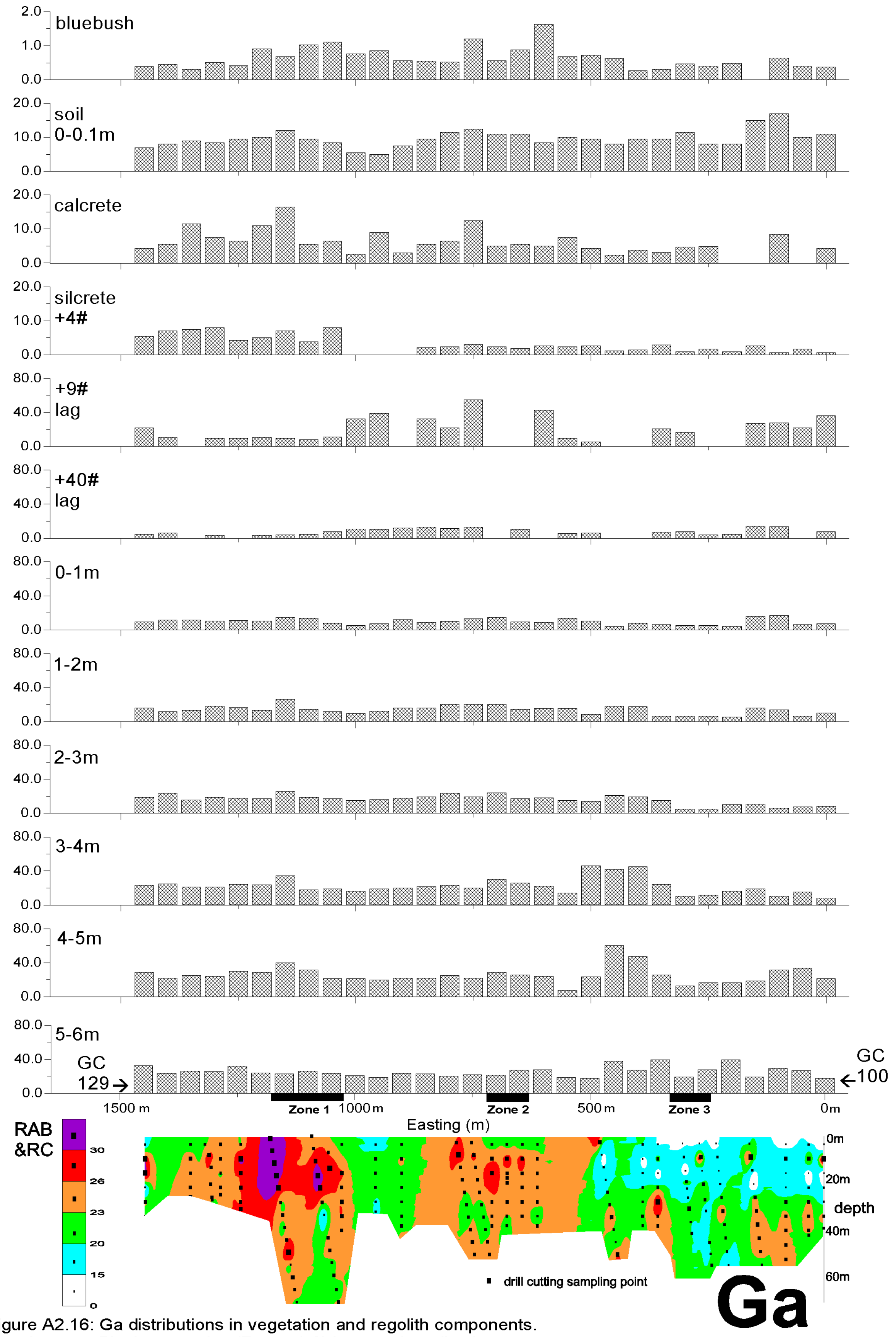

Figure A2.16: Ga distributions in vegetation and regolith components. Data in ppm. Black rectangles (Zones 1-3) locate mineralisation.

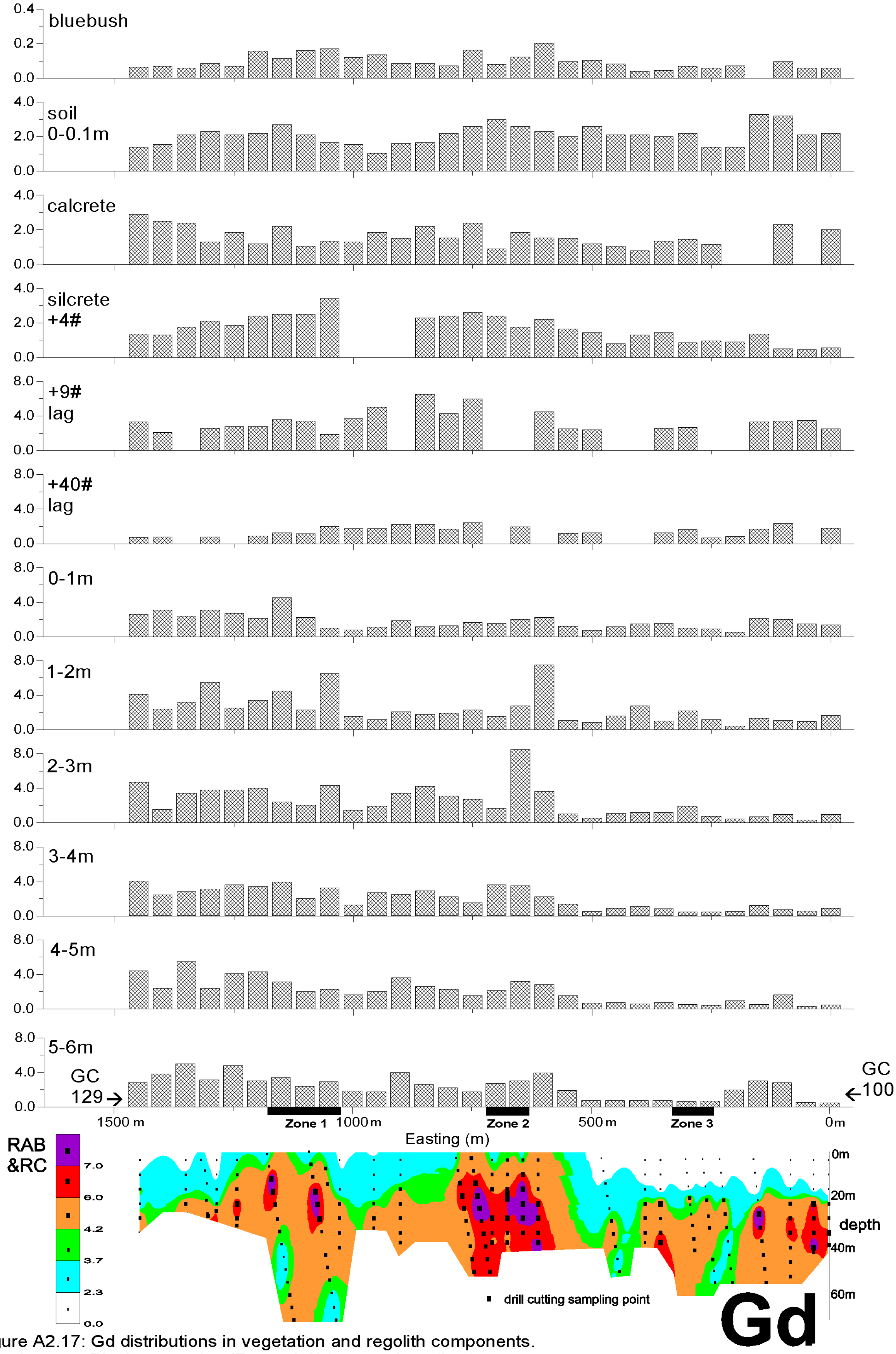

Figure A2.17: Gd distributions in vegetation and regolith components.
Data in ppm. Black rectangles (Zones 1-3) locate mineralisation.

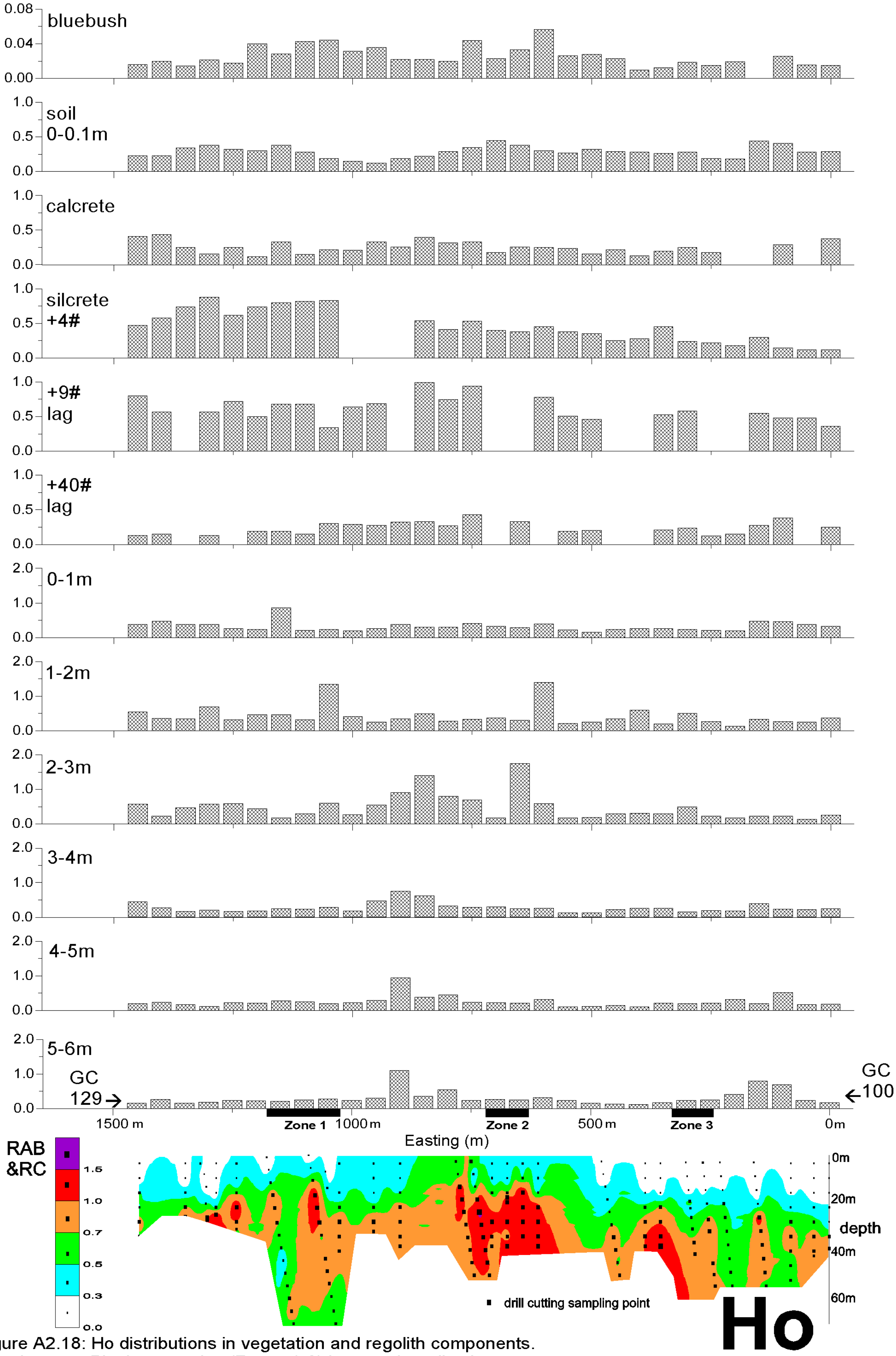

Figure A2.18: Ho distributions in vegetation and regolith components. Data in ppm. Black rectangles (Zones 1-3) locate mineralisation.

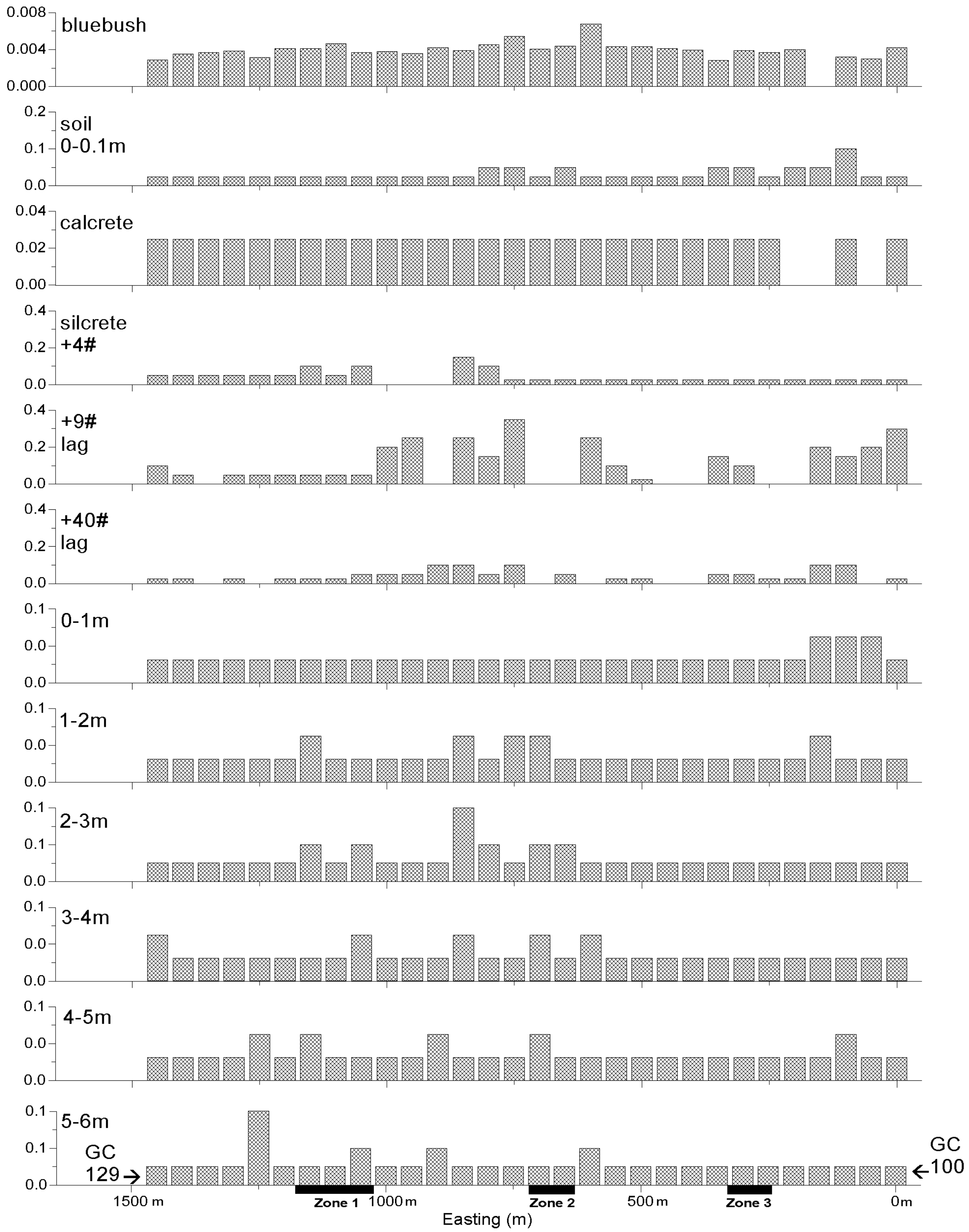

Figure A2.19: In distributions in vegetation and regolith components.
Data in ppm. Black rectangles (Zones 1-3) locate mineralisation.

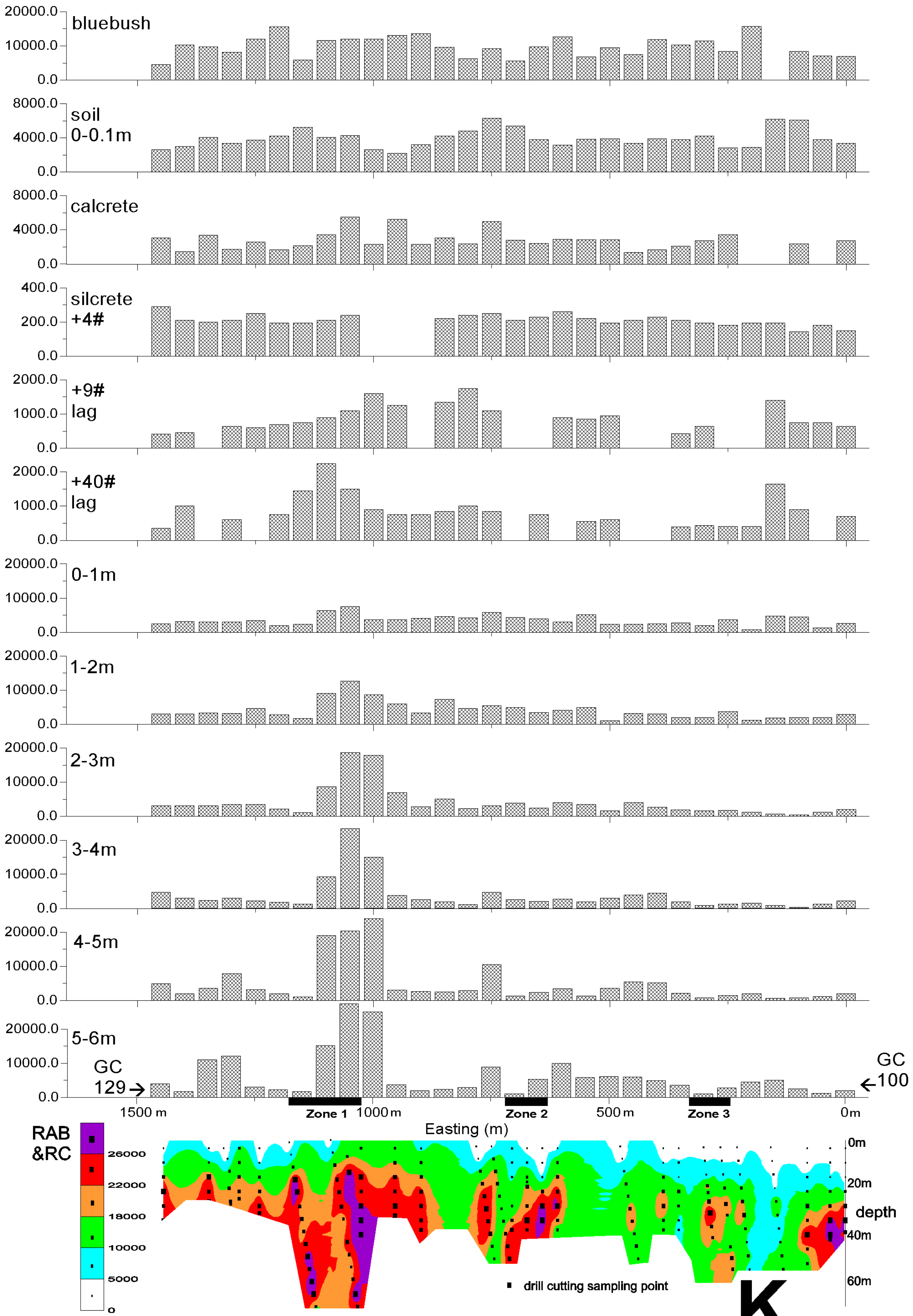

Figure A2.20: K distributions in vegetation and regolith components.
Data in ppm. Black rectangles (Zones 1-3) locate mineralisation.

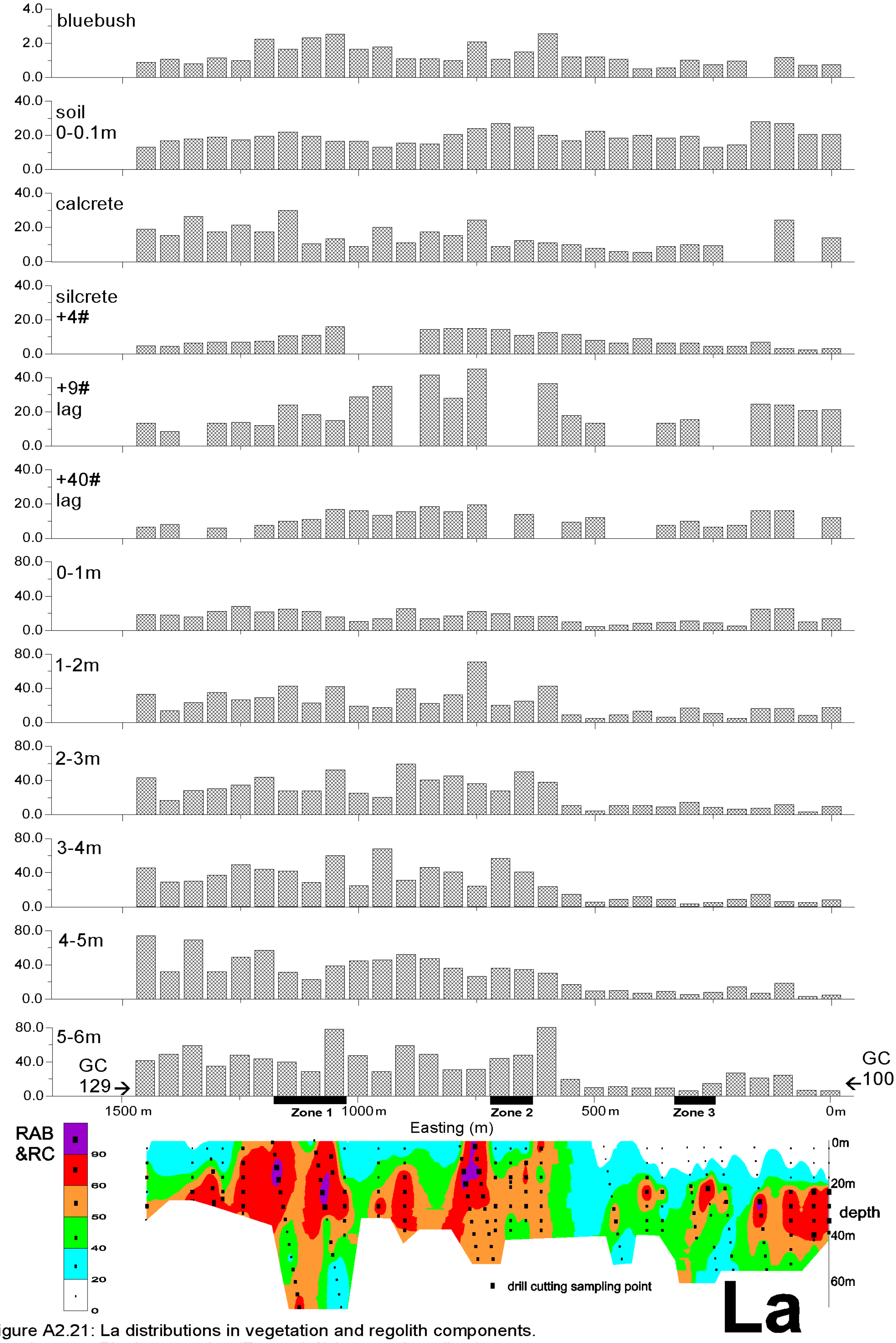

Figure A2.21: La distributions in vegetation and regolith components.
Data in ppm. Black rectangles (Zones 1-3) locate mineralisation.

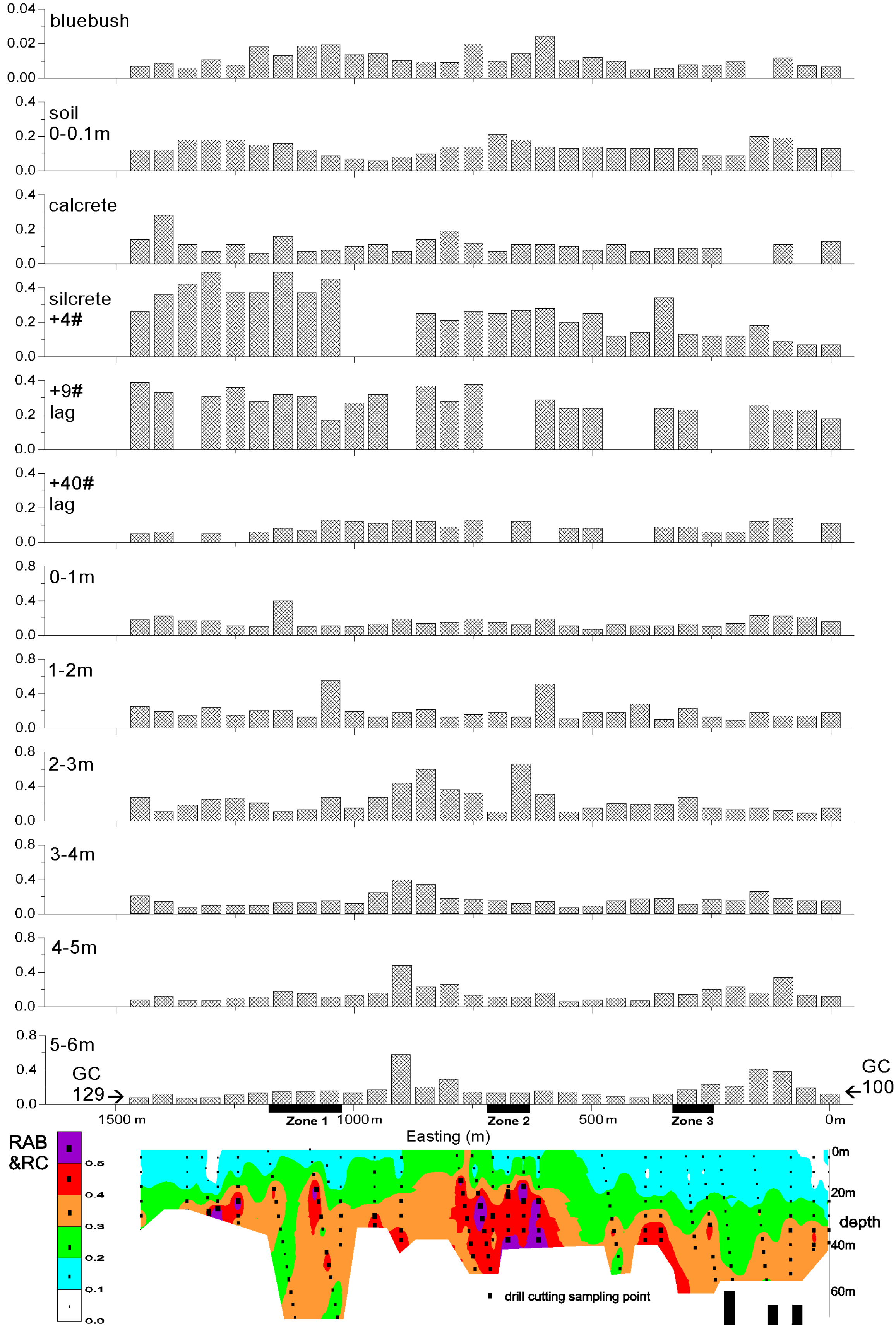

Figure A2.22: Lu distributions in vegetation and regolith components.
Data in ppm. Black rectangles (Zones 1-3) locate mineralisation.

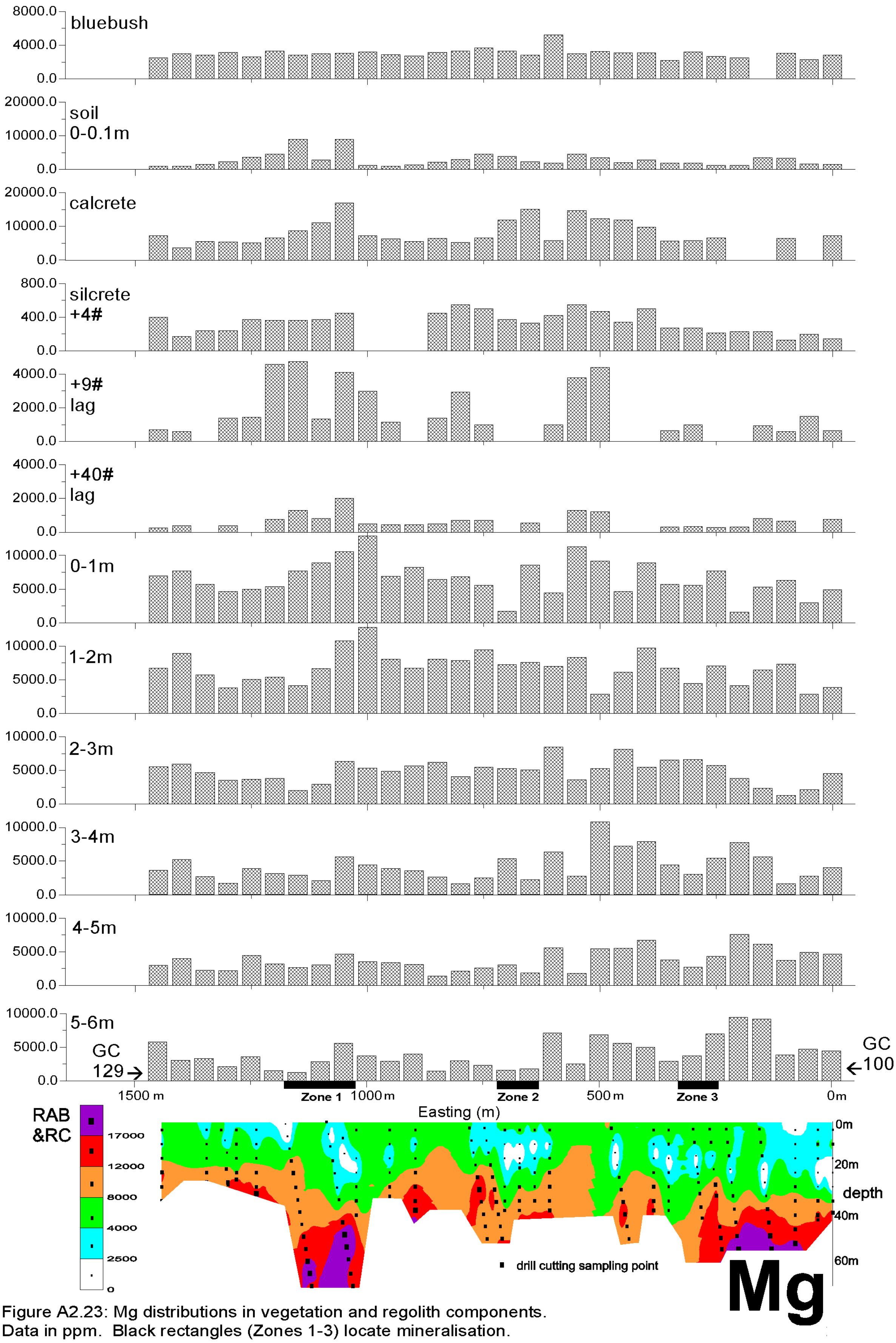

Figure A2.23: Mg distributions in vegetation and regolith components.
Data in ppm. Black rectangles (Zones 1-3) locate mineralisation.

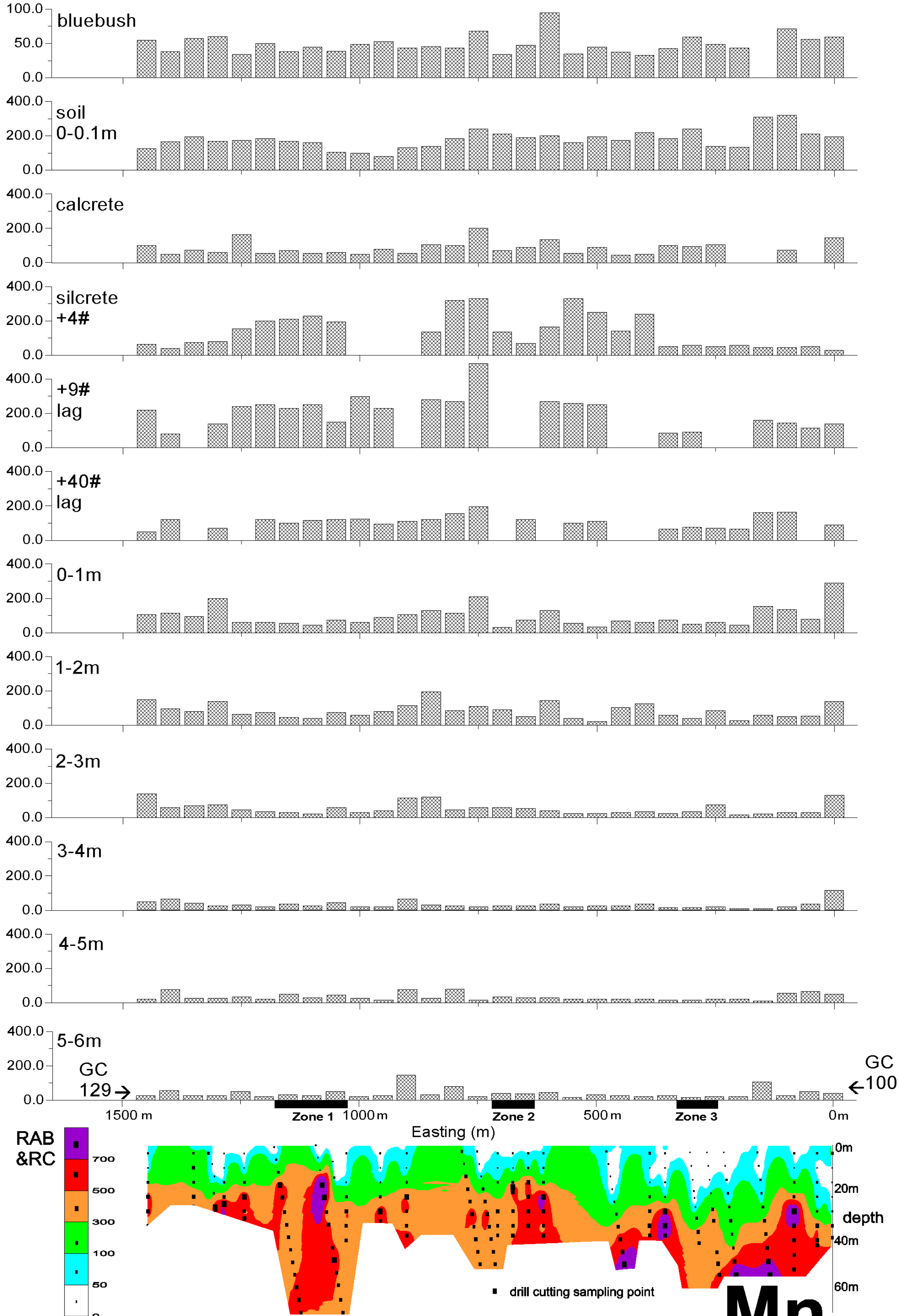

Figure A2.24: Mn distributions in vegetation and regolith components.
Data in ppm. Black rectangles (Zones 1-3) locate mineralisation.

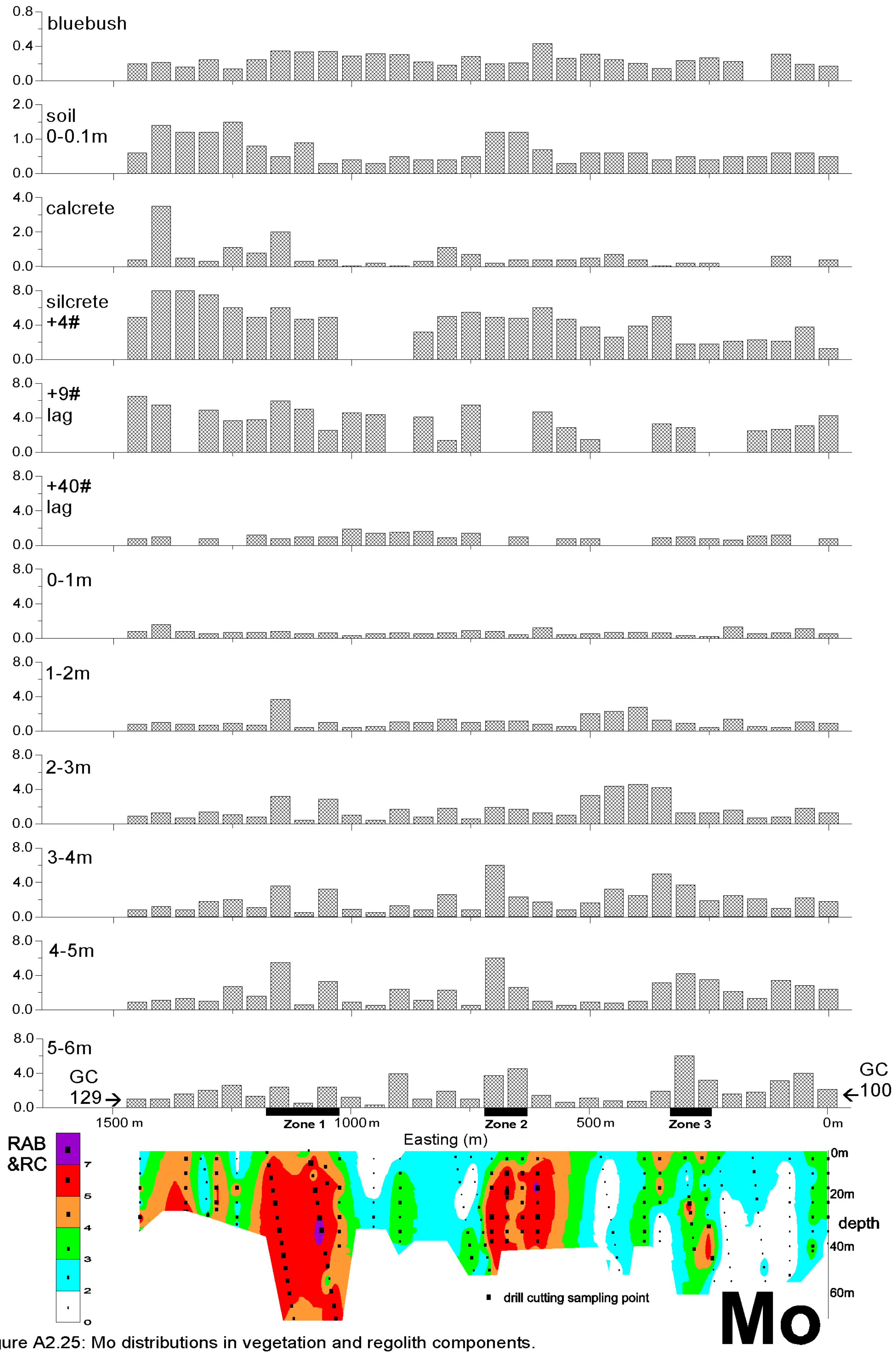

Figure A2.25: Mo distributions in vegetation and regolith components.
Data in ppm. Black rectangles (Zones 1-3) locate mineralisation.

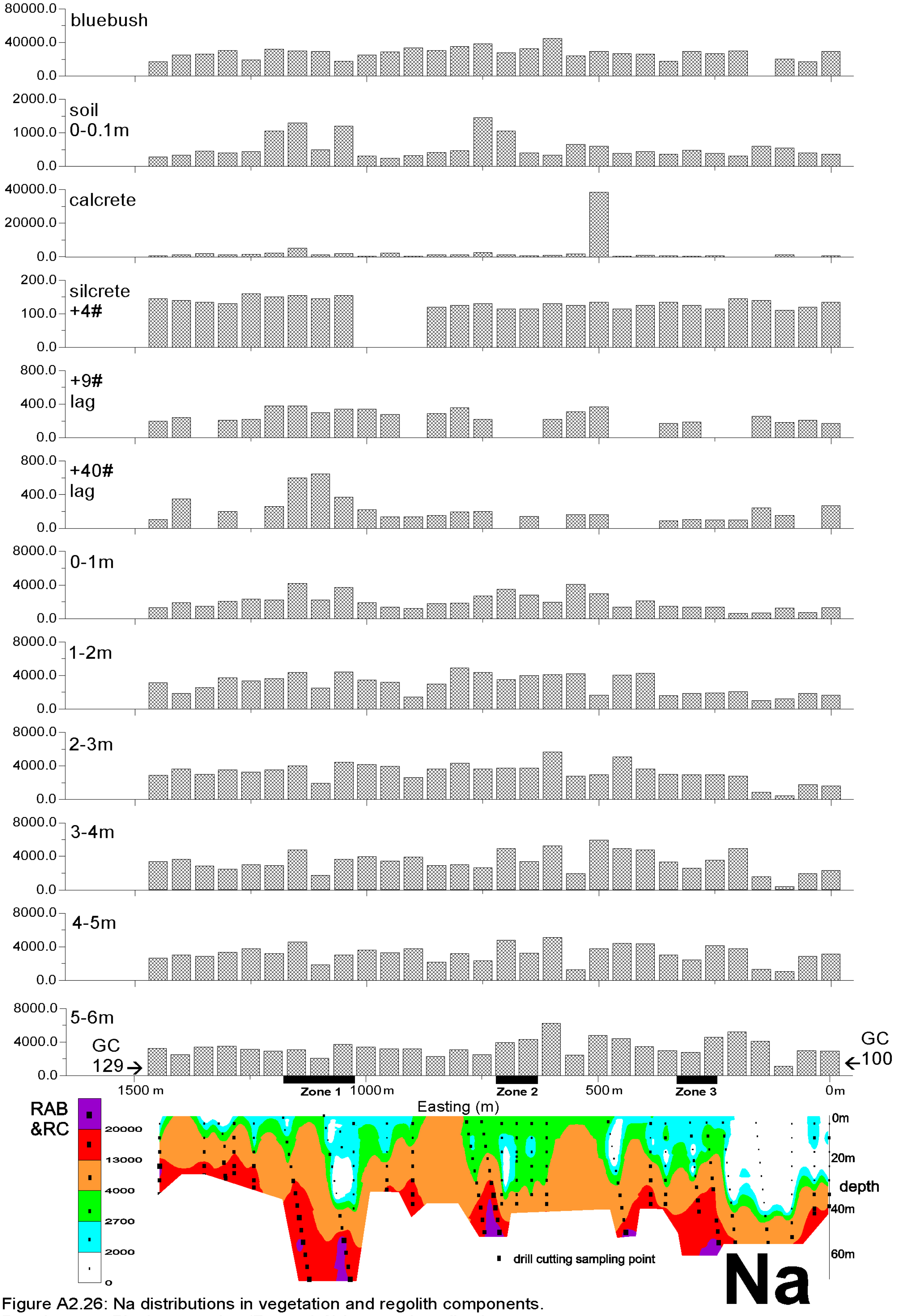

Figure A2.26: Na distributions in vegetation and regolith components.
Data in ppm. Black rectangles (Zones 1-3) locate mineralisation.

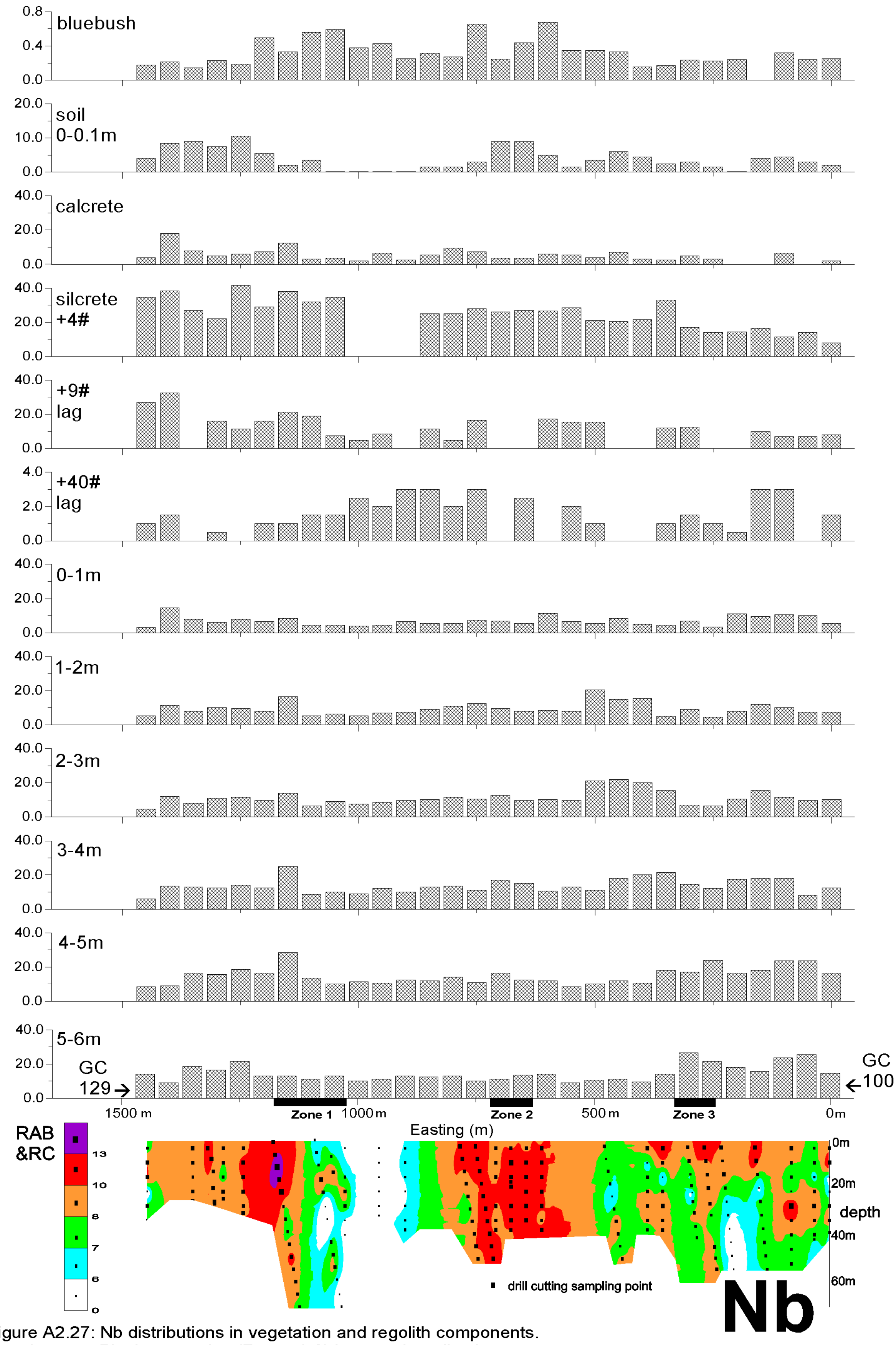

Figure A2.27: Nb distributions in vegetation and regolith components. Data in ppm. Black rectangles (Zones 1-3) locate mineralisation.

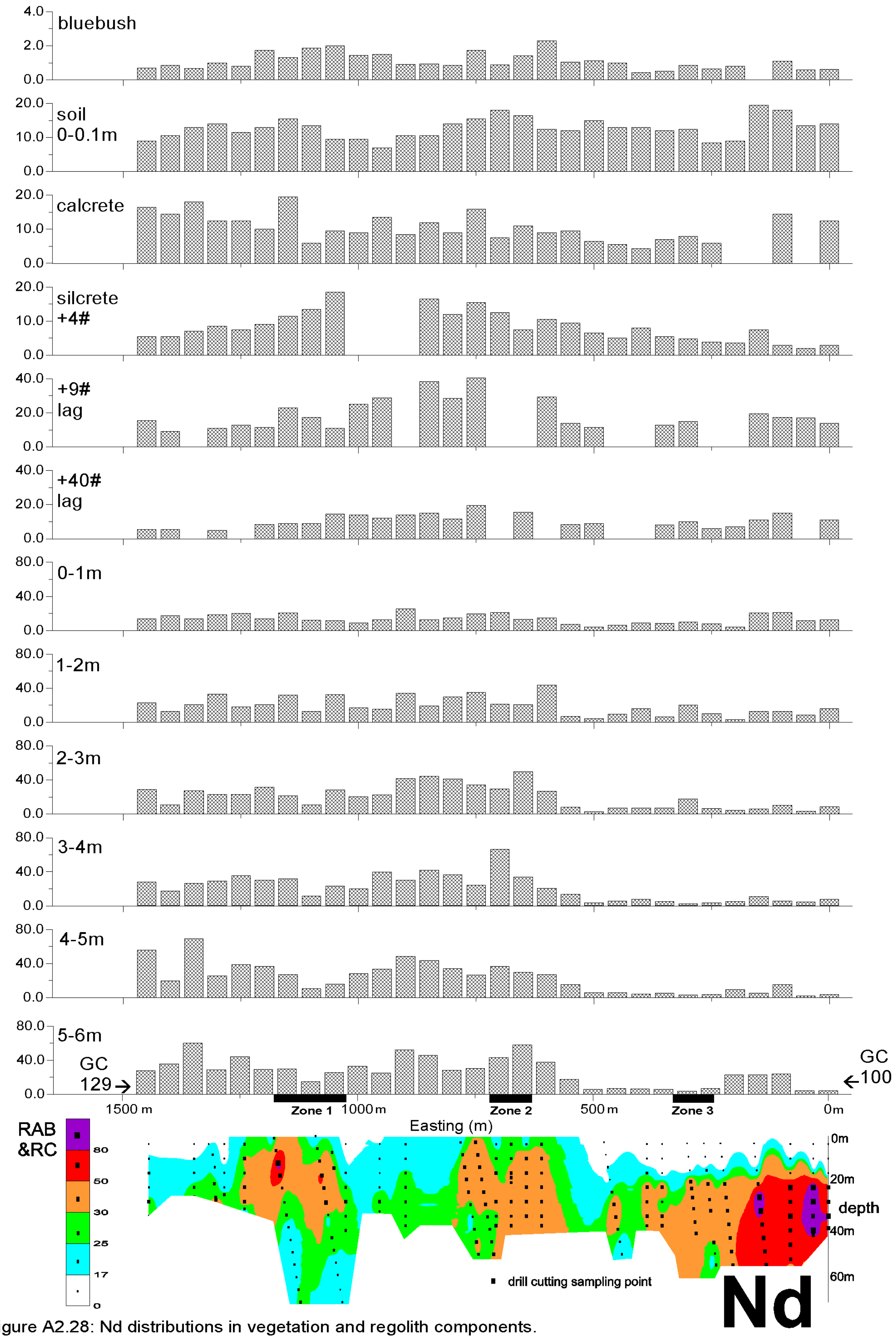

Figure A2.28: Nd distributions in vegetation and regolith components.
Data in ppm. Black rectangles (Zones 1-3) locate mineralisation.

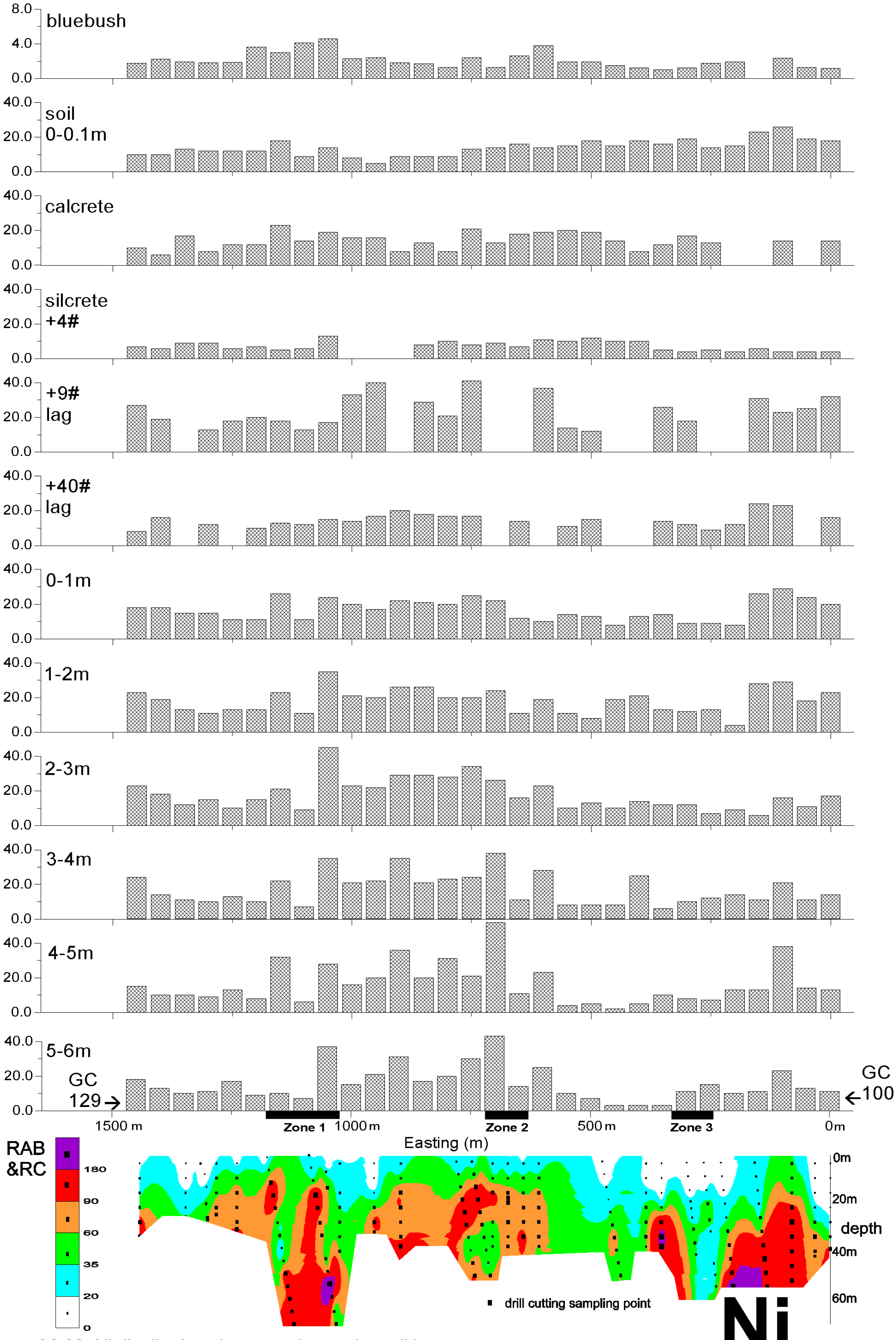

Figure A2.29: Ni distributions in vegetation and regolith components. Data in ppm. Black rectangles (Zones 1-3) locate mineralisation.

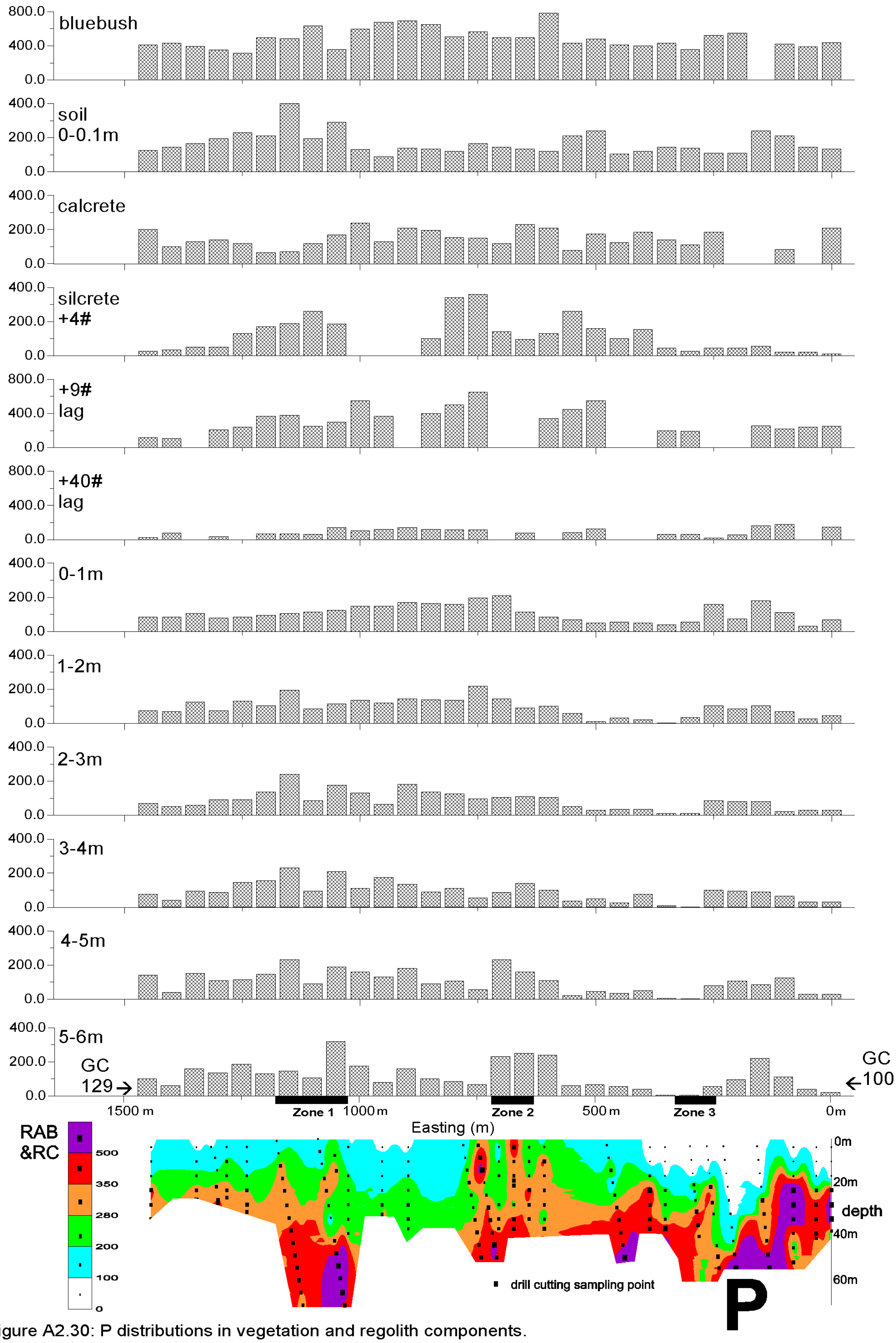

Figure A2.30: P distributions in vegetation and regolith components.
Data in ppm. Black rectangles (Zones 1-3) locate mineralisation.

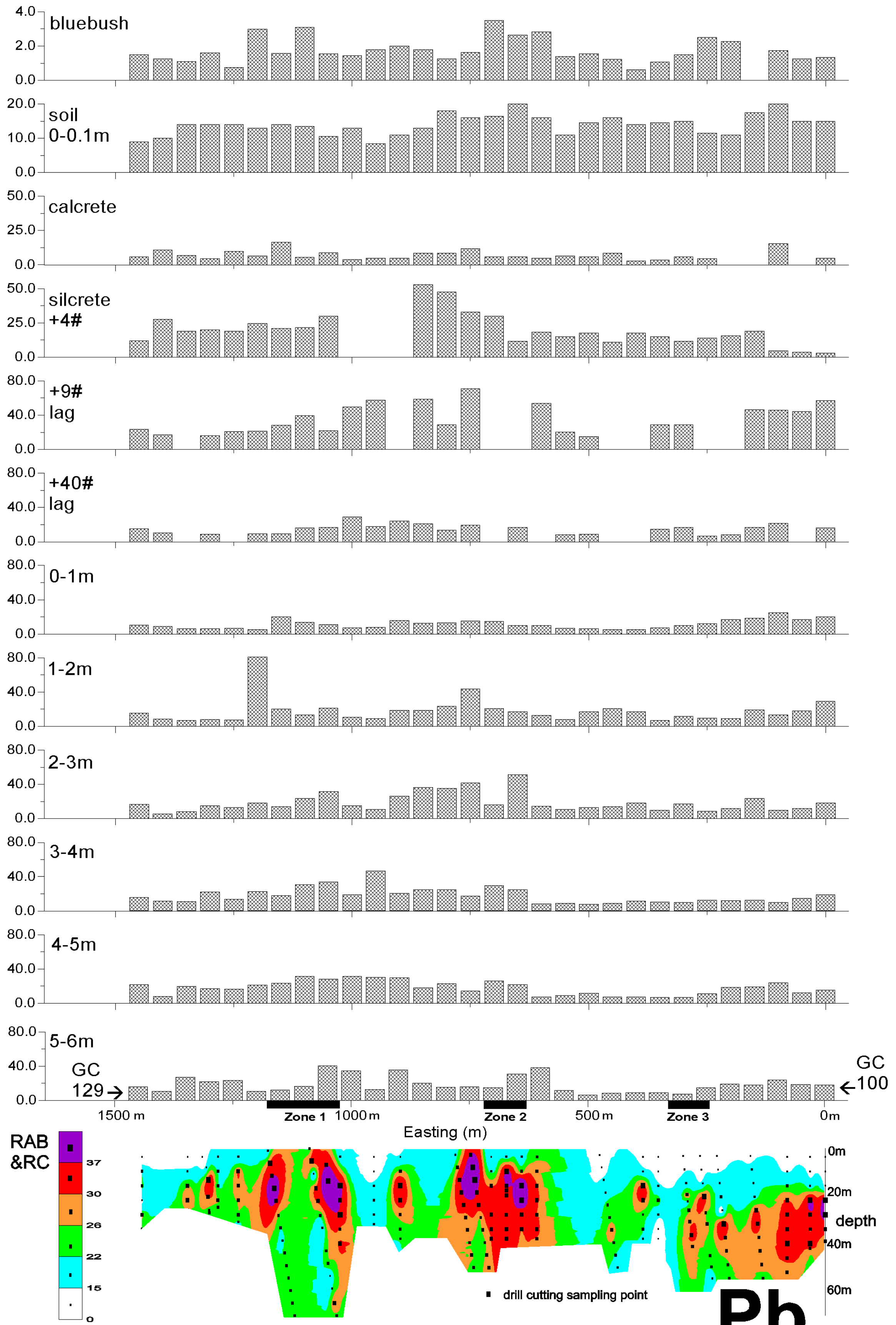

Figure A2.31: Pb distributions in vegetation and regolith components.
Data in ppm. Black rectangles (Zones 1-3) locate mineralisation.

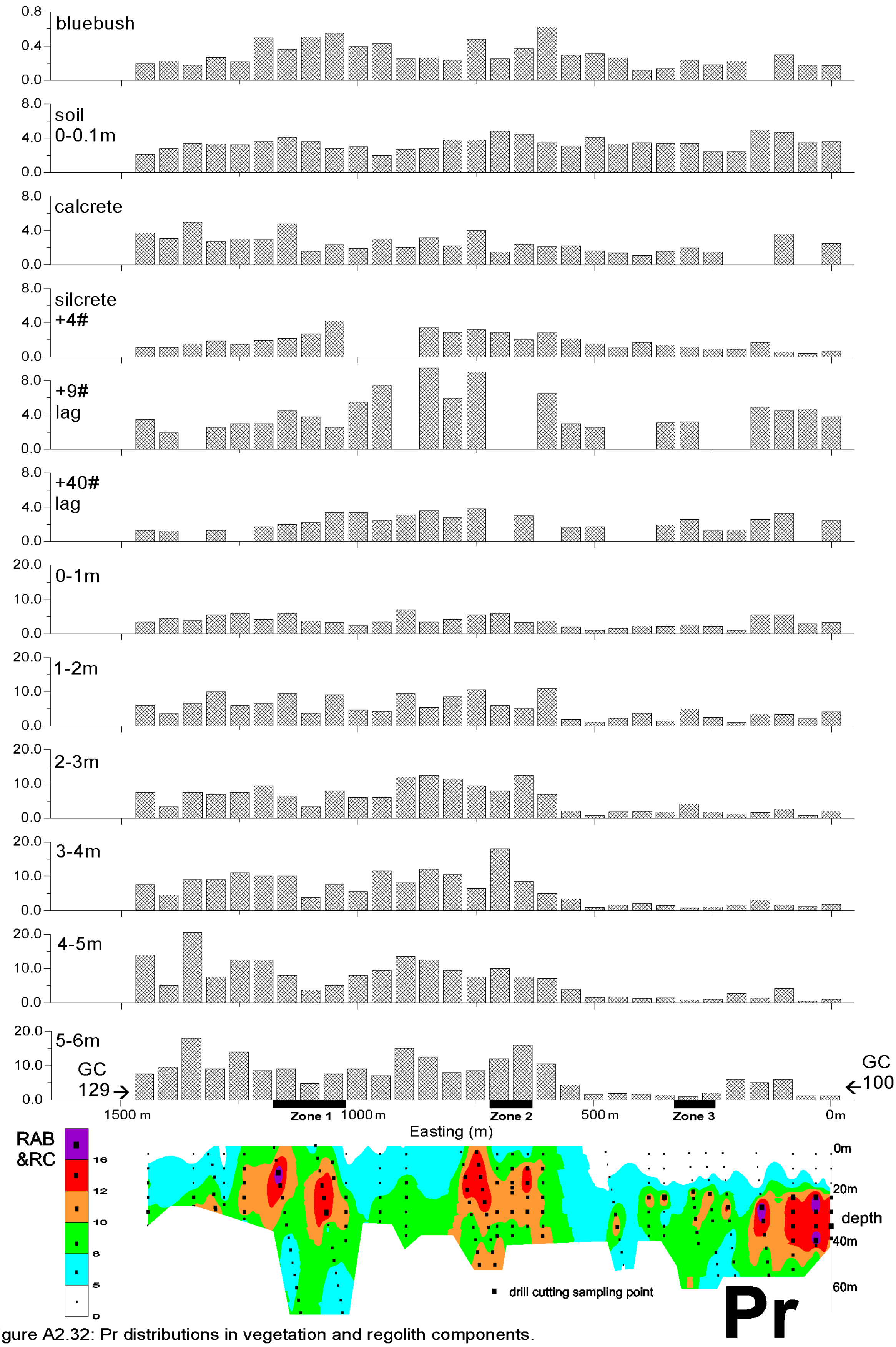

Figure A2.32: Pr distributions in vegetation and regolith components.
Data in ppm. Black rectangles (Zones 1-3) locate mineralisation.

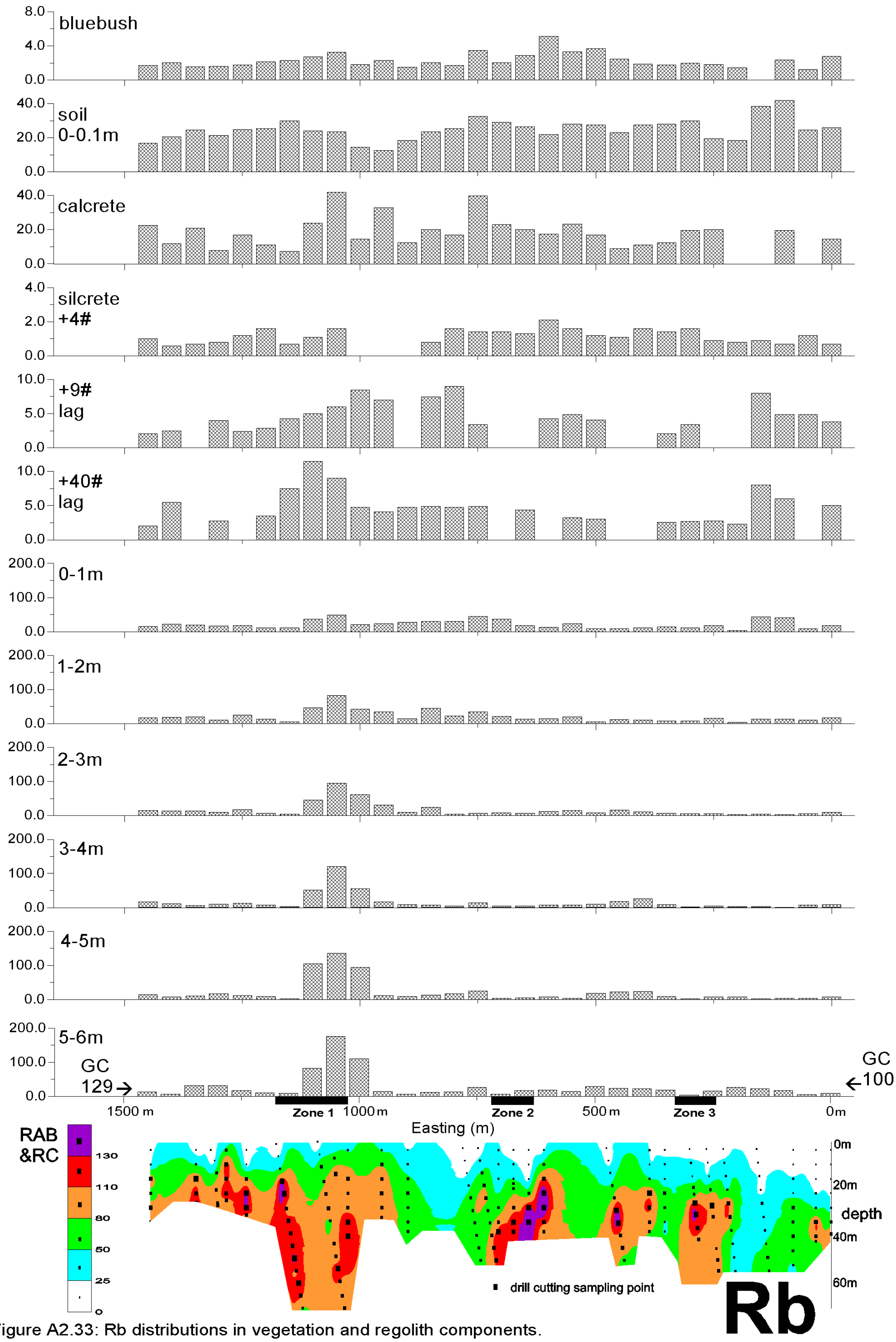

Figure A2.33: Rb distributions in vegetation and regolith components.
Data in ppm. Black rectangles (Zones 1-3) locate mineralisation.

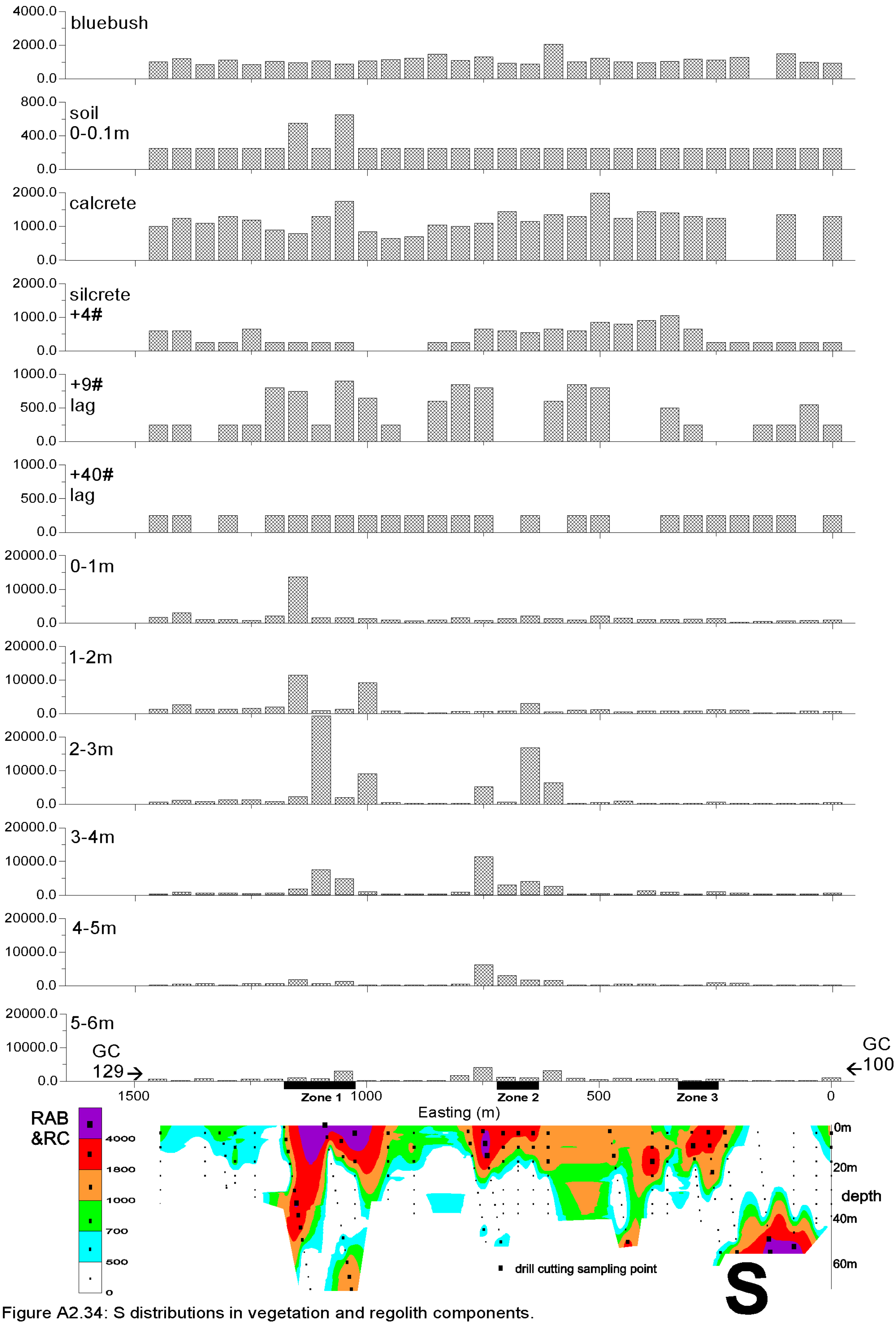

Figure A2.34: S distributions in vegetation and regolith components.
Data in ppm. Black rectangles (Zones 1-3) locate mineralisation.

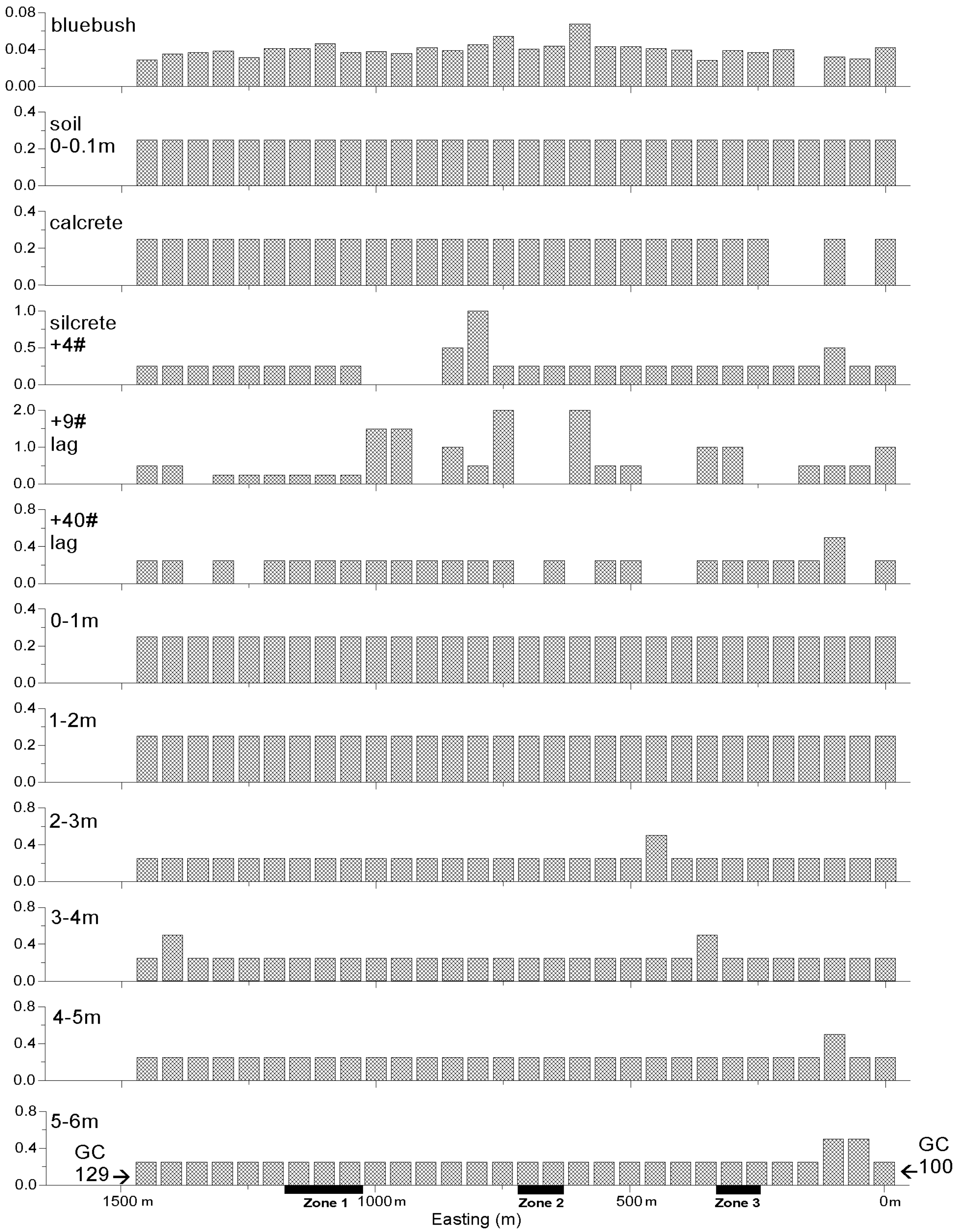

Figure A2.35: Sb distributions in vegetation and regolith components.
Data in ppm. Black rectangles (Zones 1-3) locate mineralisation.

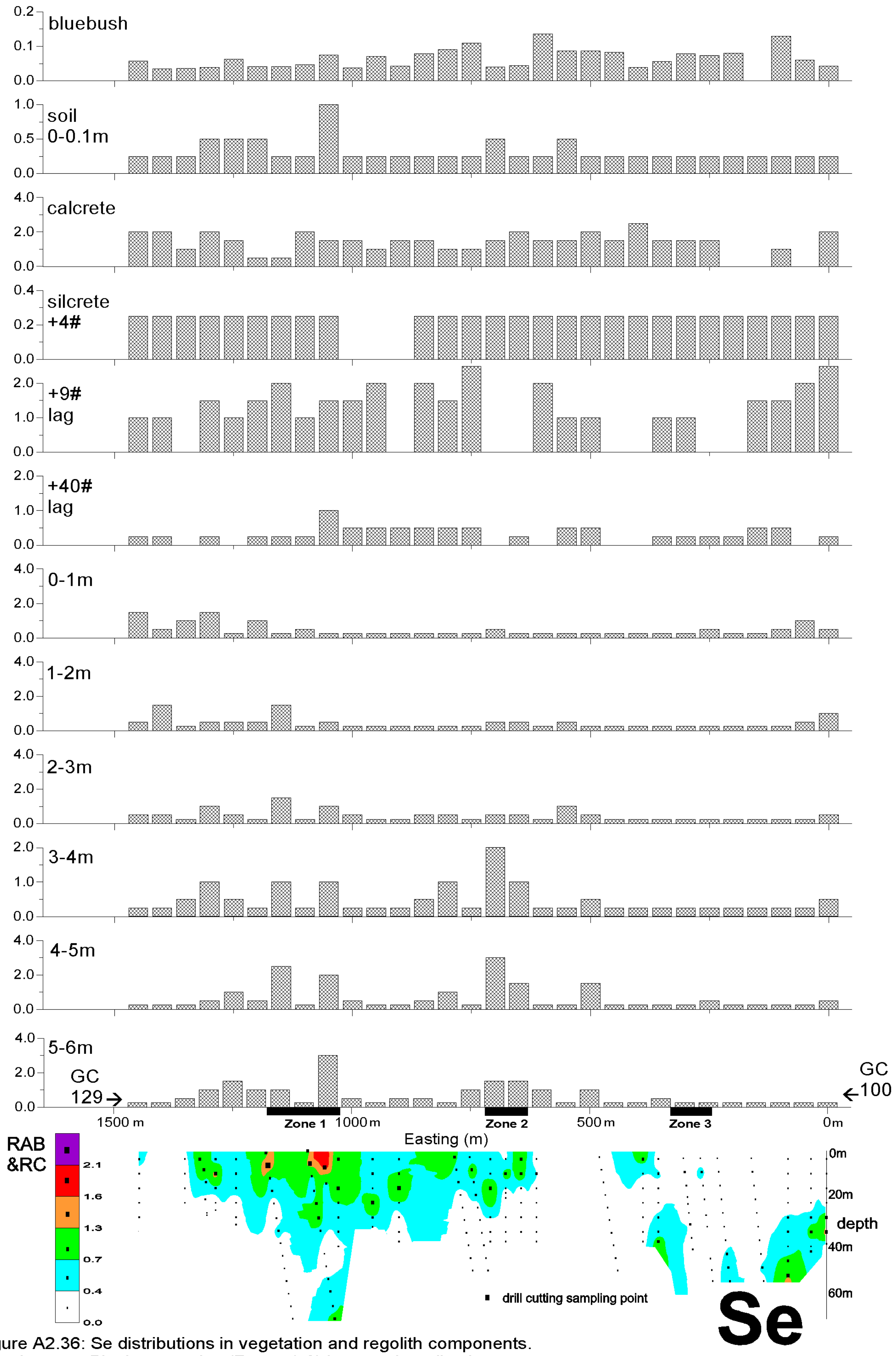

Figure A2.36: Se distributions in vegetation and regolith components. Data in ppm. Black rectangles (Zones 1-3) locate mineralisation.

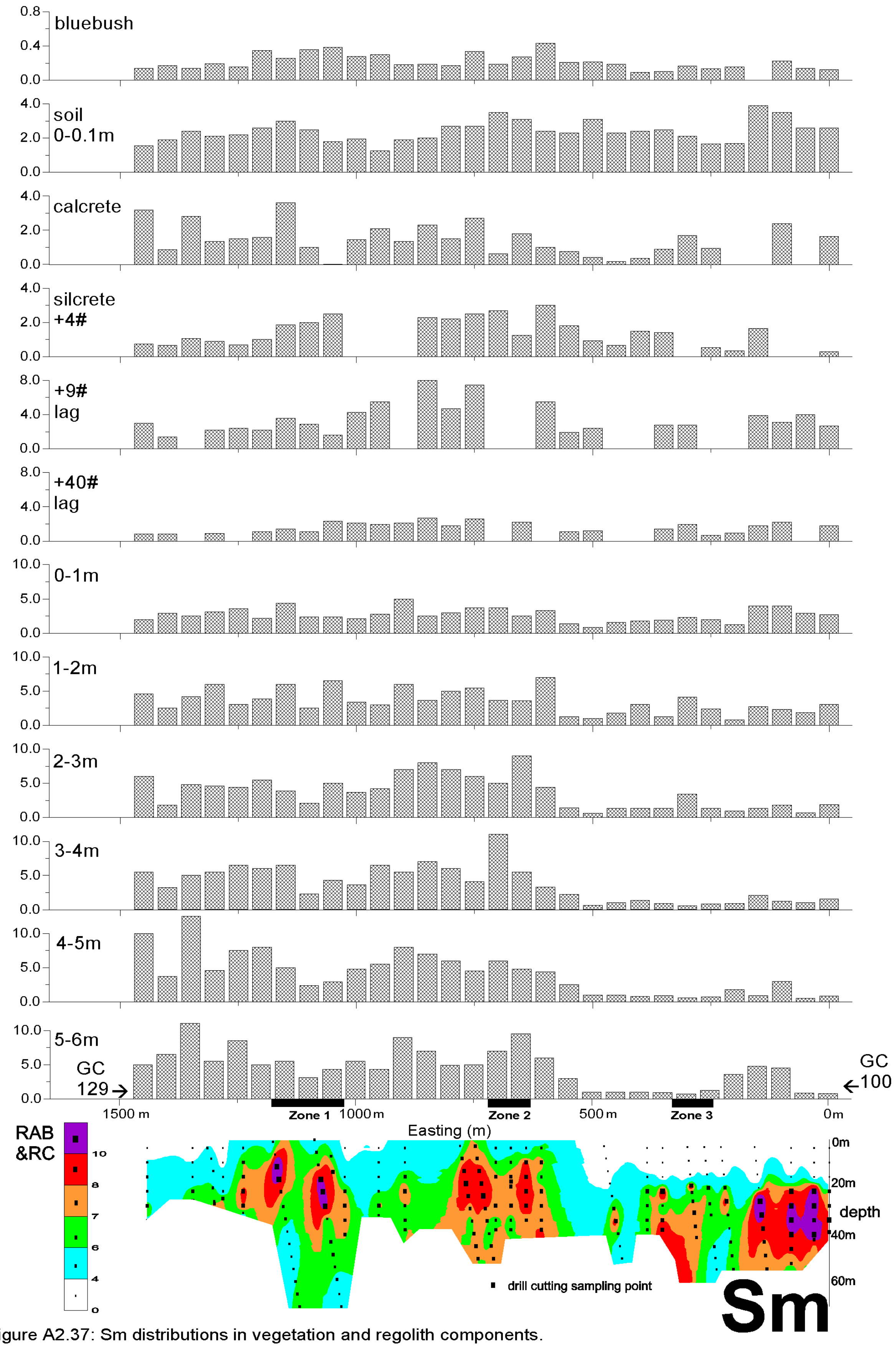

Figure A2.37: Sm distributions in vegetation and regolith components.
Data in ppm. Black rectangles (Zones 1-3) locate mineralisation.

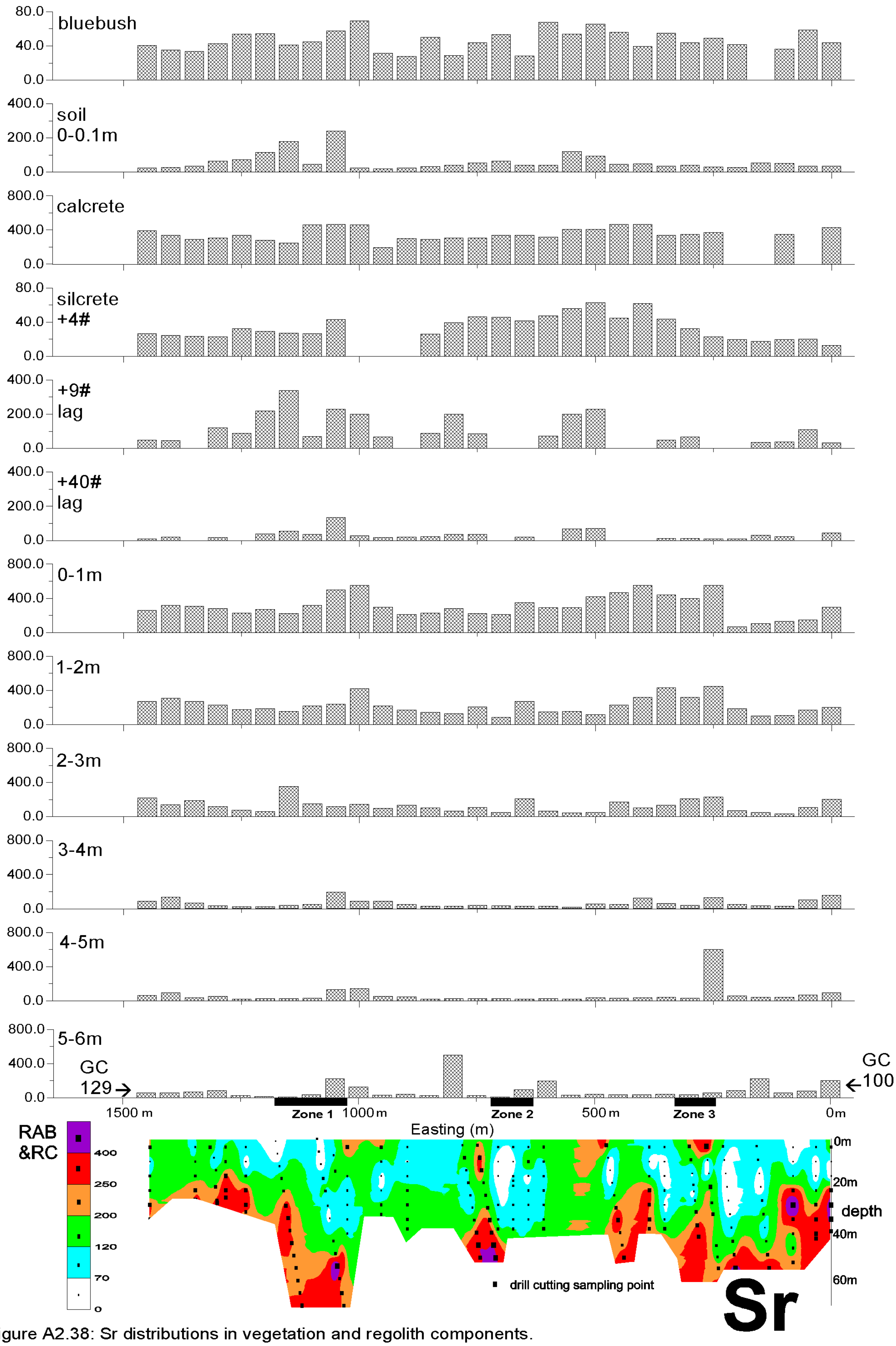

Figure A2.38: Sr distributions in vegetation and regolith components. Data in ppm. Black rectangles (Zones 1-3) locate mineralisation.

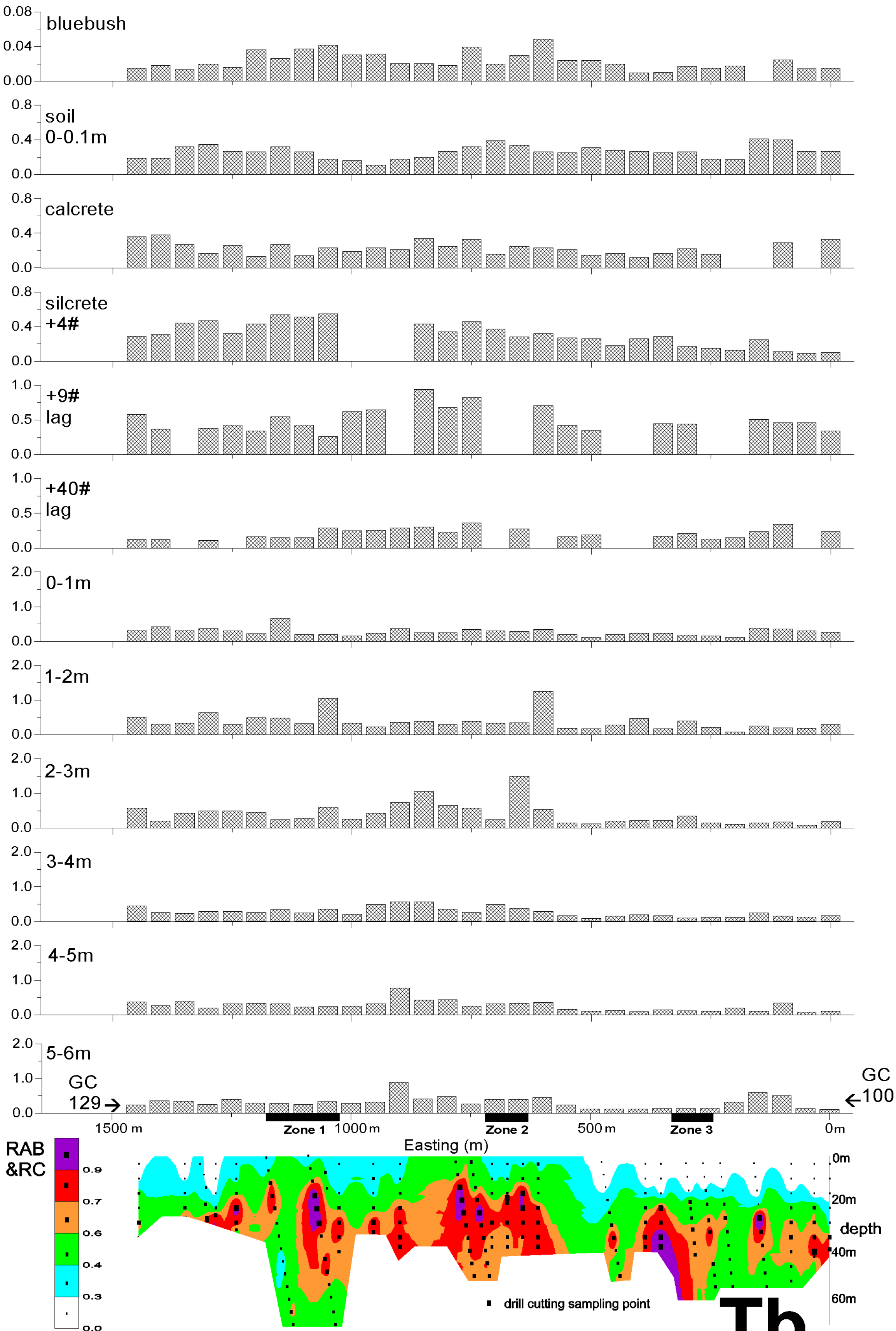

Figure A2.39: Tb distributions in vegetation and regolith components.
Data in ppm. Black rectangles (Zones 1-3) locate mineralisation.

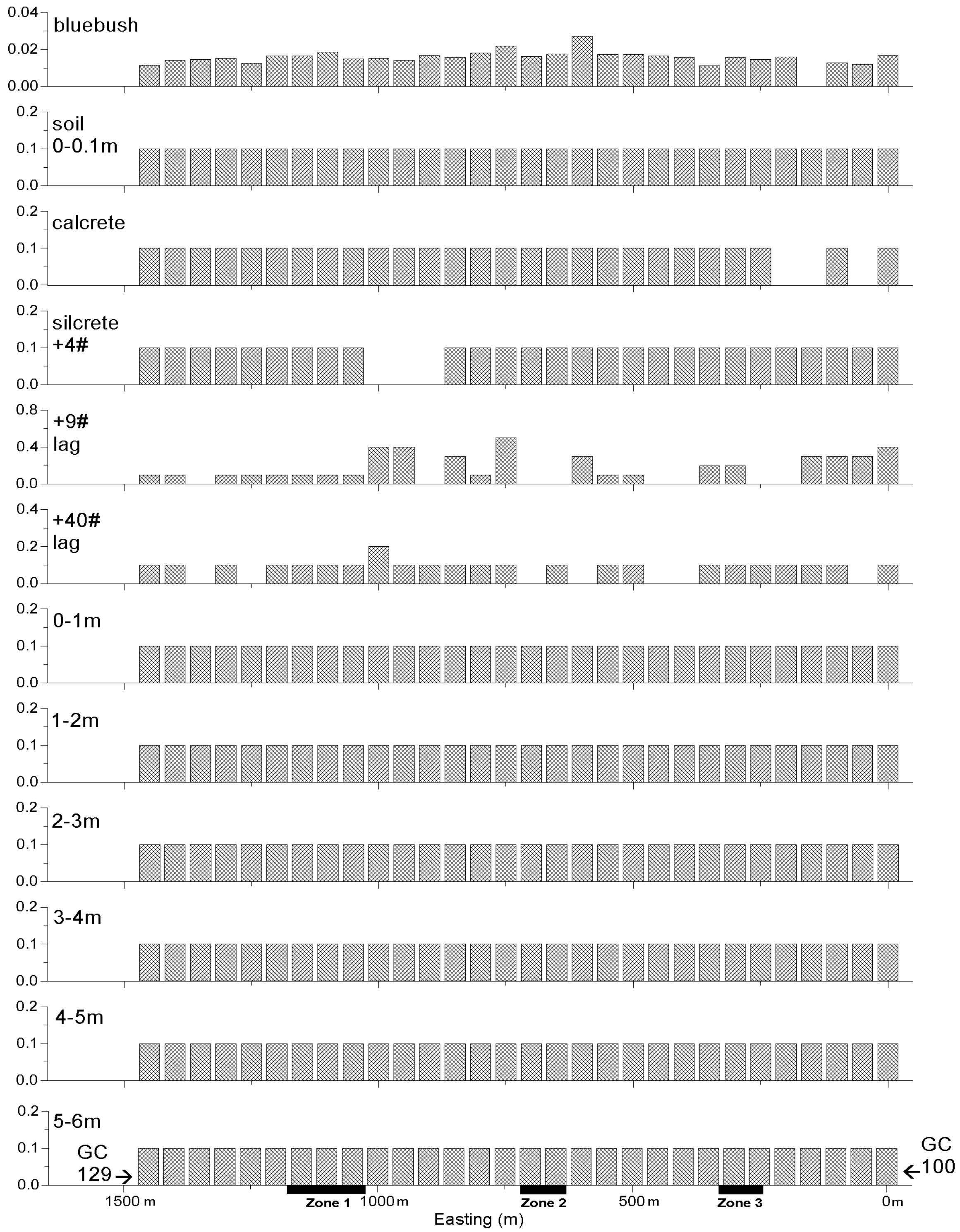

Figure A2.40: Te distributions in vegetation and regolith components.
Data in ppm. Black rectangles (Zones 1-3) locate mineralisation.

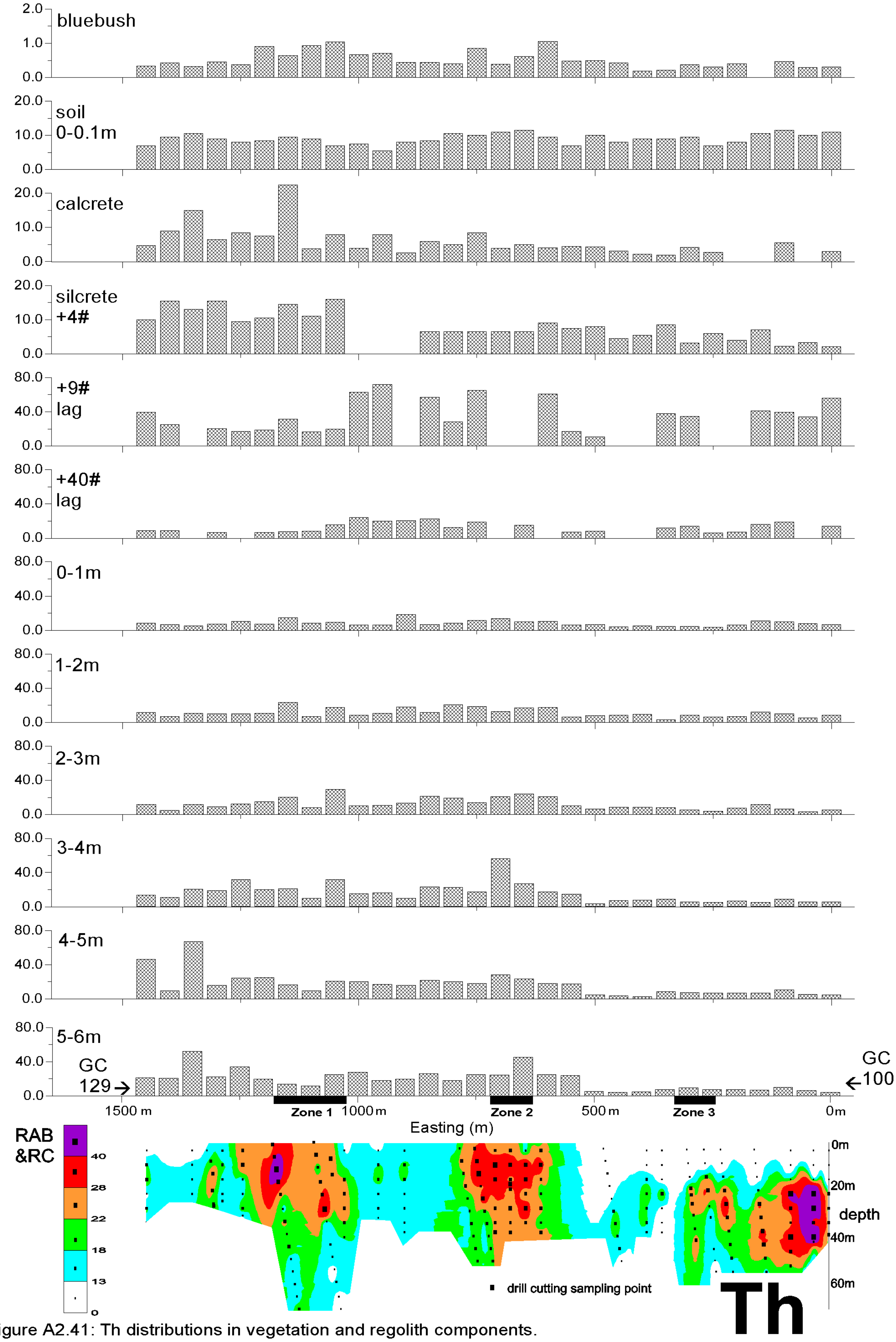

Figure A2.41: Th distributions in vegetation and regolith components. Data in ppm. Black rectangles (Zones 1-3) locate mineralisation.

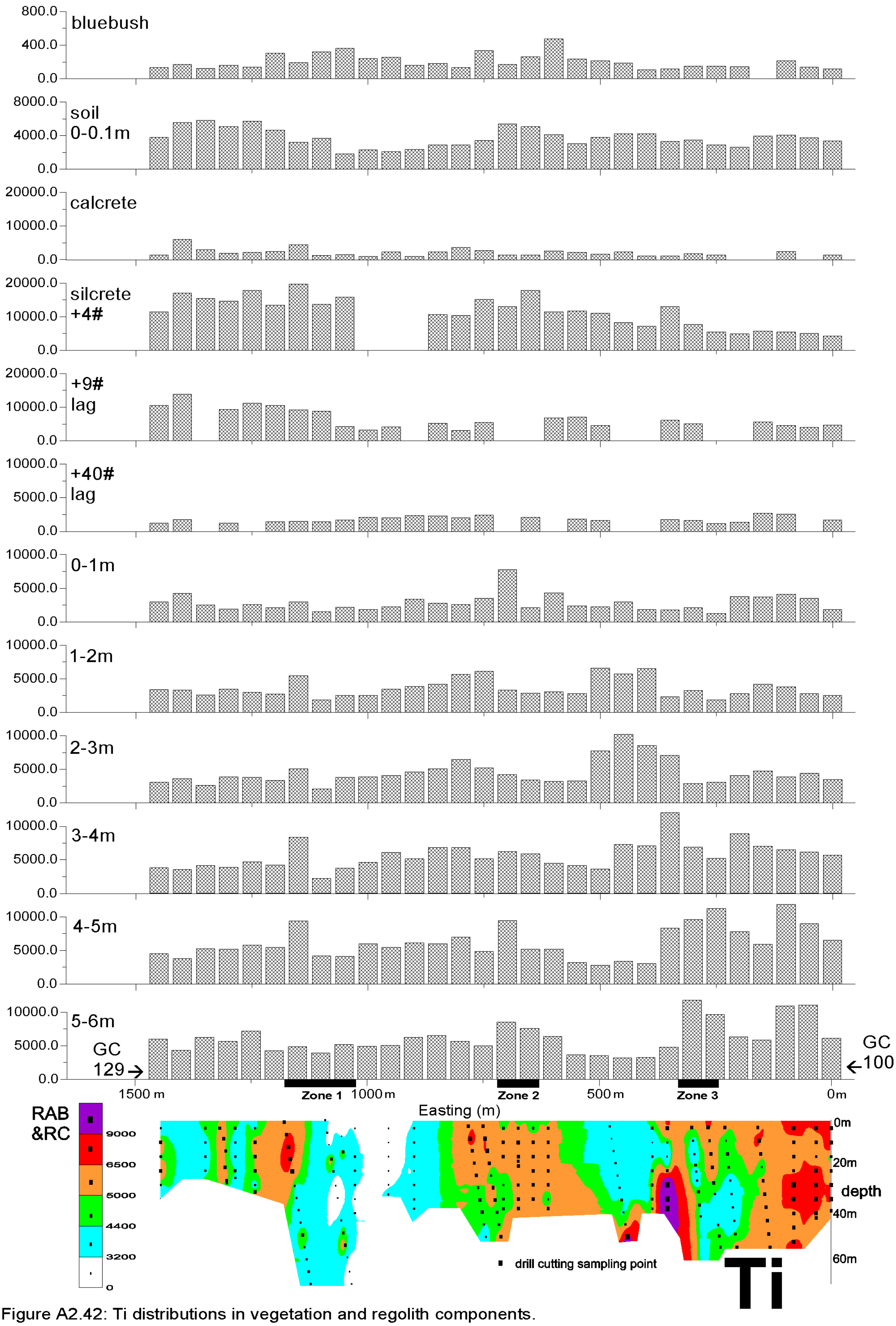

Figure A2.42: Ti distributions in vegetation and regolith components.
Data in ppm. Black rectangles (Zones 1-3) locate mineralisation.

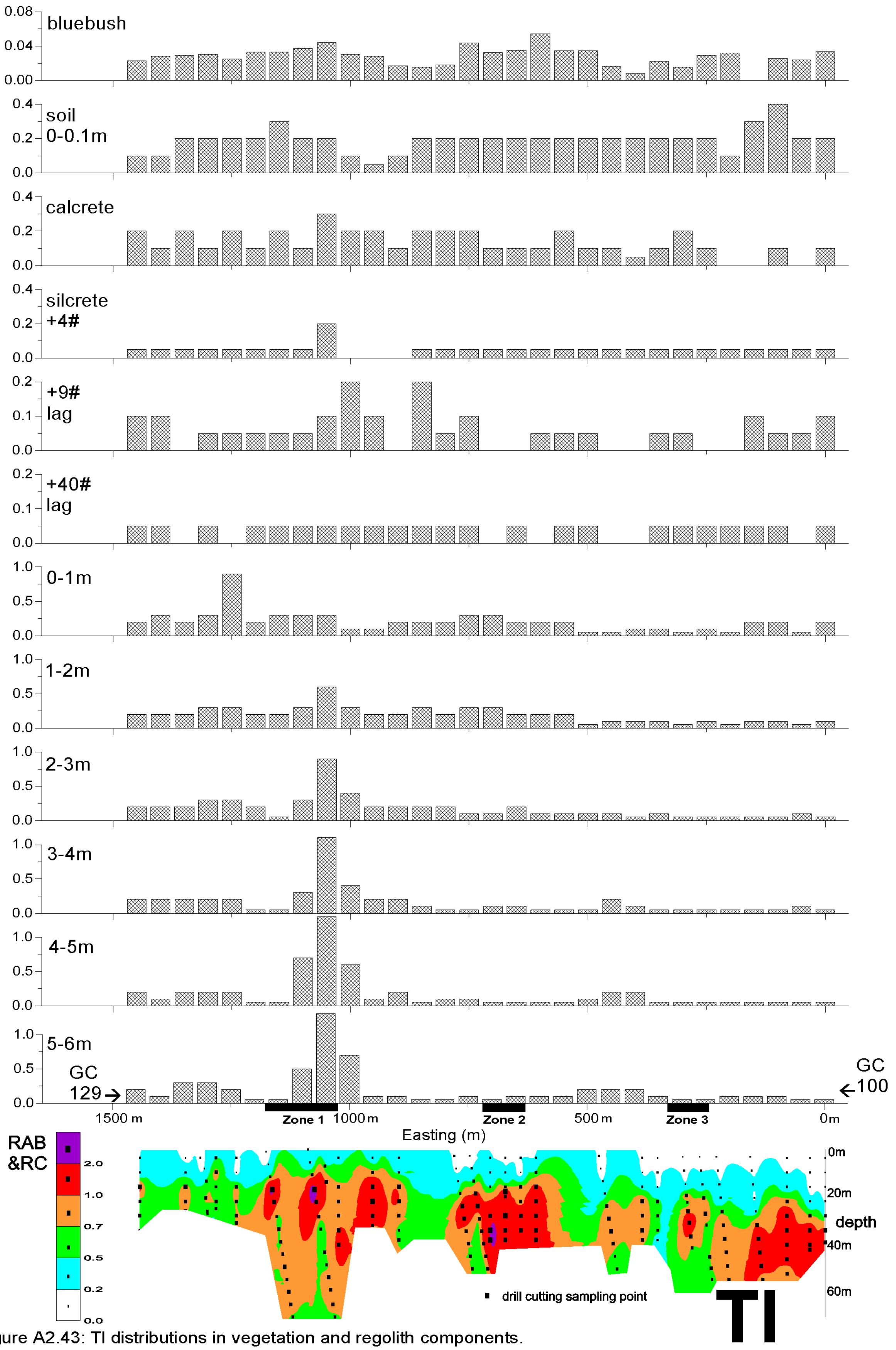

Figure A2.43: Tl distributions in vegetation and regolith components.
Data in ppm. Black rectangles (Zones 1-3) locate mineralisation.

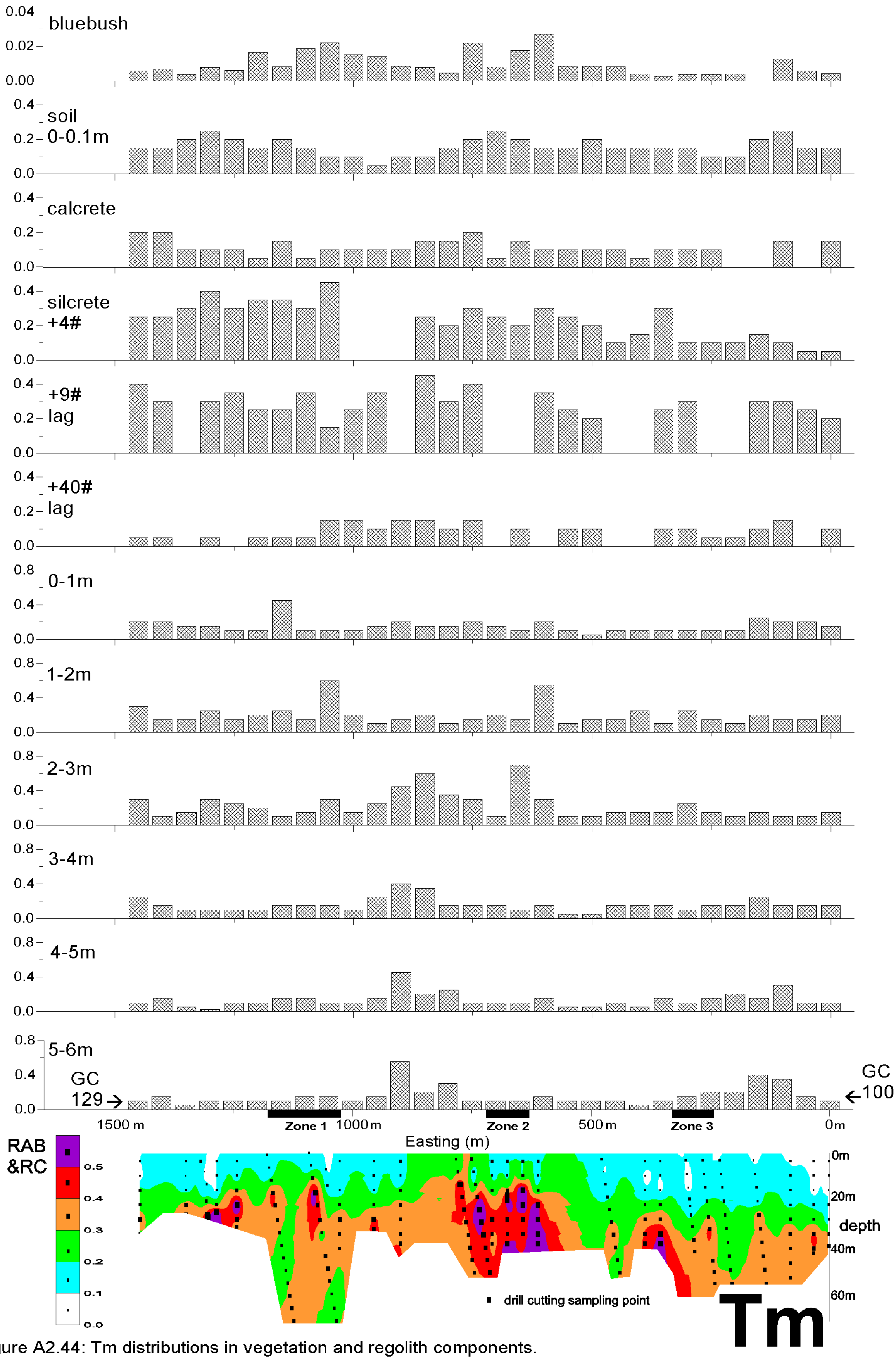

Figure A2.44: Tm distributions in vegetation and regolith components.
Data in ppm. Black rectangles (Zones 1-3) locate mineralisation.

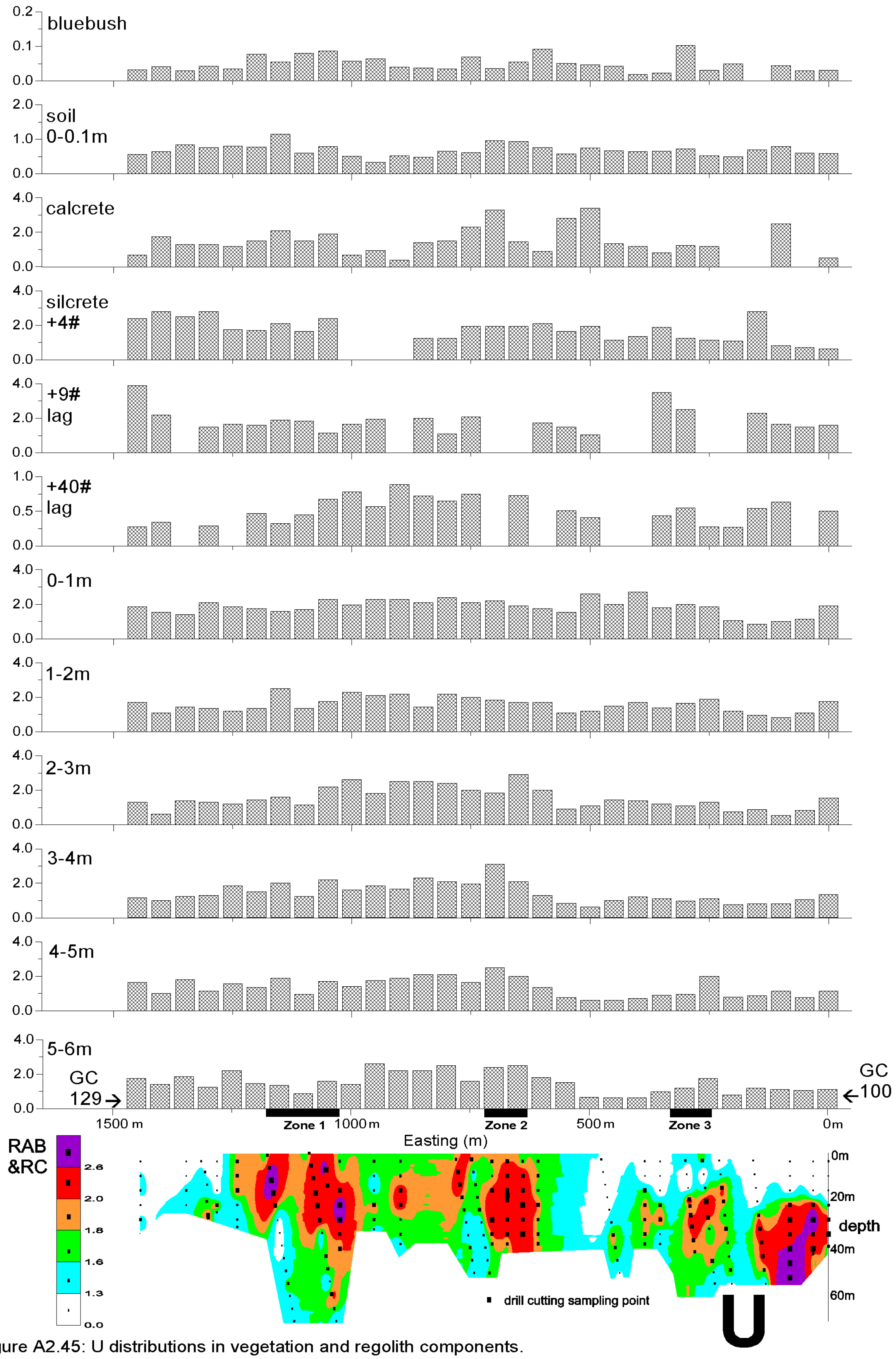

Figure A2.45: U distributions in vegetation and regolith components.
Data in ppm. Black rectangles (Zones 1-3) locate mineralisation.

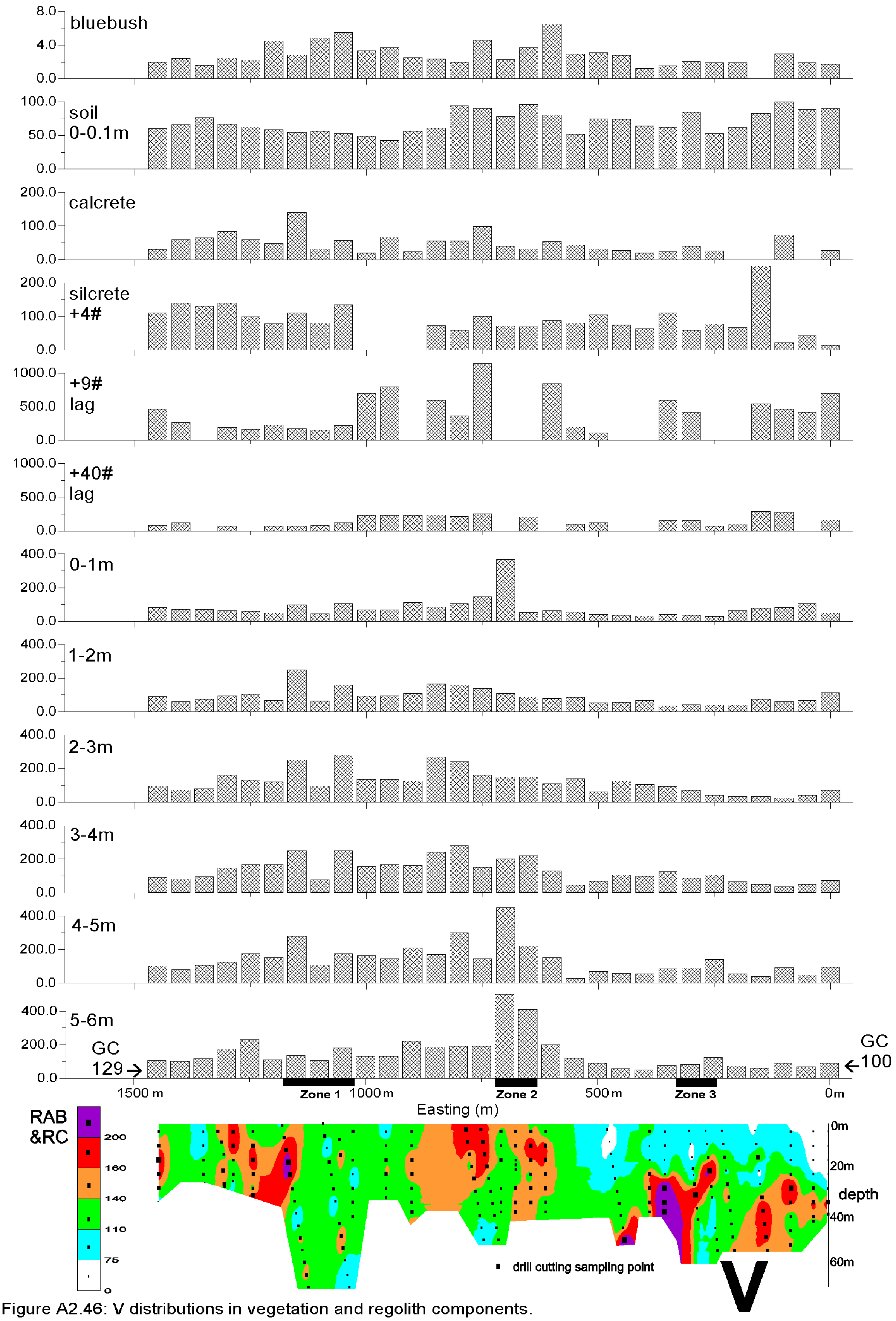

Figure A2.46: V distributions in vegetation and regolith components.
Data in ppm. Black rectangles (Zones 1-3) locate mineralisation.

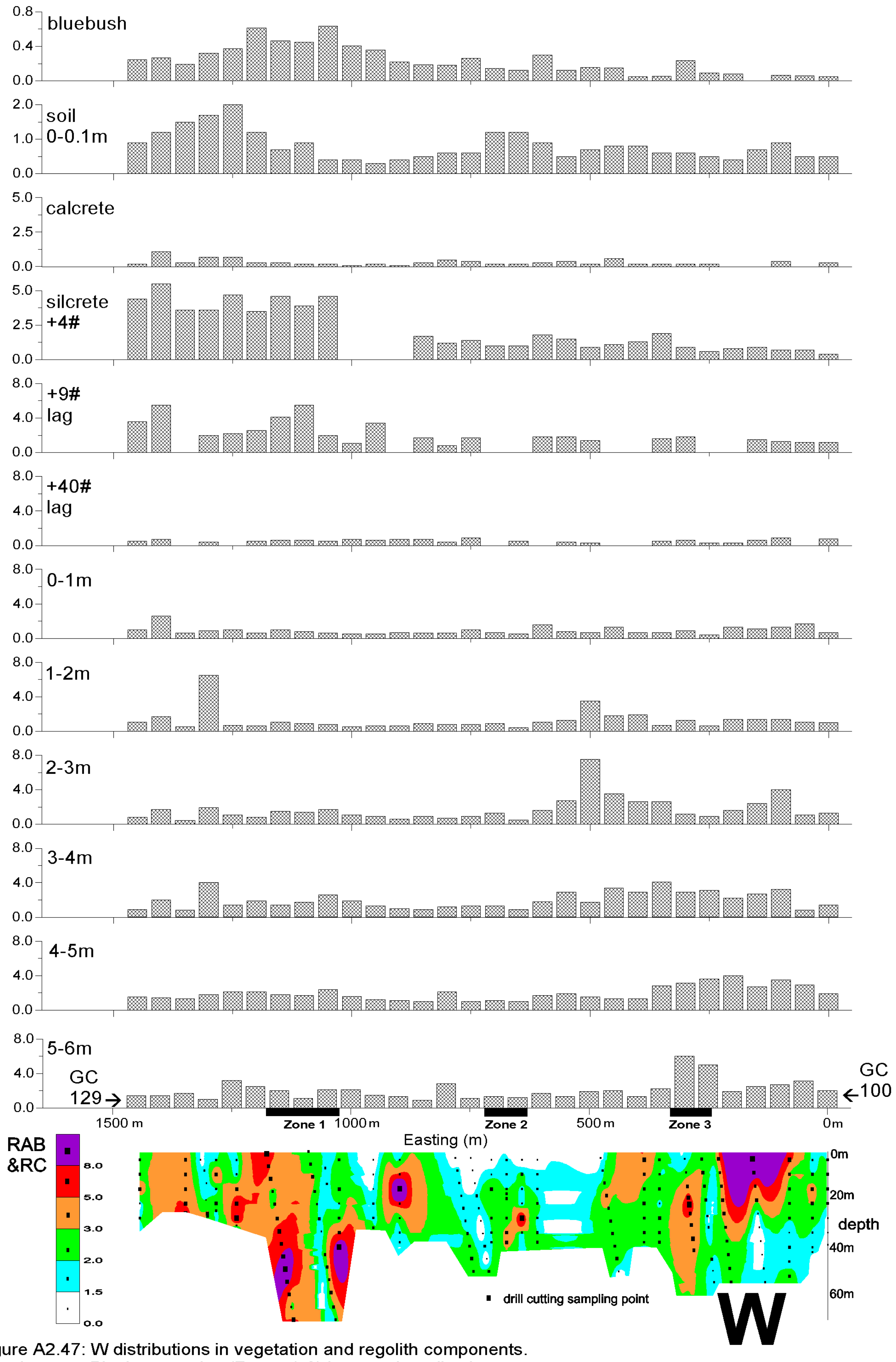

Figure A2.47: W distributions in vegetation and regolith components.
Data in ppm. Black rectangles (Zones 1-3) locate mineralisation.

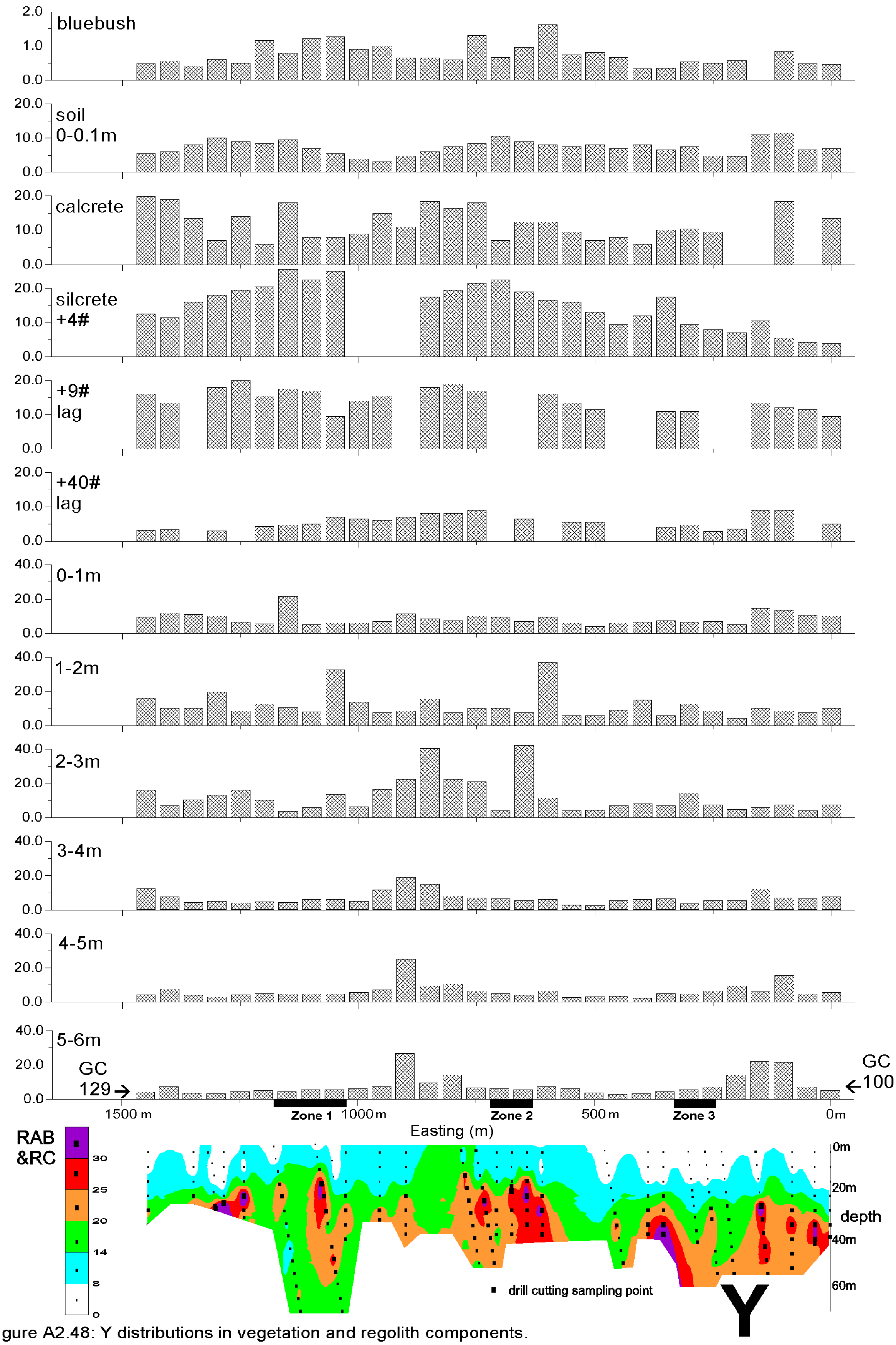

Figure A2.48: Y distributions in vegetation and regolith components.
Data in ppm. Black rectangles (Zones 1-3) locate mineralisation.

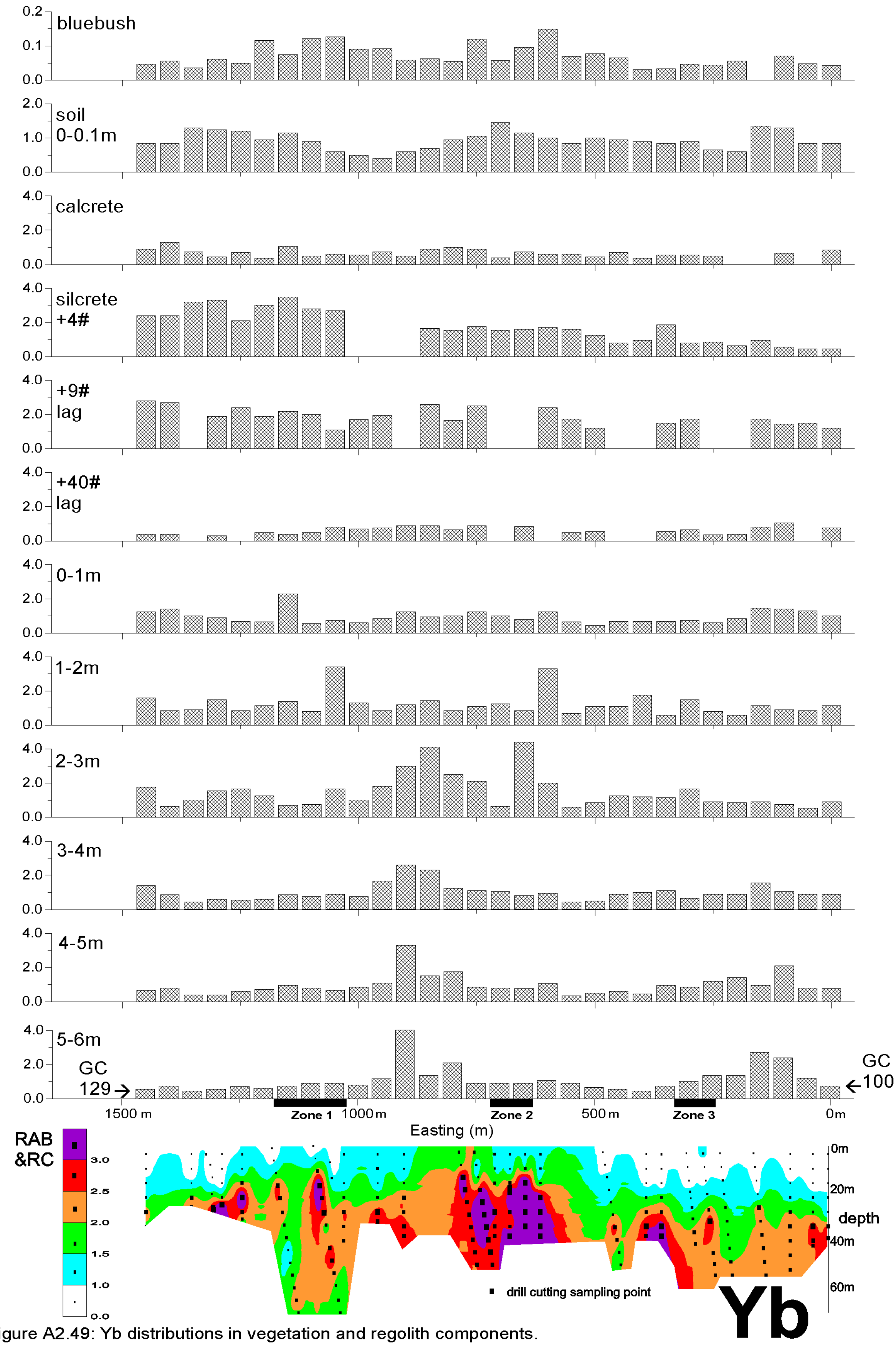

Figure A2.49: Yb distributions in vegetation and regolith components.
Data in ppm. Black rectangles (Zones 1-3) locate mineralisation.

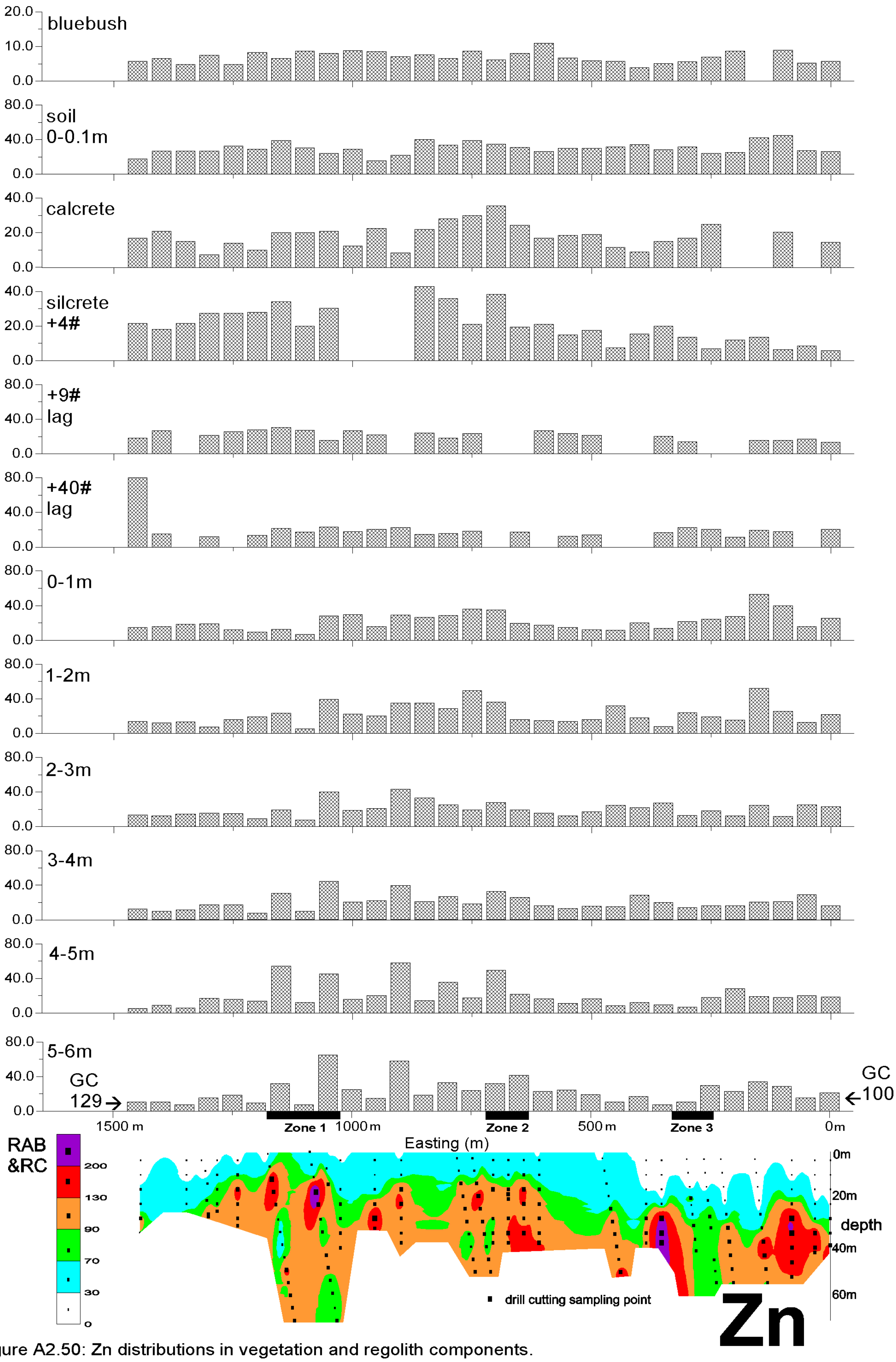

Figure A2.50: Zn distributions in vegetation and regolith components.
Data in ppm. Black rectangles (Zones 1-3) locate mineralisation.

APPENDIX 3

Appendix 3: Box-whisker and scatter plots.

Appendix 3a: Box and whisker plots. Units in ppm except for Au (ppb).

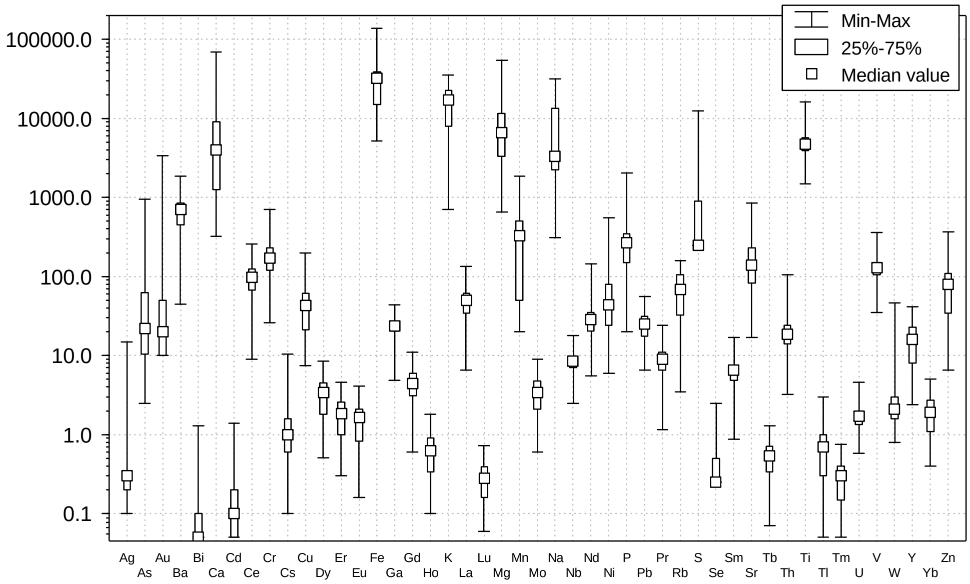

Figure A3a.1: Box and whisker plot for lower regolith samples.

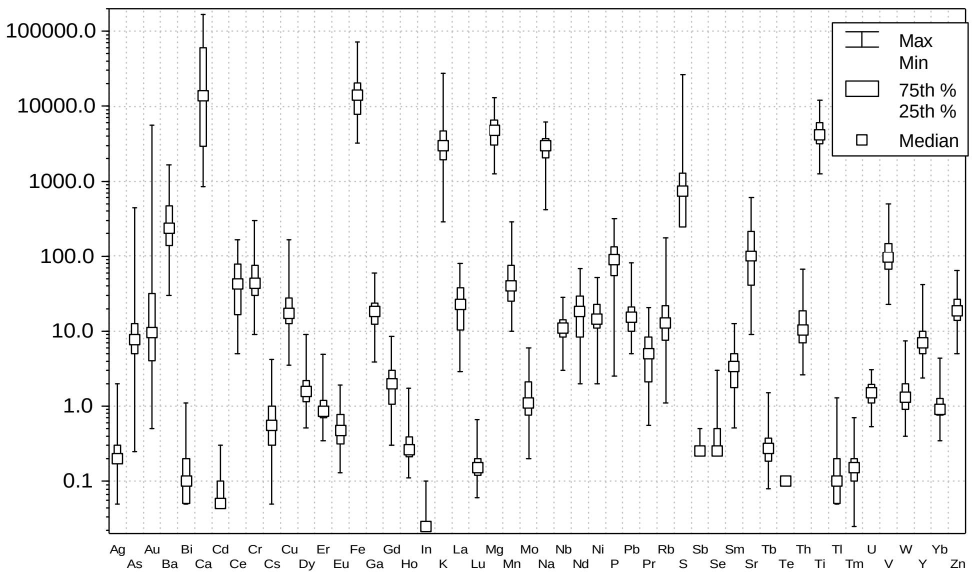

Figure A3a.2: Box and whisker plot for upper regolith samples.

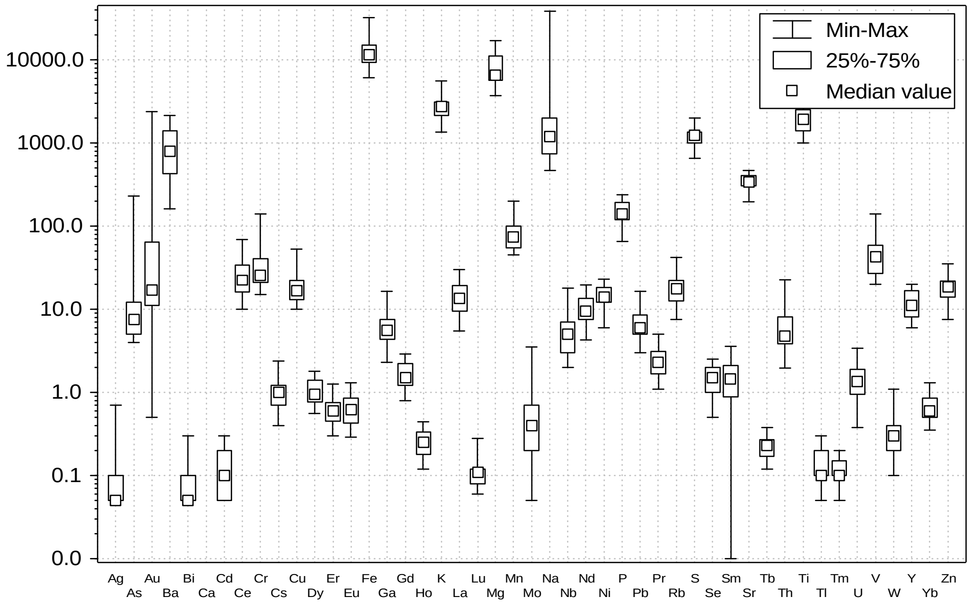

Figure A3.3a: Box and whisker plot for calcrete samples.

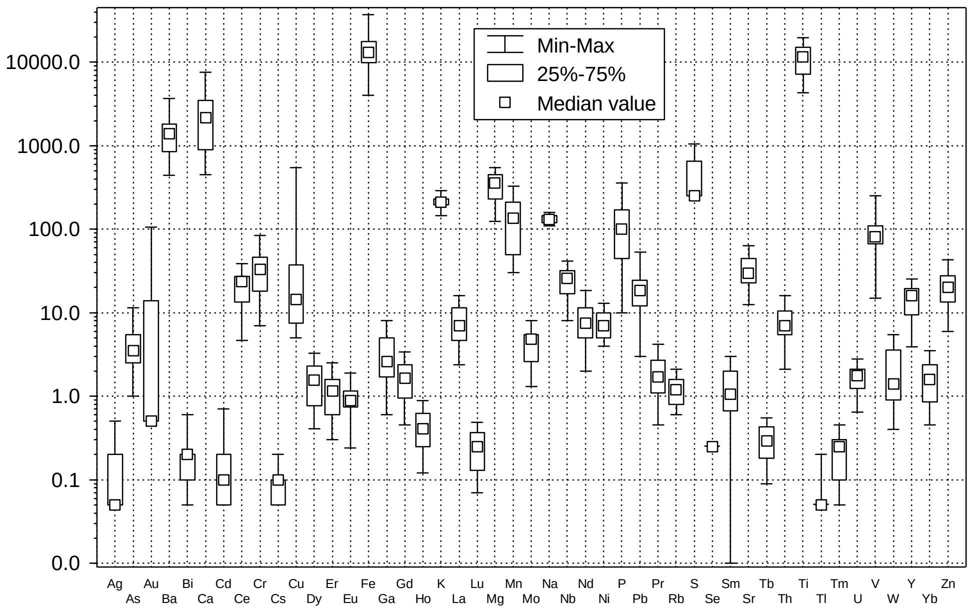

Figure A3.4a: Box and whisker plot for silcrete samples.

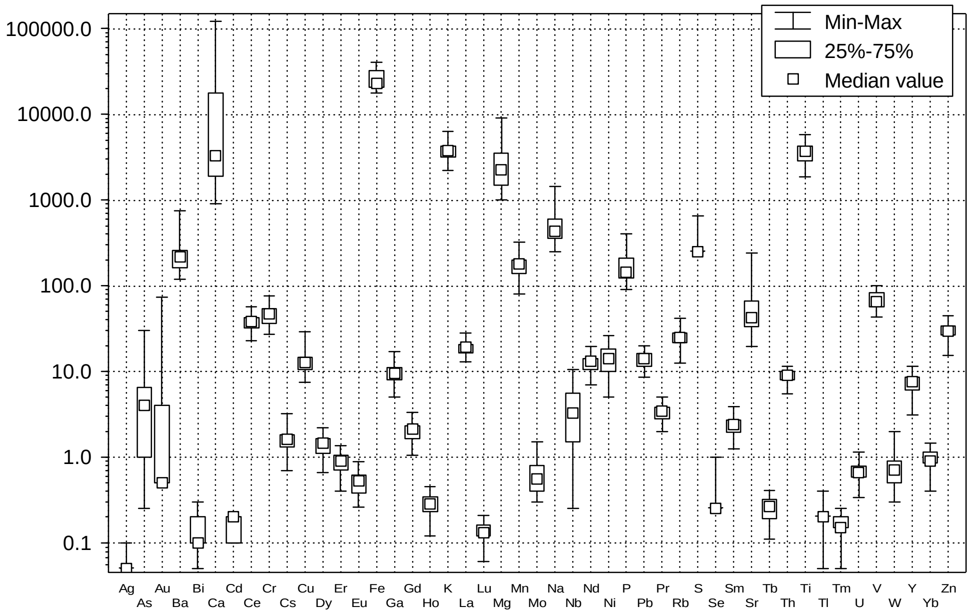

Figure A3.5a: Box and whisker plot for soil samples.

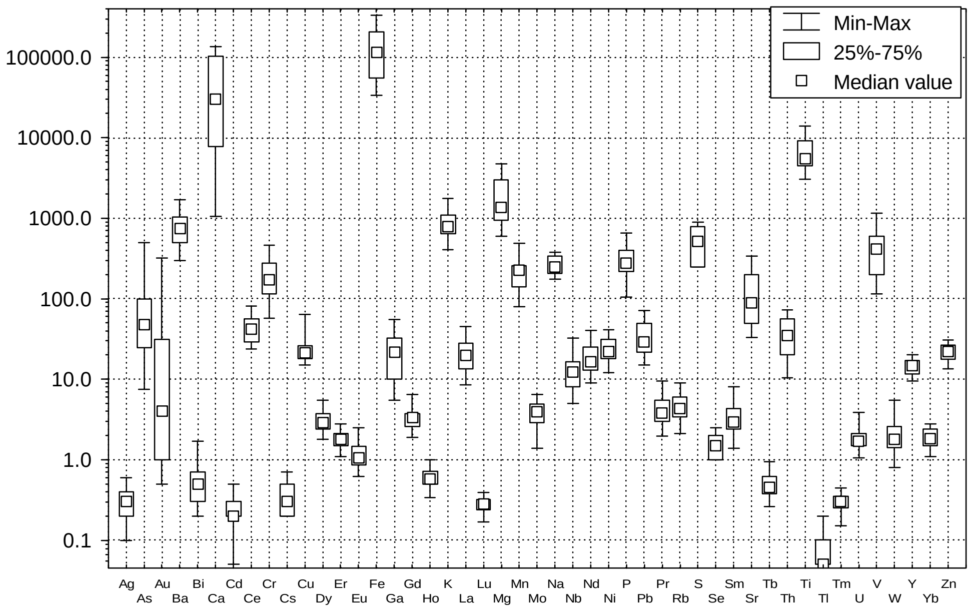

Figure A3.6a: Box and whisker plot for coarse lag samples.

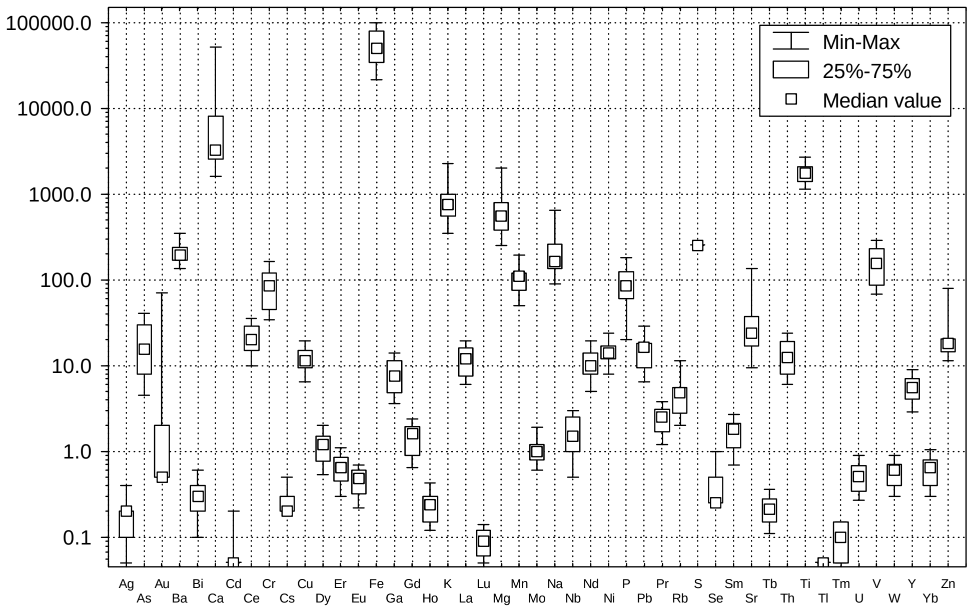

Figure A3.7a: Box and whisker plot for fine lag samples.

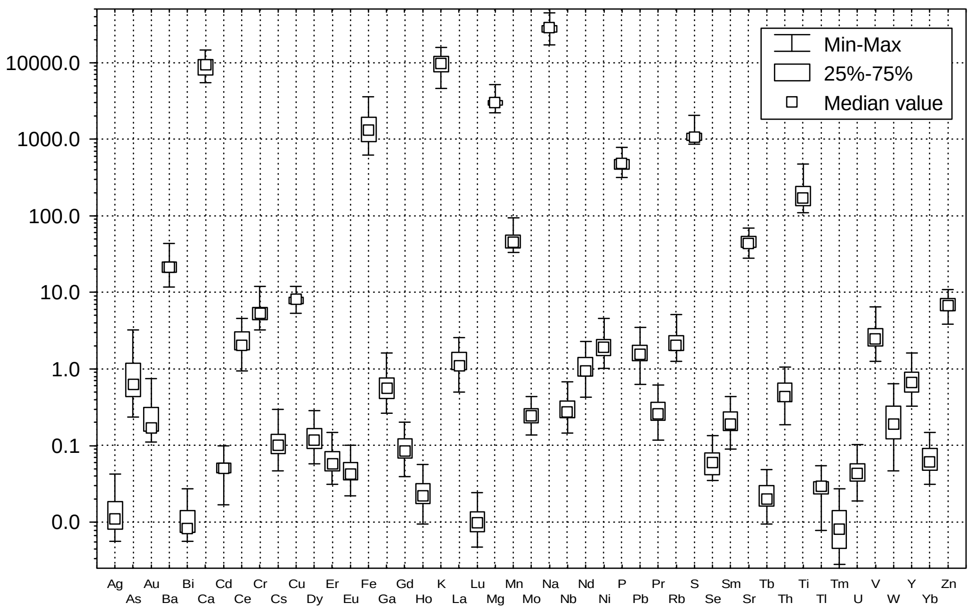

Figure A3.8a: Box and whisker plot for bluebush samples.

Appendix 3b: Scatter plots.

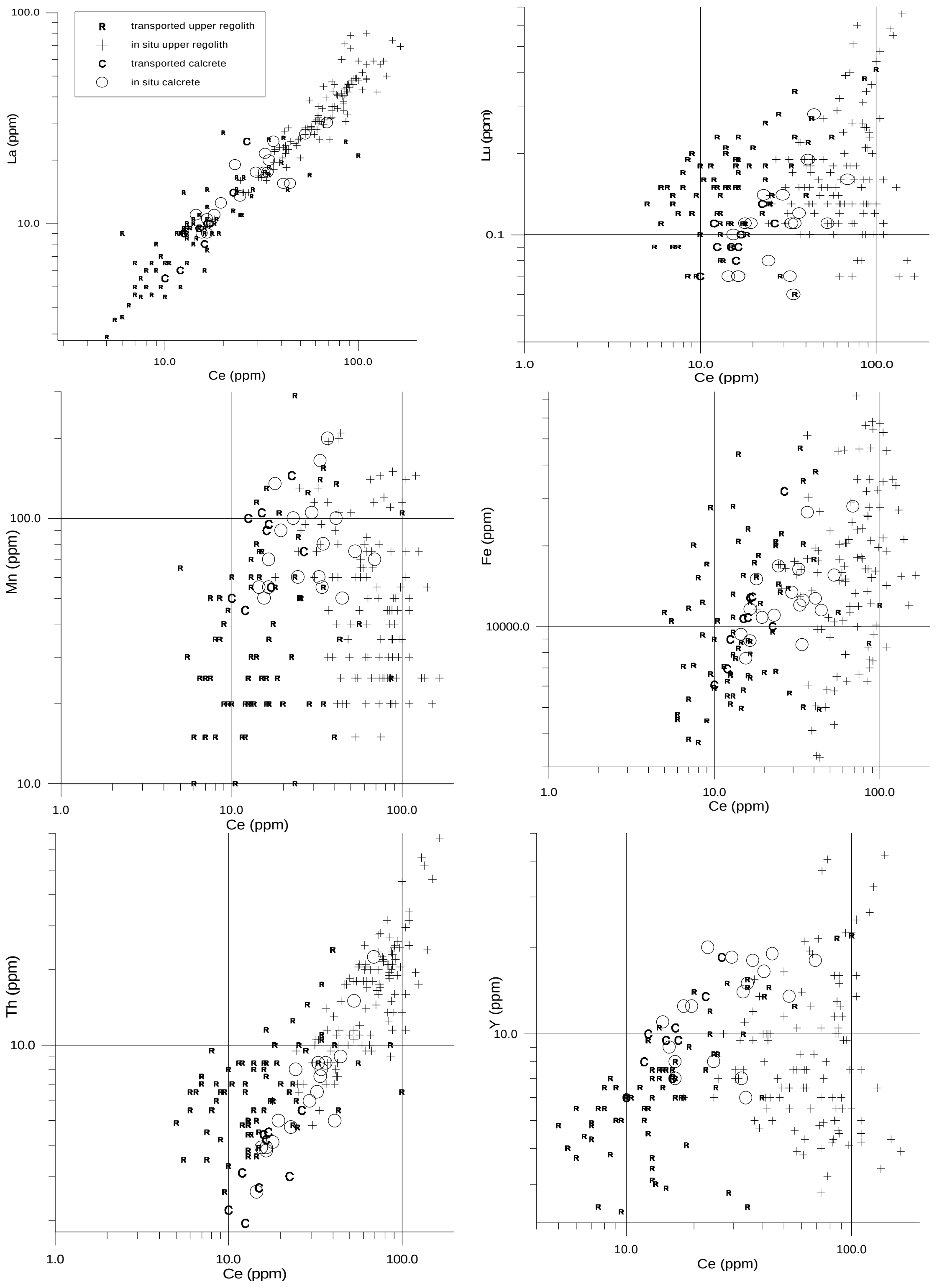

Figure A3b.1: Cerium vs selected elements for calcrete and upper regolith (transported and in situ regolith).

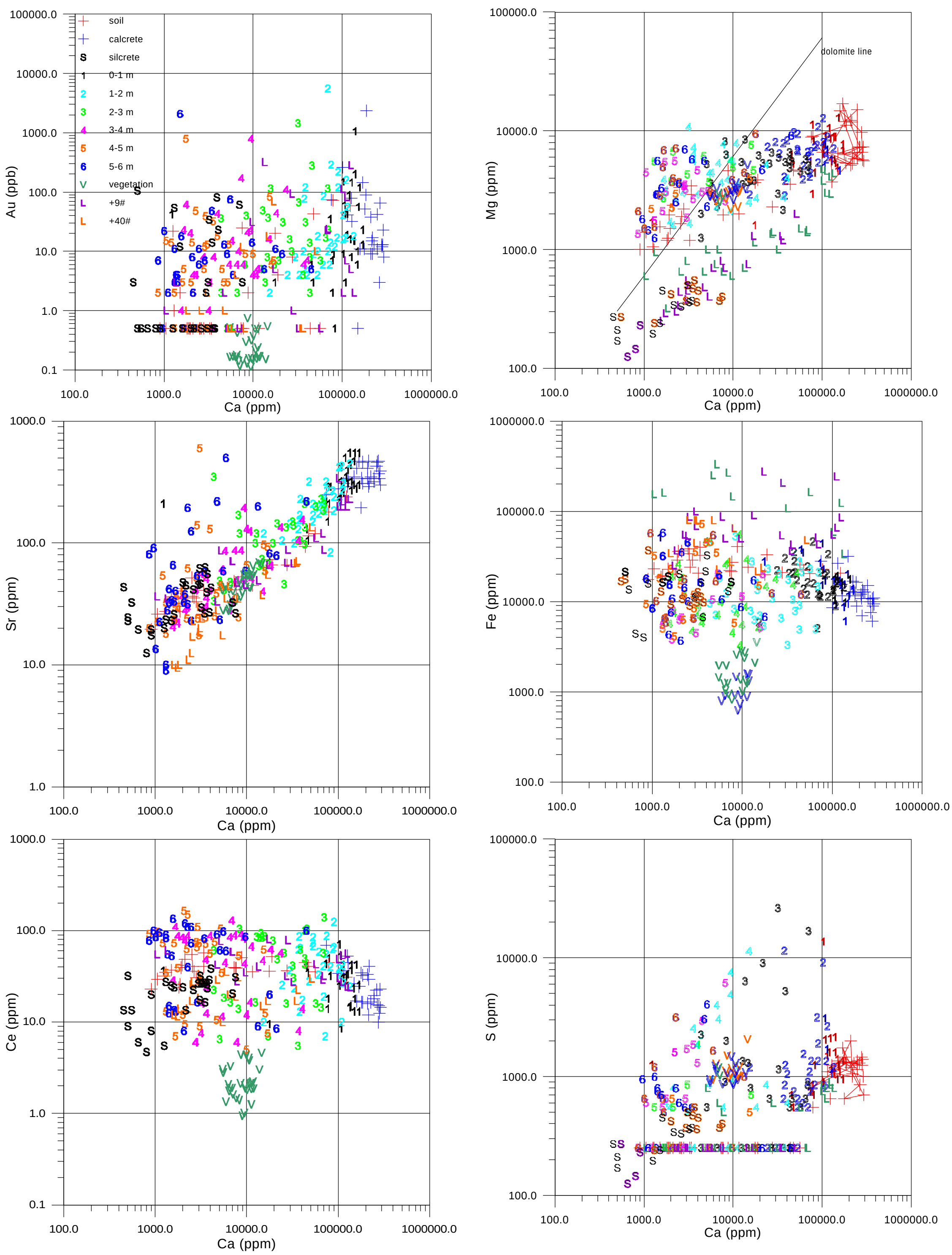

Figure A3b.2: Calcium vs selected elements for regolith line samples.

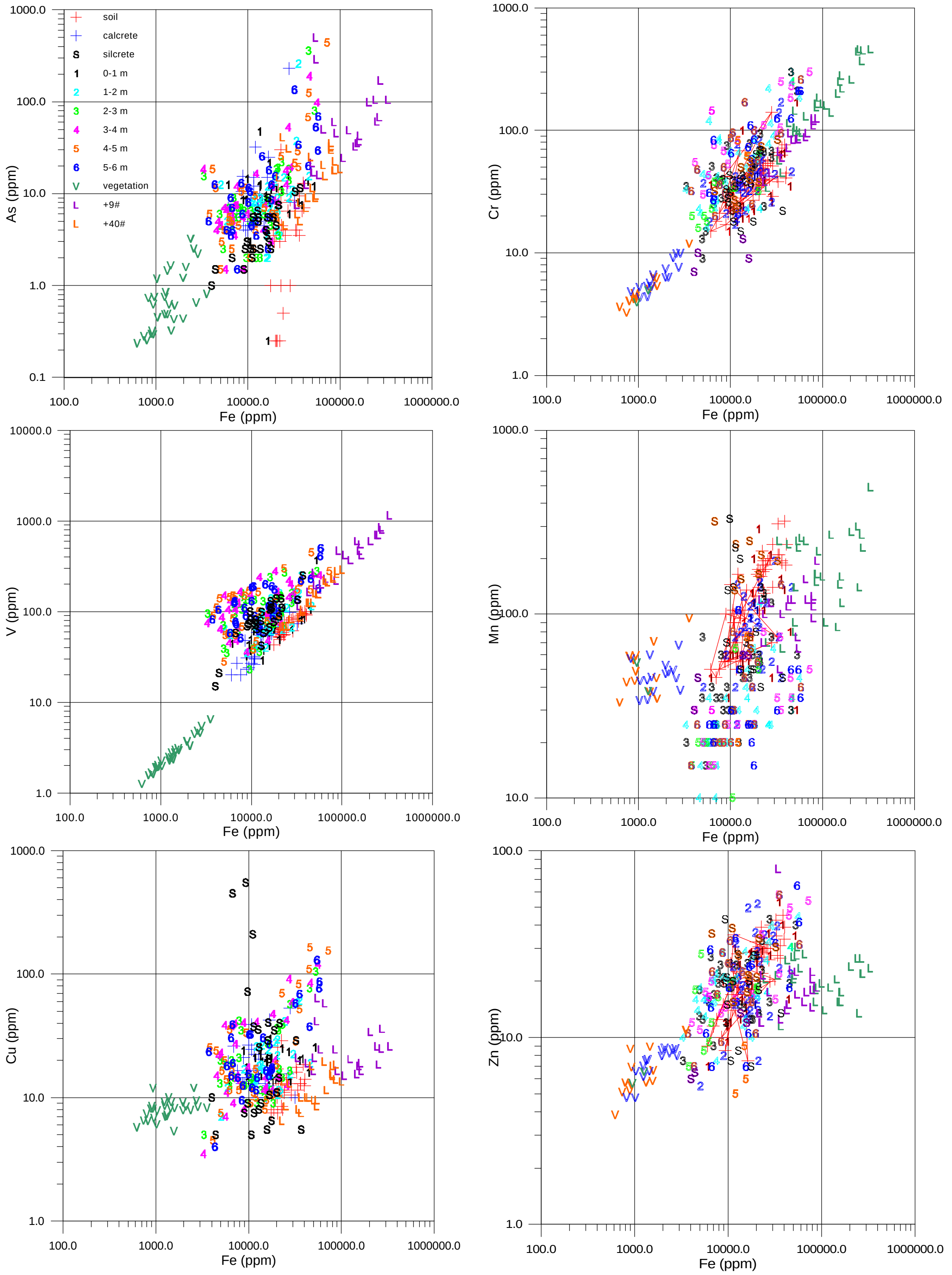

Figure A3b.3: Iron vs selected elements for regolith line samples.

APPENDIX 4

Appendix 4: Mineralogical tabulated and graphed data.

Appendix 4: Mineralogical Data

Table A4: Compiled XRD results for selected Challenger study area samples. As data has been interpreted from only standard XRD traces, clay mineral species identified (except kaolinite) and their quantities are speculative as listed under "smectites"; for more precise clay identification and quantities, pre-treatment including sedimentation of samples is required.

Sample	Pit/Hole	Type	Depth	Quartz	Kaolinite	Calcite	Halite	Goethite	"Smectites"	Anatase	Rutile
R213551	GC100	upp.reg.	0-1	XXXX	XX	XXXX	X	X			
R213552	GC100	upp.reg.	1-2	XXXX	XX	XXXX	X		XX		
R213574	GC103	upp.reg.	5-6	XXXX	XX	XXXX			XX	X	X
R213587	GC106	upp.reg.	0-1	XXXX	X	XXXX	X				
R213588	GC106	upp.reg.	1-2	XXXX	X	XXXX	X				
R213592	GC106	upp.reg.	5-6	XXXX	X				XX	XX	
R213641	GC114	upp.reg.	5-6	XXX	XXX			XXX			
R213673	GC120	upp.reg.	0-1	XXXX	XX	XXXX	X	X			
R213687	GC122	upp.reg.	2-3	XXX	XXX	XXX		X	XX		X
R213692	GC123	upp.reg.	0-1	XXXX	XXX	XXX	X	XX			X
R213696	GC123	upp.reg.	4-5	XXX	XXX			XXX			
R214296	96CHAR868	low. reg.	6-12	XXXX	XXX			X	XX		
R214234	96CHRC967	Zone 1	2-3	XXXX	XXX	XX		X			
R214235	96CHRC967	Zone 1	8-9	XXXX	XXX			XX			
R214236	96CHRC967	Zone 1	14-15	XXXX	XXX			X			
R214237	96CHRC967	Zone 1	21-22	XXXX	XX			X	X		
R214238	96CHRC967	Zone 1	27-28	XXXX	XXX			X			
R214239	96CHRC967	Zone 1	34-35	XXXX	XX			X			
R214240	96CHRC967	Zone 1	40-41	XXXX	XXX			X			
R214242	96CHRC967	Zone 1	51-52	XXXX	XXX						
R214243	96CHRC967	Zone 1	57-58	XXXX	XXX						
R214244	96CHRC967	Zone 1	63-64	XXXX	X				X		
R214245	96CHRC967	Zone 1	69-70	XXXX	X						
R214246	96CHRC967	Zone 1	76-77	XXXX	X						
R214247	96CHRC967	Zone 1	82-83	XXXX	X						
R214314	95CHAR461	Zone 2	6-12	XXXX	XXX			X			
R214315	95CHAR461	Zone 2	12-18	XXXX	XXX			X	X		
R214316	95CHAR461	Zone 2	19-20	XXXX	XX			X			
R214317	95CHAR461	Zone 2	21-22	XXXX	XXX			X	X		
R214318	95CHAR461	Zone 2	24-30	XXXX	XXX			X			
R214319	95CHAR461	Zone 2	30-36	XXXX	XXX						
R214320	95CHAR461	Zone 2	36-40	XXXX	XX						
R214354	95CHAR474	upp.reg.	0-6	XXXX	X	XX			X	X	
R214355	95CHAR474	low.reg.	6-12	XXXX	XXX				XX	X	
R214356	95CHAR474	low.reg.	12-18	XXXX	XX						
R214357	95CHAR474	low.reg.	18-24	XXXX	XX						
R214358	95CHAR474	low.reg.	24-30	XXX	XX			X	X		
R214359	95CHAR474	low.reg.	30-36	XXX	XX						
R214360	95CHAR474	low.reg.	36-40	XXX	X						
R214361	95CHAR933	Zone 3	0-6	XXX	X	XXX			X	X	
R214362	95CHAR933	Zone 3	6-12	XXXX	XXX	X			X	X	
R214363	95CHAR933	Zone 3	12-18	XXXX	X						X?
R214364	95CHAR933	Zone 3	22-23	XXXX	XX						
R214365	95CHAR933	Zone 3	25-26	XXXX	XX						X?
R214366	95CHAR933	Zone 3	29-30	XXXX	XX						
R214367	95CHAR933	Zone 3	34-35	XXXX	XX				X		
R214368	95CHAR933	Zone 3	40-41	XXX	X						
R214369	95CHAR933	Zone 3	45-46	XXXX							
R214400	96CHAR848	upp.reg.	0-6	XXXX	X	X				X	
R214401	96CHAR848	low.reg.	6-12	XXXX	X				XX	X	
R214402	96CHAR848	low.reg.	12-18	XXXX	X				X		X?
R214403	96CHAR848	low.reg.	18-24	XXXX	X						X?
R214404	96CHAR848	low.reg.	24-30	XXXX	X						
R214405	96CHAR848	low.reg.	30-36	XXXX	X			X			
R214406	96CHAR848	low.reg.	36-42	XXXX	X						
R214407	96CHAR848	low.reg.	42-48	XXXX	X						
R214408	96CHAR848	low.reg.	48-54	XXXX	X						

X trace, XX minor, XXX major and XXXX dominant

Table A4 (continued): Compiled XRD results for selected Challenger study area samples.

Sample	Type	Depth	Opal	Gypsum	Hematite	Mica	Feld-spar	Chlorite	Amphibole	Alkali feldspars
R213551	upp.reg.	0-1								
R213552	upp.reg.	1-2	XX							
R213574	upp.reg.	5-6	XXX				X			
R213587	upp.reg.	0-1	X							
R213588	upp.reg.	1-2	XX							
R213592	upp.reg.	5-6	XXX							
R213641	upp.reg.	5-6		XX	X					
R213673	upp.reg.	0-1								
R213687	upp.reg.	2-3		XXX		XX				
R213692	upp.reg.	0-1		XXX		X				
R213696	upp.reg.	4-5		XXX	XX	X				
R214296	low. reg.	6-12					X			
R214234	Zone 1	2-3			X	X				
R214235	Zone 1	8-9				X				
R214236	Zone 1	14-15				XX	X			
R214237	Zone 1	21-22				X	XX			
R214238	Zone 1	27-28				XX	X			
R214239	Zone 1	34-35				XX	X			
R214240	Zone 1	40-41				X	X			
R214242	Zone 1	51-52				X	XXX			
R214243	Zone 1	57-58				XX	XXX			
R214244	Zone 1	63-64			X	XX	XXX	XXX	XX	
R214245	Zone 1	69-70				XX	XXX	X		
R214246	Zone 1	76-77				XX	XXX		X	X
R214247	Zone 1	82-83				XX	XXX	X		
R214314	Zone 2	6-12					X			
R214315	Zone 2	12-18					X			
R214316	Zone 2	19-20					XXX			
R214317	Zone 2	21-22					XXX			X
R214318	Zone 2	24-30				XX	XXX			X
R214319	Zone 2	30-36				XX	XXX			
R214320	Zone 2	36-40				XX	XXX			
R214354	upp.reg.	0-6	XXX							
R214355	low.reg.	6-12	XX			X				
R214356	low.reg.	12-18	X							
R214357	low.reg.	18-24				X	XX			
R214358	low.reg.	24-30					X			
R214359	low.reg.	30-36					XX	XXX		
R214360	low.reg.	36-40					XXX	XXX		
R214361	Zone 3	0-6	XXX							
R214362	Zone 3	6-12	XX			X				
R214363	Zone 3	12-18					X			
R214364	Zone 3	22-23				X	XX			X
R214365	Zone 3	25-26				X	XX			
R214366	Zone 3	29-30				X	XX			
R214367	Zone 3	34-35				X	XXX			X
R214368	Zone 3	40-41				X	XXX			
R214369	Zone 3	45-46				X	XXX			
R214400	upp.reg.	0-6								
R214401	low.reg.	6-12	X							
R214402	low.reg.	12-18								
R214403	low.reg.	18-24								
R214404	low.reg.	24-30				X	XX			
R214405	low.reg.	30-36				XX	XX			
R214406	low.reg.	36-42				XX	XX			
R214407	low.reg.	42-48				XX	XXX			
R214408	low.reg.	48-54				XX	XXX	X		

X trace, XX minor, XXX major and XXXX dominant.

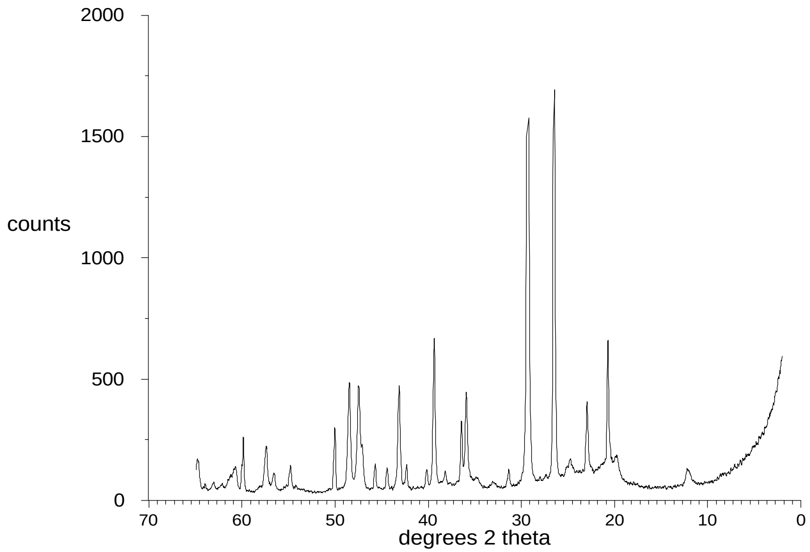

Figure A4.1: XRD trace of sample R213551 (GC100, 0 - 1 m).
Data smoothed with 5-point running average and clipped at 2000 counts

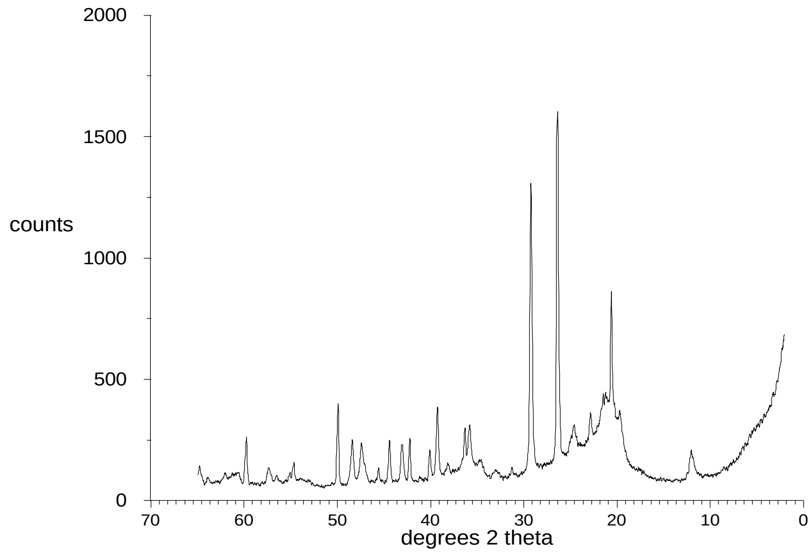

Figure A4.2: XRD trace of sample R213552 (GC100, 1 - 2 m).
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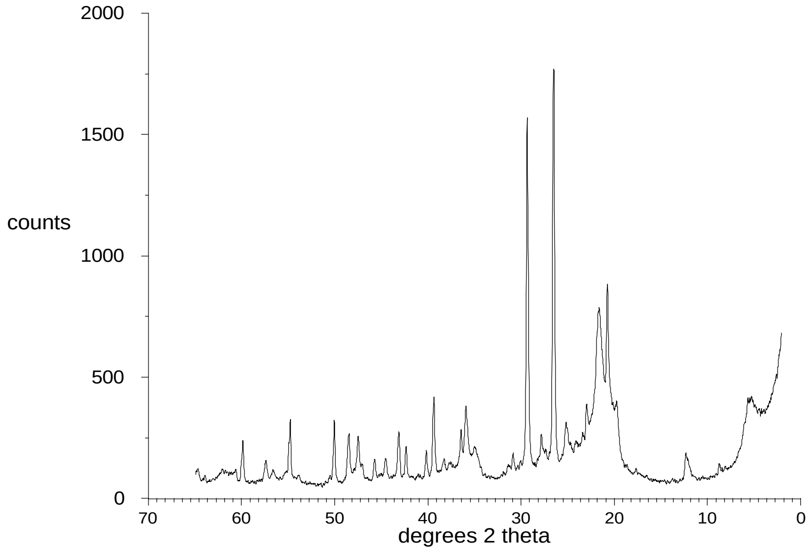

Figure A4.3: XRD trace of sample R213574 (GC103, 5 - 6 m).
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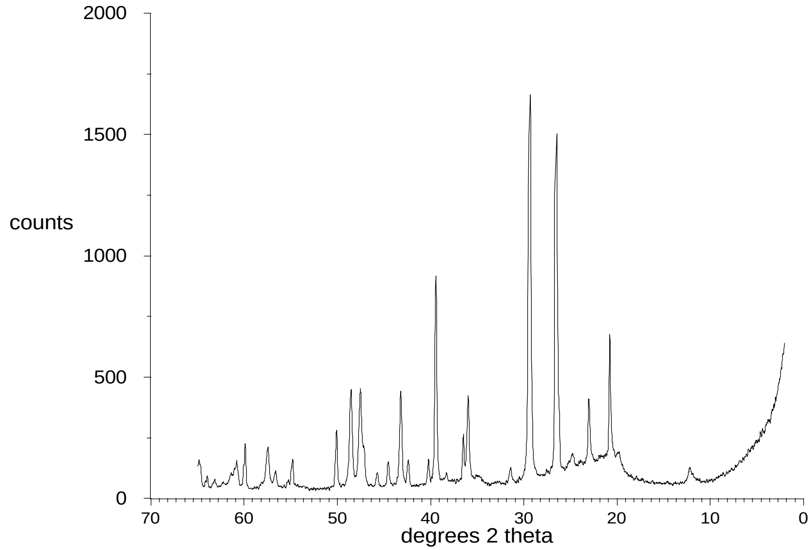

Figure A4.4: XRD trace of sample R213587 (GC106 0 - 1 m).
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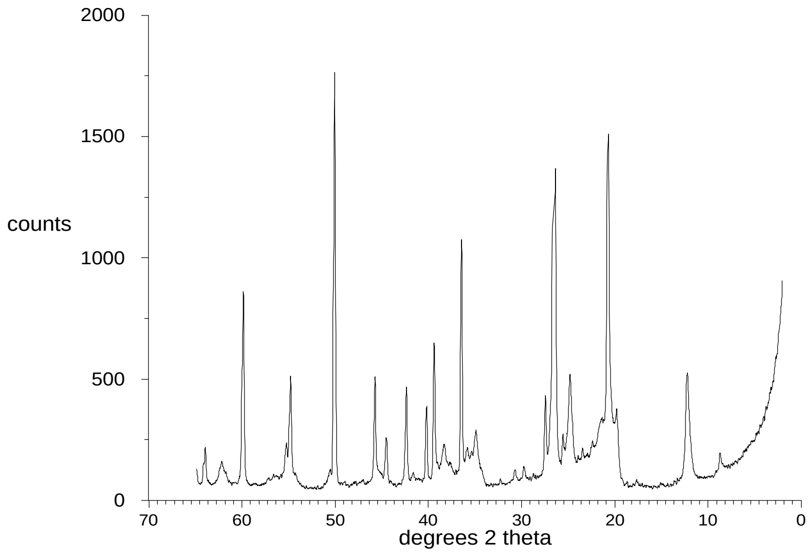

Figure A4.5: XRD trace of sample R213365 (95CHAR933, 25 - 26 m).
Data smoothed with 5-point running average and clipped at 2000 counts

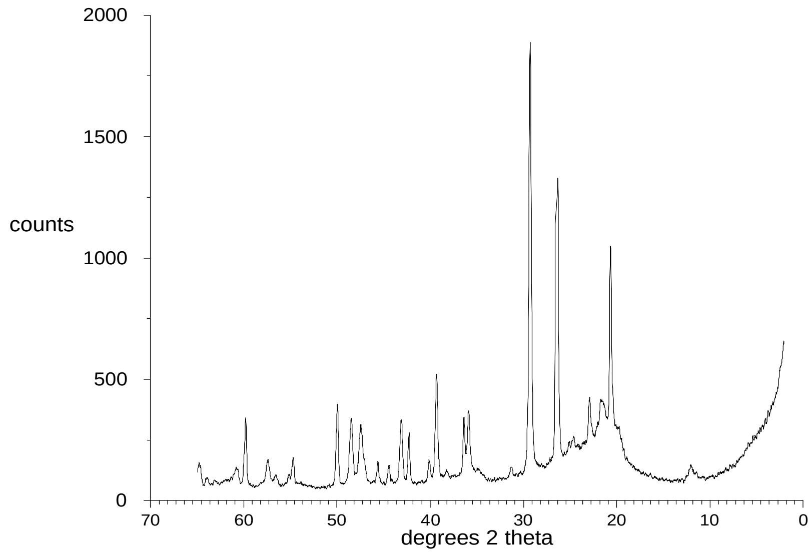

Figure A4.6: XRD trace of sample R213588 (GC106, 1 - 2 m).
Data smoothed with 5-point running average and clipped at 2000 counts

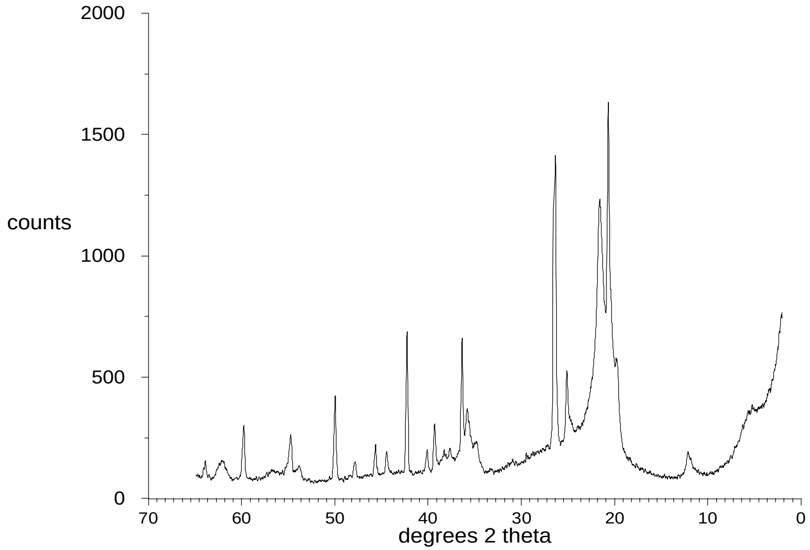

Figure A4.7: XRD trace of sample R213592 (GC106, 5 - 6 m).
Data smoothed with 5-point running average and clipped at 2000 counts

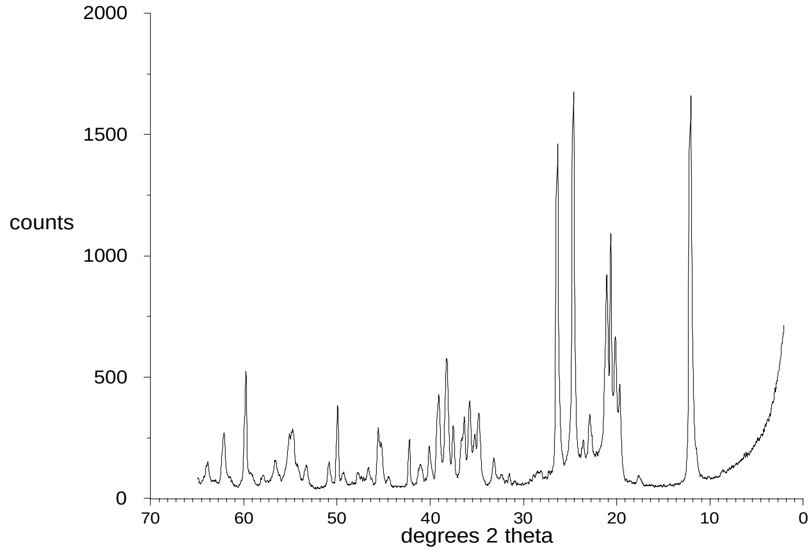

Figure A4.8: XRD trace of sample R213641 (GC114, 5 - 6 m).
Data smoothed with 5-point running average and clipped at 2000 counts

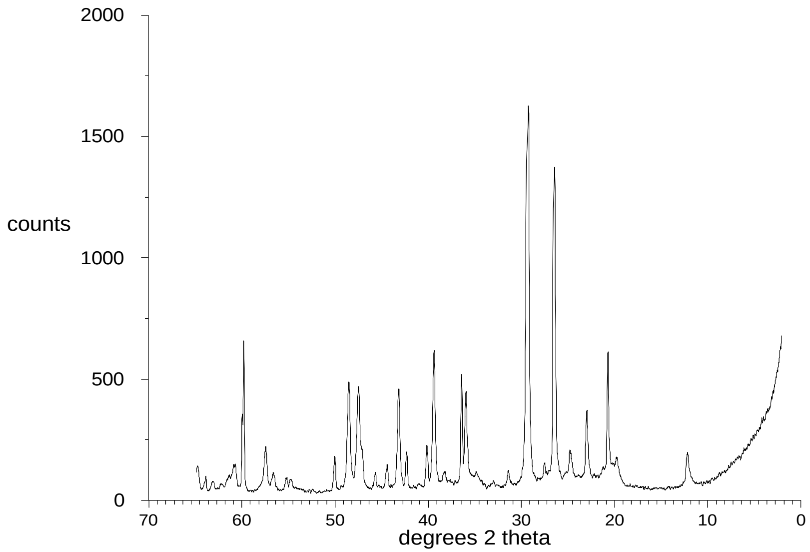

Figure A4.9: XRD trace of sample R213673 (GC120, 0 - 1 m).
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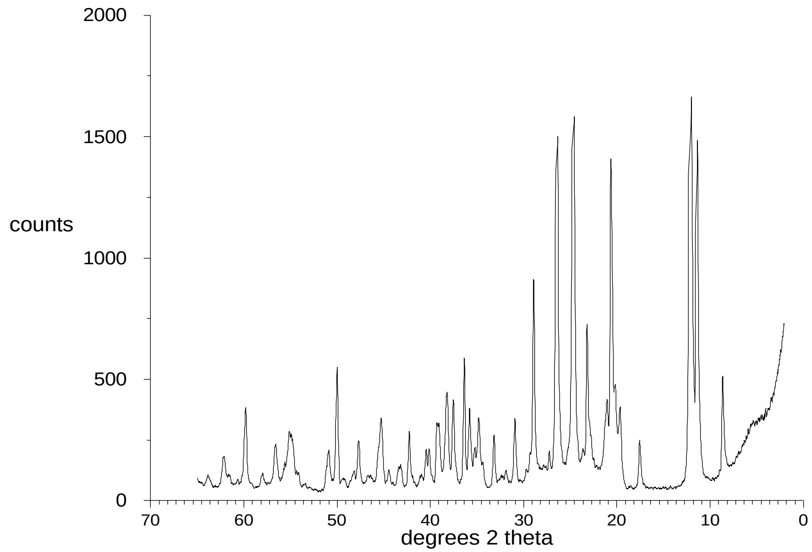

Figure A4.10: XRD trace of sample R213687 (GC122, 2 - 3 m).
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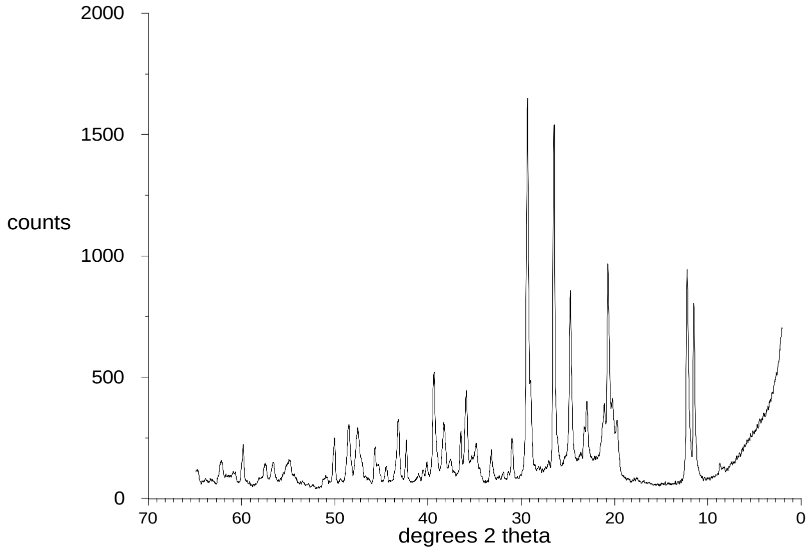

Figure A4.11: XRD trace of sample R213692 (GC123, 0 - 1 m).
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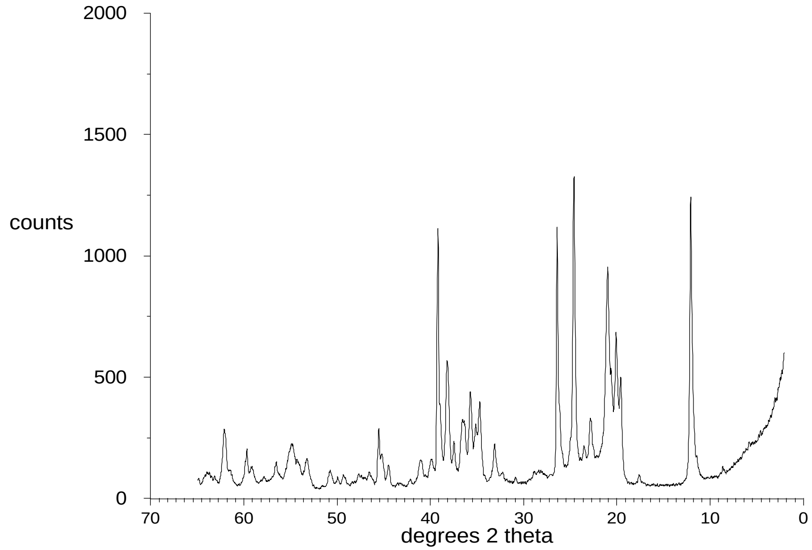

Figure A4.12: XRD trace of sample R213696 (GC123, 4 - 5 m).
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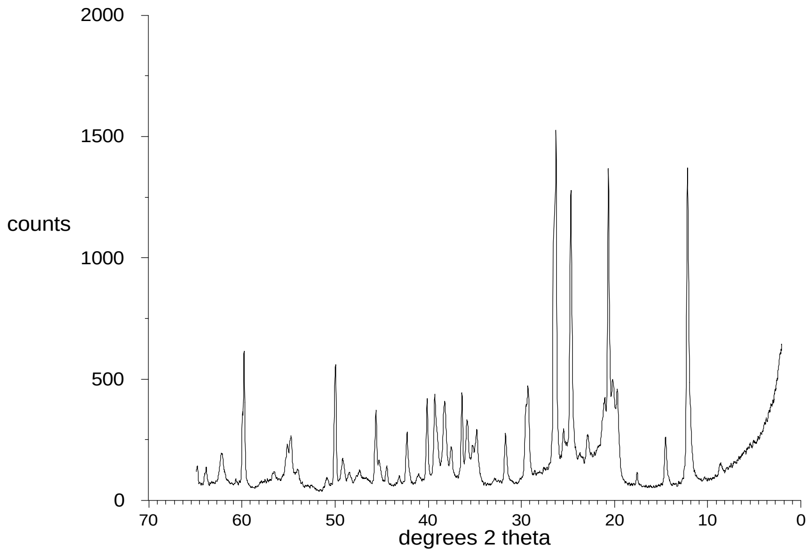

Figure A4.13: XRD trace of sample R214234 (96CHRC967, 2 - 3 m).
Data smoothed with 5-point running average and clipped at 2000 counts

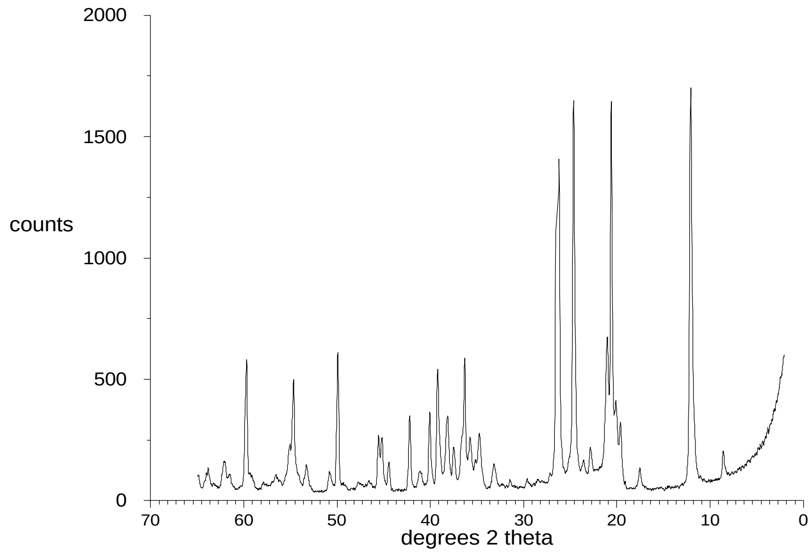

Figure A4.14: XRD trace of sample R213235 (96CHRC967, 8 - 9 m).
Data smoothed with 5-point running average and clipped at 2000 counts

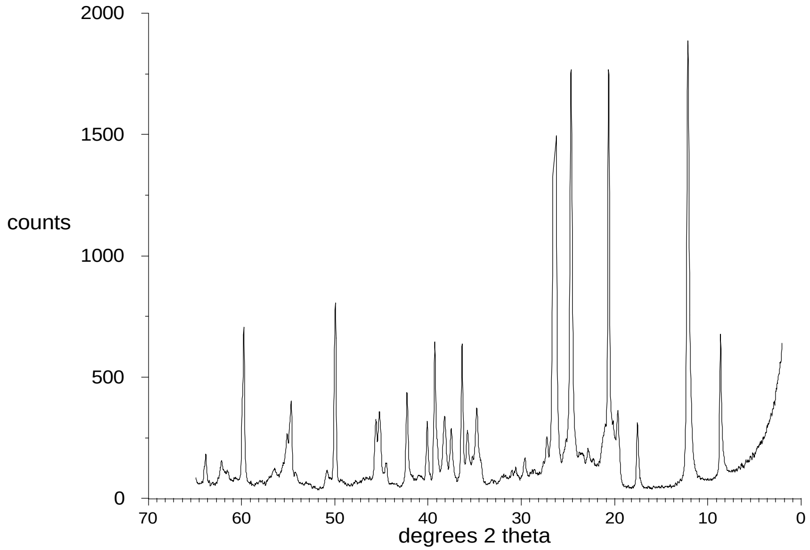

Figure A4.15: XRD trace of sample R213236 (96CHRC967, 14 - 15 m).
Data smoothed with 5-point running average and clipped at 2000 counts

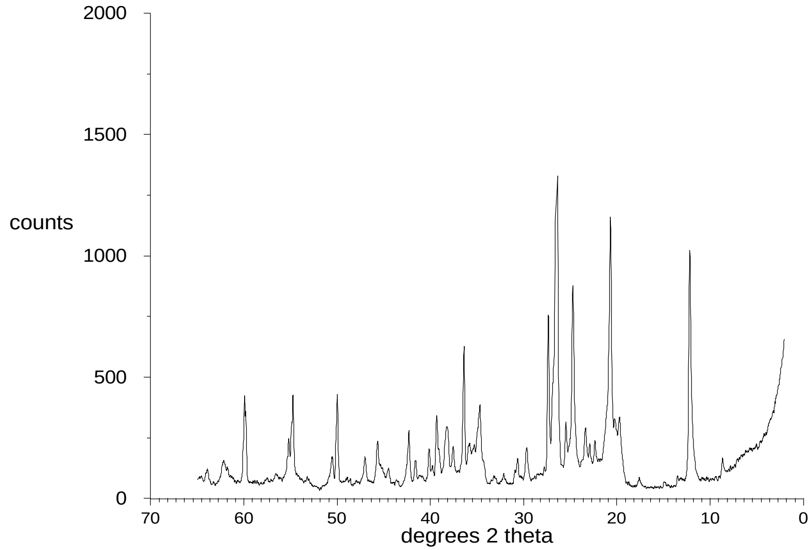

Figure A4.16: XRD trace of sample R213237 (96CHRC967, 21 - 22 m).
Data smoothed with 5-point running average and clipped at 2000 counts

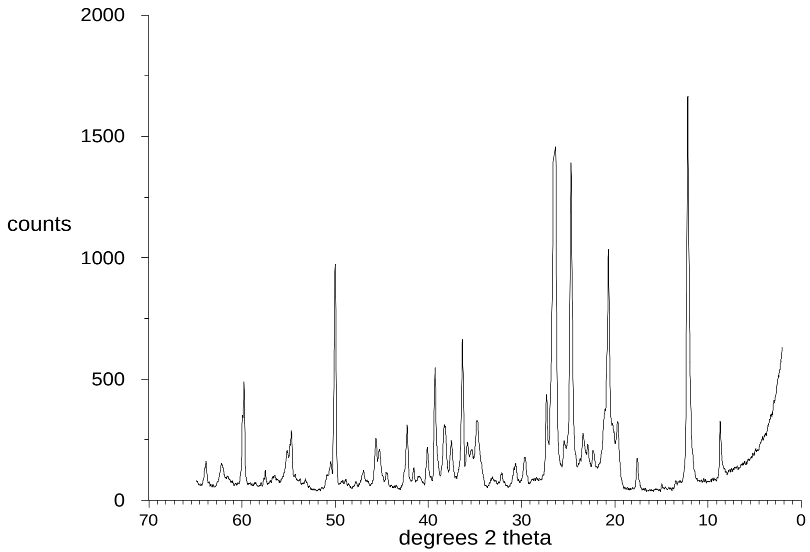

Figure A4.17: XRD trace of sample R214238 (96CHRC967, 27 - 28 m).
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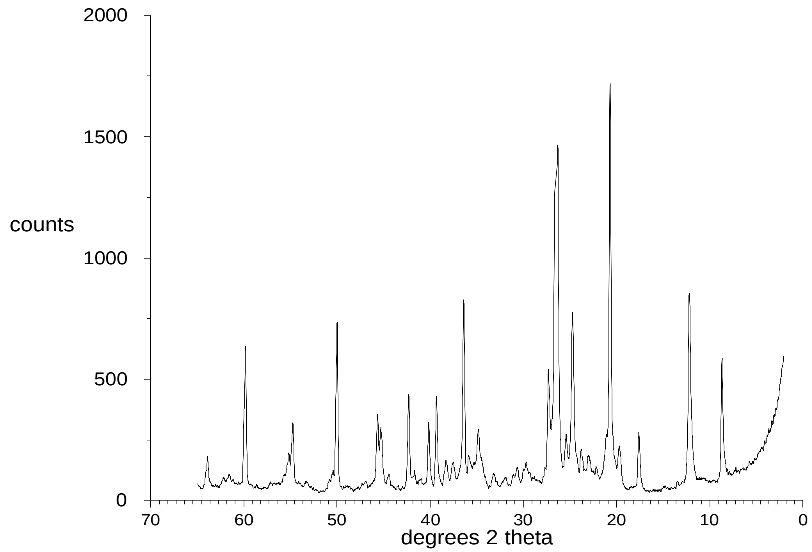

Figure A4.18: XRD trace of sample R214239 (96CHRC967, 34 - 35 m).
Data smoothed with 5-point running average and clipped at 2000 counts

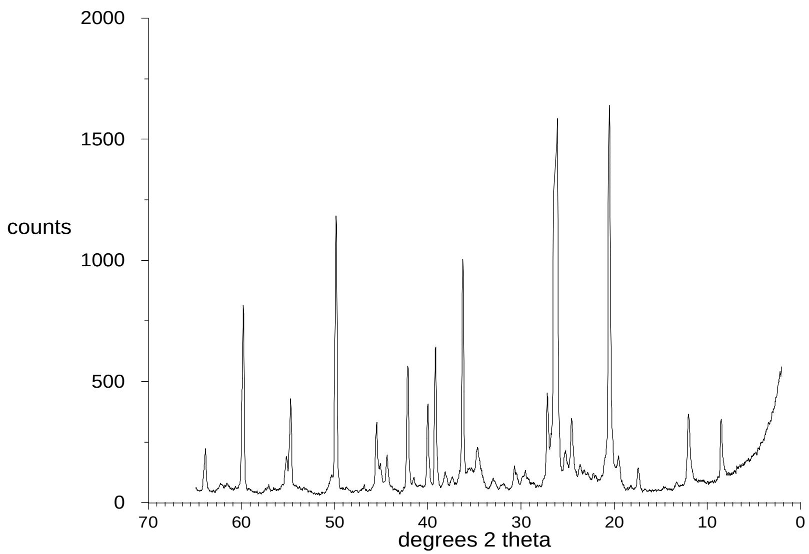

Figure A4.19: XRD trace of sample R214240 (96CHRC967, 40 41 m).
Data smoothed with 5-point running average and clipped at 2000 counts

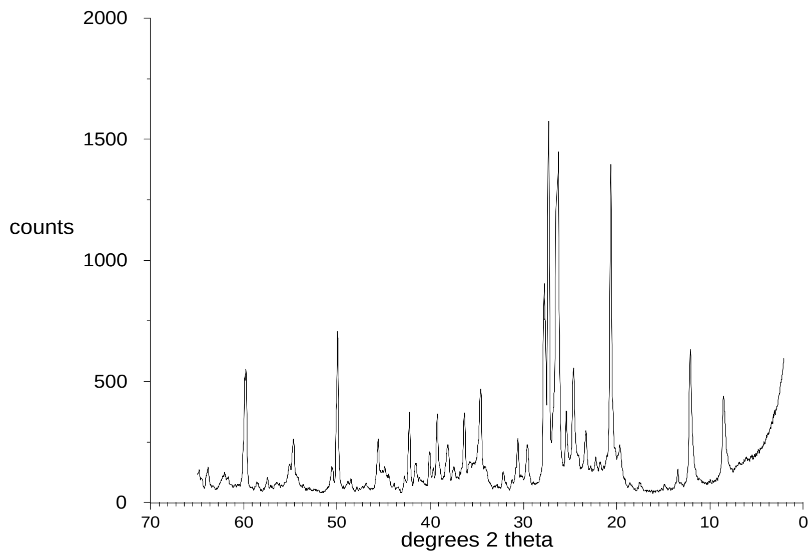

Figure A4.20: XRD trace of sample R214242 (96CHRC967, 51 52 m).
Data smoothed with 5-point running average and clipped at 2000 counts

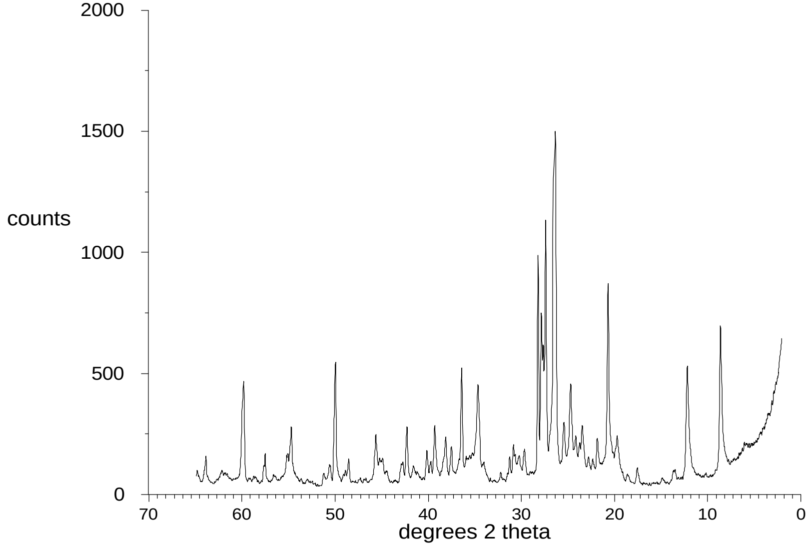

Figure A4.21: XRD trace of sample R214243 (96CHRC967, 57 - 58 m).
Data smoothed with 5-point running average and clipped at 2000 counts

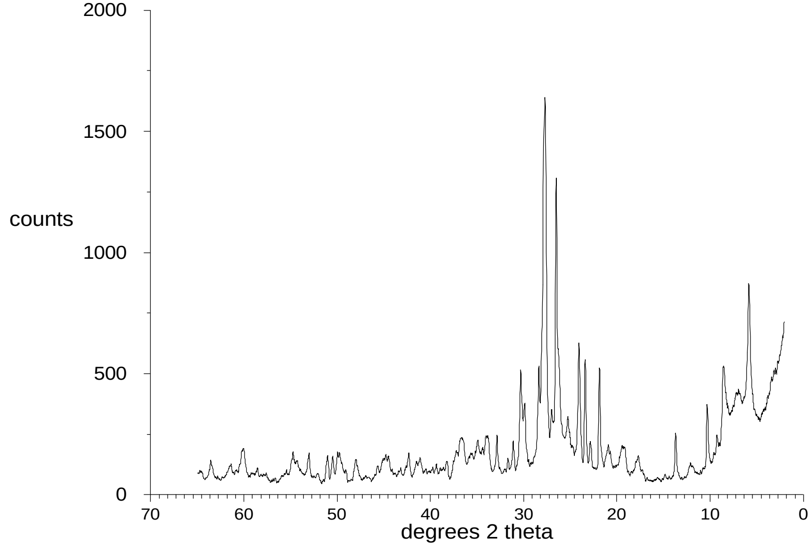

Figure A4.22: XRD trace of sample R214244 (96CHRC967, 63 - 64 m).
Data smoothed with 5-point running average and clipped at 2000 counts

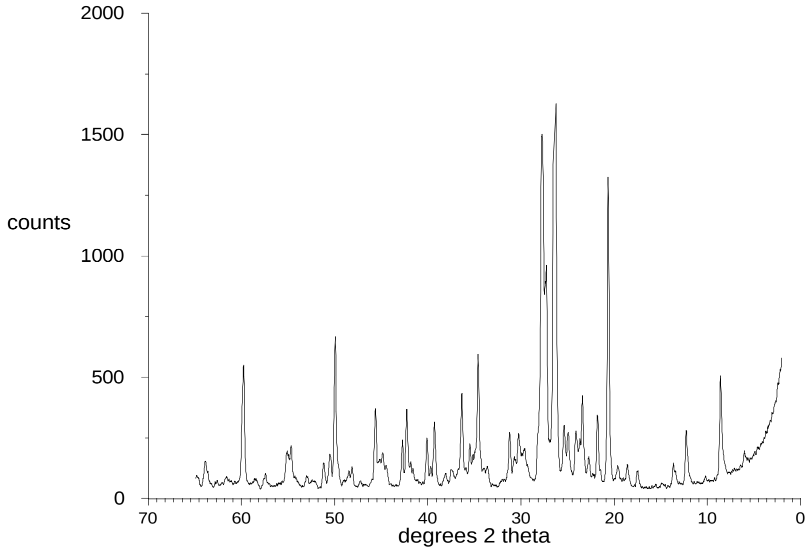

Figure A4.23: XRD trace of sample R214245 (96CHRC967, 69 - 70 m).
Data smoothed with 5-point running average and clipped at 2000 counts

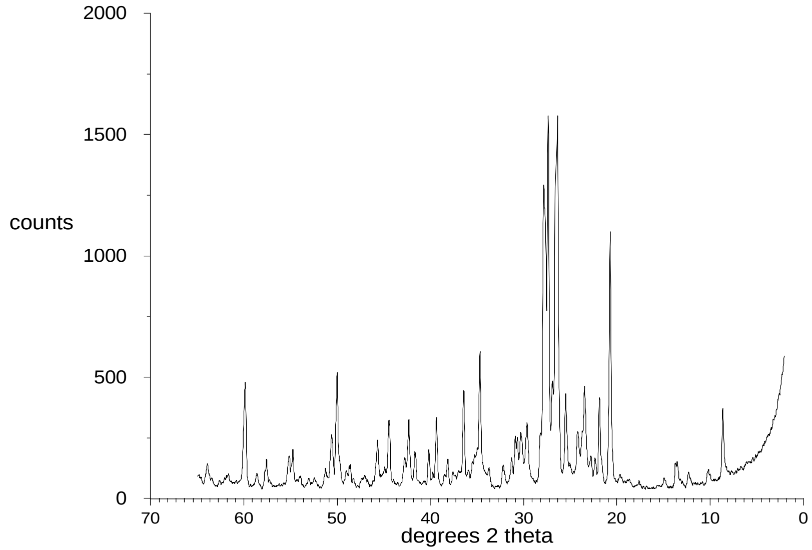

Figure A4.24: XRD trace of sample R214246 (96CHRC967, 76 - 77 m).
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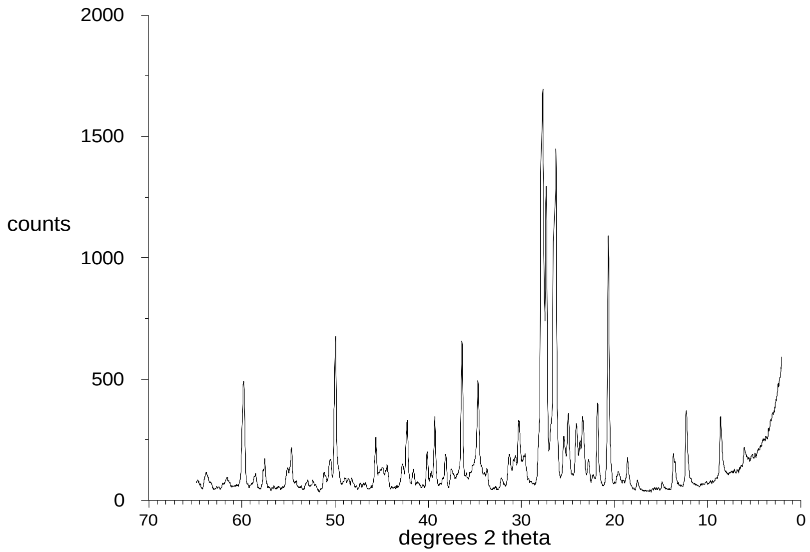

Figure A4.25: XRD trace of sample R214247 (96CHRC967, 82 - 83 m).
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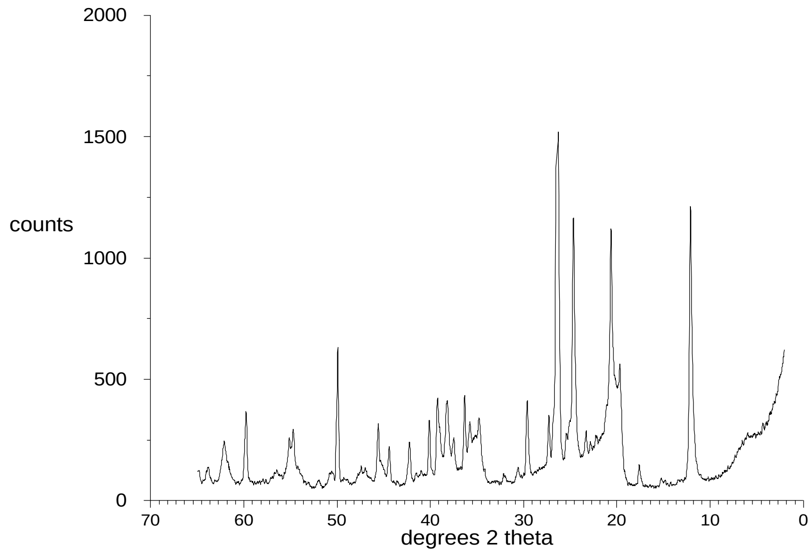

Figure A4.26: XRD trace of sample R214296 (96CHAR868, 6 - 12 m).
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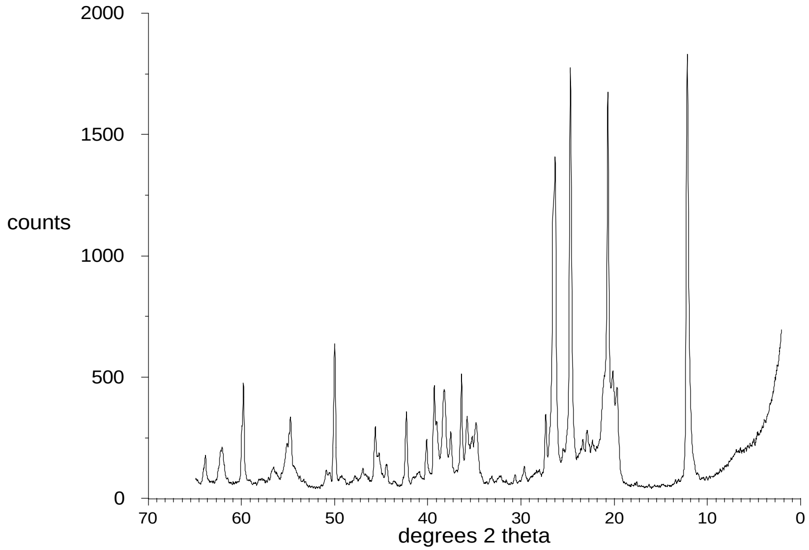

Figure A4.27: XRD trace of sample R214314 (95CHAR461, 6 - 12 m).
Data smoothed with 5-point running average and clipped at 2000 counts

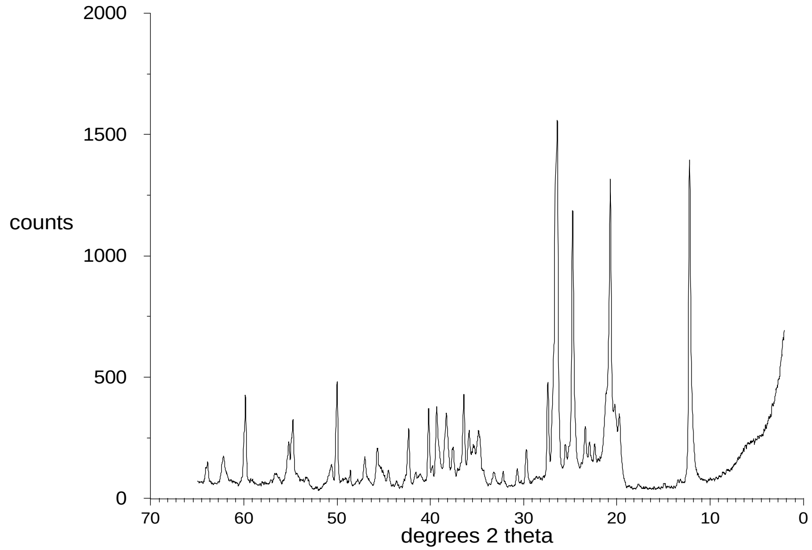

Figure A4.28: XRD trace of sample R214315 (95CHAR461, 12 - 18 m).
Data smoothed with 5-point running average and clipped at 2000 counts

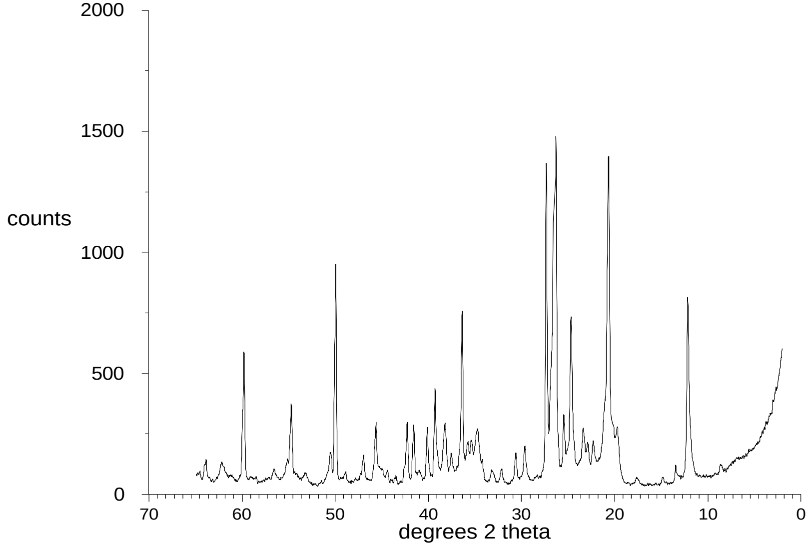

Figure A4.29: XRD trace of sample R214316 (954CHAR461, 19 - 20 m).
Data smoothed with 5-point running average and clipped at 2000 counts

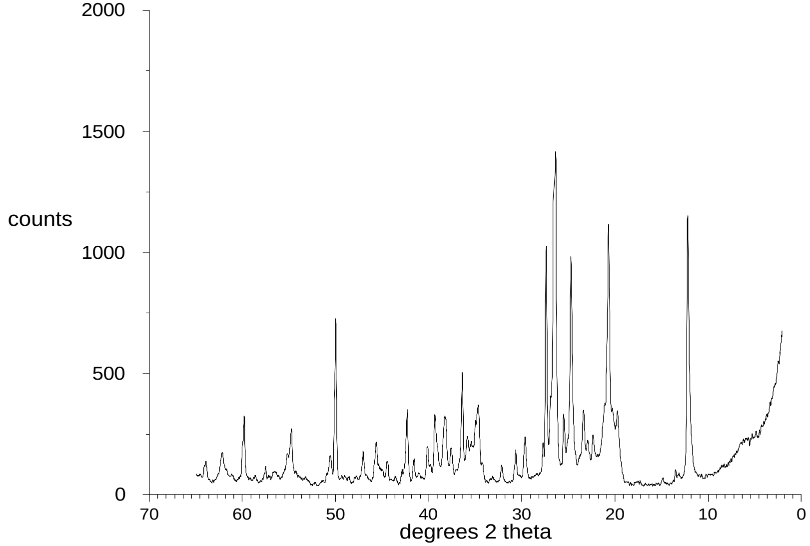

Figure A4.30: XRD trace of sample R214317 (95CHAR461, 21 - 22 m).
Data smoothed with 5-point running average and clipped at 2000 counts

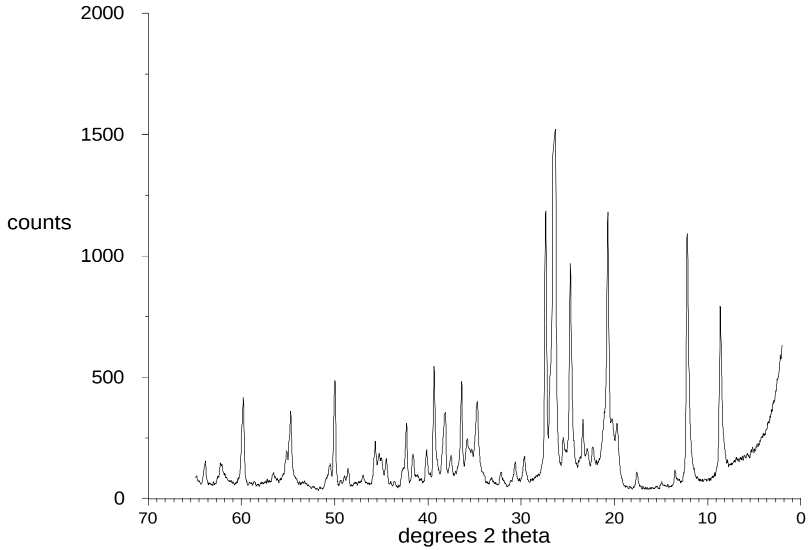

Figure A4.31: XRD trace of sample R214318 (95CHAR461, 24 - 30 m).
Data smoothed with 5-point running average and clipped at 2000 counts

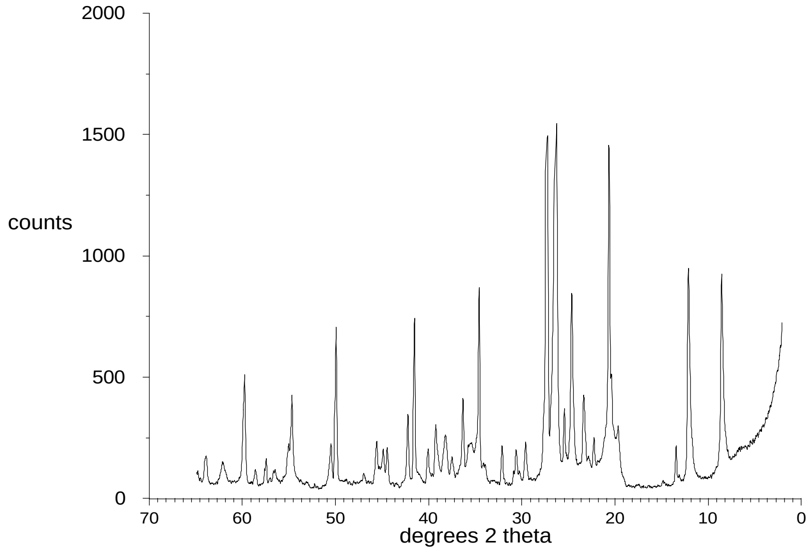

Figure A4.32: XRD trace of sample R214319 (95CHAR461, 30 - 36 m).
Data smoothed with 5-point running average and clipped at 2000 counts

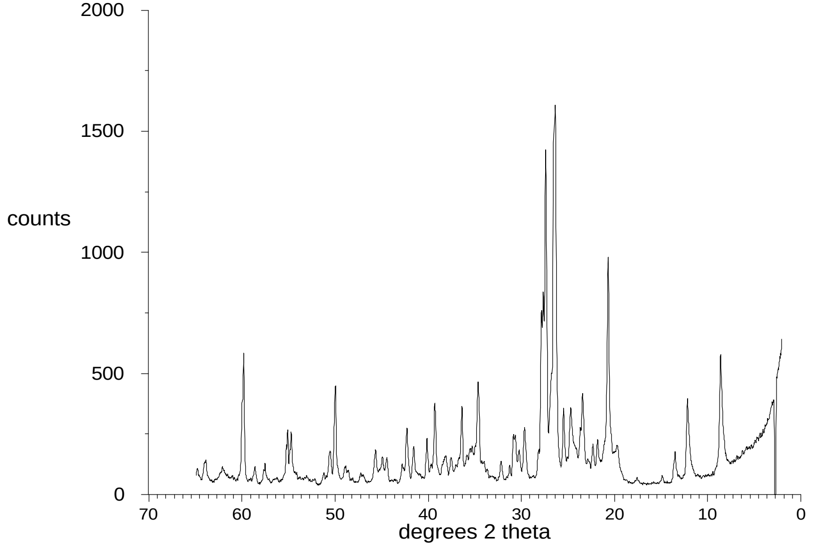

Figure A4.33: XRD trace of sample R214320 (95CHAR461, 36 - 40 m).
Data smoothed with 5-point running average and clipped at 2000 counts

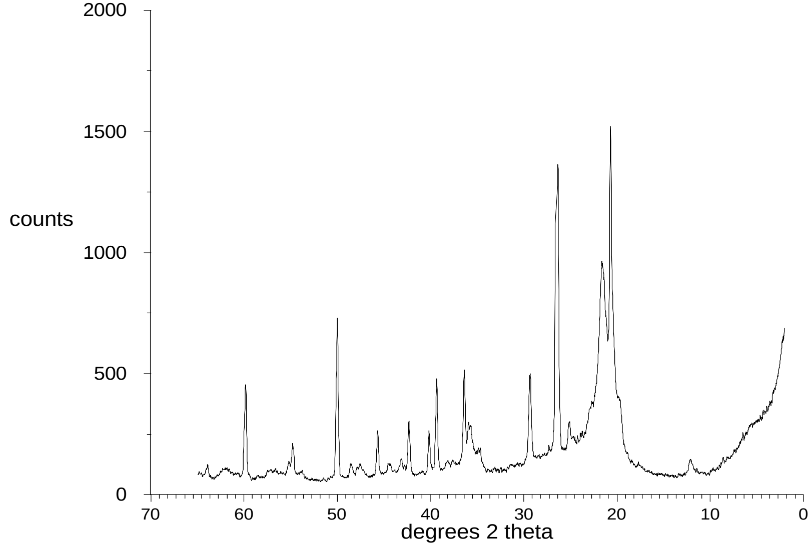

Figure A4.34: XRD trace of sample R214354 (95CHAR474, 0 - 6 m).
Data smoothed with 5-point running average and clipped at 2000 counts

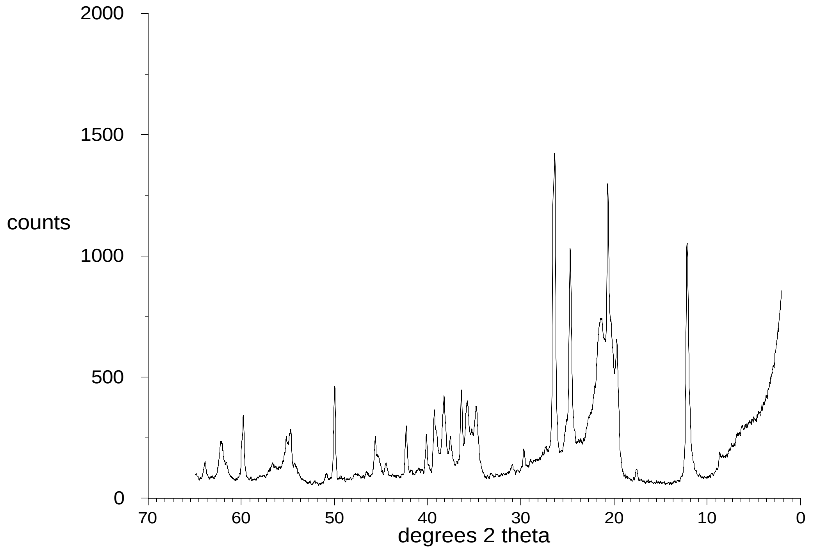

Figure A4.35: XRD trace of sample R214355 (95CHAR474, 6 - 12 m).
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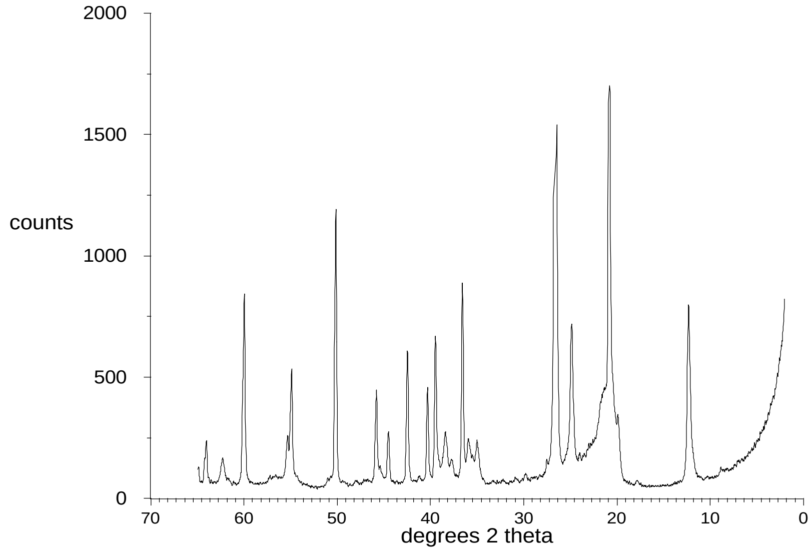

Figure A4.36: XRD trace of sample R214356 (95CHAR474, 12 - 18 m).
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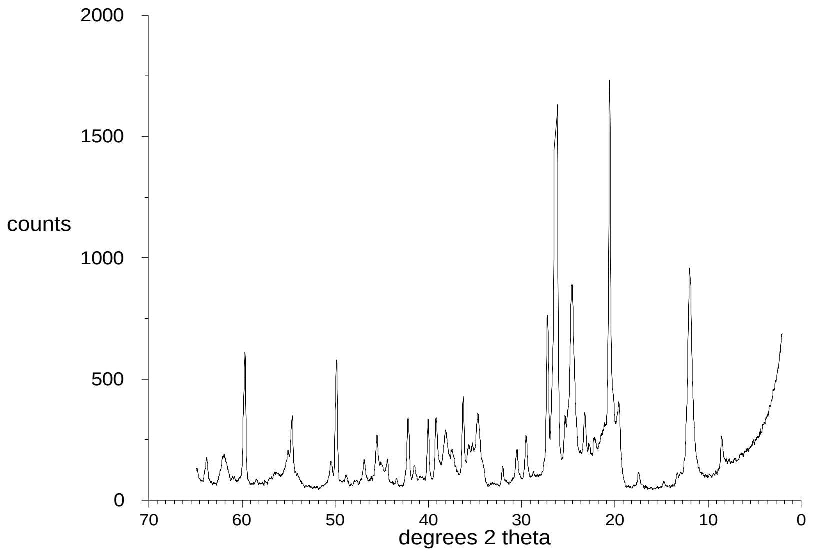

Figure A4.37: XRD trace of sample R214357 (95CHAR474, 18 - 24 m).
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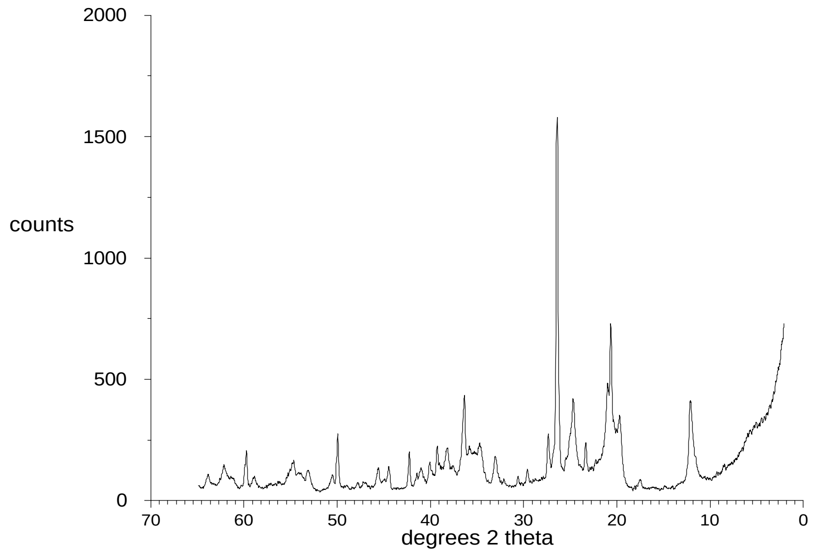

Figure A4.38: XRD trace of sample R214358 (95CHAR474, 24 - 30 m).
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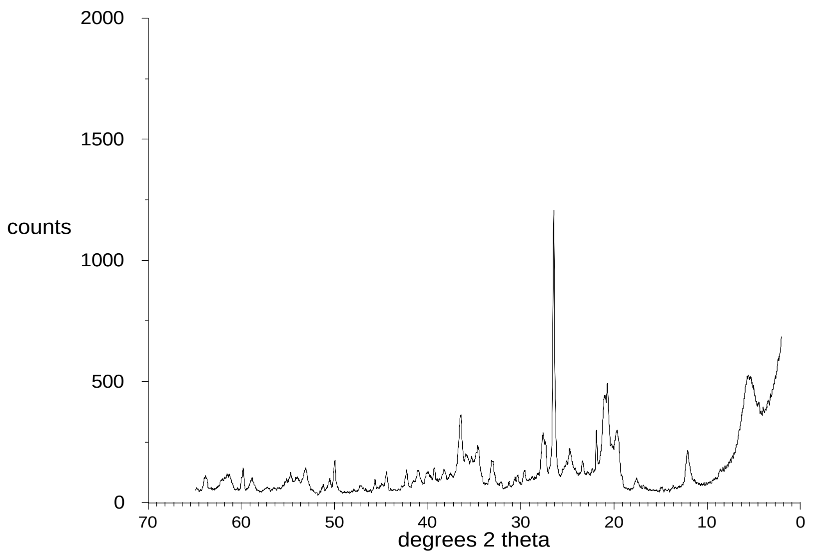


Figure A4.39: XRD trace of sample R214359 (95CHAR474, 30 - 36 m).
Data smoothed with 5-point running average and clipped at 2000 counts

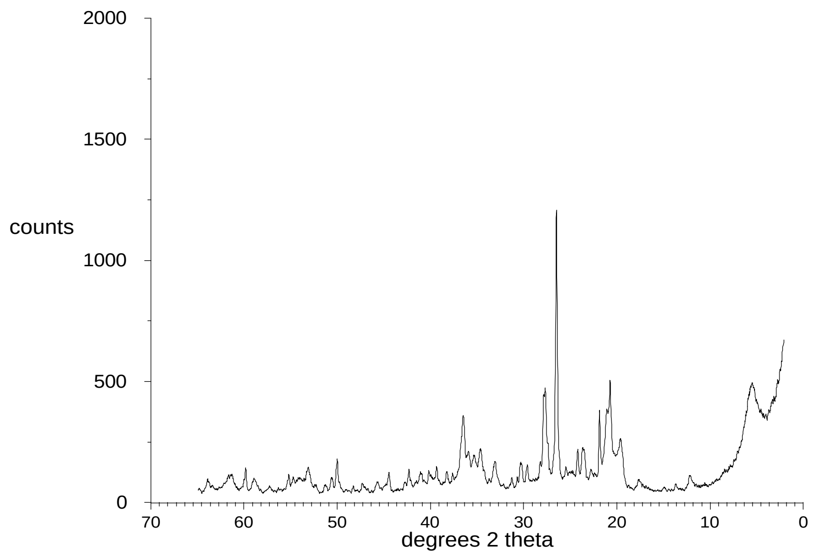


Figure A4.40: XRD trace of sample R214360 (95CHAR474, 36 - 40 m).
Data smoothed with 5-point running average and clipped at 2000 counts

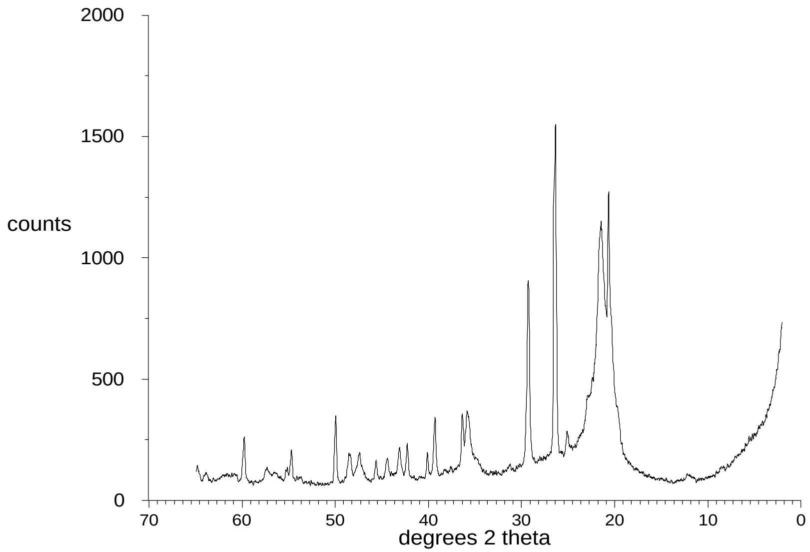


Figure A4.41: XRD trace of sample R214361 (95CHAR933, 0 - 6 m).
Data smoothed with 5-point running average and clipped at 2000 counts

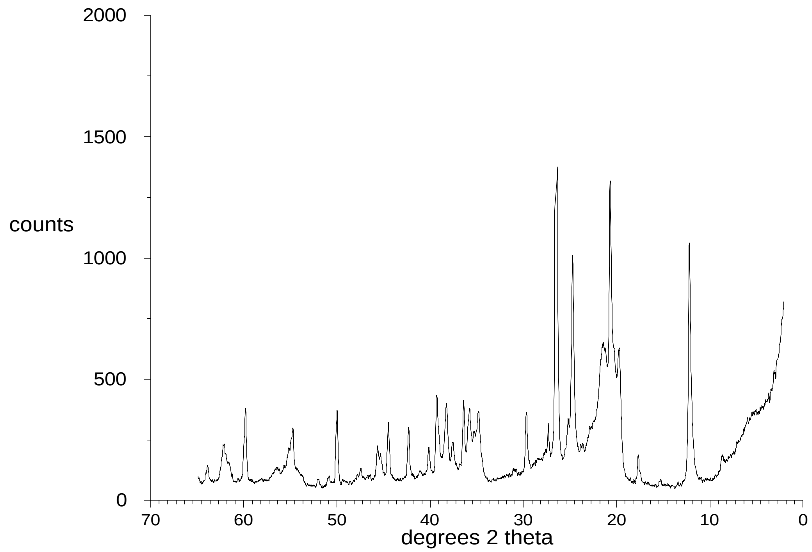


Figure A4.42: XRD trace of sample R214362 (95CHAR933, 6 - 12 m).
Data smoothed with 5-point running average and clipped at 2000 counts

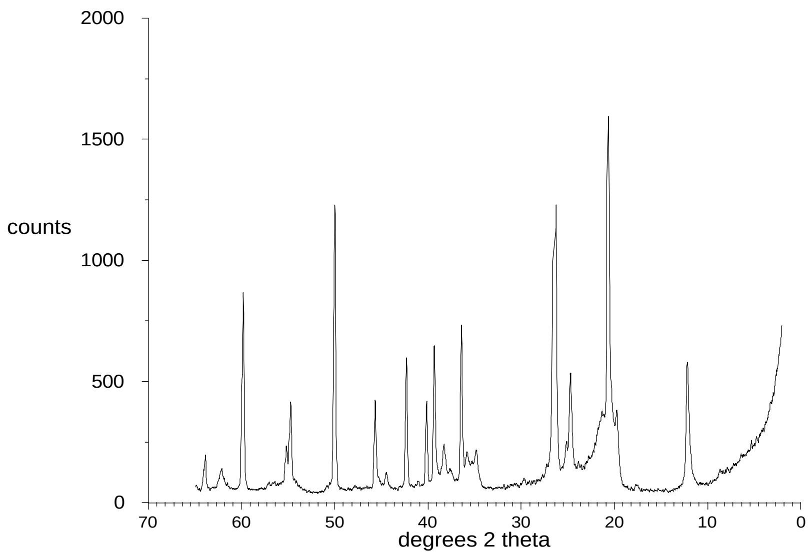


Figure A4.43: XRD trace of sample R214363 (95CHAR933, 12 - 18 m).
Data smoothed with 5-point running average and clipped at 2000 counts

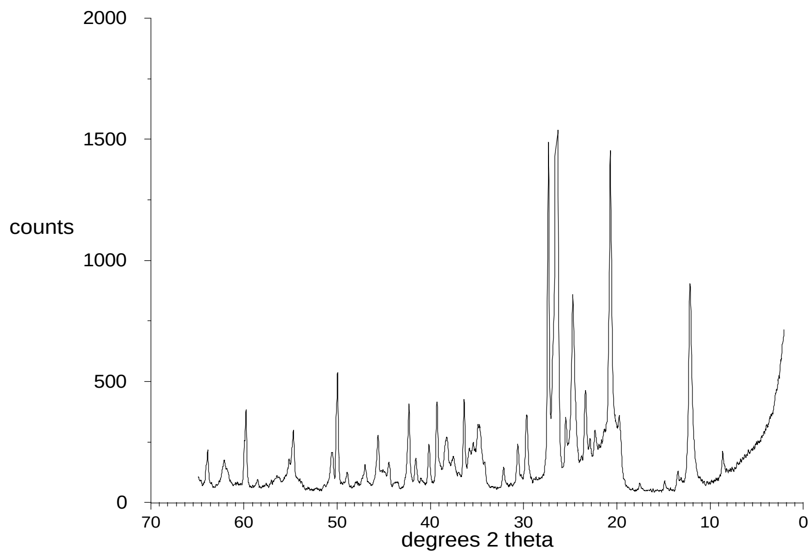


Figure A4.44: XRD trace of sample R214364 (95CHAR933, 22 - 23 m).
Data smoothed with 5-point running average and clipped at 2000 counts

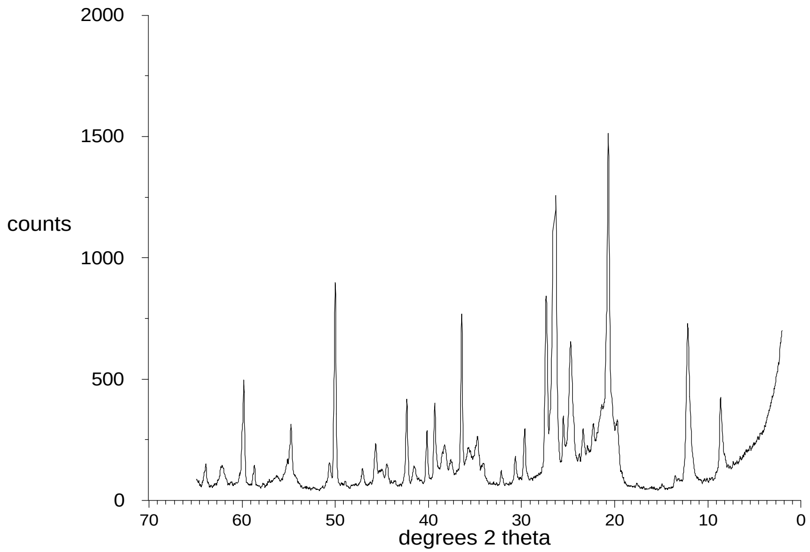


Figure A4.45: XRD trace of sample R214366 (95CHAR933, 29 - 30 m).
Data smoothed with 5-point running average and clipped at 2000 counts

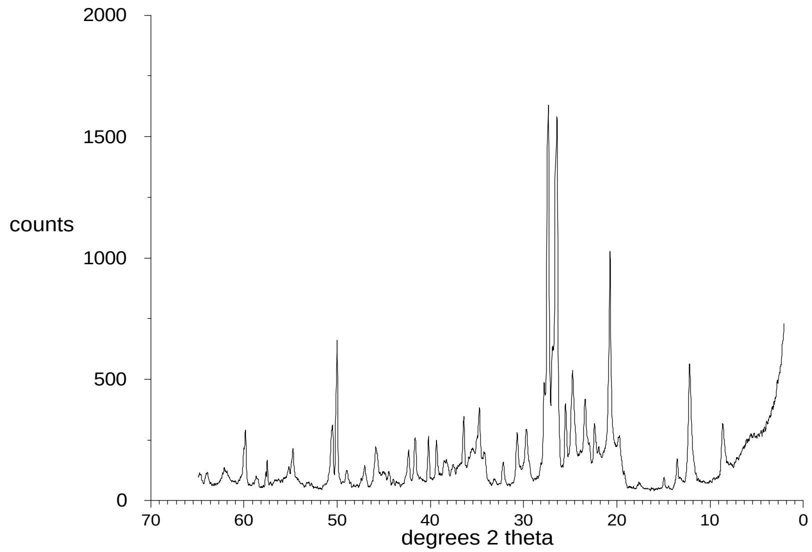


Figure A4.46: XRD trace of sample R214367 (95CHAR933, 34 - 35 m).
Data smoothed with 5-point running average and clipped at 2000 counts

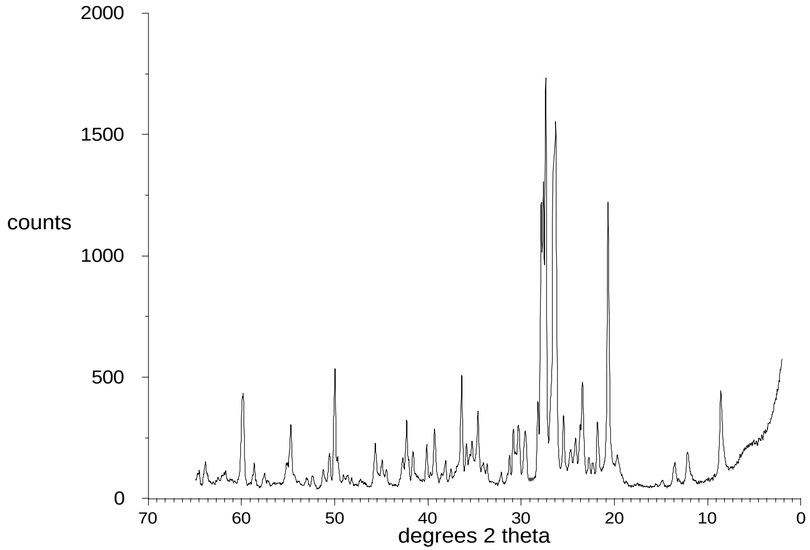


Figure A4.47: XRD trace of sample R214368 (95CHAR933, 40 - 41 m).
Data smoothed with 5-point running average and clipped at 2000 counts

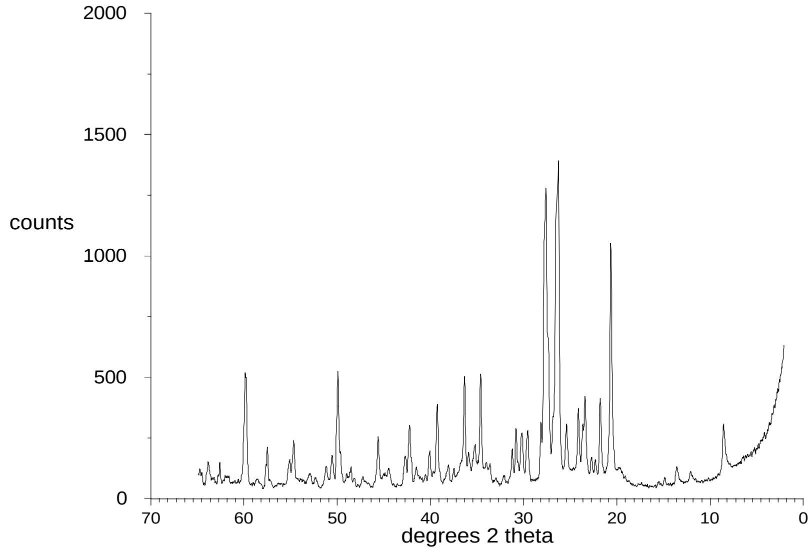


Figure A4.48: XRD trace of sample R214369 (95CHAR933, 45 - 46 m).
Data smoothed with 5-point running average and clipped at 2000 counts

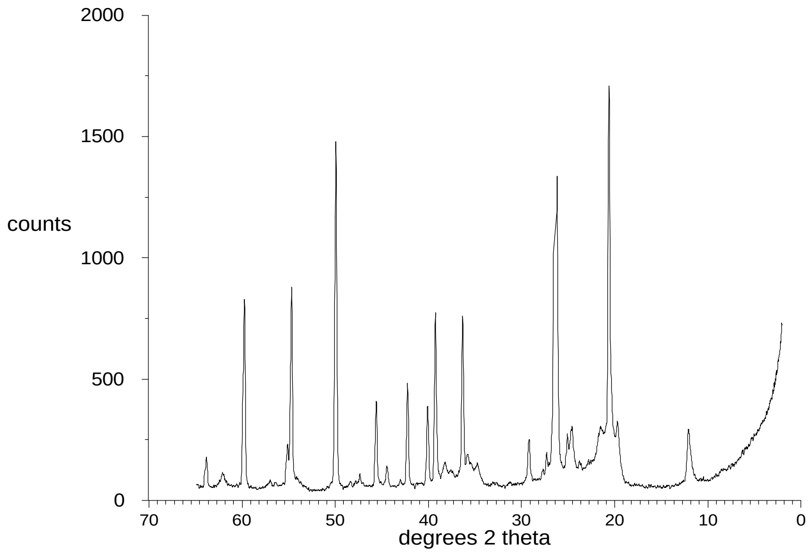


Figure A4.49: XRD trace of sample R214400 (95CHAR848, 0 - 6 m).
Data smoothed with 5-point running average and clipped at 2000 counts

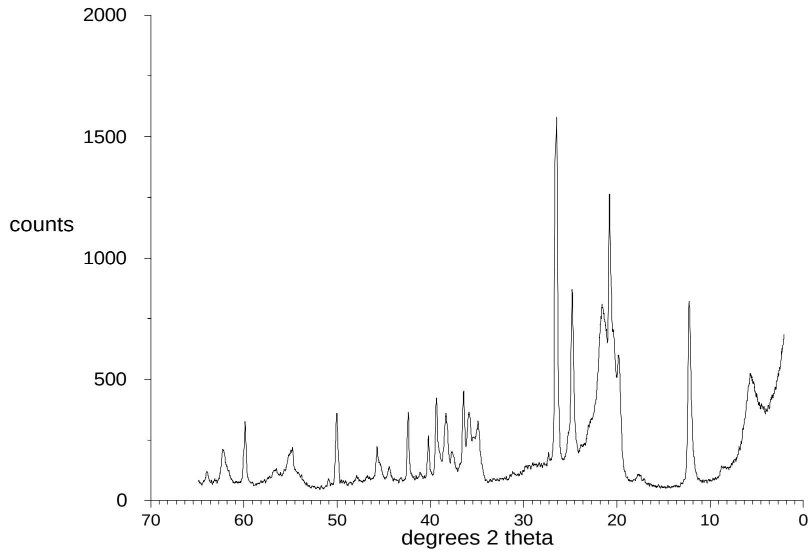


Figure A4.50: XRD trace of sample R214401 (95CHAR848, 6 - 12 m).
Data smoothed with 5-point running average and clipped at 2000 counts

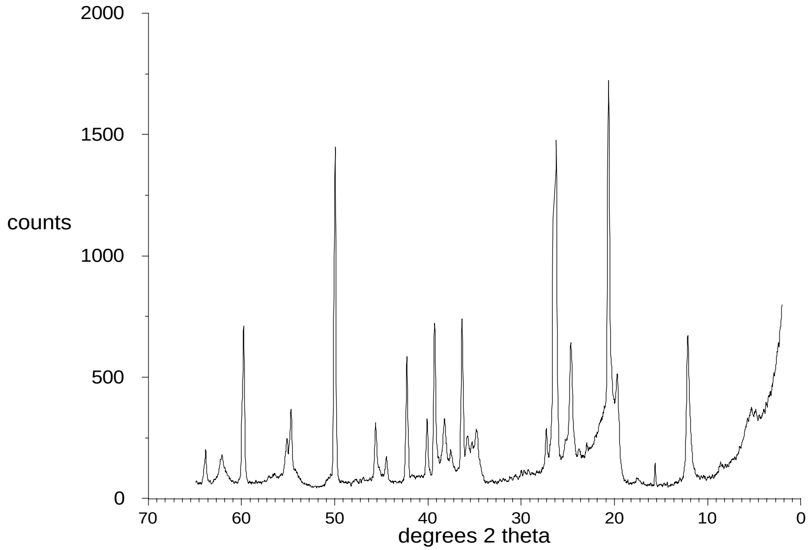


Figure A4.51: XRD trace of sample R214402 (95CHAR848, 12 - 18 m).
Data smoothed with 5-point running average and clipped at 2000 counts

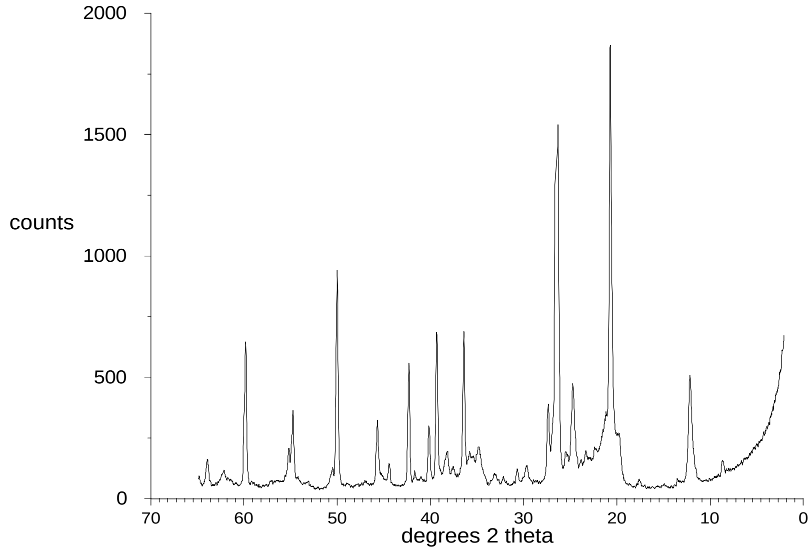


Figure A4.52: XRD trace of sample R214403 (95CHAR848, 18 - 24 m).
Data smoothed with 5-point running average and clipped at 2000 counts

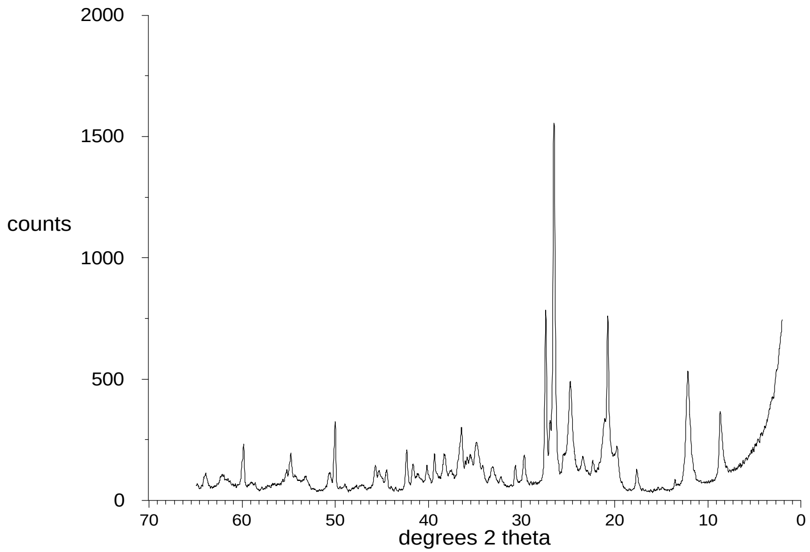


Figure A4.53: XRD trace of sample R214404 (95CHAR848, 24 - 30 m).
Data smoothed with 5-point running average and clipped at 2000 counts

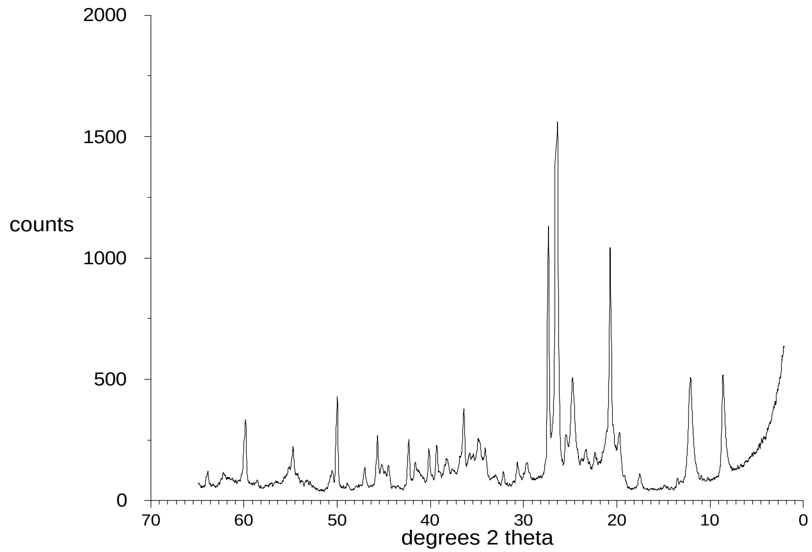


Figure A4.54: XRD trace of sample R214405 (95CHAR848, 30 - 36 m).
Data smoothed with 5-point running average and clipped at 2000 counts

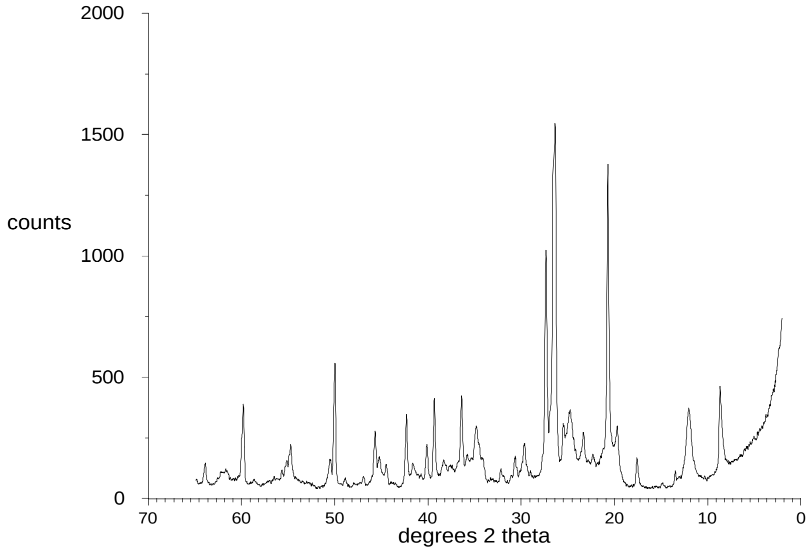


Figure A4.55: XRD trace of sample R214406 (95CHAR848, 36 - 42 m).
Data smoothed with 5-point running average and clipped at 2000 counts

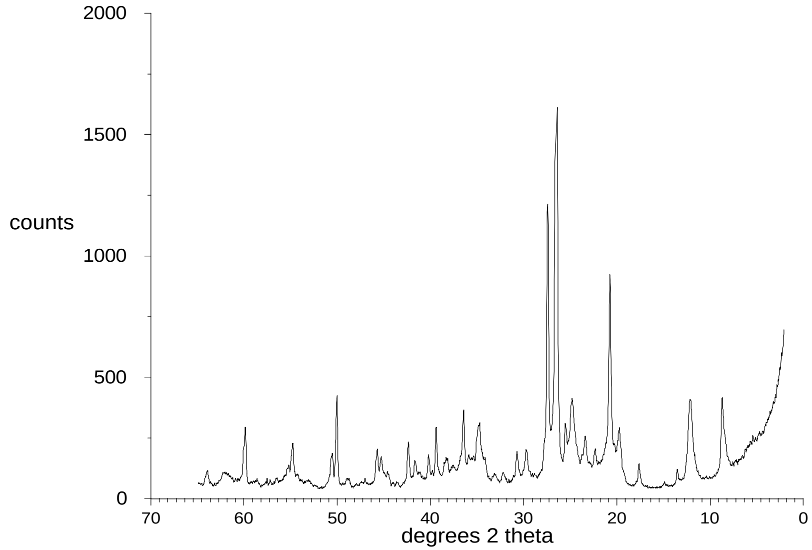


Figure A4.56: XRD trace of sample R214407 (95CHAR848, 42 - 48 m).
Data smoothed with 5-point running average and clipped at 2000 counts

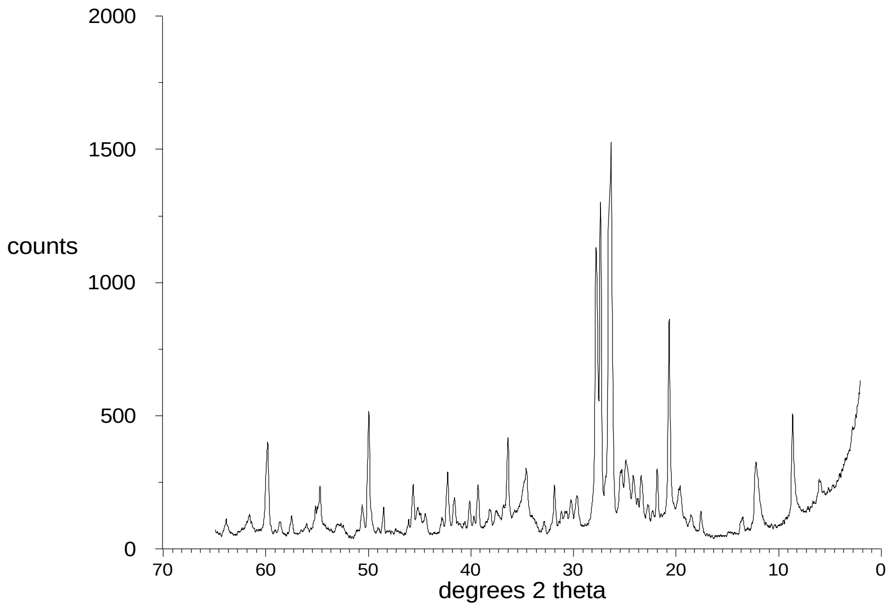


Figure A4.57: XRD trace of sample R214408.
Data smoothed with 5-point running average and clipped at 2000 counts

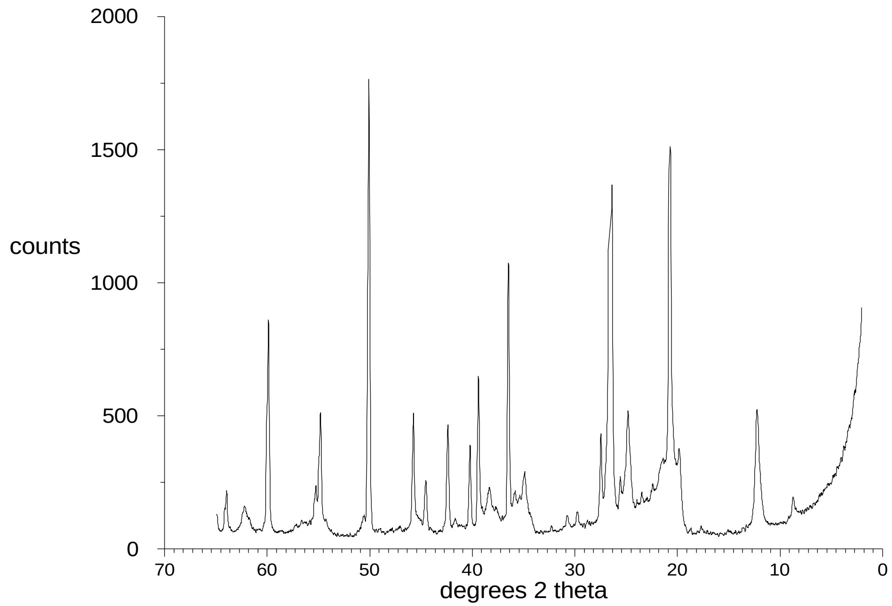


Figure A4.58: XRD trace of sample R214365.
Data smoothed with 5-point running average and clipped at 2000 counts

APPENDIX 5

Appendix 5: Graphed elemental abundances for profiles (including Hole 96 CHAR 933).

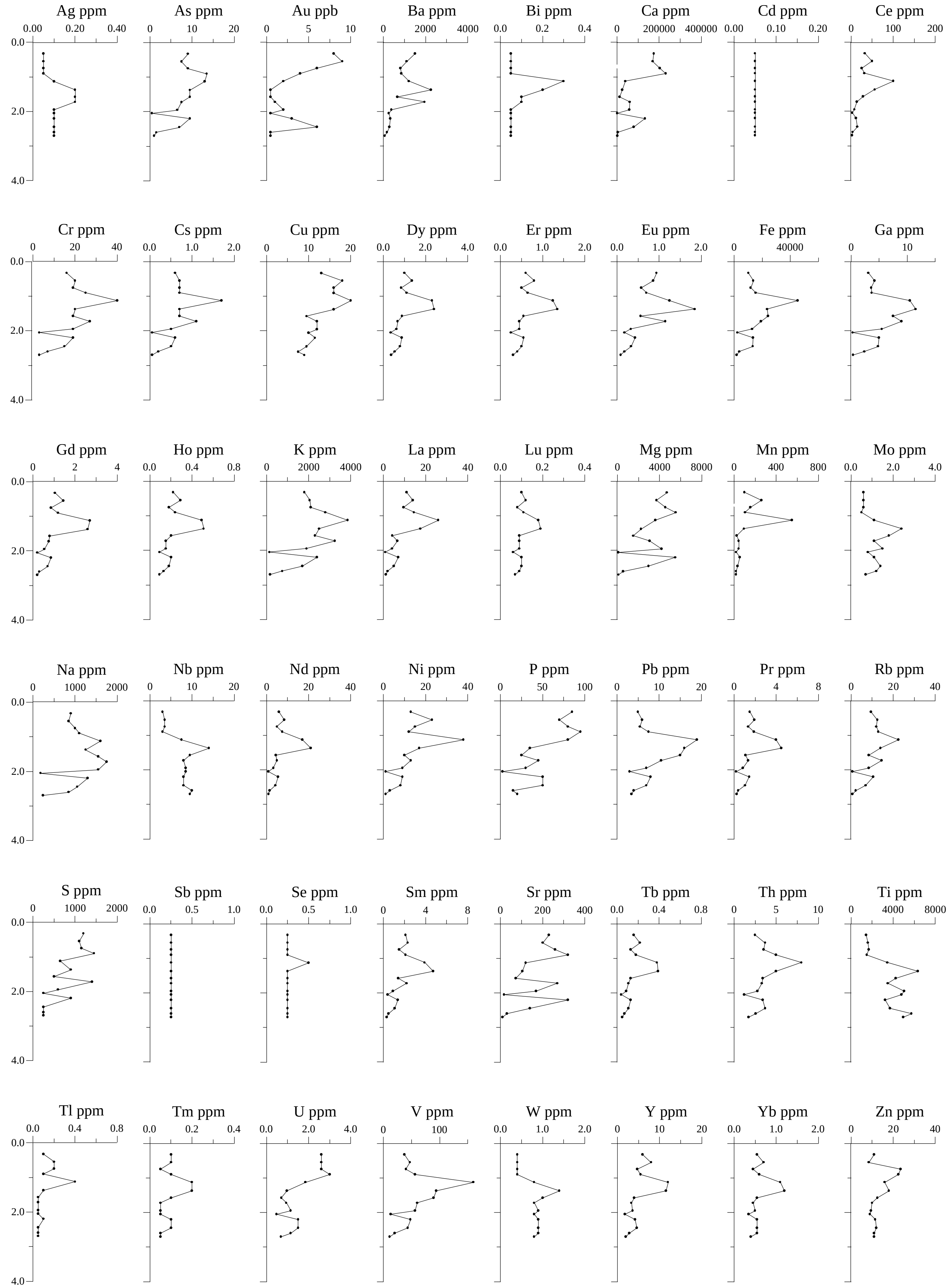


Figure A5.1 : Elemental distributions for pit profile GCP100 (364186E 6692861N) at Challenger.
Y axis is Depth (m).

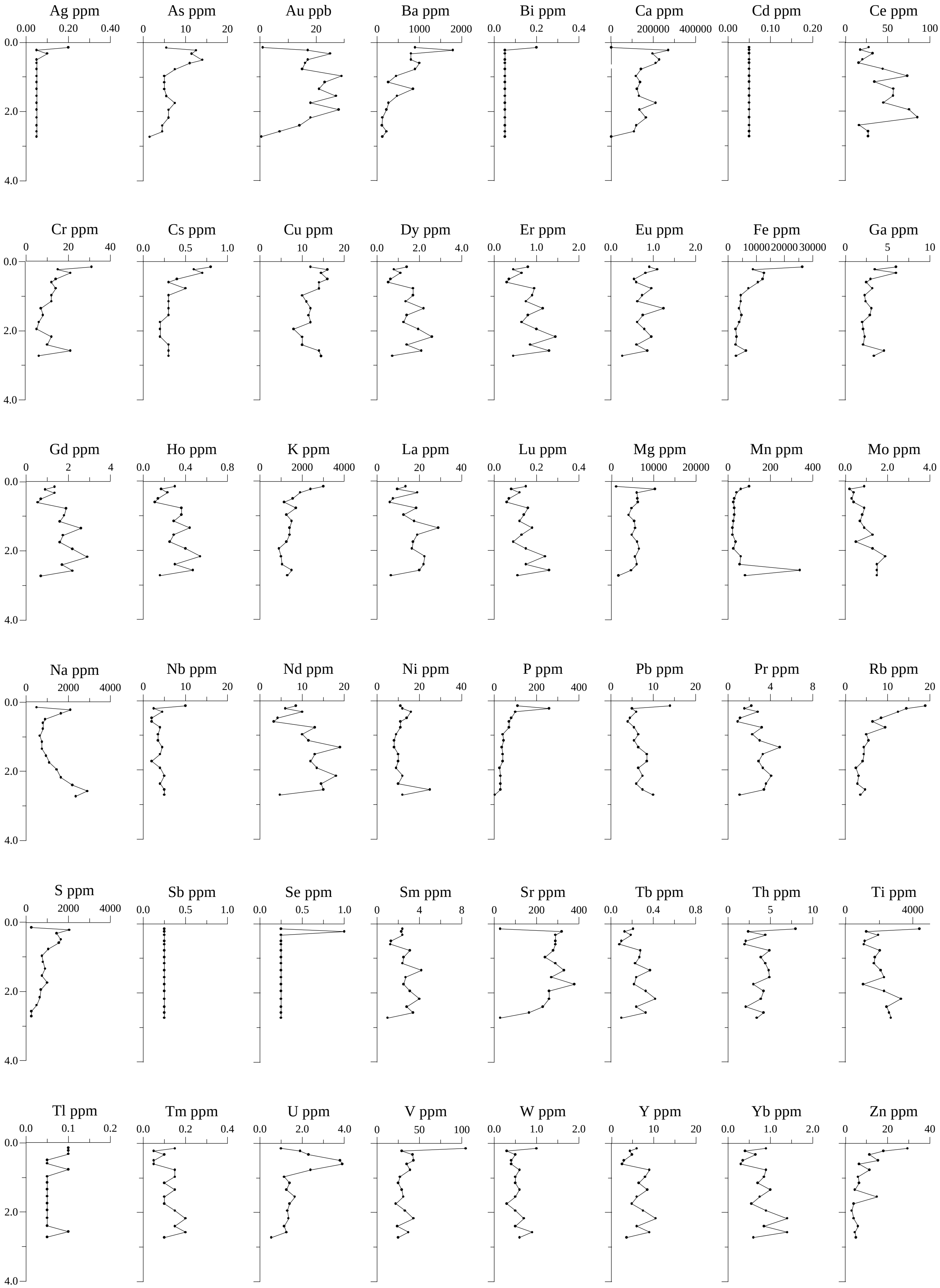


Figure A5.2: Elemental distributions for pit profile GCP106 (364035E 6693094N) at Challenger.
Y axis is Depth (m).

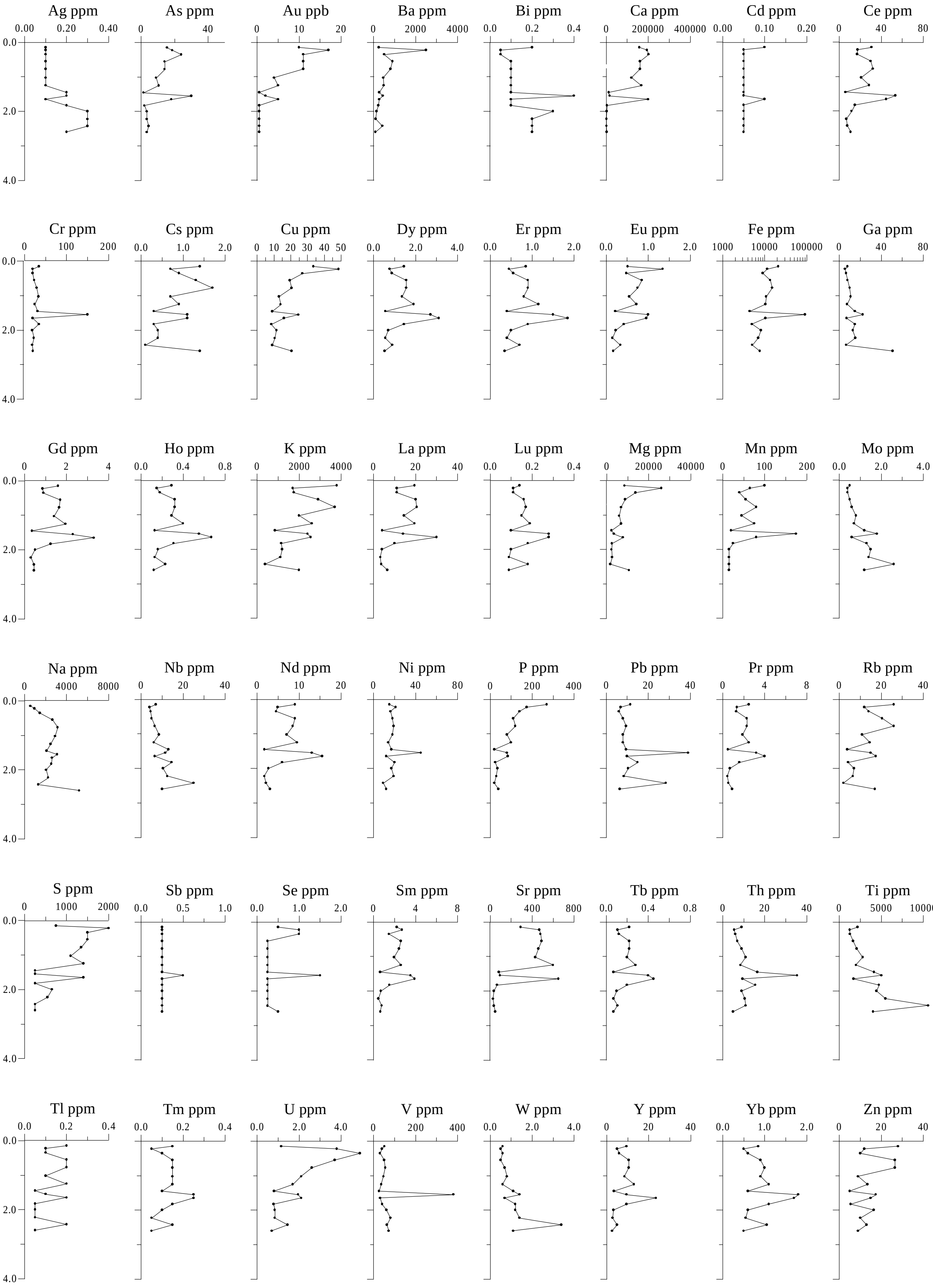


Figure A5.3 : Elemental distributions for pit profile GCP110 (363862E 6693215N) at Challenger.
Y axis is Depth (m).

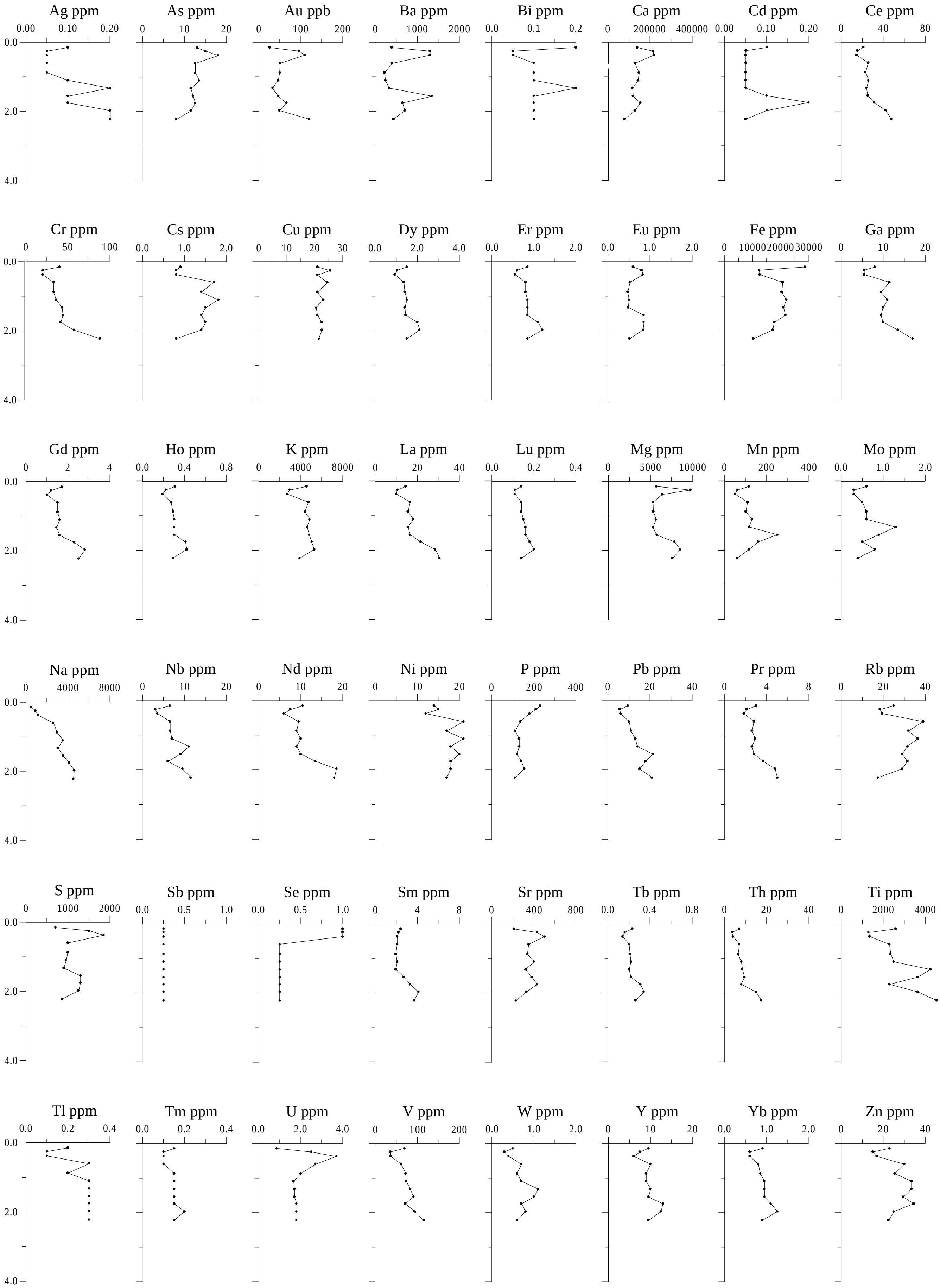


Figure A5.4 : Elemental distributions for pit profile GCP115 (363687E 6693346N) at Challenger.
Y axis is Depth (m).

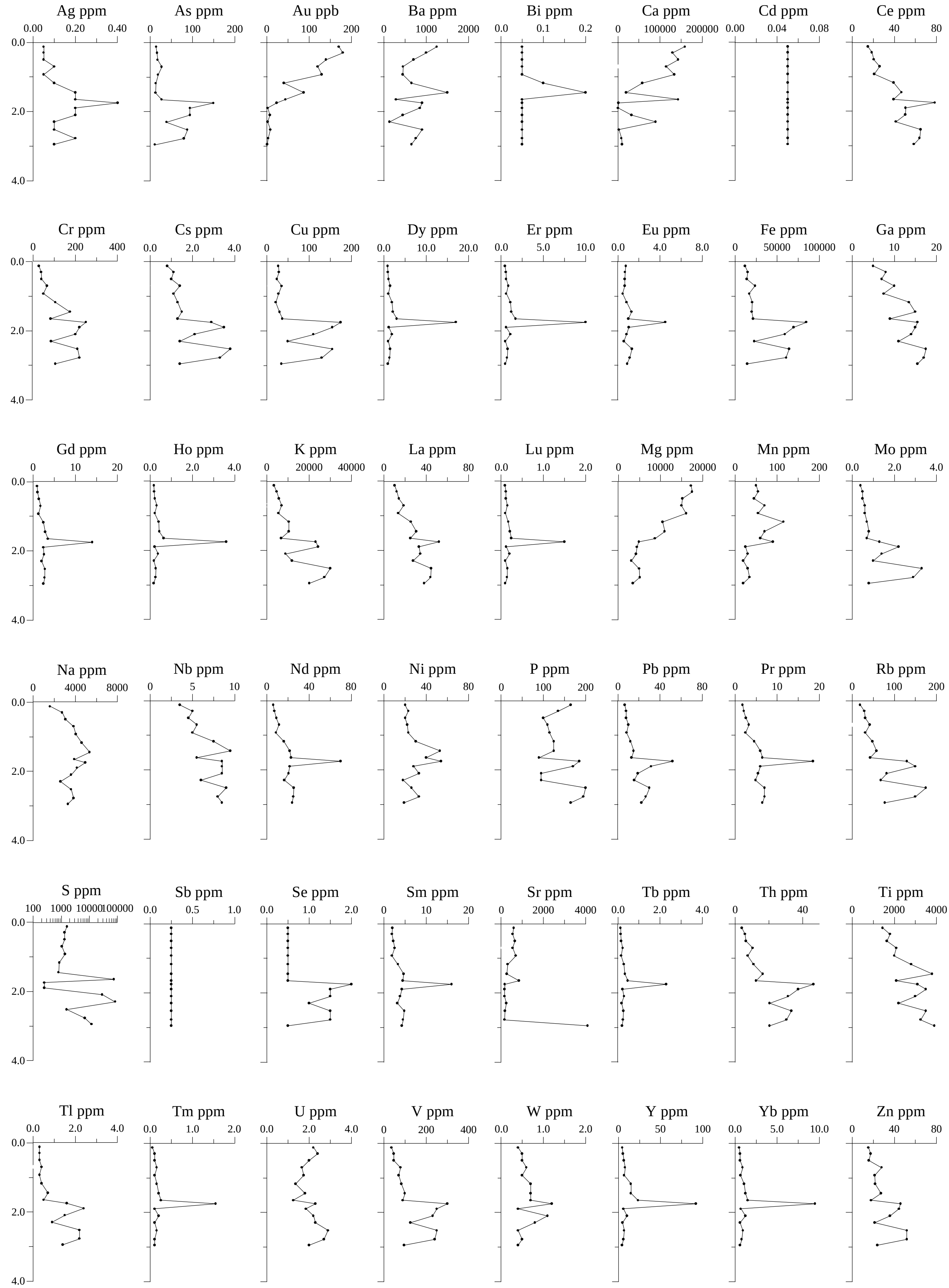


Figure A5.5 : Elemental distributions for pit profile GCP121 (363490E 6693580N) at Challenger.
Y axis is Depth (m).

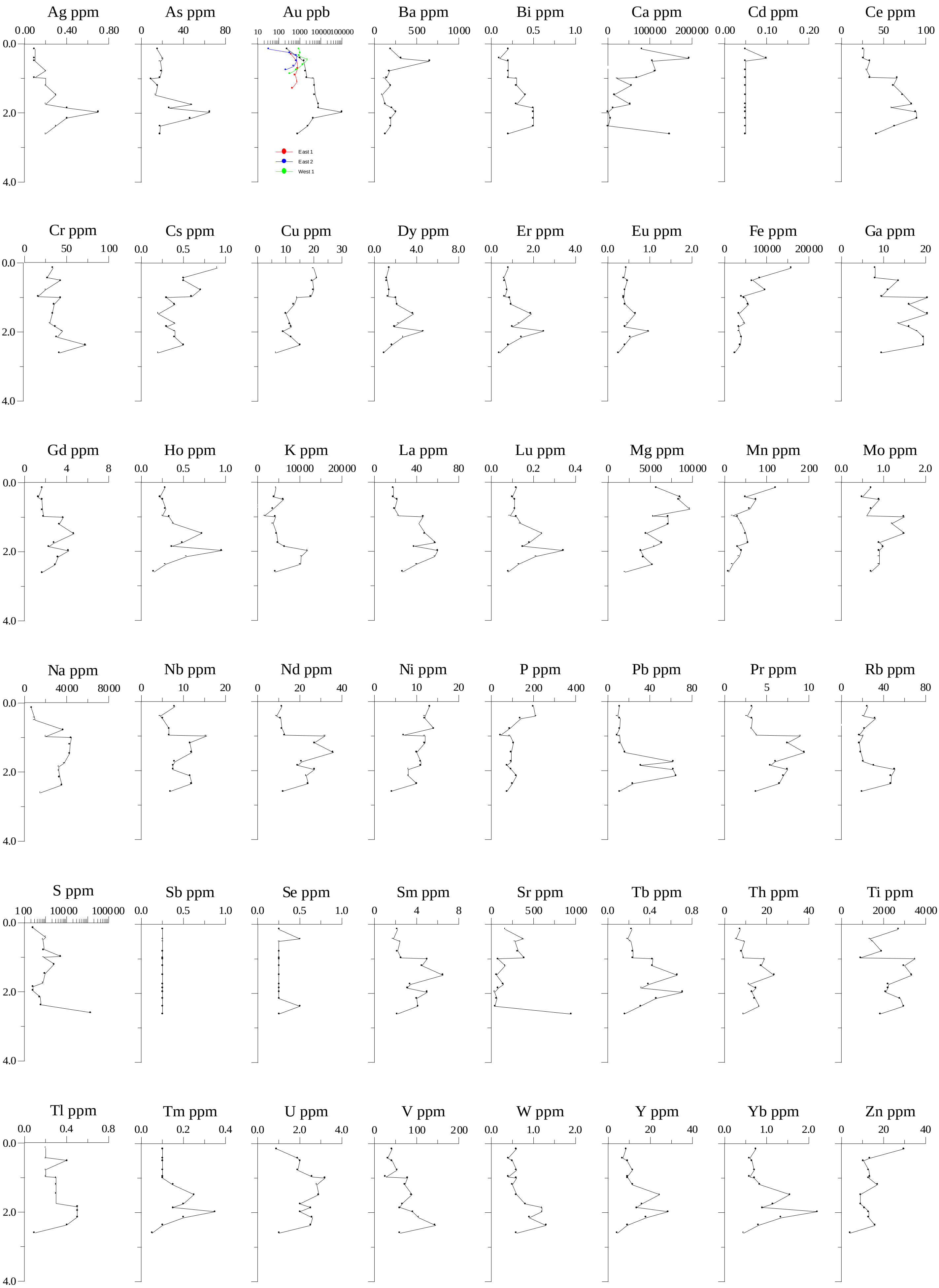


Figure A5.6 : Elemental distributions for pit profile GCP122 (363452E 6693628N) at Challenger.
Y axis is Depth (m).

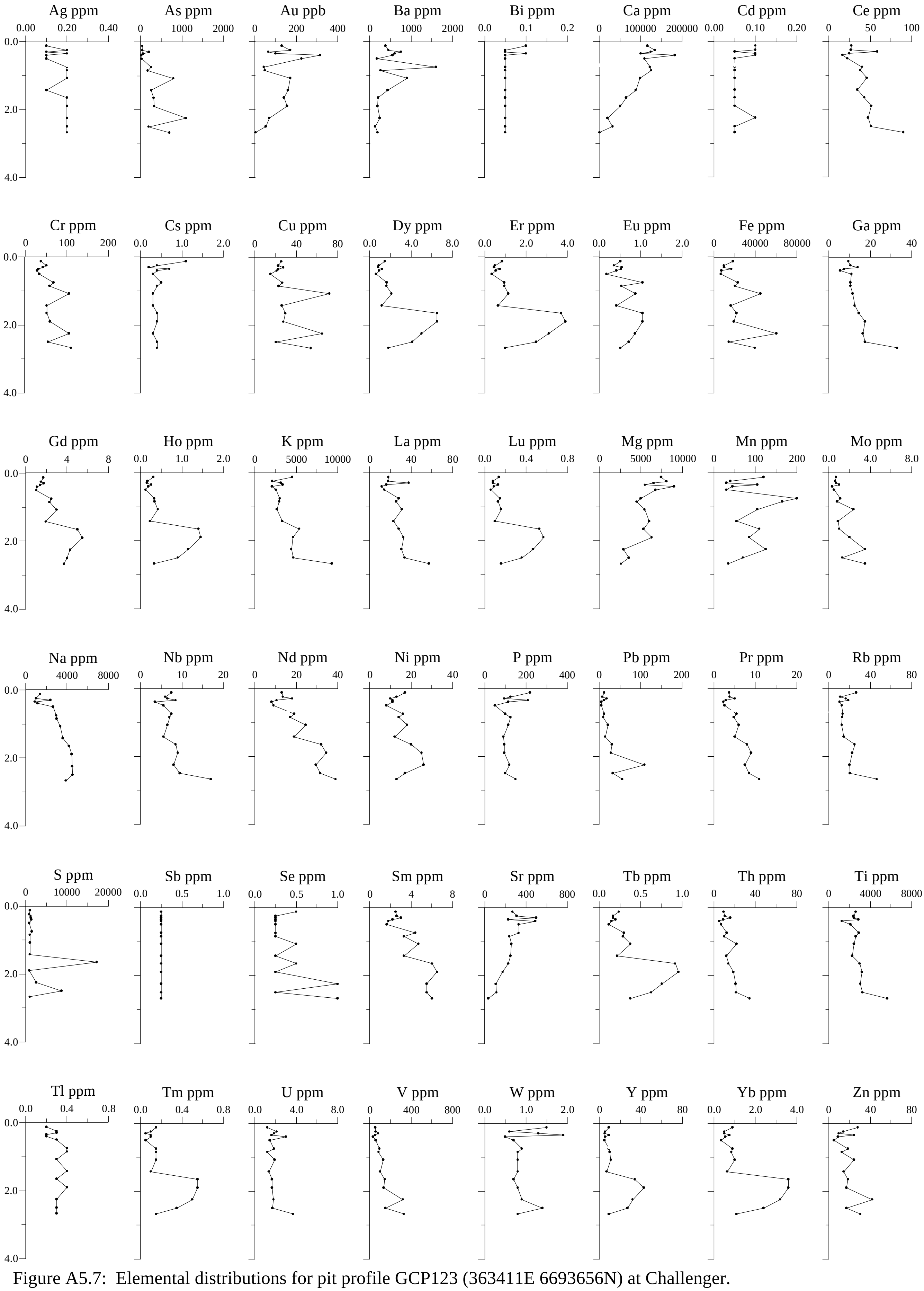


Figure A5.7: Elemental distributions for pit profile GCP123 (363411E 6693656N) at Challenger. Y axis is Depth (m).

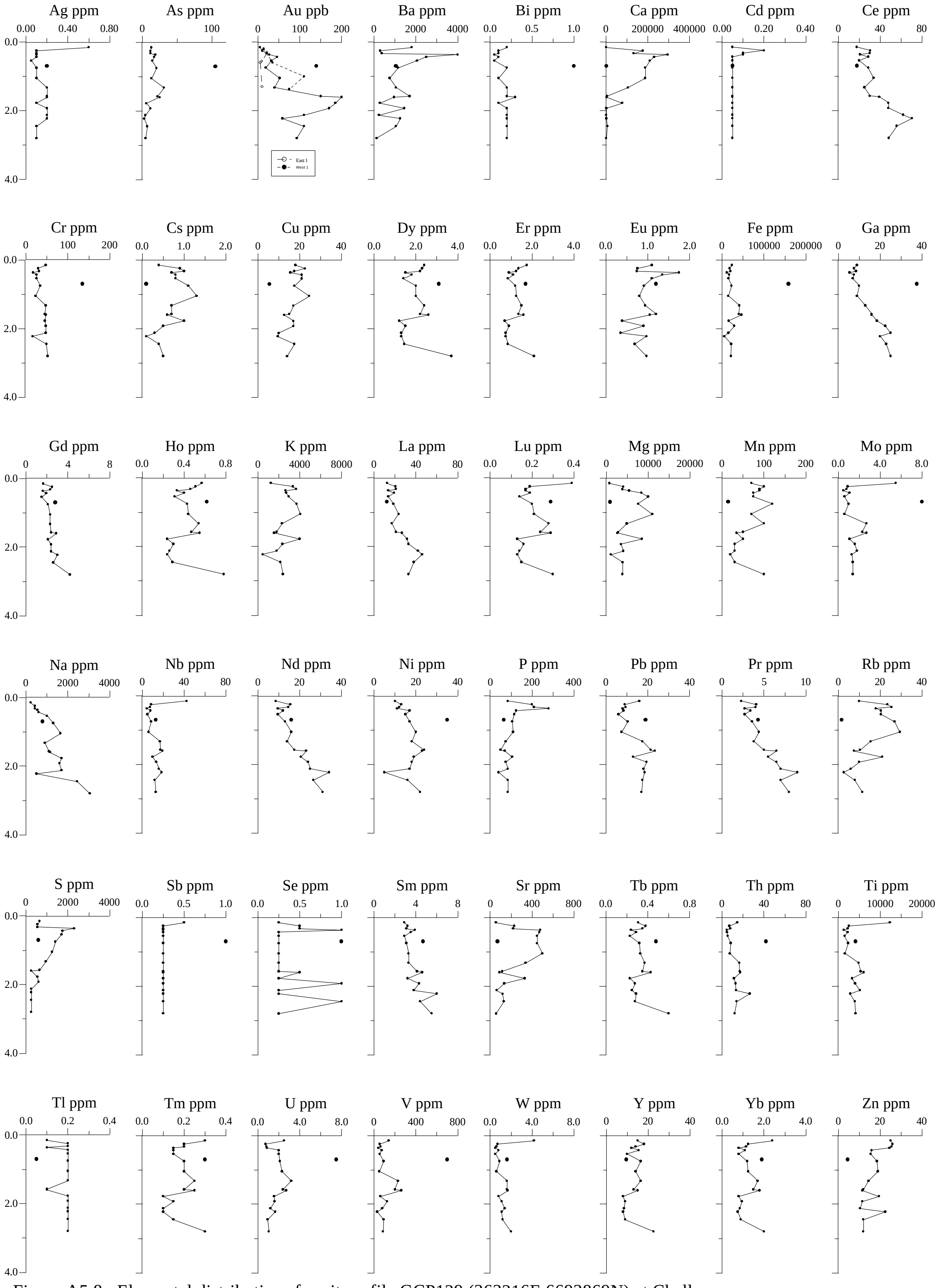


Figure A5.8: Elemental distributions for pit profile GCP129 (363216E 6693869N) at Challenger. Isolated point on each plot signifies a ferruginous sub-sample. Y axis is Depth (m).

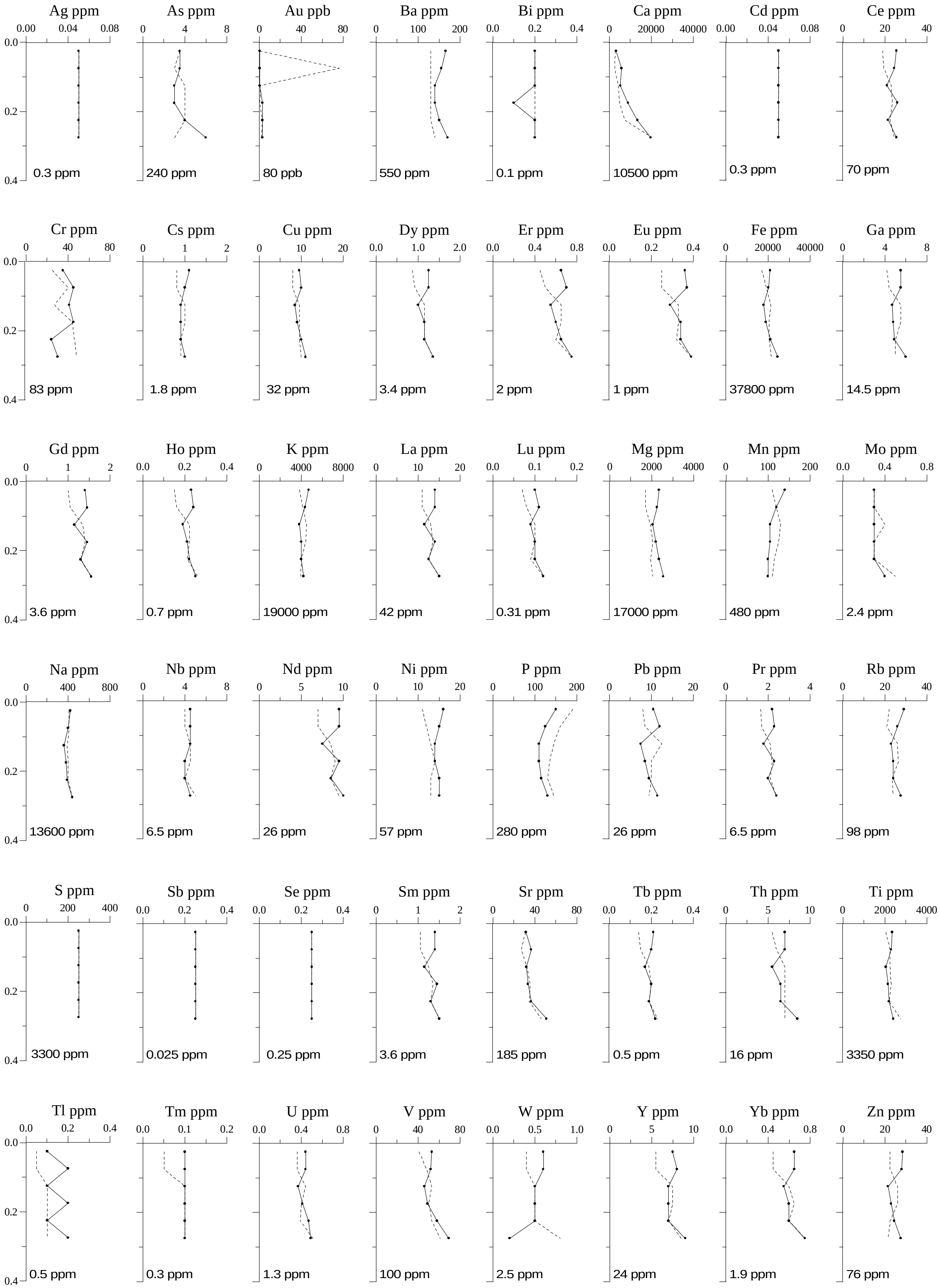


Figure A5.9: Elemental distributions for "uncontaminated" (363681E 6693814N, dashed line) and "contaminated" (363632E 6693912N, solid line) profile at Challenger. Concentration of element in drill cuttings located on surface above "contaminated" soil at base of each graph. Y axis is Depth (m)

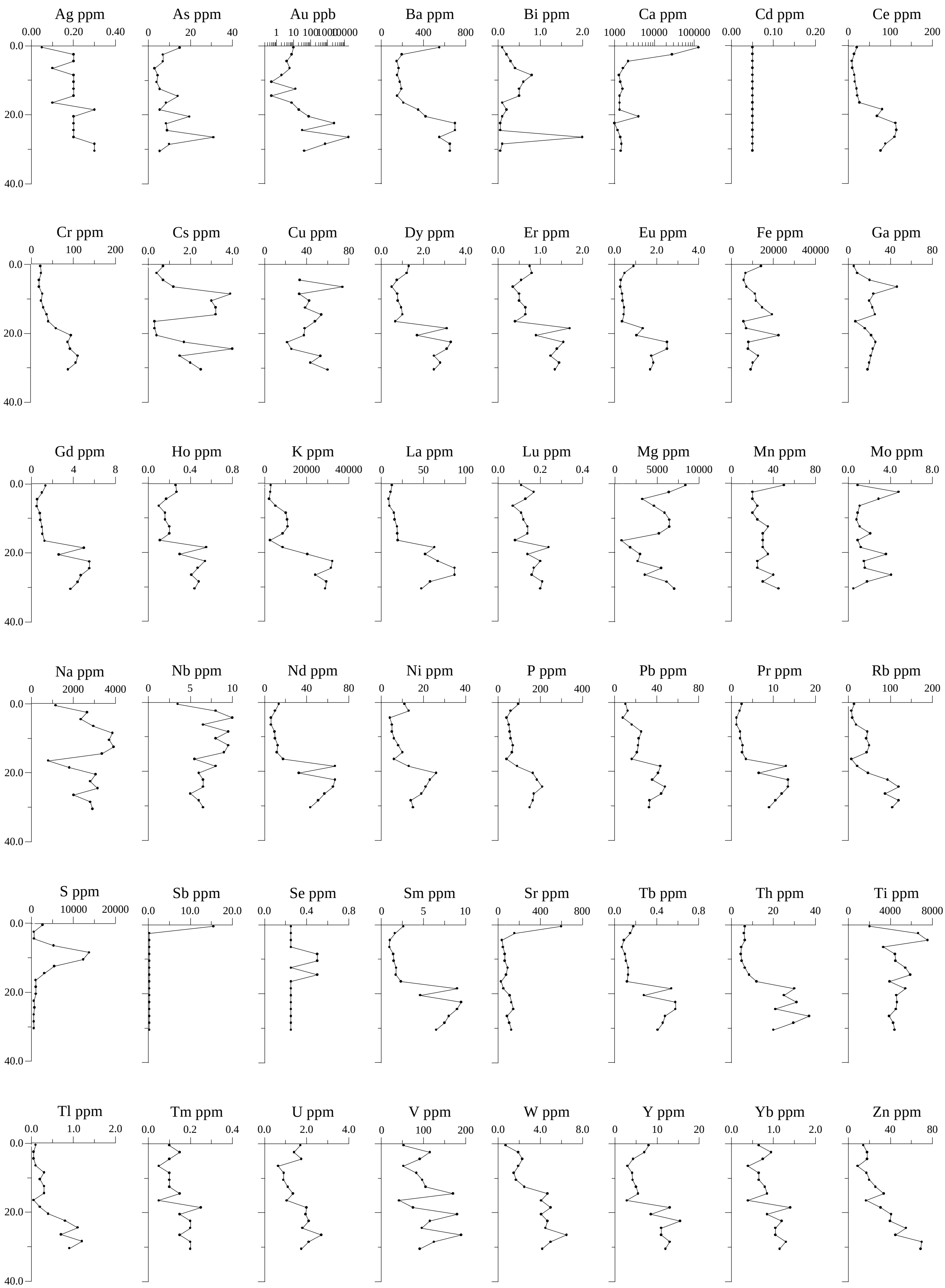
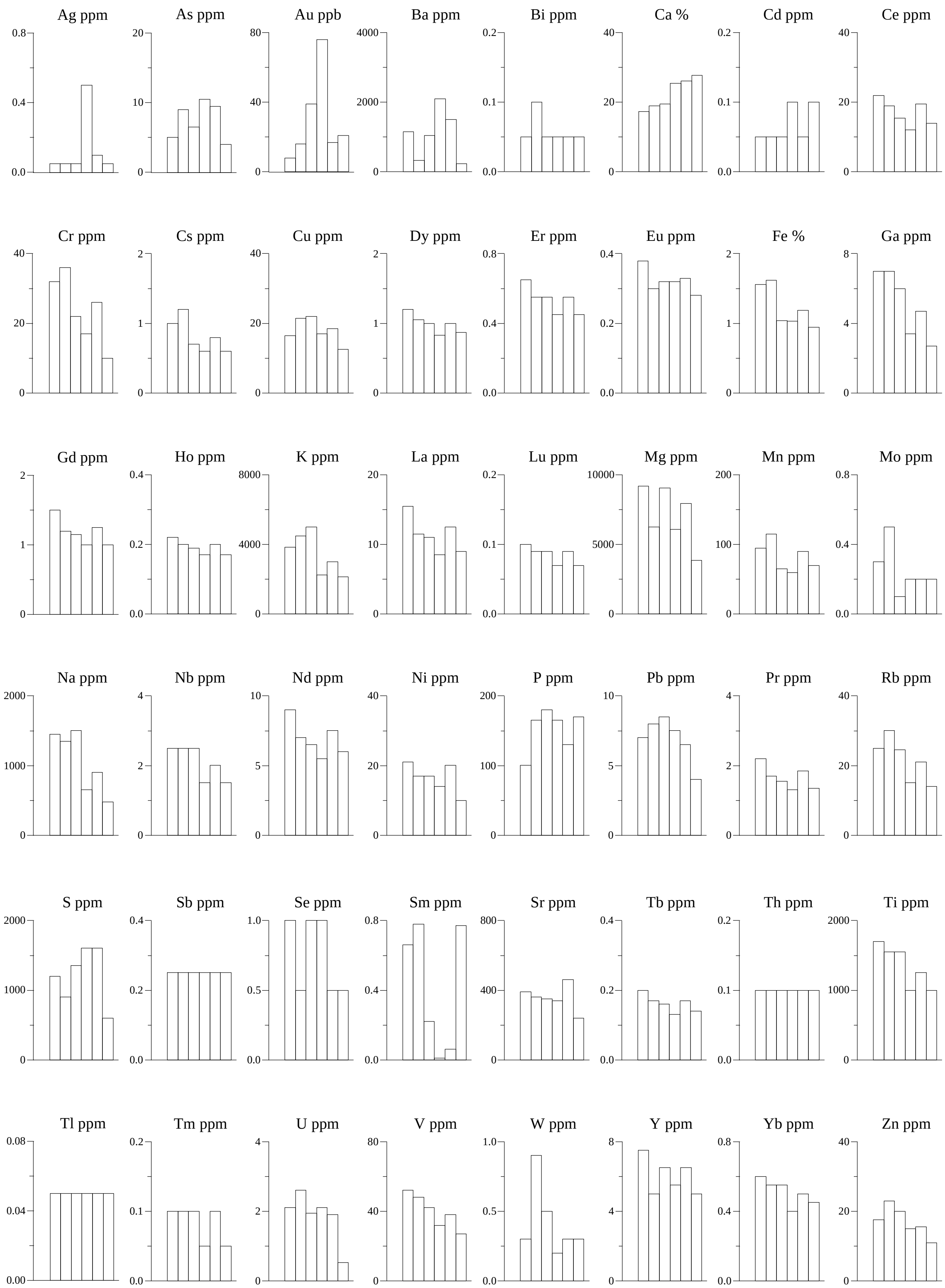


Figure A5.10: Elemental distributions for drill profile 96 CHAR 933 (364000E 6693075N) at Challenger. Y axis is Depth (m).

APPENDIX 6

Appendix 6: Graphed elemental abundances for sundry calcrete, silcrete, ferricrete and lag samples.



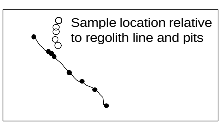


Figure A6.1: Elemental distributions for sundry calcrete samples collected from drill sumps over Challenger. Data sorted from left to right for increasing Ca concentration.
Locations (from left to right): 363550E 6694110N; 363512E 6694011N; 363501E 6693834N; 363540E 6693744N; 363550E 6694110N; 363515E 6693948N

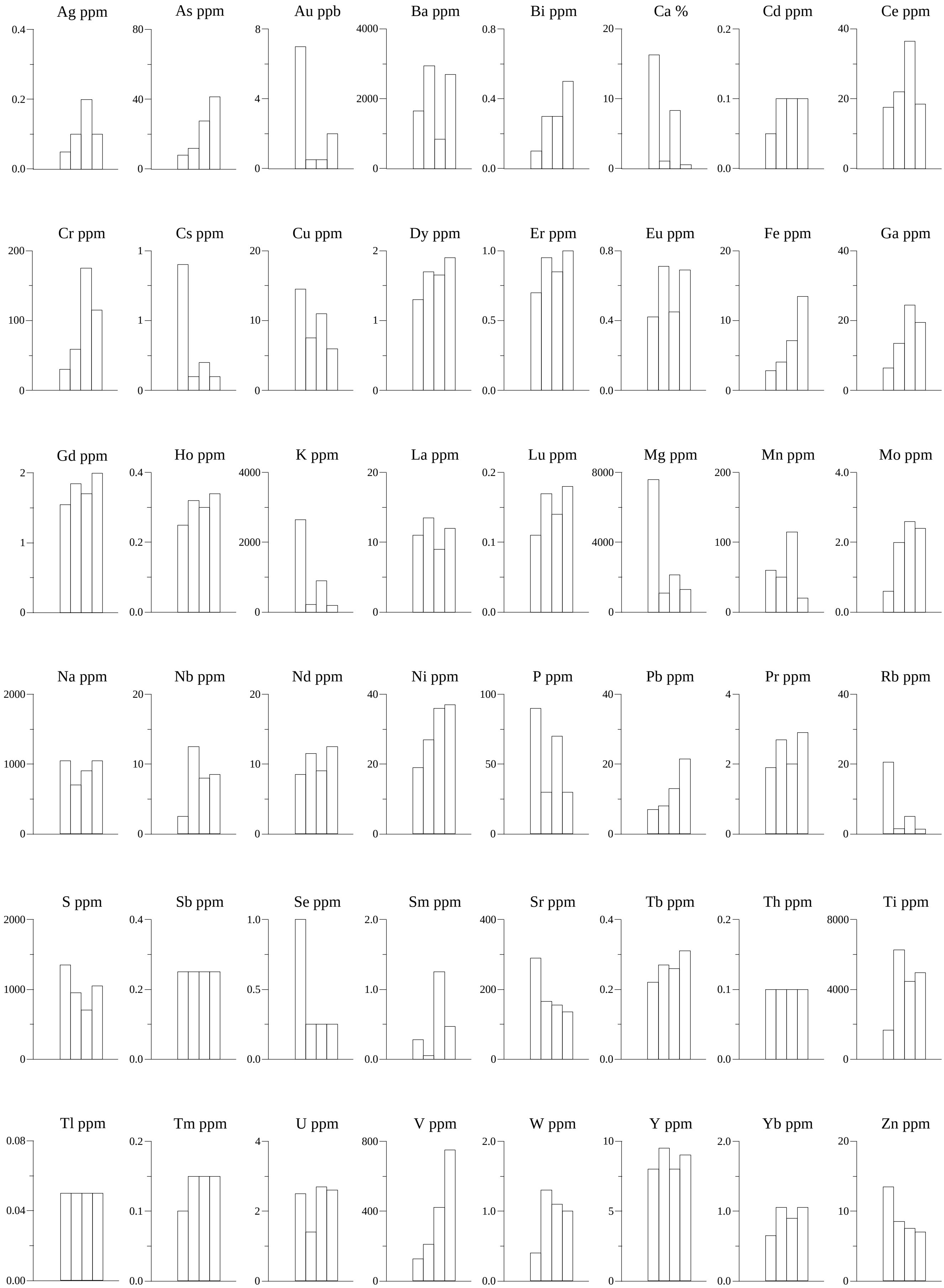
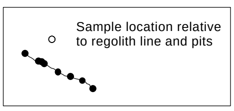


Figure A6.2: Elemental distributions for sundry ferruginous samples collected from a drill sump over Challenger. Data sorted from left to right for increasing Fe concentration. Samples were from 363603E 6694265N.



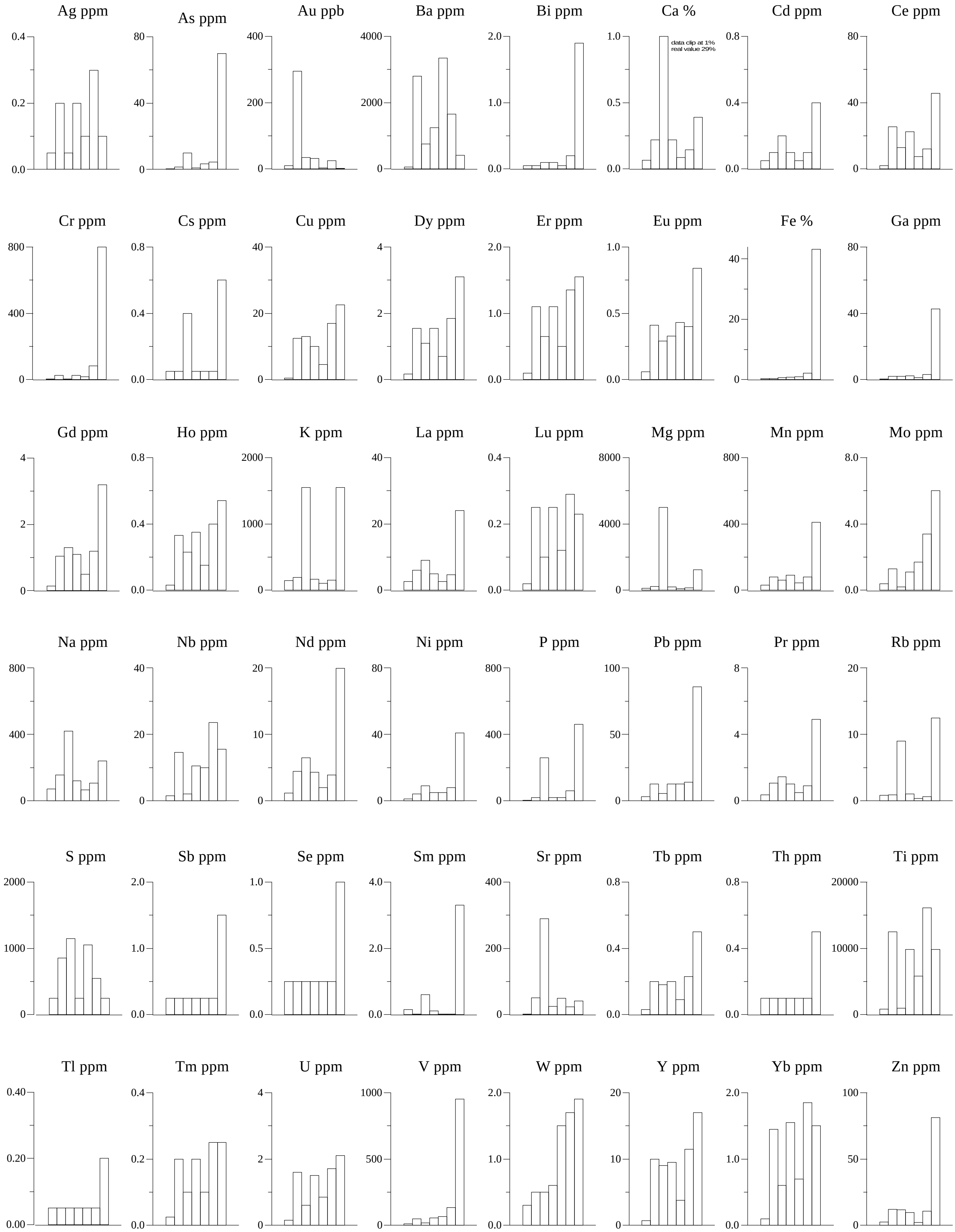
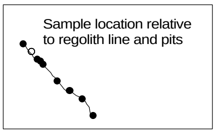


Figure A6.3: Elemental distributions for sundry surface samples collected from a topographic high adjacent to regolith line. Data sorted from left to right for increasing Fe concentration. Samples were collected from 363332E 6693762N.
Brief sample descriptions (from left to right):qtz clasts; grey silcrete; calcrete; ferruginous silcrete; fine magnetic lag.



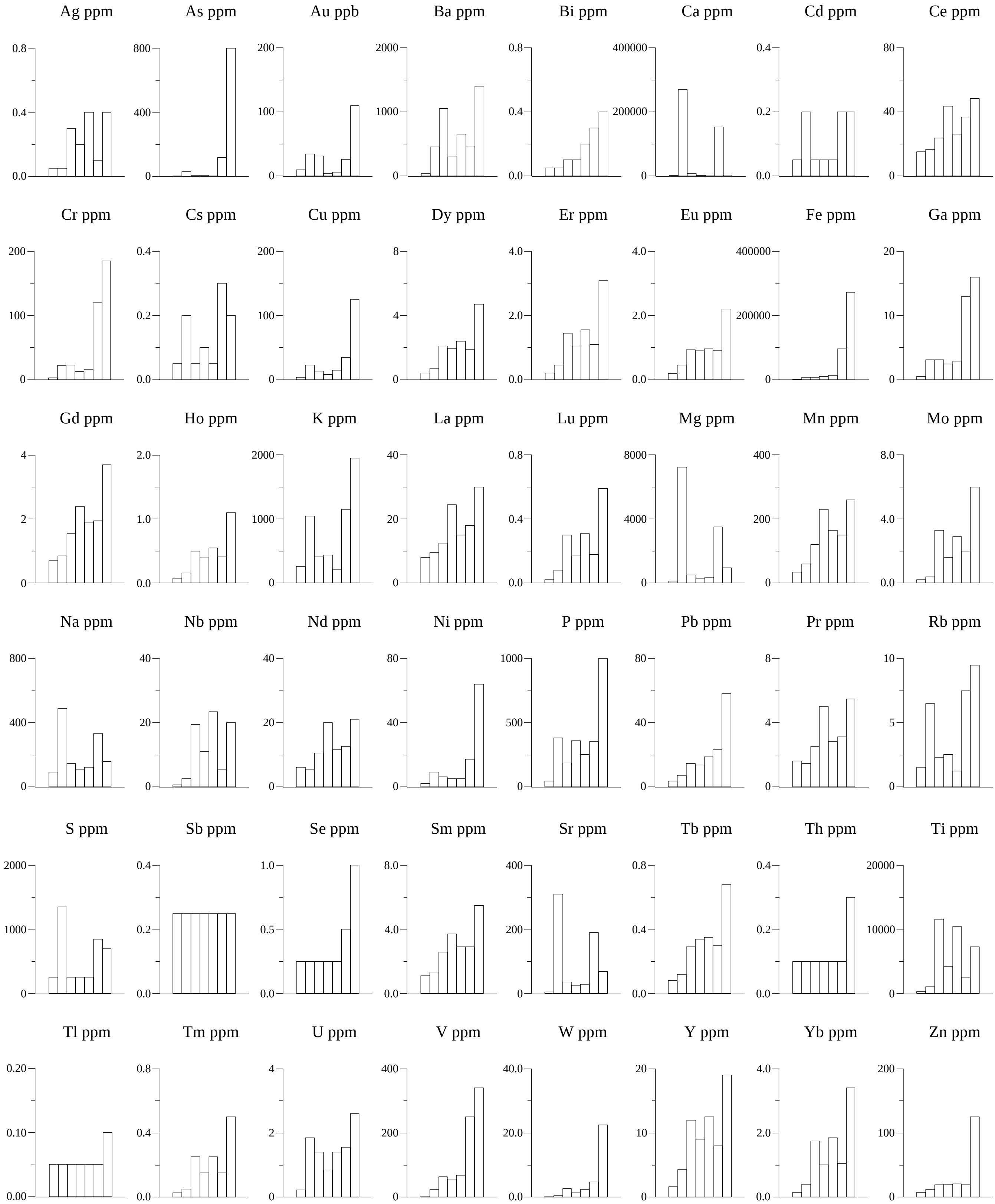
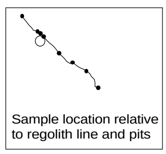


Figure A6-4: Elemental distributions for coarse (>4#) lag samples collected from close to hole 95CHAR134 (363444E 6693518N) at Challenger. Data sorted from left to right for increasing Fe concentration.
Key for samples (left to right):
1. Quartz - white and bluish with dk veins , fracture coatings and inclusions.
2. Calcrete - pale orange to creamy.
3. Silcrete - buff coloured, even grained and granulitic.
4. Exotic rounded clasts - mostly quartz and quartzitic.
5. Silcrete - iron stained brown and reddish even grained and granulitic.
6. Mixed lithic fragments all <15mm diameter most <10 mm.
7. Ferruginous material - dark brown to black - shiny.



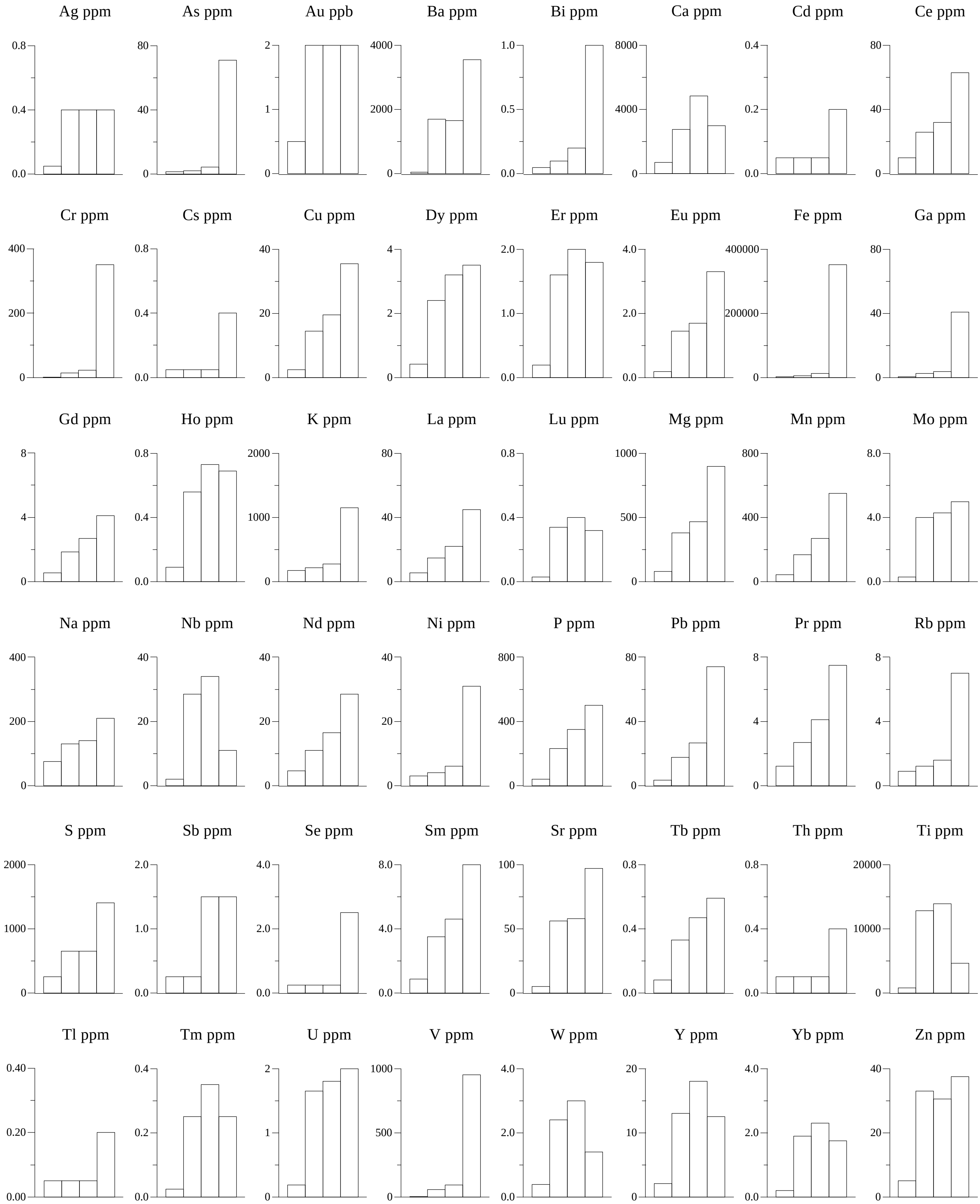
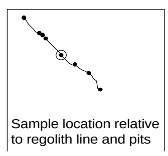


Figure A6.5: Elemental distributions for coarse (>4#) lag samples collected from close to pit 115 (363687E 6693346N) at Challenger. Data sorted from left to right for increasing Fe concentration.
Key for samples (left to right):
1. Quartz - white and bluish with dark veins, fracture coatings and inclusions.
2. Silcrete - buff coloured.
3. Silcrete - ferruginous stained.
4. Ferruginous material - dark brown to black.



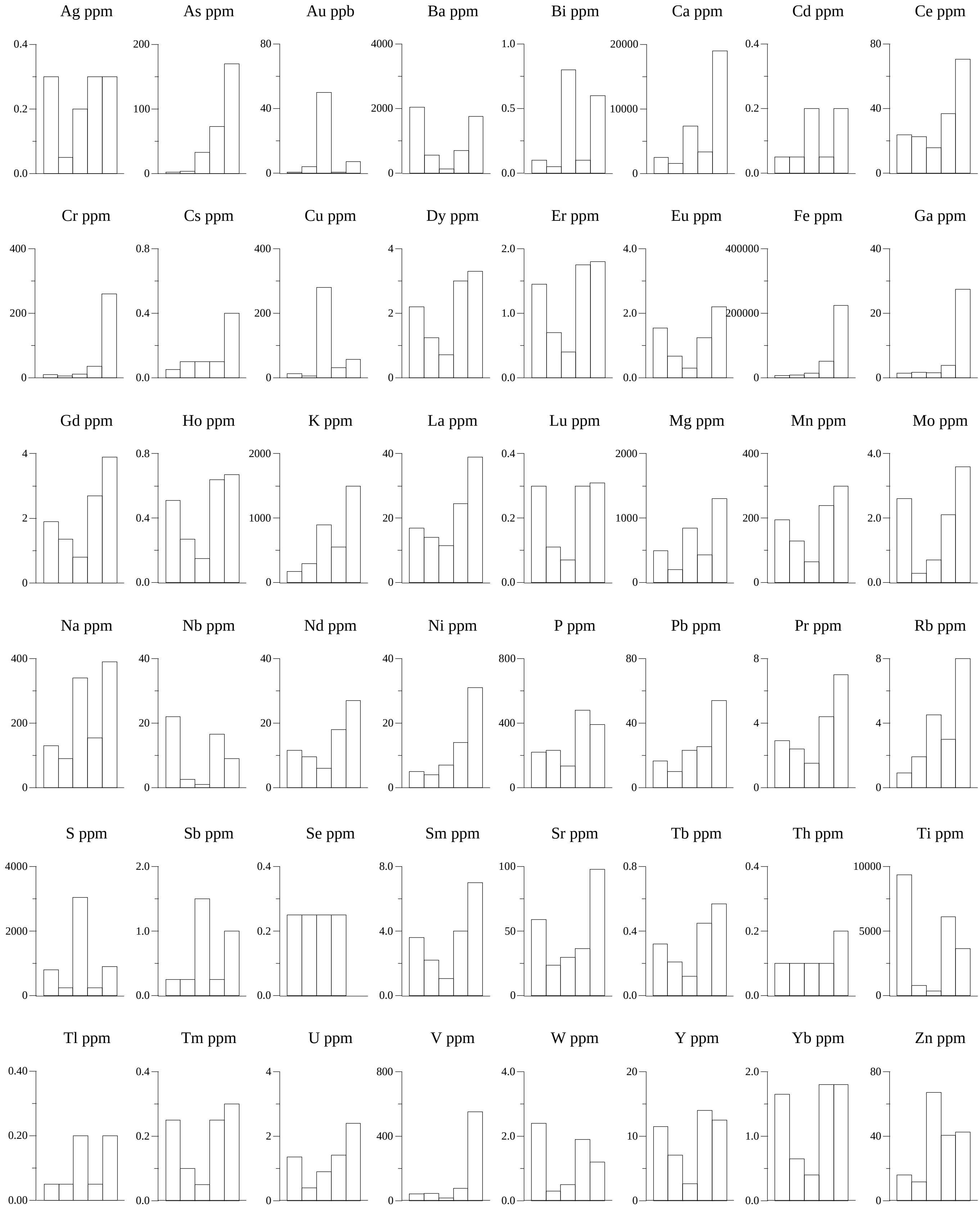
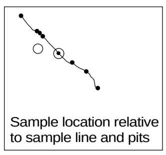


Figure A6.6: Elmental distributions for coarse (>4#) lag samples collected from close to peg 19750E 10150N (363425E 6693410N) at Challenger. Data sorted from left to right for increasing Fe concentration.
Key for samples (left to right):
1. Silcrete - buff coloured.
2. Exotic round clasts.
3. Quartz - white and bluish with dark veins with fracture coatings and inclusions.
4. Silcrete - ferruginous.
5. Polymictic lag mostly 6-10 mm dominated by ferruginous granules and ferruginous stained silcrete.



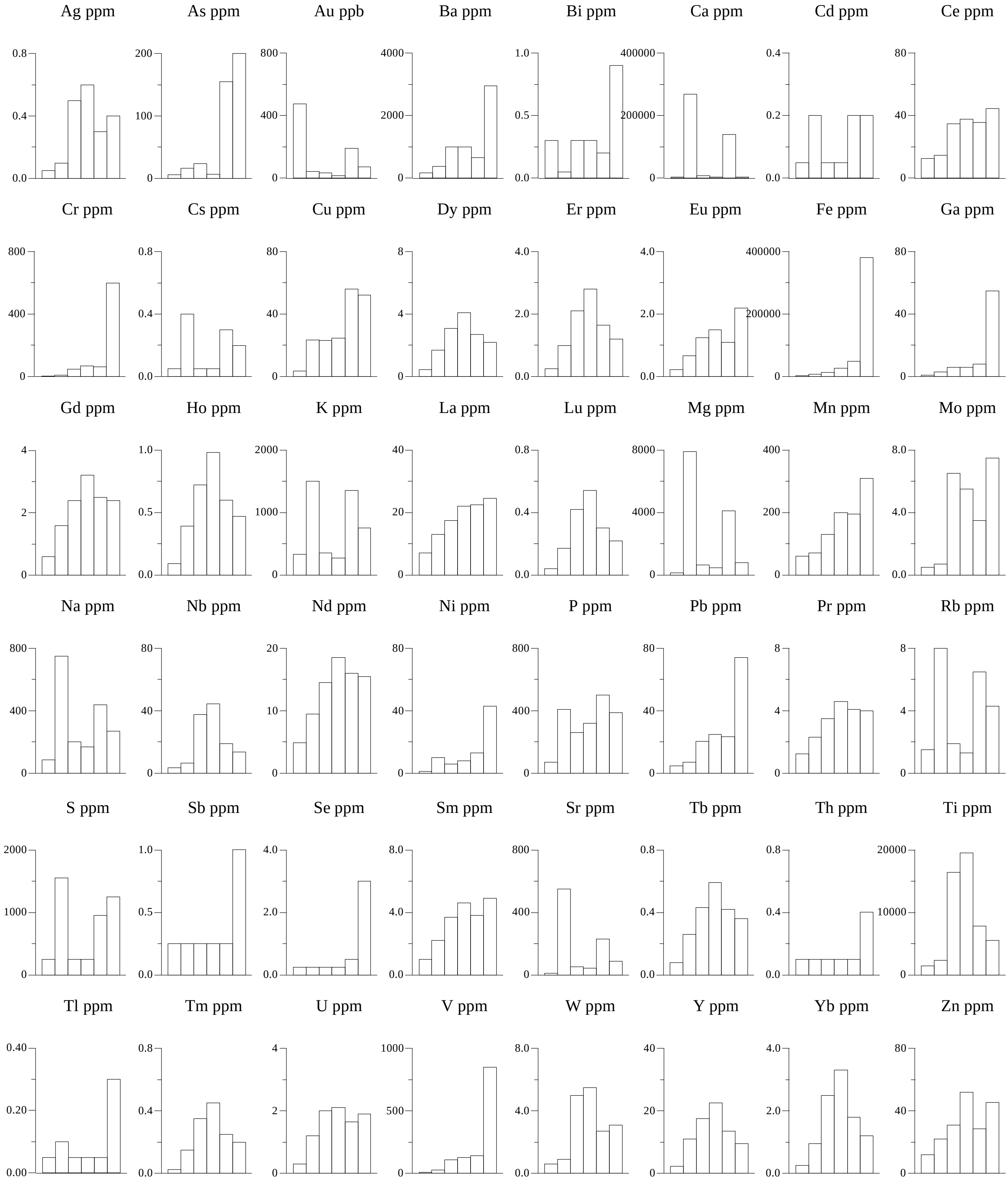
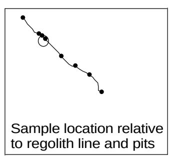


Figure A6.7: Elemental distributions for coarse (>4#) lag samples collected from close to hole 97CHRC1317 (363465E 6693554N) at Challenger. Data sorted from left to right for increasing Fe concentration.
Key for samples (left to right):
1. Quartz - white and bluish with dark veins and inclusions and fracture coatings.
2. Calcrete.
3. Silcrete - brownish.
4. Silcrete - ferruginous, reddish.
5. Polymictic material mostly 6-10mm - calcrete, qtz, silcrete, Fe material.
6. Ferruginous granules mostly 6-10mm.



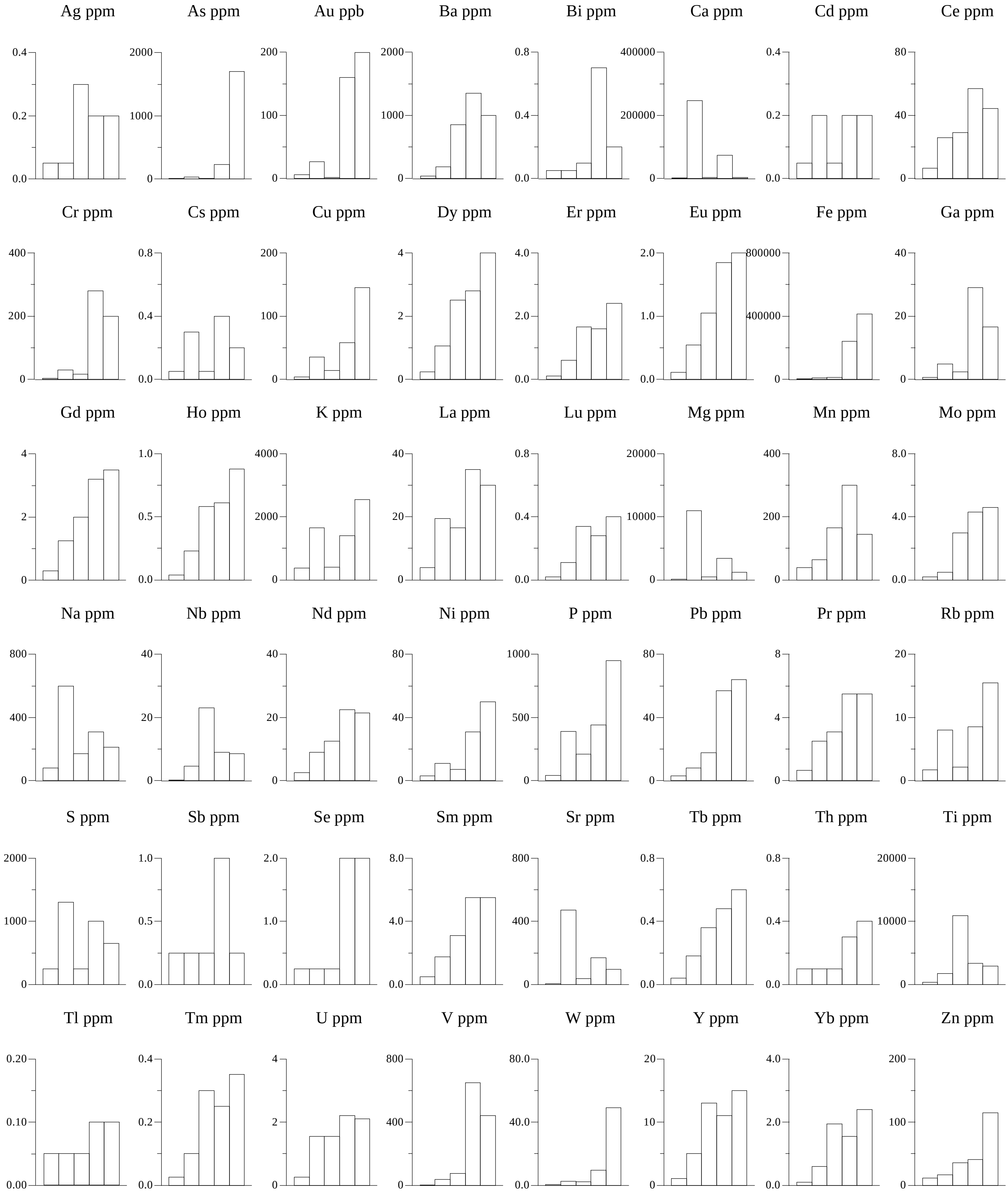
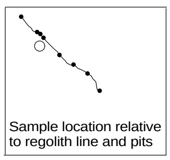


Figure A6.8: Elemental distributions for coarse (>4#) lag samples collected from close to hole 95CHAR136 (363445E 6693468N) at Challenger. Data sorted from left to right for increasing Fe concentration.
Key for samples (left to right):
1. Quartz - white to bluish with dark veins, fracture coatings and inclusions.
2. Calcrete - yellowish
3. Silcrete - buff coloured.
4. Polymictic lag - mostly 6-10 mm dominated by calcrete, silcrete and ferruginous granules.
5. Ferruginous granules and silcrete - dark brown and dense.



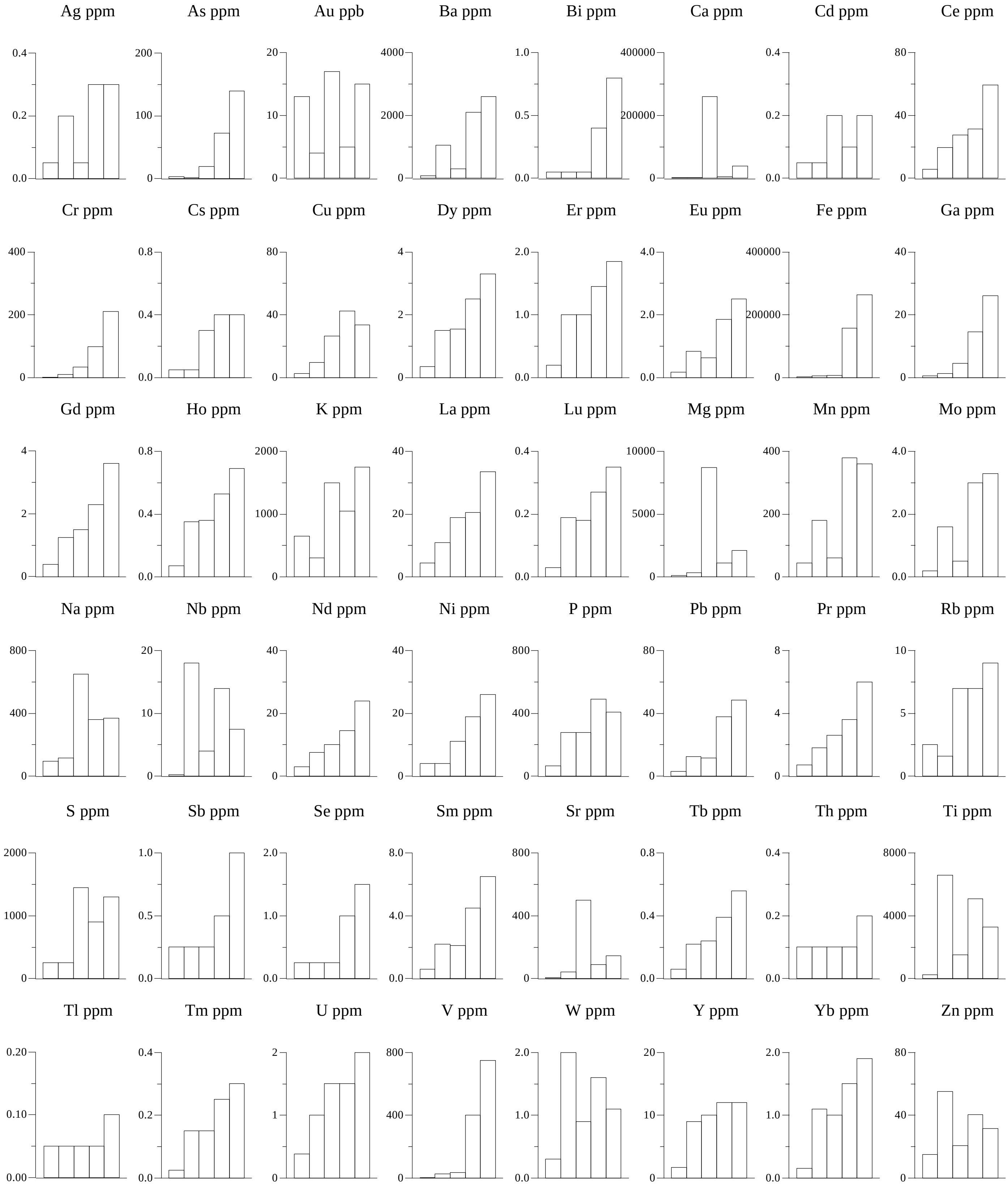
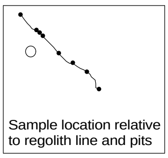


Figure A6.9: Elemental distributions for coarse (>4#) lag samples collected from close to hole 95CHAR205 (363341E 6693368N) at Challenger. Data sorted from left to right for increasing Fe concentration.
Key for samples (left to right):

1. Quartz - white, grey and bluish with dark inclusions and fracture coatings.
2. Silcrete - grey and buff, >30 mm.
3. Calcrete
4. Silcrete - ferruginous, dark brown and red.
5. Polymictic lag mostly 6-10 mm dominated by calcrete, qtz, and silcrete.



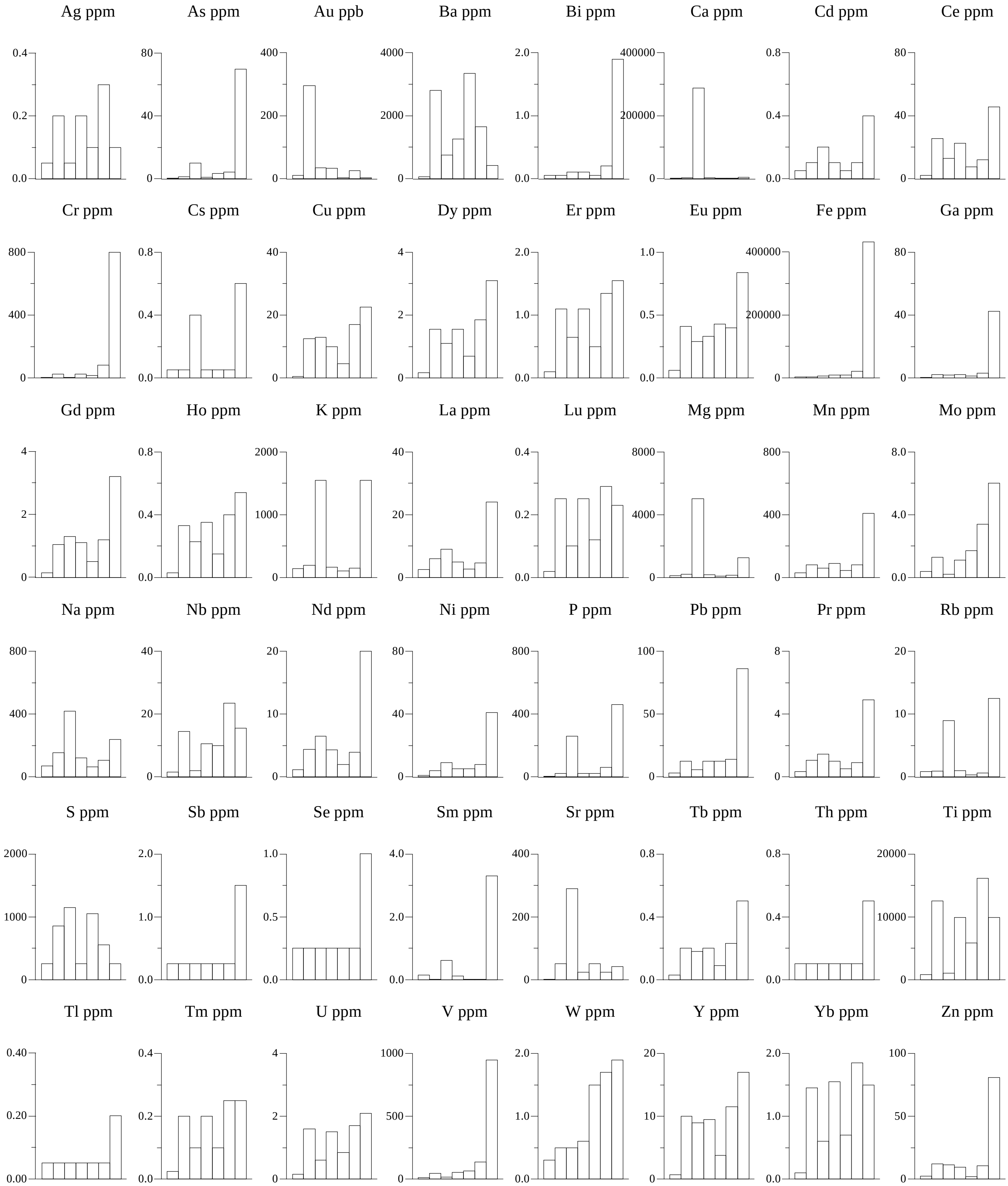
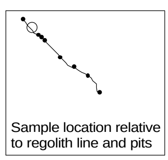


Figure A6.10: Elemental distributions for predominantly coarse (>4#) lag samples collected from (363332E 6693762N) at Challenger. Data sorted from left to right for increasing Fe concentration.
Key for samples (left to right):

1. Quartz - rounded and angular clasts.
2. Silcrete - grey and buff.
3. Calcrete
4. Silcrete - coarse-grained
5. Silcrete - ferruginous
6. Exotic rounded clasts
7. Ferruginous granules - magnetic fraction mostly <4 mm.



APPENDIX 7

Appendix 7: Histograms and principal component analyses.

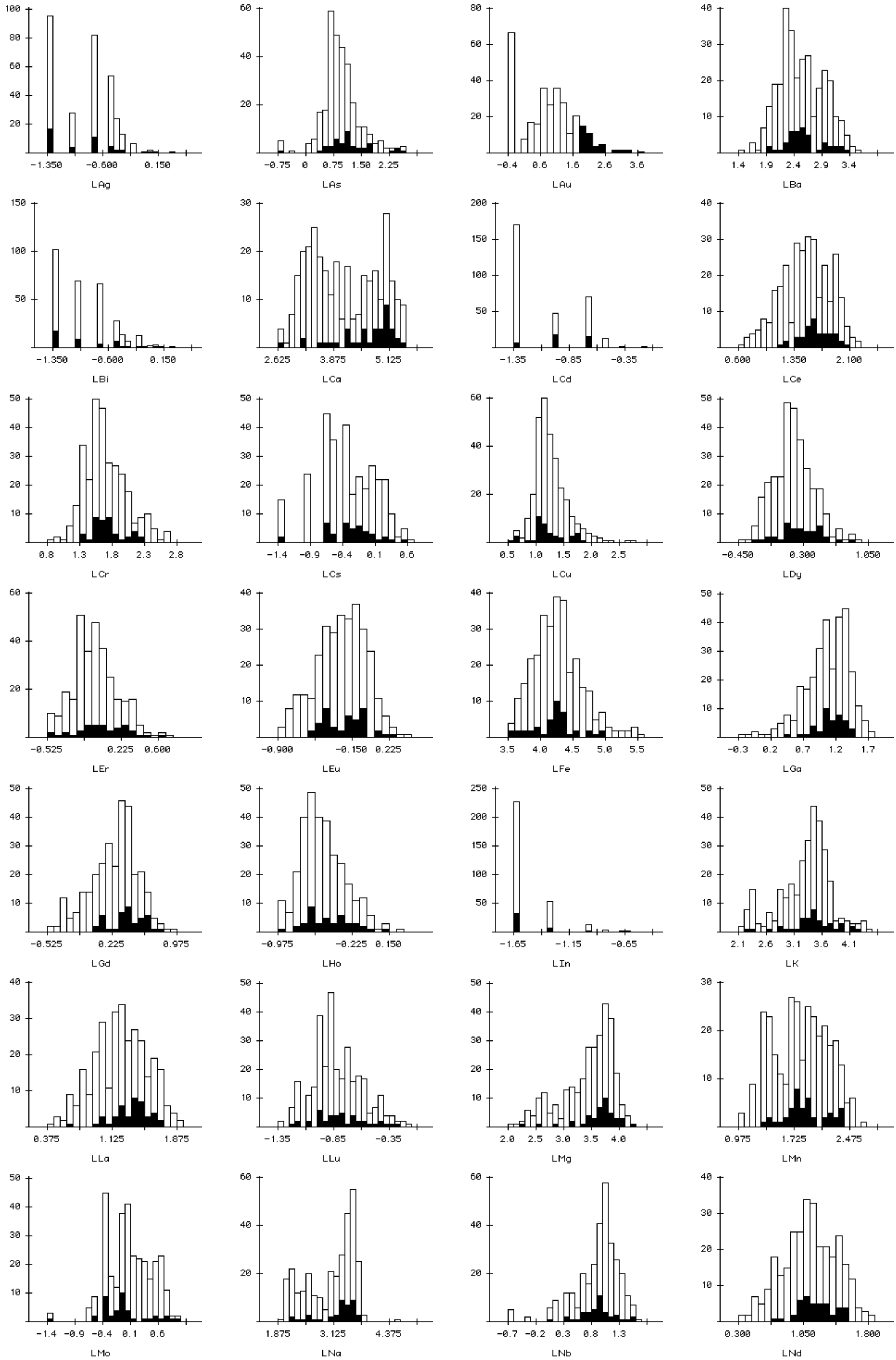


Figure A7a.1: Log transformed 0 - 6 m data. Top 10% of Au data are black.

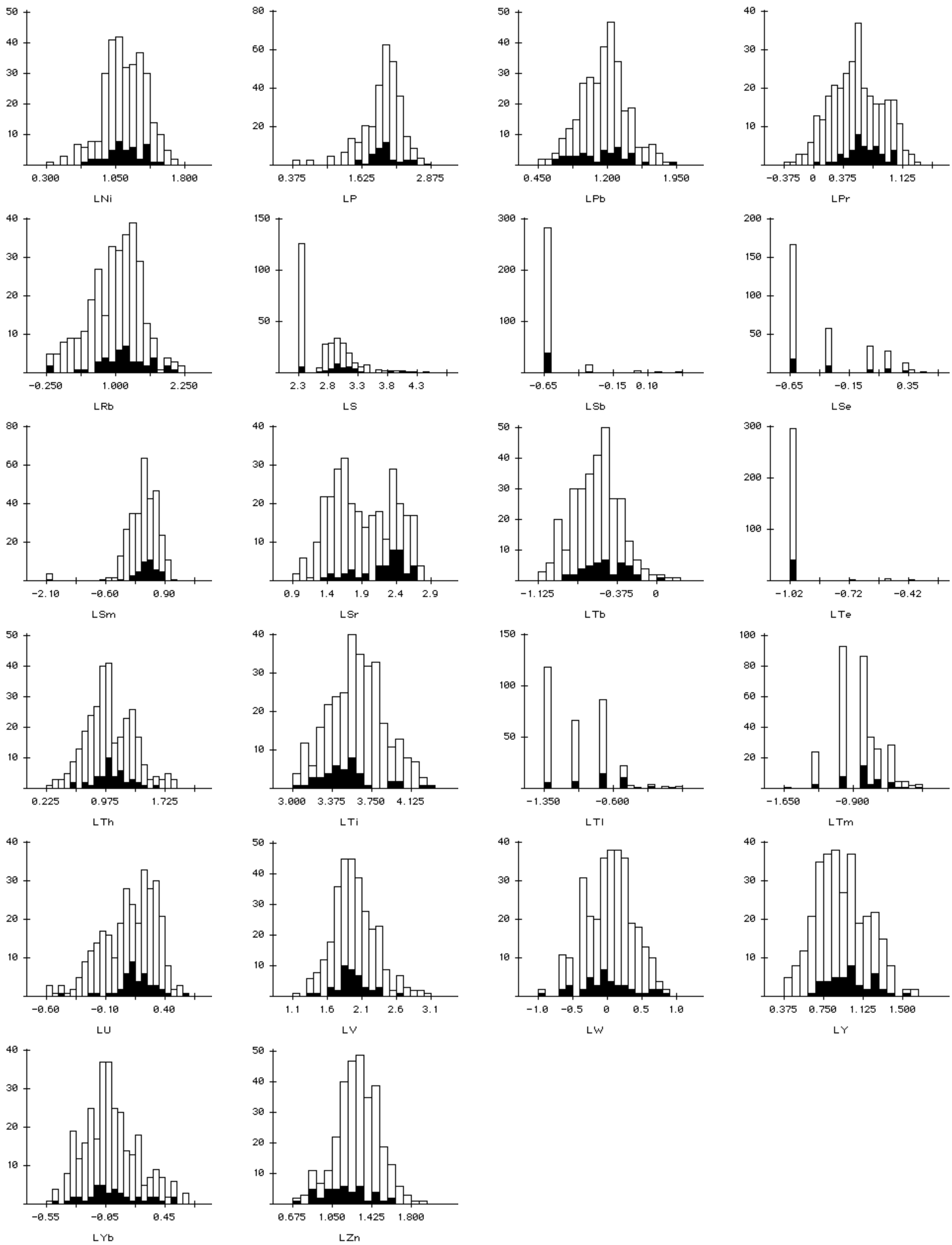


Figure A7a.1 (continued): Log transformed 0 - 6 m data. Top 10% of Au data are black.

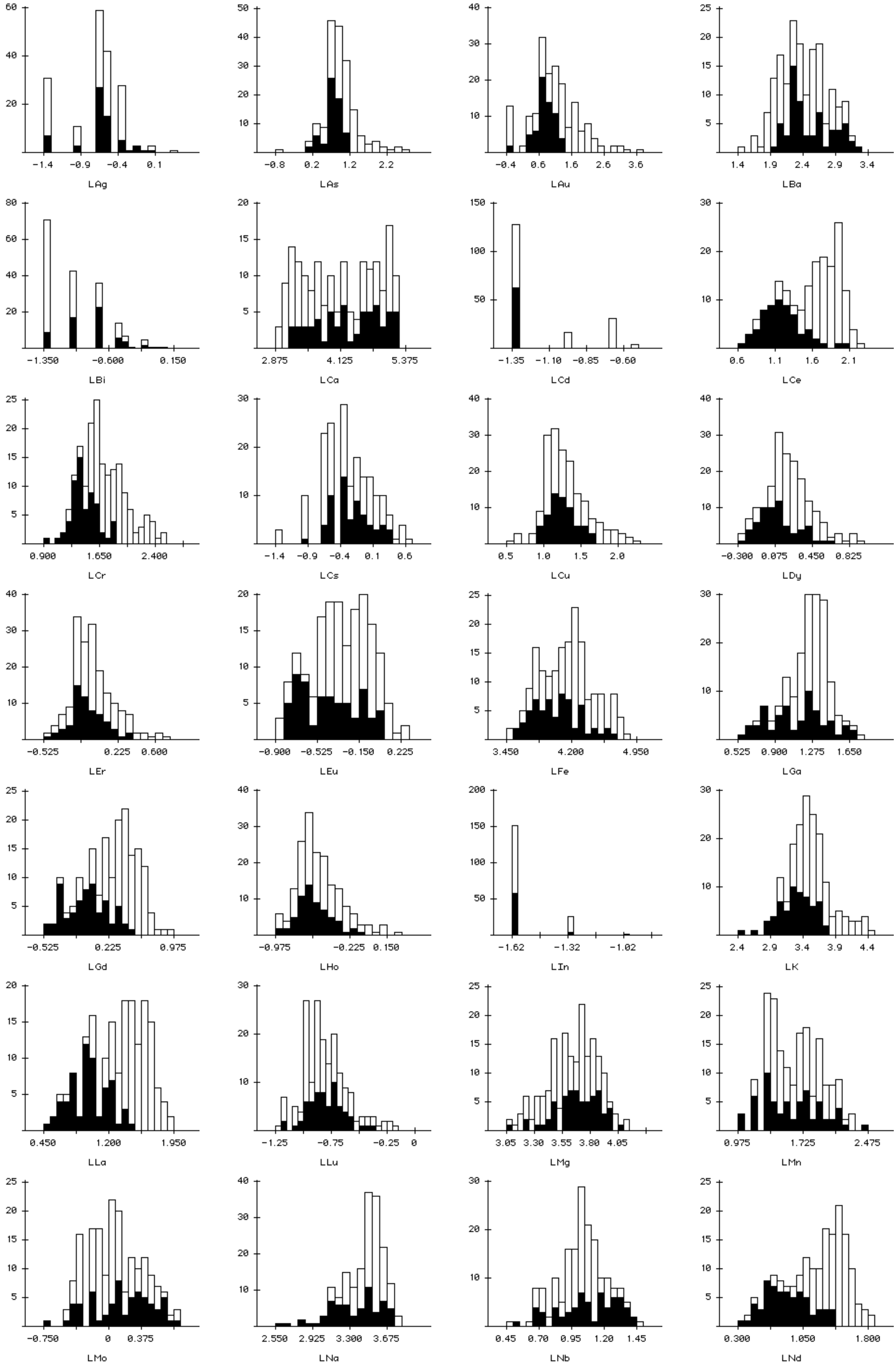


Figure A7a.2: Log transformed 0 - 6 m data. Transported data are black.

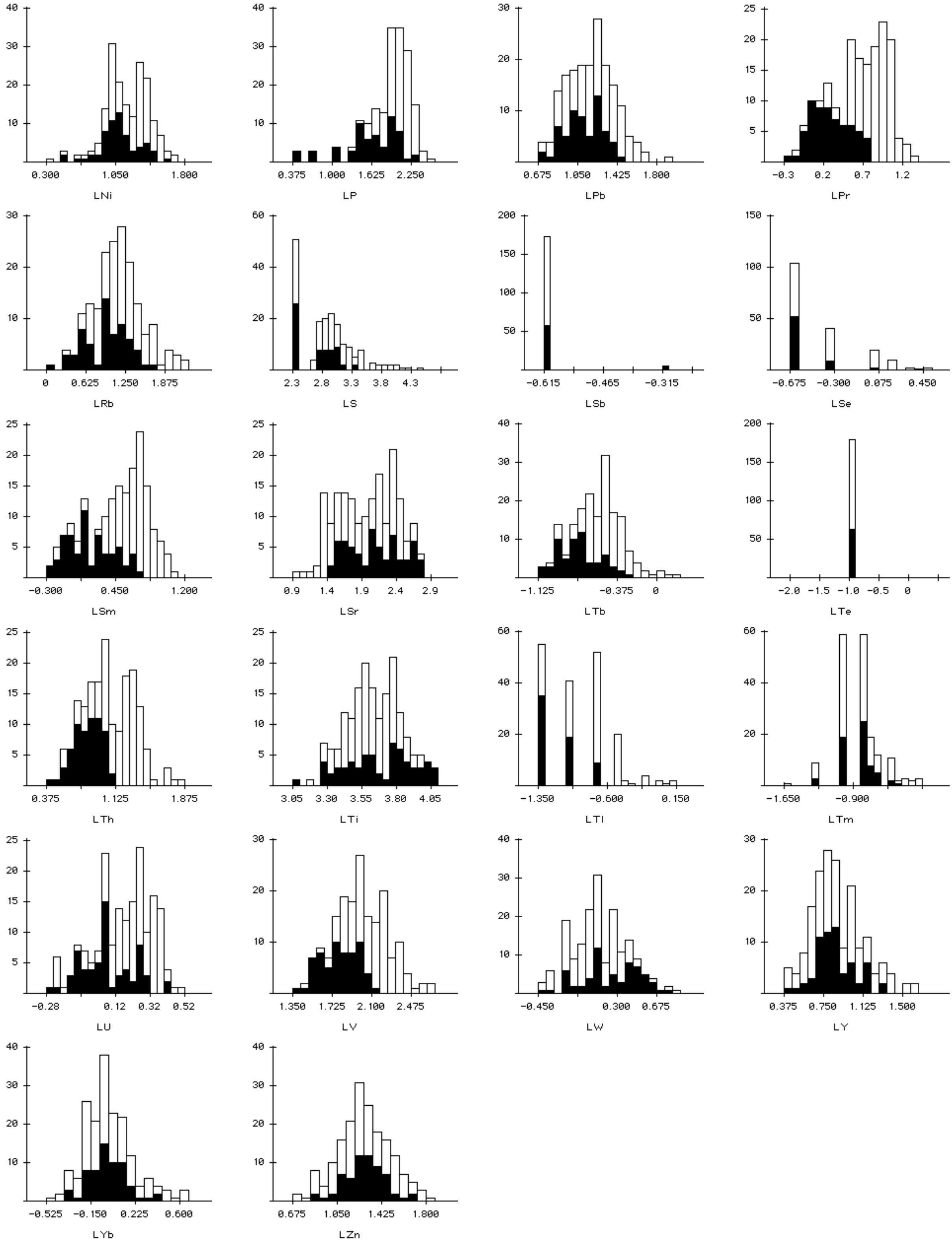


Figure A7a.2 (continued): Log transformed 0 - 6 m data. Transported data are black.

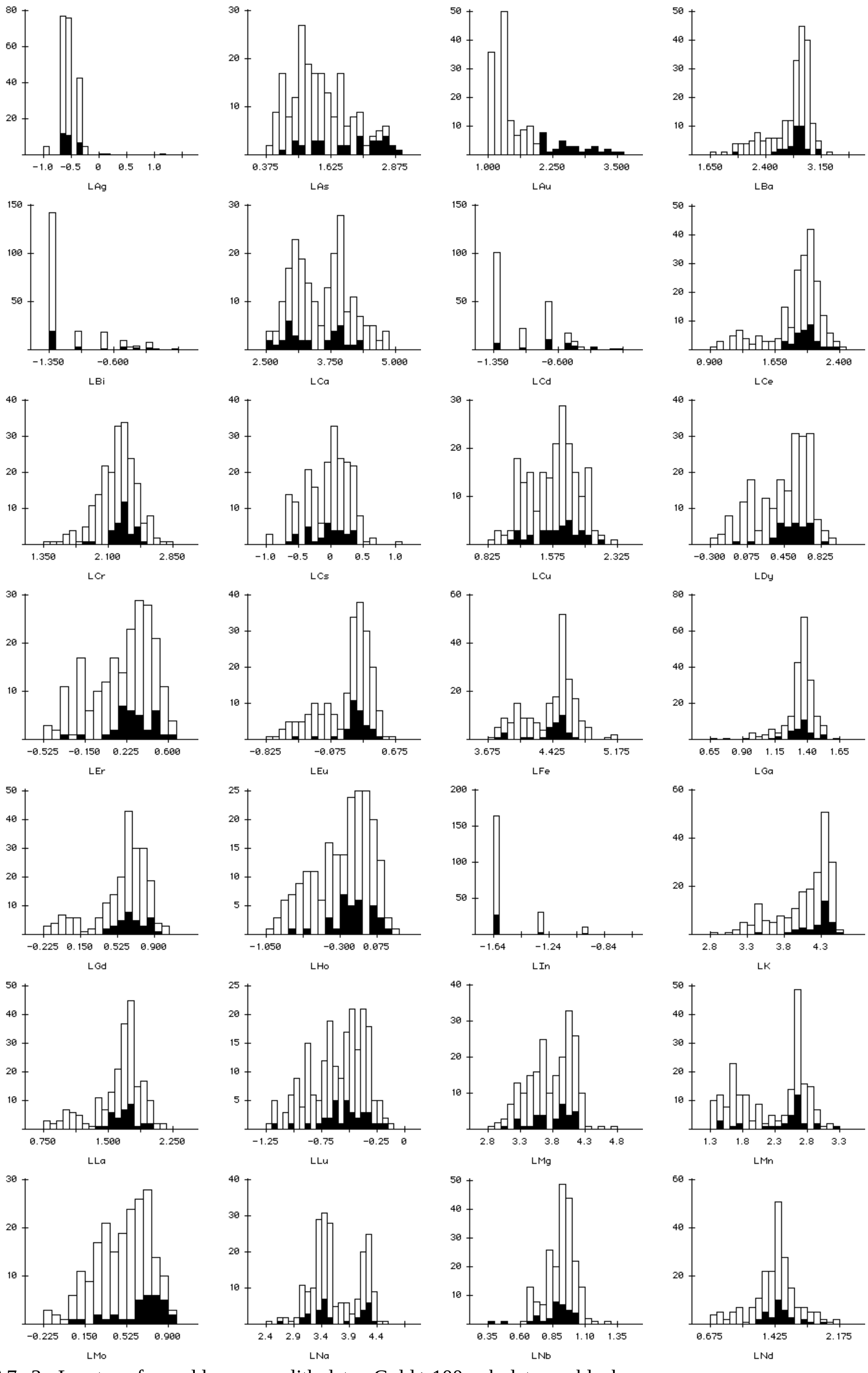


Figure A7a.3: Log transformed lower regolith data. Gold >100 ppb data are black.

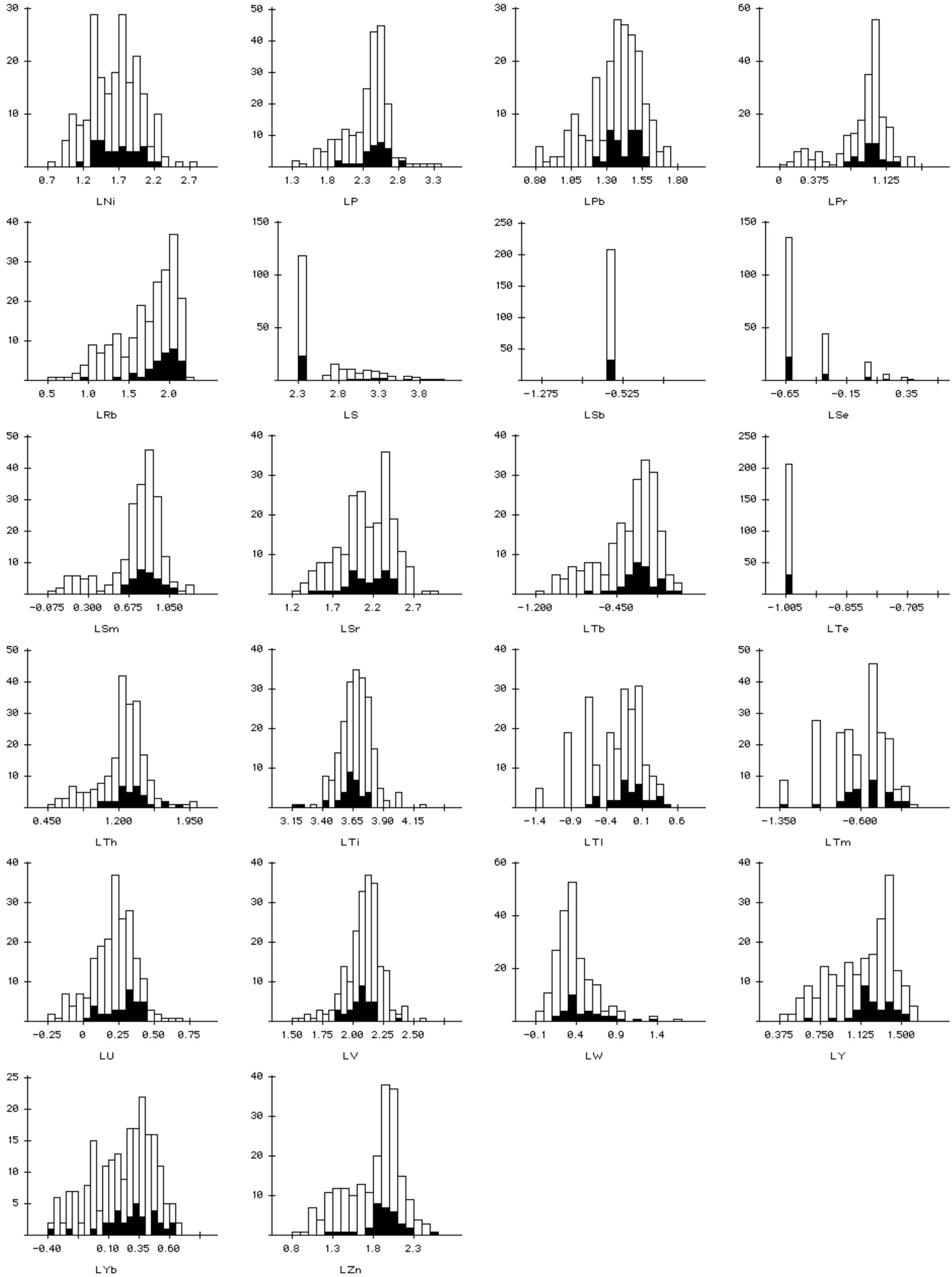


Figure A7a.3 (continued): Log transformed lower regolith data. Gold >100 ppb data are black.

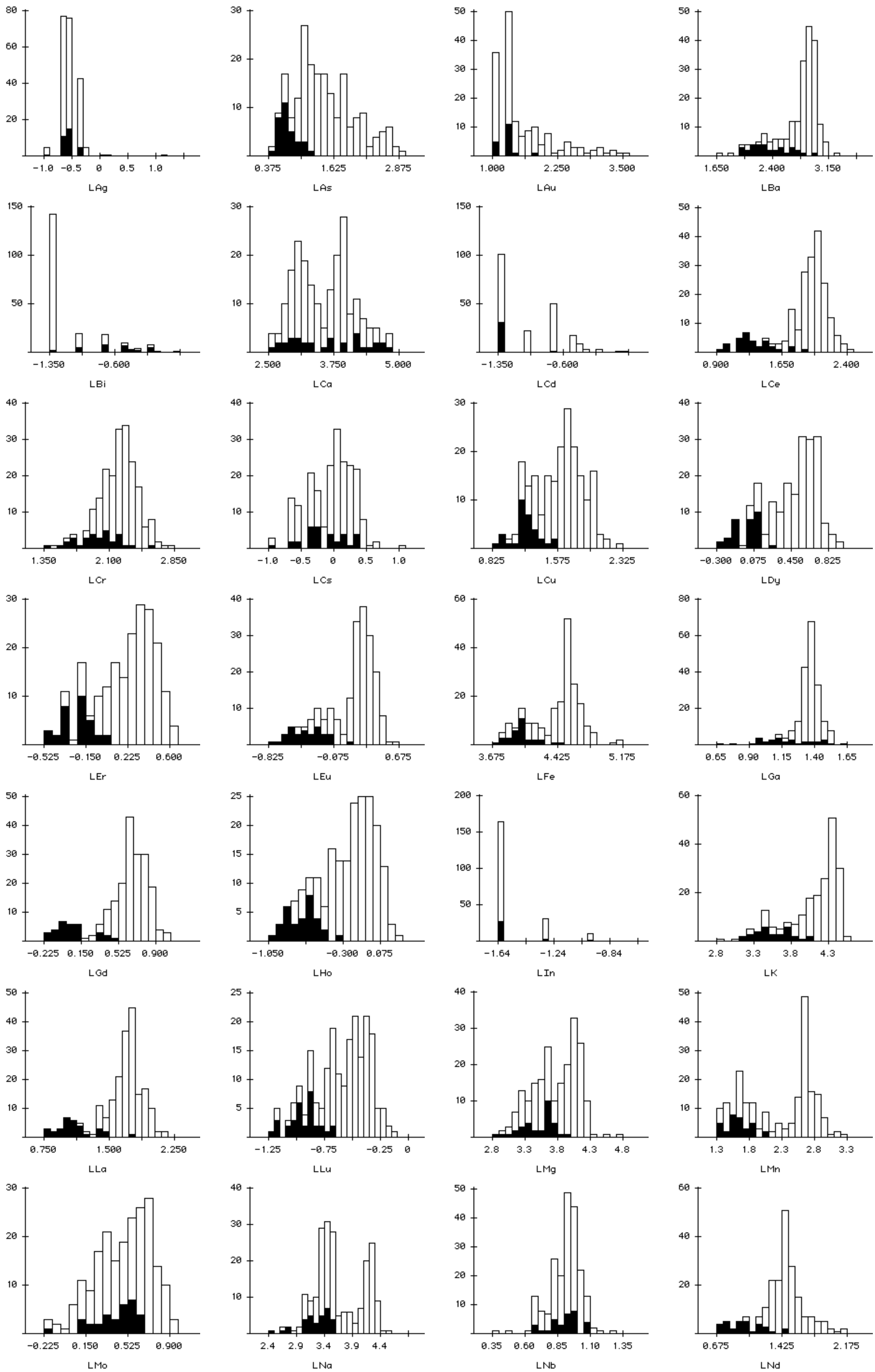


Figure A7a.4: Log transformed lower regolith data. Transported data are black.

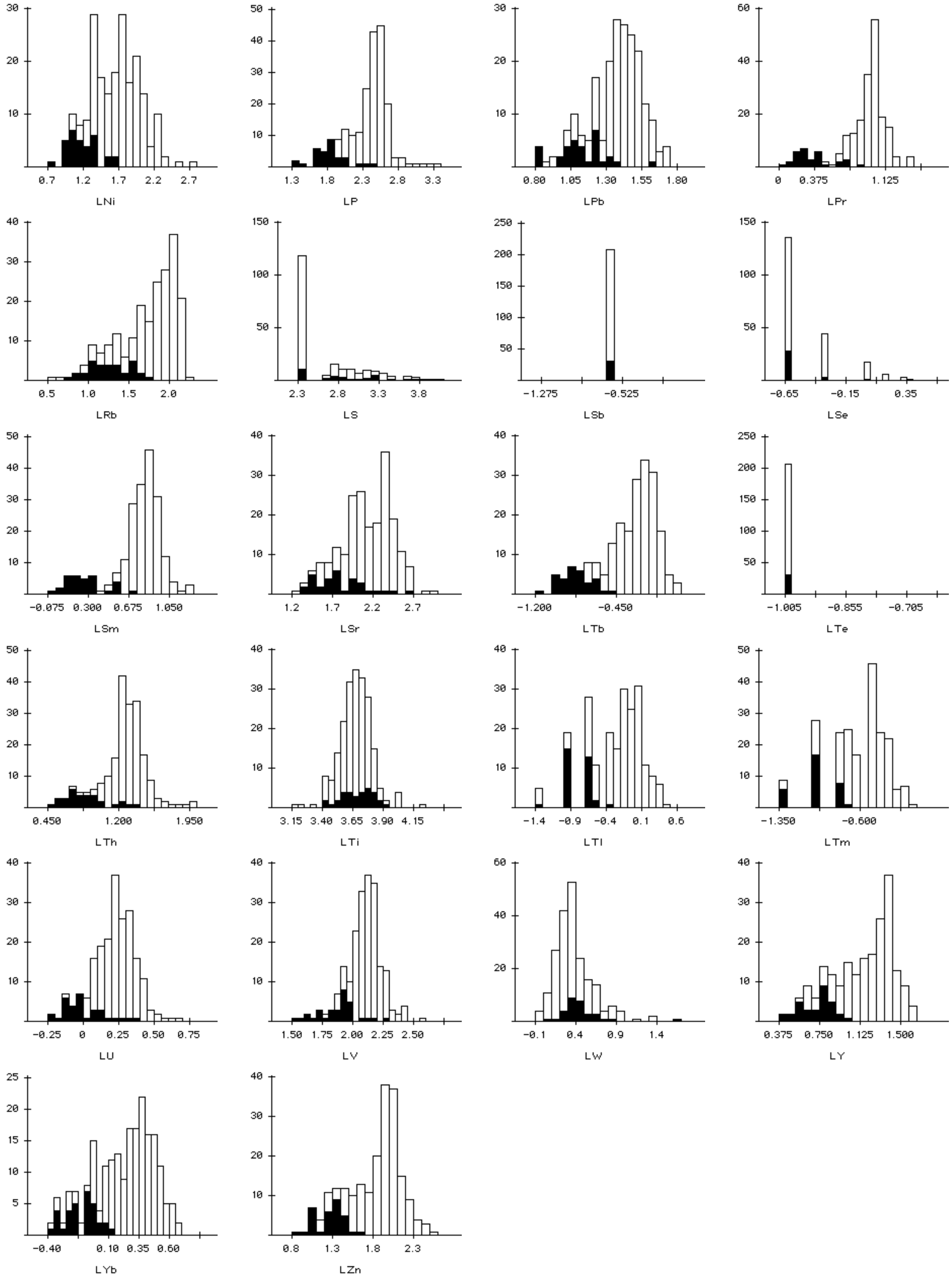


Figure A7a.4 (continued): Log transformed lower regolith data. Transported data are black.

Appendix 7b: Principal component analyses

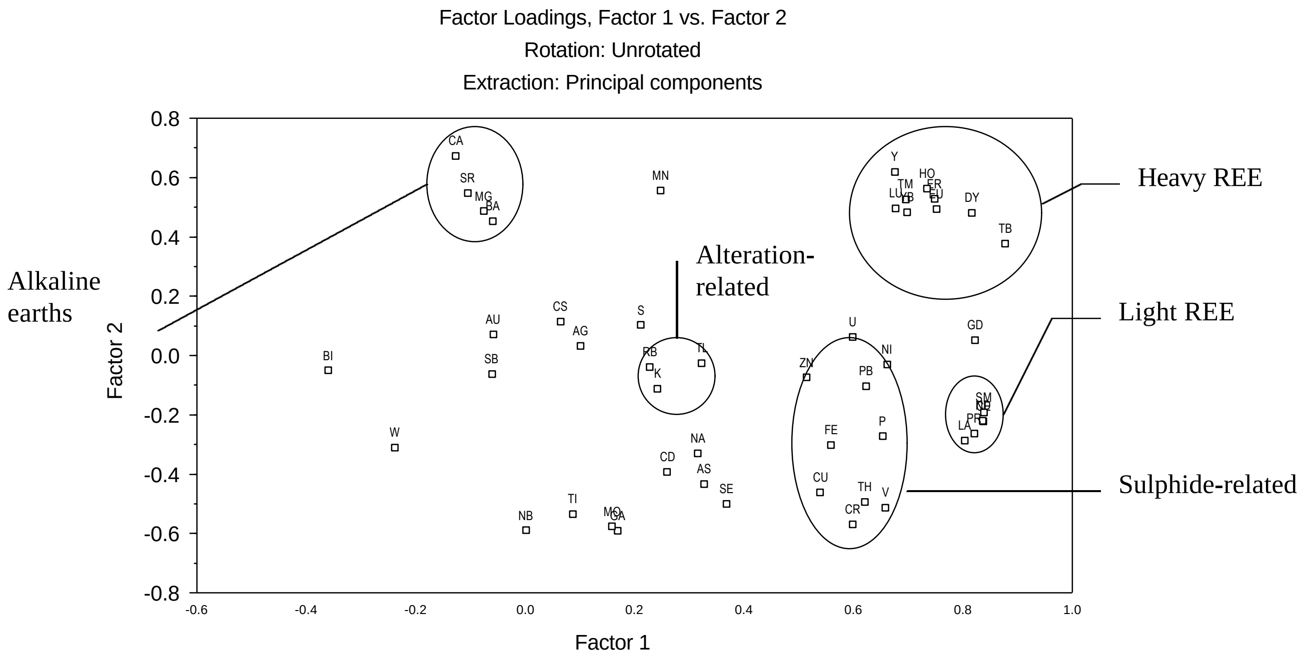


Figure A7b.1: Factor 1 vs Factor 2 for 0 - 6 m data.

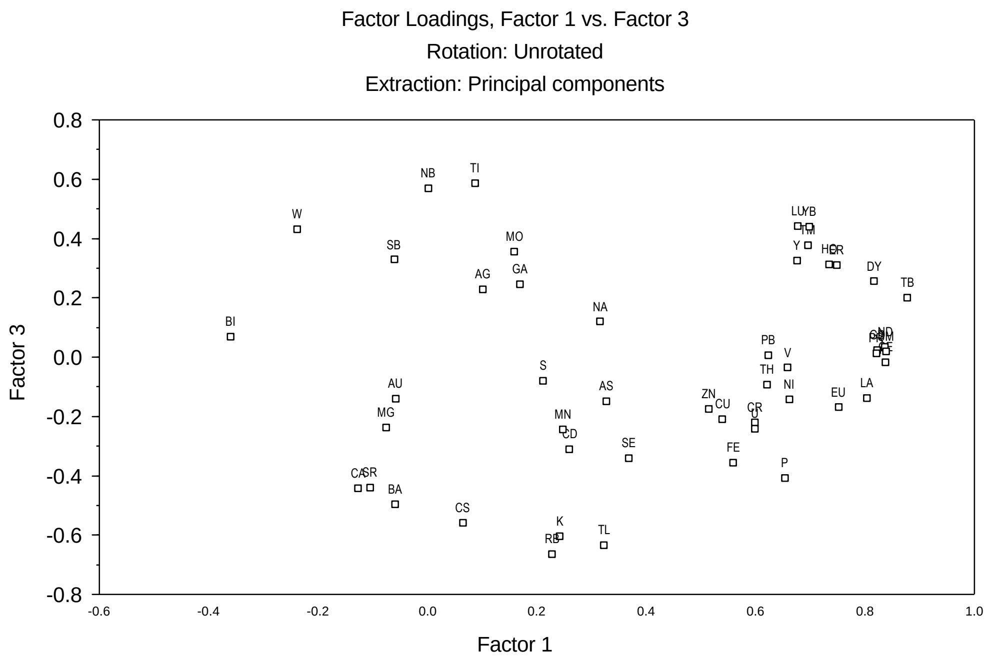


Figure A7b.2: Factor 1 vs Factor 3 for 0 - 6 m data.

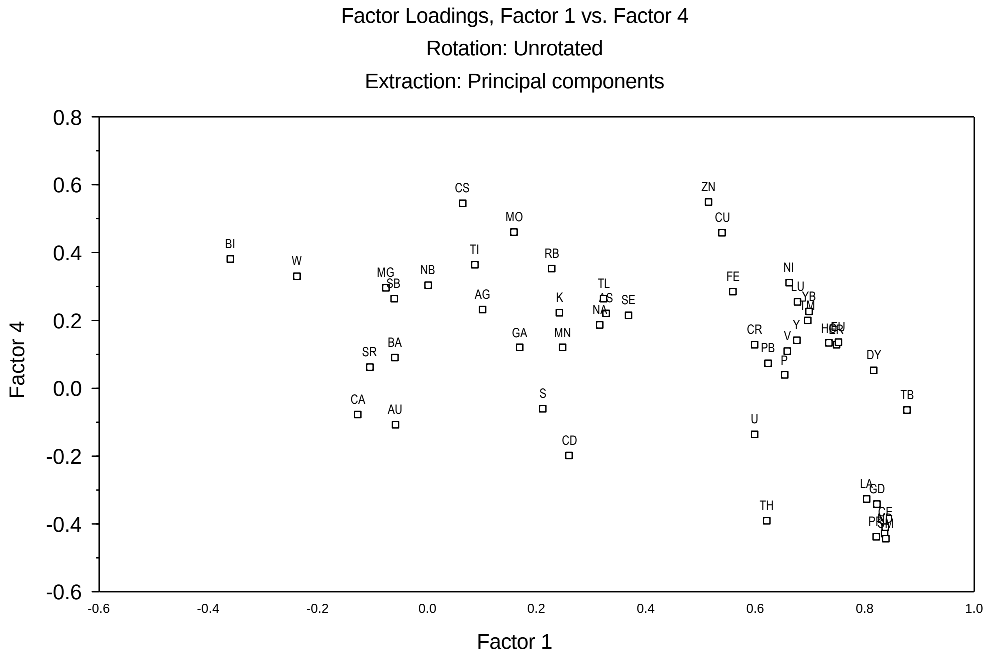


Figure A7b.3: Factor 1 vs Factor 4 for 0 - 6 m data.

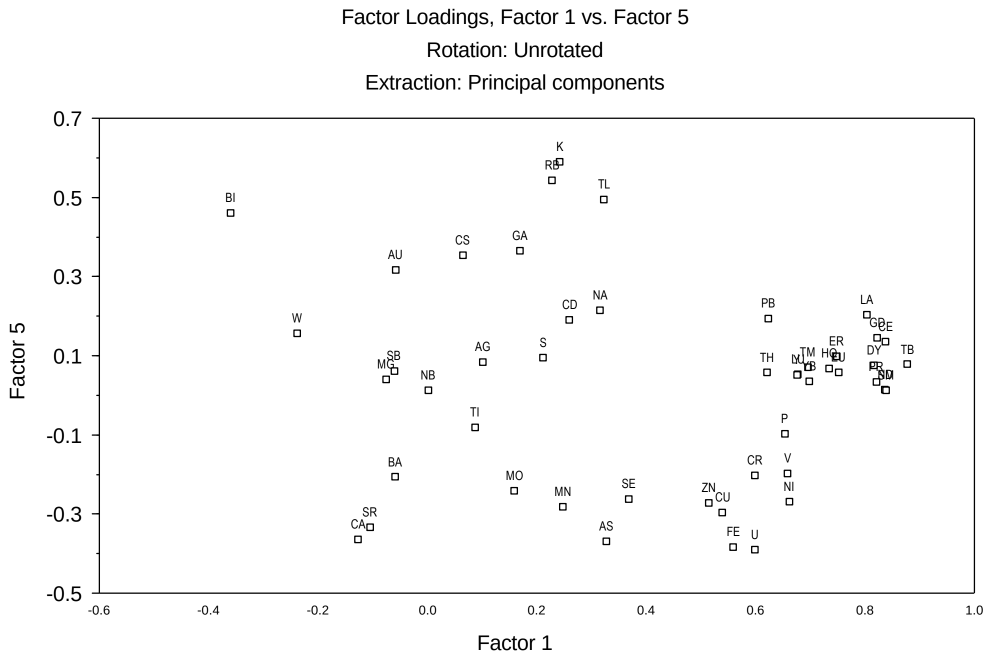


Figure A7b.4: Factor 1 vs Factor 5 for 0 - 6 m data.

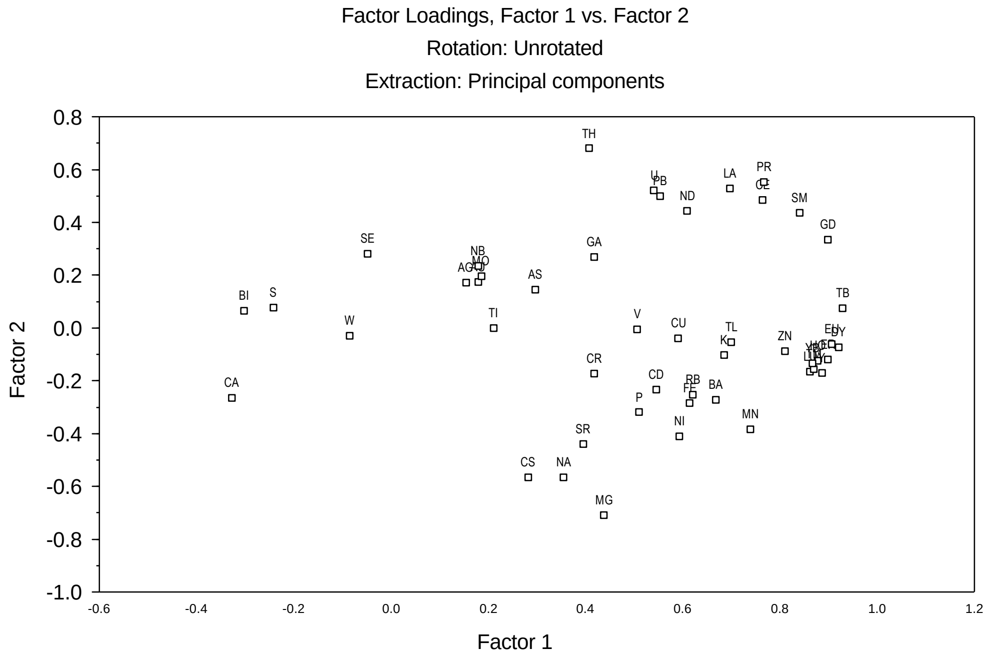


Figure A7b.5: Factor 1 vs Factor 2 for lower regolith data.

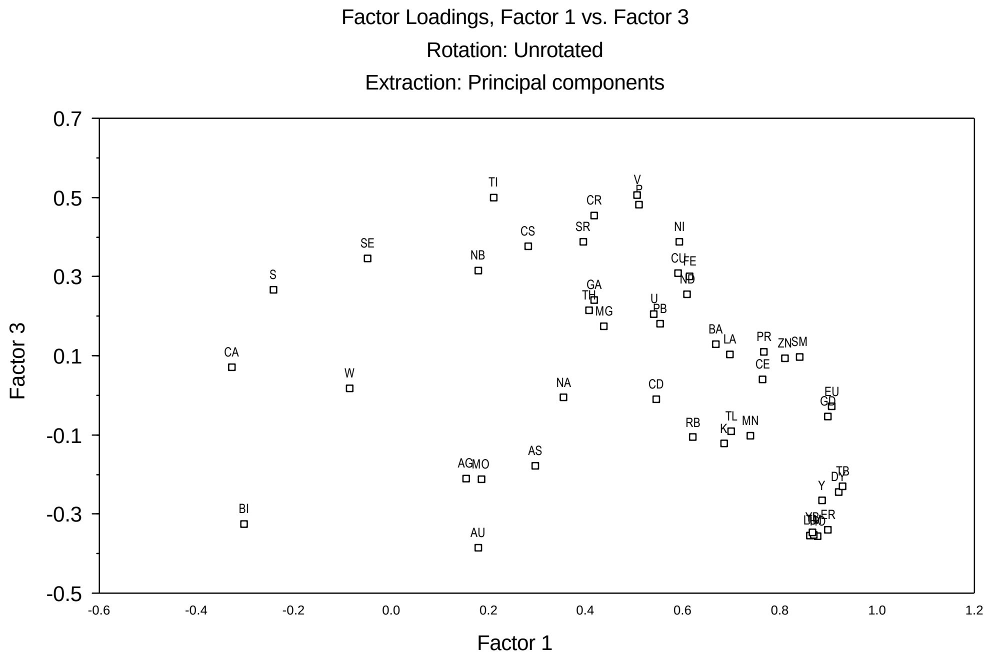


Figure A7b.6: Factor 1 vs Factor 3 for lower regolith data.

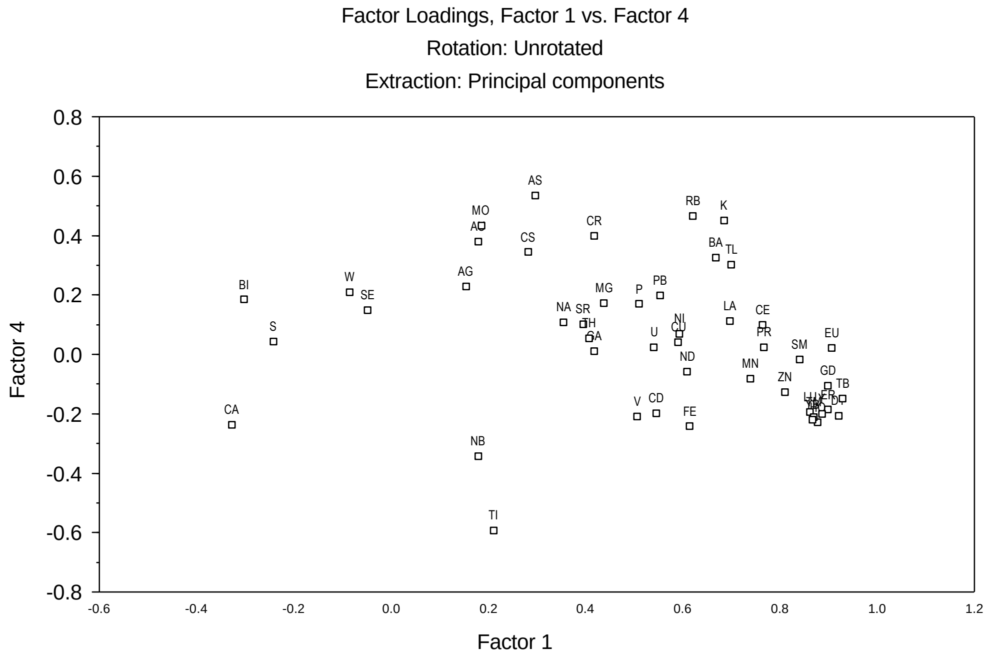


Figure A7b.7: Factor 1 vs Factor 4 for lower regolith data.

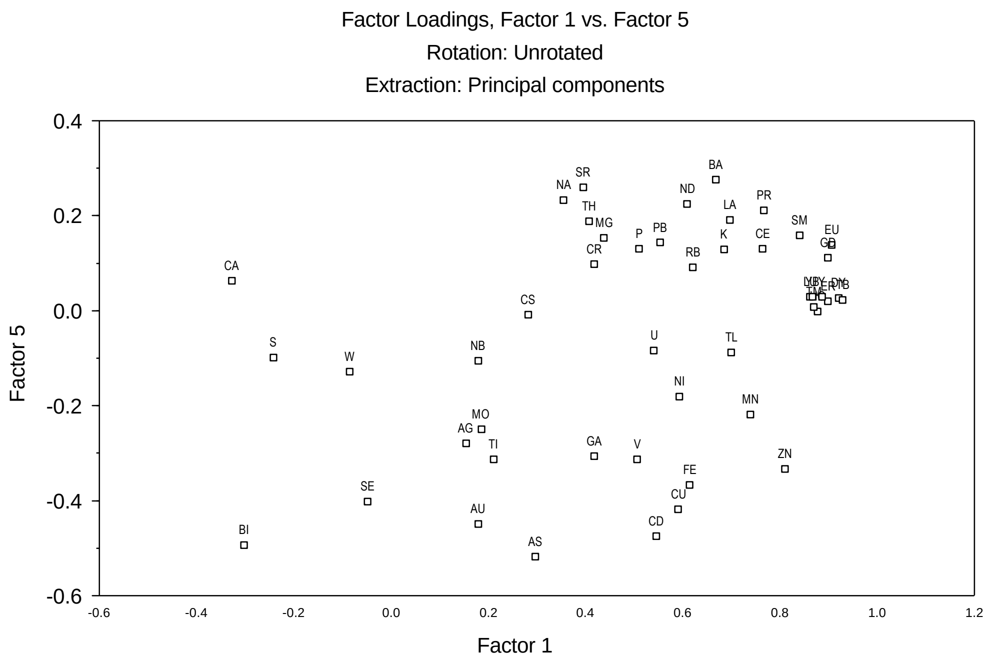


Figure A7b.8: Factor 1 vs Factor 5 for lower regolith data.

APPENDIX 8

Appendix 8: Detailed descriptions for upper regolith and pit samples (including plates).

Appendix 8a: Detailed descriptions for upper regolith samples at Challenger.

Symbols and methods used in log descriptions.

Textures	for soils and non-lithified particulate materials the methodology and terminology of Northcote (1979) has been used.
Colours	for crystalline rocks, lithified and non-lithified particulate materials the following methods were applied: - standard Munsell Color Notation, Soil Charts (Munsell Color, 1975), - word colours (Kelly and Judd, 1976) modified by Sheard and Bowman (1996), - (d) = colour description applied to DRY sample, - (w) = colour description applied to WET sample,
Mineralogy	- preliminary in-field identification made using a hand lens, follow-up detail carried out on both UNWASHED and WASHED (wet sieved samples), using a binocular microscope. Some follow-up identifications were made using XRD analyses.

Lithology logging by M.J. Sheard, Mineral Resources Group of PIRSA. 1997-98.

Mt Challenger refers to a previous unnamed topographic high feature occurring about 300 m to the north west of the main mineralized zone at Challenger (Zone 1).

References

Munsell Color, 1975. Munsell soil color charts. Munsell Color, Baltimore, Maryland, USA. Un-paginated.

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Kelly, K.L. and Judd, D.R., 1976. Color — universal language and dictionary of names. National Bureau of Standards, United States Commerce Department, Washington, D.C. 16-34 pp.

Sheard, M.J. and Bowman, G.M., 1996. Soils, stratigraphy and engineering geology of near surface materials of the Adelaide Plains. South Australia. Mines and Energy Department. Report Book, 94/9. 3 Volumes. 156 pp + figures, plates and appendices.

Hole: GC100

Location: 364186E, 6692861N

Site: within silcrete outcrop area on a slight rise on otherwise flat ground. Silcrete is massive to vughy with quartz clasts, x-bedded sandstone and ferruginous stains along fractures. Outcrop is bouldery.

Vegetation: shrubland

Soil: clayey sand, moderate reddish brown (w) (2.5YR 4/5); as discontinuous patches within silcrete outcrop.

Calcrete: not at surface, thin plates and slabs coating silcrete below soil at ~25-30 cm.

Sample #	Depth	Description
GC100A	0-1 m	UNWASHED: cuttings and fines, pale pink (d), strongly calcareous silcrete, calcrete with some of the reddish sandy soil included, strong carbonate acid reaction; texture - gritty sand and rock fragments, light brown (w) (5YR 6/6). WASHED: fragments of calcrete, silcrete and calcrete coating silcrete, creamy quartz fragments, Fe oxides as orange-brown coatings on silcrete.
GC100B	1-2 m	UNWASHED: cuttings and fines, pale grey (d) silcrete, many angular broken fragments, calcareous, pale pinkish (d), moderate to strong carbonate acid reaction; texture - rock fragments, brownish orange (w) (5YR 5/8). WASHED: cuttings of brown, grey and buff coloured silcrete, and cream, yellow, orange and grey potch opal and porcelanite, very calcareous, Fe as above.
GC100C	2-3 m	UNWASHED: as above, silcrete - very fine grained sand within each fragment, strong carbonate acid reaction; texture as above, colour - light yellowish brown (w) (7.5YR. 7/5). WASHED: as per 1-2 m.
GC100D	3-4 m	UNWASHED: cuttings and fines, creamy-grey, calcareous silcrete, mostly finer fragments (<3 mm), moderate carbonate acid reaction; colour - moderate yellowish pink (w) (5YR 7/4). WASHED: creamy silcrete and porcelanite fragments.
GC100E	4-5 m	UNWASHED: cuttings and fines, creamy grey (d), slightly clayey gritty material, contains clasts of silcrete as both large (5-10 mm) and smaller sand-sized fragments no carbonate acid reaction; texture - rock fragments, light yellowish brown (w) (7.5YR 7/4). WASHED: silcrete and porcelanite as above plus purple to pink silicified claystone.
GC100F	5-6 m	UNWASHED: cuttings and fines, pale pink (d) clay with some angular grit, no carbonate acid reaction; texture - sticky gritty loam to gritty medium clay, grayish yellowish pink (w) (2.5YR 7/2.). WASHED: pink to purple clay and claystone with some contamination from above of silcrete and opal fragments.

Hole: GC101

Location: 364146 E, 6692880N

Site: same outcrop as hole 100 but at crest of silcrete rise. Silcrete is massive to vughy with quartz clasts, x-bedded sandstone and ferruginous stains along fractures. Outcrop is bouldery.

Vegetation: shrubland

Soil: clayey sand, moderate reddish brown (w) (2.5YR 4/5); as discontinuous patches within silcrete outcrop.

Calcrete: none visible - only earthy dust at top of silcrete ~0.1m.

Sample #	Depth	Description
GC101A	0-1 m	UNWASHED: rock cuttings and fines, pale pink (d) mixture of red sand and silcrete fragments with some calcrete coatings, strong carbonate reaction to acid. Chips from drillhole are porcelanitic with blobs of hyaline potch opal - brown and translucent. Texture - gritty sand and rock , light brown (w) (5YR 6/6). WASHED: fragments of pinkish calcrete (~7%) and pale yellow-grey silcrete (silicified sandstone - fine to medium grained) - most is carbonate coated, fragments of white and grey quartzite, plus sand grains liberated from silcrete by drilling.
GC101B	1-2 m	UNWASHED: rock cuttings and fines, cream - pale yellow (d) silcrete fragments in a pink (d) powder. Strong carbonate reaction to acid; texture - grit and rock fragments, dark orange yellow (w) (7.5YR 6/8). WASHED: fragments of mildly calcareous silcrete (as above) with ~60% of potch opal (white, cream, pink, yellow, orange and brown) often colour zoned and with conchoidal fracture and vitreous lustre, some Fe staining on potch and on silcrete fractures or lining vugs.
GC101C	2-3 m	UNWASHED: rock cuttings and fines, pink to cream (d) powder with grey silcrete fragments, strong carbonate reaction to acid; texture - silty grit and rock fragments, pale orange yellow (w) (7.5YR 8/4). WASHED: fragments mostly of potch opal (white, cream and some yellow) as above with pink - purple - grey porcelanite, rare Fe staining of silcrete.
GC101D	3-4 m	UNWASHED: rock cuttings and fines, as above, mild carbonate reaction to acid; texture - silty grit and rock fragments, light yellowish brown (w) (7.5YR 7/4).. WASHED: fragments of Fe stained silcrete with veins and blebs of potch opal, grey silcrete, white - cream - yellow and pink potch and porcelanite, sand sized quartz liberated from silcrete by drilling.
GC101E	4-5 m	UNWASHED: rock fragments and fines, pale pinkish gray (d) silty clay with a few silcrete fragments, weak carbonate response to acid; texture - silty clay , grayish yellowish pink (w) (5YR 7/2). WASHED: fragments of purplish to greyish porcelanite and silicified fine-grained sandstone—siltstone, some fine to medium-grained quartz sand grains - subrounded to angular (fluvial).
GC101F	5-6 m	UNWASHED: pale pink (d) gritty clay, weak carbonate acid reaction; texture - clay loam (very sticky wet), grayish yellowish pink (w) (5YR 7/2). WASHED: small quantity of grainy matter, pink-pale purple-pale grey porcelanite and siltstone with some similar coloured potch fragments.

Hole: GC102

Location: 364141E, 6692931N (estimated)

Site: flat orange clay pan area with no vegetation.

Vegetation: none present

Soil: silty light clay, moderate reddish brown (w) (2.5YR 4/4).

Calcrete: very thin layer (~5 mm) on silcrete at 0.5m

Sample #	Depth	Description
GC102A	0-1 m	UNWASHED: sandy clay and rock fragments, reddish (d) with calcrete fragments, medium strong carbonate acid response; texture - sticky heavy clay, strong brown (w) (2.5YR 4/8). WASHED: fragments of calcrete and cream - grey silcrete (silicified sandstone), brown - orange Fe stained quartz grains and silcrete
GC102B	1-2 m	UNWASHED: rock fragments and fines, pinkish (d) silty with minor clay - powder, silcrete and calcrete fragments, strong carbonate acid response; texture - clayey silt and rock fragments, light brown (w) (7.5YR 6/4). WASHED: as above with more Fe staining and coatings
GC102C	2-3 m	UNWASHED: rock fragments and fines, creamy grey (d) silcrete, weak to moderate carbonate acid response; texture - rock fragments , brownish pink (w) (7.5YR 8/2). WASHED: as per 1-2 m, with yellow silcrete plus fragments of creamy and pale yellow potch opal and porcelanite.
GC102D	3-4 m	UNWASHED: sand and rock fragments, pale grey (d) silty fines with small silcrete fragments. No carbonate acid response; texture - silty sand and rock, yellowish gray (w) (7.5YR 8/1) to light gray (w) (N 8/-).. WASHED: as per 2-3 m plus grey quartz sand and gravel with rounded fluvial clasts.
GC102E	4-5 m	UNWASHED: siltstone/claystone, cream and grey. No carbonate acid response; texture - silty sand and rock, brownish pink (w) (7.5YR 8/2). WASHED: as per 3-4 m with some Mn oxide dendrites with in the creamy potch opal and porcelanite.
GC102F	5-6 m	UNWASHED: claystone/siltstone, pale pink. Claystone fragments are quite hard and may be partly silicified (porcelanite). Mild carbonate acid response; texture - rock and minor clay, grayish yellowish pink (w) (5YR 7/3). WASHED: pink to purple claystone and some fragments of silicified equivalents (porcelanite).

Hole: GC103

Location: 364135.5E, 6692982N

Site: on edge of flat clay pan (unvegetated), edge is slightly more sandy than the pan. Pan edge and sand are reddish orange (d).

Vegetation: shrubland with some Acacia nearby.

Soil: loam, strong brown (w) (2.5YR 4/6).

Calcrete: no obvious calcrete, red-brown clay rests directly on silcrete

Sample #	Depth	Description
GC103A	0-1 m	UNWASHED: red-brown (d) clay with some silt, calcrete fragments in sample - very small, most fragments are silcrete, strong carbonate acid response; texture - silty light clay and rock fragments, strong brown (w) (2.5YR 4/6). WASHED: mostly silcrete fragments with calcrete coatings and impregnations - reddish Fe oxide coated, greyish to pale greenish grey (w), mostly fine grained silicified sandstone, some porcelanite and potch opal, 5% fine-grained quartz sand stained orange from Fe and orange clays in the claypan overlying the silcrete.
GC103B	1-2 m	UNWASHED: pink, cream and grey (d) fines with angular fragments of silcrete, moderate - strong carbonate acid response; texture - rock fragments, light brown (w) (5YR 6/5). WASHED: mostly silcrete fragments - pale cream to grey fine to medium-grained silicified sandstone containing some rounded fluvial quartz grains, some porcelanite and potch opal, some rare black ?Mn oxide coatings and inclusions in the potch, 5-10% Fe oxide coated and stained silcrete.
GC103C	2-3 m	UNWASHED: pale pink to grey (d) gritty fines with carbonate dust and silcrete fragments, strong carbonate acid response; texture - rock fragments, pinkish gray (w) (5YR 8/1). WASHED: less fragments and grainy matter, silcrete fragments as per 1-2 m, fine to coarse-grained well rounded to subrounded to angular quartz sand - fluvial,
GC103D	3-4 m	UNWASHED: very pale grey (d) rock fragments and fines, no carbonate acid response, off-white (d) claystone fragments; texture - clayey silt and rock, light gray (w) (N 8/-). WASHED: mostly small fragments (<2 mm) of pale grey to cream silcrete and porcelanite (some is pinkish) with some potch opal (some is greenish yellow), rounded granules of bluish to grey quartz.
GC103E	4-5 m	UNWASHED: very pale pink - cream (d) silty clay to clayey silt and rock fragments, no carbonate acid response; texture - sandy light clay, pale yellowish pink (w) (5YR 8/2). WASHED: mostly porcelanite - white to pale pink, potch opal with similar colours.
GC103F	5-6 m	UNWASHED: pale pink (d) sticky clay with some grit, claystone - siltstone with carbonate imprint, strong carbonate acid response; texture - silty medium clay, sticky, brownish pink (w) (7.5YR 8/2). WASHED: pale pink - pale purple siltstone and fine-grained sandstone, both porcelanitic, potch fragments, occasional coarse-grained sand and rounded granules of quartz -fluvial.

Hole: GC104

Location: 364093E, 6693027N

Site: on rising ground at E. edge of silcrete outcrop rise at W. end of clay pan. Silcrete is massive and bouldery, grey, with reddish orange sand cover and block - boulder in-fill. Silicified portion of a tree branch found by Vicki Stamoulis (PIRSA) as very locally derived surface float (**Sample: R213958**) refer to palaeo-botanical report in Appendix 10.

Vegetation: shrubland

Soil: clayey sand, grayish reddish brown (w) (10R 4/3); soil is as scattered patches within bouldery area.

Calcrete: no obvious calcrete on silcrete although it forms thin (mm thick) plates and coatings to silcrete below soil.

Sample #	Depth	Description
GC104A	0-1 m	UNWASHED: brown, grey and pale brown (d) silcrete with medium - coarse grained quartz sand clasts within, calcrete coatings and fragments, mild carbonate acid response; texture - rock fragments, light brown (w) (7.5YR 6/4). WASHED: cream, light tan and brown coloured silcrete, white and cream porcelanite and potch opal, grey quartz grains.
GC104B	1-2 m	UNWASHED: cream - pale grey and white (d) calcrete and some silcrete, gritty, strong carbonate reaction to acid, texture - rock fragments, pale orange yellow (w) (7.5YR 8/4).. WASHED: fragments mostly of white - cream potch opal and porcelanite with some yellowish silcrete (silicified sandstone) .
GC104C	2-3 m	UNWASHED: pale grey (d), rock fragments and fines, calcrete fragments and pale siltstone fragments. Moderate - strong acid carbonate reaction. Texture - rock fragments, yellowish gray (w) (7.5YR 8/1).. WASHED: fragments of white - cream potch opal and porcelanite with Mn oxide dendrites, rare pink porcelanite chips.
GC104D	3-4 m	UNWASHED: pale creamy grey (d) fines and claystone, very weak carbonate acid response; texture - silty loam and rock fragments, brownish pink (w) (7.5YR 8/2). WASHED: as per 2-3 m.
GC104E	4-5 m	UNWASHED: pale brown - grey (d) fines and claystone, siltstone and fine-grained sandstone fragments. Weak carbonate acid response. Texture - sticky clay and rock fragments, brownish pink (w) (7.5YR 8/2).. WASHED: as per 2-3 m plus pink - purple claystone and porcelanite, rare clear quartz grains to 3 mm size.
GC104F	5-6 m	UNWASHED: pale pink (d) clay and rock fragments with mild carbonate acid response, gritty, pale claystone to siltstone fragments; texture - light clay (sticky) and rock fragments, grayish yellowish pink (w) (5YR 7/2). WASHED: pink - purple claystone fragments and silicified equivalents.

Hole: GC105 Location: 364076E, 6693061N. Site: sandy rise with silcrete gibber common at surface. Vegetation: shrubland Soil: clayey sand, moderate reddish brown (w) (10R 4/4); with some calcrete clasts. Calcrete: rubbly plates and slabs (~10-15 cm thick) on silcrete at ~25 cm below surface.		
GC105A	0-1 m	UNWASHED: reddish (d) silty sand with carbonate plates and massive forms, strong carbonate acid response; texture - sand and rock fragments, brownish orange (w) (5YR 5/8). WASHED: fragments of pale brown to pinkish calcrete, calcrete coated—impregnated silcrete, potch opal, reddish stained aeolian quartz sand, some rounded medium to coarse-grained white quartz sand - fluvial.
GC105B	1-2 m	UNWASHED: as above, carbonate is creamy to white and may be dolomitic with depth, strong carbonate acid response to fines only; texture - rock fragments, light brown (w) (5YR 6/5). WASHED: mostly silcrete fragments - brown Fe stained and grey forms, porcelanite and potch opal - white, cream, yellow-orange with some Mn oxide inclusions and coatings.
GC105C	2-3 m	UNWASHED: pale pink to cream (d) rock fragments and fines, calcrete, massive to platey, dolomitic - needs crushing to get a carbonate acid response from big chunks; texture - rock fragments, pale yellowish pink (w) (5YR 8/3). WASHED: mostly fragments of porcelanite and potch opal - white to cream and micro-breccias of the same, rare angular black grains, some Mn oxide coatings and inclusions in the potch.
GC105D	3-4 m	UNWASHED: pale gray (d) rock fragments and fines, pale grey (d) claystone fragments common, no carbonate acid reaction; texture - rock fragments, brownish pink (w) (7.5YR 8/2). WASHED: as per 2-3 m.
GC105E	4-5 m	UNWASHED: pink (d), clayey grit, pale siltstone fragments, no carbonate acid response; texture - sticky medium clay and grit, grayish yellowish pink (w) (5YR 7/3). WASHED: pale pink potch and porcelanite, some grey - cream - yellow potch fragments, rare grey silcrete and silicified sandstone chips.
GC105F	5-6 m	UNWASHED: pink - gray (d) sticky medium clay, pale claystone fragments, little grit, no carbonate acid reaction; texture - sticky light clay, grayish yellowish pink (w) (5YR 7/2). WASHED: pinkish to purplish porcelanite and incipiently silicified siltstone, quartz sand and granules - grey to clear, rounded to subrounded - fluvial.

Hole: GC106

Location: 364035E, 6693094N.

Site: relatively flat, gibber-clad sandy area (reddish orange (d)).

Vegetation: shrubland.

Soil: clayey sand, moderate reddish brown (w) (10R 4/4); with some rare calcrete clasts, gibber - all silcrete and mostly with ferruginous coatings.

Calcrete: thin rubbly platy to earthy powder calcrete on rubbly silcrete, some calcrete nodules/plates contain ferruginous silcrete clasts.

GC106A	0-1 m	UNWASHED: pale brown (d) sand with fragments of grey silcrete and creamy calcrete, strong carbonate acid response; texture - sand and rock fragments, light brown (w) (7.5YR 6/4). WASHED: brownish pink calcrete, buff - cream silcrete (silicified sandstone).
GC106B	1-2 m	UNWASHED: pale yellow brown (d) creamy calcrete fragments and fines, strong carbonate acid response; texture - rock fragments, light yellowish brown (w) (7.5YR 7/4). WASHED: as above plus cream, yellow and grey potch opal and porcelanite, grey silcrete (silicified angular sand), grey quartz fragments, Fe oxide coatings on fracture surfaces.
GC106C	2-3 m	UNWASHED: cream - pale gray (d) rock fragments and fines, white to cream calcrete fragments, strong carbonate acid response; texture - rock fragments, light grayish yellowish brown (w) (10YR 7/3). WASHED: mostly fragments of creamy potch opal and porcelanite with some fine-grained grey silcrete and buff coarse grained silcrete, some potch has Mn oxide dendrites within, some pink - brown Fe oxide coatings on fracture surfaces.
GC106D	3-4 m	UNWASHED: pale gray (d) clayey silt, pale claystone/siltstone, very weak carbonate acid response; texture - clayey sand and rock fragments, pale orange yellow (w) (10YR 8/3). WASHED: >95% fragments of cream potch opal and porcelanite with a few grey silcrete fragments and nodules, rare clasts of crystalline metamorphic lithotypes, clear quartz clasts 1-2 mm.
GC106E	4-5 m	UNWASHED: pale creamy gray (d) sticky clay texture, no acid response, bleached claystone fragments, no carbonate acid response; texture - sandy clay loam, yellowish gray (w) (10YR 8/2). WASHED: as per 3-4 m.
GC106F	5-6 m	UNWASHED: pale gray (d) clay no fragments larger than 1 mm, no carbonate acid response; texture - sandy light clay (sticky), yellowish gray (w) (10YR 8/1). WASHED: fragments of cream porcelanite and silcrete with some pink potch opal, grey to dark grey quartz grains with some rounded alluvial morphology, some near black quartz grains with tiny black inclusions.

Hole: GC107

Location: 363996E, 6693124N.

Site: similar to 106 but on slightly rising ground, near crest or rise. Gibber is of several litho types - silcrete, quartz and exotics with some calcrete clasts.

Vegetation: shrubland.

Soil: clayey sand, moderate reddish brown (w) (10R 4/4).

Calcrete: thin rubbly platy calcrete (~5 cm thick) on silcrete at 50 cm.

GC107A	0-1 m	UNWASHED: brown (d), rock fragments and fines, cream - white calcrete fragments, strong carbonate acid response, silcrete fragments; texture - sand and rock fragments, light brown (w) (5YR 6/5). WASHED: fragments of pale brown calcrete, brown and grey silcrete and yellow to cream potch opal and porcelanite.
GC107B	1-2 m	UNWASHED: pale brown, (d) rock fragments and fines, plenty of pale silcrete fragments, strong carbonate acid response; texture - rock fragments, light yellowish brown (w) (7.5YR 7/6). WASHED: rock chips, 60% as cream - yellow and grey potch opal with conchoidal fracture and vitreous lustre, Mn oxide present as black coatings and inclusions in potch, 40% as calcreted silcrete as above.
GC107C	2-3 m	UNWASHED: creamy to pale grey, (d) rock fragments and fines, creamy white calcrete fragments, mild carbonate acid response; texture - rock fragments and gritty sticky clay, pale orange yellow (w) (7.5YR 8/4). WASHED: rock chips, 70% as grey and cream potch opal, 30% as grey porcelanite.
GC107D	3-4 m	UNWASHED: very pale pink - grey, (d) clay and rock fragments, small claystone fragments, pale claystone, very weak carbonate acid response; texture - rock fragments and clay loam, grayish yellowish pink (w) (5YR 7/3). WASHED: pale pinkish - purplish porcelanite with some potch, quartz sand - medium- to coarse-grained clear and grey subrounded to well rounded - fluvial origin.
GC107E	4-5 m	UNWASHED: pale pink - pink (d) fine sandy clay with claystone fragments, very weak carbonate acid response; texture - fine sandy light - medium clay (sticky) and rock fragments, grayish yellowish pink (w) (5YR 7/3). WASHED: pinkish to reddish and pale grey porcelanite and claystone, some potch opal and sand as per 3-4 m.
GC107F	5-6 m	UNWASHED: pink (d) - pinkish pale brown, sandy loam, claystone, very weak carbonate acid response; texture - sandy clay loam (sticky) and rock fragments, light reddish brown (w) (2.5YR 6/4). WASHED: pale pink (w) siltstone to claystone and silicified equivalents, some potch opal, very little sand - as above.

Hole: GC108

Location: 363955E, 6693144N

Site: similar to GC107 but flat and with a lot more of calcrete clasts. Gibber forms an armoured surface.

Vegetation: shrubland.

Soil: loam, moderate reddish brown (w) (2.5YR4/5)

Calcrete: thin platey forms on massive silcrete at 25-30 cm.

GC108A	0-1 m	UNWASHED: pale brown (d) sand and rock fragments, creamy calcrete and grey silcrete fragments, very strong carbonate acid reaction; texture - sand and rock fragments, light brown (w) (7.5YR 6/6). WASHED: fragments of brownish pink calcrete, cream - grey silcrete (silicified sandstone), cream - yellow and grey potch opal, some Fe staining and some small quartz grains.
GC108B	1-2 m	UNWASHED: pale brown (d) sand and rock fragments, creamy calcrete fragments, strong carbonate acid reaction; texture - sand and rock fragments, light brown (w) (7.5YR 6/5). WASHED: fragments of buff - cream silcrete, porcelanite and potch opal - with Mn oxide flecks and dendrites on and near fractures, brown Fe staining present.
GC108C	2-3 m	UNWASHED: pale pinky gray (d), sand and rock fragments - pale claystone, mild carbonate acid response; texture - sand and rock fragments, pale yellowish pink (w) (7.5YR 8/3). WASHED: as per 1-2 m plus pink potch opal and porcelanite, rounded grey quartz grains - fluvial.
GC108D	3-4 m	UNWASHED: buff-gray (d) clay, with claystone fragments - pale, very weak carbonate acid response; texture - sticky light - medium clay, brownish pink (w) (7.5YR 8/2). WASHED: only a small quantity of grainy material, pink - purple claystone and porcelanite, some clear gypsum cleavage fragments (2-4 mm), some silcrete and potch fragments and Fe stained equivalents.
GC108E	4-5 m	UNWASHED: off-white (d) clay with claystone fragments, no carbonate acid response; texture - sticky medium clay, yellowish gray (w) (10YR 8/1). WASHED: fragments of pale grey incipiently silicified claystone.
GC108F	5-6 m	UNWASHED: very pale gray (d) stocky medium claystone as above, no carbonate acid response; texture - sticky light clay, light gray (w) (N 8/-). WASHED: as per 4-5 m plus some 4-6 mm sized quartzite fragments/granules.

Hole: GC109

Location: 363913E, 6693167N

Site: as per 108

Vegetation: shrubland.

Soil: loam, moderate reddish brown (w) (2.5YR4/5)

Calcrete: thin platey and nodular forms on massive silcrete at 25-30 cm.

GC109A	0-1 m	UNWASHED: pale brown (d) sand and rock fragments, creamy calcrete fragments (grey), very strong carbonate acid response; texture - sand and rock fragments, light brown (w) (5YR 6/6). WASHED: calcrete fragments - pale brown to pink and silcrete - pale grey and yellowish to brown Fe stained forms - each containing rounded to angular quartz sand grains.
GC109B	1-2 m	UNWASHED: as above, less large calcrete fragments, very strong carbonate acid response; texture - rock fragments, light brown (w) (7.5YR 6/4). WASHED: fragments of pale greenish grey silcrete - fine-grained with micro vugs and pores with bright red Fe oxide linings, some Mn oxide coatings on occasional fragments, no visible carbonate fragments.
GC109C	2-3 m	UNWASHED: pale pink (d) clay with small rock fragments, no carbonate acid response; texture - sandy light clay (sticky) and rock fragments, brownish pink (w) (7.5YR 7/3). WASHED: 70% as per 1-2 m plus fragments of pink siltstone—claystone.
GC109D	3-4 m	UNWASHED: very pale buff-grey (d) sandy clay, as above, no carbonate acid response; texture - sandy light clay (sticky), brownish pink (w) (7.5YR 7/2). WASHED: small amount of grainy matter - mostly pinkish porcelanite and potch - conchoidal fracture, some pinkish claystone fragments.
GC109E	4-5 m	UNWASHED: very pale grey (d) clay and rock fragments, no carbonate acid response; texture - light clay (sticky) and rock fragments, light gray (w) (N 8/-). WASHED: few fragments of pale pinkish grey claystone.
GC109F	5-6 m	UNWASHED: as above (4-5m), grayish yellowish brown (w) (10YR 5/2). WASHED: few fragments of very pale grey claystone.

Hole: GC110

Location: 363862E, 6693215N

Site: flat as per 108 and 109, some silcrete gibber clasts are lichen covered - ? stable site to erosion.

Vegetation: shrubland.

Soil: loamy clay, light brown (w) (5YR 5/5).

Calcrete: platy and massive calcrete at ~15 cm on greenish grey silcrete at ~50 cm.

GC110A	0-1 m	UNWASHED: pale brown (d) clayey sand with many creamy calcrete fragments and some silcrete (grey) fragments, strong carbonate acid response; texture - sand and rock fragments, light brown (w) (5YR 6/6). WASHED: fragments of brownish pink calcrete, cream silcrete - both with brown Fe staining and coatings, potch opal (dark brown, yellow, grey, bluish white) some porcelanite, subrounded clear to grey quartz grains - fluvial, some rare black Fe oxide grains (<1 mm).
GC110B	1-2 m	UNWASHED: pale pink - grey (d) clayey silt - sand, with calcrete fragments, strong carbonate acid response; texture - sand and rock fragments, light yellowish brown (w) (7.5YR 7/4). WASHED: fragments of buff - grey silcrete with yellow and brown Fe staining along fractures, quartz - clear, milky to grey angular grains and some dark grey rounded grains - fluvial, some potch opal (red, pink and grey).
GC110C	2-3 m	UNWASHED: pale yellow - buff (d) sandy clay and rock fragments, very weak carbonate acid response; texture - sandy light medium clay (sticky) and rock fragments, light yellowish brown (w) (7.5YR 7/5). WASHED: very little grainy matter, mostly silcrete fragments, quartz - milky to grey as rounded to subrounded grains - fluvial.
GC110D	3-4 m	UNWASHED: pale buff - cream (d) clay, no carbonate acid response, large lumps display a pale grey brown clay with wisps of white clay and possibly fine lamellae; texture - light clay (very sticky), brownish pink (w) (7.5YR 7/3). WASHED: only a few fragments of pale grey porcelanite and potch opal, rare quartz grains with black inclusions, rare brown quartz grains.
GC110E	4-5 m	UNWASHED: very pale grey (d) sticky clay with claystone fragments, no carbonate acid response; texture - gritty light clay (very sticky), brownish pink (w) (7.5YR 7.5/3). WASHED: as per 3-4 m with rare black Fe oxide grains (<1 mm).
GC110F	5-6 m	UNWASHED: very pale creamy grey (d) sticky medium clay and small claystone fragments, no carbonate acid response; texture - gritty light clay (very sticky), pale orange yellow (w) (10YR 8/4). WASHED: as per 4-5 m with only a few fragments of pink - purple claystone.

Hole: GC111 Location: 363823E, 6693210N Site: flat as per 108 and 109, some silcrete gibber clasts are lichen covered - ? stable site to erosion. Vegetation: shrubland. Soil: loamy clay, moderate reddish brown (w) (10R 4/5) Calcrete: platy on massive calcrete at ~20 cm		
GC111A	0-1 m	UNWASHED: pale brown (d) sandy with gravelly calcrete fragments (pink - creamy) strong carbonate acid response, grey silcrete fragments also common; texture - sand and rock fragments, light brown (w) (5YR 5/6). WASHED: calcrete fragments (~20%) - pinkish - brownish - creamy, silcrete (~50%) - red and greenish with spotty Fe staining, creamy and greyish potch opal (~30%) with Mn oxide inclusions as 3 dimensional dendrites and surface coatings.
GC111B	1-2 m	UNWASHED: pink (d) silty sand with fine calcrete gravel fragments, strong carbonate acid response; texture - rock fragments, light brown (w) (5YR 6/5). WASHED: silcrete as above (~30%), potch opal (~60%), calcrete as coatings on rock chips (~20%).
GC111C	2-3 m	UNWASHED: pale pink (d) sandy - gritty clay, weak carbonate acid response, small claystone fragments; texture - rock fragments, light grayish brown (w) (5YR 6/3). WASHED: smaller quantity of grainy matter, silcrete and potch as above (~20% of sample), rounded quartz - medium to coarse grained - grey, clear, milky and bluish - all fluvial, partly cemented by silicified kaolinitic matter, yellow and brown Fe oxide flakes and grains (2-5%).
GC111D	3-4 m	UNWASHED: pale grey (d) clay with claystone fragments, no carbonate acid response; texture - sandy clay loam, light gray (w) (N 8/-). WASHED: quartz sand (fine- medium-grained) and quartz granules—gravel (to 5 mm) - grey, milky and bluish angular to well rounded (especially the granules) - fluvial.
GC111E	4-5 m	UNWASHED: as per 3-4m; texture - clayey sand, yellowish gray (w) (10YR 8/1). WASHED: as per 3-4 m with 5-10% yellow-brown Fe oxide grains (medium sand size).
GC111F	5-6 m	UNWASHED: pink (d) clay with many small claystone fragments, no carbonate acid response; texture - sandy light clay and rock fragments, light grayish reddish brown (w) (5YR 6/4). WASHED: silicified sand fragments and sand as per 4-5 m, yellowish brown ferruginous sandstone plates of mm to sub-cm size, sand in the sandstone is dominantly milky with some kaolinitic relict feldspar grains.

Hole: GC112 Location: 363781E, 6693237N Site: as per 111. Vegetation: shrubland. Soil: clayey sand, moderate reddish brown (w) (2.5YR 4/5). Calcrete: nodular to platy on massive, ~25 cm.		
GC112A	0-1 m	UNWASHED: pale brown (d) clayey sand, calcrete and silcrete fragments, strong carbonate acid response; texture - clayey sand and rock fragments, light brown (w) (7.5YR 5/5). WASHED: rock chips - calcrete, silcrete and Fe stained silcrete, lithics - Fe stained sandstone, bluish quartz fragments, near black Fe oxide grains/fragments.
GC112B	1-2 m	UNWASHED: pale pink - brown (d) silt and rock chips, fine calcrete fragments, strong carbonate acid response; texture - fines and rock fragments, light brown (w) (7.5YR 5/4). WASHED: similar to above with cream to buff silcrete - some of which has Mn oxide grains to dendrites along fractures, Fe staining of fractures.
GC112C	2-3 m	UNWASHED: pale cream (d) clay with claystone fragments, very weak carbonate acid response; texture - gritty light clay (sticky), brownish pink (w) (7.5YR 8/2). WASHED: very little fragmentary matter, brown and cream silcrete, sand and gravel sized bluish quartz fragments
GC112D	3-4 m	UNWASHED: cream (d) clay and claystone fragments, no carbonate acid response; texture - light clay (sticky), yellowish gray (w) (10YR 8/1). WASHED: very little grainy matter, creamy to white porcelanite and potch opal, fine to medium grains of bluish quartz.
GC112E	4-5 m	UNWASHED: off-white (d) sticky medium clay with claystone fragments, no carbonate acid response; texture - light clay, yellowish gray (w) (10YR 8/1). WASHED: as per 3-4 m, less porcelanite and sand sized grains.
GC112F	5-6 m	UNWASHED: pale yellow - cream (d) medium clay and lumps of pale yellow brown clay containing white wisps, no carbonate acid response; texture - gritty light clay (sticky), light yellowish brown (w) (10YR 7/4). WASHED: very little grainy matter, mostly bluish to grey sand sized quartz - angular fragments - some with adhering kaolinite, some Fe stained grains and brown FeOH grains.

Hole: GC113

Location: 363753E, 6693275N

Site: as per 111.

Vegetation: shrubland.

Soil: clayey sand, strong brown (w) (2.5YR 4/6).

Calcrete: plates on massive calcrete at ~25 cm.

GC113A	0-1 m	UNWASHED: pale brown (d) sandy, silcrete and calcrete fragments, cream - white calcrete, strong carbonate acid response; texture - sand and rock fragments, brownish orange (w) (5YR 5/7). WASHED: cream - brown calcrete ~20%, reddish to greenish grey and cream silcrete (pedogenic form), pink porcelanite and potch opal, and silcrete-porcelanite-potch as fragments of micro breccia (silcretes total ~65%), some black to dark brown ferruginous nodules, angular quartz fragments - white to grey and zoned, quartz sand grains - grey to bluish and some white rounded to subrounded fluvial forms (loose sands ~15%).
GC113B	1-2 m	UNWASHED: as above; texture - rock fragments, strong brown (w) (7.5YR 5/7). WASHED: as above.
GC113C	2-3 m	UNWASHED: brown (d) clayey silt to sandy clay, strong carbonate acid response. Many calcrete nodules; texture - rock fragments, light brown (w) (7.5YR 6/5). WASHED: as above plus rounded fluvial quartz grains still present - grey and bluish, gypsum - clear cleavage fragments, yellow-brown Fe stained and fracture-coated silcrete, fragments of silicified saprolite with angular quartz grains containing some inclusions of chlorite and black mineral micro grains..
GC113D	3-4 m	UNWASHED: pink - brown (d) clay with white (d) claystone fragments, no carbonate acid response; texture - light clay (sticky), light brown (w) (7.5YR 6/4). WASHED: smaller quantity of particulates, white-grey-greenish porcelanite, yellow Fe stained psammite, quartz sand - fine to medium-grained, grey and bluish quartz granules—fragments, some kaolinite grains (saprolitic material).
GC113E	4-5 m	UNWASHED: yellow brown (d) clay, no carbonate acid response; texture - light clay (sticky), dark orange yellow (w) (7.5YR 6/7). WASHED: less particulates, greyish quartz grit - fine to coarse-grained, white kaolinite grains (saprolitic material).
GC113F	5-6 m	UNWASHED: bright yellow (d) clay, no carbonate acid response; texture - light clay (sticky), light yellowish brown (w) (7.5YR 7/6). WASHED: as per 4-5 m plus yellowish and dark brown ferruginous psammite relicts (saprolitic material).

Hole: GC114

Location: 363719E, 6693312N

Site: as per 109 - 113.

Vegetation: shrubland.

Soil: sandy loam, light reddish brown (w) (2.5YR 4/5).

Calcrete: massive plates on massive calcrete at ~25 cm.

GC114A	0-1 m	UNWASHED: pinkish brown (d) sandy, calcrete fragments, strong carbonate acid response; texture - sand and some rock fragments, brownish orange (w) (5YR 5/8). WASHED: rock chips - mostly brownish calcrete and some cream calcrete and calcreted silcrete, some cream potch opal, quartz - grey sand and rounded 1-2 mm grains - alluvial.
GC114B	1-2 m	UNWASHED: pale pink - brown (d) sandy clay with small calcrete fragments, strong carbonate acid response; texture - gritty clay and rock fragments, strong yellowish brown (w) (7.5YR 5.5/7). WASHED: reddish and cream silcrete, cream potch opal, quartz - bluish and grey angular fragments to 4 mm, Mn oxide dendrites and inclusions in creamy silcrete, some quartz grains with included white clay (? sericite or kaolin), small fragments of greenish silica (~1 mm).
GC114C	2-3 m	UNWASHED: cream (d) clay, moderate to weak carbonate acid response; texture - light clay (very sticky), light yellowish brown (w) (10YR 7/5). WASHED: very little grainy matter, rare large fragments of brown silcrete, many white porcelanite and kaolinite fragments ~1 mm, bluish quartz grains (<1 to 3 mm) common.
GC114D	3-4 m	UNWASHED: yellow (d) clay, no carbonate acid response; texture - light clay (very sticky), moderate orange yellow (w) (7.5YR 7/7) WASHED: very little grainy matter, mostly yellow claystone with some bluish white to grey quartz fragments (<20%, <1 to 3 mm).
GC114E	4-5 m	UNWASHED: dark yellow (d) clay, no carbonate acid response; texture - light clay (sticky), strong yellowish brown (w) (10YR 5.5/8) WASHED: as per 3-4 m with abundant fine grained kaolinite fragments.
GC114F	5-6 m	UNWASHED: yellow (d) clay, slight carbonate acid response; texture - medium clay, dark orange yellow (w) (10YR 6/8) WASHED: extremely little grainy matter, mostly sand sized kaolinite fragments.

Hole: GC115

Location: 363687E, 6693346N

Site: flat, poorly vegetated clayey sand with light silcrete fragments - small gibber cover just E. of tree covered sand dune area.

Vegetation: shrubland.

Soil: clay loam, strong brown (w) (2.5YR 4/7).

Calcrete: nodular to platy to massive, at ~20-30 cm.

GC115A	0-1 m	UNWASHED: pinky brown (d) clayey sand with calcrete and some silcrete fragments, strong carbonate acid response; texture - sand and rock fragments, brownish orange (w) (5YR 5/8). WASHED: pale brown - creamy calcrete fragments, reddish - greyish - greenish silcrete, dark brown silcrete - micro vughy, some pale yellowish silcrete.
GC115B	1-2 m	UNWASHED: pale pinky brown (d) as above; texture - rock fragments, brownish orange (w) (5YR 5/8). WASHED: fragments of brown calcrete and calcrete coatings on silcrete, reddish and pale greenish grey silcrete, pale creamy and yellowish porcelanite and potch opal with Mn oxide dendrites in some fragments, grey and bluish quartz grains - rounded to angular (fluvial origin).
GC115C	2-3 m	UNWASHED: very pale grey (d) clayey silt with some rare siltstone fragments, weak carbonate acid response; texture - clay loam and rock fragments, light yellowish brown (w) (7.5YR 7/4). WASHED: some reddish silcrete as above, mostly creamy silicified saprolite with contained angular quartz - both bluish and greyish, larger (mm - cm sized) bluish quartz fragments, fragments of silicified kaolinite with entrapped black grains (**XRD shows these to be graphite**), clear gypsum cleavage fragments (~3%). Dominantly saprolitic material.
GC115D	3-4 m	UNWASHED: very pale grey with pink cast (d), clay, greasy, no carbonate acid response; texture - light clay, yellowish gray (w) (10YR 8/2). WASHED: very little grainy matter, of this 75% is quartz grit (fine-medium) - clear, grey and bluish, and ~15% as larger bluish quartz angular fragments, gypsum as clear cleavage fragments (<0.5 mm), trace of black mineral grains (<0.01 mm), 5% kaolinite grains - fine to medium sand sizes, dominantly saprolitic gruss.
GC115E	4-5 m	UNWASHED: very pale creamy grey (d), clay, no carbonate acid response; texture - light clay, yellowish gray (w) (10YR 8/1). WASHED: as per 3-4 m with ~1-2% yellowish brown Fe stained grains.
GC115F	5-6 m	UNWASHED: pale yellow (d) clay, greasy, small claystone fragments, no carbonate acid response; texture - light clay, light yellowish brown (w) (10YR 7/4). WASHED: as per 4-5 m with ~5-7% Fe stained claystone and psammite, saprolitic.

Hole: GC116

Location: 363657E, 6693390N

Site: as per 115.

Vegetation: shrubland just east of Acacia-dominated open woodland.

Soil: clayey sand, strong brown (w) (2.5YR 4/6).

Calcrete: nodular to platy to massive, at ~20-30 cm.

GC116A	0-1 m	UNWASHED: pinky brown (d) calcrete rich sand and rock fragments, strong carbonate acid response; texture - sand and rock fragments, brownish orange (w) (5YR 5/8). WASHED: brownish calcrete, calcrete coated reddish and pale grey to cream silcrete, creamy kaolinitic silcrete and white kaolinite, rare rounded bluish quartz medium to coarse sand grains.
GC116B	1-2 m	UNWASHED: pale pinky brown (d) as above; texture - rock fragments and fines, deep orange (w) (5YR 4.5/8). WASHED: silcrete as above plus silicified saprolite - creamy-white-grey-blotchy, some is Fe stained yellow, angular fragments of bluish and grey quartz, yellow and white porcelanite, and some kaolinitic hyaline opal flakes and fragments.
GC116C	2-3 m	UNWASHED: creamy yellow (d) rock fragments and fines, mild carbonate acid response; texture - rock fragments and fines, light yellowish brown (w) (10YR 7/5). WASHED: as per 1-2 m, large chips of bluish quartz (5-10 mm), some fragments of translucent hyaline opaline silica as flakes, blebs and veins.
GC116D	3-4 m	UNWASHED: bright pale yellow (d) greasy clay, gritty. Pale grey (d) siltstone and claystone fragments, weak carbonate acid response; texture - gritty light clay, light yellowish brown (w) (10YR 7/5). WASHED: much less particulates, small fragments of silicified saprolite as above, also yellow Fe stained equivalents.
GC116E	4-5 m	UNWASHED: pale yellow to yellow (d) light clay, claystone fragments common, no carbonate acid response; texture - gritty light clay, light yellowish brown (w) (10YR 7/6). WASHED: small amount of particulates, ~50:50 mix of quartz grit and grains of Fe stained saprolite-claystone-porcelanitic saprolite-psammite, quartz is white - grey - bluish - colourless-clear, angular fine to coarse grit.
GC116F	5-6 m	UNWASHED: pale yellow (d) light clay, small claystone fragments, no carbonate acid response; texture - gritty light clay, light yellowish brown and light gray (w) (10YR 7/5) and (N 8/-). WASHED: small amount of particulates, mostly fine- medium-grained grit with ~10-15% as larger gravel sized fragments of silicified saprolite and bluish quartz, some kaolinite grains of 1-2 mm size.

Hole: GC117

Location: 363625E, 6693428N

Site: on E. flank of a low reddish sand dune, no silcrete or exotic gibber, rare calcrete fragments on sand.

Vegetation: Acacia-dominated-open woodland.

Soil: clayey sand, moderate reddish brown (w) (2.5YR 4/4).

Calcrete: nodular and platy, at ~20-30 cm.

GC117A	0-1 m	UNWASHED: pale red brown (d) sand and rock fragments, calcrete, very strong carbonate acid response; texture - sand and rock fragments, strong brown (w) (5YR 4/7). WASHED: mostly calcrete - pale brown to reddish, calcreted silcrete, silcrete - pale yellow-brown to red forms, porcelanitic and potch opal varieties - pale yellow, cream and greyish, quartz fragments (~2 mm) - greyish-white and black Mn oxide stained.
GC117B	1-2 m	UNWASHED: dark red brown (d) fragmented calcrete nodules and fines, strong carbonate acid response; texture - rock fragments and fines, strong brown (w) (5YR 4/8). WASHED: mostly reddish silcrete with calcrete coatings and fracture in-fill, some yellow-cream and grey silcrete, very little free quartz.
GC117C	2-3 m	UNWASHED: pale pinky brown (d) silty sand with calcrete nodules, strong carbonate acid response; texture - clayey sand and rock fragments, brownish orange (w) (5YR 5/8). WASHED: large (cm sized) fragments of silicified sandy clay saprolite - cream and yellow, some have 3 dimensional Mn oxide dendrites within, silcrete as above, angular quartz fragments - fine to coarse grit.
GC117D	3-4 m	UNWASHED: dark cream (d) clay and rock chips (greasy), few small white (d) claystone fragments, very weak carbonate acid response; texture - light clay, light yellowish brown (w) (10YR 7/4). WASHED: less particulate matter than above, mostly silicified kaolinitic saprolite - yellow and creamy, some angular quartz fragments - bluish and grey (<1 to 3 mm)
GC117E	4-5 m	UNWASHED: pale pinky yellow (d) clay with angular quartzite fragments 1-4 mm, no carbonate acid response; texture - silty light clay, light yellowish brown (w) (10YR 7/4). WASHED: small quantity of particulates, mostly grey quartz grit - fine to medium grained, fine to medium gravel sized angular bluish and grey quartz (~7%), silicified clay and quartz grit saprolite - white and cream, some yellow kaolinite grains and fragments.
GC117F	5-6 m	UNWASHED: pale orange (d) clay with rare grit, no carbonate acid response; texture - silty medium clay, light yellowish brown (w) (10YR 7/4). WASHED: as per 4-5 m, with some rare black grains (<0.1 mm) and dark brown Fe oxide flakes and grains.

Hole: GC118

Location: 363592E, 6693465N

Site: as per 117 with more calcrete cobbles at surface.

Vegetation: Acacia-dominated open woodland.

Soil: sand to clayey sand, moderate reddish brown (w) (2.5YR 4/4).

Calcrete: nodular, nodule aggregates, laminated platy, at ~20-30 cm.

GC118A	0-1 m	UNWASHED: dark pink (d) clayey sand, fragments of calcrete nodules, strong carbonate acid response; texture - clayey sand and rock fragments, light brown (w) (5YR 5/6). WASHED: pale brown calcrete, calcreted silcrete, silcrete - reddish, yellow and cream porcelanite - both containing large angular bluish quartz fragments (1-4 mm) (?silcreted saprolite), some grains and fragments of dark Fe oxides (<1 to 2 mm), reddish stained quartz sand (fine-medium-grained) - frosted rounded grains (aeolian) ~25% of sample.
GC118B	1-2 m	UNWASHED: dark yellow brown (d) silty sand with calcrete nodules and fragments, strong carbonate acid response; texture - rock fragments and fines, strong brown (w) (7.5YR 5/7). WASHED: calcrete coated silcrete, silcrete - reddish and greyish, silcrete containing yellow and cream porcelanite and potch opal, quartz grit and fragments as above but more common, dark brown and black granules of Fe oxides - subrounded to angular, relict fragments of weathered felsic granoblastic basement rock - kaolinitic saprolite.
GC118C	2-3 m	UNWASHED: deep yellow (d) fines with angular claystone fragments, moderate carbonate acid response; texture - rock fragments and fines, strong yellowish brown (w) (10YR 5/8). WASHED: silcrete and porcelanite as above plus minor gypsum cleavage fragments stained by yellow clay, yellow - cream kaolinitic gritty saprolite, black ?Fe oxide grains and fragments (1-3%), bluish, grey and milky quartz fragments and grit.
GC118D	3-4 m	UNWASHED: pale yellow brown (d) gritty loam, gritty quartz 1-3 mm, weak-moderate carbonate acid response; texture - clayey sand and rock fragments, light yellowish brown (w) (7.5YR 7/6). WASHED: as per 2-3 m, cream potch opal - some with 3 dimensional Mn oxide dendritic inclusions, some quartz fragments with chlorite and black mineral inclusions, saprolitic fragments, rare grains of a pale green mineral (?smectite).
GC118E	4-5 m	UNWASHED: yellow brown (d) loamy, angular quartz grit 1-3 mm, weak carbonate acid response; texture - clayey sand and rock fragments, dark orange yellow (w) (7.5YR 6.5/7). WASHED: as per 3-4 m, more greyish quartz, some purplish to reddish pink silcrete and porcelanite.
GC118F	5-6 m	UNWASHED: dark pink (d) clayey silt-sand, small siltstone fragments, no carbonate acid response; texture - clayey sand, light brown (w) (7.5YR 6/6). WASHED: abundant grey and bluish grit and fragments (0.1-4 mm), red and yellowish Fe claystone and saprolite - cm sized fragments of kaolinitic relict granoblastic basement rock.

Hole: GC119

Location: 363559E, 6693501N

Site: as per 118.

Vegetation: Acacia-dominated open woodland.

Soil: sand, moderate reddish brown (w) (2.5YR 4/4).

Calcrete: nodular and platy, at ~30 cm.

GC119A	0-1 m	UNWASHED: brown (d) sandy, ubiquitous calcrete fragments - pale pink - white (d) strong carbonate acid response; texture - sand and rock fragments, light brown (w) (5YR 6/6). WASHED: brownish calcrete is dominant with calcreted silcrete, reddish and grey silcrete, yellow to cream potch opal and porcelanite fragments - some with Mn oxide dendrite inclusions, quartz grit and fragments - white and grey - some with yellow and brown Fe staining and black Fe oxide grains.
GC119B	1-2 m	UNWASHED: yellow brown (d) rock chips and fines, as above; texture - rock fragments and fines, light brown (w) (5YR 5/6). WASHED: reddish and greyish silcrete, pink-yellow-cream-white porcelanite and potch opal, silicified kaolinitic grit, quartz fragments - grey and milky, relict weathered basement rock with granoblastic textures - saprolitic.
GC119C	2-3 m	UNWASHED: pale pink - pink brown (d) loamy, calcrete fragments and grit, moderate carbonate acid response; texture - clayey sand and rock fragments, pale yellowish pink (w) (5YR 8/3). WASHED: fragments of creamy to white kaolinitic gneiss and granoblastic basement rock relicts with Mn oxide dendrites on fracture surfaces, some degree of silicification present, some brownish and pinkish silcrete fragments, quartz grit as above, quartz fragments with Mn oxide coatings and dendrites, some quartz grit with yellow and pink Fe staining.
GC119D	3-4 m	UNWASHED: off white (d) silty clay, some grit, mild carbonate acid response; texture - silty clay, yellowish gray (w) (10YR 8/2). WASHED: much less fragmentary matter than above, kaolinite grains and fragments, kaolinitic gneiss relicts to 15 mm, quartz fine-medium grit - grey and milky.
GC119E	4-5 m	UNWASHED: off white (d) clay, weak carbonate acid response; texture - light clay, pale yellowish pink (w) (5YR 8/2). WASHED: very little grainy matter, mostly quartz grit - fine-medium and some coarse fragments.
GC119F	5-6 m	UNWASHED: off white (d) clay, no carbonate acid response; texture - silty light clay, pale yellowish pink (w) (5YR 8/2). WASHED: as per 4-5 m with fragments 2-3 mm of relict gneiss - kaolinitic and quartz rich.

Hole: GC120

Location: 363521E, 6693542N

Site: W. side of dune and lower eastern flank of *Mt Challenger*. Gibber and sandy lithosol.

Vegetation: shrubland.

Soil: sand, moderate reddish brown (w) (2.5YR 4/5).

Calcrete: nodules and aggregates in sand at ~15 cm, platy to massive below sand at ~30 cm.

GC120A	0-1 m	UNWASHED: pale brown (d) clayey sand, calcrete nodules and fragments, strong carbonate acid response; texture - clayey sand and rock fragments, light brown (w) (5YR 5/6). WASHED: pale and dark brown and pink calcrete with included aeolian reddish stained quartz sand, reddish-greyish silcrete and calcreted equivalents, yellowish cream and grey potch opal fragments, angular grit - grey and milky quartz and yellowish cream kaolinite. Saprolitic.
GC120B	1-2 m	UNWASHED: pink - brown (d) as above; texture - rock fragments and fines, strong brown (w) (5YR 4/8). UNWASHED: as above with near white kaolinitic relict gneiss fragments, silicified equivalents - quite reddish to dark pink. Saprolitic.
GC120C	2-3 m	UNWASHED: pink (d) clay, gritty, ferruginous stained quartz fragments 2-5 mm, moderate carbonate acid response; texture - gritty light clay and some rock fragments, light grayish reddish brown (w) (5YR 6/4). WASHED: much less grainy matter, some silcrete - pink, reddish, yellowish, kaolinitic relict gneiss fragments, kaolinite grains, quartz grit (fine-coarse) - bluish and grey and some fragments 2-3 mm, some fragments of a pale greenish mineral (?smectite). Saprolitic.
GC120D	3-4 m	UNWASHED: buff - cream (d) light clay, moderate carbonate acid response; texture - light clay, light grayish yellowish brown (w) (10YR 7/3). WASHED: very little grainy matter, mostly grey and bluish quartz grit and a few 1-4 mm fragments of kaolinitic relict gneiss, rare yellow Fe stained claystone. Saprolitic.
GC120E	4-5 m	UNWASHED: buff - very pale brown (d) clay, no carbonate acid response; texture - light clay, light grayish yellowish brown (w) (10YR 7/3). WASHED: very little grainy matter, mostly quartz grit (fine-medium) - bluish, grey and milky, some quartz fragments are strongly zoned bluish to grey to clear, some kaolinite grains, more yellow Fe stained claystone and quartz grains. Saprolitic.
GC120F	5-6 m	UNWASHED: very pale brown - buff (d) slightly sandy clay, no carbonate acid response; texture - silty light clay, light grayish yellowish brown (w) (10YR 7/3). WASHED: extremely little grainy matter, composition as per 4-5 m, few larger saprolitic relict gneiss fragments, dark bluish quartz - zoned with chlorite inclusions forming a streaky fabric - foliation. Saprolitic.

Hole: GC121

Location: 363490E, 6693580N

Site: Lower eastern flank of *Mt Challenger*, flat sandy site with scattered small gibber of exotics, silcrete and quartz. Gravel - pebbles, reddish sand.

Vegetation: shrubland.

Soil: sandy loam, light brown (w) (5YR 6/6).

Calcrete: massive to laminar, at ~15-20 cm.

GC121A	0-1 m	UNWASHED: dark pink (d) sand, calcrete plate fragments, strong carbonate acid reaction; texture - sand and rock fragments, strong brown (w) (7.5YR 4/6). WASHED: creamy grey and brown platy calcrete fragments enclosing grey-milky-bluish angular quartz fragments with chlorite inclusions, reddish and grey silcrete enclosing white quartz grains, loose quartz grains - angular to subrounded - similar to the cemented grains, rare rounded black Fe oxide granules. Saprolitic.
GC121B	1-2 m	UNWASHED: yellow (d) sand and rock fragments, many calcrete fragments, strong carbonate acid reaction; texture - rock fragments and fines, light brown (w) (7.5YR 5/6). WASHED: as above, with no Fe granules, more quartz fragments - clear and grey.
GC121C	2-3 m	UNWASHED: strong yellow (d) rock chips and fines, many grey shale and quartzite fragments with ferruginous nodules, no carbonate acid reaction; texture - rock fragments and fines, strong yellowish brown (w) (10YR 5/8). WASHED: yellow-brown to brown calcrete fragments (5%), yellowish brown - yellowish grey silcrete fragments (~60%), conspicuous angular quartz fragments and grains (1-5 mm) - grey-clear-milky and mostly bluish - some to 10 mm, some quartz with black equant grain inclusions <0.1 mm (?magnetite or ilmenite). Saprolitic.
GC121D	3-4 m	UNWASHED: pale yellow (d) clay with some fragments of yellow and cream shale siltstone, weak carbonate acid reaction; texture - gritty light clay, light yellowish brown (w) (10YR 6/6). WASHED: small quantity of grainy matter, small (<2 mm) fragments of silcrete as per 2-3 m, abundant quartz - angular fragments - cream-milky-grey-bluish, bluish quartz with black equant grain inclusions <0.1 mm (?magnetite or ilmenite), kaolinite grains and fragments. Saprolitic.
GC121E	4-5 m	UNWASHED: yellow (d) clay, small shale and quartz fragments, no carbonate acid reaction; texture - gritty light clay, moderate orange yellow (w) (7.5YR 6.5/8). WASHED: quartz sand (fine-coarse) as above, mostly sub-mm grit, bluish quartz fragments 1-3 mm. Saprolitic.
GC121F	5-6 m	UNWASHED: yellow (d) clay, yellow, grey and white shale fragments and thin quartz vein fragments, no carbonate acid reaction; texture - light clay, dark orange yellow (w) (10YR 6/8). WASHED: as per 4-5 m, with higher % of coarse bluish grit, ~30% of washed sample is yellowish Fe stained psammite and claystone. Saprolitic.

Hole: GC122

Location: 363452E, 6693628N

Site: flat sandy (red) to gravelly area - minimal blue bush. East flank of *Mt Challenger*. Gravel is multi-lithotype, angular - rounded.

Vegetation: shrubland (sparse)

Soil: loam, grayish reddish orange (w) (2.5YR 4.5/5).

Calcrete: platy to massive, at ~20-30 cm.

GC122A	0-1 m	UNWASHED: pale pinkish grey (d) sand, rock chips and fines, ubiquitous calcrete fragments, very strong carbonate acid reaction; texture - sand and rock fragments, light brown (w) (7.5YR 6/4). WASHED: calcrete (25%) - pale-medium yellowish brown and bright reddish, silcrete (with calcrete coatings) - pale yellowish-grey-pale brown enclosing bluish quartz fragments and grains, pastel coloured hyaline silica (~50%), bluish-grey quartz fragments 1-4 mm (~20%), minor organic material and charcoal, fine quartz sand ~5%. Saprolitic.
GC122B	1-2 m	UNWASHED: as above - white (d); texture - rock fragments and fines, brownish pink (w) (7.5YR 7/2). WASHED: less calcrete and silcrete than above, some brown silcrete fragments, ~30% silicified kaolinitic relict gneiss fragments up to 14 mm, quartz fragments - mostly gray or milky (5-8 mm), Mn oxide dendrites in porcelanitic hyaline silica. Saprolitic.
GC122C	2-3 m	UNWASHED: off white (d) light clay, white (d) claystone fragments, weak carbonate acid reaction; texture - gritty light clay and rock fragments, yellowish gray (w) (10YR 8/2). WASHED: dominantly quartz fragments (0.1 to 8 mm) - grey and bluish grey, kaolinite fragments, kaolinitic relict fragments of gneiss, rare small grains of Fe oxides. Saprolitic.
GC122D	3-4 m	UNWASHED: very pale grey (d) clay with some medium grit, claystone fragments, no carbonate acid reaction; texture - gritty light clay and rock fragments, light gray (w) (N 8/-). WASHED: 80% fine-coarse quartz grit - clear-milky-grey-bluish with some fragments to 10 mm, 20% kaolinite fragments. Saprolitic.
GC122E	4-5 m	UNWASHED: off white (d) light slightly gritty clay, no carbonate acid reaction); texture - gritty silty light clay, pale yellowish pink (w) (2.5YR 8/2). WASHED: as per 3-4 m with more bluish quartz which contains small black grains and chlorite inclusions, fragments of chloritic-kaolinitic relict gneiss. Saprolite.
GC122F	5-6 m	UNWASHED: off white (d) greasy light clay, with white (d) claystone and weathered shale fragments, no carbonate acid reaction); texture - gritty silty light clay, light gray (w) (N 8/-). WASHED: very little grainy matter, as per 4-5m.

Hole: GC123

Location: 363411E, 6693656N

Site: similar to 122 but near rise of *Mt Challenger*.

Vegetation: shrubland.

Soil: gritty loamy light clay, grayish reddish orange (w) (2.5YR 5/6).

Calcrete: platy to massive, at ~5-10 cm.

GC123A	0-1 m	UNWASHED: yellow brown to yellow grey (d) sand and crushed calcrete, calcrete is white (d), strong carbonate acid reaction; texture - clayey sand and rock fragments, light brown (w) (7.5YR 6.5/4). WASHED: brownish calcrete and calcreted silcrete, silcrete with entrapped bluish quartz fragments, silcrete - silica cement is yellow, brown and cream, hyaline silica in porcelanite and potch opal forms, many fragments of bluish quartz, silicified kaolinite fragments, Mn oxide dendrites in some saprolite and porcelanite fragments. Saprolitic.
GC123B	1-2 m	UNWASHED: yellow (d) clayey with some calcrete fragments, moderate carbonate acid response; texture - clay loam and rock fragments, light yellowish brown (w) (10YR 6/6). WASHED: lithotypes as above, increase to 50% of yellow - yellow-brown silcrete and porcelanite, fragments of chloritic-kaolinitic relict gneiss with Mn oxide dendrites, quartz fragments common -greyish and bluish - some with small black grain inclusions. Saprolite.
GC123C	2-3 m	UNWASHED: yellow (d) light clay and small claystone fragments, no carbonate acid reaction; texture - light clay and rock fragments, light yellowish brown (w) (10YR 6/6). WASHED: dominated by yellow clay saprolite fragments, fragments of pale green mineral/rock (?smectite), some ferruginous flakes and fragments, other components as per 1-2 m.. Saprolite.
GC123D	3-4 m	UNWASHED: yellow (d) clay, as above; texture - light clay, light yellowish brown (w) (10YR 6/6). WASHED: very little grainy matter, mostly fragments (<0.5 mm) of yellow claystone, grey quartz fragments (0.1 to 3 mm), 2% small black grains. Saprolite.
GC123E	4-5 m	UNWASHED: yellow - orange (d) clay with small white to yellow claystone fragments, no carbonate acid reaction; texture - light clay (sticky), strong yellowish brown (w) (10YR 5.5/8). WASHED: as per 3-4 m, with more dark brown Fe fragments and grains (~5%), white kaolinitic relict gneiss fragments (~10%). Saprolite.
GC123F	5-6 m	UNWASHED: yellow - orange (d) clay as above, very weak carbonate acid reaction; texture - light clay, strong yellowish brown (w) (10YR 5.5/8). WASHED: very little grainy matter, composition as above. Saprolitic.

Hole: GC124

Location: 363354E, 6693679N

Site: SE flank of *Mt Challenger* stony area with multi lithotype gibber on reddish sand, sparse blue bush vegetation.

Vegetation: shrubland.

Soil: gritty loam, grayish reddish orange (w) (2.5YR 5/6).

Calcrete: platy to massive, at ~10-15 cm.

GC124A	0-1 m	UNWASHED: pale brown (d) sand and crushed calcrete and quartz fragments, very strong acid reaction white (d) carbonate fragments common, strong calcrete acid reaction; texture - clayey sand (gritty) (w) (5YR 6/6). WASHED: calcrete - pale brown to red, silcrete - grey-cream-red with porcelanitic and hyaline silica fragments - yellowish and grey, cream silicified kaolinitic relict gneiss, quartz - milky to clear and chlorite bearing. Saprolitic.
GC124B	1-2 m	UNWASHED: pale pinky brown (d) as above; texture - rock fragments and fines, light grayish reddish brown (w) (5YR 6/4). WASHED: fragments of calcreted silcrete, silcrete - brownish-greyish-creamy-reddish, some opaline silica and porcelanite - yellow and creamy, silicified kaolinitic relict gneiss fragments - white and cream, Mn oxide dendrites within potch opal, porcelanite and saprolitic fragments, quartz - white-grey-milky-bluish, rare rounded granules of ferruginous minerals. Saprolite.
GC124C	2-3 m	UNWASHED: pale pinkish grey (d) rock chips and fines, with large calcrete fragments, strong carbonate acid reaction; texture - rock fragments and fines, brownish pink (w) (7.5YR 7/3). WASHED: some carbonate coatings and fracture linings of silica rich fragments, silcrete as above, sample mostly creamy kaolinitic relict gneiss and silicified equivalents. Saprolite.
GC124D	3-4 m	UNWASHED: off white (d) clay, small white claystone fragments, no carbonate acid reaction; texture - light clay, yellowish gray (w) (10YR 8/2). WASHED: sharp change - much less grainy matter, dominantly kaolinite and quartz grit - <<1.5 mm, quartz fragments - dark bluish and grey strongly zoned with chlorite and minute black grain inclusions, some dark yellow ferruginous fragments and grains. Saprolite.
GC124E	4-5 m	UNWASHED: very pale brownish grey (d) clay, very small claystone fragments, no carbonate acid reaction; texture - gritty light clay (sticky), yellowish gray (w) (10YR 8/2). WASHED: very little grainy matter, as per 3-4 m, and some fragments of yellow claystone, most fragments fine-medium grit size.
GC124F	5-6 m	UNWASHED: very pale orange grey (d) clay, large and small white (d) claystone fragments, no carbonate acid reaction; texture - light clay (sticky), pale orange yellow (w) (7.5YR 8/4). WASHED: very little grainy matter, 85% is clear and greyish quartz (fine-medium) grit and 5% as coarse grit and granular grit, 10% kaolinite, rare fragment ferruginous /silica 5-6 mm. Saprolite.

Hole: GC125 Location: 363332E, 6693717N Site: S. flank of *Mt Challenger* similar to 124, very stony. Vegetation: shrubland. Soil: gritty loamy clay, strong brown (w) (2.5YR 3/8). Calcrete: nodules over plates over massive, at ~20 cm.		
GC125A	0-1 m	UNWASHED: pinkish (d) sandy, mostly crushed calcrete, vigorous carbonate acid reaction; texture - sand and rock fragments, light grayish reddish brown (w) (5YR 6/4). WASHED: calcrete - pale brown-cream-reddish - also as coatings on silcrete, silcrete - grey-cream-brown, kaolinitic relict gneiss and silicified equivalents, quartz grit - greyish and bluish, Mn oxide dendrites and coatings to siliceous matter. Saprolitic.
GC125B	1-2 m	UNWASHED: yellowish dark pink (d) as above, white (d) calcrete fragments, strong carbonate acid reaction; texture - rock fragments and fines, light brown (w) (5YR 6/5). WASHED: calcrete and silcrete fragments as above, creamy silicified kaolinitic relict gneiss, quartz - greyish and white with chlorite and black mineral grain inclusions. Saprolite.
GC125C	2-3 m	UNWASHED: pinkish brown (d) as above; texture - rock fragments and fines, light brown (w) (7.5YR 6/4). WASHED: fragments of kaolinitic relict gneiss - cream and silicified equivalents, some silcrete as above, occasional gypsum cleavage fragments (2x10 mm), some carbonate coatings and fracture linings, silica cements have some Mn oxide dendrites and coatings. Saprolite.
GC125D	3-4 m	UNWASHED: pale yellow brown (d) clay, small white (d) claystone fragments, no carbonate acid reaction; texture - gritty light clay (sticky), light yellowish brown (w) (7.5YR 7/4). WASHED: sharp change to fewer and finer grains, quartz (white-grey-milky) and kaolinite (yellowish-cream-white) grit, larger bluish quartz - fragments. Saprolite.
GC125E	4-5 m	UNWASHED: yellow orange (d) clay, as above; texture - light clay, light yellowish brown (w) (7.5YR 6.5/5). WASHED: as per 3-4 m, small amount of grainy matter, and yellow claystone, ferruginous grit and fragments - dark yellow and brown (<2 mm). Saprolite.
GC125F	5-6 m	UNWASHED: orange brown (d) clay, pink (d) claystone fragments present and quartz grit, no carbonate acid reaction; texture - light clay, brownish orange (w) (5YR 5.5/7). WASHED: as above but more sample, fragments of highly weathered gneiss with bright red garnets (~0.2 mm) and kaolinitic—sericitic feldspars. most fragments <1.5 mm, dark reddish brown Fe staining on many fragments and grains. Saprolite.

Hole GC126

Location: 363300E, 6693752N

Site - as per 125, SW flank of *Mt Challenger*.

Vegetation: Acacia-dominated open woodland.

Soil: sand, strong brown (w) (2.5YR 4/6).

Calcrete: platy to massive, at ~20-30 cm.

GC126A	0-1 m	UNWASHED: pale yellow brown (d) sand and clay, crushed calcrete and gravel, very strong carbonate acid reaction; texture - sand to sandy clay and rock fragments, light brown (w) (5YR 5/6). WASHED: calcrete - pale brown to reddish - also as coatings to silcrete, orange-stained frosted quartz sand (fine-medium) - aeolian, silcrete - mostly reddish with greenish and pale brown forms, porcelanite and hyaline opal silica - creamy - often with Mn oxide dendrite inclusions or staining and coatings.
GC126B	1-2 m	UNWASHED: pale yellow grey (d) as above; texture - rock fragments and fines, light brown (w) (7.5YR 6/4). WASHED: calcrete and silcrete fragments as above, now mostly creamy and grey, slightly more Mn oxides.
GC126C	2-3 m	UNWASHED: pale yellow pink (d) rock chips and fines, crushed calcrete and yellow (d) claystone fragments, moderate carbonate acid reaction; texture - rock fragments and fines, light brown (w) (7.5YR 6/5). WASHED: mostly silcrete fragments - cream-light brown-reddish-yellow-grey with porcelanite and some hyaline silica blebs and coatings (?cutans), silcrete encloses quartz fragments (fine-coarse grit) - grey and milky, common are white kaolinitic relict gneiss and silicified equivalents, dark brown-black ferruginous grains <0.1 mm, Mn oxide spotting and dendrites present in some fragments. Saprolitic.
GC126D	3-4 m	UNWASHED: pale yellow brown (d) silty clay, gritty - angular quartz, no carbonate acid reaction; texture - gritty light clay and rock fragments, light brown (w) (7.5YR 6/4). WASHED: much less grainy matter, some silcrete as above, kaolinitic relict feldspathic granoblastic rock, kaolinite grains, quartz grains (fine-medium grit) - clear-grey-milky-dark grey (smoky)-bluish and many are chloritic. Saprolite.
GC126E	4-5 m	UNWASHED: very pale pinky grey (d) silty clay as above; texture - gritty light clay, light grayish yellowish brown (w) (10YR 7/3). WASHED: very little grainy matter - most grains <1 mm, composition as per 3-4 m, and black Fe oxide grains <0.1 mm (1-2%). Saprolite.
GC126F	5-6 m	UNWASHED: very pale yellow grey (d) loam, no carbonate acid reaction; texture - silty light clay, pale yellow (w) (2.5Y 8/3). WASHED: as per 4-5 m, and 3% of yellow claystone (? Fe stained). Saprolite.

Hole GC127 Location: 363269E, 6693790N Site: SW side of *Mt Challenger* high, thicker reddish sand spread and larger gibber - multi lithotypes and large angular silcrete blocks 15-30 cm. Vegetation: Acacia-dominated open woodland. Soil: sand, moderate reddish brown (w) (2.5YR 4/5). Calcrete: platy to massive on silcrete, at ~20-50 cm.		
GC127A	0-1 m	UNWASHED: pinkish pale brown (d) sand and crushed calcrete and silcrete, very strong carbonate acid reaction; texture - clayey sand and rock chips, light brown (w) (5YR 5/6). WASHED: orange stained and frosted quartz sand (fine-medium) - aeolian (~15%), calcrete - brown and reddish (~50%), silcrete - grey-greenish-reddish-yellowish-brown, white kaolinitic relict gneiss and silicified equivalents (mostly porcelanitic), quartz - bluish-grey-zoned-milky grains <1 to 3 mm. Saprolitic.
GC127B	1-2 m	UNWASHED: light orange - brown (d) as above; texture - rock fragments and fines, brownish orange (w) (5YR 5/8). WASHED: as above, quartz coarser - both loose and enclosed by silcrete, some Mn oxide dendrites present. Saprolitic.
GC127C	2-3 m	UNWASHED: light orange - brown (d) as above; texture - rock fragments and fines, light brown (w) (5YR 6/6). WASHED: calcreted silcrete and silcrete as above with fragments of potch and hyaline opal silica - pale yellow and yellow, quartz fragments - bluish-grey-milky (1-3 mm) - loose and enclosed by silcrete, Mn oxides as spotting, coatings and dendrites. Saprolitic.
GC127D	3-4 m	UNWASHED: pale brown - grey (d) sandy loam, crushed silcrete and some calcrete, moderate carbonate acid reaction; texture - clayey grit and rock fragments, moderate yellowish pink (w) (5YR 7/4). WASHED: change to white porcelanitic kaolinitic relict gneiss and kaolinite, these contain quartz grains <1 to 1.5 mm - bluish and milky, loose quartz fragments 1-3 mm - bluish-grey-milky. Saprolite.
GC127E	4-5 m	UNWASHED: cream (d) loam with angular clear and white vein quartz fragments and siltstone - kaolinite fragments, no carbonate acid reaction; texture - gritty loam, yellowish gray (w) (10YR 8/1). WASHED: less grainy matter, ~60% kaolinite fragments - white, quartz fragments - greyish-milky-zoned dark grey, some have small inclusions (<0.1 mm) of black minerals with both acicular and prismatic habits - ?rutile, tourmaline and ilmenite (**XRD on black minerals indicated rutile and altered ilmenite - loss of Fe**), small (<0.5 mm) dark flakes of biotite and dark grey ?graphite also present in relict feldspar grains (<0.1%). Saprolite.
GC127F	5-6 m	UNWASHED: cream (d) clay with quartz grit, no carbonate acid reaction; texture - gritty light clay, yellowish gray (w) (10YR 8/2). WASHED: very little grainy matter, as per 4-5 m, with 2-3% yellow Fe stained claystone, some larger milky grey quartz fragments to 8 mm. Saprolite.

Hole GC128

Location: 363243E, 6693831N

Site: W. side of *Mt Challenger* on E. side of low reddish dune with quite a lot of gibber deriving from *Mt Challenger*.

Vegetation: Acacia-dominated open woodland.

Soil: sand, moderate reddish brown (w) (10R 4/5).

Calcrete: nodular aggregates to platy to massive on silcrete, at ~25-50 cm.

GC128A	0-1 m	UNWASHED: light red - brown (d) crushed calcrete (cream - white (d)) and silcrete fragments, sandy and gravelly, strong carbonate acid reaction; texture - sand and rock fragments, brownish orange (w) (5YR 5/7). WASHED: orange stained frosted quartz sand (fine-medium) ~10%, calcrete ~50% - pale and red-brown to reddish and cream, silcrete 30% - greys, browns and reds, some potch opal and porcelanitic forms - all with quartz fragments within - some of these contain black grain inclusions, quartz ~10% - bluish-grey-milky (<1 to 3 mm). Saprolitic.
GC128B	1-2 m	UNWASHED: orange brown (d) as above; texture - rock fragments and fines, brownish orange (w) (5YR 5/7). WASHED: as above.
GC128C	2-3 m	UNWASHED: pale orange (d) as per 1-2 m; texture - rock fragments and fines, light brown (w) (7.5YR 5/6). WASHED: as above, with more silicified kaolinitic relict gneiss, grey and pale brown hyaline silica chips common, Mn oxide as dendrites, coatings and inclusions.
GC128D	3-4 m	UNWASHED: as per 2-3m, moderate carbonate acid response; texture - rock fragments and fines, light brown (w) (7.5YR 6/5). WASHED: as per 2-3 m.
GC128E	4-5 m	UNWASHED: pale yellow brown (d), clayey sand, silicified claystone fragments, moderate carbonate acid reaction; texture - clayey grit, light brown (w) (7.5YR 5.5/5). WASHED: mostly pale coloured and cream silicified kaolinitic relict gneiss, white to cream hyaline silica coatings and chips, quartz as above. Saprolite
GC128F	5-6 m	UNWASHED: pale pink brown (d) sandy loam with claystone fragments as per 4-5 m, moderate to weak acid response; texture - clayey grit, light brown (w) (7.5YR 6/4). WASHED: much less grainy matter, silicified saprolite as above with some pink and yellowish Fe staining and coatings. Saprolite.

Hole: GC129

Location: 363216E, 6693869N

Site: slightly W. sloping site on low reddish sand dune on the W. side of *Mt Challenger*.

Vegetation: Acacia-dominated open woodland.

Soil: sand, moderate reddish brown (w) (10R 4/5).

Calcrete: nodular aggregates to platy to massive on silcrete, at ~20 cm.

GC129A	0-1 m	UNWASHED: pink - pale brown (d) crushed calcrete and reddish sand mix, calcrete is pale yellow (d) and cuttings, strong carbonate acid reaction; texture - sand and rock fragments, brownish orange (w) (5YR 5/7). WASHED: calcrete with complex laminar and micro breccia textures - nodules and massive - pale red-brown to reddish, some orange stained frosted quartz sand (fine-medium) - aeolian, silcrete - pale brown-grey-reddish, quartz - clear-grey-milky forms - mostly grit <1 to 3 mm.
GC129B	1-2 m	UNWASHED: pale brown (d) as above; texture - rock fragments and fines, light brown (w) (5YR 5/6). WASHED: as above - calcrete coated and fracture lined, silicified multi-coloured saprolite, porcelanite and hyaline silica - cream, prominent Mn oxide coatings and dendrites, quartz loose and silica cemented - grey and milky - many with black prismatic and acicular crystal inclusions (?rutile, ilmenite). Saprolitic.
GC129C	2-3 m	UNWASHED: pale yellow brown (d) crushed calcrete yellow - cream (d), grey (d) silcrete, strong carbonate acid reaction; texture - rock fragments and fines, strong brown (w) (7.5YR 5/7). WASHED: as above with more fragments of pale silicified saprolite - kaolinitic relict gneiss. Saprolite.
GC129D	3-4 m	UNWASHED: pale yellow grey (d) crushed calcrete cream (d) and grey (d) silcrete, moderate carbonate acid reaction; texture - rock fragments and fines, light brown (w) (7.5YR 6.5/5). WASHED: less grainy matter than above, silcrete reduced to <30%, fragments of white kaolinitic relict gneiss and kaolinite ~50%, quartz fragments ~20% - most milky and some greyish. Saprolite.
GC129E	4-5 m	UNWASHED: very pale pinkish grey (d) clayey silt to silty clay with cuttings of white to grey and pale yellow (d) claystone, no carbonate acid reaction; texture - gritty clayey silt (? loamy), light yellowish brown (w) (10YR 7/3). WASHED: little grainy matter - almost all is creamy white kaolinite and kaolinitic gneiss remnants with some yellow and orange Fe staining, quartz (medium-coarse) grit - milky and greyish. Saprolite.
GC129F	5-6 m	UNWASHED: very pale yellow-grey (d) gritty clay, white (d) claystone cuttings common, no carbonate acid reaction; texture - gritty light clay, yellowish gray (w) (2.5Y 8/2). WASHED: very little grainy matter, fine-coarse-grained grit of kaolinite and quartz - bluish-greyish-milky, larger bluish quartz fragments 2-3 mm, some yellow and orange Fe stained fragments, some black mineral inclusions to some quartz and relict feldspar fragments - these have prismatic to acicular habits (?rutile and ilmenite), occasional greenish fragment ?smectite.

Appendix 8b: Detailed descriptions for pit samples at Challenger.

Logged and described by M.J. Lintern (CRC LEME) and M.J. Sheard (PIRSA) 1997.

NOTE: The following logs are rough field notes only **-** with few additions other than sample numbers and references to relevant data.

Methods: field logs and descriptions were followed by laboratory examinations, geochemistry and XRD. All data are available in the appropriate Appendices.

Samples: Samples of between 1 to >5 kg were collected from each of the described depth intervals and from some intervals several samples were collected. These samples consisted of bulks and individual blocks, and included grab samples that displayed interesting features from the pit mullock heaps.

All samples that have been submitted for laboratory analysis have been issued with a standard PIRSA Minerals Group "**R**" number, these are displayed on the following logs in bold type.

LIST OF PLATES

Pit: GCP100	**Profile on North West face, centre** (Excavated by blasting and bulldozing)	
Location	364186E, 6692861N Nearest Regolith RC Hole: GC100 - only metres away.	
Site	Bouldery silcrete outcrop area with thin patchy reddish sandy soil and sparse shrubby vegetation. Pit excavation too difficult for bulldozer at hand, pit messed up in process. The most accessible face (northern) was not typical of the pit S side - this consisted of massive to bouldery pedogenic "grey billy" silcrete with a sporadic thick massive calcrete capping. This silcrete is vughy with Fe staining on fractures and vug linings, and ferruginous granules within.	
Photographic images	45504 to 45508	
Sample #	Depth (cm)	Description
GCP100-1	25-40	NOTE: top soil (0-25 cm) disturbed by blasting and pit excavation. Friable calcareous silty loam soil (B horizon) with clasts of calcrete, silcrete, porcelanite and potch opal. Adjacent to sample line are friable aggregates of calcrete in a red-brown sandy soil. **Sample: R214139**
GCP100-2	40-70	Silcrete with calcrete coatings and dust with Fe granules (to 3 mm) and nodules within, laminated to blocky calcrete with silcrete and porcelanite fragments. **Sample: R214140**
GCP100-3	70-80	Calcrete - friable with small fragments (to 20 mm) of silcrete and Fe granules. **Sample: R214141**
GCP100-4	80-100	Blocky to massive calcrete with abundant potch opal as fragments and ?breccia clasts . **Sample: R214142**
GCP100-5	100-125	Beginning of a strongly layered zone - non calcareous, siliceous with fragments of silcrete and potch opal - with silica cement containing much Fe and Mn staining, distinctly layered it forms the top of this zone. Quite a reddish brown horizon with layers on a cm scale. **Sample: R214143**
GCP100-6	125-150	Siliceous, thin layers over larger block silcrete, Mn stained, minor Fe staining, some potch opal fragments, non calcareous. **Sample: R214144**
GCP100-7	150-165	Silcrete, layered "grey billy" and brown forms with ?weathered potch (dull), some Mn and Fe staining, with minor calcrete cement. **Sample: R214145**
GCP100-8	165-180	Base of layered zone, various silcretes as layers, potch opal breccias and Fe staining, with calcrete cement and coatings. **Sample: R214146**
GCP100-9	180-210	Calcareous loam with silcrete boulder ("grey billy") in an adjacent horizon, silcrete nodules and fragments with plenty of potch opal and porcelanite bands and fragments. A band within calcareous earth of Fe stained silcrete. Large silcrete block (Sub-sample A). (9) **Samples: R214147**, (9A) **R214148**
GCP100-10	210-230	Calcrete cemented silcrete, potch opal, gravels and cobbles of the same, matrix is calcareous loamy material. Silcrete is pedogenic. **Sample: R214149**
GCP100-11	230-260	Silcrete with bands of potch opal - yellow and grey, basal horizon of silcrete cobble, pebble and gravel sized concretions—nodules in a matrix of calcareous silty loam. Ferruginous coated silcrete fragments in indurated calcrete. **Sample: R214150**
GCP100-12	260-275	silcrete as rounded nodules 2-15 cm diameter (single small boulder as sub-sample 12A), bands and nodules of yellow to grey potch opal in a siliceous dust or earth (?calcareous). **Samples: R214151,** (12A) **214152 and 367478**
GCP100-grab	pit spoil pile	Vitreous potch opal, mostly yellow creamy, some has reddish Fe coating. **Sample: R214153**
GCP100-grab	pit spoil pile	Greenish grey silcrete with Fe granules and angular gravel encapsulates, partly calcreted. **Sample: R214154**

GCP100-grab	pit spoil pile	Grey billy massive silcrete **-** silicified sandstone, from near the surface **Sample: R214155**
GCP100-grab	pit spoil pile	Pure potch opal **-** yellow and cream and grey with no other adhering matter, curiosity assay. **Sample: R214156**
GCP100 -grab m	pit spoil pile	Potch opal-calcrete breccia. **Sample: R367479**
GCP100 -grab f	pit spoil pile	Ferruginous granules in calcrete **Sample: R367480**
GCP100 -grab j	pit spoil pile	Porcelanite chunk with potch opal core **Sample: R367481**
GCP100 -grab h	pit spoil pile	polymict breccia **-** silcrete-porcelanite-potch-ferricrete-calcrete **Sample: R367482**

(a) *Pit GCP100, wide angle view, NW face with logged and sampled profile marked by measuring tape.* (*Photo 45504)*

(b) *Pit GCP100, NW face, top metre (red mark at 1 m) with central logged and sampled profile marked by measuring tape.* *(Photo 45505)*

(c) *Pit GCP100, NW face, ~1-2 m (red mark at 1 m) with central logged and sampled profile marked by measuring tape.* *(Photo 45506)*

(d) *Pit GCP100, NW face, 2.5-2.75 m (red mark at 2 m) with central logged and sampled profile marked by measuring tape.* *(Photo 45507)*

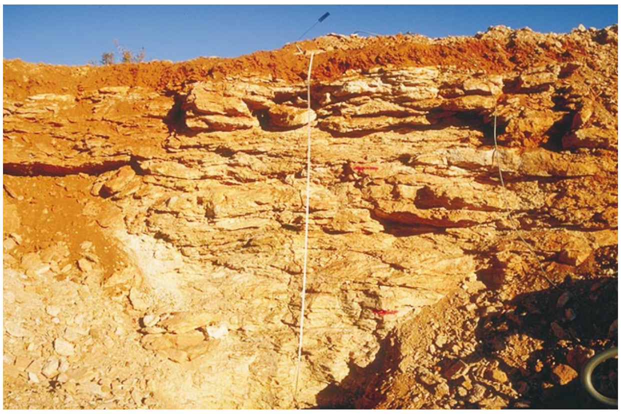
(e) *Pit GCP100, view of the bouldery, grey billy silcrete on the SE side of the pit, in marked contrast to the laminar calcrete-silcrete breccia on the N and W sides of the pit. View from atop the sampled pit face.* *(Photo 45508)*

Plate 1: Pit GCP100.

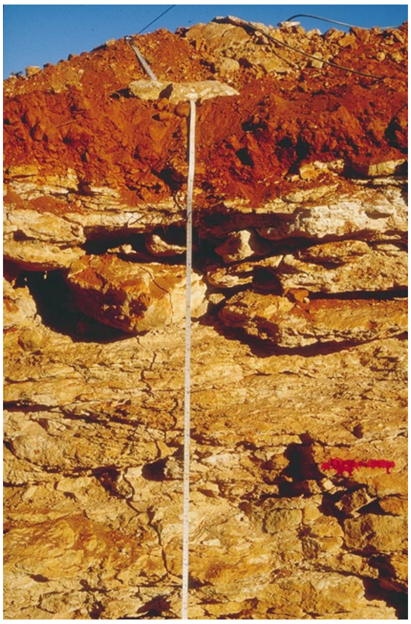
Pit: GCP106	**Profile on South East face, centre** (Excavated by blasting and bulldozing)	
Location	364035E, 6693094N Nearest Regolith RC Hole: GC106 - only meters away.	
Site	Relatively flat, gibber clad silty sand, reddish-orange (d), rare calcrete clasts at the surface, gibber is all silcrete - most with ferruginous coatings. Sparsely vegetated by shrubby plants.	
Photographic images	45470 to 45472, 45497.	

Sample #	Depth (cm)	Description
GCP106-1	10-20	Red-brown clayey sand with abundant angular silcrete cobbles and pebbles up to 10 cm diameter. **Sample: R214119**
GCP106-2	20-25	Platy laminated calcrete (cream) with some siliceous banding (minor), sandy, plant roots within rock fractures and cracks. **Sample: R214120**
GCP106-3	25-40	Laminated calcrete with siliceous material as bands (greenish) ?opaline, some dark matter ?Mn oxides, silcrete breccia with calcrete. **Sample: R214121**
GCP106-4	40-65	Silcrete breccia, calcareous. **Samples: R214122**, (4A) **214123**
GCP106-5	65-90	Laminated calcrete and silcrete breccia, clasts of silcrete in breccia (10-30 mm), hyaline opaline cutans on surfaces - translucent micro-botryoidal forms, large silcrete chunks 3-5 cm.. **Sample: R214124**
GCP106-6	90-105	Grey massive to laminated silcrete that breaks up into blocks, silcrete is silicifies fine- to medium-layered sandstone. Calcrete is impregnated along partings and joints. Opaline cutans are present also. The base is more porous kaolinitic silicified rock that is non calcareous. **Sample: R214125**
GCP106-7	105-125	Silcrete breccia with calcrete on partings, calcrete > silcrete by volume in some places, hyaline opal cutans and rims on weathered silcrete. Plant root channels with weakly developed Fe staining. **Sample: R214126**
GCP106-8	125-145	Silcrete breccia with carbonate matrix, clear to translucent hyaline opal cutans, silica mostly has a greenish colour. **Sample: R214127**
GCP106-9	145-165	Friable silcrete breccia zone, silcrete units-bands are 1-2 cm in thickness and laminar with calcrete earth and cement between - making the whole zone friable. **Sample: R214128**
GCP106-10 and-10A	165-185	Silcrete breccia, harder than above, more silica present, silcrete fragments within a silica matrix, calcrete occurs on partings, hyaline opal silica cutans on fractures, bottom of this horizon sees Mn oxide present as stains on partings. Sample -10: bulk of horizon. Sample -10A: single block of very hard silcrete - bedded sandstone with uniform grey silica cement, contains fossil wood (twig) mould (to left of described profile line). [Refer to report on fossil wood and dating in Appendix 10]. **Samples: R214129,** (10A) **367477**
GCP106-11	185-205	Silcrete breccia consisting of fragments of silcrete in a matrix of silica, minor calcrete on partings, abundant Mn oxide staining. Opaline silica in two forms - potch with conchoidal fracture, vitreous lustre and opaque to translucent pastel colours; the other is dull greenish porcelanite containing most of the Mn oxide staining.. **Sample: R214130**
GCP106-12	205-230	Slabs of silcrete with cutans of colourless clear-translucent hyaline silica with Mn and Fe oxide staining and greenish coatings. Porcelanite and potch opal present **Sample: R214131**
GCP106-13	230-250	Silcrete breccia with calcrete and hyaline silica-opal on partings, this unit has book-like partings along ?original bedding planes, highly friable, Mn and some Fe oxide staining. Some porcelanite and potch opal - yellow to grey vitreous lustre and conchoidal fracture. **Sample: R214132**
GCP106-14	250-265	Silcrete breccia, abundant Mn oxides, calcrete on partings, layered partings -

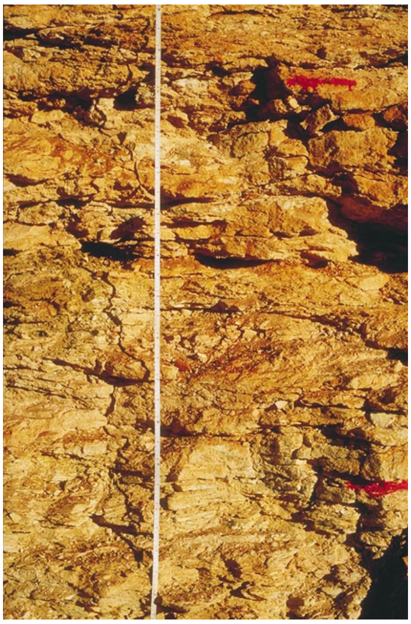
		slaty book-like appearance, very friable, may have a silicified substrate. **Sample: R214133**
GCP106-15	265-280	Low density porous porcelanite, rare calcrete, Mn oxide coatings, variably porous-platy-chalky, pallid colours, some quartz grains in a silicified silt-claystone, hyaline opal cutans. **Sample: R214134**
GCP106-grab	pit spoil pile	Banded calcrete rind on a ferruginous breccia with saprolite, FeOH and other angular clasts in an orange-brown matrix. **Sample: R214134**
GCP106-grab	pit spoil pile	Laminar calcrete rind on a ferruginous band with Fe pisoliths scattered within. **Sample: R214134**
GCP106-grab	pit spoil pile	Porcelanite breccia (white porcelanite with potch opal cores) in a brown matrix. **Sample: R214134**



(a) *Pit GCP106, wide angle view, SE face with logged and sampled profile marked by measuring tape.* *(Photo 45497)*



(b) *Pit GCP106, SE face, top metre (red mark at 1 m) with central logged and sampled profile marked by measuring tape* *(Photo 45470)*



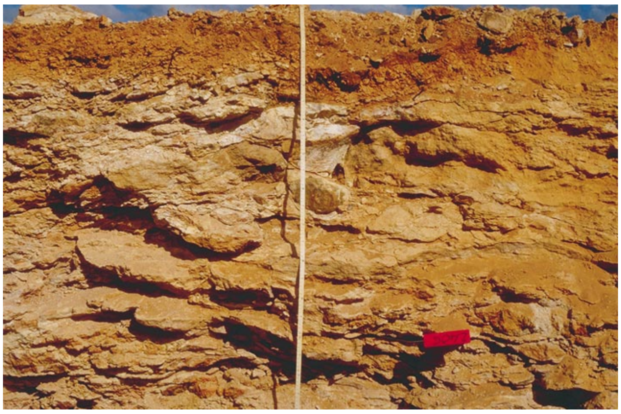
(c) *Pit GCP106, SE face, ~1-2 m (red mark at 1 and 2 m) with central logged and sampled profile marked by measuring tape.* *(Photo 45471)*

(d) *Pit GCP106, SE face, 2.5-2.75 m (red mark at 2 m) with central logged and sampled profile marked by measuring tape.* *(Photo 45472)*

Plate 2: Pit GCP106.

Pit: GCP110	**Profile on South East face, centre** (Excavated by blasting and bulldozing)	
Location	363862E, 6693215N Nearest Regolith RC Hole: GC110 only metres away	
Site	Flat. Pit was excavated in an area where deeper RAB drilling indicated that fluvial transported material exists from surface to >10 m (>14 M only 50 m N of Pit), saprolite occurs below transported matter.	
Photographic images	45499 to 45503.	
Sample #	Depth (cm)	Description
GCP110-1	10-20	Red-brown sandy clay, gritty, with plant rootlets, calcrete nodules to 2-3 cm, silcrete clasts. **Sample: R214104**
GCP110-2	20-25	Top laminar calcrete horizon. **Sample: R214105**
GCP110-3	25-45	Laminar calcrete, abundant Fe staining, pale grey and grey, calcareous earth between partings. **Sample: R214106**
GCP110-4	45-65	Laminar to blocky calcrete with quartz grit, siliceous cement, Fe staining, at same level is a cobble of silcrete >10 cm sitting in a calcareous cement. **Sample: R214107**
GCP110-5	65-90	Blocky calcrete with abundant Fe staining, siliceous with hyaline opal cutans and minor Mn oxide staining. **Sample: R214108**
GCP110-6	90-115	calcareous, horizon variable, calcareous nodular and friable silcrete chunks with carbonate cement, minor Mn oxide and abundant Fe staining. Adjacent zone is laminar and laminar-blocky calcrete.. **Sample: R214109**
GCP110-7	115-135	Laminar to blocky calcrete and siliceous material, minor Mn oxide and abundant Fe stains. **Sample: R214110**
GCP110-8	135-155	Siliceous and calcareous rock (carbonate coatings 1-2 cm thick), Fe staining, abundant quartz grains. This unit is mottled ferruginous zone, also an apple-green stain. Same horizon, to the left ~1 m, is nodular Fe material with a silica cement and carbonate capping - sample 8A. **Samples: R214111,** (8A) **214118**
GCP110-9	155-175	Calcareous, siliceous, laminar, abundant Fe oxides staining, laminar calcrete and apple-green staining.. **Sample: R214112**
GCP110-10	175-190	Siliceous boulder, Mn oxide staining's with some calcareous matter, zone is mostly siliceous, abundant Fe staining. **Sample: R214113**
GCP110-11	190-210	Silcrete (large clast >10 cm) with minor gypsum in a non calcareous sandy silt (red-brown) with abundant small fragments of silcrete. **Sample: R214114**
GCP110-12	210-235	Rounded quartz pieces in a siliceous (matt) cementation - greyish with coatings of reddish Fe staining. **Sample: R214115**
GCP110-13	235-250	Gley clay with yellowish and bright apple-green coatings, very salty, clay is smectitic and illitic, with large rounded quartz clasts (3 cm) and sub-rounded (1 cm), silcrete clast >10 cm. **Sample: R214116**
GCP110-14	>250	Clay block as above, picked out of pit floor with G-pick, clay is quite moist. **Sample: R214117**

(a) *Pit GCP110, wide angle view, SE face with logged and sampled profile marked by measuring tape.* *(Photo 45499)*



(b) *Pit GCP110, SE face, top metre (red mark at 1 m) with central logged and sampled profile marked by measuring tape.* *(Photo 45500)*

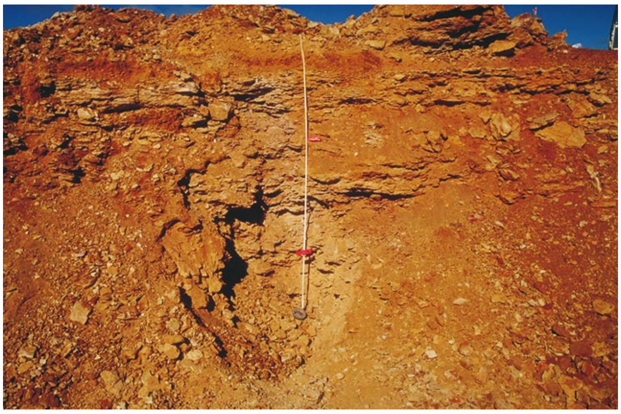
(c) *Pit GCP110, SE face, ~1-2 m (red mark at 1 and 2 m) with central logged and sampled profile marked by measuring tape.* *(Photo 45501)*

(d) *Pit GCP110, SE face, 2.5-2.6 m (red mark at 2 m) with central logged and sampled profile marked by measuring tape.* *(Photo 45502)*

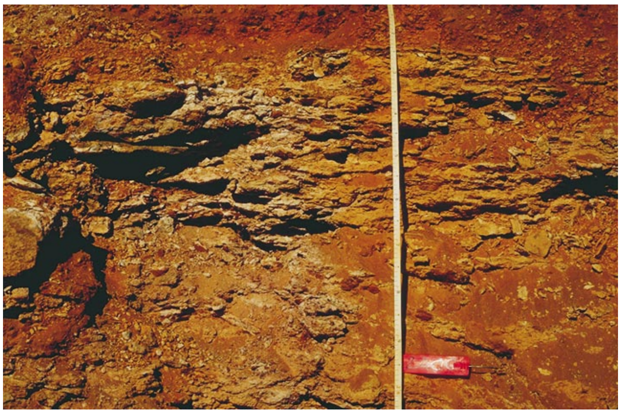
(e) *Pit GCP110, view of SE face, detailed sampling and logging of the pit profile.* *(Photo 45503)*

Plate 3: Pit GCP110.

Pit: GCP115	**Profile on South East face, centre** (Excavated by blasting and bulldozing)	
Location	363687E, 6693346N Nearest Regolith RC Hole: GC115 only metres away	
Site	Flat, poorly vegetated area of clayey sand with silcrete fragments and small gibber cover, just east of tree covered low sand dunes.	
Photographic images	45485 to 45487, 45498.	
Sample #	Depth (cm)	Description
GCP115-1	10-20	Red-brown friable calcareous loam with broken calcrete nodules (up to 2 cm) and plant rootlets. **Sample: R214086**
GCP115-2	20-30	Laminar calcrete, surface is fractured (? blast artefact), Fe staining, plant rootlets. **Sample: R214087**
GCP115-3	30-45	Laminar calcrete, as above, Fe blotches and staining, siliceous, plant rootlets. **Sample: R214088**
GCP115-4	45-75	Laminar calcrete, Fe staining, abundant opaline silica cutans and veins. **Sample: R214089**
GCP115-5	75-100	As above, with more red Fe blotches, some gypsum cement. **Sample: R214090**
GCP115-6	100-120	Laminar calcrete as above with less Fe blotches. **Sample: R214091**
GCP115-7	120-145	Laminar calcrete, Fe staining, opaline silica and silcrete ?clast or remnant core (up to 5 cm). **Sample: R214092**
GCP115-8	145-165	Blocky calcrete with abundant opaline silica and silcrete pieces (3 cm) and abundant siliceous Fe stained nodules. **Sample: R214093**
GCP115-9	165-185	Laminar **-** blocky calcrete with silty calcareous loam separating the layers, Fe staining, abundant opaline silica. **Sample: R214094**
GCP115-10	185-210	Blocky **-** laminar calcrete with silcrete fragments (2-3 cm), opaline silica, Fe staining and minor Mn oxide staining **Sample: R214095**
GCP115-11	210-235	Silcrete **-** red with greenish grey cores, cream calcrete along fractures and calcareous loam in-fill, blocks to 10 cm, Mn and Fe oxides staining, opaline silica, angular bluish quartz in silcrete, saprolitic chunks with thin quartz veining. **Sample: R214096**
GCP115-12	235-255	Silcrete, brecciated, greenish cast, blocks up to 10 cm in a carbonate loam and carbonate cement (12), minor Mn and Fe oxides staining, opaline silica, abundant quartz fragments. Sample (12A) **-** siliceous saprolite (proto-silcrete) coated with calcrete. **Samples: R214097,** (12A) **R214098**
GCP115-13	255-260	Silcrete nodule (10 x 5 cm), Fe staining, opaline silica and gypsum, calcareous cement. **Sample: R214099**
GCP115-14	~300 - pit floor	White kaolinitic saprolite with quartz veining **-** bluish, these veins pass up into the silcrete capping. **Sample: R214100**
GCP115-grab	pit spoil pile	Calcareous **-** siliceous material, with silcrete clasts and quartz. **Sample: R214101**
GCP115-grab	pit spoil pile	Saprolite with fine quartz veins. **Sample: R214102**
GCP115 -grab A	pit spoil pile	Complex calcrete **-** calcrete/Fe oxides (reddish) breccia. **Sample: R367476**
GCP115 -grab C	pit spoil pile	Bluish quartz vein material, large chunks. **Sample: R367488**



(a) *Pit GCP115, wide angle view, SE face with logged and sampled profile marked by measuring tape.* *(Photo 45485)*



(b) *Pit GCP115, SE face, top metre (red mark at 1 m) with central logged and sampled profile marked by measuring tape.* *(Photo 45486)*

(c) *Pit GCP115, SE face, ~1-2 m (red mark at 1 and 2 m) with central logged and sampled profile marked by measuring tape.* *(Photo 45487)*

(d) *Pit GCP115, SE face, 2.5-3 m (red mark at 2 m) with central logged and sampled profile marked by measuring tape.* *(Photo 45498)*

Plate 4: Pit GCP115.

Pit: GCP121	**Profile of South East face, centre** (Excavated by blasting and bulldozing)	
Location	363490E, 6693580N Nearest Regolith RC Hole: GC121 only metres away	
Site	Eastern side of a vegetation denuded area east of *Mt Challenger;* flat sandy (reddish) with scattered small gibber (gravel to pebbles) of exotics, silcrete and quartz clasts. Sandy soil removed by pit excavation blasting and exploration vehicular traffic	
Photographic images	45481 to 45484.	
Sample #	Depth (cm)	Description
GCP121-1	5-20	Laminar calcrete with fine plant rootlets and calcareous loam. **Sample: R214071**
GCP121-2	20-40	Laminar calcrete - rough surfaced. **Sample: R214072**
GCP121-3	40-60	Calcrete - greys, zone is multi-coloured in pastel shades of red and yellow. **Sample: R214073**
GCP121-4	60-80	Red-mottled olive-green laminar to blocky material, calcareous, with silcrete chunks. **Sample: R214074**
GCP121-5	80-105	As per 60-80 cm. **Sample: R214075**
GCP121-6	105-130	As per 60-80 cm. **Sample: R214076**
GCP121-7	130-160	Friable siliceous and calcareous zone with greenish colour and Fe staining and nodules of ? mineral within. **Sample: R214077**
GCP121-8	160-170	White zone - marker band right around pit, possibly kaolinite, some Mn oxide staining. **Sample: R214078**
GCP121-9	170-180	Reddish Fe zone below white zone, blocks of earthy material, olive silcrete and blocky to platy mineral with Mn oxide coatings. **Sample: R214079**
GCP121-10	180-200	As above with gypsum. **Sample: R214080**
GCP121-11	200-220	Gypsum pieces up to 10 cm in a red-brown clay, Fe-rich saprolite and nodules, lumps of siliceous matter. **Sample: R214081**
GCP121-12	220-240	Gypseous chunks in a red-brown clay. **Sample: R214082**
GCP121-13	240-260	Mottled gypseous yellow clay, mottling - red-brown and greenish. **Sample: R214083**
GCP121-14	260-290	Clay saprolite, gypseous and intensely mottled - orange and grey-green, gypsum fine to medium well crystallised coatings and veins, siliceous patches - greenish. **Sample: R214084**
GCP121-15	290-300	Orange saprolite with greenish grey blotches, gypseous, quartz, clay, Ferruginous earthy material surrounding blocks, small crystals of dark red vitreous mineral ?rutile. **Sample: R214085**

(a) *Pit GCP121, wide angle view, SE face with logged and sampled profile marked by measuring tape.* *(Photo 45481)*

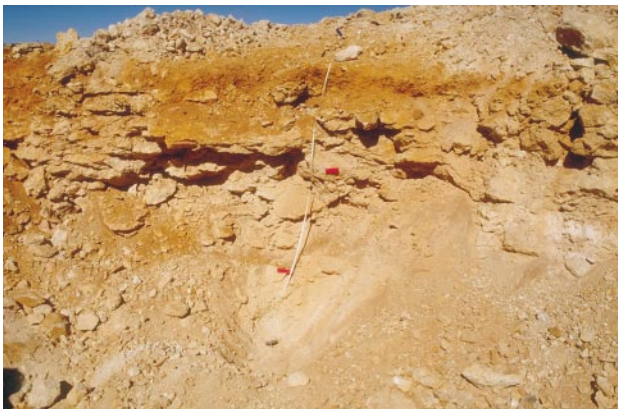
(b) *Pit GCP121, SE face, top metre (red mark at 1 m) with central logged and sampled profile marked by measuring tape.* *(Photo 45482)*

(c) *Pit GCP121, SE face, ~1-2 m (red mark at 1 and 2 m) with central logged and sampled profile marked by measuring tape.* *(Photo 45483)*

(d) *Pit GCP121, SE face, 2.5-3 m (red mark at 2 m) with central logged and sampled profile marked by measuring tape.* *(Photo 45484)*

Plate 5: Pit GCP121.

Pit: GCP122	**Main Profile on South face, centre** (Excavated by blasting and bulldozing)	
Location	363452E, 6693628N Nearest Regolith RC Hole: GC122 only metres away	
Site	Flat, sandy area in the middle of a denuded area with minimal vegetative cover. Gravel is multi-lithotype, angular to rounded	
Photographic images	45476 to 45479.	
Sample #	Depth (cm)	Description
GCP122-1	10-20	Red-brown clayey sand with calcrete nodules and plates - broken with plant rootlets. **Sample: R214036**
GCP122-2	20-65	Massive calcrete with large quartz fragments and silcrete - buff colour. Two samples: (2) large boulder - calcrete with silcrete inclusions within of remnant quartz veins; (2A) massive calcrete chunks (some >10 cm) with unknown centres. **Samples: R214037,** (2A) **214038**
GCP122-3	65-90	Ferruginous mottled siliceous, silcrete-clasted calcareous material, blocky. **Sample: R214039**
GCP122-4	90-105	Siliceous rubble, silcrete and calcrete infill and coatings of blocks, crystalline gypsum coatings. Two samples: (4) **Samples: R214040,** (4A) **214041**
GCP122-5	105-135	As above with strong orange-brown mottles and blotches, siliceous - calcareous nodules/fragments, quartz fragments, greenish grey overall colour. **Sample: R214042**
GCP122-6	135-160	Siliceous and calcareous, silcrete fragments sitting in a calcareous loam. **Sample: R214043**
GCP122-7	160-190	As above, blocks are carbonate coated, quartz and silcrete clasts. (7) calcrete nodules with calcareous loam (<10 cm) - probably with silcrete core; (7A) large calcrete coated boulder with fractured quartz. **Samples: R214044,** (4A) **214045**
GCP122-8	190-205	Siliceous, hard to friable quartz-rich material, earthy calcareous loam to grit. **Sample: R214046**
GCP122-9	205-225	Calcareous sandy loam material with fragments of siliceous to calcareous nodules with dark blue quartz fragments, un-cemented overall. **Sample: R214047**
GCP122-10	225-250	As above, calcareous. **Sample: R214048**
GCP122-11	250-270	Non calcareous friable to soft, blotchy clay saprolite - grey-yellow-white and rich in crystalline gypsum. **Sample: R214049**
GCP122-grab	pit spoil pile	Banded silica rock. **Sample: R214049**



(a) *Pit GCP122, wide angle view, SE face with logged and sampled profile marked by measuring tape.* *(Photo 45476)*

(c) *Pit GCP122, SE face, ~1-2 m (red mark at 1 and 2 m) with central logged and sampled profile marked by measuring tape.* *(Photo 45478)*

(b) *Pit GCP122, SE face, top metre (red mark at 1 m) with central logged and sampled profile marked by measuring tape.* *(Photo 45477)*

(d) *Pit GCP122, SE face, ~2-2.7 m (red mark at 2 m) with central logged and sampled profile marked by measuring tape.* *(Photo 45479)*

Pit: GCP122	**Sub-Profiles on South East face** (Excavated by blasting and bulldozing) **Sub-Profiles: -E; 2.2 m East of Main 3 m profile** **-2E; 4.4 m East of Main 3 m profile** **-W; 2.4 m West of Main 3 m profile**	
Location	363452E, 6693628N Nearest Regolith RC Hole: GC122 only metres away	
Sub-Profiles	These were collected to check on local lithotype and geochemical variability.	
Photographic images	45432 (see Volume 1)	
Sub-Profile E		
Sample #	Depth (cm)	Description
GCP122-E1	20-40	0-10 cm lost. Laminar calcrete with black mouldy plant roots along partings, some Fe staining, some siliceous matter. **Sample: R214051**
GCP122-E2	40-60	Calcrete matrix with silcrete clasts and quartz. **Sample: R214052**
GCP122-E3	60-80	Calcareous and siliceous material with more quartz, some minor Fe staining and hyaline silica cutans and veins. **Sample: R214053**
GCP122-E4	80-100	As above. **Sample: R214054**
GCP122-E5	100-120	As above, with calcrete coatings only and more quartz, calcrete along root channels, hyaline silica cutans. **Sample: R214055**
GCP122-E6	120-140	As above. **Sample: R214056**
Sub-Profile 2E		
GCP122-2E1	10-20	0-10 cm not taken. Red-brown clayey sand, soil, calcareous. **Sample: R214058**
GCP122-2E2	20-30	Friable laminar calcrete in a matrix of sandy-silty clay, minor bluish quartz fragments to 2 mm in size. **Sample: R214059**
GCP122-2E3	30-40	Laminar to blocky calcrete with minor silty clay matrix. **Sample: R214060**
GCP122-2E4	40-60	Massive calcrete with abundant bluish - grey quartz from a disintegrating vein (*photo 45436*). **Sample: R214061**
GCP122-2E5	60-70	As above with hyaline silica and plenty of bluish quartz, siliceous, some Mn and Fe oxides staining. **Sample: R214062**
GCP122-2E6	$70\text{-}80^{+}$	Bluish quartz vein protruding into above units, possible Au carrier. **Sample: R214063**
Sub-Profile W		
GCP122-W1	10-20	0-10 cm not taken. Laminar calcrete shattered by pit excavation blast, silty sandy clay matrix. **Sample: R214064**
GCP122-W2	20-30	Massive calcrete with minor to rare hyaline silica and some quartz present. **Sample: R214065**
GCP122-W3	30-40	Massive calcrete with silcrete and quartz present and hyaline silica cutans. **Sample: R214066**
GCP122-W4	40-50	Calcareous silcrete in a silty clay matrix with gypsum crystals up to 10 mm long, loose horizon. **Sample: R214067**
GCP122-W5	50-70	Silcrete with quartz fragments and calcite veins. **Sample: R214068**
GCP122-W6	70-80	Friable horizon, calcareous, contains silty quartz coating aggregates of quartz, minor hyaline silica, calcrete. **Sample: R214069**
GCP122-W7	80-90	Pale grey quartz silt and as aggregates of nodules - very odd horizon! - quite irregular horizon (5-10 cm thick) right across pit's W end. **Sample: R214070**

Pit: GCP123	**Profile on South East face, centre** (Excavated by blasting and bulldozing)	
Location	363411E, 6693656N Nearest Regolith RC Hole: GC123 only metres away	
Site	Near the rise of *Mt Challenger* flat and sandy in the middle of a sparsely vegetated area. Gravel is multi-lithotype, angular to rounded	
Photographic images	45473 to 45475.	
Sample #	Depth (cm)	Description
GCP123-1	5-20	Red-brown sandy clay soil (A horizon may be missing), loose and calcareous silty clay with plant rootlets, minor silcrete rounded gravel <2 cm. Calcrete - angular pieces, laminar calcrete with smooth top and black organic matter (mouldy plant rootlets) along partings, hyaline silica and rubbly silcrete plates. **Sample: R213986**
GCP123-2	20-30	Calcreted siliceous ?saprolitic rubble with yellow Fe staining, as a cemented zone full of black mouldy plant rootlets, Fe nodules and calcrete as nodules below laminar calcrete. (2) saprolitic material at the top of this zone; to the RHS of vertical sample line (2A) calcrete with bluish quartz grains/fragments and silcrete clasts. **Samples: R213987,** (2A) **214000**
GCP123-3	30-40	Massive calcrete with bluish quartz fragments, laminar on upper surface, within a loose calcareous red-brown loam, siliceous nodules - calcareous, yellowish (wet) saprolite. (3) loamy calcareous clay with some calcrete; (3A) massive calcrete with enclosed silcrete nodules. **Samples: R213988,** (3A) **213989**
GCP123-4	40-60	Very hard silcrete rubble with bluish quartz angular fragments, whole mass has been cemented by silica and calcrete, silcrete is greenish with minor Mn oxides staining, some larger grey - bluish quartz fragments. **Sample: R213990**
GCP123-5	60-90	Silcrete as above, very hard (chiselled out) and calcareous. (5) calcrete with silcrete and quartz; (5A) massive calcrete with Mn stained silcrete. **Samples: R213991,** (5A) **213992, 367475**
GCP123-6	90-125	Silcrete as above but much more Fe staining and rare Fe oxide nodules, Mn oxide staining, highly calcareous (chisel sample). **Sample: R213993**
GCP123-7	125-160	Silicified saprolite with relict quartz veining, hard and cemented, greenish to grey with some Fe staining. **Sample: R213994**
GCP123-8	160-170	Loose horizon of sand-silcrete fragments and breccia clasts of greenish silcrete cemented by brownish silica. **Sample: R213995**
GCP123-9	170-210	Breccia of greenish silcrete in brown sandy silicified and calcified matrix - hard and massive but also in-part rubbly and porous, quartz fragments common. **Sample: R213996**
GCP123-10	210-240	Siliceous loose horizon, greenish with yellow Fe and black Mn staining, highly calcareous with silica veins and gypsum as crystals and coatings, quartz fragments, friable calcareous earthy material and some nodules. **Sample: R213997**
GCP123-11	240260	Friable to blocky saprolite, yellow - orange - greenish colours, blocks of harder material near bottom of pit - hard to sample. **Sample: R213998**
GCP123-12	260-275	Soft friable blotched saprolite zone, yellow-grey-white-greenish, poorly cemented, blocky unit (?explosive artefact). **Sample: R213999**

***(a)** Pit GCP123, wide angle view, SE face with logged and sampled profile marked by measuring tape. (Photo 45473)*

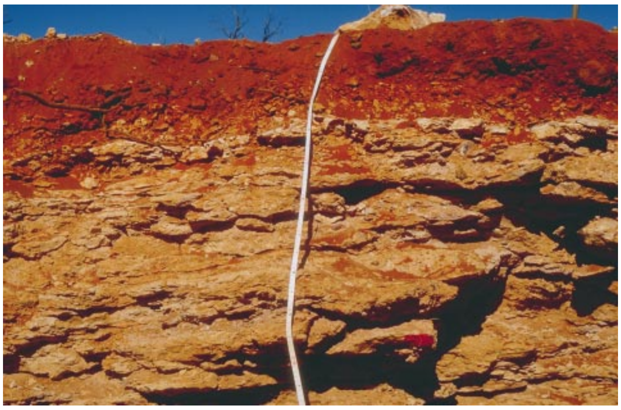
***(b)** Pit GCP123, SE face, top metre (red mark at 1 m) with central logged and sampled profile marked by measuring tape. (Photo 45474)*

***(c)** Pit GCP123, SE face,~1-2.2 m (red mark at 1 and 2 m) with central logged and sampled profile marked by measuring tape. Note: base of pit not photographed due to shadowing. (Photo 45475)*

Plate 7: Pit GCP123.

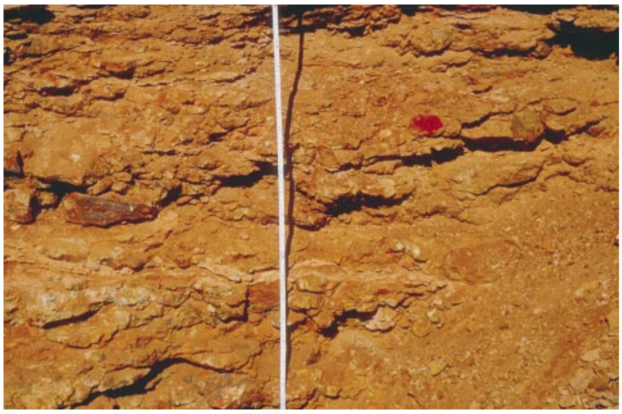
Pit: GCP129	**Profile on South East face, centre** (Excavated by blasting and bulldozing)	
Location	363216E, 6693869N Nearest Regolith RC Hole: GC129 only metres away	
Site	Slightly west sloping on a low reddish sand dune on the western side of *Mt Challenger*.	
Photographic images	45490, 45492 to 45496.	
Sample #	Depth (cm)	Description
GCP129-1	10-20	Sandy clay with assorted silcrete clasts as above, non calcareous with rootlets. **Sample: R 213959** ** (0-10 cm **- not sampled**: sandy clay with assorted silcrete and ferruginous cobbles and pebbles, non calcareous) **.
GCP129-2	20-30	As above with calcrete nodules and gravels, plant rootlets. **Sample: 213960**
GCP129-3	30-35	Sandy clay with small calcrete nodules and pisoliths - just above laminar calcrete, some nodules are coalescing with laminar form. **Sample: R 13961**
GCP129-4	35-38	Laminar calcrete with accreted nodules. **Sample: R 213962**
GCP129-5	38-48	Laminar calcrete with abundant nodules and gravels (up to 5 cm) embedded in calcrete, some rare quartz grains, hard, base of unit is natural break in profile, some silcrete pebbles with carbonate rinds on their tops only. **Sample: R 213963**
GCP129-6	48-60	Pebbles and gravel - ferruginous, with laminar calcrete, hard and quite layered, bottom of zone is a natural break in the profile. **Samples: R 213964, 367474**
GCP129-7	60-90	Laminar calcrete with abundant ferruginous nodules/pebbles, prolific plant roots here and down to 2.5 m (up to 4 mm diameter). **Sample: R 213965**
GCP129-8	90-120	As above - with Fe and silcrete pebbles - ?old land surface, mangans present, smooth topped calcrete. **Sample: R 213966**
GCP129-9	120-145	As above, near the zone bottom (140-145 cm) are abundant nodules (2-3 cm) with silcrete pebbles, quartz - rare small fragments, some nodules are forming with small quartz cores, large tree roots to 50 mm following partings and joints. **Sample: R 213967**
GCP129-10	145-170	Fine gravels, very slightly calcareous, ferruginous variable sized nodules 1-10 mm, rare quartz, siliceous, alluvial/colluvial polymict gravel cemented up. Adjacent to this profile the unit appears as a pod-like ?channel, the pod is surrounded by laminar calcrete. Two samples submitted for analysis to check on variability. **Samples: R 213968, 213969**
GCP129-11	170-185	Transition horizon, laminar calcrete 1-3 cm thick on laminar calcrete and ferruginous silcrete, on this in several bands is Mn oxides - moderate amount. **Sample: R 213970**
GCP129-12	185-200	Silcrete breccia with siliceous cement, has mangans, silcrete is olive-green, zone is ferruginous and non calcareous. **Sample: R 213971**
GCP129-13	200-230	Non gravelly massive silcrete with mangans - manganiferrous zone is dark purple-black-brown and contains calcrete layers within. **Sample: R 13972**
GCP129-14	230-260	Manganiferrous blocky siliceous matrix with brecciated silcrete, vughy, Fe as red and brown staining. **Sample: R 213973**
GCP129-15	260-300	As above but less brecciated, still fragmental greenish silcrete, profile has a laminar appearance, manganiferrous and ferruginous, probably silicified saprolite. **Sample: R 213974**
GCP129-16 *	* 215-230	Silcrete hand specimens with abundant Mn and Fe staining, greenish and vesicular internal structure. **Sample: R 213975**
GCP129-grab	pit spoil pile	Siliceous Fe-rich, vesicular with cutans, from ~70 cm. **Samples: R 213976, 367487**

(a) *Pit GCP129, wide angle view, SE face with logged and sampled profile marked by measuring tape.* *(Photo 45490)*

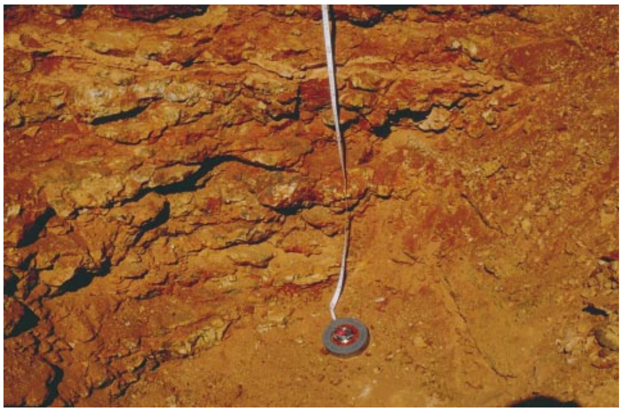


(b) *Pit GCP129, SE face, top metre (red mark at 1 m) with central logged and sampled profile marked by measuring tape.* *(Photo 45492)*

(c) *Pit GCP129, SE face, ~1-2 m (red mark at 1 m) with central logged and sampled profile marked by measuring tape.* *(Photo 45493)*



(d) *Pit GCP129, SE face, 2.0-2.5 m (red mark at 2 m) with central logged and sampled profile marked by measuring tape.* *(Photo 45494)*



(e) *Pit GCP129, SE face, 2.5-3.0 m (red mark at 2 m) with central logged and sampled profile marked by measuring tape.* *(Photo 45495)*

(f) *Pit GCP129, SE face, soil zone, upper surface of the sub-soil laminar calcrete with pisoliths and nodules cemented to it.* *(Photo 45496)*

Plate 8: Pit GCP129.

Pit: GCP129	**Sub-Profiles on South East face** (Excavated by blasting and bulldozing) **Sub-Profiles: -E; 4 m East of Main 3 m profile** **-W; 2 m West of Main 3 m profile**	
Location	363452E, 6693628N	
Sub-Profiles	These were collected to check on local lithotype and geochemical variability.	
Sub-Profile E		
Sample #	Depth (cm)	Description
GCP129-E1	20-40	Laminar calcrete with ferruginous nodules, this unit is above the main gravelly unit, Fe nodules are siliceous with weak cutans. **Sample: R213977**
GCP129-E2 and -E2A	40-70 60	Calcrete with abundant Fe nodules and some silcrete clasts; (2A) from 60 cm similar to (2) but less Fe nodules. Includes a grab sample of an Fe-rich block. **Samples: R213978,** (2A) **213979**
GCP129-E3	130	Laminar calcrete with moderate amount of Fe nodules. **Sample: R213980**
Sub-Profile W		
GCP129-W1	15-25	Top laminar calcrete horizon. **Sample: R213981**
GCP129-W2	50-70	Laminar calcrete with minor Fe gravels. **Sample: R213982**
GCP129-W3	90-110	Laminar calcrete with minor silcrete and Fe gravels and some Mn oxide staining. **Sample: R213983**
GCP129-W4	130-145	Laminar calcrete with moderate Mn and Fe staining, abundant silcrete up to 5 mm diameter, minor Fe material. **Sample: R213984**

Soil Pit: A (Drilling Sump Pit)	**Profile on Western face, centre** (Excavated by bulldozing)
Location:	363615E, 6693934N (GPS) Nearest RC Hole: 96 CHRC 799 and next to grid point: 10520N, 20150E
Site	Pit chosen as part of reconnaissance orientation pilot. Pit has conspicuous calcrete pile next to it, site relatively flat with some Mulga trees nearby, on E edge of the sparsely vegetated flank of *Mt Challenger*.

Depth (cm)	Sample #	Description
0-7	GC014	Red silty sand, non calcareous, stony material is angular to sub-rounded. **Sample: R208926**
7-20	GC015	Darker red **-** red-brown stony silty sand, quite stony, consolidated, calcareous, invertebrate burrows to 18^{+} cm. **Sample: R208927**
20-30	GC016	As above. **Sample: R208928**
30-40	GC017	As above, paler red-brown, quite stony, no nodular calcrete but has a strong carbonate acid reaction. **Sample: R208929**
40-50	GC018	As above. **Sample: R208930**
50-60	GC019	As above but with and earthy nodular calcrete **-** as scattered segregations, matrix is quite sandy. **Sample: R208931**
60-70	GC020	As above. **Sample: R208932**
70-80	GC021	As above. **Sample: R208933**
80-90	GC022	As above. **Sample: R208934**
90-100	GC023	As above. **Sample: R208935**
100-110	GC024	As above to 105 cm, then with incipient laminar calcrete and large angular clasts (15 x 10 x 10 cm) within pale red-brown and creamy calcrete. **Sample: R208936**
110-120	GC025	As above with silcrete fragments. **Samples: R208937,** (silcrete) **R208938**
120-130	GC026	As per 105-110 cm. **Sample: R208939**
130-140	GC027	As above to 135 cm, then calcrete with silcrete fragments. **Sample: R213512**
140-150	GC028	Calcrete on silcrete. **Sample: R213513**

Contamination pilot survey **-** to assess the affect of RC and RAB drilling dust-spray on soil geochemistry (locally) down soil profiles to ~30 cm.

Soil Profiles	**Control** site and **Contaminated** site	
Location	**Control:** 363681E, 6693814N; **Contaminated:** 363632E, 6693912 (GPS) Nearest RC Hole: 97 CHRC 320	
Sites	~25 m apart in an E-W sense **-** centred on the Location above. Flat area next to an Acacia tree **-** **Control** with minimal contamination mostly from vehicular traffic dust. **Contaminated** site: ground covered to several cm depth with a bluish 'frosting' of RC drill dust and spray (from depth and ?mineralised), area also with mulga trees both alive and dead.	
Photographic image	45896 (see Volume 1).	
Control site		
Depth (cm)	Sample #	Description
0-5	GC001	Reddish sandy soil. **Sample: R208913**
5-10	GC002	As above. **Sample: R208914**
10-15	GC003	As above, hard setting. **Sample: R208915**
15-20	GC004	As above. **Sample: R208916**
20-25	GC005	As above. **Sample: R208917**
25-30	GC006	As above and nodular calcrete. **Sample: R208918**
Contaminated site		
Depth (cm)	Sample #	Description
surface contamination	GC007	Bluish grey drilling dust, spray and cuttings ~ 7 cm thick. **Sample: R208919**
0-5	GC008	Reddish soil with visual contamination from material on top. **Sample: R208920**
5-10	GC009	As above with some drilling contamination via soil cracks and invertebrate (?spider) burrows. **Sample: R208921**
10-15	GC010	As above. **Sample: R208922**
15-20	GC011	As above without visible soil cracks or burrowing, and coarse gravel. **Sample: R208923**
20-25	GC012	As above. **Sample: R208924**
25-30	GC013	As above with calcrete nodules. **Sample: R208925**

Appendix 8c: Brief laboratory descriptions for pit samples from Challenger.

Regolith Pit samples were more fully examined at the PIRSA Core Library Complex (Glenside) following field description and collection (see Appendix 8b). Most of the coherent - blocky specimens were either sawn or broken open to expose interiors and provide subsample material for assay and other examinations. The Tables following, list all samples submitted for analysis and provide additional descriptions from the cleaned, broken or cut faces of these materials. There are several samples that have more than one PIRSA '**R**' number.

Descriptions by M.J. Lintern (CRC LEME) and M.J. Sheard (PIRSA) 1997.

Samples from Regolith Pit GCP100

FIELD NUMBER	DEPTH (cm)	DESCRIPTION
GCP100-1	25-40	**Sample R214139**. Brown soil, calcrete, silcrete, porcelanite, potch opal.
GCP100-2	40-70	**Sample R214140**. Pale brown soil-calcareous, calcrete, calcreted silcrete, porcelanite and potch opal.
GCP100-3	70-80	**Sample R214141.** Rubbly calcareous fines, calcreted silcrete, silcrete, porcelanite and potch opal.
GCP100-4	80-100	**Sample R214142.** As per (-3).
GCP100-5	100-125	**Sample R214143.** Fe-stained calcrete-silcrete and silcrete - potch opal breccia.
GCP100-6	125-150	**Sample R214144.** Platey greenish silcrete with MnO dendrites and some Fe OH staining along partings yellow potch opal blebs and layers.
GCP100-7	150-165	**Sample R214145.** Porcelanite and potch opal (green and yellow) with some rubbly silcrete with MnO staining.
GCP100-8	165-180	**Sample R214146.** As per (- 8) - a lot of potch.
GCP100-9	180-210	**Sample R214147.** Mostly sandy → gravelly rubble of potch, silcrete, clay etc, with silcrete, porcelanite and potch opal.
GCP100-9A	180-210	**Sample R214148.** Single grey silcrete boulder - silicified sandstone fine to coarse-grained.
GCP100-10	210-230	**Sample R214149.** Silcrete nodules and plates, porcelanite, potch opal, copious fines - mostly shattered fragments.
GCP100-11	230-260	**Sample R214150.** Silcrete nodules and plates, potch opal blebs and breccia, pale brown fines- mostly shattered fragments. (2 bags bulked and split)
GCP100-12	260-275	**Sample R214151.** Silcrete nodules of plates, porcelanite, potch opal fragments and blebs, silcrete nodules some have potch cores or partly are replaced by opal.
GCP100-12A	260-275	**Sample R214152, 367478.** Large silcrete boulder - cobble, grey silicified sandstone with laminated rind. Hand specimen.
GCP100-grab	pit spoil pile	**Sample R214153.** Vitreous potch opal - mostly yellow or creamy grey, some has reddish Fe coating.
GCP100-grab	pit spoil pile	**Sample R214154.** Greenish grey silcrete with Fe granules dark brown to dark brown and angular gravel encapsulated some is calcreted.
GCP100-grab	pit spoil pile	**Sample R214155.** “Greybilly” massive silcrete -siliceous cemented sands.
GCP100-grab	pit spoil pile	**Sample R214188.** Near pure potch opal - yellow- cream- grey with little or no porcelanite and silcrete adhering. (curiosity assay)
GCP100 -grab M	pit spoil pile	**Sample R367479.** Silcrete-potch-porcelanite breccia with calcrete cement..
GCP100 -grab F	pit spoil pile	**Sample R367480.** Fe granules with quartz and silcrete fragments in calcrete, small specimen.
GCP100 -grab J	pit spoil pile	**Sample R367481.** White porcelanite with potch opal core and end, small specimen.
GCP100 -grab H	pit spoil pile	**Sample R367482.** Porcelanite bearing calcrete with laminated calcrete rind.

Samples from Regolith Pit GCP106

FIELD NUMBER	**DEPTH (cm)**	**DESCRIPTION**
GCP106-1	10-20	**Sample R214119**. Red-brown sand with ?calcrete and silcrete chunks and cobbles.
GCP106-2	20-25	**Sample R214120**. Creamy laminar-biscuity calcrete, platy calcrete-silcrete.
GCP106-3	25-40	**Sample R214121.** Creamy greenish and brown calcreted platy silcrete.
GCP106-4	40-65	**Sample R214122.** Creamy greenish and brown calcreted platy silcrete.
GCP106-4A	40-65	**Sample R214123.** As per (-4) large lump cut in half.
GCP106-5	65-90	**Sample R214124.** As per (-4) with lumps and plates of creamy yellow potch opal.
GCP106-6	90-105	**Sample R214125.** Calcareous silcrete in platy blocks with opal potch.
GCP106-7	105-125	**Sample R214126.** Calcareous silcrete in platy block with opal potch.
GCP106-8	125-145	**Sample R214127.** 3 bags of sample, greenish and brown platy silcrete, calcrete, 4 blocks cut in the half and bulked, and some smaller loose fragments.
GCP106-9	145-165	**Sample R214128.** Massive calcrete - siliceous.
GCP106-10	165-185	**Sample R214129.** Massive calcrete with ?saprolite and quartz (also in sample analysed). Cut specimen reveals quartz vein running through proto-silcrete.
GCP110-10A	~170	**Sample R367477.** Silicified laminated sandstone (silcrete) with fossilised twig.
GCP106-11	185-205	**Sample R214130.** Platy silcrete and blebs and bands of porcelanite and potch opals, core.
GCP106-12	205-230	**Sample R214131.** Platy silcrete and blebs and bands of porcelanite and potch opal, MnO dendrites.
GCP106-13	230-250	**Sample R214132.** As per - 12 but more laminated.
GCP106-14	250-265	**Sample R214133.** Very platy porcelanite with MnO dendrites, yellow clay, Calcareous, very friable.
GCP106-15	265-280	**Sample R214134.** Blocky to platy chalky porcelanitic kaolinite with some blebby layers - saprolite.
GCP106-grab	pit spoil pile	**Sample R214135.** Calcrete (banded) rind on a ferruginous breccia with saprolite, Fe OH and other angular clasts in an orange-brown fine-grained. matrix. Blocks and cut slabs. Hand specimen.
GCP106-grab	pit spoil pile	**Sample R214136.** Calcrete laminar rind on a ferruginous band with ?Fe OH pisoliths scattered within.
GCP-106-grab	pit spoil pile	**Sample R214137.** Porcelanitic breccia (white Porcelanite - kaolinite with opal potch cores) in a brown matrix. Several blocks cut - ½ assay and ½ specimens.

Samples from Regolith Pit GCP110

FIELD NUMBER	DEPTH (cm)	DESCRIPTION
GCP110-1	10-20	**Sample R214104**. Calcareous loam with abundant small (mostly <1cm) calcrete nodules.
GCP110-2	20-25	**Sample R214105**. Platy calcrete with some calcrete loam.
GCP110-3	25-45	**Sample R214106.** Whitish platy calcrete.
GCP110-4	45-65	**Sample R214107.** Laminar calcrete (pink + white).
GCP110-5	65-90	**Sample R214108.** Massive - Laminar calcrete. Some very dense (>10cm).
GCP110-6	90-115	**Sample R214109.** Massive less laminar calcrete. Siliceous. Silcrete present.
GCP110-7	115-135	**Sample R214110.** Massive calcrete - siliceous.
GCP110-8	135-155	**Sample R214111.** Silcrete - quartz grain-rich (probably a partially silicified grus).
GCP110-8A	135-155	**Sample R214118.** Polymict pod of ferruginous nodules (abundant). Quartz silcrete. ?Animal burrow in retained section.
GCP110-9	155-175	**Sample R214112.** Platy calcrete.
GCP110-10	175-190	**Sample R214113.** Silcrete - Boulder. Silicified grus. Greenish patch on cut face.
GCP110-11	190-210	**Sample R214114.** Silicified grus. ?gypseous. Red brown. Boulder cut - silicified grus.
GCP110-12	210-235	**Sample R214115.** Silicified grus. Non calcareous. Small specimens of greenish material.
GCP110-13	235-250	**Sample R214116.** Siliceous. Some greenish staining on outside. Silicified grus with yellow brown colouration.
GCP110-14	250-270	**Sample R214117.** Puggy damp clay. Dried in oven.

Samples from Regolith Pit GCP115

FIELD NUMBER	DEPTH (cm)	DESCRIPTION
GCP115-1	10-20	**Sample R214086**. Calcareous loam with abundant small (mostly <1cm) calcareous nodules.
GCP115-2	20-30	**Sample R214087**. Platy calcrete cemented together. Some large pieces (>10cm).
GCP115-3	30-45	**Sample R214088.** Platy calcrete ?siliceous. Pieces up to 10cm.
GCP115-4	45-75	**Sample R214089.** Platy calcrete ?siliceous.
GCP115-5	75-100	**Sample R214090.** Platy - massive calcrete - siliceous.
GCP115-6	100-120	**Sample R214091.** As per (-5)
GCP115-7	120-145	**Sample R214092.** Platy to massive siliceous calcrete. Silcrete nodules >5cm present.
GCP115-8	145-165	**Sample R214093.** Massive siliceous calcrete. Silcrete nodules to 5cm present.
GCP115-9	165-185	**Sample R214094.** No silcrete nodules deserved, though cut specimen reveals cutaneous calcrete - nodular calcrete aggregate. Nodules to 3 cm, cores calcareous.
GCP115-10	185-210	**Sample R214095.** Massive calcrete - siliceous.
GCP115-11	210-235	**Sample R214096.** Massive calcrete with ?saprolite and quartz (also in sample analysed). Cut specimen reveals quartz vein running through proto-silcrete.
GCP115-12	235-255	**Sample R214097.** Massive calcrete - siliceous.
GCP115-12A	235-255	**Sample R214098.** Cut specimen reveals siliceous saprolite similar to R214096 but with no quartz veining coated with calcrete.
GCP115-13	255-260	**Sample R214099.** As per (-12A)
GCP115-14	~300	**Sample R214100.** Whitish ?talcose (sericitic) boulders (>10 cm).
GCP115-grab	pit spoil pile	**Sample R214101.** Calcareous, siliceous material with silcrete clasts and quartz.
GCP115-grab	pit spoil pile	**Sample R214102.** Saprolite with fine quartz veins, (other half retained as hand specimen).
GCP115 -grab A	pit spoil pile	**Sample R367476.** Complex calcrete - calcrete-Fe oxide breccia, reddish.
GCP115 -grab C	pit spoil pile	**Sample R367488.** Bluish quartz vein material from spoil pile.

Samples from Regolith Pit GCP121

FIELD NUMBER	DEPTH (cm)	DESCRIPTION
GCP121-1	5-20	**Sample R214071.** Laminae-massive calcrete in calcareous loam (~10cm)..
GCP121-2	20-40	**Sample R214072.** Laminar calcrete? siliceous.
GCP121-3	40-60	**Sample R214073**. Calcrete massive and siliceous.
GCP121-4	60-80	**Sample R214074.** Calcrete massive with proto-calcrete some Ferruginous - stained yellow.
GCP121-5	80-105	**Sample R214075.** Calcrete massive and siliceous.
GCP121-6	105-130	**Sample R214076.** Calcrete massive with proto-silcrete units in cut face.
GCP121-7	130-160	**Sample R214077.** Calcrete-siliceous. Calcareous loam. Nodules up to 10 cm.
GCP121-8	160-170	**Sample R214078.** Calcrete-siliceous. Calcareous loam. Nodules up to 10 cm.
GCP121-9	170-180	**Sample R214079.** Silicified unit with Mn oxide staining on outside only and ferruginous mottling on inside.
GCP121-10	180-200	**Sample R214080.** As per (-9).
GCP121-11	200-220	**Sample R214081.** Reddy brown. Nodules? Siliceous, gypseous. Non-calcareous. Nodules up to 10cm. Gypcrete nodules (5-10cm) Gypseous loam.
GCP121-12	220-240	**Sample R214082.** Reddy brown. Nodules? Siliceous, As above.
GCP121-13	240-265	**Sample R214083.** Mottled siliceous boulder, yellow and yellow-browns.
GCP121-14	265-290	**Sample R214084.** Reddy brown and yellow. (Fe rich). Mottled nodular material. Similar to (-13) in section. Siliceous.
GCP121-15	290-300	**Sample R214085.** As per (-14).

Samples from Regolith Pit GCP122

FIELD NUMBER	DEPTH (cm)	DESCRIPTION
GCP122-1	10-20	**Sample R214036**. Sandy clay with abundant coarse silcrete and gravels and nodules (5 cm) suggest separate sand from silcrete. Non-calcareous.
GCP122-2	20-65	**Sample R214037**. Calcareous nodules 5 cm. Hard. Sandy clay. Very minor silcrete.
GCP122-2A	20-65	**Sample R214038.** (in anticipation of variation) Calcrete massive. (some >10cm) with unknown centres.
GCP122-3	65-90	**Sample R214039.** Massive calcrete with minor quartz and silcrete.
GCP122-4	90-105	**Sample R214040.** Massive silcrete with small crypto crystalline drip structures on outside. (internal structure with remnant quartz veins). hand specimen analysed separately.
GCP122-4A	90-105	**Sample R214041.** As per (-4) hand specimen with remnant quartz veining.
GCP122-5	105-135	**Sample R214042.** Silcrete (massive) with carbon coatings. Cut piece in bag.
GCP122-6	135-160	**Sample R214043.** As per (-5).
GCP122-7	160-190	**Sample R214044.** Calcrete - (<10cm) with calcareous loam. Probably has silcrete core.
GCP122-7A	160-190	**Sample R214045.** Large boulder sectioned. ½ hand specimen. Calcrete coated silcrete with fractured quartz.
GCP122-8	190-205	**Sample R214046.** Large boulder of pale saprolite with abundant quartz. ** only the boulder analysed.
GCP122-9	205-225	**Sample R214047.** Pink calcareous loam with nodular material (?silcrete + quartz). Nodules up to 10cm.
GCP122-10	225-250	**Sample R214048.** Slightly yellowish calcareous loam with nodular material.
GCP122-11	250-270	**Sample R214049.** Whitish material nodular. Gypsum enclosing sample Hand specimen.
GCP122-grab	pit spoil pile	**Sample R214050.** Grab specimen. Banded silica rock? Hand specimen.
GCP122-E1	20-40	**Sample R214051.** Platy calcrete, no loam.
GCP122-E2	40-60	**Sample R214052.** Platy calcrete - siliceous. No loam.
GCP122-E3	60-80	**Sample R214053.** Calcrete with abundant quartz.
GCP122-E4	80-100	**Sample R214054.** Calcrete with silcrete and quartz.
GCP122-E5	100-120	**Sample R214055.** Calcrete massive with proto silcrete containing quartz veining.
GCP122-E6	120-140	**Sample R214056.** As per (-E5) with ?pseudo bedding of quartz veins
GCP122-2E1	10-20	**Sample R214058**. Red brown sandy loam, very few nodules.
GCP122-2E2	20-30	**Sample R214059.** Brown sandy loam with abundant calcrete nodules (platy).
GCP122-2E3	30-40	**Sample R214060.** Pinky brown calcrete loam with abundant large calcrete nodules (platy).
GCP122-2E4	40-60	**Sample R214061.** Whitish calcrete - siliceous with quartz. Large abundant nodules 5-10cm.
GCP122-2E5	60-70	**Sample R214062.** Whitish calcrete - siliceous with abundant quartz. Abundant large nodules.
GCP122-2E6	70-80	**Sample R214063.** Mainly quartz with a little calcrete as coatings. Quartz bluish with pieces up to 5cm. Large quartz piece.
GCP122-W1	10-20	**Sample R214064.** Nodular calcrete (up to 10cm) with calcareous loam.

GCP122-W2	20-30	**Sample R214065.** Nodular calcrete (massive) - ?siliceous.
GCP122-W3	30-40	**Sample R214066.** Massive calcrete - siliceous.
GCP122-W4	40-50	**Sample R214067.** Siliceous calcrete in abundant calcareous loam. Nodules up to 5cm.
GCP122-W5	50-70	**Sample R214068.** Siliceous calcrete. Silcrete nodules in massive calcrete. Quartz veining in silcrete.
GCP122-W6	70-80	**Sample R214069.** Calcrete nodular. Minor siliceous component. Nodules up to 5-10cm.
GCP122-W7	80-90	**Sample R214070.** Whitish. Soft-brittle nodules. Non calcareous in calcareous loam. Mineralogy required. Nodules extremely light.

Samples from Regolith Pit GCP123

FIELD NUMBER	DEPTH (cm)	DESCRIPTION
GCP123-1	~5-20	**Sample R213986**. Massive calcrete with smooth top. Calcareous loamy material.
GCP123-2	20-30	**Sample R213987**. Massive calcrete with smooth top. Large lumps (>10cm). Pieces brake off and have black organic-rich material on partings also rootlets present.
GCP123-2A	20-30	**Sample R214000.** "Slab" of calcrete with quartz. Mainly silcrete boulders inside.
GCP123-3	30-40	**Sample R213988**. Loamy calcareous clay. Some calcrete (massive).
GCP123-3A	30-40	**Sample R213989.** Massive calcrete from same horizon AA. Silcrete nodules inside, other half retained as hand specimen.
GCP123-4	40-60	**Sample R213990.** Massive calcrete with silcrete and quartz "floating".
GCP123-5	60-90	**Sample R213991.** Massive calcrete with silcrete and quartz..
GCP123-5A	60-90	**Sample R213992, 367475.** Massive calcrete from some horizon as per (-5). Mn oxides inside silcrete.
GCP123-6	90-125	**Sample R213993.** Massive calcrete/silcrete. Iron stained "proto"silcrete and quartz.
GCP123-7	125-160	**Sample R213994.** Massive calcrete with quartz veining. Matrix supported "proto-ferruginous-silcrete".
GCP123-8	160-170	**Sample R213995.** Massive calcrete with silcrete and quartz heating. Some quartz rods associated with minor yellow Fe staining. About half of the sample is calcareous loam.
GCP123-9	170-210	**Sample R213996.** Massive calcrete with silcrete "floaters". Minor Mn staining.
GCP123-10	210-240	**Sample R213997.** Silcrete gravels and cobbles in calcareous loams.
GCP123-11	240-260	**Sample R213998.** Silcrete gravels and cobbles in calcareous loam. Some silcrete has blue quartz.
GCP123-12	260-275	**Sample R213999.** "Greasy" boulder. Silicified clay - ?talc mica rich. (Very fine grained). Brown yellow-pale yellow mottling (irregular).

Samples from Regolith Pit GCP129

FIELD NUMBER	DEPTH (cm)	DESCRIPTION
GCP129-1	10-20	**Sample R213959**. Sandy clay with abundant coarse silcrete and gravels and nodules (5 cm). Non-calcareous.
GCP129-2	20-30	**Sample R213960**. Calcareous nodules 5 cm. Hard. Sandy clay. Very minor silcrete.
GCP129-3	30-35	**Sample R213961**. Calcareous nodules 2 cm. Sandy clay. Very minor silcrete.
GCP129-4	35-38	**Sample R213962.** Platy calcrete. ?old soil horizon. Good example of formation of silcrete nodules within calcrete.
GCP129-5	38-48	**Sample R213963.** Platy calcrete. Silcrete nodules within calcrete**.**
GCP129-6	48-60	**Sample R213964, 367474.** Platy calcrete.
GCP129-7	60-90	**Sample R213965.** Massive calcrete - pseudo laminar with minor quartz and silcrete and Fe stained silcrete contained therein.
GCP129-8	90-120	**Sample R213966.** Platy -massive calcrete. Minor rounded silcrete nodules within.
GCP129-9	120-145	**Sample R213967.** Massive calcrete - Minor -moderate rounded ferruginous pisoliths and silcrete.
GCP129-10	145-170	**Sample R213968.** Massive silicified unit with abundant bluish quartz fragments.
GCP129-10 * (duplicate)	145-170	**Sample R213969.** As above. Submitted separately to look at variation. Cut face exposes clasts supported polymict unit with blue quartz-silcrete, Fe silcrete. Fe stained-silicified units.
GCP129-11	170-185	**Sample R213970.** Platy calcrete.
GCP129-12	185-200	**Sample R213971.** Silcrete with Mn and Fe staining.
GCP129-13	200-225	**Sample R213972.** Similar to above (-12).
GCP129-14	230-260	**Sample R213973.** Similar to above (-12). Minor calcrete nodules.
GCP129-15	260-300	**Sample R213974.** Silcrete with abundant Mn and minor Fe staining.
GCP129-16	215-230	**Sample R213975.** Silcrete hand specimens with abundant Mn and Fe staining.
GCP129-grab	~70	**Sample R213976, 367487.** Fe-rich grab sample (siliceous). ?70cm. Vesicular. Cutanous.
GCP129-grab	pit spoil pile	**Sample R214425**. Green Mn/Fe rock, grab sample, XRD analysis of green subsample
GCP129-E1	20-40	**Sample R213977**. Platy calcrete with abundant nodules. (Siliceous + ferruginous).
GCP129-E2	40-70	**Sample R213978.** Massive calcrete with abundant nodules (silicified and ferruginous)
GCP129-E2A	60 cm	**Sample R213979.** Massive calcrete with abundant nodules (siliceous and ferruginous).
GCP129-E3	130 cm	**Sample R213980.** Massive laminar calcrete with moderate nodules.
GCP129-W1	15-25 cm	**Sample R213981.** Platy calcrete with minor silcrete nodules.
GCP129-W2	50-70 cm	**Sample R213982.** Massive calcrete.
GCP129-W3	90-110	**Sample R213983.** Massive with silcrete nodules.
GCP129-W4	130-145	**Sample R213984.** Laminar-massive calcrete with silcrete.

APPENDIX 9

Appendix 9: Tabulated data (Excel File)

Appendix Table A9.1: Chemical data.

Number	Sample_id	Type Code	Drill Hole	Zone	E	N	from	to	av depth	dip	Ag	As	Au	Ba	Bi	Ca	Cd	Ce
units											ppm	ppm	ppb	ppm	ppm	ppm	ppm	ppm
techique											icpms	icpms	aas	icpoes	icpms	icpoes	icpms	icpms
detn limit											0.1	1.5	1	5	0.1	10	0.1	0.5
R208913	GC001	soil		53	363681	6693814	0.00	0.05	0.025		<0.1	3.5	<1	130	0.2	2900	<0.1	19
R208914	GC002	soil		53	363681	6693814	0.05	0.10	0.075		<0.1	3	76	130	0.2	2650	<0.1	19.5
R208915	GC003	soil		53	363681	6693814	0.10	0.15	0.125		<0.1	4	1	130	0.2	4350	<0.1	23
R208916	GC004	soil		53	363681	6693814	0.15	0.20	0.175		<0.1	4	<1	130	0.2	5000	<0.1	23.5
R208917	GC005	soil		53	363681	6693814	0.20	0.25	0.225		<0.1	4	3	130	0.2	7450	<0.1	22.5
R208918	GC006	soil		53	363681	6693814	0.25	0.30	0.275		<0.1	3	2	140	0.2	20300	<0.1	24.5
R208919	GC007	soil		53	363632	6693912	0.00	0.05	0.025		<0.1	3.5	<1	165	0.2	3300	<0.1	25.5
R208920	GC008	soil		53	363632	6693912	0.05	0.10	0.075		<0.1	3.5	<1	155	0.2	5900	<0.1	24.5
R208921	GC009	soil		53	363632	6693912	0.10	0.15	0.125		<0.1	3	<1	140	0.2	5400	<0.1	21
R208922	GC0010	soil		53	363632	6693912	0.15	0.20	0.175		<0.1	3	3	140	0.1	9000	<0.1	26
R208923	GC0011	soil		53	363632	6693912	0.20	0.25	0.225		<0.1	4	3	150	0.2	13500	<0.1	21.5
R208924	GC0012	soil		53	363632	6693912	0.25	0.30	0.275		<0.1	6	3	170	0.2	19700	<0.1	25.5
R208925	GC0013	soil		53	363632	6693912	0.00	0.01	0.005		0.3	240	80	550	0.1	10500	0.3	70
R208926	GC0014	pit A		53	363615	6693934	0.00	0.07	0.035		1.3	7.5	3	145	0.2	15100	<0.1	24
R208927	GC0015	pit A		53	363615	6693934	0.07	0.20	0.135		<0.1	3.5	2	135	0.1	13200	<0.1	20.5
R208928	GC0016	pit A		53	363615	6693934	0.20	0.30	0.25		<0.1	5.5	3	140	0.2	18900	<0.1	22.5
R208929	GC0017	pit A		53	363615	6693934	0.30	0.40	0.35		<0.1	5.5	5	150	0.2	24300	<0.1	24
R208930	GC0018	pit A		53	363615	6693934	0.40	0.50	0.45		<0.1	8.5	6	155	0.1	47500	<0.1	22
R208931	GC0019	pit A		53	363615	6693934	0.50	0.60	0.55		<0.1	9	24	165	0.2	62500	<0.1	22.5
R208932	GC0020	pit A		53	363615	6693934	0.60	0.70	0.65		<0.1	5	5	175	0.2	65600	<0.1	27
R208933	GC0021	pit A		53	363615	6693934	0.70	0.80	0.75		<0.1	8.5	9	240	0.1	68200	<0.1	27
R208934	GC0022	pit A		53	363615	6693934	0.80	0.90	0.85		<0.1	6.5	9	195	0.2	74900	<0.1	29
R208935	GC0023	pit A		53	363615	6693934	0.90	1.00	0.95		<0.1	6	11	180	0.2	75200	<0.1	32.5
R208936	GC0024	pit A		53	363615	6693934	1.00	1.10	1.05		<0.1	6.5	6	260	0.1	73800	<0.1	29
R208937	GC0025	pit A		53	363615	6693934	1.10	1.20	1.15		<0.1	6	8	650	0.1	152000	0.1	40
R208938	GC0025	silcrete		53	363615	6693934	1.10	1.20	1.15		0.3	18	<1	<5	<0.1	8150	0.1	115
R208939	GC0026	pit A		53	363615	6693934	1.20	1.30	1.25		0.1	5.5	13	800	0.1	186000	<0.1	77
R213512	GC0027	pit A		53	363615	6693934	1.30	1.40	1.35		<0.1	8	12	1400	0.1	131000	<0.1	73
R213513	GC0028	pit A		53	363615	6693934	1.40	1.50	1.45		0.1	8.5	17	<5	<0.1	112000	0.1	95
R213514	GC0029	calcrete		53	363501	6693834	0.00	1.00	0.5		<0.1	6.5	39	1050	<0.1	195000	<0.1	15.5
R213515	GC0030	calcrete		53	363540	6693744	0.00	1.00	0.5		0.5	10.5	76	2100	<0.1	255000	0.1	12
R213516	GC0031	calcrete		53	363515	6693948	0.00	1.00	0.5		<0.1	4	21	230	<0.1	278000	0.1	14
R213517	GC0032	calcrete		53	363512	6694011	0.00	1.00	0.5		<0.1	9	16	330	0.1	190000	<0.1	19
R213518	GC0033	calcrete		53	363550	6694110	0.00	1.00	0.5		<0.1	5	8	1150	<0.1	173000	<0.1	22
R213519	GC0033	calcrete		53	363550	6694110	0.00	1.00	0.5		0.1	9.5	17	1500	<0.1	261000	<0.1	19.5
R213520	GC0034a	sundry		53	363603	6694265	0.00	1.00	0.5		0.1	41.5	2	2700	0.5	5600	0.1	18.5
R213521	GC0034bi	sundry		53	363603	6694265	0.00	1.00	0.5		0.1	12	<1	2950	0.3	10600	0.1	22
R213522	GC0034bii	sundry		53	363603	6694265	0.00	1.00	0.5		0.2	27.5	<1	850	0.3	83400	0.1	36.5
R213523	GC0034c	sundry		53	363603	6694265	0.00	1.00	0.5		<0.1	8	7	1650	0.1	163000	<0.1	17.5
R213524	GC0035	sundry		53	363332	6693762	0.00	0.01	0.005		<0.1	10	34	750	0.1	288000	0.2	13
R213525	GC0036	sundry		53	363332	6693762	0.00	0.01	0.005		0.1	70	2	420	1.9	3900	0.4	45.5
R213526	GC0037	sundry		53	363332	6693762	0.00	0.01	0.005		0.2	1.5	295	2800	<0.1	2200	0.1	25.5
R213527	GC0038	sundry		53	363332	6693762	0.00	0.01	0.005		0.3	4.5	25	1650	0.2	1450	0.1	12
R213528	GC0039	sundry		53	363332	6693762	0.00	0.01	0.005		0.2	1	32	1250	0.1	2200	0.1	22.5
R213529	GC0040	sundry		53	363332	6693762	0.00	0.01	0.005		0.1	3.5	3	3350	<0.1	850	<0.1	7.5
R213530	GC0041	sundry		53	363332	6693762	0.00	0.01	0.005		<0.1	0.5	10	55	<0.1	650	<0.1	2.1
R213545	GC dummy 0-1	upper regolith	GC100-	53	364191	6692856	0	1	0.5		0.2	15	6	1050	0.2	92400	<0.1	24
R213546	GC dummy 1-2	upper regolith	GC100-	53	364191	6692856	1	2	1.5		0.2	13	6	1150	0.2	84200	<0.1	23
R213547	GC dummy 2-3	upper regolith	GC100-	53	364191	6692856	2	3	2.5		0.1	6.5	7	410	0.1	56000	<0.1	12.5
R213548	GC dummy 3-4	upper regolith	GC100-	53	364191	6692856	3	4	3.5		0.2	5	4	290	0.1	37100	<0.1	9.5
R213549	GC dummy 4-5	upper regolith	GC100-	53	364191	6692856	4	5	4.5		0.4	4	3	210	0.1	9500	<0.1	4.1
R213550	GC dummy 5-6	upper regolith	GC100-	53	364191	6692856	5	6	5.5		0.6	7	<1	150	0.2	2950	<0.1	5
R213551	GC100A	upper regolith	GC100	53	364186	6692861	0	1	0.5		0.2	11.5	6	850	0.1	145000	<0.1	23.5

Appendix Table A9.1: Chemical data.

Number	Sample_id	Type Code	Drill Hole	Zone	E	N	from	to	av depth	dip	Ag	As	Au	Ba	Bi	Ca	Cd	Ce
R213552	GC100B	upper regolith	GC100	53	364186	6692861	1	2	1.5		0.3	15.5	6	750	0.2	60600	<0.1	33
R213553	GC100C	upper regolith	GC100	53	364186	6692861	2	3	2.5		0.3	10.5	7	490	0.2	56900	<0.1	16
R213554	GC100D	upper regolith	GC100	53	364186	6692861	3	4	3.5		0.2	8	7	440	0.1	40400	<0.1	14
R213555	GC100E	upper regolith	GC100	53	364186	6692861	4	5	4.5		0.2	6	7	220	0.1	16900	<0.1	7.5
R213556	GC100F	upper regolith	GC100	53	364186	6692861	5	6	5.5		0.2	5.5	5	175	0.2	13200	<0.1	9
R213557	GC101A	upper regolith	GC101	53	364146	6692880	0	1	0.5		0.2	13.5	2	1150	0.2	76300	<0.1	14
R213558	GC101B	upper regolith	GC101	53	364146	6692880	1	2	1.5		0.3	9	5	900	0.2	37900	<0.1	13
R213559	GC101C	upper regolith	GC101	53	364146	6692880	2	3	2.5		0.3	5	4	240	0.2	36300	<0.1	5.5
R213560	GC101D	upper regolith	GC101	53	364146	6692880	3	4	3.5		0.3	4	6	320	0.2	36700	<0.1	8
R213561	GC101E	upper regolith	GC101	53	364146	6692880	4	5	4.5		0.3	2.5	9	160	0.1	9900	<0.1	5
R213562	GC101F	upper regolith	GC101	53	364146	6692880	5	6	5.5		0.3	3.5	9	150	0.2	21100	<0.1	8.5
R213563	GC102A	upper regolith	GC102	53	364141	6692931	0	1	0.5		0.2	7.5	6	1200	0.3	44400	<0.1	41
R213564	GC102B	upper regolith	GC102	53	364141	6692931	1	2	1.5		0.2	3.5	4	700	0.2	24300	<0.1	25.5
R213565	GC102C	upper regolith	GC102	53	364141	6692931	2	3	2.5		0.2	2	2	195	0.1	4350	<0.1	22.5
R213566	GC102D	upper regolith	GC102	53	364141	6692931	3	4	3.5		0.2	1.5	3	140	0.1	3250	<0.1	16
R213567	GC102E	upper regolith	GC102	53	364141	6692931	4	5	4.5		0.7	5.5	13	165	0.2	5300	<0.1	34.5
R213568	GC102F	upper regolith	GC102	53	364141	6692931	5	6	5.5		0.3	6	14	120	0.3	9650	<0.1	86
R213569	GC103A	upper regolith	GC103	53	364136	6692982	0	1	0.5		0.2	8	3	1100	0.2	46100	<0.1	34.5
R213570	GC103B	upper regolith	GC103	53	364136	6692982	1	2	1.5		0.7	4	4	900	0.2	33000	<0.1	23.5
R213571	GC103C	upper regolith	GC103	53	364136	6692982	2	3	2.5		0.4	2	2	550	0.1	6600	<0.1	16.5
R213572	GC103D	upper regolith	GC103	53	364136	6692982	3	4	3.5		0.2	5	8	80	0.2	3600	<0.1	23.5
R213573	GC103E	upper regolith	GC103	53	364136	6692982	4	5	4.5		0.2	2	3	180	0.1	4650	<0.1	10.5
R213574	GC103F	upper regolith	GC103	53	364136	6692982	5	6	5.5		0.6	5	5	175	0.2	44700	<0.1	100
R213575	GC104A	upper regolith	GC104	53	364093	6693027	0	1	0.5		1.2	6	3	1100	0.1	17300	<0.1	9.5
R213576	GC104B	upper regolith	GC104	53	364093	6693027	1	2	1.5		0.2	5	6	400	0.1	72000	<0.1	7
R213577	GC104C	upper regolith	GC104	53	364093	6693027	2	3	2.5		0.1	2.5	6	260	0.1	17200	<0.1	7
R213578	GC104D	upper regolith	GC104	53	364093	6693027	3	4	3.5		0.2	4	6	160	0.1	7750	<0.1	6
R213579	GC104E	upper regolith	GC104	53	364093	6693027	4	5	4.5		0.3	3	6	250	0.2	15900	<0.1	12.5
R213580	GC104F	upper regolith	GC104	53	364093	6693027	5	6	5.5		0.2	4	11	110	0.3	17700	<0.1	20
R213581	GC105A	upper regolith	GC105	53	364076	6693061	0	1	0.5		0.2	12	13	1550	<0.1	168000	<0.1	13
R213582	GC105B	upper regolith	GC105	53	364076	6693061	1	2	1.5		<0.1	8	18	1400	<0.1	134000	<0.1	24.5
R213583	GC105C	upper regolith	GC105	53	364076	6693061	2	3	2.5		0.2	4.5	17	185	<0.1	65000	<0.1	14.5
R213584	GC105D	upper regolith	GC105	53	364076	6693061	3	4	3.5		0.2	7	4	320	0.1	9900	<0.1	12
R213585	GC105E	upper regolith	GC105	53	364076	6693061	4	5	4.5		0.3	11.5	13	185	0.3	3050	<0.1	9
R213586	GC105F	upper regolith	GC105	53	364076	6693061	5	6	5.5		0.4	9	7	190	0.4	2850	<0.1	16.5
R213587	GC106A	upper regolith	GC106	53	364035	6693094	0	1	0.5		0.2	12.5	8	1200	<0.1	125000	<0.1	25
R213588	GC106B	upper regolith	GC106	53	364035	6693094	1	2	1.5		0.1	9	14	650	0.1	73600	<0.1	56
R213589	GC106C	upper regolith	GC106	53	364035	6693094	2	3	2.5		0.3	6	8	240	<0.1	43000	<0.1	43
R213590	GC106D	upper regolith	GC106	53	364035	6693094	3	4	3.5		0.3	5	8	230	0.1	2750	<0.1	6
R213591	GC106E	upper regolith	GC106	53	364035	6693094	4	5	4.5		0.2	6	5	165	0.2	1650	<0.1	7
R213592	GC106F	upper regolith	GC106	53	364035	6693094	5	6	5.5		0.3	5	8	165	0.2	2050	<0.1	8
R213593	std 9	standard									0.6	400	53	300	1.3	1600	0.5	22
R213594	GC107A	upper regolith	GC107	53	363996	6693124	0	1	0.5		0.3	9.5	15	750	0.1	134000	<0.1	15
R213595	GC107B	upper regolith	GC107	53	363996	6693124	1	2	1.5		<0.1	6.5	17	490	<0.1	109000	<0.1	10
R213596	GC107C	upper regolith	GC107	53	363996	6693124	2	3	2.5		0.2	4.5	10	210	0.2	27000	<0.1	16
R213597	GC107D	upper regolith	GC107	53	363996	6693124	3	4	3.5		0.5	7.5	6	230	0.3	5350	<0.1	11.5
R213598	GC107E	upper regolith	GC107	53	363996	6693124	4	5	4.5		0.2	5.5	3	130	0.4	2000	<0.1	12
R213599	GC107F	upper regolith	GC107	53	363996	6693124	5	6	5.5		<0.1	7	4	115	0.9	1400	<0.1	12.5
R213600	GC108A	upper regolith	GC108	53	363955	6693144	0	1	0.5		<0.1	8.5	15	360	<0.1	132000	<0.1	14.5
R213601	GC108B	upper regolith	GC108	53	363955	6693144	1	2	1.5		0.7	6	9	250	0.2	47900	<0.1	28
R213602	GC108C	upper regolith	GC108	53	363955	6693144	2	3	2.5		0.2	5.5	5	175	0.3	12400	<0.1	16.5
R213603	GC108D	upper regolith	GC108	53	363955	6693144	3	4	3.5		0.2	5.5	4	160	0.5	10800	<0.1	16.5
R213604	GC108E	upper regolith	GC108	53	363955	6693144	4	5	4.5		0.5	2.5	2	110	0.6	2100	<0.1	9.5
R213605	GC108F	upper regolith	GC108	53	363955	6693144	5	6	5.5		0.9	1.5	<1	115	0.7	1600	<0.1	13.5
R213606	GC109A	upper regolith	GC109	53	363913	6693167	0	1	0.5		<0.1	8.5	10	900	<0.1	147000	<0.1	13
R213607	GC109B	upper regolith	GC109	53	363913	6693167	1	2	1.5		0.2	6	10	290	0.2	69200	<0.1	19

Appendix Table A9.1: Chemical data.

Number	Sample_id	Type Code	Drill Hole	Zone	E	N	from	to	av depth	dip	Ag	As	Au	Ba	Bi	Ca	Cd	Ce
R213608	GC109C	upper regolith	GC109	53	363913	6693167	2	3	2.5		0.3	7	6	430	0.4	8100	<0.1	14
R213609	GC109D	upper regolith	GC109	53	363913	6693167	3	4	3.5		0.2	6	8	185	0.4	3600	<0.1	12.5
R213610	GC109E	upper regolith	GC109	53	363913	6693167	4	5	4.5		0.2	4	<1	115	0.4	1300	<0.1	13
R213611	GC109F	upper regolith	GC109	53	363913	6693167	5	6	5.5		<0.1	4	3	120	0.6	1400	<0.1	15
R213612	GC110A	upper regolith	GC110	53	363862	6693215	0	1	0.5		<0.1	8.5	3	270	0.2	107000	<0.1	8.5
R213613	GC110B	upper regolith	GC110	53	363862	6693215	1	2	1.5		0.4	5	2	440	0.1	15300	<0.1	10
R213614	GC110C	upper regolith	GC110	53	363862	6693215	2	3	2.5		0.3	5.5	<1	120	0.2	5050	<0.1	6.5
R213615	GC110D	upper regolith	GC110	53	363862	6693215	3	4	3.5		0.3	3.5	1	150	0.3	3150	<0.1	7.5
R213616	GC110E	upper regolith	GC110	53	363862	6693215	4	5	4.5		2	4.5	<1	95	0.8	1700	<0.1	13
R213617	GC110F	upper regolith	GC110	53	363862	6693215	5	6	5.5		0.3	4.5	<1	105	0.7	1650	<0.1	13
R213618	GC111A	upper regolith	GC111	53	363823	6693210	0	1	0.5		<0.1	7.5	7	240	0.2	76400	<0.1	18
R213619	GC111B	upper regolith	GC111	53	363823	6693210	1	2	1.5		<0.1	7	4	195	0.4	40500	<0.1	17.5
R213620	GC111C	upper regolith	GC111	53	363823	6693210	2	3	2.5		0.2	8.5	<1	110	0.3	5600	<0.1	18.5
R213621	GC111D	upper regolith	GC111	53	363823	6693210	3	4	3.5		<0.1	1.5	1	100	0.2	1550	<0.1	28.5
R213622	GC111E	upper regolith	GC111	53	363823	6693210	4	5	4.5		0.4	1.5	2	80	<0.1	1300	<0.1	34.5
R213623	GC111F	upper regolith	GC111	53	363823	6693210	5	6	5.5		0.2	8.5	<1	370	<0.1	2250	<0.1	40
R213624	GC112A	upper regolith	GC112	53	363781	6693237	0	1	0.5		0.1	7	<1	1650	0.2	81500	<0.1	32
R213625	GC112B	upper regolith	GC112	53	363781	6693237	1	2	1.5		<0.1	7	4	390	0.1	52500	<0.1	74
R213626	GC112C	upper regolith	GC112	53	363781	6693237	2	3	2.5		<0.1	7	3	150	<0.1	13600	<0.1	84
R213627	GC112D	upper regolith	GC112	53	363781	6693237	3	4	3.5		0.2	6.5	<1	65	0.1	3550	<0.1	48
R213628	GC112E	upper regolith	GC112	53	363781	6693237	4	5	4.5		0.1	5	<1	115	<0.1	2200	<0.1	63
R213629	GC112F	upper regolith	GC112	53	363781	6693237	5	6	5.5		0.3	25.5	<1	420	<0.1	2250	<0.1	110
R213630	GC113A	upper regolith	GC113	53	363753	6693275	0	1	0.5		0.2	9	16	400	<0.1	121000	<0.1	31.5
R213631	GC113B	upper regolith	GC113	53	363753	6693275	1	2	1.5		0.2	16.5	17	185	<0.1	87100	<0.1	63
R213632	GC113C	upper regolith	GC113	53	363753	6693275	2	3	2.5		1	19	23	100	<0.1	70300	<0.1	140
R213633	GC113D	upper regolith	GC113	53	363753	6693275	3	4	3.5		0.2	18	6	75	<0.1	6500	<0.1	85
R213634	GC113E	upper regolith	GC113	53	363753	6693275	4	5	4.5		0.1	19.5	<1	65	<0.1	3000	<0.1	73
R213635	GC113F	upper regolith	GC113	53	363753	6693275	5	6	5.5		0.4	29.5	<1	145	0.2	950	<0.1	100
R213636	GC114A	upper regolith	GC114	53	363719	6693312	0	1	0.5		0.2	12	42	130	0.2	1200	<0.1	36.5
R213637	GC114B	upper regolith	GC114	53	363719	6693312	1	2	1.5		0.3	13.5	12	310	0.2	82400	<0.1	40.5
R213638	GC114C	upper regolith	GC114	53	363719	6693312	2	3	2.5		0.4	18.5	16	240	<0.1	25600	<0.1	57
R213639	GC114D	upper regolith	GC114	53	363719	6693312	3	4	3.5		0.5	53	10	280	0.1	6850	<0.1	130
R213640	GC114E	upper regolith	GC114	53	363719	6693312	4	5	4.5		0.5	125	5	250	0.1	4450	<0.1	75
R213641	GC114F	upper regolith	GC114	53	363719	6693312	5	6	5.5		0.4	69	3	180	<0.1	1300	<0.1	90
R213642	std 7	standard									0.8	56	285	40	3	1100	<0.1	10.5
R213643	GC115A	upper regolith	GC115	53	363687	6693346	0	1	0.5		0.3	15.5	35	350	0.3	72500	<0.1	43.5
R213644	GC115B	upper regolith	GC115	53	363687	6693346	1	2	1.5		0.5	12	18	390	0.2	53000	<0.1	85
R213645	GC115C	upper regolith	GC115	53	363687	6693346	2	3	2.5		0.4	7	31	180	0.1	38500	<0.1	62
R213646	GC115D	upper regolith	GC115	53	363687	6693346	3	4	3.5		0.4	4.5	16	210	<0.1	15000	<0.1	47
R213647	GC115E	upper regolith	GC115	53	363687	6693346	4	5	4.5		0.3	4	9	470	<0.1	8150	<0.1	53
R213648	GC115F	upper regolith	GC115	53	363687	6693346	5	6	5.5		0.3	18	9	390	<0.1	5050	<0.1	61
R213649	GC116A	upper regolith	GC116	53	363657	6693390	0	1	0.5		0.2	11	19	470	0.2	112000	<0.1	30.5
R213650	GC116B	upper regolith	GC116	53	363657	6693390	1	2	1.5		0.3	6.5	10	340	0.1	36600	<0.1	62
R213651	GC116C	upper regolith	GC116	53	363657	6693390	2	3	2.5		0.4	8.5	8	140	<0.1	14400	<0.1	94
R213652	GC116D	upper regolith	GC116	53	363657	6693390	3	4	3.5		0.3	12	4	40	<0.1	2100	<0.1	77
R213653	GC116E	upper regolith	GC116	53	363657	6693390	4	5	4.5		0.5	25.5	3	85	0.3	1600	<0.1	73
R213654	GC116F	upper regolith	GC116	53	363657	6693390	5	6	5.5		0.5	10.5	4	120	0.1	5900	<0.1	60
R213655	GC117A	upper regolith	GC117	53	363625	6693428	0	1	0.5		0.2	8	9	410	0.2	102000	<0.1	25
R213656	GC117B	upper regolith	GC117	53	363625	6693428	1	2	1.5		0.2	11	8	650	0.3	29700	<0.1	37
R213657	GC117C	upper regolith	GC117	53	363625	6693428	2	3	2.5		0.4	22	7	550	0.2	19300	<0.1	78
R213658	GC117D	upper regolith	GC117	53	363625	6693428	3	4	3.5		0.4	16.5	4	105	<0.1	2250	<0.1	88
R213659	GC117E	upper regolith	GC117	53	363625	6693428	4	5	4.5		0.3	11.5	2	80	<0.1	850	<0.1	92
R213660	GC117F	upper regolith	GC117	53	363625	6693428	5	6	5.5		0.3	11.5	2	75	<0.1	1100	<0.1	95
R213661	GC118A	upper regolith	GC118	53	363592	6693465	0	1	0.5		0.3	11	9	1150	0.2	78400	<0.1	50
R213662	GC118B	upper regolith	GC118	53	363592	6693465	1	2	1.5		0.3	15	10	400	0.1	53000	<0.1	68
R213663	GC118C	upper regolith	GC118	53	363592	6693465	2	3	2.5		0.2	18.5	2	220	<0.1	43300	<0.1	100

Appendix Table A9.1: Chemical data.

Number	Sample_id	Type Code	Drill Hole	Zone	E	N	from	to	av depth	dip	Ag	As	Au	Ba	Bi	Ca	Cd	Ce
R213664	GC118D	upper regolith	GC118	53	363592	6693465	3	4	3.5		0.3	19.5	5	90	<0.1	11200	<0.1	67
R213665	GC118E	upper regolith	GC118	53	363592	6693465	4	5	4.5		0.4	29	3	90	<0.1	5150	<0.1	105
R213666	GC118F	upper regolith	GC118	53	363592	6693465	5	6	5.5		0.4	34	2	75	<0.1	2100	<0.1	120
R213667	GC119A	upper regolith	GC119	53	363559	6693501	0	1	0.5		0.1	8.5	23	950	0.1	168000	<0.1	25.5
R213668	GC119B	upper regolith	GC119	53	363559	6693501	1	2	1.5		0.2	7.5	16	550	0.1	103000	<0.1	33
R213669	GC119C	upper regolith	GC119	53	363559	6693501	2	3	2.5		0.3	6.5	14	270	<0.1	43100	<0.1	50
R213670	GC119D	upper regolith	GC119	53	363559	6693501	3	4	3.5		0.4	7.5	21	145	<0.1	8650	<0.1	91
R213671	GC119E	upper regolith	GC119	53	363559	6693501	4	5	4.5		0.3	5	5	145	<0.1	2800	<0.1	75
R213672	GC119F	upper regolith	GC119	53	363559	6693501	5	6	5.5		0.3	3.5	4	155	<0.1	1350	<0.1	55
R213673	GC120A	upper regolith	GC120	53	363521	6693542	0	1	0.5		0.2	9.5	56	850	0.1	150000	<0.1	18
R213674	GC120B	upper regolith	GC120	53	363521	6693542	1	2	1.5		0.2	9	41	550	0.1	102000	<0.1	39
R213675	GC120C	upper regolith	GC120	53	363521	6693542	2	3	2.5		0.3	6.5	31	470	0.1	21500	<0.1	49
R213676	GC120D	upper regolith	GC120	53	363521	6693542	3	4	3.5		0.4	6	15	350	<0.1	5750	<0.1	44.5
R213677	GC120E	upper regolith	GC120	53	363521	6693542	4	5	4.5		0.3	9.5	12	700	<0.1	2850	<0.1	66
R213678	GC120F	upper regolith	GC120	53	363521	6693542	5	6	5.5		0.3	8	6	700	<0.1	2450	<0.1	73
R213679	GC121A	upper regolith	GC121	53	363490	6693580	0	1	0.5		0.2	21.5	88	500	0.1	118000	<0.1	24.5
R213680	GC121B	upper regolith	GC121	53	363490	6693580	1	2	1.5		0.3	37.5	120	440	0.1	89700	0.1	125
R213681	GC121C	upper regolith	GC121	53	363490	6693580	2	3	2.5		0.4	80	40	700	<0.1	8350	0.2	105
R213682	GC121D	upper regolith	GC121	53	363490	6693580	3	4	3.5		0.2	98	23	650	0.1	9300	0.2	82
R213683	GC121E	upper regolith	GC121	53	363490	6693580	4	5	4.5		<0.1	68	18	550	0.1	3950	0.2	56
R213684	GC121F	upper regolith	GC121	53	363490	6693580	5	6	5.5		0.3	53	13	700	<0.1	4700	0.3	91
R213685	GC122A	upper regolith	GC122	53	363452	6693628	0	1	0.5		0.1	12.5	1055	270	0.3	138000	0.2	37
R213686	GC122B	upper regolith	GC122	53	363452	6693628	1	2	1.5		0.2	12.5	5600	270	0.3	68600	0.1	41
R213687	GC122C	upper regolith	GC122	53	363452	6693628	2	3	2.5		0.1	15.5	1450	200	0.4	31800	0.1	41.5
R213688	GC122D	upper regolith	GC122	53	363452	6693628	3	4	3.5		0.5	18.5	790	210	0.3	9400	0.2	43.5
R213689	GC122E	upper regolith	GC122	53	363452	6693628	4	5	4.5		0.2	18.5	790	410	1.1	1750	0.2	39
R213690	GC122F	upper regolith	GC122	53	363452	6693628	5	6	5.5		0.1	12.5	2085	350	0.7	1500	0.2	53
R213691	std 6	standard									0.3	2	77	280	0.3	1400	0.1	31.5
R213692	GC123A	upper regolith	GC123	53	363411	6693656	0	1	0.5		0.2	47.5	150	140	<0.1	102000	0.1	71
R213693	GC123B	upper regolith	GC123	53	363411	6693656	1	2	1.5		0.2	260	77	85	<0.1	37400	0.2	87
R213694	GC123C	upper regolith	GC123	53	363411	6693656	2	3	2.5		<0.1	360	36	80	<0.1	4350	0.2	61
R213695	GC123D	upper regolith	GC123	53	363411	6693656	3	4	3.5		0.2	190	43	45	0.1	3950	0.3	88
R213696	GC123E	upper regolith	GC123	53	363411	6693656	4	5	4.5		<0.1	440	32	45	0.1	3550	0.3	72
R213697	GC123F	upper regolith	GC123	53	363411	6693656	5	6	5.5		0.2	135	11	30	<0.1	1300	0.2	83
R213698	GC124A	upper regolith	GC124	53	363354	6693679	0	1	0.5		<0.1	14.5	200	350	<0.1	137000	0.1	42
R213699	GC124B	upper regolith	GC124	53	363354	6693679	1	2	1.5		1	8	220	280	0.1	89600	0.2	66
R213700	GC124C	upper regolith	GC124	53	363354	6693679	2	3	2.5		0.3	9	115	95	<0.1	15700	0.1	87
R213701	GC124D	upper regolith	GC124	53	363354	6693679	3	4	3.5		0.2	12	61	70	<0.1	1750	0.2	87
R213702	GC124E	upper regolith	GC124	53	363354	6693679	4	5	4.5		0.2	10.5	39	70	<0.1	2900	0.2	110
R213703	GC124F	upper regolith	GC124	53	363354	6693679	5	6	5.5		0.2	13	22	80	<0.1	1000	0.2	85
R213704	GC125A	upper regolith	GC125	53	363332	6693717	0	1	0.5		0.1	3	60	370	0.2	105000	0.1	53
R213705	GC125B	upper regolith	GC125	53	363332	6693717	1	2	1.5		0.2	2	85	330	<0.1	61600	0.1	59
R213706	GC125C	upper regolith	GC125	53	363332	6693717	2	3	2.5		0.2	2	37	170	<0.1	14700	<0.1	84
R213707	GC125D	upper regolith	GC125	53	363332	6693717	3	4	3.5		0.3	8.5	23	60	<0.1	1650	0.2	110
R213708	GC125E	upper regolith	GC125	53	363332	6693717	4	5	4.5		<0.1	21.5	15	95	<0.1	1050	0.2	97
R213709	GC125F	upper regolith	GC125	53	363332	6693717	5	6	5.5		<0.1	20	11	90	<0.1	2450	0.2	110
R213710	GC126A	upper regolith	GC126	53	363300	6693752	0	1	0.5		0.2	12	120	1200	0.1	155000	0.1	42.5
R213711	GC126B	upper regolith	GC126	53	363300	6693752	1	2	1.5		<0.1	6	120	1500	<0.1	38400	0.1	65
R213712	GC126C	upper regolith	GC126	53	363300	6693752	2	3	2.5		0.5	14	49	470	<0.1	12800	0.2	86
R213713	GC126D	upper regolith	GC126	53	363300	6693752	3	4	3.5		0.4	12.5	20	220	<0.1	1950	0.2	84
R213714	GC126E	upper regolith	GC126	53	363300	6693752	4	5	4.5		0.3	6	14	370	<0.1	1200	0.2	73
R213715	GC126F	upper regolith	GC126	53	363300	6693752	5	6	5.5		<0.1	12.5	7	500	<0.1	850	0.3	78
R213716	GC127A	upper regolith	GC127	53	363269	6693790	0	1	0.5		0.2	<0.5	145	900	0.1	126000	0.1	33.5
R213717	GC127B	upper regolith	GC127	53	363269	6693790	1	2	1.5		0.2	3.5	160	310	<0.1	111000	0.1	42
R213718	GC127C	upper regolith	GC127	53	363269	6693790	2	3	2.5		0.2	6	115	125	<0.1	68700	0.1	57
R213719	GC127D	upper regolith	GC127	53	363269	6693790	3	4	3.5		0.2	4	44	105	<0.1	18200	0.1	62

Appendix Table A9.1: Chemical data.

Number	Sample_id	Type Code	Drill Hole	Zone	E	N	from	to	av depth	dip	Ag	As	Au	Ba	Bi	Ca	Cd	Ce
R213720	GC127E	upper regolith	GC127	53	363269	6693790	4	5	4.5		0.1	4	14	185	<0.1	2050	0.2	165
R213721	GC127F	upper regolith	GC127	53	363269	6693790	5	6	5.5		<0.1	4	18	470	<0.1	1550	0.2	135
R213722	GC128A	upper regolith	GC128	53	363243	6693831	0	1	0.5		0.3	5.5	42	1100	0.1	106000	0.2	36.5
R213723	GC128B	upper regolith	GC128	53	363243	6693831	1	2	1.5		0.5	2	56	950	0.1	114000	0.2	27
R213724	GC128C	upper regolith	GC128	53	363243	6693831	2	3	2.5		<0.1	4.5	67	360	0.1	32400	0.1	30.5
R213725	GC128D	upper regolith	GC128	53	363243	6693831	3	4	3.5		<0.1	3	110	340	0.2	23400	0.2	57
R213726	GC128E	upper regolith	GC128	53	363243	6693831	4	5	4.5		<0.1	7	83	195	0.2	15300	0.2	62
R213727	GC128F	upper regolith	GC128	53	363243	6693831	5	6	5.5		<0.1	15.5	75	220	0.1	5500	0.2	98
R213728	GC129A	upper regolith	GC129	53	363216	6693869	0	1	0.5		<0.1	5.5	43	1100	<0.1	112000	0.1	42.5
R213729	GC129B	upper regolith	GC129	53	363216	6693869	1	2	1.5		<0.1	9	290	650	<0.1	74800	0.2	88
R213730	GC129C	upper regolith	GC129	53	363216	6693869	2	3	2.5		<0.1	3.5	280	370	<0.1	45700	0.1	105
R213731	GC129D	upper regolith	GC129	53	363216	6693869	3	4	3.5		<0.1	7.5	170	220	<0.1	7350	0.2	89
R213732	GC129E	upper regolith	GC129	53	363216	6693869	4	5	4.5		<0.1	4	48	210	<0.1	2250	0.2	150
R213733	GC129F	upper regolith	GC129	53	363216	6693869	5	6	5.5		<0.1	2.5	48	195	<0.1	3400	0.2	82
R213734	GC100S	soil		53	364186	6692861	0.00	0.05	0.025		<0.1	3.5	<1	145	0.2	1950	0.1	42
R213735	GC101S	soil		53	364146	6692880	0.00	0.05	0.025		<0.1	4	<1	220	0.2	2550	0.1	40.5
R213736	GC102S	soil		53	364141	6692931	0.00	0.05	0.025		<0.1	6.5	<1	260	0.2	2500	0.2	55
R213737	GC103S	soil		53	364136	6692982	0.00	0.05	0.025		<0.1	6.5	<1	230	0.2	3400	0.2	57
R213738	GC104S	soil		53	364093	6693027	0.00	0.05	0.025		<0.1	1	<1	140	0.1	1850	0.1	26
R213739	GC105S	soil		53	364076	6693061	0.00	0.05	0.025		<0.1	3.5	<1	135	0.1	1800	0.1	24
R213740	std 10	std		53							<0.1	21	26	320	0.3	121000	0.1	7.5
R213741	GC106S	soil		53	364035	6693094	0.00	0.05	0.025		<0.1	1	<1	380	0.2	1900	0.2	39.5
R213742	GC107S	soil		53	363996	6693124	0.00	0.05	0.025		0.1	0.5	<1	165	0.2	2650	0.1	36
R213743	GC108S	soil		53	363955	6693144	0.00	0.05	0.025		<0.1	<0.5	<1	260	0.1	7300	0.2	39.5
R213744	GC109S	soil		53	363913	6693167	0.00	0.05	0.025		<0.1	4	<1	280	0.2	11600	0.2	35.5
R213745	GC110S	soil		53	363862	6693215	0.00	0.05	0.025		<0.1	3.5	<1	360	0.1	43700	0.2	44.5
R213746	GC111S	soil		53	363823	6693210	0.00	0.05	0.025		<0.1	<0.5	<1	195	0.1	56300	0.1	35.5
R213747	GC112S	soil		53	363781	6693237	0.00	0.05	0.025		<0.1	6.5	<1	250	0.2	7700	0.2	39
R213748	GC113S	soil		53	363753	6693275	0.00	0.05	0.025		0.1	9.5	<1	250	0.2	2100	0.2	48.5
R213749	GC114S	soil		53	363719	6693312	0.00	0.05	0.025		<0.1	4	4	300	0.2	18800	0.2	52
R213750	GC115S	soil		53	363687	6693346	0.00	0.05	0.025		<0.1	7	2	310	0.2	8750	0.1	51
R213751	GC116S	soil		53	363657	6693390	0.00	0.05	0.025		<0.1	13	<1	250	0.3	3400	0.1	40.5
R213752	GC117S	soil		53	363625	6693428	0.00	0.05	0.025		<0.1	8.5	<1	165	0.1	2800	0.1	30.5
R213753	GC118S	soil		53	363592	6693465	0.00	0.05	0.025		<0.1	4.5	<1	140	0.1	1050	0.1	29.5
R213754	GC119S	soil		53	363559	6693501	0.00	0.05	0.025		<0.1	1	<1	120	<0.1	900	0.1	23
R213755	GC120S	soil		53	363521	6693542	0.00	0.05	0.025		<0.1	6.5	<1	135	0.1	3250	0.1	29
R213756	GC121S	soil		53	363490	6693580	0.00	0.05	0.025		<0.1	<0.5	59	220	<0.1	123000	0.1	31
R213757	GC122S	soil		53	363452	6693628	0.00	0.05	0.025		<0.1	11	25	195	0.1	7550	0.2	39
R213758	GC123S	soil		53	363411	6693656	0.00	0.05	0.025		<0.1	30	73	185	<0.1	78500	0.2	45
R213759	GC124S	soil		53	363354	6693679	0.00	0.05	0.025		<0.1	3	43	200	<0.1	47800	0.2	41
R213760	GC125S	soil		53	363332	6693717	0.00	0.05	0.025		<0.1	<0.5	20	185	0.1	17700	0.2	36
R213761	GC126S	soil		53	363300	6693752	0.00	0.05	0.025		0.1	6.5	8	750	0.1	27600	0.2	36.5
R213762	GC127S	soil		53	363269	6693790	0.00	0.05	0.025		<0.1	8	2	270	0.1	1500	0.2	37
R213763	GC128S	soil		53	363243	6693831	0.00	0.05	0.025		<0.1	3	1	125	0.1	1300	0.2	35
R213764	GC129S	soil		53	363216	6693869	0.00	0.05	0.025		<0.1	4	22	260	<0.1	1250	0.1	32
R213765	GC100N	calcrete		53	364186	6692861	0.00	0.50	0.25		0.1	4	3	800	<0.1	263000	0.2	22.5
R213766	GC102N	calcrete		53	364141	6692931	0.00	0.50	0.25		0.1	8	<1	1200	0.2	150000	0.1	26.5
R213767	GC105N	calcrete		53	364076	6693061	0.00	0.50	0.25		<0.1	5	12	650	<0.1	279000	0.2	15
R213768	GC106N	calcrete		53	364035	6693094	0.00	0.50	0.25		<0.1	7.5	13	1450	<0.1	229000	0.1	16.5
R213769	GC107N	calcrete		53	363996	6693124	0.00	0.50	0.25		0.7	4.5	13	1350	<0.1	283000	0.3	12.5
R213770	GC108N	calcrete		53	363955	6693144	0.00	0.50	0.25		0.2	7	13	950	<0.1	277000	<0.1	10
R213771	GC109N	calcrete		53	363913	6693167	0.00	0.50	0.25		<0.1	6	15	900	<0.1	215000	<0.1	12
R213772	GC110N	calcrete		53	363862	6693215	0.00	0.50	0.25		<0.1	9	9	2150	<0.1	210000	<0.1	16
R213773	GC111N	calcrete		53	363823	6693210	0.00	0.50	0.25		<0.1	7.5	11	800	0.1	159000	<0.1	17
R213774	GC112N	calcrete		53	363781	6693237	0.00	0.50	0.25		<0.1	4.5	11	950	<0.1	247000	0.2	18
R213775	GC113N	calcrete		53	363753	6693275	0.00	0.50	0.25		<0.1	5.5	42	360	<0.1	248000	<0.1	19.5

Appendix Table A9.1: Chemical data.

Number	Sample_id	Type Code	Drill Hole	Zone	E	N	from	to	av depth	dip	Ag	As	Au	Ba	Bi	Ca	Cd	Ce
R213776	GC114N	calcrete		53	363719	6693312	0.00	0.50	0.25		<0.1	12	52	700	<0.1	180000	<0.1	16.5
R213777	GC115N	calcrete		53	363687	6693346	0.00	0.50	0.25		<0.1	12	41	500	0.2	115000	<0.1	36.5
R213778	GC116N	calcrete		53	363657	6693390	0.00	0.50	0.25		0.1	7.5	17	550	0.2	219000	0.1	41
R213779	GC117N	calcrete		53	363625	6693428	0.00	0.50	0.25		<0.1	9.5	9	550	<0.1	217000	<0.1	29.5
R213780	GC118N	calcrete		53	363592	6693465	0.00	0.50	0.25		<0.1	4	8	280	<0.1	291000	0.2	14.5
R213781	GC119N	calcrete		53	363559	6693501	0.00	0.50	0.25		<0.1	5	11	380	<0.1	178000	0.2	34.5
R213782	GC120N	calcrete		53	363521	6693542	0.00	0.50	0.25		<0.1	5.5	65	220	<0.1	267000	0.1	15.5
R213783	GC121N	calcrete		53	363490	6693580	0.00	0.50	0.25		<0.1	25	145	2050	<0.1	170000	<0.1	24.5
R213784	GC122N	calcrete		53	363452	6693628	0.00	0.50	0.25		<0.1	15.5	2370	430	0.1	187000	0.1	16.5
R213785	GC123N	calcrete		53	363411	6693656	0.00	0.50	0.25		0.1	230	74	160	<0.1	75000	<0.1	69
R213786	GC124N	calcrete		53	363354	6693679	0.00	0.50	0.25		<0.1	10.5	260	360	<0.1	101000	0.1	34
R213787	GC125N	calcrete		53	363332	6693717	0.00	0.50	0.25		0.1	32	38	1500	0.3	209000	0.2	33
R213788	GC126N	calcrete		53	363300	6693752	0.00	0.50	0.25		<0.1	15	90	1750	<0.1	185000	<0.1	32.5
R213789	GC127N	calcrete		53	363269	6693790	0.00	0.50	0.25		<0.1	5.5	78	1400	<0.1	126000	<0.1	53
R213790	GC128N	calcrete		53	363243	6693831	0.00	0.50	0.25		0.2	15	32	1950	0.1	129000	0.2	44.5
R213791	GC129N	calcrete		53	363216	6693869	0.00	0.50	0.25		<0.1	4.5	23	550	<0.1	288000	0.3	23
R213792	std 7	standard		53							0.5	66	225	35	2.4	3300	<0.1	10.5
R213793	GC100O	silcrete		53	364186	6692861	0.00	0.05	0.025		<0.1	1.5	<1	370	<0.1	3100	<0.1	3.5
R213794	GC100LVC	silcrete (+4#)		53	364186	6692861	0.00	0.01	0.005		<0.1	1	<1	440	<0.1	800	<0.1	4.7
R213795	GC101LVC	silcrete (+4#)		53	364146	6692880	0.00	0.01	0.005		<0.1	5	<1	750	<0.1	1250	<0.1	5.5
R213796	GC102LVC	silcrete (+4#)		53	364141	6692931	0.00	0.01	0.005		<0.1	1.5	<1	800	<0.1	650	<0.1	6
R213797	GC103LVC	silcrete (+4#)		53	364136	6692982	0.00	0.01	0.005		<0.1	11.5	<1	1050	0.1	900	<0.1	20
R213798	GC104LVC	silcrete (+4#)		53	364093	6693027	0.00	0.01	0.005		<0.1	4	<1	850	0.1	900	<0.1	8
R213799	GC105LVC	silcrete (+4#)		53	364076	6693061	0.00	0.01	0.005		<0.1	2.5	<1	950	<0.1	500	<0.1	9
R213800	GC106LVC	silcrete (+4#)		53	364035	6693094	0.00	0.01	0.005		<0.1	2.5	<1	2100	<0.1	550	<0.1	13.5
R213801	GC107LVC	silcrete (+4#)		53	363996	6693124	0.00	0.01	0.005		<0.1	3	3	3650	0.2	450	<0.1	13.5
R213802	GC108LVC	silcrete (+4#)		53	363955	6693144	0.00	0.01	0.005		<0.1	2.5	<1	2650	0.1	3050	<0.1	17.5
R213803	GC109LVC	silcrete (+4#)		53	363913	6693167	0.00	0.01	0.005		<0.1	2.5	<1	2350	<0.1	2150	<0.1	13.5
R213804	GC110LVC	silcrete (+4#)		53	363862	6693215	0.00	0.01	0.005		<0.1	3.5	<1	2550	0.2	3500	0.1	16.5
R213805	GC111LVC	silcrete (+4#)		53	363823	6693210	0.00	0.01	0.005		<0.1	3	<1	1650	0.2	3700	<0.1	23.5
R213806	GC112LVC	silcrete (+4#)		53	363781	6693237	0.00	0.01	0.005		<0.1	4.5	<1	1800	0.2	2000	0.1	24
R213807	GC113LVC	silcrete (+4#)		53	363753	6693275	0.00	0.01	0.005		<0.1	1.5	<1	1400	0.1	2600	<0.1	22.5
R213808	GC114LVC	silcrete (+4#)		53	363719	6693312	0.00	0.01	0.005		0.2	2	2	1450	0.2	2950	0.3	26.5
R213809	GC115LVC	silcrete (+4#)		53	363687	6693346	0.00	0.01	0.005		<0.1	3	3	1650	0.1	3100	0.1	32
R213810	GC116LVC	silcrete (+4#)		53	363657	6693390	0.00	0.01	0.005		0.2	2	<1	1200	0.1	3650	0.7	26
R213811	GC117LVC	silcrete (+4#)		53	363625	6693428	0.00	0.01	0.005		0.4	2.5	<1	800	0.1	1600	0.7	24
R213812	GC118LVC	calcrete (+4#)		53	363592	6693465	0.00	0.01	0.005		0.2	3.5	5	210	<0.1	295000	0.8	13
R213813	GC119LVC	calcrete (+4#)		53	363559	6693501	0.00	0.01	0.005		<0.1	5	4	220	<0.1	302000	0.8	12
R213814	GC120LVC	calcrete (+4#)		53	363521	6693542	0.00	0.01	0.005		<0.1	6.5	12	290	0.2	265000	0.7	18
R213815	GC121LVC	silcrete (+4#)		53	363490	6693580	0.00	0.01	0.005		0.2	10.5	23	1000	0.6	4050	0.2	38.5
R213816	GC122LVC	silcrete (+4#)		53	363452	6693628	0.00	0.01	0.005		0.2	5.5	14	1000	0.2	3450	0.2	27
R213817	GC123LVC	silcrete (+4#)		53	363411	6693656	0.00	0.01	0.005		0.4	7.5	81	800	0.3	3900	0.2	29
R213818	GC124LVC	silcrete (+4#)		53	363354	6693679	0.00	0.01	0.005		0.3	6.5	34	800	0.3	3200	0.3	26.5
R213819	GC125LVC	silcrete (+4#)		53	363332	6693717	0.00	0.01	0.005		0.3	5.5	61	2000	0.2	7000	0.3	20.5
R213820	GC126LVC	silcrete (+4#)		53	363300	6693752	0.00	0.01	0.005		0.2	5.5	12	1150	0.3	1500	0.2	25
R213821	GC127LVC	silcrete (+4#)		53	363269	6693790	0.00	0.01	0.005		0.3	5.5	54	1450	0.2	1300	0.2	27.5
R213822	GC128LVC	silcrete (+4#)		53	363243	6693831	0.00	0.01	0.005		0.5	7.5	105	1800	0.3	500	0.1	32
R213823	GC129LVC	silcrete (+4#)		53	363216	6693869	0.00	0.01	0.005		0.2	9	3	1750	0.2	7550	0.2	31
R213824	std 6	standard		53							0.2	6	71	320	0.2	1600	0.1	39.5
R213825	GC100LC	lag +9#		53	364186	6692861	0.00	0.01	0.005		0.2	61	2	550	0.7	4750	0.5	42.5
R213826	GC101LC	lag +9#		53	364146	6692880	0.00	0.01	0.005		0.1	42.5	<1	700	0.5	57500	0.3	43
R213827	GC102LC	lag +9#		53	364141	6692931	0.00	0.01	0.005		0.1	35.5	1	750	0.6	1050	0.4	55
R213828	GC103LC	lag +9#		53	364136	6692982	0.00	0.01	0.005		0.1	37	3	750	0.5	1350	0.4	61
R213829	GC106LC	lag +9#		53	364035	6693094	0.00	0.01	0.005		0.2	24.5	<1	850	0.6	32300	0.1	27.5
R213830	GC107LC	lag +9#		53	363996	6693124	0.00	0.01	0.005		0.3	32.5	<1	1200	0.6	7850	0.1	28
R213831	GC110LC	lag +9#		53	363862	6693215	0.00	0.01	0.005		0.2	7.5	2	550	0.3	136000	0.2	24

Appendix Table A9.1: Chemical data.

Number	Sample_id	Type Code	Drill Hole	Zone	E	N	from	to	av depth	dip	Ag	As	Au	Ba	Bi	Ca	Cd	Ce
R213832	GC111LC	lag +9#		53	363823	6693210	0.00	0.01	0.005		0.4	16	2	900	0.4	103000	0.2	30.5
R213833	GC112LC	lag +9#		53	363781	6693237	0.00	0.01	0.005		0.6	68	<1	1150	1.2	7000	0.2	59
R213834	GC115LC	lag +9#		53	363687	6693346	0.00	0.01	0.005		0.5	105	<1	1700	1.7	5200	0.3	77
R213835	GC116LC	lag +9#		53	363657	6693390	0.00	0.01	0.005		0.3	49	5	800	0.6	126000	0.2	56
R213836	GC117LC	lag +9#		53	363625	6693428	0.00	0.01	0.005		0.3	99	1	1050	1.1	28400	0.2	79
R213837	GC119LC	lag +9#		53	363559	6693501	0.00	0.01	0.005		0.3	170	5	500	1.1	17500	0.3	81
R213838	GC120LC	lag +9#		53	363521	6693542	0.00	0.01	0.005		0.3	105	7	450	0.9	112000	0.3	54
R213839	GC121LC	lag +9#		53	363490	6693580	0.00	0.01	0.005		0.2	60	285	850	0.3	126000	0.2	24.5
R213840	GC122LC	lag +9#		53	363452	6693628	0.00	0.01	0.005		0.3	500	94	300	0.3	27500	0.2	32
R213841	GC123LC	lag +9#		53	363411	6693656	0.00	0.01	0.005		0.4	290	113	310	0.2	102000	0.3	49
R213842	GC124LC	lag +9#		53	363354	6693679	0.00	0.01	0.005		0.3	50	82	440	0.2	113000	0.2	27.5
R213843	GC125LC	lag +9#		53	363332	6693717	0.00	0.01	0.005		0.6	12.5	24	410	0.3	70200	0.1	32
R213844	GC126LC	lag +9#		53	363300	6693752	0.00	0.01	0.005		0.4	17	23	500	0.3	68400	0.2	29
R213845	GC128LC	lag +9#		53	363243	6693831	0.00	0.01	0.005		0.5	21.5	31	1150	0.4	9700	0.1	35
R213846	GC129LC	lag +9#		53	363216	6693869	0.00	0.01	0.005		0.3	45.5	320	1100	0.5	13500	<0.1	40.5
R213847	std 9	standard		53							1	400	95	270	1.2	2250	0.4	16
R213848	GC100LF	lag +40#		53	364186	6692861	0.00	0.01	0.005		0.3	11.5	4	135	0.4	6500	0.1	20
R213849	GC102LF	lag +40#		53	364141	6692931	0.00	0.01	0.005		0.2	18	1	330	0.5	2600	<0.1	27.5
R213850	GC103LF	lag +40#		53	364136	6692982	0.00	0.01	0.005		0.2	18.5	2	310	0.4	3050	<0.1	28
R213851	GC104LF	lag +40#		53	364093	6693027	0.00	0.01	0.005		<0.1	5	1	175	0.2	1850	<0.1	14
R213852	GC105LF	lag +40#		53	364076	6693061	0.00	0.01	0.005		<0.1	4.5	<1	170	0.1	1750	<0.1	11.5
R213853	GC106LF	lag +40#		53	364035	6693094	0.00	0.01	0.005		0.2	9	<1	190	0.4	2500	0.1	17
R213854	GC107LF	lag +40#		53	363996	6693124	0.00	0.01	0.005		0.2	9.5	<1	195	0.3	2300	<0.1	14
R213855	GC110LF	lag +40#		53	363862	6693215	0.00	0.01	0.005		0.1	7	<1	240	0.2	36500	<0.1	22.5
R213856	GC111LF	lag +40#		53	363823	6693210	0.00	0.01	0.005		0.1	8	<1	240	0.2	35200	<0.1	17
R213857	GC113LF	lag +40#		53	363753	6693275	0.00	0.01	0.005		0.2	15.5	<1	250	0.4	3100	<0.1	33.5
R213858	GC115LF	lag +40#		53	363687	6693346	0.00	0.01	0.005		0.2	22.5	<1	350	0.6	6000	<0.1	35.5
R213859	GC116LF	lag +40#		53	363657	6693390	0.00	0.01	0.005		0.1	20.5	<1	320	0.3	8150	0.1	31
R213860	GC117LF	lag +40#		53	363625	6693428	0.00	0.01	0.005		0.2	32	<1	240	0.5	3250	0.2	30.5
R213861	GC118LF	lag +40#		53	363592	6693465	0.00	0.01	0.005		0.1	33	<1	180	0.5	3100	<0.1	29
R213862	GC119LF	lag +40#		53	363559	6693501	0.00	0.01	0.005		0.2	35.5	<1	170	0.4	2550	<0.1	26
R213863	GC120LF	lag +40#		53	363521	6693542	0.00	0.01	0.005		0.2	30	1	160	0.6	4800	0.2	29
R213864	GC121LF	lag +40#		53	363490	6693580	0.00	0.01	0.005		0.2	25	10	240	0.3	51700	<0.1	30
R213865	GC122LF	lag +40#		53	363452	6693628	0.00	0.01	0.005		0.1	31	12	220	0.2	7600	<0.1	19
R213866	GC123LF	lag +40#		53	363411	6693656	0.00	0.01	0.005		<0.1	41	70	200	0.1	17100	<0.1	17
R213867	GC124LF	lag +40#		53	363354	6693679	0.00	0.01	0.005		<0.1	15	18	195	0.1	14800	<0.1	15
R213868	GC126LF	lag +40#		53	363300	6693752	0.00	0.01	0.005		0.2	5	<1	170	0.1	5450	<0.1	10
R213869	GC128LF	lag +40#		53	363243	6693831	0.00	0.01	0.005		0.1	9	<1	165	0.2	3050	<0.1	18.5
R213870	GC129LF	lag +40#		53	363216	6693869	0.00	0.01	0.005		0.4	6	<1	145	0.2	1600	<0.1	12
R213871	GC42	lag +9#		53	363465	6693215	0.00	0.01	0.005		0.7	91	<1	1500	1.4	10000	0.2	94
R213872	GC43	lag +9#		53	363244	6693165	0.00	0.01	0.005		0.5	120	<1	1350	1.6	3600	0.2	69
R213873	GC100V	bluebush		53	364186	6692861					0.008	0.3	0.2	12	0.017	5902	0.05	1.3
R213874	GC101V	bluebush		53	364146	6692880					0.012	0.3	0.2	26	0.006	11287	0.06	1.3
R213875	GC102V	bluebush		53	364141	6692931					0.013	0.3	0.1	40	0.006	8569	0.09	2.1
R213877	GC104V	bluebush		53	364093	6693027					0.008	0.3	0.2	16	0.016	6434	0.03	1.8
R213878	GC105V	bluebush		53	364076	6693061					0.007	0.3	0.3	19	0.007	8278	0.04	1.4
R213879	GC106V	bluebush		53	364035	6693094					0.031	0.6	0.2	23	0.008	9659	0.05	1.9
R213880	GC107V	bluebush		53	363996	6693124					0.006	0.3	0.1	21	0.006	9405	0.04	1.0
R213881	GC108V	bluebush		53	363955	6693144					0.008	0.2	0.2	16	0.008	8956	0.03	0.9
R213882	GC109V	bluebush		53	363913	6693167					0.008	0.5	0.2	24	0.008	11805	0.03	1.9
R213883	GC110V	bluebush		53	363862	6693215					0.009	0.4	0.2	22	0.009	11734	0.05	2.2
R213884	GC111V	bluebush		53	363823	6693210					0.017	0.6	0.2	18	0.009	11351	0.05	2.2
R213885	GC112V	bluebush		53	363781	6693237					0.027	0.8	0.5	43	0.027	14506	0.08	4.6
R213886	GC113V	bluebush		53	363753	6693275					0.018	0.4	0.5	19	0.009	5498	0.05	2.8
R213887	GC114V	bluebush		53	363719	6693312					0.008	0.5	0.5	20	0.008	11237	0.05	1.9
R213888	GC115V	bluebush		53	363687	6693346					0.011	0.7	0.2	27	0.011	10649	0.07	3.8

Appendix Table A9.1: Chemical data.

Number	Sample_id	Type Code	Drill Hole	Zone	E	N	from	to	av depth	dip	Ag	As	Au	Ba	Bi	Ca	Cd	Ce
R213889	GC116V	bluebush		53	363657	6693390					0.009	0.5	0.2	14	0.009	6531	0.04	1.9
R213890	GC117V	bluebush		53	363625	6693428					0.008	0.6	0.3	22	0.008	9551	0.05	2.0
R213891	GC118V	bluebush		53	363592	6693465					0.008	0.8	0.2	17	0.008	6306	0.02	2.1
R213892	GC119V	bluebush		53	363559	6693501					0.029	1.2	0.4	21	0.014	6648	0.03	3.3
R213893	GC120V	bluebush		53	363521	6693542					0.015	1.6	0.2	26	0.015	13820	0.06	3.0
R213894	GC121V	bluebush		53	363490	6693580					0.030	2.2	0.1	31	0.015	9881	0.06	4.4
R213895	GC122V	bluebush		53	363452	6693628					0.019	2.5	0.7	25	0.019	8618	0.06	4.4
R213896	GC123V	bluebush		53	363411	6693656					0.017	1.7	0.2	15	0.008	5467	0.10	3.1
R213897	GC124V	bluebush		53	363354	6693679					0.033	3.2	0.5	30	0.017	10522	0.05	4.1
R213898	GC125V	bluebush		53	363332	6693717					0.006	1.2	0.4	21	0.006	10048	0.05	1.8
R213899	GC126V	bluebush		53	363300	6693752					0.008	1.5	0.2	25	0.008	10900	0.05	2.1
R213900	GC127V	bluebush		53	363269	6693790					0.029	0.7	0.1	24	0.007	7640	0.06	1.5
R213901	GC128V	bluebush		53	363243	6693831					0.042	0.8	0.1	20	0.007	6887	0.06	1.9
R213902	GC129V	bluebush		53	363216	6693869					0.006	0.8	0.1	19	0.006	7075	0.03	1.6
R213959	GCP129-1	pit		53	363216	6693869	0.10	0.20	0.15		0.6	13	5	1800	0.2	1500	<0.1	17.75
R213960	GCP129-2	pit		53	363216	6693869	0.20	0.30	0.25		0.1	12	11	290	0.1	177000	0.2	30.5
R213961	GCP129-3	pit		53	363216	6693869	0.30	0.35	0.325		0.1	12	21	370	0.1	133000	0.1	30.25
R213962	GCP129-4	pit		53	363216	6693869	0.35	0.38	0.365		0.1	19	27	4000	<0.1	296000	0.1	20.75
R213963	GCP129-5	pit		53	363216	6693869	0.38	0.48	0.43		0.1	17.5	46	2500	0.1	231000	<0.1	28.75
R213964	GCP129-6	pit		53	363216	6693869	0.48	0.60	0.54		<0.1	14.5	32	2050	<0.1	210000	<0.1	20
R213965	GCP129-7	pit		53	363216	6693869	0.60	0.90	0.75		0.1	20.5	19	1150	0.2	188000	<0.1	28.75
R213966	GCP129-8	pit		53	363216	6693869	0.90	1.20	1.05		0.1	13.5	52	750	0.1	188000	<0.1	34
R213967	GCP129-9	pit		53	363216	6693869	1.20	1.45	1.325		0.2	31.5	40	1050	0.2	106000	<0.1	25
R213968	GCP129-10	pit		53	363216	6693869	1.45	1.70	1.575		0.2	22	150	1700	0.2	5750	<0.1	30.25
R213969	GCP129-10	pit		53	363216	6693869	1.45	1.70	1.575		0.2	25	200	950	0.3	3550	<0.1	39.25
R213970	GCP129-11	pit		53	363216	6693869	1.70	1.85	1.775		0.1	6	185	280	0.1	78100	<0.1	48
R213971	GCP129-12	pit		53	363216	6693869	1.85	2.00	1.925		0.2	12	170	1450	0.2	2750	<0.1	48
R213972	GCP129-13	pit		53	363216	6693869	2.00	2.25	2.125		0.2	4.5	110	240	0.2	2300	<0.1	62
R213973	GCP129-14	pit		53	363216	6693869	2.30	2.60	2.45		0.1	7.5	110	1050	0.2	7750	<0.1	56
R213974	GCP129-15	pit		53	363216	6693869	2.60	3.00	2.8		0.1	5	93	125	0.2	1650	<0.1	48.25
R213975	GCP129-16	pit		53	363216	6693869	2.15	2.30	2.225		0.2	3	59	1250	0.2	2900	<0.1	70.5
R213976	GCP129	pit		53	363216	6693869	? 0.7				0.2	105	140	1050	1	2450	<0.1	18
R213985	std 10	standard											8.5					
R213986	GCP123-1	pit		53	363411	6693656	0.05	0.20	0.125		0.1	50	130	380	0.1	117000	0.1	27.25
R213987	GCP123-2	pit		53	363411	6693656	0.20	0.30	0.25		0.2	50	170	450	<0.1	135000	0.1	26.75
R213988	GCP123-3	pit		53	363411	6693656	0.30	0.40	0.35		0.2	62	100	600	0.1	101000	0.1	24.75
R213989	GCP123-3A	pit		53	363411	6693656	0.30	0.40	0.35		0.1	27.5	315	550	<0.1	183000	0.1	16.5
R213990	GCP123-4	pit		53	363411	6693656	0.40	0.60	0.5		0.1	32.5	225	170	<0.1	110000	<0.1	22.5
R213991	GCP123-5	pit		53	363411	6693656	0.60	0.90	0.75		0.2	260	43	1600	<0.1	123000	<0.1	40.25
R213992	GCP123-5A	pit		53	363411	6693656	0.60	0.90	0.75		0.2	175	48	260	<0.1	126000	<0.1	38.25
R213993	GCP123-6	pit		53	363411	6693656	0.90	1.25	1.075		0.2	800	170	900	<0.1	99200	<0.1	46
R213994	GCP123-7	pit		53	363411	6693656	1.25	1.60	1.425		0.1	260	160	430	<0.1	88600	<0.1	34.5
R213995	GCP123-8	pit		53	363411	6693656	1.60	1.70	1.65		0.2	320	140	200	<0.1	65400	<0.1	43
R213996	GCP123-9	pit		53	363411	6693656	1.70	2.10	1.9		0.2	330	155	190	<0.1	51300	<0.1	51.25
R213997	GCP123-10	pit		53	363411	6693656	2.10	2.40	2.25		0.2	1100	69	240	<0.1	20900	0.1	47.25
R213998	GCP123-11	pit		53	363411	6693656	2.40	2.60	2.5		0.2	200	53	130	<0.1	32900	<0.1	51
R213999	GCP123-12	pit		53	363411	6693656	2.60	2.75	2.675		0.2	700	4	190	<0.1	1300	<0.1	90
R214000	GCP123-2A	pit		53	363411	6693656	0.20	0.30	0.25		0.1	210	65	750	<0.1	125000	<0.1	58.5
R214001	std 9	standard									0.6	400	40	300	1.2	330	0.4	18.25
R214036	GCP122-1	pit		53	363452	6693628	0.10	0.20	0.15		0.1	15	250	190	0.2	82300	<0.1	26.75
R214038	GCP122-2	pit		53	363452	6693628	0.20	0.65	0.425		0.1	20.5	1035	310	0.1	193000	0.1	26.25
R214037	GCP122-2A	pit		53	363452	6693628	0.20	0.65	0.425		0.1	18	1530	650	0.2	105000	<0.1	33.5
R214039	GCP122-3	pit		53	363452	6693628	0.65	0.90	0.775		0.2	19.5	1930	180	0.2	114000	<0.1	30
R214040	GCP122-4	pit		53	363452	6693628	0.90	1.05	0.975		0.1	17.5	2140	145	0.2	68500	<0.1	34.5
R214041	GCP122-4A	pit		53	363452	6693628	0.90	1.05	0.975		0.2	9	4635	120	0.3	21200	<0.1	66
R214042	GCP122-5	pit		53	363452	6693628	1.05	1.35	1.2		0.2	15.5	4850	190	0.3	56000	<0.1	62

Appendix Table A9.1: Chemical data.

Number	Sample_id	Type Code	Drill Hole	Zone	E	N	from	to	av depth	dip	Ag	As	Au	Ba	Bi	Ca	Cd	Ce
R214043	GCP122-6	pit		53	363452	6693628	1.35	1.60	1.475		0.3	13.5	5380	90	0.4	14900	<0.1	73.5
R214044	GCP122-7	pit		53	363452	6693628	1.60	1.90	1.75		0.2	48	7320	125	0.3	53600	<0.1	83.5
R214045	GCP122-7A	pit		53	363452	6693628	1.60	1.90	1.75		0.4	26.5	7760	210	0.5	12300	<0.1	59.5
R214046	GCP122-8	pit		53	363452	6693628	1.90	2.05	1.975		0.7	65	98325	250	0.5	1600	<0.1	89
R214047	GCP122-9	pit		53	363452	6693628	2.05	2.25	2.15		0.4	47	4175	190	0.5	6300	<0.1	89.5
R214048	GCP122-10	pit		53	363452	6693628	2.25	2.50	2.375		0.3	18	2360	190	0.5	1600	<0.1	63
R214049	GCP122-11	pit		53	363452	6693628	2.50	2.70	2.6		0.2	17.5	760	125	0.2	148000	<0.1	41.25
R214050	GCP122	pit		53	363452	6693628					0.2	24	820	430	0.3	6700	<0.1	49
R214071	GCP121-1	pit		53	363490	6693580	0.05	0.20	0.125		<0.1	14	170	1250	<0.1	159000	<0.1	15
R214072	GCP121-2	pit		53	363490	6693580	0.20	0.40	0.3		<0.1	16	180	1000	<0.1	130000	<0.1	18.75
R214073	GCP121-3	pit		53	363490	6693580	0.40	0.60	0.5		<0.1	17.5	140	700	<0.1	143000	<0.1	20.5
R214074	GCP121-4	pit		53	363490	6693580	0.60	0.80	0.7		0.1	27	120	450	<0.1	115000	<0.1	26.25
R214075	GCP121-5	pit		53	363490	6693580	0.80	1.05	0.925		<0.1	18.5	130	440	<0.1	134000	<0.1	21
R214076	GCP121-6	pit		53	363490	6693580	1.05	1.30	1.175		0.1	13	40	650	0.1	58200	<0.1	39.25
R214077	GCP121-7	pit		53	363490	6693580	1.30	1.60	1.45		0.2	12.5	87	1500	0.2	19900	<0.1	46.75
R214078	GCP121-8	pit		53	363490	6693580	1.60	1.70	1.65		0.2	27	44	280	<0.1	143000	<0.1	39.5
R214079	GCP121-9	pit		53	363490	6693580	1.70	1.80	1.75		0.4	150	23	900	<0.1	1750	<0.1	78.5
R214080	GCP121-10	pit		53	363490	6693580	1.80	2.00	1.9		0.2	94	2	850	<0.1	900	<0.1	50.75
R214081	GCP121-11	pit		53	363490	6693580	2.00	2.20	2.1		0.2	94	7	440	<0.1	32800	<0.1	50.5
R214082	GCP121-12	pit		53	363490	6693580	2.20	2.40	2.3		0.1	38.5	2	130	<0.1	89900	<0.1	41.5
R214083	GCP121-13	pit		53	363490	6693580	2.40	2.65	2.525		0.1	88	8	900	<0.1	2600	<0.1	65
R214084	GCP121-14	pit		53	363490	6693580	2.65	2.90	2.775		0.2	80	3	750	<0.1	8650	<0.1	64
R214085	GCP121-15	pit		53	363490	6693580	2.90	3.00	2.95		0.1	11	0.5	650	<0.1	10500	<0.1	58.5
R214086	GCP115-1	pit		53	363687	6693346	0.10	0.20	0.15		0.1	13	26	390	0.2	139000	0.1	21
R214087	GCP115-2	pit		53	363687	6693346	0.20	0.30	0.25		<0.1	15	96	1300	<0.1	214000	<0.1	15.5
R214088	GCP115-3	pit		53	363687	6693346	0.30	0.45	0.375		<0.1	18	110	1300	<0.1	218000	<0.1	14.5
R214089	GCP115-4	pit		53	363687	6693346	0.45	0.75	0.6		<0.1	12.5	51	400	0.1	128000	<0.1	25.75
R214090	GCP115-5	pit		53	363687	6693346	0.75	1.00	0.875		<0.1	12.5	50	220	0.1	147000	<0.1	23
R214091	GCP115-6	pit		53	363687	6693346	1.00	1.20	1.1		0.1	13.5	46	240	0.1	144000	<0.1	26
R214092	GCP115-7	pit		53	363687	6693346	1.20	1.45	1.325		0.2	11.5	33	330	0.2	117000	<0.1	24
R214093	GCP115-8	pit		53	363687	6693346	1.45	1.65	1.55		0.1	12	46	1350	0.1	119000	0.1	25.25
R214094	GCP115-9	pit		53	363687	6693346	1.65	1.85	1.75		0.1	12.5	66	650	0.1	155000	0.2	31.5
R214095	GCP115-10	pit		53	363687	6693346	1.85	2.10	1.975		0.2	11.5	49	700	0.1	129000	0.1	42.25
R214096	GCP115-11	pit		53	363687	6693346	2.10	2.35	2.225		0.2	8	120	430	0.1	79500	<0.1	47.5
R214097	GCP115-12	pit		53	363687	6693346	2.10	2.35	2.225		0.2	9	15	340	0.1	69100	<0.1	49.25
R214098	GCP115-12A	pit		53	363687	6693346	2.35	2.55	2.45		0.2	5.5	8	500	<0.1	48300	<0.1	60.5
R214099	GCP115-13	pit		53	363687	6693346	2.55	2.60	2.575		0.1	4.5	9	400	<0.1	51600	<0.1	39.5
R214100	GCP115-14	pit		53	363687	6693346	2.90	3.00	2.95		0.2	4	11	65	<0.1	1300	<0.1	61.5
R214101	GCP115 GRAB	pit		53	363687	6693346	?				0.1	12	56.5	550	0.1	121000	<0.1	36.75
R214102	GCP115 GRAB	pit		53	363687	6693346	?				0.1	2	7	700	<0.1	5850	<0.1	58
R214103	std 6	standard									0.2	2	73	310	0.3	165	<0.1	37.75
R214104	GCP110-1	pit		53	363862	6693215	0.10	0.20	0.15		0.1	15.5	10	240	0.2	158000	0.1	30.75
R214105	GCP110-2	pit		53	363862	6693215	0.20	0.25	0.225		0.1	18.5	17	2500	<0.1	195000	<0.1	17.5
R214106	GCP110-3	pit		53	363862	6693215	0.25	0.45	0.35		0.1	24	11	500	<0.1	202000	<0.1	17
R214107	GCP110-4	pit		53	363862	6693215	0.45	0.65	0.55		0.1	14	11	900	0.1	161000	<0.1	30
R214108	GCP110-5	pit		53	363862	6693215	0.65	0.90	0.775		0.1	14	11	800	0.1	161000	<0.1	32
R214109	GCP110-6	pit		53	363862	6693215	0.90	1.15	1.025		0.1	9	4	460	0.1	121000	<0.1	21
R214110	GCP110-7	pit		53	363862	6693215	1.15	1.35	1.25		0.1	10.5	5	480	0.1	168000	<0.1	28.5
R214111	GCP110-8	pit		53	363862	6693215	1.35	1.55	1.45		0.2	1.5	0.5	270	0.1	12500	<0.1	6
R214112	GCP110-9	pit		53	363862	6693215	1.55	1.75	1.65		0.1	18	5	270	0.1	200000	0.1	44.75
R214113	GCP110-10	pit		53	363862	6693215	1.75	1.90	1.825		0.2	2	0.5	220	0.1	4150	<0.1	15
R214114	GCP110-11	pit		53	363862	6693215	1.90	2.10	2		0.3	3.5	0.5	135	0.3	2400	<0.1	11.75
R214115	GCP110-12	pit		53	363862	6693215	2.10	2.35	2.225		0.3	3.5	0.5	95	0.2	1900	<0.1	6.75
R214116	GCP110-13	pit		53	363862	6693215	2.35	2.50	2.425		0.3	4.5	0.5	420	0.2	1700	<0.1	7.75
R214117	GCP110-14	pit		53	363862	6693215	2.50	2.70	2.6		0.2	3.5	0.5	85	0.2	2600	<0.1	11
R214118	GCP110-8A	pit		53	363862	6693215	1.35	1.55	1.45		0.2	30	2	430	0.4	16800	<0.1	53.5

Appendix Table A9.1: Chemical data.

Number	Sample_id	Type Code	Drill Hole	Zone	E	N	from	to	av depth	dip	Ag	As	Au	Ba	Bi	Ca	Cd	Ce
R214119	GCP106-1	pit		53	364035	6693094	0.10	0.20	0.15		0.2	5.5	1	900	0.2	2600	<0.1	27.75
R214120	GCP106-2	pit		53	364035	6693094	0.20	0.25	0.225		<0.1	12.5	17	1800	<0.1	272000	<0.1	17.75
R214121	GCP106-3	pit		53	364035	6693094	0.25	0.40	0.325		0.1	11.5	25	800	<0.1	197000	<0.1	32.5
R214122	GCP106-4	pit		53	364035	6693094	0.40	0.65	0.525		<0.1	14	17	800	<0.1	229000	<0.1	20.25
R214123	GCP106-4A	pit		53	364035	6693094	0.40	0.65	0.525		<0.1	11	16	1000	<0.1	212000	<0.1	16
R214124	GCP106-5	pit		53	364035	6693094	0.65	0.90	0.775		<0.1	7.5	15	900	<0.1	142000	<0.1	44.25
R214125	GCP106-6	pit		53	364035	6693094	0.90	1.05	0.975		<0.1	5	29	450	<0.1	118000	<0.1	73.5
R214126	GCP106-7	pit		53	364035	6693094	1.05	1.25	1.15		<0.1	5	23	260	<0.1	138000	<0.1	34.5
R214127	GCP106-8	pit		53	364035	6693094	1.25	1.45	1.35		<0.1	5	21	850	<0.1	123000	<0.1	57
R214128	GCP106-9	pit		53	364035	6693094	1.45	1.65	1.55		<0.1	5.5	27	470	<0.1	133000	<0.1	56.5
R214129	GCP106-10	pit		53	364035	6693094	1.65	1.85	1.75		<0.1	7.5	18	270	<0.1	212000	<0.1	45
R214130	GCP106-11	pit		53	364035	6693094	1.85	2.05	1.95		<0.1	6	28	220	<0.1	135000	<0.1	75.5
R214131	GCP106-12	pit		53	364035	6693094	2.05	2.30	2.175		<0.1	6	18	125	<0.1	166000	<0.1	85.5
R214132	GCP106-13	pit		53	364035	6693094	2.30	2.50	2.4		<0.1	4.5	14	115	<0.1	120000	<0.1	16.25
R214133	GCP106-14	pit		53	364035	6693094	2.50	2.65	2.575		<0.1	4.5	7	220	<0.1	109000	<0.1	27
R214134	GCP106-15	pit		53	364035	6693094	2.65	2.80	2.725		<0.1	1.5	0.5	125	<0.1	2200	<0.1	27
R214135	GCP106 GRAB	pit		53	364035	6693094	1.00	2.00	1.5		<0.1	9	14	550	0.1	198000	<0.1	33.75
R214136	GCP106 GRAB	pit		53	364035	6693094	1.00	2.00	1.5		<0.1	9	18.5	900	0.1	198000	<0.1	29.25
R214137	GCP106 GRAB	pit		53	364035	6693094	1.00	2.00	1.5		<0.1	6.5	29.5	260	<0.1	150000	<0.1	19
R214138	std 10	standard									0.2	22	24	340	0.4	150000	<0.1	7.5
R214139	GCP100-1	pit		53	364186	6692861	0.25	0.40	0.325		<0.1	9	8	1500	<0.1	175000	<0.1	33
R214140	GCP100-2	pit		53	364186	6692861	0.40	0.70	0.55		<0.1	7.5	9	1100	<0.1	170000	<0.1	50
R214141	GCP100-3	pit		53	364186	6692861	0.70	0.80	0.75		<0.1	9	6	800	<0.1	204000	<0.1	26
R214142	GCP100-4	pit		53	364186	6692861	0.80	1.00	0.9		<0.1	13.5	4	850	<0.1	232000	<0.1	32
R214143	GCP100-5	pit		53	364186	6692861	1.00	1.25	1.125		0.1	13	2	1200	0.3	39400	<0.1	100.5
R214144	GCP100-6	pit		53	364186	6692861	1.25	1.50	1.375		0.2	9.5	0.5	2250	0.2	25600	<0.1	56.5
R214145	GCP100-7	pit		53	364186	6692861	1.50	1.65	1.575		0.2	9.5	0.5	650	0.1	12600	<0.1	28.5
R214146	GCP100-8	pit		53	364186	6692861	1.65	1.80	1.725		0.2	7.5	1	1950	0.1	61400	<0.1	14
R214147	GCP100-9	pit		53	364186	6692861	1.80	2.10	1.95		0.1	6.5	2	380	<0.1	58500	<0.1	8.25
R214148	GCP100-9A	pit		53	364186	6692861	1.80	2.10	1.95		0.1	0.5	0.5	250	<0.1	1200	<0.1	3.1
R214149	GCP100-10	pit		53	364186	6692861	2.10	2.30	2.2		0.1	9.5	3	330	<0.1	133000	<0.1	12.25
R214150	GCP100-11	pit		53	364186	6692861	2.30	2.60	2.45		0.1	7	6	290	<0.1	79200	<0.1	15.5
R214151	GCP100-12	pit		53	364186	6692861	2.60	2.75	2.675		0.1	1.5	0.5	170	<0.1	4500	<0.1	4.05
R214152	GCP100-12A	pit		53	364186	6692861	2.60	2.75	2.675		0.1	1	0.5	60	<0.1	1600	<0.1	2.15
R214153	GCP100 GRAB	pit		53	364186	6692861	1.00	2.00	1.5		0.1	16	9	900	0.1	137000	<0.1	18
R214154	GCP100 GRAB	pit		53	364186	6692861	1.00	2.00	1.5		<0.1	3.5	0.5	1000	<0.1	1800	<0.1	13.5
R214155	GCP100 GRAB	pit		53	364186	6692861	0.00	0.01	0.005		0.2	2.5	0.5	185	<0.1	1600	<0.1	3.05
R214156	lag + 4 mm	lag		53	363444	6693518	0.00	0.01	0.005		<0.1	3.5	10	35	<0.1	1650	<0.1	15.25
R214157	lag + 4 mm	lag		53	363444	6693518	0.00	0.01	0.005		<0.1	29.5	34	450	<0.1	270000	0.2	16.5
R214158	lag + 4 mm	lag		53	363444	6693518	0.00	0.01	0.005		0.1	120	26	470	0.3	153000	0.2	36.75
R214159	lag + 4 mm	lag		53	363444	6693518	0.00	0.01	0.005		0.3	5.5	31	1050	0.1	6900	<0.1	23.75
R214160	lag + 4 mm	lag		53	363444	6693518	0.00	0.01	0.005		0.4	3.5	6	650	0.2	2500	<0.1	26
R214161	lag + 4 mm	lag		53	363444	6693518	0.00	0.01	0.005		0.4	800	110	1400	0.4	2750	0.2	48.25
R214162	lag + 4 mm	lag		53	363444	6693518	0.00	0.01	0.005		0.2	6.5	4	300	0.1	1800	<0.1	43.75
R214163	lag + 4 mm	lag		53	363687	6693346	0.00	0.01	0.005		<0.1	1.5	0.5	45	<0.1	700	<0.1	10
R214164	lag + 4 mm	lag		53	363687	6693346	0.00	0.01	0.005		0.4	4.5	2	1650	0.2	4850	<0.1	31.75
R214165	lag + 4 mm	lag		53	363687	6693346	0.00	0.01	0.005		0.4	2	2	1700	0.1	2750	<0.1	25.75
R214166	lag + 4 mm	lag		53	363687	6693346	0.00	0.01	0.005		0.4	71	2	3550	1	3000	0.2	63
R214167	lag + 4 mm	lag		53	363425	6693410	0.00	0.01	0.005		0.2	33	50	125	0.8	7350	0.2	15.75
R214168	lag + 4 mm	lag		53	363425	6693410	0.00	0.01	0.005		0.3	170	7	1750	0.6	19000	0.2	70.5
R214169	lag + 4 mm	lag		53	363425	6693410	0.00	0.01	0.005		0.3	73	0.5	700	0.1	3350	<0.1	36.75
R214170	lag + 4 mm	lag		53	363425	6693410	0.00	0.01	0.005		0.3	2	0.5	2050	0.1	2500	<0.1	23.75
R214171	lag + 4 mm	lag		53	363425	6693410	0.00	0.01	0.005		<0.1	3.5	4	550	<0.1	1600	<0.1	22.5
R214172	lag + 4 mm	lag		53	363465	6693554	0.00	0.01	0.005		<0.1	6	475	165	0.3	2650	<0.1	12.5
R214173	lag + 4 mm	lag		53	363465	6693554	0.00	0.01	0.005		0.4	200	72	2950	0.9	2650	0.2	44.5
R214174	lag + 4 mm	lag		53	363465	6693554	0.00	0.01	0.005		0.3	155	190	650	0.2	140000	0.2	35.75

Appendix Table A9.1: Chemical data.

Number	Sample_id	Type Code	Drill Hole	Zone	E	N	from	to	av depth	dip	Ag	As	Au	Ba	Bi	Ca	Cd	Ce
R214175	lag + 4 mm	lag		53	363465	6693554	0.00	0.01	0.005		0.5	24	34	1000	0.3	8600	<0.1	34.75
R214176	lag + 4 mm	lag		53	363465	6693554	0.00	0.01	0.005		0.6	7	16	1000	0.3	3500	<0.1	37.75
R214177	lag + 4 mm	lag		53	363465	6693554	0.00	0.01	0.005		0.1	16	42	380	<0.1	269000	0.2	14.75
R214178	lag + 4 mm	lag		53	363445	6693468	0.00	0.01	0.005		<0.1	2	6	40	<0.1	1950	<0.1	6.75
R214179	lag + 4 mm	lag		53	363445	6693468	0.00	0.01	0.005		<0.1	33	27	185	<0.1	247000	0.2	26
R214180	lag + 4 mm	lag		53	363445	6693468	0.00	0.01	0.005		0.2	1700	1320	1000	0.2	3550	0.2	44.5
R214181	lag + 4 mm	lag		53	363445	6693468	0.00	0.01	0.005		0.3	11.5	2	850	0.1	3600	<0.1	29.25
R214182	lag + 4 mm	lag		53	363445	6693468	0.00	0.01	0.005		0.2	230	160	1350	0.7	73400	0.2	57
R214183	lag + 4 mm	lag		53	363341	6693368	0.00	0.01	0.005		<0.1	3	13	90	<0.1	1250	<0.1	5.75
R214184	lag + 4 mm	lag		53	363341	6693368	0.00	0.01	0.005		0.2	2	4	1050	<0.1	2200	<0.1	19.75
R214185	lag + 4 mm	lag		53	363341	6693368	0.00	0.01	0.005		0.3	73	5	2100	0.4	5550	0.1	31.5
R214186	lag + 4 mm	lag		53	363341	6693368	0.00	0.01	0.005		<0.1	19.5	17	310	<0.1	260000	0.2	27.75
R214187	lag + 4 mm	lag		53	363341	6693368	0.00	0.01	0.005		0.3	140	15	2600	0.8	40000	0.2	59.5
R214188	GCP 100 grab	pit		53	364186	6692861	0.00	0.01	0.005		0.1	5	0.5	950	<0.1	10500	<0.1	10
R214189	std 9	standard									0.6	360	78	320	1.5	1900	0.5	22
R214190	std 10	standard									0.3	19		310	0.4	121000	0.05	4.05
R214191	G171665	lower regolith	97CHAR1311	53	363199	6693858	0	6	3	90	0.2	13.5	50	1000	0.2	62400	0.05	28.75
R214192	G171666	lower regolith	97CHAR1311	53	363199	6693858	6	12	9	90	0.2	14	30	290	0.05	1200	0.05	77
R214193	G171667	lower regolith	97CHAR1311	53	363199	6693858	12	18	15	90	0.2	28	10	650	0.05	2250	0.05	105
R214194	G171668	lower regolith	97CHAR1311	53	363199	6693858	18	24	21	90	0.1	14	<20	950	0.05	11900	0.05	59.5
R214195	G171669	lower regolith	97CHAR1311	53	363199	6693858	24	30	27	90	0.3	120	10	750	0.05	8350	0.2	110
R214196	G171670	lower regolith	97CHAR1311	53	363199	6693858	30	36	33	90	0.3	33.5	30	900	0.05	8100	0.1	90.5
R214197	E49879	lower regolith	95CHAR312	53	363266	6693836	0	6	3	90	0.2	14.5	60	750	0.2	23000	0.05	34.75
R214198	E49880	lower regolith	95CHAR312	53	363266	6693836	6	12	9	90	0.2	19	200	390	0.05	1600	0.05	63
R214199	E49881	lower regolith	95CHAR312	53	363266	6693836	12	18	15	90	0.2	54	20	1000	0.05	3100	0.05	74.5
R214200	E49882	lower regolith	95CHAR312	53	363266	6693836	18	24	21	90	0.2	36.5	10	850	0.05	9350	0.1	115
R214201	E49883	lower regolith	95CHAR312	53	363266	6693836	24	28	26	90	0.3	27.5	<20	800	0.05	9650	0.1	117.5
R214202	E46708	lower regolith	95CHAR073	53	363288	6693812	0	6	3	70	0.2	14	50	700	0.2	58600	0.05	51
R214203	E46709	lower regolith	95CHAR073	53	363288	6693812	6	12	9	70	0.2	27.5	10	210	0.05	2450	0.05	77.5
R214204	E46710	lower regolith	95CHAR073	53	363288	6693812	12	18	15	70	0.2	10	<20	550	0.05	1700	0.05	94
R214205	E46711	lower regolith	95CHAR073	53	363288	6693812	18	24	21	70	0.2	14	<20	800	0.05	6450	0.05	117.5
R214206	E46712	lower regolith	95CHAR073	53	363288	6693812	24	30	27	70	0.4	18.5	<20	850	0.05	9000	0.05	150
R214207	E46713	lower regolith	95CHAR073	53	363288	6693812	30	31	31	70	0.2	30	<20	650	0.05	10500	0.1	127.5
R214208	E49874	lower regolith	95CHAR311	53	363311	6693746	0	6	3	90	0.2	37.5	20	550	0.05	13700	0.05	50.25
R214209	E49875	lower regolith	95CHAR311	53	363311	6693746	6	12	9	90	0.2	100	<20	650	0.05	2850	0.05	57.5
R214210	E49876	lower regolith	95CHAR311	53	363311	6693746	12	18	15	90	0.2	160	<20	800	0.05	5750	0.05	82
R214211	E49877	lower regolith	95CHAR311	53	363311	6693746	18	24	21	90	0.2	160	<20	900	0.05	8550	0.05	110
R214212	E49878	lower regolith	95CHAR311	53	363311	6693746	24	27	26	90	0.2	38.5	10	800	0.05	8900	0.2	98
R214213	E48277	lower regolith	95CHAR147	53	363342	6693720	0	6	3	90	0.2	17.5	30	220	0.05	28000	0.05	88.5
R214214	E48278	lower regolith	95CHAR147	53	363342	6693720	6	12	9	90	0.2	31.5	<20	155	0.05	850	0.05	115
R214215	E48279	lower regolith	95CHAR147	53	363342	6693720	12	18	15	90	0.3	180	<20	650	0.05	900	0.05	107.5
R214216	E48280	lower regolith	95CHAR147	53	363342	6693720	18	24	21	90	0.3	110	<20	750	0.05	7900	0.1	157.5
R214217	E48281	lower regolith	95CHAR147	53	363342	6693720	24	30	27	90	0.2	140	10	850	0.05	8500	0.2	127.5
R214218	E48282	lower regolith	95CHAR147	53	363342	6693720	30	33	32	90	0.3	66	20	800	0.05	6750	0.2	89
R214219	std 10	standard									0.2	24		320	0.3	122000	0.05	4.55
R214220	G196484	lower regolith	96CHRC957	53	363384	6693714	3	4	4	60	0.3	11.5	20	110	0.05	750	0.05	92
R214221	G196490	lower regolith	96CHRC957	53	363384	6693714	9	10	10	60	0.3	56	10	180	0.05	400	0.05	98.5
R214222	G196496	lower regolith	96CHRC957	53	363384	6693714	15	16	16	60	0.6	135	50	450	0.05	1950	0.05	260
R214223	G196502	lower regolith	96CHRC957	53	363384	6693714	21	22	22	60	0.4	430	10	1100	0.05	1000	0.1	190
R214224	G196508	lower regolith	96CHRC957	53	363384	6693714	27	28	28	60	0.5	350	50	1200	0.05	1250	0.3	137.5
R214225	G196515	lower regolith	96CHRC957	53	363384	6693714	34	35	35	60	0.2	280	340	550	0.2	7450	0.2	101.5
R214226	G196521	lower regolith	96CHRC957	53	363384	6693714	40	41	41	60	0.2	650	460	550	0.05	6900	0.3	102.5
R214227	G196527	lower regolith	96CHRC957	53	363384	6693714	46	47	47	60	0.2	290	830	550	0.05	11700	0.3	74
R214228	G196533	lower regolith	96CHRC957	53	363384	6693714	52	53	53	60	0.3	410	270	650	0.05	13700	0.3	87.5
R214229	G196539	lower regolith	96CHRC957	53	363384	6693714	58	59	59	60	0.4	460	160	800	0.05	8750	0.4	79.5
R214230	G196545	lower regolith	96CHRC957	53	363384	6693714	64	65	65	60	0.4	120	30	600	0.05	12400	0.3	86.5

Appendix Table A9.1: Chemical data.

Number	Sample_id	Type Code	Drill Hole	Zone	E	N	from	to	av depth	dip	Ag	As	Au	Ba	Bi	Ca	Cd	Ce
R214231	G196551	lower regolith	96CHRC957	53	363384	6693714	70	71	71	60	0.3	68	40	700	0.05	7750	0.2	97.5
R214232	G196557	lower regolith	96CHRC957	53	363384	6693714	76	77	77	60	0.3	51	60	850	0.05	7200	0.3	105
R214233	G196563	lower regolith	96CHRC957	53	363384	6693714	82	83	83	60	0.4	98	30	1050	0.05	4300	0.2	110
R214234	G198483	lower regolith	96CHRC967	53	363446	6693645	2	3	3	60	0.2	63	250	95	0.5	22100	0.05	62
R214235	G198489	lower regolith	96CHRC967	53	363446	6693645	8	9	9	60	0.2	550	50	120	0.05	1250	0.05	125
R214236	G198495	lower regolith	96CHRC967	53	363446	6693645	14	15	15	60	0.3	58	90	550	0.05	700	0.05	110
R214237	G198502	lower regolith	96CHRC967	53	363446	6693645	21	22	22	60	1.5	700	1780	800	0.1	900	0.4	240
R214238	G198508	lower regolith	96CHRC967	53	363446	6693645	27	28	28	60	1	950	3360	650	1.3	800	0.7	162.5
R214239	G198515	lower regolith	96CHRC967	53	363446	6693645	34	35	35	60	15	450	2580	750	0.7	420	0.4	185
R214240	G198521	lower regolith	96CHRC967	53	363446	6693645	40	41	41	60	0.2	350	700	500	0.8	400	0.3	79.5
R214241	G198526	lower regolith	96CHRC967	53	363446	6693645	45	46	46	60			90					
R214242	G198532	lower regolith	96CHRC967	53	363446	6693645	51	52	52	60	0.2	72	10	750	0.05	2200	0.2	105
R214243	G198538	lower regolith	96CHRC967	53	363446	6693645	57	58	58	60	0.2	60	10	650	0.05	5250	0.2	105
R214244	G198544	lower regolith	96CHRC967	53	363446	6693645	63	64	64	60	0.3	81	10	1850	0.05	13600	0.1	51.5
R214245	G198550	lower regolith	96CHRC967	53	363446	6693645	69	70	70	60	0.4	420	260	600	0.05	6850	0.2	78.5
R214246	G198557	lower regolith	96CHRC967	53	363446	6693645	76	77	77	60	0.2	86	200	950	0.05	9000	0.2	57.5
R214247	G198563	lower regolith	96CHRC967	53	363446	6693645	82	83	83	60	0.3	78	30	550	0.05	7900	0.2	82.5
R214248	E46813	lower regolith	95CHRC081	53	363469	6693620	2	3	3	70			510					
R214249	E46820	lower regolith	95CHRC081	53	363469	6693620	9	10	10	70	0.2	370	<20	470	0.05	1750	0.05	135
R214250	E46827	lower regolith	95CHRC081	53	363469	6693620	16	17	17	70	0.2	280	70	850	0.05	750	0.05	132.5
R214251	E46833	lower regolith	95CHRC081	53	363469	6693620	22	23	23	70			1890					
R214252	E46838	lower regolith	95CHRC081	53	363469	6693620	27	28	28	70			2440					
R214253	E46844	lower regolith	95CHRC081	53	363469	6693620	33	34	34	70			720					
R214254	E46850	lower regolith	95CHRC081	53	363469	6693620	39	40	40	70			350					
R214255	std 10	standard									0.2	29.5		340	0.4	123000	0.05	4.75
R214256	E48078	lower regolith	95CHAR115	53	363493	6693568	0	6	3	90	0.2	22	20	480	0.2	38900	0.05	41.5
R214257	G133132	lower regolith	95CHAR115	53	363493	6693568	9	10	10	90			<20					
R214258	E48080	lower regolith	95CHAR115	53	363493	6693568	12	18	15	90	0.2	105	10	800	0.2	950	0.05	79.5
R214259	E48081	lower regolith	95CHAR115	53	363493	6693568	18	24	21	90	0.5	125	20	750	0.2	600	0.05	132.5
R214260	E48082	lower regolith	95CHAR115	53	363493	6693568	24	30	27	90	0.4	62	60	950	0.7	750	0.1	127.5
R214261	E48083	lower regolith	95CHAR115	53	363493	6693568	30	36	33	90	0.3	210	40	850	0.05	1000	0.2	112.5
R214262	E48084	lower regolith	95CHAR115	53	363493	6693568	36	42	39	90	0.3	480	450	800	0.7	1100	0.2	115
R214263	G133136	lower regolith	95CHAR115	53	363493	6693568	43	44	44	90			1160					
R214264	E48302	lower regolith	95CHAR151	53	363543	6693518	0	6	3	90	0.1	12.5	20	490	0.1	69600	0.05	37.75
R214265	E48303	lower regolith	95CHAR151	53	363543	6693518	6	12	9	90	0.1	5.5	<20	650	0.05	1900	0.05	92.5
R214266	E48304	lower regolith	95CHAR151	53	363543	6693518	12	18	15	90	0.1	13	<20	700	0.05	900	0.05	78
R214267	E48305	lower regolith	95CHAR151	53	363543	6693518	18	24	21	90	0.2	64	10	650	0.05	1000	0.05	142.5
R214268	E48306	lower regolith	95CHAR151	53	363543	6693518	24	30	27	90	0.4	105	50	800	0.05	3450	0.2	132.5
R214269	E48307	lower regolith	95CHAR151	53	363543	6693518	30	34	32	90	0.3	36	10	700	0.05	6150	0.2	105
R214270	G130694	lower regolith	95CHAR446	53	363582	6693433	0	6	3	90	0.2	7	10	470	0.1	32600	0.05	53.5
R214271	G130695	lower regolith	95CHAR446	53	363582	6693433	6	12	9	90	0.2	11.5	<20	800	0.05	1350	0.05	93.5
R214272	G130696	lower regolith	95CHAR446	53	363582	6693433	12	18	15	90	0.2	46	<20	900	0.05	1200	0.05	150
R214273	G130697	lower regolith	95CHAR446	53	363582	6693433	18	24	21	90	0.2	12	<20	950	0.05	3850	0.05	177.5
R214274	G130698	lower regolith	95CHAR446	53	363582	6693433	24	30	27	90	0.2	8.5	<20	850	0.05	6450	0.1	130
R214275	G130699	lower regolith	95CHAR446	53	363582	6693433	30	36	33	90	0.2	13.5	<20	900	0.05	6300	0.2	130
R214276	G130700	lower regolith	95CHAR446	53	363582	6693433	36	40	38	90	0.3	12	10	850	0.05	4800	0.2	120
R214283	E46907	lower regolith	95CHAR088	53	363623	6693404	36	40	38	70			10					
R214284	std 10	standard									0.2	25.5		330	0.3	122000	0.05	4.55
R214285	G174374	lower regolith	96CHAR870	53	363661	6693389	0	6	3	60	0.2	23.5	20	260	0.1	17600	0.05	60.5
R214286	G174375	lower regolith	96CHAR870	53	363661	6693389	6	12	9	60	0.3	13.5	20	45	0.05	2400	0.05	125
R214287	G174376	lower regolith	96CHAR870	53	363661	6693389	12	18	15	60	0.2	12	20	550	0.05	1450	0.05	180
R214288	G174377	lower regolith	96CHAR870	53	363661	6693389	18	24	21	60	0.3	12.5	20	900	0.05	1200	0.05	175
R214289	G174378	lower regolith	96CHAR870	53	363661	6693389	24	30	27	60	0.3	13	30	1050	0.2	1300	0.1	155
R214290	G174379	lower regolith	96CHAR870	53	363661	6693389	30	36	33	60	0.3	9	20	900	0.05	1350	0.2	132.5
R214291	G174380	lower regolith	96CHAR870	53	363661	6693389	36	42	39	60	0.3	9.5	20	850	0.05	5200	0.2	112.5
R214292	G174381	lower regolith	96CHAR870	53	363661	6693389	42	48	45	60	0.3	11	20	850	0.05	7700	0.2	117.5

Appendix Table A9.1: Chemical data.

Number	Sample_id	Type Code	Drill Hole	Zone	E	N	from	to	av depth	dip	Ag	As	Au	Ba	Bi	Ca	Cd	Ce
R214293	G174382	lower regolith	96CHAR870	53	363661	6693389	48	54	51	60	0.3	57	20	850	0.05	9750	0.2	122.5
R214294	G174383	lower regolith	96CHAR870	53	363661	6693389	54	60	57	60	0.2	42	20	850	0.05	9900	0.2	110
R214295	G174354	lower regolith	96CHAR868	53	363684	6693344	0	6	3	60	0.2	16	20	270	0.05	26500	0.05	142.5
R214296	G174355	lower regolith	96CHAR868	53	363684	6693344	6	12	9	60	0.2	12	20	400	0.05	1350	0.05	137.5
R214297	G174356	lower regolith	96CHAR868	53	363684	6693344	12	18	15	60	0.6	20.5	20	900	0.05	1700	0.05	177.5
R214298	G174357	lower regolith	96CHAR868	53	363684	6693344	18	24	21	60	0.4	37.5	20	1150	0.05	1300	0.05	145
R214299	G174358	lower regolith	96CHAR868	53	363684	6693344	24	30	27	60	0.3	21	20	650	0.05	2750	0.2	152.5
R214300	G174359	lower regolith	96CHAR868	53	363684	6693344	30	36	33	60	0.2	16.5	20	950	0.05	6850	0.2	110
R214301	G174360	lower regolith	96CHAR868	53	363684	6693344	36	42	39	60	0.2	13	20	900	0.05	8100	0.2	107.5
R214302	G174361	lower regolith	96CHAR868	53	363684	6693344	42	48	45	60	0.2	37	20	750	0.05	9500	0.1	102
R214303	G174362	lower regolith	96CHAR868	53	363684	6693344	48	54	51	60	0.3	40	20	900	0.05	9850	0.2	112.5
R214304	G174363	lower regolith	96CHAR868	53	363684	6693344	54	60	57	60	0.4	46	20	1050	0.05	14000	0.2	117.5
R214305	E49343	lower regolith	95CHAR218	53	363717	6693389	0	6	3	90	0.4	17	40	400	0.2	29800	0.05	50.25
R214306	E49344	lower regolith	95CHAR218	53	363717	6693389	6	12	9	90	0.2	7.5	10	330	0.1	1750	0.05	98
R214307	E49345	lower regolith	95CHAR218	53	363717	6693389	12	18	15	90	0.2	77	100	360	0.3	1000	0.2	120
R214308	G133311	lower regolith	95CHAR218	53	363717	6693389	18	19	19	90			890					
R214309	G133314	lower regolith	95CHAR218	53	363717	6693389	21	22	22	90			2180					
R214310	E49347	lower regolith	95CHAR218	53	363717	6693389	24	30	27	90	0.3	175	100	750	0.05	750	0.2	125
R214311	E49348	lower regolith	95CHAR218	53	363717	6693389	30	36	33	90	0.2	135	100	800	0.05	1950	0.3	88
R214312	E49349	lower regolith	95CHAR218	53	363717	6693389	36	40	38	90	0.2	120	30	850	0.05	1850	0.2	117.5
R214313	G130799	lower regolith	95CHAR461	53	363740	6693344	0	6	3	90	0.2	11.5	10	200	0.1	28700	0.05	68
R214314	G130800	lower regolith	95CHAR461	53	363740	6693344	6	12	9	90	0.4	20	<20	310	0.05	1350	0.05	110
R214315	G130801	lower regolith	95CHAR461	53	363740	6693344	12	18	15	90	0.3	66	<20	600	0.05	700	0.05	127.5
R214316	G133336	lower regolith	95CHAR461	53	363740	6693344	19	20	20	90	0.2	440	900	700	0.5	950	0.3	130
R214317	G133338	lower regolith	95CHAR461	53	363740	6693344	21	22	22	90	0.4	140	1460	800	0.05	1050	0.2	117.5
R214318	G130803	lower regolith	95CHAR461	53	363740	6693344	24	30	27	90	0.3	160	260	700	0.05	950	0.3	125
R214319	G130804	lower regolith	95CHAR461	53	363740	6693344	30	36	33	90	0.3	175	40	800	0.1	1800	0.3	78.5
R214320	G130805	lower regolith	95CHAR461	53	363740	6693344	36	40	38	90	0.2	240	400	750	0.1	5200	0.4	95.5
R214321	std 10	standard									0.2	30.5		370	0.3	129000	0.05	4.75
R214322	E49336	lower regolith	95CHAR217	53	363762	6693299	0	6	3	90	0.2	19.5	10	200	0.05	33200	0.05	59
R214323	E49337	lower regolith	95CHAR217	53	363762	6693299	6	12	9	90	0.3	36	10	65	0.05	1900	0.05	142.5
R214324	E49338	lower regolith	95CHAR217	53	363762	6693299	12	18	15	90	0.6	33.5	10	250	0.05	1300	0.1	147.5
R214325	E49339	lower regolith	95CHAR217	53	363762	6693299	18	24	21	90	0.3	67	10	750	0.2	2400	0.2	107.5
R214326	E49340	lower regolith	95CHAR217	53	363762	6693299	24	30	27	90	0.3	48.5	40	800	0.05	1450	0.2	127.5
R214327	E49341	lower regolith	95CHAR217	53	363762	6693299	30	36	33	90	0.3	59	50	850	0.1	1350	0.2	88
R214328	G133308	lower regolith	95CHAR217	53	363762	6693299	37	38	38	90			180					
R214329	G130792	lower regolith	95CHAR460	53	363785	6693255	0	6	3	90	0.2	13.5	10	230	0.1	23400	0.05	99
R214330	G130793	lower regolith	95CHAR460	53	363785	6693255	6	12	9	90	0.4	28	<20	1150	0.05	1950	0.1	94
R214331	G130794	lower regolith	95CHAR460	53	363785	6693255	12	18	15	90	0.2	35	<20	800	0.05	1050	0.05	77.5
R214332	G130795	lower regolith	95CHAR460	53	363785	6693255	18	24	21	90	0.3	45	<20	1100	0.05	1200	0.1	132.5
R214333	G130796	lower regolith	95CHAR460	53	363785	6693255	24	30	27	90	0.3	46.5	20	900	0.05	1350	0.2	91.5
R214334	G130797	lower regolith	95CHAR460	53	363785	6693255	30	36	33	90	0.2	62	20	650	0.05	2700	0.2	84
R214335	G130798	lower regolith	95CHAR460	53	363785	6693255	36	40	38	90	0.3	15.5	<20	600	0.05	7600	0.2	97
R214336	G174417	lower regolith	96CHAR874	53	363875	6693188	0	6	3	60	0.2	10.5	20	430	0.3	53600	0.05	13.5
R214337	G174418	lower regolith	96CHAR874	53	363875	6693188	6	12	9	60	0.2	4	20	95	0.4	1900	0.05	20.25
R214338	G174419	lower regolith	96CHAR874	53	363875	6693188	12	18	15	60	0.3	3.5	20	550	0.1	950	0.2	35.75
R214339	G174420	lower regolith	96CHAR874	53	363875	6693188	18	24	21	60	0.3	4	20	850	0.1	600	0.05	27.25
R214340	G174421	lower regolith	96CHAR874	53	363875	6693188	24	30	27	60	0.3	5	20	800	0.05	1000	0.05	78.5
R214341	G174422	lower regolith	96CHAR874	53	363875	6693188	30	36	33	60	0.3	11.5	20	800	0.05	850	0.05	125
R214342	G174423	lower regolith	96CHAR874	53	363875	6693188	36	42	39	60	0.3	13.5	20	850	0.05	2800	0.1	160
R214343	G174424	lower regolith	96CHAR874	53	363875	6693188	42	48	45	60	0.3	14.5	20	900	0.05	5750	0.1	91.5
R214344	G174425	lower regolith	96CHAR874	53	363875	6693188	48	54	51	60	0.3	27.5	60	700	0.05	4400	0.1	78
R214345	G174426	lower regolith	96CHAR874	53	363875	6693188	54	60	57	60	0.3	10	20	460	0.1	21300	0.3	55.5
R214346	G130873	lower regolith	95CHAR473	53	363942	6693165	0	6	3	90	0.2	14.5	<20	600	0.3	28400	0.05	28.25
R214347	G130874	lower regolith	95CHAR473	53	363942	6693165	6	12	9	90	0.3	4.5	<20	120	0.3	650	0.05	19.5
R214348	G130875	lower regolith	95CHAR473	53	363942	6693165	12	18	15	90	0.3	4.5	<20	460	0.05	320	0.05	84

Appendix Table A9.1: Chemical data.

Number	Sample_id	Type Code	Drill Hole	Zone	E	N	from	to	av depth	dip	Ag	As	Au	Ba	Bi	Ca	Cd	Ce
R214349	G130876	lower regolith	95CHAR473	53	363942	6693165	18	24	21	90	0.2	11	<20	900	0.05	1850	0.05	220
R214350	G130877	lower regolith	95CHAR473	53	363942	6693165	24	30	27	90	0.3	10.5	<20	800	0.05	5150	0.1	99
R214351	G130878	lower regolith	95CHAR473	53	363942	6693165	30	36	33	90	0.3	22.5	40	800	0.05	6300	0.2	105
R214352	G130879	lower regolith	95CHAR473	53	363942	6693165	36	40	38	90	0.2	7.5	<20	750	0.05	6950	0.1	93
R214353	std 10	standard									0.2	26.5		320	0.3	137000	0.05	5.75
R214354	G130880	lower regolith	95CHAR474	53	363965	6693121	0	6	3	90	0.3	6.5	<20	390	0.2	19800	0.05	16
R214355	G130881	lower regolith	95CHAR474	53	363965	6693121	6	12	9	90	0.2	5.5	<20	145	0.6	1050	0.05	17.75
R214356	G130882	lower regolith	95CHAR474	53	363965	6693121	12	18	15	90	0.1	5	<20	280	0.1	500	0.05	29.25
R214357	G130883	lower regolith	95CHAR474	53	363965	6693121	18	24	21	90	0.2	3.5	<20	750	0.05	600	0.05	215
R214358	G130884	lower regolith	95CHAR474	53	363965	6693121	24	30	27	90	0.4	13	10	410	0.05	1450	0.5	57.5
R214359	G130885	lower regolith	95CHAR474	53	363965	6693121	30	36	33	90	0.4	2.5	<20	430	0.05	2750	1	94.5
R214360	G130886	lower regolith	95CHAR474	53	363965	6693121	36	40	38	90	0.4	4.5	10	290	0.05	8700	1.4	115
R214361	G211602	lower regolith	96CHAR933	53	364000	6693075	0	6	3	70	0.2	9	10	220	0.2	38700	0.05	14.75
R214362	G211603	lower regolith	96CHAR933	53	364000	6693075	6	12	9	70	0.2	4	<20	165	0.6	850	0.05	16
R214363	G211604	lower regolith	96CHAR933	53	364000	6693075	12	18	15	70	0.2	6	70	200	0.2	440	0.05	30.5
R214364	G212079	lower regolith	96CHAR933	53	364000	6693075	22	23	23	70	0.3	8	1280	750	0.05	500	0.05	135
R214365	G212082	lower regolith	96CHAR933	53	364000	6693075	25	26	26	70	0.2	9	2150	340	0.3	650	0.05	100
R214366	G212086	lower regolith	96CHAR933	53	364000	6693075	29	30	30	70	0.3	9.5	1310	650	0.05	750	0.05	105
R214367	G212091	lower regolith	96CHAR933	53	364000	6693075	34	35	35	70	0.4	27.5	420	1250	0.05	1800	0.05	125
R214368	G212097	lower regolith	96CHAR933	53	364000	6693075	40	41	41	70	0.3	30	130	650	0.05	9700	0.2	117.5
R214369	G212102	lower regolith	96CHAR933	53	364000	6693075	45	46	46	70	0.3	63	80	600	0.05	10100	0.2	112.5
R214370	G215091	lower regolith	97CHAR1123	53	364025	6693125	0	6	3	70	0.4	11.5	20	450	0.2	66600	0.05	18.75
R214371	G215092	lower regolith	97CHAR1123	53	364025	6693125	6	12	9	70	0.2	6	<20	165	0.6	4000	0.05	23
R214372	G215093	lower regolith	97CHAR1123	53	364025	6693125	12	18	15	70	0.4	5.5	10	250	0.1	900	0.05	56.5
R214373	G215094	lower regolith	97CHAR1123	53	364025	6693125	18	24	21	70	0.3	73	10	900	0.05	1150	0.05	200
R214374	G171887	lower regolith	97CHAR1123	53	364025	6693125	30	31	31	70	0.3	10.5	550	750	0.05	5350	0.1	87.5
R214375	G171892	lower regolith	97CHAR1123	53	364025	6693125	35	36	36	70	0.3	20.5	260	650	0.05	8800	0.2	97
R214376	G171894	lower regolith	97CHAR1123	53	364025	6693125	49	50	50	70	0.4	72	130	700	0.05	7400	0.2	96.5
R214377	G171899	lower regolith	97CHAR1123	53	364025	6693125	54	55	55	70	0.3	12	1010	900	0.3	9900	0.2	69
R214378	G171904	lower regolith	97CHAR1123	53	364025	6693125	59	60	60	70	0.4	7	80	550	0.05	10200	0.2	79
R214379	G211623	lower regolith	96CHAR935	53	364050	6693075	0	6	3	70	0.3	7	10	260	0.2	40400	0.05	13.5
R214380	G211624	lower regolith	96CHAR935	53	364050	6693075	6	12	9	70	0.2	5	<20	140	0.6	1200	0.05	16
R214381	G211625	lower regolith	96CHAR935	53	364050	6693075	12	18	15	70	0.3	10.5	<20	175	0.3	1250	0.05	60
R214382	G211626	lower regolith	96CHAR935	53	364050	6693075	18	24	21	70	0.3	5	130	650	0.05	600	0.05	115
R214383	G211627	lower regolith	96CHAR935	53	364050	6693075	24	30	27	70	0.4	7.5	10	750	0.05	550	0.05	122.5
R214384	G211628	lower regolith	96CHAR935	53	364050	6693075	30	36	33	70	0.4	25	80	700	0.05	700	0.2	62
R214385	G211629	lower regolith	96CHAR935	53	364050	6693075	36	42	39	70	0.2	15.5	70	550	0.05	700	0.2	61
R214386	G211630	lower regolith	96CHAR935	53	364050	6693075	42	48	45	70	0.2	22	20	700	0.05	2150	0.2	67
R214387	G211631	lower regolith	96CHAR935	53	364050	6693075	48	54	51	70	0.3	27	70	800	0.05	6050	0.3	72
R214388	G211632	lower regolith	96CHAR935	53	364050	6693075	54	60	57	70	0.2	26.5	20	950	0.05	11100	0.4	59.5
R214389	std 10	standard									0.3	29.5		480	0.4	130000	0.05	4.9
R214390	G217553	lower regolith	96CHAR1077	53	364100	6692975	0	6	3	70	0.3	7	20	550	0.2	17500	0.05	14
R214391	G217554	lower regolith	96CHAR1077	53	364100	6692975	6	12	9	70	0.4	4.5	30	115	0.5	8350	0.05	25.5
R214392	G217555	lower regolith	96CHAR1077	53	364100	6692975	12	18	15	70	0.3	9	20	195	0.4	5500	0.05	17
R214393	G217556	lower regolith	96CHAR1077	53	364100	6692975	18	24	21	70	0.2	3.5	20	170	0.05	4300	0.05	40.5
R214394	G217557	lower regolith	96CHAR1077	53	364100	6692975	24	30	27	70	0.3	5	30	650	0.05	5250	0.05	190
R214395	G217558	lower regolith	96CHAR1077	53	364100	6692975	30	36	33	70	0.3	13	20	800	0.05	5350	0.05	125
R214396	G217559	lower regolith	96CHAR1077	53	364100	6692975	36	42	39	70	0.4	15	70	750	0.05	7250	0.3	90
R214397	G217560	lower regolith	96CHAR1077	53	364100	6692975	42	48	45	70	0.3	12.5	50	750	0.05	11200	0.4	79.5
R214398	G217561	lower regolith	96CHAR1077	53	364100	6692975	48	54	51	70	0.4	23.5	40	800	0.05	14500	0.3	82
R214399	G217562	lower regolith	96CHAR1077	53	364100	6692975	54	60	57	70	0.3	23.5	20	750	0.05	14200	0.1	84.5
R214400	G174159	lower regolith	96CHAR848	53	364156	6692964	0	6	3	90	0.3	4.5	20	340	0.2	15300	0.05	10
R214401	G174160	lower regolith	96CHAR848	53	364156	6692964	6	12	9	90	0.3	5	20	95	0.5	16800	0.05	35.75
R214402	G174161	lower regolith	96CHAR848	53	364156	6692964	12	18	15	90	0.3	4.5	20	180	0.3	15800	0.05	20.5
R214403	G174162	lower regolith	96CHAR848	53	364156	6692964	18	24	21	90	0.4	22.5	100	480	0.1	18900	0.1	132.5
R214404	G174163	lower regolith	96CHAR848	53	364156	6692964	24	30	27	90	0.6	75	70	1400	0.1	23300	0.4	165

Appendix Table A9.1: Chemical data.

Number	Sample_id	Type Code	Drill Hole	Zone	E	N	from	to	av depth	dip	Ag	As	Au	Ba	Bi	Ca	Cd	Ce
R214405	G174164	lower regolith	96CHAR848	53	364156	6692964	30	36	33	90	0.5	35.5	30	1200	0.05	1000	0.5	93.5
R214406	G174165	lower regolith	96CHAR848	53	364156	6692964	36	42	39	90	0.5	24	110	1200	0.05	1350	0.6	117.5
R214407	G174166	lower regolith	96CHAR848	53	364156	6692964	42	48	45	90	0.5	21	20	1050	0.05	1700	0.4	82
R214408	G174167	lower regolith	96CHAR848	53	364156	6692964	48	54	51	90	0.4	19.5	50	750	0.05	5750	0.3	71
R214409	G131470	lower regolith	95CHAR559	53	364190	6692897	0	6	3	90	0.3	5.5	10	340	0.2	9750	0.05	9.75
R214410	G131471	lower regolith	95CHAR559	53	364190	6692897	6	12	9	90	0.3	3	<20	135	0.7	1750	0.05	13.75
R214411	G131472	lower regolith	95CHAR559	53	364190	6692897	12	18	15	90	0.3	3.5	<20	190	0.3	1800	0.05	19.25
R214412	G131473	lower regolith	95CHAR559	53	364190	6692897	18	24	21	90	0.4	6	10	600	0.1	7050	0.05	162.5
R214413	G131474	lower regolith	95CHAR559	53	364190	6692897	24	30	27	90	0.5	29	<20	850	0.2	1550	0.2	125
R214414	G131475	lower regolith	95CHAR559	53	364190	6692897	30	36	33	90	0.5	57	30	900	0.05	2550	0.6	107.5
R214415	G131476	lower regolith	95CHAR559	53	364190	6692897	36	42	39	90	0.5	29.5	10	750	0.05	8150	0.5	182.5
R214416	G131477	lower regolith	95CHAR559	53	364190	6692897	42	44	43	90	0.4	22.5	<20	950	0.05	8950	0.3	69
R214417	G131463	lower regolith	95CHAR558	53	364213	6692852	0	6	3	90	0.4	9	<20	340	0.1	46200	0.05	10.75
R214418	G131464	lower regolith	95CHAR558	53	364213	6692852	6	12	9	90	0.4	4	<20	105	0.4	5300	0.05	9
R214419	G131465	lower regolith	95CHAR558	53	364213	6692852	12	18	15	90	0.2	4	10	145	0.3	1700	0.05	18.25
R214420	G131466	lower regolith	95CHAR558	53	364213	6692852	18	24	21	90	0.3	5.5	<20	800	0.1	1150	0.05	107.5
R214421	G131467	lower regolith	95CHAR558	53	364213	6692852	24	30	27	90	0.4	28	10	1050	0.05	7200	0.1	110
R214422	G131468	lower regolith	95CHAR558	53	364213	6692852	30	36	33	90	0.6	29	20	900	0.05	3750	0.3	140
R214423	G131469	lower regolith	95CHAR558	53	364213	6692852	36	41	39	90	0.4	10.5	10	750	0.05	4100	0.4	87
R214424	std 10	standard									0.4	31.5		350	0.4	136000	0.05	4.55
R214426	challenger 2	lower regolith	96CHAR933	53	364000	6693075	0	1	0.5		0.05	15	10	550	0.1	129000	0.05	20.75
R214427	challenger 2	lower regolith	96CHAR933	53	364000	6693075	2	3	2.5		0.2	7	8	195	0.2	27700	0.05	14
R214428	challenger 2	lower regolith	96CHAR933	53	364000	6693075	4	5	4.5		0.2	7	4	145	0.3	2200	0.05	9.25
R214429	challenger 2	lower regolith	96CHAR933	53	364000	6693075	6	7	6.5		0.1	3	6	165	0.4	1650	0.05	9.75
R214430	challenger 2	lower regolith	96CHAR933	53	364000	6693075	8	9	8.5		0.2	4.5	2	150	0.8	1300	0.05	14.75
R214431	challenger 2	lower regolith	96CHAR933	53	364000	6693075	10	11	10.5		0.2	4	0.5	175	0.6	1400	0.05	16
R214432	challenger 2	lower regolith	96CHAR933	53	364000	6693075	12	13	12.5		0.2	5.5	13	190	0.5	1600	0.05	20
R214433	challenger 2	lower regolith	96CHAR933	53	364000	6693075	14	15	14.5		0.2	14	0.5	150	0.5	1350	0.05	21.75
R214434	challenger 2	lower regolith	96CHAR933	53	364000	6693075	16	17	16.5		0.1	8.5	8	210	0.1	1350	0.05	27
R214435	challenger 2	lower regolith	96CHAR933	53	364000	6693075	18	19	18.5		0.3	5.5	21	350	0.2	1350	0.05	81
R214436	challenger 2	lower regolith	96CHAR933	53	364000	6693075	20	21	20.5		0.2	19.5	79	420	0.1	4050	0.05	68.5
R214437	challenger 2	lower regolith	96CHAR933	53	364000	6693075	22	23	22.5		0.2	8.5	2490	700	0.05	1000	0.05	112.5
R214438	challenger 2	lower regolith	96CHAR933	53	364000	6693075	24	25	24.5		0.2	9	33	700	0.05	1200	0.05	115
R214439	challenger 2	lower regolith	96CHAR933	53	364000	6693075	26	27	26.5		0.2	31	17360	550	2	1400	0.05	110
R214440	challenger 2	lower regolith	96CHAR933	53	364000	6693075	28	29	28.5		0.3	10	740	650	0.1	1500	0.05	88.5
R214441	challenger 2	lower regolith	96CHAR933	53	364000	6693075	30	31	30.5		0.3	5.5	43	650	0.05	1450	0.05	77
R214442	grab	lower regolith	96CHRC687	53			64	65	64.5		0.2	83	11	850	0.6	20700	0.1	47.5

Appendix Table A9.1: Chemical data.

Number	Cr	Cs	Cu	Dy	Er	Eu	Fe	Ga	Gd	Ho	In	K	La	Lu	Mg	Mn	Mo	Na	Nb	Nd	Ni	P	Pb
units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
techique	icpoes	icpms	icpms	icpms	icpms	icpms	icpoes	icpms	icpms	icpms	icpms	icpoes	icpms	icpms	icpoes	icpoes	icpms	icpoes	icpms	icpms	icpoes	icpoes	icpms
detn limit	2	0.1	0.5	0.02	0.05	0.02	100	0.1	0.05	0.02	0.05	10	0.5	0.02	10	5	0.1	10	0.5	0.02	2	5	0.5
R208913	25	0.8	8	0.86	0.45	0.25	17000	4.2	1	0.15	<0.05	3800	11	0.07	1700	110	0.3	410	4	7	11	190	8
R208914	40	0.8	8	0.92	0.5	0.25	19300	4.4	1.05	0.16	<0.05	4150	11	0.08	1700	120	0.3	410	4	7	12	160	8.5
R208915	27	1	9.5	1.15	0.65	0.33	21300	5.5	1.35	0.22	<0.05	4500	13	0.1	1950	130	0.4	390	4.5	8.5	13	145	12.5
R208916	44	1	9.5	1.15	0.65	0.33	20400	5.5	1.4	0.22	<0.05	4400	13.5	0.1	2050	125	0.3	400	4.5	9	14	135	10
R208917	46	0.9	9.5	1.15	0.6	0.32	20600	5	1.3	0.21	<0.05	4000	12.5	0.09	1950	115	0.3	400	4	8.5	13	130	10
R208918	48	0.9	10	1.35	0.75	0.39	21600	5	1.55	0.26	<0.05	3950	15	0.12	2050	110	0.5	440	5	9.5	13	145	9.5
R208919	35	1.1	9.5	1.25	0.65	0.36	21000	5.5	1.4	0.23	<0.05	4700	14	0.1	2350	140	0.3	420	4.5	9.5	16	150	10.5
R208920	45	1	10	1.25	0.7	0.37	20200	5.5	1.45	0.24	<0.05	4350	14	0.11	2250	120	0.3	400	4.5	9.5	15	125	12
R208921	41	0.9	8.5	1	0.55	0.29	17900	4.7	1.15	0.19	<0.05	3800	11.5	0.09	2050	105	0.3	360	4.5	7.5	14	110	7.5
R208922	45	0.9	9	1.15	0.6	0.34	19000	4.8	1.45	0.21	<0.05	4000	14	0.1	2200	105	0.3	380	4	9.5	14	110	8.5
R208923	24	0.9	10	1.15	0.65	0.34	21200	4.9	1.3	0.22	<0.05	4000	12.5	0.1	2350	100	0.3	390	4	8.5	15	115	9.5
R208924	30	1	11	1.35	0.75	0.39	24600	6	1.55	0.25	<0.05	4200	15	0.12	2550	100	0.4	440	4.5	10	15	130	11.5
R208925	83	1.8	32	3.4	2	0.99	37800	14.5	3.6	0.67	<0.05	18600	42	0.31	16700	480	2.4	13600	6.5	26	57	280	26
R208926	21	0.8	10	1.2	0.65	0.34	19600	5	1.4	0.22	<0.05	4000	13	0.1	2050	120	0.4	420	5	9.5	12	185	10
R208927	19	0.8	8	1.05	0.55	0.3	17700	4.4	1.25	0.2	<0.05	3600	12	0.08	1900	100	0.2	330	4	8.5	11	130	10
R208928	41	0.9	9.5	1.1	0.6	0.31	18900	5	1.25	0.2	<0.05	3650	13	0.09	2200	95	0.3	340	4.5	8.5	12	120	9
R208929	20	0.9	12.5	1.2	0.65	0.33	20300	5	1.4	0.22	<0.05	3850	14	0.1	2500	95	0.5	380	5	9.5	13	135	10.5
R208930	25	0.9	12	1.25	0.7	0.35	23000	5.5	1.45	0.25	<0.05	3750	13.5	0.1	2800	90	0.4	380	3.5	9	13	150	9.5
R208931	25	0.9	11.5	1.3	0.7	0.38	24600	5.5	1.55	0.24	<0.05	3700	13.5	0.11	3150	85	0.3	410	4	9.5	13	160	9.5
R208932	24	1	12	1.5	0.8	0.43	22300	5.5	1.75	0.27	<0.05	3800	15.5	0.12	3300	85	0.5	450	5	11	13	155	10
R208933	13	1	12.5	1.35	0.7	0.42	25000	6	1.65	0.27	<0.05	3500	16	0.11	3200	80	0.4	480	4	10.5	13	145	10.5
R208934	37	1	11.5	1.6	0.85	0.45	23000	5.5	1.85	0.29	<0.05	3700	17	0.12	3400	85	0.3	490	4	11.5	13	145	9.5
R208935	32	1.1	13	1.65	0.85	0.5	20800	6	2	0.3	<0.05	3500	19	0.12	3350	85	0.4	490	4	13.5	13	140	11.5
R208936	45	1.2	12	1.6	0.85	0.47	21200	6	1.85	0.29	<0.05	3700	17	0.12	3500	90	0.3	490	4.5	12	14	140	10
R208937	30	0.9	19.5	1.7	0.9	0.51	24100	5.5	2.2	0.31	<0.05	2850	23	0.14	3700	65	0.3	450	3.5	16	13	155	10.5
R208938	130	<0.1	67	3.1	1.55	1.25	54200	19.5	4.3	0.49	0.05	500	60	0.29	850	25	1.3	1650	10.5	42	29	170	27.5
R208939	31	0.9	26	2.1	1.05	0.52	25200	5.5	3.3	0.35	<0.05	2550	43.5	0.15	4300	65	0.3	440	3.5	29.5	14	170	12
R213512	40	0.9	32.5	2.1	1	0.76	33000	8.5	3	0.35	<0.05	2450	43	0.17	3900	65	0.3	440	5	27	18	160	18.5
R213513	72	0.5	48	2.4	1.15	1.15	41400	10.5	3.5	0.39	<0.05	1700	53	0.21	2950	55	0.4	950	5	33.5	19	185	23
R213514	22	0.7	22	1	0.55	0.32	10400	6	1.15	0.19	<0.05	5000	11	0.09	9050	65	0.1	1500	2.5	6.5	17	180	8.5
R213515	17	0.6	17	0.83	0.45	0.32	10300	3.4	1	0.17	<0.05	2250	8.5	0.07	6100	60	0.2	650	1.5	5.5	14	165	7.5
R213516	10	0.6	12.5	0.87	0.45	0.28	9450	2.7	1	0.17	<0.05	2150	9	0.07	3850	70	0.2	480	1.5	6	10	170	4
R213517	36	1.2	21.5	1.05	0.55	0.3	16200	7	1.2	0.2	<0.05	4500	11.5	0.09	6250	115	0.5	1350	2.5	7	17	165	8
R213518	32	1	16.5	1.2	0.65	0.38	15600	7	1.5	0.22	<0.05	3850	15.5	0.1	9200	95	0.3	1450	2.5	9	21	100	7
R213519	26	0.8	18.5	1	0.55	0.33	11900	4.7	1.25	0.2	<0.05	3000	12.5	0.09	7950	90	0.2	900	2	7.5	20	130	6.5
R213520	115	0.1	6	1.9	1	0.69	135000	19.5	2	0.34	0.05	200	12	0.18	1300	20	2.4	1050	8.5	12.5	37	30	21.5
R213521	59	0.1	7.5	1.7	0.95	0.71	40700	13.5	1.85	0.32	<0.05	220	13.5	0.17	1100	50	2	700	12.5	11.5	27	30	8
R213522	175	0.2	11	1.65	0.85	0.45	71100	24.5	1.7	0.3	0.05	900	9	0.14	2150	115	2.6	900	8	9	36	70	13
R213523	30	0.9	14.5	1.3	0.7	0.42	28500	6.5	1.55	0.25	<0.05	2650	11	0.11	7600	60	0.6	1050	2.5	8.5	19	90	7
R213524	5	0.4	13	1.1	0.65	0.29	6550	1.9	1.3	0.23	<0.05	1550	9	0.1	5000	60	0.2	420	2	6.5	9	260	5.5
R213525	800	0.6	22.5	3.1	1.55	0.84	432000	42.5	3.2	0.54	0.25	1550	24	0.23	1250	410	6	240	15.5	20	41	460	86
R213526	25	<0.1	12.5	1.55	1.1	0.41	3700	2	1.05	0.33	<0.05	195	6	0.25	220	80	1.3	155	14.5	4.4	4	20	12.5
R213527	83	<0.1	17	1.85	1.35	0.4	20900	3	1.2	0.4	<0.05	150	4.7	0.29	150	80	3.4	105	23.5	3.9	8	60	14
R213528	25	<0.1	10	1.55	1.1	0.33	8800	2.3	1.1	0.35	<0.05	165	5	0.25	195	90	1.1	120	10.5	4.3	5	20	12.5
R213529	17	<0.1	4.5	0.7	0.5	0.43	9050	1.2	0.5	0.15	<0.05	105	2.7	0.12	80	45	1.7	65	10	2	5	20	12.5
R213530	5	<0.1	0.5	0.17	0.1	0.06	3450	<0.1	0.15	0.03	<0.05	145	2.6	0.02	120	30	0.4	70	1.5	1.15	<2	<5	3
R213545	41	0.9	21	2.2	1.2	0.91	36700	8.5	1.75	0.41	<0.05	2300	17.5	0.19	4550	190	1.4	1450	10.5	16.5	22	65	20.5
R213546	38	0.9	20	1.55	0.85	0.72	33600	6.5	1.15	0.28	<0.05	2650	12	0.15	4350	125	0.9	1650	10	10.5	16	45	19
R213547	23	0.6	15	1	0.6	0.35	13800	5.5	0.65	0.19	<0.05	1950	6	0.11	4200	55	1.1	1950	8.5	6	10	35	11
R213548	16	0.7	14.5	0.93	0.6	0.27	9700	6	0.55	0.18	<0.05	1550	5	0.13	3250	40	1.7	1900	10.5	4.5	5	15	11.5
R213549	26	0.4	12.5	0.54	0.4	0.12	11900	19	0.25	0.12	<0.05	1150	2.5	0.09	3300	15	2.5	2750	18	1.75	8	15	16
R213550	43	0.2	15	0.91	0.7	0.15	24900	44	0.3	0.21	<0.05	1100	3.1	0.18	5650	10	4.3	3600	26	1.95	15	30	14
R213551	38	1	20.5	1.8	0.95	0.71	20000	7.5	1.4	0.33	<0.05	2600	14	0.16	4900	290	0.5	1300	5.5	12.5	20	70	20

Appendix Table A9.1: Chemical data.

Number	Cr	Cs	Cu	Dy	Er	Eu	Fe	Ga	Gd	Ho	In	K	La	Lu	Mg	Mn	Mo	Na	Nb	Nd	Ni	P	Pb
R213552	46	1.3	19	2.1	1.1	0.77	46300	10	1.65	0.38	<0.05	2900	17.5	0.18	3900	140	0.9	1650	7.5	16	23	45	29.5
R213553	24	0.7	14.5	1.35	0.8	0.47	23100	8	0.95	0.26	<0.05	2000	9.5	0.15	4550	130	1.3	1600	10	8.5	17	30	18
R213554	23	0.6	14.5	1.3	0.75	0.4	20800	8	0.85	0.25	<0.05	2150	8	0.15	4000	115	1.8	2300	12.5	7.5	14	30	19
R213555	32	0.4	18.5	0.84	0.55	0.21	20100	21	0.45	0.18	<0.05	2000	4.5	0.12	4650	50	2.4	3100	16.5	3.7	13	30	15.5
R213556	25	0.4	16.5	0.82	0.55	0.19	17100	17.5	0.45	0.17	<0.05	1900	6	0.12	4450	40	2.1	2900	14.5	4	11	20	18
R213557	35	0.6	16	2.2	1.15	0.85	44000	6	1.45	0.39	0.05	1300	10	0.21	2950	80	1.1	750	10	11.5	24	30	17
R213558	26	0.8	15.5	1.3	0.75	0.54	28000	6.5	0.95	0.25	<0.05	1900	8.5	0.14	2850	55	1.1	1850	7.5	8.5	18	25	18
R213559	22	0.5	13	0.62	0.4	0.18	10500	7.5	0.35	0.13	<0.05	1200	3.5	0.09	2150	30	1.8	1750	9.5	3	11	30	12
R213560	23	0.5	14.5	1.05	0.7	0.28	15200	15	0.55	0.22	<0.05	1300	5	0.15	2750	35	2.2	1950	8	4.4	11	30	14.5
R213561	34	0.2	11	0.75	0.55	0.15	11300	33.5	0.3	0.17	<0.05	1200	2.9	0.13	4900	65	2.8	2850	23.5	2	14	30	12
R213562	38	0.3	14.5	1.1	0.85	0.21	12300	26.5	0.5	0.24	<0.05	1200	6.5	0.19	4700	50	4	2950	25.5	4	13	40	18.5
R213563	65	2	20.5	2.5	1.3	1.05	37700	17	2	0.46	0.05	4500	25.5	0.22	6300	135	0.6	1250	10.5	21	29	110	25
R213564	60	0.9	11	1.45	0.8	0.56	22200	14	1.1	0.27	<0.05	1900	16.5	0.14	7350	50	0.4	1250	10	13	29	70	13.5
R213565	26	0.3	9	1.25	0.65	0.39	9550	6	0.95	0.23	<0.05	450	11.5	0.12	1250	30	0.8	450	11.5	10	16	20	9.5
R213566	33	0.1	8	1.2	0.75	0.28	8850	10.5	0.7	0.23	<0.05	290	6	0.18	1650	20	1	420	18	5.5	21	65	10
R213567	64	0.3	11	2.6	1.65	0.66	20300	31	1.65	0.52	0.05	800	18.5	0.34	3700	55	3.4	1050	23.5	15.5	38	125	24
R213568	31	0.8	12.5	3.7	2.1	0.98	8650	29	2.8	0.69	<0.05	2450	24.5	0.38	3850	25	3.1	1100	23.5	24	23	110	24
R213569	64	1.9	20	2.6	1.4	1.05	34900	16	2.1	0.48	0.05	4750	25	0.23	5300	155	0.5	700	9.5	20.5	26	180	18.5
R213570	70	0.7	10.5	1.85	1	0.73	20700	16	1.35	0.34	0.05	1850	16.5	0.18	6450	60	0.5	1000	12	13	28	105	19
R213571	24	0.2	9	1.15	0.7	0.37	12300	11	0.7	0.23	<0.05	700	7.5	0.15	2300	20	0.7	850	15.5	6	6	80	23.5
R213572	23	0.4	9	1.95	1.25	0.46	6800	19	1.2	0.39	<0.05	850	14.5	0.26	5600	10	2.1	1550	18	11	11	90	12.5
R213573	34	0.2	9	0.96	0.65	0.23	10500	18.5	0.5	0.2	<0.05	650	6.5	0.16	6100	10	1.3	1300	18	4.9	13	85	19
R213574	21	0.9	11.5	4.4	2.3	1.1	12000	19	3	0.8	<0.05	4950	21	0.41	9150	105	1.8	4100	15.5	22.5	11	220	18
R213575	26	0.2	13.5	0.96	0.6	0.44	27800	4.1	0.55	0.19	<0.05	800	5	0.14	1600	45	1.3	650	11	4.1	8	75	17
R213576	19	0.3	13.5	0.69	0.45	0.23	11700	5.5	0.4	0.13	<0.05	1200	4.6	0.09	4100	25	1.4	2100	8	3.3	4	85	9
R213577	15	0.3	18.5	0.86	0.6	0.24	5350	10	0.45	0.18	<0.05	1150	6.5	0.13	3800	15	1.6	2750	10.5	4.3	9	80	11.5
R213578	23	0.3	15	0.86	0.6	0.21	4500	16.5	0.5	0.18	<0.05	1550	9	0.15	7750	10	2.5	4900	17.5	5	14	95	12
R213579	20	0.5	16.5	1.5	1	0.37	5150	16.5	0.95	0.32	<0.05	2000	14	0.23	7600	20	2.1	3750	16.5	9.5	13	105	18.5
R213580	20	1.7	19	2.2	1.2	0.72	6750	39.5	1.95	0.41	<0.05	4450	27	0.21	9450	20	1.6	5200	18	22.5	10	95	19
R213581	19	0.7	25.5	1.1	0.6	0.68	13200	5.5	0.9	0.21	<0.05	3750	9	0.1	7700	60	0.2	1350	3.5	8	9	160	12
R213582	22	0.7	17	1.45	0.8	0.7	14400	6	1.15	0.27	<0.05	3750	11	0.13	7100	85	0.4	1950	4.5	10	13	105	9.5
R213583	9	0.4	20	1.15	0.75	0.3	4950	4.7	0.75	0.23	<0.05	1750	8.5	0.15	5750	75	1.3	2950	6.5	6.5	7	85	8.5
R213584	16	0.3	38.5	0.9	0.65	0.22	5500	11.5	0.45	0.19	<0.05	1300	5	0.16	5450	20	1.9	3550	12	3.5	12	100	12.5
R213585	16	0.5	24	0.94	0.75	0.18	4450	16.5	0.4	0.21	<0.05	1400	8	0.2	4300	20	3.5	4150	24	3.5	7	80	11
R213586	27	1.1	30.5	1.15	0.85	0.25	6450	27.5	0.65	0.25	<0.05	2750	14.5	0.23	7000	20	3.2	4550	21.5	6.5	15	55	15
R213587	24	0.6	15	1.25	0.7	0.72	13400	5	1	0.23	<0.05	1900	11	0.13	5550	50	0.3	1400	7	10	9	55	10
R213588	17	0.4	12	2.8	1.45	0.99	11300	6	2.2	0.5	<0.05	1950	17	0.23	4450	40	0.9	1850	9	20	12	35	11.5
R213589	13	0.4	13	2.5	1.5	0.74	4900	4.6	1.95	0.49	<0.05	1650	14.5	0.27	6600	35	1.3	2950	7	17.5	12	10	17
R213590	21	0.3	22	0.67	0.5	0.17	4700	10.5	0.45	0.15	<0.05	800	3.6	0.11	3000	15	3.7	2550	14.5	2.5	10	<5	10
R213591	20	0.3	25.5	0.82	0.65	0.16	3800	12.5	0.5	0.19	<0.05	700	5	0.14	2700	15	4.2	2450	17	2.9	8	<5	7
R213592	32	0.4	23.5	0.96	0.75	0.18	3700	19	0.6	0.23	<0.05	1000	6	0.17	3700	15	6	2750	26.5	3.2	11	5	7
R213593	460	0.4	135	2.6	1.55	0.79	481000	27	2.5	0.53	0.25	1600	11.5	0.24	850	1650	4.7	210	4.5	13	62	550	55
R213594	19	0.9	19.5	1.3	0.8	0.57	15500	6.5	1.55	0.27	<0.05	2800	9.5	0.11	5700	75	0.6	1500	4.5	8.5	14	40	7.5
R213595	21	0.6	17	0.96	0.6	0.37	8950	6.5	1	0.2	<0.05	2000	6.5	0.1	6700	60	1.3	1600	5	6	13	<5	7
R213596	25	0.6	20	1.35	0.95	0.3	6550	15	1.15	0.3	<0.05	1850	9	0.19	6550	25	4.2	3000	15.5	7	12	10	9.5
R213597	27	0.7	40	1.15	0.9	0.24	7100	24	0.8	0.26	<0.05	1900	9	0.18	4400	15	5	3300	21.5	4.8	6	10	10.5
R213598	23	0.5	35.5	0.96	0.75	0.21	6250	25.5	0.75	0.21	<0.05	2100	9	0.15	3750	15	3.1	3050	18	5	10	5	7
R213599	29	1.3	39	0.79	0.55	0.18	6650	39.5	0.75	0.17	<0.05	3600	9.5	0.12	2900	25	1.9	2950	14	5.5	3	5	9
R213600	25	0.7	24	1.3	0.75	0.45	8700	8	1.45	0.26	<0.05	2550	8.5	0.11	8900	60	0.7	2100	5	9	13	50	5
R213601	31	0.7	26.5	2.9	1.8	0.73	13900	17.5	2.8	0.6	<0.05	3100	13.5	0.28	9750	125	2.8	4250	15.5	16	21	20	17
R213602	28	0.7	42	1.4	1	0.32	7900	19	1.15	0.31	<0.05	2750	10.5	0.19	5450	35	4.6	3650	20	7	14	35	18
R213603	38	2	40.5	1.2	0.85	0.3	8800	45	1.1	0.26	<0.05	4450	12	0.17	7900	35	2.5	4750	20	7.5	25	75	11.5
R213604	38	2.3	15	0.51	0.35	0.16	6650	47	0.55	0.11	<0.05	5100	7	0.07	6700	20	1	4350	10.5	4.4	5	50	7.5
R213605	36	1.9	14.5	0.62	0.4	0.17	7600	27	0.75	0.12	<0.05	4800	9.5	0.08	4950	20	0.7	3450	9.5	6	3	40	9
R213606	15	0.5	15	1.15	0.7	0.52	9500	3.9	1.15	0.23	<0.05	2300	6.5	0.12	4650	70	0.7	1400	8.5	6.5	8	55	5
R213607	33	0.7	26	1.65	1.05	0.45	12200	18	1.6	0.35	<0.05	3250	9	0.18	6150	105	2.3	4050	15	9.5	19	30	21

Appendix Table A9.1: Chemical data.

Number	Cr	Cs	Cu	Dy	Er	Eu	Fe	Ga	Gd	Ho	In	K	La	Lu	Mg	Mn	Mo	Na	Nb	Nd	Ni	P	Pb
R213608	40	1.1	35	1.35	1	0.36	8300	21	1.1	0.3	<0.05	3950	10.5	0.2	8150	30	4.4	5050	22	7	10	35	14
R213609	26	1.4	38	0.97	0.7	0.22	6600	42	0.85	0.22	<0.05	3950	9	0.15	7250	25	3.2	4950	18	5.5	8	25	8.5
R213610	18	2	20	0.72	0.5	0.2	5500	60	0.75	0.15	<0.05	5500	10	0.1	5500	20	0.8	4400	12	6	2	35	7.5
R213611	31	1.8	18	0.64	0.45	0.17	5800	37.5	0.75	0.13	<0.05	6000	11	0.09	5600	25	0.8	4400	11	6.5	3	55	8.5
R213612	32	0.5	17.5	0.72	0.45	0.23	9300	10.5	0.75	0.15	<0.05	2350	4.6	0.07	9150	35	0.5	2950	5.5	4.2	13	50	6
R213613	18	0.3	12	1.15	0.85	0.33	5900	8.5	0.85	0.26	<0.05	1050	4.5	0.18	2900	20	2	1650	20.5	4	8	10	17
R213614	37	0.5	14.5	0.83	0.65	0.16	7100	14	0.55	0.19	<0.05	1600	4.1	0.15	5250	25	3.3	2950	21	2.8	13	30	13
R213615	42	1.2	27	0.53	0.4	0.14	7150	46	0.5	0.12	<0.05	3000	5.5	0.09	10800	25	1.6	5950	11	3.3	8	50	7.5
R213616	38	1.8	11.5	0.59	0.4	0.16	7850	23.5	0.65	0.12	<0.05	3550	9.5	0.08	5450	20	0.9	3800	10	5.5	5	45	11.5
R213617	36	2.9	12	0.75	0.55	0.2	10800	17.5	0.75	0.16	<0.05	6050	10	0.11	6850	30	1.1	4750	10.5	5.5	7	65	6
R213618	41	1.8	19	1.1	0.65	0.33	15300	14	1.2	0.22	<0.05	5200	10	0.11	11300	55	0.4	4100	6.5	7.5	14	70	7
R213619	49	1.6	15.5	1.05	0.65	0.3	17300	15.5	1.1	0.21	<0.05	4900	9	0.11	8350	40	0.5	4200	8	7	11	60	8
R213620	53	1.4	9	0.82	0.55	0.2	18400	15	1	0.17	<0.05	3450	10.5	0.1	3600	25	1	2800	9.5	8	10	50	11
R213621	43	0.7	7	0.7	0.45	0.14	5650	14	1.35	0.13	<0.05	1950	14.5	0.07	2750	20	0.8	1950	13	13.5	8	35	9
R213622	30	0.3	7.5	0.64	0.35	0.13	5000	7.5	1.5	0.11	<0.05	1300	17	0.06	1750	20	0.5	1250	8.5	15.5	4	20	9
R213623	84	0.6	17	1.25	0.75	0.33	17800	18.5	1.9	0.24	<0.05	5750	19.5	0.14	2500	15	0.6	2450	9	17.5	10	60	11.5
R213624	53	0.8	17.5	2	1.2	1	17200	9	2.2	0.4	<0.05	3000	16.5	0.19	4450	130	1.2	1950	11.5	14.5	10	85	10
R213625	77	0.7	14	7	3.9	1.9	11900	15.5	7.5	1.4	<0.05	4150	42.5	0.51	7000	145	0.8	4100	8.5	44	19	100	13
R213626	51	0.6	12.5	3.1	1.8	0.62	6250	18	3.6	0.59	<0.05	4050	38	0.31	8450	40	1.3	5650	10	26.5	23	105	14.5
R213627	120	0.3	11	1.4	0.85	0.22	5800	22	2.2	0.26	0.05	2750	23.5	0.14	6350	35	1.7	5250	10.5	20.5	28	100	8
R213628	145	0.3	11.5	1.65	0.95	0.3	6250	24	2.8	0.31	<0.05	3450	30.5	0.16	5550	30	1	5100	12	27	23	110	7.5
R213629	170	0.4	30.5	1.9	1	0.85	14200	27.5	3.9	0.32	0.05	10000	80	0.16	7100	45	1.4	6200	14	37.5	25	240	38
R213630	41	1.1	22	1.5	0.85	0.51	15600	9.5	2	0.29	<0.05	4000	16.5	0.12	8550	75	0.4	2800	5.5	13	12	115	10
R213631	83	0.8	29.5	1.7	0.9	0.45	20500	14.5	2.8	0.31	<0.05	3450	25	0.13	7600	50	1.2	4000	8	21	11	90	17
R213632	94	0.3	35	9	4.9	1.4	21100	17	8.5	1.75	0.05	2450	50	0.66	5100	55	1.7	3750	9.5	49.5	16	110	51
R213633	220	0.2	42.5	1.5	0.75	0.31	25700	25.5	3.5	0.25	<0.05	2050	40.5	0.12	2250	25	2.3	3400	15	34	11	140	24.5
R213634	250	0.1	52	1.3	0.65	0.29	35400	25.5	3.2	0.21	<0.05	2300	34.5	0.11	1850	30	2.6	3250	12.5	29.5	11	160	21.5
R213635	210	0.4	77	1.7	0.8	0.47	57300	27	3	0.25	<0.05	5300	47.5	0.13	1800	35	4.5	4300	13.5	58	14	250	30.5
R213636	170	1.8	25.5	1.8	0.95	0.59	51600	15	1.55	0.33	<0.05	4450	19.5	0.15	1700	30	0.8	3500	7	21	22	210	15
R213637	32	1	28	2.1	1.1	0.58	19600	20	1.55	0.37	0.05	4950	20.5	0.18	7300	90	1.2	3500	9.5	21.5	24	145	21
R213638	68	1.1	36.5	1.15	0.55	0.41	20300	24	1.65	0.18	0.05	3900	28	0.1	5300	60	1.9	3750	12.5	29.5	26	105	16
R213639	115	0.5	91	2	0.95	0.55	27200	30	3.6	0.3	0.05	2650	57	0.15	5350	25	6	4950	17	66	38	85	29.5
R213640	230	0.2	165	1.45	0.65	0.48	45900	28.5	2.1	0.22	0.05	1350	36	0.11	3050	35	6	4800	16.5	36.5	52	230	26
R213641	260	0.2	87	1.75	0.8	0.54	57900	21	2.7	0.26	<0.05	1050	44	0.13	1550	40	3.7	3900	11	43	43	230	15
R213642	130	1	48	0.77	0.45	0.24	32300	32	0.45	0.15	0.15	1300	3.5	0.08	1100	35	2.9	3250	9	4.1	36	150	26.5
R213643	29	2.3	23.5	2.2	1.15	0.81	26800	13	1.65	0.41	<0.05	5800	22.5	0.19	5550	210	0.9	2700	7.5	19.5	25	195	15.5
R213644	43	1.5	24.5	2.1	1	0.97	16400	20.5	2.3	0.34	0.05	5500	71	0.16	9450	110	1	4350	12.5	35	20	220	44
R213645	39	0.2	21	3.8	2	0.85	7850	19	2.7	0.7	<0.05	3050	36	0.32	5450	60	0.6	3650	10.5	34	34	95	41.5
R213646	44	0.1	23	1.55	0.85	0.38	5000	20	1.5	0.28	<0.05	4700	24	0.16	2500	20	0.8	2650	11	24	24	55	17
R213647	43	0.2	14	1.3	0.7	0.46	5750	21.5	1.55	0.23	<0.05	10500	26.5	0.13	2550	15	0.5	2350	11	26.5	21	55	14
R213648	58	0.3	27	1.4	0.7	0.44	16800	21.5	1.75	0.23	<0.05	8900	31	0.14	2300	20	1	2500	10	30	30	65	16
R213649	23	1.5	21	1.65	0.9	0.66	17400	10	1.25	0.3	<0.05	4200	17	0.15	6850	115	0.6	1850	5.5	15	20	160	13
R213650	49	1	22	1.65	0.8	0.6	20500	20.5	1.9	0.28	<0.05	4650	32.5	0.13	7900	85	1.4	4900	11	30	20	135	23.5
R213651	78	0.1	27.5	4.3	2.3	1	16100	23.5	3.1	0.8	0.05	2250	45.5	0.36	4100	45	1.8	4300	11.5	41	28	125	35.5
R213652	84	0.1	47.5	1.9	1	0.49	18200	23	2.2	0.32	<0.05	1150	41	0.18	1600	25	2.6	3000	13.5	36.5	23	110	25
R213653	110	0.2	70	2.6	1.4	0.85	22900	25	2.3	0.45	<0.05	2850	36	0.26	2100	80	2.3	3200	14	34	31	105	23
R213654	96	0.2	32.5	3	1.6	1.1	10500	20	2.2	0.54	<0.05	2900	30.5	0.29	2950	80	1.9	3050	13	28	20	85	15.5
R213655	36	1.5	20	1.6	0.85	0.63	17000	9	1.15	0.3	<0.05	4700	14	0.14	6450	130	0.5	1800	5.5	12.5	21	165	12.5
R213656	44	2.1	22.5	2.6	1.45	0.93	30300	16	1.75	0.49	0.05	7400	22.5	0.22	8050	195	1	3000	9	19	26	140	18.5
R213657	67	1	39	7.5	4	1.6	23200	19.5	4.2	1.4	0.1	5000	40.5	0.6	6200	120	0.8	3600	10	44.5	29	135	36.5
R213658	66	0.1	41	3.5	1.9	0.72	12200	21.5	2.9	0.62	0.05	1950	46	0.34	2650	30	0.8	2900	13	42	21	90	24.5
R213659	53	0.1	33.5	2.2	1.2	0.69	9350	21.5	2.6	0.38	<0.05	2450	47.5	0.23	1350	25	1.1	2150	12	43.5	20	90	18
R213660	65	0.1	32.5	2.1	1.1	0.61	10100	22.5	2.6	0.35	<0.05	2300	49	0.2	1450	30	1	2250	12.5	45.5	17	100	20
R213661	39	1.3	25	2.2	1.15	0.96	22700	12	1.85	0.39	<0.05	4150	25.5	0.19	8250	105	0.6	1200	6.5	25.5	22	170	16
R213662	45	0.6	41.5	2	1.05	0.84	24500	16	2.1	0.35	<0.05	3400	39.5	0.18	6750	115	1.1	1450	7.5	34	26	145	18.5
R213663	60	0.3	57	4.8	2.7	1.15	27800	17.5	3.4	0.91	<0.05	2850	59	0.44	5650	115	1.7	2600	9.5	41.5	29	180	26

Appendix Table A9.1: Chemical data.

Number	Cr	Cs	Cu	Dy	Er	Eu	Fe	Ga	Gd	Ho	In	K	La	Lu	Mg	Mn	Mo	Na	Nb	Nd	Ni	P	Pb
R213664	91	0.2	59	3.9	2.2	0.85	29100	20	2.5	0.75	<0.05	2650	31	0.39	3550	65	1.3	3900	10	30	35	135	20.5
R213665	105	0.2	83	5	2.8	1.4	34700	22	3.6	0.94	0.05	2650	52	0.48	3100	75	2.4	3800	12.5	48.5	36	180	29.5
R213666	95	0.1	69	6	3.3	1.4	35300	23.5	4	1.1	0.05	2000	59	0.58	4000	145	3.9	3150	13	52	31	160	35.5
R213667	35	1.1	19.5	1.45	0.8	0.81	13900	7.5	1.1	0.27	<0.05	3650	14	0.13	6900	90	0.5	1400	4.5	12.5	17	150	8
R213668	35	1.1	18	1.4	0.75	0.58	13000	12.5	1.15	0.25	<0.05	5950	17.5	0.13	8050	80	0.5	3200	7	15.5	20	120	9
R213669	75	0.3	12.5	2.9	1.65	0.73	9100	16	1.9	0.55	<0.05	7000	20.5	0.27	4850	40	0.4	3950	8.5	22.5	22	65	10.5
R213670	82	0.2	14	2.7	1.4	1.15	7450	19	2.7	0.47	<0.05	3750	68	0.24	3900	20	0.5	3450	12	39.5	22	175	46.5
R213671	76	0.1	17	1.7	0.9	0.65	6600	19.5	2	0.29	<0.05	3000	45.5	0.16	3400	15	0.5	3300	10.5	33.5	20	130	30.5
R213672	83	0.2	15	1.75	0.9	0.54	6500	18.5	1.75	0.3	<0.05	3650	28.5	0.17	2900	25	0.3	3200	11	25	21	80	12.5
R213673	18	0.9	21	1.1	0.6	0.67	11600	5.5	0.8	0.2	<0.05	3650	10.5	0.1	12900	60	0.3	1900	4	9	20	150	7.5
R213674	40	1.3	18.5	2.2	1.25	0.92	13600	9.5	1.55	0.42	<0.05	8650	19.5	0.19	12800	60	0.4	3450	5.5	17	21	135	11
R213675	39	0.7	14.5	1.55	0.85	0.89	10800	15	1.45	0.27	<0.05	17800	25	0.15	5350	30	1	4150	7.5	20.5	23	130	15
R213676	67	0.5	17.5	1.05	0.6	0.64	9750	16.5	1.25	0.18	<0.05	15000	24.5	0.12	4450	20	0.9	3950	9	20	21	110	19
R213677	82	0.9	17	1.3	0.7	1.1	11900	21	1.65	0.22	<0.05	24000	44.5	0.13	3500	25	0.9	3600	11.5	28	16	160	31.5
R213678	87	1.9	15.5	1.35	0.7	1.1	10000	20.5	1.85	0.23	<0.05	25000	47	0.13	3700	20	1.2	3400	10	33	15	175	34.5
R213679	54	1.8	30	1.25	0.65	0.7	17000	8	1	0.23	<0.05	7600	16	0.11	10600	75	0.6	3700	4.5	11.5	24	125	11
R213680	140	3.4	59	7.5	4.5	1.85	33600	12	6.5	1.35	<0.05	12700	42	0.55	10800	75	1	4450	6.5	32.5	35	115	21.5
R213681	210	3.8	105	3.4	2	1.15	52900	17	4.3	0.6	0.05	18700	52	0.27	6300	60	2.9	4450	9	28.5	45	175	31.5
R213682	185	3.9	120	1.95	0.95	1.15	56100	19	3.2	0.28	0.05	23400	60	0.15	5650	45	3.2	3650	10	23	35	210	34
R213683	185	3.7	110	1.3	0.75	0.79	45000	21	2.3	0.2	<0.05	20300	38.5	0.11	4650	45	3.3	3000	10	16	28	190	28
R213684	210	4.2	130	2	0.95	1.4	54500	23.5	2.9	0.28	0.05	27400	78	0.16	5600	50	2.4	3700	13	25.5	37	320	40.5
R213685	36	0.6	13.5	1.35	0.7	0.35	6050	14	2.2	0.21	<0.05	6300	22	0.1	8900	45	0.5	2250	4.5	12	11	115	13.5
R213686	37	0.6	7	1.95	1.05	0.39	5050	14.5	2.3	0.32	<0.05	9050	23	0.13	6650	40	0.4	2500	5.5	13	11	85	13.5
R213687	35	0.3	5	1.6	0.9	0.3	3300	18.5	2	0.29	<0.05	8700	27.5	0.13	2950	20	0.4	1900	6.5	10.5	9	85	23.5
R213688	33	0.4	3.5	1.6	0.9	0.27	3250	18	2	0.23	<0.05	9300	28.5	0.13	2100	25	0.5	1750	8.5	11.5	7	95	30.5
R213689	55	0.7	4.5	1.45	0.95	0.38	4100	31	2	0.25	<0.05	19000	23	0.15	3050	30	0.6	1850	13.5	10.5	6	90	31
R213690	48	0.7	4	1.3	0.9	0.44	4300	26	2.4	0.25	<0.05	15100	28.5	0.15	2850	25	0.5	2050	11	15	7	105	16.5
R213691	38	7.5	7	1.1	0.7	0.4	3850	24.5	1.2	0.2	<0.05	24700	15.5	0.11	1650	25	0.5	2500	2	8.5	11	80	10
R213692	100	0.5	22	4.8	3	0.68	13300	15	4.5	0.86	<0.05	2300	25	0.4	7700	55	0.8	4200	8.5	20.5	26	105	20
R213693	170	0.2	61	3.1	1.6	0.55	35400	26	4.5	0.46	0.05	1650	42.5	0.21	4100	45	3.7	4350	16.5	32	23	195	20.5
R213694	300	0.2	77	1.4	0.7	0.27	45500	25.5	2.4	0.18	0.05	1100	28	0.11	2000	30	3.2	4000	14	21.5	21	240	14
R213695	250	<0.1	85	1.75	0.85	0.34	46400	34.5	3.9	0.24	<0.05	1200	42	0.13	2900	35	3.6	4750	25	31.5	22	230	18
R213696	300	<0.1	155	1.75	0.9	0.4	72300	40	3.1	0.28	0.05	1050	31.5	0.18	2650	50	5.5	4550	28.5	27	32	230	23.5
R213697	125	<0.1	58	1.65	0.9	0.31	31900	22.5	3.4	0.21	<0.05	1650	40	0.15	1250	30	2.4	3050	13	29.5	10	145	12
R213698	23	0.5	13.5	1.35	0.75	0.37	9750	10.5	2.1	0.24	<0.05	1900	21.5	0.1	5350	60	0.7	2200	6.5	14	11	95	5.5
R213699	42	0.6	14	3.1	1.7	0.58	11300	13.5	3.4	0.47	<0.05	2800	29.5	0.2	5400	75	0.7	3600	8	21	13	105	81
R213700	41	0.2	14.5	2.8	1.55	0.75	7000	17	4	0.44	<0.05	2100	43.5	0.21	3800	35	0.8	3500	9.5	31.5	15	135	18
R213701	86	0.2	15	1.55	0.7	0.37	7500	23.5	3.4	0.18	<0.05	1850	44	0.1	3150	20	1.1	2900	12.5	30	10	155	22.5
R213702	68	0.3	12.5	1.7	0.85	0.39	8400	28.5	4.3	0.21	<0.05	1950	57	0.11	3200	20	1.6	3200	16.5	36.5	8	145	21
R213703	50	0.3	9.5	1.65	0.8	0.46	8400	24	3	0.22	<0.05	2150	43.5	0.13	1500	20	1.3	2900	13	29	9	130	10.5
R213704	29	0.7	12	1.65	0.85	0.5	10400	11	2.7	0.26	<0.05	3400	28	0.11	5000	60	0.7	2350	8	20	11	85	7
R213705	32	0.8	12	1.85	1	0.4	15900	16.5	2.5	0.32	<0.05	4650	26.5	0.15	5100	65	0.9	3350	9.5	18	13	130	7.5
R213706	43	0.5	11.5	3	1.95	0.7	13500	17.5	3.8	0.59	<0.05	3450	34.5	0.26	3700	45	1.1	3250	11.5	23	10	90	13
R213707	59	0.4	20	1.55	0.65	0.27	19100	24	3.6	0.16	<0.05	2250	49	0.1	3850	30	2	3000	14	35.5	13	145	13.5
R213708	91	0.3	28.5	1.65	0.75	0.36	32200	29.5	4.1	0.22	0.05	3200	49	0.1	4450	35	2.7	3750	18.5	38.5	13	115	16.5
R213709	125	0.3	37.5	1.95	0.9	0.44	45200	32	4.8	0.23	0.1	3000	48	0.11	3600	50	2.6	3100	21.5	44	17	185	23
R213710	22	0.9	16	2.3	1.25	0.98	17600	10.5	3.1	0.38	<0.05	3050	22.5	0.17	4650	200	0.5	2050	6	18.5	15	80	6.5
R213711	46	0.5	11.5	3.7	2.2	1.2	21100	18	5.5	0.7	<0.05	3250	35	0.24	3800	140	0.7	3750	10	33	11	75	8
R213712	68	0.4	16.5	3.3	1.9	0.76	27800	18.5	3.8	0.58	<0.05	3450	30.5	0.25	3550	75	1.4	3500	11	23	15	90	15
R213713	78	0.3	12.5	1.75	0.85	0.39	25900	21	3.1	0.21	<0.05	2950	37	0.1	1700	25	1.8	2500	12.5	29	10	85	22
R213714	100	0.2	10.5	1.1	0.5	0.45	18100	24	2.4	0.12	<0.05	7850	32	0.07	2200	25	1	3350	15.5	25.5	9	110	17
R213715	100	0.2	17.5	1.3	0.55	0.78	17900	25.5	3.1	0.18	<0.05	12100	35	0.08	2100	25	2	3500	16.5	28.5	11	135	21.5
R213716	46	0.9	12.5	2.1	1.2	0.83	16300	11.5	2.4	0.38	<0.05	3000	16	0.17	5750	95	0.8	1450	8	14	15	105	6
R213717	32	0.9	12	2.2	1.15	0.61	15900	13.5	3.2	0.35	<0.05	3400	23.5	0.15	5750	80	0.8	2550	8	21	13	125	7
R213718	38	0.7	10	2.5	1.35	0.64	14800	15.5	3.4	0.46	<0.05	3150	28.5	0.18	4650	70	0.7	3000	8	27	12	60	8
R213719	50	0.2	11.5	1.4	0.6	0.34	14700	21	2.8	0.16	<0.05	2300	30	0.07	2700	40	0.8	2850	13	26.5	11	95	11

Appendix Table A9.1: Chemical data.

Number	Cr	Cs	Cu	Dy	Er	Eu	Fe	Ga	Gd	Ho	In	K	La	Lu	Mg	Mn	Mo	Na	Nb	Nd	Ni	P	Pb
R213720	61	0.2	9.5	1.75	0.65	0.35	15500	25	5.5	0.17	<0.05	3500	69	0.07	2250	25	1.3	2850	16.5	69	10	150	19.5
R213721	73	0.3	16.5	1.7	0.7	0.63	15400	26	5	0.16	<0.05	11000	59	0.07	3300	25	1.6	3400	18.5	60	10	160	27
R213722	42	1	13.5	2.3	1.6	0.87	17900	11.5	3.1	0.48	<0.05	3200	18	0.22	7750	115	1.6	1900	14.5	17.5	18	85	9
R213723	39	0.9	15	1.85	1.2	0.78	16500	11.5	2.4	0.36	<0.05	3050	14	0.19	8900	95	1	1850	11.5	13	19	70	8.5
R213724	50	0.6	11.5	1.4	0.75	0.4	17500	23.5	1.55	0.23	<0.05	3150	16.5	0.11	5950	60	1.3	3600	12	10.5	18	50	5.5
R213725	61	0.7	11.5	1.4	0.8	0.44	17800	25	2.4	0.27	<0.05	2950	29	0.14	5200	65	1.2	3650	13.5	17	14	40	11.5
R213726	62	0.3	8	1.25	0.75	0.36	15000	21.5	2.4	0.23	<0.05	2000	32	0.12	4000	75	1.1	3000	9	19.5	10	40	8
R213727	57	0.5	11	1.6	0.8	0.46	19700	23	3.8	0.26	<0.05	1650	49	0.12	3050	55	1	2500	9	35.5	13	60	10.5
R213728	43	1.2	14	1.8	1.1	0.79	19200	9.5	2.6	0.38	<0.05	2500	18.5	0.18	6950	105	0.8	1300	3	14	18	85	10.5
R213729	58	1.3	15.5	2.6	1.7	0.94	20900	16	4.1	0.55	<0.05	3100	33	0.25	6750	150	0.8	3150	5.5	23	23	75	15.5
R213730	69	1.1	17	3	1.8	0.94	21400	18.5	4.7	0.58	<0.05	3100	43	0.27	5550	140	0.9	2900	4.5	29	23	70	16.5
R213731	63	0.7	12	2.4	1.45	0.75	15200	23	4	0.45	0.05	4700	45.5	0.21	3650	50	0.8	3400	6	28	24	75	15.5
R213732	83	0.5	10	1.45	0.65	0.47	12000	28.5	4.4	0.19	<0.05	4950	74	0.08	2950	20	0.9	2650	8.5	56	15	140	22
R213733	110	0.5	15	1.05	0.55	0.35	16400	32.5	2.8	0.15	<0.05	3900	41.5	0.08	5750	25	1	3250	14	27.5	18	100	16
R213734	72	1.7	13	1.45	0.9	0.51	36100	11	2.2	0.29	<0.05	3400	20.5	0.13	1500	195	0.5	360	2	14	18	135	15
R213735	62	1.7	11.5	1.4	0.85	0.55	33800	10	2.1	0.28	<0.05	3800	20.5	0.13	1650	210	0.6	410	3	13.5	19	145	15
R213736	76	3.2	18.5	2.1	1.3	0.79	38700	17	3.2	0.41	0.1	6100	27	0.19	3350	320	0.6	550	4.5	18	26	210	20
R213737	66	2.9	17.5	2.2	1.35	0.88	32800	15	3.3	0.44	0.05	6200	28	0.2	3450	310	0.5	600	4	19.5	23	240	17.5
R213738	45	1.2	8.5	0.91	0.55	0.35	22700	8	1.4	0.18	0.05	2900	14.5	0.09	1250	135	0.5	310	<0.5	9	15	110	11
R213739	35	1.3	10	0.98	0.6	0.37	20200	8	1.4	0.19	<0.05	2850	13	0.09	1200	140	0.4	390	1.5	8.5	14	110	11.5
R213740	115	0.4	30.5	0.51	0.35	0.22	69200	20	0.6	0.1	<0.05	1600	4.1	0.07	3650	320	1.4	1200	7	2.6	115	85	6
R213741	51	2	13	1.45	0.85	0.56	28700	11.5	2.2	0.28	0.05	4250	19.5	0.13	1950	240	0.5	490	3	12.5	19	140	15
R213742	52	1.8	11.5	1.35	0.8	0.53	24200	9.5	2	0.26	0.05	3800	18.5	0.13	1900	185	0.4	370	2.5	12	16	145	14.5
R213743	49	1.8	11.5	1.45	0.95	0.52	22100	9.5	2.1	0.28	<0.05	3900	20	0.13	2800	220	0.6	450	4.5	13	18	120	14
R213744	39	1.5	11	1.35	0.9	0.55	24200	8	2.1	0.29	<0.05	3350	18.5	0.13	2000	175	0.6	390	6	13	15	105	16
R213745	54	1.7	14	1.65	1	0.66	25500	9.5	2.6	0.32	<0.05	3900	22.5	0.14	3550	195	0.6	600	3.5	15	18	240	14.5
R213746	32	1.8	17	1.35	0.8	0.51	20400	10	2	0.27	<0.05	3850	17	0.13	4550	160	0.3	650	1.5	12	15	210	11
R213747	56	1.4	14.5	1.45	0.95	0.57	27400	8.5	2.3	0.3	<0.05	3150	20	0.14	1950	200	0.7	340	5	12.5	14	120	16
R213748	63	1.6	13	1.8	1.05	0.63	36200	11	2.6	0.38	0.05	3800	25	0.18	2350	190	1.2	400	9	16.5	16	135	20
R213749	38	1.9	16	2	1.3	0.75	32900	11	3	0.45	<0.05	5400	27	0.21	3850	210	1.2	1050	9	18	14	145	16.5
R213750	45	2.2	14	1.65	1.05	0.61	40600	12.5	2.6	0.35	0.05	6300	24	0.14	4600	240	0.5	1450	3	15.5	13	165	16
R213751	41	1.7	12.5	1.5	0.95	0.53	40100	11.5	2.2	0.29	0.05	4800	20.5	0.14	2900	185	0.4	470	1.5	14	9	120	18
R213752	29	1.5	10.5	1.1	0.7	0.43	28700	9.5	1.65	0.22	<0.05	4200	15	0.1	2200	140	0.4	420	1.5	10.5	9	135	13
R213753	45	1.2	8	0.96	0.55	0.38	23200	7.5	1.6	0.19	<0.05	3200	15.5	0.08	1400	130	0.5	330	<0.5	10.5	9	140	11
R213754	27	0.7	7.5	0.66	0.4	0.26	17600	5	1.05	0.12	<0.05	2200	13	0.06	1000	80	0.3	250	<0.5	7	5	90	8.5
R213755	30	0.8	7.5	0.89	0.5	0.35	20600	5.5	1.55	0.15	<0.05	2600	16.5	0.07	1200	100	0.4	310	<0.5	9.5	8	130	13
R213756	47	1.4	25.5	0.93	0.6	0.38	20700	8.5	1.65	0.19	<0.05	4300	16.5	0.09	9050	105	0.3	1200	<0.5	9.5	14	290	10.5
R213757	48	1.4	11	1.3	0.85	0.48	21400	9.5	2.1	0.28	<0.05	4050	19.5	0.12	2850	160	0.9	500	3.5	13.5	9	195	13.5
R213758	57	2	29	1.9	1.1	0.67	22700	12	2.7	0.38	<0.05	5250	22	0.16	9000	170	0.5	1300	2	15.5	18	400	14
R213759	48	1.6	14.5	1.5	1	0.54	22300	10	2.2	0.3	<0.05	4250	19.5	0.15	4650	185	0.8	1050	5.5	13	12	210	13
R213760	34	1.4	14	1.5	1	0.53	19900	9.5	2.1	0.32	<0.05	3750	17.5	0.18	3650	175	1.5	450	10.5	11.5	12	230	14
R213761	46	1.3	13	1.65	1.05	0.74	21000	8.5	2.3	0.38	<0.05	3350	19	0.18	2300	170	1.2	410	7.5	14	12	195	14
R213762	54	1.6	11.5	1.6	1.05	0.57	22900	9	2.1	0.34	<0.05	4050	18	0.18	1550	195	1.2	460	9	13	13	165	14
R213763	36	1.3	10	1.2	0.75	0.36	19400	8	1.55	0.23	<0.05	3000	17	0.12	1000	165	1.4	340	8.5	10.5	10	145	10
R213764	33	1.1	8	1.05	0.65	0.36	18800	7	1.4	0.23	<0.05	2600	13	0.12	1050	125	0.6	280	4	9	10	125	9
R213765	23	0.9	26.5	1.8	0.95	0.82	10000	4.4	2	0.38	<0.05	2750	14	0.13	7300	145	0.4	750	2	12.5	14	210	5
R213766	42	1.4	10	1.4	0.75	0.89	31900	8.5	2.3	0.29	<0.05	2400	24.5	0.11	6450	75	0.6	1200	6.5	14.5	14	85	15.5
R213767	22	1.1	14	0.76	0.45	0.41	10700	4.9	1.15	0.18	<0.05	3450	9.5	0.09	6600	105	0.2	800	3	6	13	185	4.5
R213768	22	1.1	14.5	0.91	0.55	0.85	12800	4.8	1.45	0.25	<0.05	2750	10	0.09	5850	95	0.2	550	5	8	17	110	6
R213769	17	0.8	13	0.99	0.5	0.76	8950	3.1	1.35	0.2	<0.05	2100	9	0.09	5700	100	<0.1	650	2.5	7	12	140	3.5
R213770	15	0.6	19.5	0.62	0.35	0.56	6050	3.8	0.8	0.13	<0.05	1700	5.5	0.07	9750	50	0.4	1100	3	4.3	8	185	3
R213771	18	0.5	26	0.77	0.6	0.68	6950	2.3	1.05	0.22	<0.05	1350	6	0.11	11900	45	0.7	600	7	5.5	14	125	8.5
R213772	23	0.9	24.5	0.67	0.45	0.98	10800	4.3	1.2	0.16	<0.05	2850	8	0.08	12300	90	0.5	38600	4	6.5	19	175	6
R213773	28	1.4	22.5	0.81	0.6	0.57	12900	7.5	1.5	0.24	<0.05	2850	10	0.1	14700	55	0.4	1650	5.5	9.5	20	80	6.5
R213774	32	1.1	13	0.94	0.65	0.62	15000	5	1.55	0.25	<0.05	2900	11	0.11	5850	135	0.4	1100	6	9	19	210	5
R213775	32	1.2	39	1.15	0.65	0.54	10800	5.5	1.85	0.26	<0.05	2450	12.5	0.11	15100	90	0.4	800	3.5	11	18	230	6

Appendix Table A9.1: Chemical data.

Number	Cr	Cs	Cu	Dy	Er	Eu	Fe	Ga	Gd	Ho	In	K	La	Lu	Mg	Mn	Mo	Na	Nb	Nd	Ni	P	Pb
R213776	25	1.4	22.5	0.61	0.35	0.41	11600	5	0.9	0.18	<0.05	2800	9	0.07	12000	70	0.2	1400	3.5	7.5	13	120	6
R213777	40	2.4	15.5	1.4	0.75	0.76	26600	12.5	2.4	0.33	<0.05	5000	24.5	0.12	6600	200	0.7	2650	7.5	16	21	150	12
R213778	35	1	17	1.4	0.75	0.55	12700	6.5	1.55	0.32	<0.05	2400	15.5	0.19	5300	100	1.1	1150	9.5	9	8	155	8.5
R213779	21	1	20.5	1.25	0.85	0.53	13400	5.5	2.2	0.4	<0.05	3100	17.5	0.14	6500	105	0.3	1300	5.5	12	13	195	8.5
R213780	21	0.7	14.5	0.95	0.55	0.43	9350	3	1.5	0.26	<0.05	2300	11	0.07	5550	55	<0.1	470	2.5	8.5	8	210	5
R213781	68	1	10	1.1	0.7	0.53	12500	9	1.85	0.33	<0.05	5250	20	0.11	6350	80	0.2	2200	6.5	13.5	16	130	5
R213782	21	0.7	16.5	0.89	0.55	0.42	7600	2.6	1.3	0.21	<0.05	2350	9	0.1	7250	50	<0.1	500	2	9	16	240	4
R213783	51	1.9	42.5	0.94	0.5	1.2	16800	6.5	1.35	0.22	<0.05	5550	13.5	0.08	17000	60	0.4	2050	3.5	9.5	19	170	9
R213784	26	1.1	21	0.66	0.4	0.4	8850	5.5	1.05	0.15	<0.05	3450	10.5	0.07	11100	55	0.3	1400	3	6	14	120	5.5
R213785	140	0.4	53	1.45	0.85	0.34	28000	16.5	2.2	0.33	<0.05	2150	30	0.16	8800	70	2	5200	12.5	19.5	23	70	16.5
R213786	42	0.6	13	0.56	0.3	0.29	8550	11	1.2	0.12	<0.05	1700	17.5	0.06	6600	55	0.8	2200	7.5	10	12	65	6.5
R213787	41	0.9	16.5	1.2	0.6	0.85	12000	6.5	1.85	0.25	<0.05	2600	21.5	0.11	5150	165	1.1	1450	6	12.5	12	120	10
R213788	45	0.5	12.5	0.78	0.35	0.88	16300	7.5	1.3	0.16	<0.05	1750	17.5	0.07	5350	60	0.3	1300	5	12.5	8	140	4.5
R213789	32	1	10	1.15	0.7	0.78	15500	11.5	2.4	0.25	<0.05	3400	26.5	0.11	5600	75	0.5	2000	8	18	17	130	7
R213790	21	0.7	13	1.6	1.25	1.3	11500	5.5	2.5	0.44	<0.05	1450	15.5	0.28	3700	50	3.5	1150	18	14.5	6	100	11
R213791	24	1.2	13.5	1.7	1	0.82	11000	4.3	2.9	0.41	<0.05	3100	19	0.14	7350	100	0.4	700	4	16.5	10	200	6
R213792	380	1.2	46	0.45	0.3	0.19	206000	33.5	0.6	0.13	0.2	1250	3.3	0.07	1400	230	2.6	550	11	3.4	48	130	25
R213793	11	<0.1	11	0.2	0.2	0.17	4700	0.5	0.2	0.06	<0.05	125	1.15	0.05	650	65	2.3	135	7.5	0.96	5	30	2.5
R213794	7	<0.1	10	0.41	0.3	0.24	4000	0.7	0.55	0.12	<0.05	150	3.2	0.07	145	30	1.3	135	8	3	4	10	3
R213795	15	0.1	8	0.47	0.3	0.34	12900	1.7	0.45	0.12	<0.05	180	2.4	0.07	195	50	3.8	120	14	2	4	20	3.5
R213796	10	<0.1	5	0.57	0.4	0.45	4400	0.6	0.5	0.15	<0.05	145	3.1	0.09	125	45	2.1	110	11.5	3	4	20	4.5
R213797	22	<0.1	5.5	1.45	0.7	0.78	36900	2.6	1.35	0.3	<0.05	195	7	0.18	230	45	2.3	140	16.5	7.5	6	55	19
R213798	9	<0.1	5.5	0.76	0.45	0.43	15800	0.9	0.9	0.18	<0.05	195	4.4	0.12	230	60	2.1	145	14.5	3.6	4	45	15.5
R213799	18	<0.1	6.5	0.64	0.55	0.45	17700	1.7	0.95	0.22	<0.05	180	4.6	0.12	210	50	1.8	115	14	3.9	5	45	14
R213800	13	<0.1	9	0.71	0.6	0.65	13600	0.9	0.85	0.24	<0.05	195	6.5	0.13	270	60	1.8	125	17	4.8	4	25	11.5
R213801	37	0.1	10.5	1.85	1.3	1.9	16800	2.9	1.45	0.45	<0.05	210	6.5	0.34	270	50	5	135	33	5.5	5	45	15
R213802	23	0.1	7.5	1	0.65	1.35	11400	1.5	1.3	0.28	<0.05	230	9	0.14	500	240	3.9	125	21.5	8	10	155	17.5
R213803	18	0.1	5	0.77	0.5	0.97	10700	1.2	0.8	0.25	<0.05	210	6.5	0.12	340	140	2.6	115	20.5	5	10	100	11
R213804	40	0.1	29	1.25	0.85	1.4	16100	2.7	1.45	0.35	<0.05	195	8	0.25	470	250	3.8	135	21	6.5	12	160	17.5
R213805	31	0.1	9	1.55	1	1.15	9800	2.4	1.65	0.38	<0.05	220	11.5	0.2	550	330	4.7	125	28.5	9.5	10	260	15
R213806	38	0.2	11	1.55	1.2	1.45	20200	2.6	2.2	0.45	<0.05	260	12.5	0.28	420	165	6	130	26.5	10.5	11	130	18.5
R213807	33	0.1	7.5	1.35	1.15	0.74	9000	1.8	1.75	0.38	<0.05	230	11	0.27	330	70	4.8	115	27	7.5	7	95	11.5
R213808	27	0.1	210	1.65	1.3	1.05	11100	2.4	2.4	0.4	<0.05	210	14.5	0.25	370	135	4.9	115	26	12.5	9	140	30
R213809	43	<0.1	72	1.8	1.25	1.15	9750	3.1	2.6	0.53	<0.05	250	15	0.26	500	330	5.5	130	28	15.5	8	360	33
R213810	32	0.1	450	1.5	1.05	0.95	6700	2.4	2.4	0.41	0.1	240	15	0.21	550	320	5	125	25	12	10	340	47.5
R213811	28	0.1	550	2.2	1.15	0.8	9300	2.1	2.3	0.54	0.15	220	14.5	0.25	450	135	3.2	120	25	16.5	8	100	53
R213812	21	0.7	75	1.25	0.65	0.33	8800	3.3	1.25	0.24	0.1	2400	8.5	0.1	5900	80	0.6	500	3	7	9	370	5.5
R213813	19	0.8	24	1.55	0.8	0.45	7900	3.8	1.8	0.34	0.1	2600	9	0.12	5400	90	0.3	450	3	10.5	9	360	6
R213814	21	0.6	47	1.85	1.2	0.62	5700	3	2.3	0.38	0.1	1800	9	0.18	5650	90	0.4	460	2.5	12	15	550	8
R213815	84	0.1	29	3.3	2.1	1.15	32500	8	3.4	0.83	0.1	240	16	0.45	450	195	4.9	155	34.5	18.5	13	185	30
R213816	35	0.1	37.5	3	2.1	1.05	11300	3.9	2.5	0.82	0.05	210	11	0.37	370	230	4.7	145	32	13.5	6	260	21.5
R213817	74	<0.1	40	3.1	2.5	0.89	21600	7	2.5	0.8	0.1	195	10.5	0.49	360	210	6	155	38	11.5	5	190	21
R213818	40	<0.1	35.5	2.7	1.8	0.79	12700	5	2.4	0.74	0.05	195	7.5	0.37	360	200	4.9	150	29	9	7	170	24.5
R213819	50	0.1	25.5	2.3	1.6	1.05	13000	4.3	1.85	0.62	0.05	250	7	0.37	370	155	6	160	41.5	7.5	6	130	19
R213820	64	<0.1	35	2.9	2.3	1	18900	8	2.1	0.88	0.05	210	7	0.49	240	80	7.5	130	22	8.5	9	50	20
R213821	56	<0.1	40.5	2.5	1.75	0.78	16300	7.5	1.75	0.74	0.05	200	6.5	0.42	240	75	8	135	27	7	9	50	19
R213822	69	<0.1	14.5	1.9	1.5	0.88	21300	7	1.3	0.58	0.05	210	4.5	0.36	170	40	8	140	38.5	5.5	6	35	27.5
R213823	46	0.1	20.5	1.85	1.3	0.76	16500	5.5	1.35	0.47	0.05	290	4.7	0.26	400	65	4.9	145	34.5	5.5	7	25	12
R213824	49	9.5	5.5	1.1	0.8	0.61	4300	26.5	1.45	0.22	<0.05	29500	24.5	0.13	2000	30	0.5	3050	<0.5	11.5	12	50	16.5
R213825	460	0.4	18.5	1.9	1.15	0.81	252000	36.5	2.5	0.36	0.3	650	21.5	0.18	650	140	4.3	175	8	14	32	250	57
R213826	220	0.4	16.5	2.4	1.6	1.05	163000	22	3.5	0.48	0.2	750	21	0.23	1500	115	3.1	210	7	17	25	240	44.5
R213827	250	0.5	18	2.4	1.35	1.05	155000	28	3.4	0.48	0.15	750	24	0.23	600	145	2.7	185	7	17.5	23	220	46
R213828	280	0.6	19	2.6	1.55	1.05	161000	27.5	3.3	0.55	0.2	1400	24.5	0.26	950	160	2.5	260	10	19.5	31	260	46.5
R213829	160	0.3	15	2.9	1.6	1.1	108000	16.5	2.7	0.58	0.1	650	15.5	0.23	1000	90	2.9	190	12.5	15	18	195	29
R213830	200	0.2	15.5	2.9	1.4	1.2	146000	21	2.6	0.53	0.15	430	13.5	0.24	650	85	3.3	175	12	13	26	200	29
R213831	57	0.3	21	1.8	1.35	0.69	33800	5.5	2.4	0.46	<0.05	950	13.5	0.24	4400	250	1.5	370	15.5	11.5	12	550	15

Appendix Table A9.1: Chemical data.

Number	Cr	Cs	Cu	Dy	Er	Eu	Fe	Ga	Gd	Ho	In	K	La	Lu	Mg	Mn	Mo	Na	Nb	Nd	Ni	P	Pb
R213832	96	0.4	24.5	2.4	1.5	1.05	59100	10	2.5	0.51	0.1	850	18	0.24	3800	260	2.9	310	15.5	14	14	450	20.5
R213833	370	0.4	25	3.8	2.1	1.6	268000	43	4.5	0.78	0.25	900	36.5	0.29	1000	270	4.7	220	17.5	29.5	37	340	54
R213834	460	0.2	26	5.5	2.6	2.5	333000	55	6	0.94	0.35	1100	45	0.38	1000	490	5.5	220	16.5	40.5	41	650	71
R213835	140	0.7	20.5	3.7	2.1	1.45	124000	22	4.3	0.75	0.15	1750	28	0.28	2950	270	1.4	360	5	28.5	21	500	29
R213836	260	0.6	34	4.8	2.8	2.2	207000	32.5	6.5	0.99	0.25	1350	41.5	0.37	1400	280	4.1	290	11.5	38.5	29	400	59
R213837	450	0.5	36	3.9	2.3	1.5	275000	39	5	0.69	0.25	1250	35	0.32	1150	230	4.4	280	8.5	29	40	370	58
R213838	440	0.6	26	3.1	1.8	1.2	243000	32.5	3.7	0.64	0.2	1600	29	0.27	3000	300	4.6	340	5	25	33	550	49.5
R213839	155	0.3	24.5	1.8	1.1	0.91	85800	11.5	1.9	0.34	0.05	1100	15	0.17	4100	150	2.6	340	7.5	11	17	300	22
R213840	89	0.2	41.5	2.9	2	0.96	54200	8	3.4	0.68	0.05	900	18.5	0.31	1350	250	5	300	19	17.5	13	250	39.5
R213841	100	0.2	64	3	1.9	0.73	55000	10	3.6	0.68	0.05	750	24	0.32	4750	230	6	380	21.5	23	18	380	28.5
R213842	130	0.2	58	2.3	1.8	0.62	65900	10.5	2.8	0.5	0.05	700	12	0.28	4600	250	3.8	380	16	11.5	20	370	21.5
R213843	115	0.2	19	3.1	2.2	0.88	43100	9.5	2.8	0.72	0.05	600	14	0.36	1450	240	3.7	220	11.5	13	18	240	21
R213844	105	0.3	21	2.6	1.7	0.77	51100	9.5	2.6	0.57	0.05	650	13.5	0.31	1400	140	4.9	210	16	11	13	210	16
R213845	145	0.2	16.5	2.3	1.8	0.86	50000	11	2.1	0.57	0.05	450	8.5	0.33	600	80	5.5	240	32.5	9	19	105	17
R213846	185	0.2	16.5	3.7	2.1	1.5	90600	22	3.3	0.8	0.1	410	13.5	0.39	700	220	6.5	200	27	15.5	27	120	23.5
R213847	450	0.3	160	1.75	1.25	0.69	443000	30	1.9	0.46	0.15	1100	8.5	0.2	750	1800	4.4	155	2	10.5	77	800	45.5
R213848	97	0.4	9.5	1.35	0.75	0.48	50200	7.5	1.8	0.25	<0.05	700	12	0.11	750	90	0.8	270	1.5	11	16	145	16.5
R213849	165	0.5	14	2	1.1	0.67	86900	13.5	2.3	0.38	0.1	900	16	0.14	650	165	1.2	150	3	15	23	180	21.5
R213850	165	0.4	13.5	1.4	0.85	0.54	100000	14	1.7	0.28	0.1	1650	16	0.12	800	160	1.1	240	3	11	24	160	17
R213851	45	0.2	7.5	0.71	0.45	0.29	36800	4.8	0.85	0.15	<0.05	410	7.5	0.06	320	65	0.6	100	0.5	7	12	55	8.5
R213852	34	0.2	8.5	0.67	0.3	0.28	25200	3.8	0.65	0.12	<0.05	410	6.5	0.06	290	70	0.8	100	1	6	9	20	6.5
R213853	85	0.2	8.5	1.45	0.75	0.5	53800	7.5	1.6	0.24	0.05	430	10	0.09	340	75	1	105	1.5	10	12	60	17
R213854	85	0.2	9.5	0.83	0.5	0.38	55000	7	1.25	0.21	0.05	390	7.5	0.09	300	65	0.9	90	1	8	14	60	14.5
R213855	72	0.2	10	1	0.55	0.37	42600	6	1.25	0.2	<0.05	600	12	0.08	1200	110	0.8	165	1	9	15	125	9
R213856	60	0.3	10	0.97	0.6	0.42	36500	5.5	1.2	0.19	<0.05	550	9.5	0.08	1300	100	0.8	165	2	8.5	11	85	8.5
R213857	95	0.3	11.5	1.35	0.8	0.52	68700	10.5	1.95	0.33	0.05	750	14	0.12	550	120	1	140	2.5	15.5	14	80	17
R213858	125	0.3	18.5	1.7	1	0.69	87300	13	2.4	0.43	0.1	850	19.5	0.13	700	195	1.4	200	3	19.5	17	115	19.5
R213859	88	0.3	19.5	1.2	0.65	0.48	65300	11.5	1.7	0.27	0.05	1000	15.5	0.09	700	155	0.9	195	2	11.5	17	115	13.5
R213860	110	0.3	15.5	1.8	1	0.69	79400	13	2.2	0.33	0.1	850	18.5	0.12	500	120	1.6	150	3	15	18	120	21
R213861	125	0.3	18	1.55	0.9	0.64	80000	12	2.2	0.32	0.1	750	15.5	0.13	450	110	1.5	135	3	14	20	140	24.5
R213862	120	0.2	15	1.35	0.65	0.56	79900	10.5	1.75	0.28	0.05	750	13.5	0.11	440	95	1.4	135	2	12	17	120	18
R213863	120	0.2	15	1.5	0.9	0.6	79600	11	1.75	0.29	0.05	900	16	0.12	480	125	1.9	220	2.5	14	14	105	29
R213864	84	0.3	18	1.6	0.85	0.67	48000	7.5	2	0.3	0.05	1500	17	0.13	2000	120	1	370	1.5	14.5	15	140	17
R213865	45	0.2	13	0.91	0.5	0.43	27600	4.8	1.15	0.15	<0.05	2250	11	0.07	800	115	1	650	1.5	9	12	60	16.5
R213866	38	0.2	13.5	0.77	0.5	0.35	23600	4	1.25	0.19	<0.05	1450	10	0.08	1300	100	0.8	600	1	9	13	65	9.5
R213867	38	0.2	11	0.79	0.45	0.32	21600	3.6	0.9	0.19	<0.05	750	7.5	0.06	750	120	1.2	260	1	8.5	10	65	9.5
R213868	43	0.2	6.5	0.54	0.3	0.22	22800	3.6	0.8	0.13	<0.05	600	6	0.05	400	70	0.8	200	0.5	5	12	35	9
R213869	95	0.2	10	0.6	0.4	0.25	44500	6	0.8	0.15	<0.05	1000	8	0.06	380	120	1	350	1.5	5.5	16	80	10.5
R213870	67	0.2	8	0.63	0.4	0.27	34400	4.4	0.7	0.13	<0.05	350	6.5	0.05	250	50	0.8	105	1	5.5	8	25	15
R213871	300	0.5	23.5	4.5	2.8	2.1	290000	48	6	1.05	0.3	1550	41.5	0.44	1150	360	3.1	260	10.5	41	31	340	69
R213872	330	0.7	43.5	4.4	2.6	2.4	286000	50	6	0.88	0.3	1250	35.5	0.39	950	195	4.2	190	9.5	35.5	39	290	82
R213873	4.0	0.08	7	0.08	0.04	0.03	793	0.37	0.06	0.02	0.004	6998	0.8	0.007	2850	59	0.17	29173	0.3	0.6	1.2	438	1.3
R213874	4.2	0.07	8	0.08	0.04	0.03	886	0.39	0.06	0.02	0.003	7110	0.7	0.007	2298	56	0.19	16876	0.2	0.6	1.3	389	1.3
R213875	6.3	0.13	9	0.14	0.07	0.06	1461	0.65	0.10	0.03	0.003	8401	1.2	0.012	3024	71	0.31	20422	0.3	1.1	2.3	420	1.7
R213877	4.7	0.08	9	0.10	0.05	0.04	901	0.48	0.07	0.02	0.004	15667	1.0	0.010	2541	43	0.23	30079	0.2	0.8	1.9	547	2.3
R213878	4.4	0.07	8	0.08	0.04	0.03	924	0.40	0.06	0.01	0.004	8367	0.7	0.007	2676	49	0.27	26609	0.2	0.7	1.8	525	2.5
R213879	4.2	0.08	12	0.10	0.05	0.04	930	0.47	0.07	0.02	0.004	11520	1.0	0.008	3204	59	0.23	29072	0.2	0.9	1.3	359	1.5
R213880	3.3	0.06	7	0.06	0.03	0.03	735	0.30	0.04	0.01	0.003	10291	0.6	0.006	2188	43	0.15	17620	0.2	0.5	1.0	432	1.1
R213881	3.6	0.05	6	0.06	0.03	0.02	621	0.27	0.04	0.01	0.004	11800	0.5	0.005	3111	33	0.20	26083	0.2	0.4	1.3	401	0.6
R213882	5.1	0.11	7	0.12	0.06	0.04	1320	0.62	0.08	0.02	0.004	7542	1.1	0.010	3115	38	0.25	26889	0.3	1.0	1.5	410	1.2
R213883	6.2	0.14	5	0.14	0.07	0.05	1559	0.72	0.10	0.03	0.004	9425	1.2	0.012	3274	45	0.31	29293	0.3	1.1	1.9	482	1.6
R213884	5.4	0.14	8	0.13	0.07	0.05	1586	0.68	0.10	0.03	0.004	6759	1.2	0.010	2998	35	0.26	24089	0.3	1.0	1.9	433	1.4
R213885	11.9	0.30	8	0.28	0.15	0.10	3545	1.62	0.20	0.06	0.007	12720	2.6	0.024	5196	95	0.43	44927	0.7	2.3	3.8	785	2.8
R213886	6.3	0.18	8	0.18	0.09	0.06	1961	0.88	0.12	0.03	0.004	9788	1.5	0.014	2802	47	0.21	32395	0.4	1.4	2.6	499	2.6
R213887	4.4	0.10	9	0.12	0.06	0.04	1244	0.55	0.08	0.02	0.004	5529	1.1	0.010	3334	34	0.20	27645	0.2	0.9	1.3	496	3.5
R213888	7.6	0.24	9	0.22	0.11	0.08	2728	1.20	0.16	0.04	0.005	9231	2.1	0.020	3666	68	0.28	38624	0.7	1.7	2.4	567	1.6

Appendix Table A9.1: Chemical data.

Number	Cr	Cs	Cu	Dy	Er	Eu	Fe	Ga	Gd	Ho	In	K	La	Lu	Mg	Mn	Mo	Na	Nb	Nd	Ni	P	Pb
R213889	4.3	0.09	8	0.11	0.05	0.04	1031	0.52	0.07	0.02	0.005	6350	1.0	0.009	3292	43	0.18	35276	0.3	0.9	1.3	507	1.3
R213890	5.3	0.11	10	0.11	0.05	0.04	1372	0.55	0.09	0.02	0.004	9551	1.1	0.009	3152	45	0.22	30582	0.3	0.9	1.7	651	1.8
R213891	5.4	0.10	9	0.12	0.06	0.04	1233	0.55	0.08	0.02	0.004	13552	1.1	0.010	2717	44	0.30	33377	0.3	0.9	1.8	696	2.0
R213892	7.4	0.16	9	0.18	0.09	0.06	1954	0.86	0.14	0.04	0.004	13010	1.8	0.014	2867	53	0.31	28816	0.4	1.5	2.4	678	1.8
R213893	6.4	0.14	8	0.17	0.08	0.06	2102	0.76	0.12	0.03	0.004	12051	1.7	0.014	3221	48	0.29	25100	0.4	1.4	2.3	597	1.4
R213894	9.9	0.22	8	0.24	0.12	0.08	2830	1.11	0.17	0.04	0.004	11970	2.5	0.019	3052	39	0.34	17481	0.6	2.0	4.6	356	1.6
R213895	9.9	0.19	12	0.21	0.11	0.07	2561	1.03	0.16	0.04	0.005	11609	2.3	0.019	2972	45	0.34	29162	0.6	1.9	4.1	636	3.1
R213896	6.6	0.12	8	0.15	0.07	0.05	1437	0.68	0.12	0.03	0.004	5863	1.7	0.013	2824	38	0.35	30059	0.3	1.3	3.0	487	1.6
R213897	9.1	0.17	8	0.22	0.11	0.07	2366	0.91	0.16	0.04	0.004	15585	2.2	0.018	3292	50	0.25	32097	0.5	1.7	3.6	496	3.0
R213898	5.3	0.08	6	0.09	0.04	0.04	1015	0.41	0.07	0.02	0.003	12065	1.0	0.008	2619	34	0.14	19169	0.2	0.8	1.9	313	0.8
R213899	5.7	0.09	7	0.12	0.06	0.04	1320	0.51	0.08	0.02	0.004	8106	1.2	0.011	3147	60	0.25	30703	0.2	1.0	1.8	353	1.6
R213900	4.8	0.06	6	0.07	0.04	0.03	823	0.31	0.06	0.01	0.004	9697	0.8	0.006	2821	57	0.16	26152	0.1	0.7	1.9	397	1.1
R213901	4.9	0.08	7	0.10	0.06	0.04	1263	0.45	0.07	0.02	0.004	10261	1.1	0.008	3006	38	0.21	24981	0.2	0.8	2.3	430	1.3
R213902	3.9	0.07	7	0.09	0.05	0.03	949	0.38	0.06	0.02	0.003	4608	0.9	0.007	2513	54	0.20	17137	0.2	0.7	1.7	411	1.5
R213959	47	0.4	18	2.4	1.75	1.1	23600	9	1.65	0.57	<0.05	1250	12.5	0.39	700	70	5.5	220	42.5	8.5	10	85	16
R213960	29	0.9	22.5	2.3	1.35	0.76	18300	7.5	2.5	0.51	<0.05	3350	20.5	0.19	4050	100	0.9	420	8.5	15.5	13	200	9
R213961	31	1	17.5	2.2	1.25	0.74	20300	8.5	2.3	0.46	<0.05	3650	21	0.17	3850	90	0.8	430	7.5	14.5	12	210	9.5
R213962	17	0.7	15.5	1.5	0.9	1.75	11600	5.5	1.6	0.33	<0.05	2650	13.5	0.17	5450	90	0.5	550	4.5	9.5	11	280	8
R213963	25	0.8	21	1.8	1.1	1.35	17300	7.5	1.95	0.4	<0.05	2700	19	0.19	8350	75	1.1	600	8	12	17	125	8.5
R213964	25	0.8	21	1.4	0.85	1.1	15600	7	1.5	0.31	<0.05	2950	13.5	0.14	10000	75	0.6	1000	5	9.5	15	115	6
R213965	34	1.1	17.5	2	1.2	0.91	22900	10	2.1	0.43	<0.05	3700	18.5	0.2	7600	120	1	1300	8.5	13	17	105	10.5
R213966	23	1.3	24.5	2	1.25	0.8	15300	9	2.3	0.44	<0.05	4050	23.5	0.21	11000	70	0.6	1650	6	16	20	110	7.5
R213967	47	0.7	17	2.4	1.5	0.94	41700	13	2.3	0.54	<0.05	2300	17	0.28	4900	100	2.7	900	17	14	18	75	17.5
R213968	45	0.7	15	2.2	1.35	1.2	40300	16	2.4	0.47	0.05	1800	21	0.24	2850	50	2.3	1100	17.5	17.5	24	50	21.5
R213969	47	0.6	12.5	2.6	1.6	1.05	46500	16	2.9	0.55	<0.05	1550	26.5	0.29	2650	35	2.7	1150	19.5	23	23	70	23.5
R213970	45	1	17	1.2	0.7	0.39	15900	18.5	2.1	0.24	<0.05	4000	31.5	0.13	8500	50	1.1	1700	10	20.5	19	105	13
R213971	47	0.5	17	1.5	0.9	0.9	29400	22.5	2.4	0.3	<0.05	2350	33	0.16	3500	30	1.6	1600	13.5	24	18	75	19.5
R213972	47	0.3	10	1.3	0.75	0.35	15400	25	2.4	0.26	<0.05	1800	42	0.14	4100	30	1.8	1700	16	25	17	85	18
R213973	49	0.4	17.5	1.45	0.85	0.69	22100	23	2.6	0.29	<0.05	2150	38	0.15	3900	30	1.4	2450	12	26.5	16	85	17.5
R213974	52	0.5	14	3.7	2.1	0.97	21300	25	4.2	0.78	<0.05	2400	33	0.3	3850	100	1.4	3050	13	31	22	85	17
R213975	16	0.1	9.5	1.3	0.75	0.97	5150	20	3	0.24	<0.05	460	46	0.13	1100	20	1.3	500	18.5	34	5	40	18.5
R213976	135	0.1	5.5	3.1	1.7	1.2	159000	37.5	2.8	0.62	0.15	350	12.5	0.29	900	15	8	800	13	16	35	65	19
R213985																							
R213986	37	1.1	25.5	1.45	0.85	0.52	18400	9.5	1.7	0.31	<0.05	4500	18	0.14	7450	120	0.7	1400	7.5	13	17	220	12.5
R213987	50	0.4	22.5	0.87	0.5	0.36	9700	10.5	1.5	0.17	<0.05	2100	17.5	0.08	8100	40	0.6	1000	6	13.5	13	125	8
R213988	31	0.7	22.5	1.2	0.75	0.53	17000	7.5	1.4	0.26	<0.05	3350	16	0.13	5500	105	1	900	8.5	10.5	11	210	12
R213989	28	0.4	21	0.9	0.55	0.42	7350	5.5	1.1	0.19	<0.05	2050	11.5	0.09	9000	45	0.3	1150	3.5	8	11	115	5.5
R213990	33	0.3	15	0.6	0.35	0.18	6650	11	1.05	0.12	<0.05	2550	14	0.06	6750	30	0.5	2650	5.5	9	8	50	6
R213991	67	0.5	26.5	1.65	0.95	1.05	23200	10.5	2.5	0.33	<0.05	3000	28	0.15	5000	200	1.1	2950	7.5	19	16	100	12.5
R213992	58	0.4	23	1.6	0.95	0.54	20300	10.5	2.3	0.34	<0.05	2950	25.5	0.13	4500	165	0.8	3000	7	17	14	125	10.5
R213993	105	0.3	72	2.1	1.15	0.88	45000	11.5	3	0.42	<0.05	2650	31	0.16	5450	105	2.4	3350	6.5	24.5	18	115	21.5
R213994	51	0.3	26	1.15	0.65	0.42	16200	12.5	1.95	0.23	<0.05	3300	23	0.1	6000	55	0.9	3600	5.5	19	12	90	15
R213995	51	0.4	29.5	6.5	3.7	1.05	21800	14.5	5	1.4	0.05	5350	28	0.53	5300	110	1	4200	8.5	32	20	95	31.5
R213996	59	0.4	27.5	6.5	3.9	1.05	19300	17.5	5.5	1.45	<0.05	4600	32.5	0.57	6300	85	2	4450	9	34.5	25	95	28.5
R213997	105	0.3	65	5	3.1	0.87	60300	16.5	4.3	1.15	0.1	4400	30.5	0.47	2900	125	3.5	4500	8	29.5	26	120	110
R213998	54	0.4	20.5	4.1	2.5	0.72	14400	17.5	4	0.9	<0.05	4650	33.5	0.36	3550	70	1.3	4550	9.5	31.5	17	100	33.5
R213999	110	0.4	54	1.8	1	0.52	39700	33	3.7	0.33	0.05	9300	57	0.16	2600	35	3.5	3900	17	39	13	150	56
R214000	42	0.2	27.5	0.82	0.45	0.55	9900	14	1.75	0.15	<0.05	3150	37.5	0.08	6550	30	0.7	2400	6.5	18	10	95	18.5
R214001	380	0.3	145	1.85	1.2	0.59	421000	25.5	1.6	0.42	0.15	1450	12	0.21	900	1600	5	185	4.5	8.5	67	800	51
R214036	34	0.9	20	1.35	0.8	0.43	15800	8	1.65	0.28	<0.05	4350	18	0.12	5800	120	0.7	650	8	11.5	13	200	11
R214038	27	0.5	21	1.1	0.6	0.39	8300	8	1.3	0.22	<0.05	3850	18	0.1	8600	50	0.5	950	4.5	9	12	210	9.5
R214037	43	0.5	19.5	1.2	0.65	0.47	6650	13.5	1.65	0.25	<0.05	6150	21.5	0.11	8400	75	0.9	1000	5	11	12	140	12
R214039	25	0.7	20	1.35	0.75	0.4	9600	11	1.7	0.29	<0.05	3700	19	0.11	9700	60	0.7	3650	6.5	11.5	14	90	11.5
R214040	16	0.6	19	1.3	0.65	0.39	4150	9.5	1.8	0.25	<0.05	1600	23	0.09	5350	20	0.6	2000	6.5	13	7	45	8.5
R214041	43	0.3	14	2	0.85	0.37	4800	20.5	3.7	0.33	<0.05	4250	46	0.12	7100	30	1.5	4450	15.5	32	12	90	11.5
R214042	35	0.4	13	2.1	0.95	0.42	5700	16	3.3	0.38	<0.05	3700	42	0.14	7150	40	1.2	4350	11.5	27	12	105	12

Appendix Table A9.1: Chemical data.

Number	Cr	Cs	Cu	Dy	Er	Eu	Fe	Ga	Gd	Ho	In	K	La	Lu	Mg	Mn	Mo	Na	Nb	Nd	Ni	P	Pb
R214043	33	0.2	10	3.7	1.9	0.65	3400	20.5	4.7	0.72	<0.05	4450	48	0.24	4550	50	1.5	4250	12	36	10	95	16.5
R214044	30	0.4	11.5	2.3	1.3	0.47	4800	13.5	2.8	0.49	<0.05	4800	58	0.18	6400	55	0.9	3750	8	21	11	95	62
R214045	37	0.3	12	1.85	1	0.4	3350	16	2.3	0.37	<0.05	6300	38	0.15	5500	30	1	3250	7.5	19	11	75	31
R214046	45	0.4	9	4.6	2.5	0.98	3450	18	4.2	0.96	<0.05	11800	60	0.34	3850	40	0.9	3250	7.5	27	8	95	62
R214047	39	0.4	12	2.7	1.45	0.55	4000	19.5	3.2	0.54	<0.05	10300	57	0.21	4200	35	0.9	3350	11.5	23	8	120	65
R214048	73	0.5	15	1.65	0.8	0.4	3750	19.5	2.9	0.29	<0.05	10200	40	0.13	5200	20	0.9	3550	12	24	10	100	24.5
R214049	42	0.2	6.5	0.85	0.4	0.25	2400	9.5	1.65	0.15	<0.05	4150	26.5	0.08	2000	10	0.7	1500	7	12	4	75	11.5
R214050	75	0.8	6.5	1.95	1.05	0.38	4600	28	2.2	0.38	<0.05	22100	31.5	0.16	5400	35	0.8	2600	14.5	13.5	7	100	26
R214071	28	0.8	27	0.85	0.45	0.76	12000	5	0.95	0.17	<0.05	3300	10	0.09	17200	50	0.4	1600	3.5	6	20	165	6.5
R214072	38	1.1	28.5	0.91	0.55	0.69	15100	8	1.05	0.18	<0.05	4600	12	0.11	17500	55	0.5	2750	5	7	23	135	8
R214073	39	1	23.5	1.05	0.6	0.65	14100	7	1.35	0.21	<0.05	5650	14	0.11	15200	45	0.5	3050	4.5	9	20	100	8
R214074	66	1.4	35	1.45	0.85	0.66	23800	10	1.75	0.3	<0.05	7000	18.5	0.15	15000	70	0.6	3850	5.5	11.5	22	110	10
R214075	48	1.1	27.5	1	0.6	0.46	17000	7.5	1.25	0.21	<0.05	5500	13.5	0.1	16100	55	0.6	4050	5	8.5	23	115	8.5
R214076	105	1.3	21	1.85	1.1	0.85	20600	13.5	2.4	0.39	<0.05	10400	25.5	0.17	10500	115	0.7	4600	7.5	16	30	125	12
R214077	175	1.5	30	2.1	1.2	1.3	19900	15	2.9	0.43	<0.05	10400	30.5	0.21	11000	70	0.8	5350	9.5	21.5	53	125	15
R214078	82	1.3	36.5	3	1.7	1	21500	9	3.5	0.63	<0.05	6750	25	0.24	8700	60	0.7	3900	5.5	23	40	90	13
R214079	250	2.9	175	17	10	4.5	84600	15.5	14	3.6	0.05	23100	52	1.5	4900	90	1.3	4950	8.5	70	54	185	52
R214080	220	3.5	155	1.1	0.6	1.05	69800	15	2.4	0.2	0.05	24300	33	0.12	4450	25	2.2	4150	8.5	21.5	28	170	31.5
R214081	200	2.1	110	1.9	1.1	0.85	59200	14	2.6	0.37	0.05	8800	34.5	0.2	4250	30	1.4	3600	8.5	20.5	33	95	19
R214082	85	1.4	49	0.95	0.5	0.57	22900	11	2	0.17	<0.05	11900	27.5	0.1	3100	20	1	2600	6	16.5	18	95	15.5
R214083	210	3.8	155	1.4	0.8	1.35	64400	17.5	2.8	0.26	0.05	30000	44.5	0.15	4950	30	3.3	3600	9	25.5	26	200	30
R214084	220	3.3	130	1.3	0.7	1.15	60800	17	2.7	0.24	0.05	27300	44	0.14	5100	35	2.9	3850	8	25	33	195	26.5
R214085	105	1.4	34.5	0.9	0.5	0.9	14800	15.5	2.4	0.16	<0.05	20100	38	0.1	3500	20	0.8	3300	8.5	24	19	165	22.5
R214086	40	0.9	21	1.5	0.85	0.6	28700	8	1.7	0.31	<0.05	4550	14.5	0.14	5700	115	0.6	500	6.5	10.5	14	230	9.5
R214087	20	0.8	25.5	1.05	0.6	0.8	12400	5.5	1.2	0.22	<0.05	2950	10.5	0.11	9750	60	0.3	900	3	7.5	15	210	5.5
R214088	20	0.8	21	0.92	0.55	0.83	12600	5.5	1	0.19	<0.05	2700	10	0.11	6400	50	0.3	1150	3.5	6	12	180	6
R214089	33	1.7	24.5	1.35	0.8	0.52	20800	11.5	1.5	0.27	<0.05	4750	16.5	0.14	5300	110	0.5	2600	6.5	9.5	21	135	10
R214090	33	1.4	21	1.4	0.8	0.47	20400	9.5	1.5	0.29	<0.05	4400	15.5	0.14	5350	100	0.6	2950	6.5	9	17	110	11
R214091	36	1.8	23	1.5	0.85	0.5	22100	11	1.6	0.3	<0.05	4850	18	0.15	5650	130	0.6	3500	7	10	21	130	13
R214092	43	1.5	20.5	1.4	0.85	0.48	21000	10	1.45	0.3	<0.05	4600	15.5	0.16	5300	115	1.3	3050	11	9	18	130	14
R214093	44	1.4	21	1.45	0.85	0.85	21700	9.5	1.6	0.3	<0.05	4800	16.5	0.16	5750	250	0.9	3550	9	10	20	120	21.5
R214094	41	1.5	22.5	2	1.1	0.85	17700	10	2.3	0.41	<0.05	5050	21.5	0.18	7850	160	0.5	4100	6	13.5	18	140	18
R214095	57	1.4	22.5	2.1	1.2	0.84	17200	13.5	2.8	0.42	<0.05	5300	28.5	0.2	8550	115	0.8	4600	9.5	18.5	18	155	15
R214096	88	0.8	21.5	1.5	0.85	0.51	10300	17	2.5	0.29	<0.05	3900	30.5	0.14	7600	60	0.4	4500	11.5	18	17	110	21
R214097	97	0.7	21.5	1.6	0.9	0.5	9550	18.5	2.4	0.3	<0.05	4550	33.5	0.16	6250	65	0.5	4450	12.5	17.5	16	95	22
R214098	105	0.3	15.5	1.45	0.8	0.51	5700	18	2.8	0.27	<0.05	3800	41	0.15	5200	35	0.3	3850	12	23.5	13	85	21
R214099	110	0.6	11	1.8	1	0.6	6150	17	2.3	0.34	<0.05	7800	26.5	0.18	5200	35	0.2	4000	10.5	17	13	80	17
R214100	130	0.1	22	1.35	0.8	0.22	4150	20.5	2.4	0.25	0.05	1300	39.5	0.15	1950	15	0.4	2950	13.5	20.5	19	95	22
R214101	55	1.3	17.5	1.3	0.75	0.58	13500	12	1.85	0.25	<0.05	6300	25.5	0.13	8300	100	0.5	4200	7.5	12.5	15	160	15
R214102	105	0.1	15.5	1.25	0.7	0.53	3600	20	2.6	0.23	<0.05	2950	39.5	0.13	3700	20	0.2	3550	10	24	21	65	23.5
R214103	82	7	6.5	0.95	0.6	0.52	2550	20.5	1.2	0.2	<0.05	22100	26	0.12	1700	5	0.5	2950	1	9	7	40	14
R214104	34	1.4	33.5	1.45	0.85	0.51	21200	8	1.6	0.29	<0.05	3800	19.5	0.14	8500	100	0.5	550	7	9	15	270	11.5
R214105	19	0.7	48.5	0.76	0.45	1.35	11600	5.5	0.85	0.15	<0.05	1700	11	0.11	26100	65	0.4	950	4	4.9	21	175	7
R214106	19	0.9	27	0.86	0.55	0.48	8950	6.5	0.9	0.18	<0.05	1750	11	0.11	13800	40	0.4	1450	4.5	4.5	16	140	6
R214107	23	1.3	19.5	1.55	0.9	0.85	13500	8	1.7	0.32	<0.05	2900	20	0.16	8850	55	0.5	2650	5	9	18	110	8
R214108	29	1.7	20.5	1.55	0.9	0.75	15100	10	1.65	0.32	<0.05	3700	20.5	0.17	6850	80	0.6	3150	6.5	8.5	19	120	9.5
R214109	33	0.7	13	1.35	0.8	0.55	10900	11	1.4	0.29	<0.05	2000	14.5	0.15	6000	45	0.8	2900	8.5	7	18	80	8
R214110	24	0.9	14	1.9	1.15	0.72	10400	7.5	1.95	0.4	<0.05	2600	19.5	0.19	6950	75	0.7	2500	6	9.5	14	100	8
R214111	31	0.3	9	0.55	0.4	0.22	4400	15	0.35	0.13	<0.05	850	4	0.1	2350	20	1.2	2100	13	1.75	17	20	9.5
R214112	19	1.1	16	3.1	1.85	0.96	10500	7	3.3	0.67	<0.05	2550	30	0.28	7750	80	0.6	2600	6.5	15.5	12	85	10
R214113	34	0.3	8.5	1.45	0.9	0.42	5000	15	1.25	0.31	<0.05	1150	10	0.18	2550	25	1.3	2550	14.5	6	20	25	15
R214114	18	0.4	11.5	0.7	0.5	0.23	8200	13	0.5	0.16	<0.05	1200	3.9	0.1	2300	15	1.5	2050	10.5	2.7	17	35	10.5
R214115	22	0.4	10.5	0.55	0.4	0.15	7000	15.5	0.3	0.13	<0.05	1100	3.2	0.09	2650	15	1.4	2250	12.5	1.7	19	30	8.5
R214116	18	0.1	9	0.89	0.7	0.34	5050	6.5	0.45	0.23	<0.05	370	3.6	0.18	1750	15	2.6	1300	25	2.1	9	20	28.5
R214117	20	1.4	20.5	0.52	0.35	0.17	7650	51	0.45	0.12	<0.05	2000	6.5	0.09	10700	15	1.2	5200	10	3.1	12	40	6.5
R214118	150	1.1	24.5	2.7	1.5	1	91100	22.5	2.3	0.55	0.1	2400	14	0.28	3550	175	1.8	3100	11.5	13	45	80	39

Appendix Table A9.1: Chemical data.

Number	Cr	Cs	Cu	Dy	Er	Eu	Fe	Ga	Gd	Ho	In	K	La	Lu	Mg	Mn	Mo	Na	Nb	Nd	Ni	P	Pb
R214119	31	0.8	12	1.4	0.8	0.91	26400	6	1.35	0.3	<0.05	3000	13.5	0.15	1150	100	0.9	500	10	8.5	11	110	14
R214120	15	0.6	16	0.79	0.45	1.1	8850	3.5	0.9	0.17	<0.05	2400	9.5	0.08	10300	60	0.2	2100	2.5	6	12	260	5
R214121	21	0.7	14.5	1.1	0.65	0.82	12800	6	1.35	0.23	<0.05	1900	19	0.12	6000	40	0.4	1650	4.5	10	16	100	6
R214122	14	0.4	16	0.63	0.35	0.55	12300	3	0.7	0.14	<0.05	1550	7.5	0.07	6150	30	0.3	900	2	4.2	14	80	4.5
R214123	12	0.3	14	0.52	0.3	0.6	10600	2.5	0.55	0.11	<0.05	1150	6	0.06	6250	25	0.4	800	2	3.3	11	70	4
R214124	14	0.5	14	1.7	0.95	0.96	7250	3.2	1.9	0.36	<0.05	1700	18.5	0.16	4750	30	0.9	800	4	13	11	70	5.5
R214125	12	0.3	10	1.7	0.9	0.74	4500	2.3	1.8	0.36	<0.05	1250	12.5	0.14	4050	30	0.8	650	3.5	10	9	40	6.5
R214126	12	0.3	11	1.35	0.75	0.63	4500	2.4	1.6	0.29	<0.05	1500	17.5	0.12	5450	25	0.7	750	3.5	11.5	8	45	5.5
R214127	7	0.3	12	2.2	1.15	1.25	3900	3.1	2.6	0.44	<0.05	1400	29	0.18	5650	20	0.9	750	4.5	19	8	35	6.5
R214128	8	0.3	11.5	1.4	0.8	0.76	4800	2.9	1.75	0.29	<0.05	1400	19	0.13	4800	20	1.3	950	4	13	10	40	8.5
R214129	6	0.2	12	1.25	0.65	0.62	3950	2	1.6	0.25	<0.05	1250	17	0.09	6100	35	0.5	1100	2	12	10	40	8.5
R214130	5	0.2	8	1.95	1	0.79	2700	2.1	2.2	0.4	<0.05	900	16.5	0.15	6550	25	1.3	1450	4	13.5	9	25	6.5
R214131	12	0.2	10	2.6	1.45	0.96	3050	2.3	2.9	0.54	<0.05	1000	22.5	0.24	5600	60	1.9	1650	5	18	12	30	7.5
R214132	10	0.3	10	1.4	0.85	0.61	2650	2.1	1.7	0.3	<0.05	1050	22	0.15	6000	55	1.5	2200	4	14.5	10	30	6
R214133	21	0.3	14	2.1	1.3	0.86	6350	4.6	2.2	0.47	<0.05	1500	20	0.26	4700	340	1.5	2900	5	15	25	30	7.5
R214134	6	0.3	14.5	0.71	0.45	0.27	2850	3.4	0.7	0.16	<0.05	1300	6.5	0.11	1700	80	1.5	2350	5	4.7	12	<5	10
R214135	18	0.7	14	1.8	1	0.88	16800	4.8	2	0.38	<0.05	2750	18	0.15	5200	110	0.5	950	3.5	12.5	15	80	7.5
R214136	16	1	16	1.8	1	1.1	14400	5	2	0.39	<0.05	4050	19.5	0.15	5000	105	0.3	1200	3.5	12.5	15	120	6
R214137	9	0.4	13	1.1	0.7	0.46	4700	2.5	1.1	0.25	<0.05	1400	10	0.13	5200	105	0.9	1000	4	7	13	30	5
R214138	105	0.3	29	0.44	0.3	0.29	77700	16	0.4	0.1	<0.05	1900	4.2	0.07	3900	300	1.6	1350	10	2.1	115	80	6.5
R214139	16	0.6	13	1	0.6	0.94	10300	3.1	1.05	0.22	<0.05	1800	11	0.1	4700	100	0.6	900	3	6	13	85	5
R214140	20	0.7	18	1.35	0.8	0.86	13800	4.2	1.45	0.29	<0.05	2050	14	0.12	3700	260	0.6	850	3.5	8.5	23	70	6
R214141	19	0.7	16	0.84	0.5	0.58	11900	3.6	0.85	0.18	<0.05	2100	9.5	0.08	4550	155	0.6	1000	3.5	5	15	80	5.5
R214142	25	0.7	16	1.1	0.65	0.7	15400	3.7	1.2	0.24	<0.05	2800	14.5	0.11	5550	105	0.5	1100	3	7.5	12	95	7.5
R214143	40	1.7	20	2.3	1.25	1.25	45300	10.5	2.7	0.49	<0.05	3850	26	0.18	3600	550	1.1	1600	7.5	17	38	80	19
R214144	20	0.7	16	2.4	1.35	1.85	23600	11.5	2.6	0.51	<0.05	2500	17.5	0.19	2250	95	2.4	1250	14	21	17	35	16
R214145	19	0.7	9.5	0.88	0.55	0.56	24400	7.5	0.8	0.2	<0.05	2300	4.2	0.09	1500	25	1.8	1550	9.5	4.5	10	25	15
R214146	27	1.1	12	0.67	0.45	1.15	19200	9	0.75	0.15	<0.05	3250	6.5	0.09	3050	45	1.1	1750	8	5	13	45	10.5
R214147	19	0.5	12	0.61	0.45	0.33	12900	5.5	0.55	0.15	<0.05	1900	4.1	0.09	4200	45	1.5	1550	8.5	3.3	9	30	7
R214148	3	<0.1	10	0.34	0.25	0.18	2400	0.3	0.2	0.09	<0.05	140	0.85	0.06	95	20	0.8	180	8.5	0.87	<2	<5	3
R214149	19	0.6	11.5	0.86	0.55	0.43	13600	5	0.85	0.2	<0.05	2400	7	0.1	5500	55	1.1	1300	8	5.5	9	50	8
R214150	15	0.5	9.5	0.79	0.5	0.34	13400	4.8	0.7	0.18	<0.05	1700	5	0.1	2950	35	1.4	1050	8	4.3	8	50	7
R214151	7	0.2	7.5	0.54	0.4	0.18	3850	2.4	0.3	0.13	<0.05	750	1.95	0.09	550	20	1.2	850	10	1.6	3	15	4
R214152	3	<0.1	9	0.37	0.3	0.09	1950	0.4	0.2	0.09	<0.05	175	1.1	0.07	105	20	0.7	240	9.5	0.96	<2	20	3.5
R214153	28	0.5	16	1.1	0.6	0.81	30900	5.5	1.05	0.24	<0.05	1700	9	0.11	5650	80	1	750	5.5	6.5	14	110	12
R214154	8	0.4	5	0.46	0.3	0.59	4750	2.5	0.45	0.11	<0.05	1300	4.2	0.06	850	10	1.4	1400	5	2.6	5	10	4.5
R214155	4	<0.1	10	0.35	0.25	0.17	3800	1.1	0.25	0.08	<0.05	140	1.3	0.06	150	25	0.9	145	10.5	1.2	<2	35	3.5
R214156	3	<0.1	3.5	0.41	0.2	0.19	1800	0.5	0.7	0.08	<0.05	260	8	0.02	135	35	0.2	90	0.5	6	2	45	3.5
R214157	22	0.2	22.5	0.71	0.45	0.45	6850	3.1	0.85	0.16	<0.05	1050	9.5	0.08	7250	60	0.4	490	2.5	5.5	9	380	7
R214158	120	0.3	34.5	1.9	1.1	0.92	96800	13	1.95	0.41	0.05	1150	18	0.18	3500	150	2	330	5.5	12.5	17	350	23
R214159	23	<0.1	13	2.1	1.45	0.94	7250	3.1	1.55	0.5	<0.05	410	12.5	0.3	500	120	3.3	145	19.5	10.5	6	185	14.5
R214160	16	<0.1	15	2.4	1.55	0.96	13200	2.9	1.9	0.55	<0.05	220	15	0.31	370	165	2.9	120	23.5	11.5	5	250	18.5
R214161	185	0.2	125	4.7	3.1	2.2	272000	16	3.7	1.1	0.05	1950	30	0.59	950	260	6	155	20	21	64	1000	58
R214162	12	0.1	8	1.95	1.05	0.91	10800	2.4	2.4	0.4	<0.05	440	24.5	0.17	310	230	1.6	110	11	20	5	360	13.5
R214163	<2	<0.1	2.5	0.43	0.2	0.2	2950	0.5	0.55	0.09	<0.05	175	5.5	0.03	80	45	0.3	75	2	4.6	3	40	3.5
R214164	23	<0.1	19.5	3.2	2	1.7	14200	3.9	2.7	0.73	<0.05	280	22	0.4	470	270	4.3	140	34	16.5	6	350	26.5
R214165	14	<0.1	14.5	2.4	1.6	1.45	6550	2.7	1.85	0.56	<0.05	220	15	0.34	380	170	4	130	28.5	11	4	230	17.5
R214166	350	0.4	35.5	3.5	1.8	3.3	352000	41	4.1	0.69	0.25	1150	45	0.32	900	550	5	210	11	28.5	31	500	74
R214167	12	0.1	280	0.71	0.4	0.3	14000	1.6	0.8	0.15	<0.05	900	11.5	0.07	850	65	0.7	340	1	6	7	135	23
R214168	260	0.4	58	3.3	1.8	2.2	225000	27.5	3.9	0.67	0.15	1500	39	0.31	1300	300	3.6	390	9	27	31	390	54
R214169	36	0.1	32	3	1.75	1.25	51300	3.8	2.7	0.64	<0.05	550	24.5	0.3	430	240	2.1	155	16.5	18	14	480	25.5
R214170	10	<0.1	13	2.2	1.45	1.55	6850	1.4	1.9	0.51	<0.05	175	17	0.3	500	195	2.6	130	22	11.5	5	220	16.5
R214171	6	0.1	5.5	1.25	0.7	0.67	9300	1.7	1.35	0.27	<0.05	300	14	0.11	200	130	0.3	90	2.5	9.5	4	230	10
R214172	4	<0.1	3.5	0.44	0.25	0.22	2750	0.8	0.6	0.09	<0.05	330	7	0.04	150	60	0.5	85	3.5	4.9	<2	70	4.5
R214173	600	0.2	52	2.2	1.2	2.2	381000	55	2.4	0.47	0.25	750	24.5	0.22	800	310	7.5	270	13.5	15.5	43	390	74
R214174	61	0.3	56	2.7	1.65	1.1	49200	8	2.5	0.6	<0.05	1350	22.5	0.3	4100	195	3.5	440	19	16	13	500	23.5

Appendix Table A9.1: Chemical data.

Number	Cr	Cs	Cu	Dy	Er	Eu	Fe	Ga	Gd	Ho	In	K	La	Lu	Mg	Mn	Mo	Na	Nb	Nd	Ni	P	Pb
R214175	47	<0.1	23	3.1	2.1	1.25	13200	6	2.4	0.72	<0.05	350	17.5	0.42	650	130	6.5	200	37.5	14.5	6	260	20.5
R214176	68	<0.1	24.5	4.1	2.8	1.5	26800	6	3.2	0.98	<0.05	270	22	0.54	470	200	5.5	170	44.5	18.5	8	320	25
R214177	10	0.4	23.5	1.7	1	0.67	7900	2.9	1.6	0.39	<0.05	1500	13	0.17	7900	70	0.7	750	6.5	9.5	10	410	7
R214178	3	<0.1	3.5	0.23	0.1	0.11	2150	0.6	0.3	0.04	<0.05	380	4	0.02	125	40	0.2	80	<0.5	2.5	3	40	3
R214179	30	0.3	35.5	1.05	0.6	0.54	9900	4.9	1.25	0.23	<0.05	1650	19.5	0.11	11000	65	0.5	600	4.5	9	11	390	8
R214180	200	0.2	145	4	2.4	2	413000	16.5	3.5	0.88	0.05	2550	30	0.4	1200	145	4.6	210	8.5	21.5	50	950	64
R214181	16	<0.1	14	2.5	1.65	1.05	13600	2.3	2	0.58	<0.05	410	16.5	0.34	480	165	3	170	23	12.5	7	210	17.5
R214182	280	0.4	58	2.8	1.6	1.85	241000	29	3.2	0.61	0.15	1400	35	0.28	3450	300	4.3	310	9	22.5	31	440	57
R214183	<2	<0.1	2.5	0.35	0.2	0.18	2200	0.6	0.4	0.07	<0.05	650	4.4	0.03	130	45	0.2	95	<0.5	2.9	4	65	3
R214184	10	<0.1	9.5	1.5	1	0.84	5000	1.3	1.25	0.35	<0.05	300	11	0.19	350	180	1.6	115	18	7.5	4	280	12.5
R214185	98	0.4	42.5	2.5	1.45	1.85	158000	14.5	2.3	0.53	0.1	1050	20.5	0.27	1100	380	3	360	14	14.5	19	490	38
R214186	34	0.3	26.5	1.55	1	0.63	7000	4.6	1.5	0.36	<0.05	1500	19	0.18	8700	60	0.5	650	4	10	11	280	11.5
R214187	210	0.4	33.5	3.3	1.85	2.5	263000	26	3.6	0.69	0.15	1750	33.5	0.35	2100	360	3.3	370	7.5	24	26	410	48.5
R214188	12	0.4	10	0.56	0.35	0.58	8650	4	0.5	0.13	<0.05	1500	5.5	0.07	1700	20	1.5	1600	7.5	3.3	8	25	5
R214189	390	0.3	155	2.1	1.3	0.78	454000	27	1.75	0.47	0.2	1550	12.5	0.24	1050	1650	4.5	240	4.5	9.5	68	850	53
R214190	92	0.3	27	0.38	0.25	0.22	62300	18	0.35	0.07	0.025	1500	2.9	0.05	3650	280	1.7	1150	8.5	1.75	110	75	4.5
R214191	84	1	17	1.25	0.7	0.71	28600	17	1.55	0.23	0.025	3250	15.5	0.12	4200	55	2.1	1850	7.5	9.5	19	85	8.5
R214192	155	0.4	17	1.1	0.5	0.48	17800	30	2.5	0.16	0.025	7300	48.5	0.08	2950	25	2.6	2950	9.5	20.5	21	140	22
R214193	170	2.1	35.5	3.2	1.55	1.7	33400	33	4.1	0.54	0.1	21500	54	0.22	7400	270	4.6	6850	10	26	31	195	23.5
R214194	250	0.5	15.5	2.7	1.45	1.1	50400	13.5	3	0.48	0.025	27400	34.5	0.21	13800	650	2	23800	4.5	18.5	52	410	13
R214195	185	1.8	91	5	2.7	1.9	48800	24	5.5	0.9	0.025	21800	61	0.39	10800	550	6.5	18500	8	30	125	310	27
R214196	115	1.1	49.5	3.1	1.7	1.65	26700	19	3.9	0.56	0.025	22800	54	0.26	11500	380	2.3	19000	7	24.5	105	300	23.5
R214197	100	0.6	15.5	1.35	0.8	0.67	25000	20.5	1.75	0.25	0.025	3100	16.5	0.14	3550	75	5	2100	9.5	11	15	85	7.5
R214198	140	0.5	17	0.98	0.45	0.57	13400	27	2.4	0.15	0.025	9200	32	0.07	3600	380	4.1	2650	8.5	18	14	120	16
R214199	180	1.6	31	1.85	0.9	1.3	31300	22.5	2.9	0.3	0.025	27800	43.5	0.14	5200	125	4.9	8250	7.5	19.5	22	270	30
R214200	230	1.1	27.5	4.9	2.6	2.1	34200	23	5.5	0.87	0.025	23300	67	0.38	10500	500	4.3	17500	8.5	29.5	25	300	30
R214201	230	1.5	43.5	4.5	2.4	1.95	36200	26	5	0.81	0.025	25300	70	0.36	11400	490	7.5	18000	9.5	29	40	360	24
R214202	74	0.9	19.5	2.3	1.25	0.88	28000	20	2.7	0.42	0.025	3050	23	0.19	5650	115	2.9	2450	9.5	16	21	105	12
R214203	105	0.2	27	1.05	0.5	0.34	24000	29.5	2.8	0.15	0.025	2650	42	0.07	2250	30	2.6	2400	10.5	22.5	11	115	12
R214204	170	1.4	24.5	1.25	0.6	0.76	16800	25	3.1	0.18	0.025	12100	60	0.09	3900	30	2.2	3250	8.5	23	16	195	44
R214205	195	1.3	51	2.4	1.3	1.45	33000	25.5	4.1	0.4	0.025	19900	87	0.21	8950	90	1.8	13400	9.5	28.5	43	320	30.5
R214206	260	1.1	35.5	5.5	3.3	1.85	46800	24	5.5	1.05	0.025	21200	73	0.52	14300	900	1.9	17700	9.5	27	67	360	22
R214207	160	1	27.5	6	3.4	1.95	38400	22	6	1.15	0.025	17100	81	0.47	11300	500	4	17000	9	33.5	58	370	23.5
R214208	175	2	38.5	1.05	0.55	0.73	37000	24	1.85	0.18	0.025	10500	22.5	0.09	4300	45	4.2	3050	8.5	14	22	150	17
R214209	210	3	72	1.2	0.6	0.94	62700	25.5	2.1	0.19	0.05	16400	29	0.1	5350	45	4.9	5550	8	15	37	220	22
R214210	180	1.8	90	1.25	0.65	1.55	63700	22.5	2.8	0.2	0.025	18400	47	0.11	5350	65	5	12700	7.5	20.5	56	260	22.5
R214211	190	1.1	46.5	2.7	1.65	1.9	43700	24.5	3.7	0.51	0.025	21500	51	0.3	8000	450	5	18100	9.5	21.5	71	330	26.5
R214212	170	1.1	41.5	6.5	4	1.85	38300	23.5	6	1.3	0.025	19600	62	0.59	13500	700	4.7	18600	9	28.5	80	310	23.5
R214213	115	0.4	18	2.3	1.2	0.57	16400	22.5	3.6	0.38	0.025	2900	51	0.17	3000	40	1.9	2300	8.5	25	17	140	15.5
R214214	220	0.3	49	1.8	0.9	0.56	39000	32	4	0.27	0.05	4500	66	0.14	2700	45	1.9	2350	10.5	31	43	170	31.5
R214215	240	1.8	91	3.7	2	1.65	43300	26	4.8	0.64	0.025	17400	61	0.32	6500	170	5.5	2850	9.5	29	88	200	28.5
R214216	280	1.7	27.5	8	4.3	2.7	42500	26	7	1.45	0.025	21300	80	0.61	11300	750	2.5	14200	9.5	33.5	59	290	26
R214217	220	3	31.5	5	2.8	2.5	39700	25.5	6	0.92	0.025	24600	75	0.41	10600	450	3.1	17700	8	34	62	360	26
R214218	300	1.6	58	3.7	1.95	1.65	53500	29	4.2	0.66	0.025	24100	48.5	0.29	18100	650	2.8	14500	9.5	21.5	105	290	20
R214219	90	0.3	25	0.44	0.3	0.29	64300	19.5	0.4	0.09	0.025	1450	3.1	0.06	3500	270	1.9	1100	10	2.1	110	65	5
R214220	220	0.3	11	1.15	0.6	0.37	12100	32.5	3	0.17	0.025	2850	56	0.1	1600	20	3.2	2450	11.5	22	10	100	15
R214221	240	0.2	51	1.35	0.7	0.5	32900	27.5	3.4	0.2	0.05	4400	55	0.12	850	55	6.5	1900	11	25	29	170	37
R214222	260	0.5	88	3.1	1.5	1	55900	43.5	9	0.44	0.05	13000	130	0.23	2850	105	5.5	3500	18	100	94	340	33.5
R214223	370	2.6	69	5	2.8	2.6	53600	30	7	0.93	0.05	29300	93	0.43	10200	700	6	3400	12.5	61	175	300	56
R214224	320	2.5	49.5	4.9	2.6	2.3	48000	32	6	0.89	0.05	30000	75	0.39	13200	650	7.5	3050	13	29.5	68	310	34
R214225	260	1.3	30.5	4	2.3	1.8	30400	21	4.4	0.75	0.025	20600	64	0.35	9600	420	4.1	14900	7.5	24.5	33	290	24.5
R214226	300	1.8	49	3	1.85	1.6	32600	24	4.2	0.56	0.025	22000	56	0.29	9300	400	7	13600	8	27.5	38	320	22
R214227	250	1.7	47.5	2.6	1.6	1.3	24700	20.5	3.3	0.5	0.025	19900	34	0.25	8450	490	6	18300	7.5	20	20	380	20.5
R214228	195	1.4	46.5	2.2	1.25	1.55	23300	25.5	3.5	0.4	0.025	23300	48	0.19	7100	230	7	21600	8	23.5	27	420	23.5
R214229	250	2.4	58	2.7	1.55	1.6	42500	32	3.5	0.51	0.025	28300	36	0.23	15100	400	6	17200	10.5	20.5	120	440	23
R214230	260	1.6	41.5	3.3	1.95	1.5	37300	19	3.8	0.63	0.025	24500	52	0.31	14200	450	5.5	22600	8.5	21	84	440	24

Appendix Table A9.1: Chemical data.

Number	Cr	Cs	Cu	Dy	Er	Eu	Fe	Ga	Gd	Ho	In	K	La	Lu	Mg	Mn	Mo	Na	Nb	Nd	Ni	P	Pb
R214231	270	1.9	51	3.9	2.1	1.65	50500	27.5	4.4	0.71	0.05	29200	50	0.32	18900	600	6.5	14900	8	23	99	370	24
R214232	380	1.7	46.5	4.5	2.5	1.9	50700	25.5	4.9	0.82	0.025	27400	60	0.39	19000	650	4.9	15400	8.5	25.5	87	340	22
R214233	220	1.1	60	3.4	1.85	2	40500	21.5	4.5	0.61	0.025	15900	64	0.29	15700	470	3.9	20800	7	26	115	330	24
R214234	175	0.2	21	1.3	0.7	0.33	7300	23	2.7	0.22	0.025	2850	30	0.09	4750	30	2.8	2950	6.5	19	21	90	20
R214235	390	0.3	64	1.7	0.95	0.49	41600	24	4.2	0.28	0.05	5050	76	0.14	1350	25	7.5	2350	7	28.5	24	220	45
R214236	135	0.6	17	3.3	2.1	1.75	9900	29.5	4.4	0.66	0.025	18500	62	0.33	2900	45	3.7	1850	6.5	27.5	22	145	12.5
R214237	195	0.4	61	7.5	4.2	2.4	38400	32	8.5	1.45	0.05	23700	87	0.58	4400	1850	7.5	3300	10	59	180	320	34.5
R214238	130	0.6	75	5.5	3.3	2.1	25500	32	7	1.1	0.025	23900	100	0.44	3500	950	6	2150	8.5	40	125	320	31
R214239	200	0.8	87	5.5	3.2	2.9	30800	23.5	7.5	1.1	0.025	25600	96	0.44	3850	300	7	1350	3	57	69	260	22
R214240	74	0.5	95	3.2	1.85	1.5	29600	15	3.8	0.63	0.025	17500	34.5	0.25	4200	600	8	1150	2.5	21	69	160	16
R214241																							
R214242	240	0.8	51	4.4	2.8	1.85	36900	25	5	0.92	0.025	25100	55	0.42	15000	480	5.5	5100	8	28	44	300	25.5
R214243	270	0.8	32.5	4.4	2.8	1.45	44600	25.5	4.9	0.91	0.025	21100	50	0.43	19300	750	5.5	9650	8	26.5	51	380	25.5
R214244	700	10.5	105	3.6	2.2	2.1	48200	20	3.9	0.74	0.05	17300	24.5	0.34	54300	480	2.5	31900	8.5	19.5	550	1900	11.5
R214245	240	0.9	35.5	2.8	1.85	1.2	31300	24.5	3.6	0.58	0.025	20800	35.5	0.29	15600	480	6.5	16600	6	22.5	61	460	21.5
R214246	290	0.7	29	2.6	1.6	1.5	25900	21	3	0.53	0.025	31200	26	0.25	12100	380	5.5	19200	5	16	54	750	31
R214247	195	0.7	33.5	3.2	2	1.55	33900	24	3.7	0.65	0.025	20500	39.5	0.31	16800	450	5.5	20100	6	21.5	61	350	22.5
R214248																							
R214249	360	0.6	71	1.75	0.95	0.83	35900	25	4.2	0.29	0.025	15700	84	0.15	2600	30	4.8	2100	7	27	24	270	36
R214250	290	2.7	71	2.2	1.2	1.95	41600	30	4.7	0.37	0.025	29000	87	0.18	2000	70	5.5	2600	9	32.5	65	310	49.5
R214251																							
R214252																							
R214253																							
R214254																							
R214255	91	0.3	28	0.52	0.4	0.33	65200	21.5	0.5	0.11	0.025	1500	3.3	0.07	3650	290	2	1150	9	2.6	115	75	5
R214256	78	0.6	19	1.8	1.15	0.77	11600	20.5	2.1	0.36	0.025	12400	21.5	0.18	7900	55	3	2800	5.5	14	22	105	16
R214257																							
R214258	110	0.8	52	1.6	0.95	1.25	14000	28	2.9	0.3	0.05	26800	40.5	0.15	1900	45	6	2050	7	19	25	220	43.5
R214259	77	1.1	34	3.2	1.9	1.85	16800	23.5	4.9	0.61	0.025	20900	71	0.3	1650	185	2.2	2100	9	29	38	240	36.5
R214260	92	1.1	22.5	5	3.2	2	21800	26.5	5.5	1.05	0.025	26800	73	0.43	4850	650	5.5	2000	8	31	41	270	38.5
R214261	125	1.1	48	4	2.5	1.8	30200	26.5	5	0.8	0.025	31700	54	0.36	8650	420	4.9	1900	5	29.5	59	230	25
R214262	290	2.1	91	3.7	2.2	1.95	34900	24.5	5	0.73	0.025	31200	49	0.31	9200	340	4.3	2200	5.5	28.5	52	220	32.5
R214263																							
R214264	80	0.8	15	1.8	1.15	0.77	10800	17.5	2.2	0.36	0.025	10000	23	0.18	7300	50	0.6	2550	4	16	19	80	8
R214265	76	0.6	11.5	2.3	1.45	1.3	6700	23.5	3.4	0.44	0.025	19500	49.5	0.26	2850	25	1.1	1900	4.5	22.5	11	135	13.5
R214266	92	2	30.5	1.4	0.9	0.98	9900	22	2.4	0.27	0.05	24900	37.5	0.15	2300	30	1.2	1850	4.5	16	13	160	16.5
R214267	125	1.3	125	2.8	1.55	1.55	23100	20.5	4.1	0.51	0.1	20900	52	0.25	3900	270	2.2	3700	5	23.5	45	155	16.5
R214268	155	1.1	105	6	3.5	2.3	34300	19.5	6	1.15	0.025	27700	82	0.5	10600	800	3.9	12300	4.5	35	155	320	19.5
R214269	155	1.1	45	4.1	2.8	1.75	31300	19.5	4.1	0.88	0.025	23200	49.5	0.43	11400	480	2.1	15800	5.5	22	58	290	18
R214270	110	0.6	16	2.1	1.3	0.72	12700	20	2.6	0.41	0.025	8150	27.5	0.21	5000	65	1.7	3050	6	19.5	23	85	12.5
R214271	160	0.4	58	1.55	0.9	1.05	11900	25.5	2.8	0.27	0.05	13600	44.5	0.15	2500	30	3.8	2050	7	18.5	28	110	29
R214272	170	1.1	125	2.4	1.35	1.7	32500	21.5	4.4	0.42	0.05	19300	84	0.22	3650	55	3.4	4250	6	28.5	110	210	41
R214273	185	1.4	62	5	3	2.2	38600	21.5	5.5	0.99	0.025	25400	76	0.43	11000	700	4.4	11100	5.5	29.5	98	270	33.5
R214274	210	1.5	39	3.8	2.3	1.7	35600	21	4.6	0.76	0.025	23400	59	0.35	13100	480	2.6	14300	6	25.5	54	290	25.5
R214275	190	1.2	58	4.6	2.8	2	36900	21	5	0.93	0.025	23900	67	0.43	13400	440	4.8	14700	6.5	27	62	280	24
R214276	220	1.4	70	4.5	2.8	1.8	40100	23.5	5	0.91	0.025	23200	56	0.42	17800	550	2.6	14600	7	26.5	140	210	21.5
R214283																							
R214284	92	0.3	25.5	0.41	0.3	0.28	62600	19	0.4	0.09	0.025	1500	3	0.05	3650	270	1.9	1150	7.5	2.1	110	45	5
R214285	135	0.6	21.5	2.8	1.7	0.66	32400	25.5	3.2	0.55	0.025	3700	26.5	0.24	5300	125	2	4050	9.5	18.5	26	135	16.5
R214286	210	0.1	41.5	2.2	1.25	0.5	36400	31	4	0.38	0.025	1000	50	0.19	2650	95	2.8	2750	12.5	28.5	31	150	26
R214287	180	0.2	38.5	6	3.5	1.9	27200	23.5	6.5	1.15	0.025	12100	95	0.52	3750	350	2.3	2750	9	36	54	250	35.5
R214288	130	0.2	53	6	3.4	2.7	21200	23.5	7	1.15	0.025	21500	105	0.46	4000	390	1.3	2800	8	38.5	93	310	35.5
R214289	380	3.5	92	5.5	3	2.9	29500	23.5	6	1	0.025	25200	63	0.41	14200	420	1.5	3400	8	33	175	210	34
R214290	260	2.1	88	4.7	2.9	2.2	36400	21.5	5	0.95	0.025	26300	59	0.43	17300	600	1.9	3250	7.5	28	115	240	26.5
R214291	150	0.8	31.5	3.8	2.4	1.65	32200	22.5	4.3	0.78	0.025	25200	50	0.37	11100	450	3.9	11900	8.5	23	35	310	28
R214292	160	0.7	37	4.4	2.9	1.9	33400	23	4.7	0.92	0.025	24100	55	0.45	10600	500	3.7	17900	9	25.5	28	350	25

Appendix Table A9.1: Chemical data.

Number	Cr	Cs	Cu	Dy	Er	Eu	Fe	Ga	Gd	Ho	In	K	La	Lu	Mg	Mn	Mo	Na	Nb	Nd	Ni	P	Pb
R214293	140	1.2	79	4.1	2.5	2.3	34000	26	6.5	0.99	0.025	13400	59	0.4	10200	360	4.1	17800	10	32	77	330	27
R214294	110	1.3	47.5	3.7	2.3	2.2	34300	23.5	6	0.9	0.025	13100	54	0.36	11500	420	2.9	19300	8	29.5	94	450	25
R214295	90	0.3	29	3.5	2.1	1.25	11900	23	6	0.8	0.025	1950	105	0.35	3900	50	2.6	3050	11	31.5	25	280	34.5
R214296	105	0.1	45.5	1.85	1	1.2	14900	27	5.5	0.36	0.05	11000	76	0.16	2600	30	1.6	3700	12	34	42	450	51
R214297	130	0.2	70	2.4	1.35	1.9	25900	24.5	7	0.48	0.05	20600	110	0.21	2550	45	1.2	3950	11	43	95	600	51
R214298	190	2.6	135	4.8	2.6	3	34400	24.5	7	1.05	0.05	21500	50	0.41	9800	270	1.9	3400	8.5	31	170	175	34
R214299	120	1.2	77	7.5	4.6	2.9	27900	25.5	10	1.8	0.025	12000	72	0.73	8900	450	3.6	7200	11	46.5	75	270	33.5
R214300	140	0.6	44	4.9	3.1	2.4	37300	21	6.5	1.2	0.025	15500	56	0.51	12200	550	2.5	16500	10	30	62	360	25.5
R214301	145	0.7	44	4.8	3	2.3	38500	22.5	6.5	1.2	0.025	13300	55	0.49	12400	490	3.2	20200	10.5	28.5	52	360	26
R214302	135	0.9	38.5	4.1	2.6	2.1	32200	21.5	6	1.05	0.025	20800	52	0.45	10200	390	3.8	20200	9.5	27	52	340	23.5
R214303	78	0.8	44.5	4.3	2.7	2.3	33000	23.5	6.5	1.05	0.025	23300	56	0.45	9900	410	2.3	19200	11	29	30	550	26.5
R214304	125	1	48.5	3.9	2.5	2.3	39600	24	6.5	0.96	0.025	24200	57	0.4	12700	460	3.7	25700	10.5	30.5	73	480	28
R214305	130	0.7	27	1.9	1.25	0.68	15000	20.5	3.3	0.46	0.025	6550	27.5	0.21	4750	70	2.3	3300	9	21.5	28	160	14.5
R214306	110	0.3	19.5	1.65	1	0.65	7300	26.5	4.5	0.35	0.025	8350	41.5	0.18	1800	25	4.3	2400	8.5	29	20	165	18.5
R214307	260	0.4	130	2.8	1.6	1.6	25100	29.5	6	0.6	0.15	9050	55	0.28	1700	55	5	2050	9.5	30.5	130	260	32.5
R214308																							
R214309																							
R214310	165	0.8	58	5.5	3.3	2.3	30600	24.5	7.5	1.3	0.025	11900	61	0.5	3550	500	7.5	2550	9.5	31.5	44	250	36.5
R214311	165	1	54	3.4	2.2	1.8	35100	23.5	5.5	0.84	0.025	20600	48	0.37	7450	310	6	3900	8.5	28.5	34	310	30.5
R214312	135	1	55	3.6	2.2	1.8	33500	23.5	6	0.85	0.025	25500	54	0.35	8250	330	6.5	5350	9.5	30.5	43	310	30.5
R214313	125	0.5	19	1.85	1.1	0.53	14700	21	4.2	0.41	0.025	3450	38	0.18	5150	50	3.4	3450	9	30	24	420	17
R214314	155	0.3	47.5	1.45	0.85	0.87	22100	29.5	4.7	0.29	0.05	8100	47	0.14	1800	45	7	2800	13	28.5	34	320	44.5
R214315	135	0.2	65	2.8	1.75	1.85	33700	23.5	6	0.63	0.025	16000	60	0.32	1600	150	4.8	2800	11.5	32.5	84	290	36
R214316	145	0.3	78	5.5	3.2	2	33500	23	7.5	1.3	0.025	15400	54	0.49	1750	950	9	2600	9	33	105	370	34.5
R214317	135	0.3	43	5.5	3.5	1.9	34000	24	7	1.4	0.025	22500	54	0.51	4100	500	4.2	3150	10.5	29	90	350	30
R214318	200	1.1	45.5	4.3	2.6	1.85	35000	25.5	7	1.05	0.025	18700	54	0.42	8300	450	5.5	2750	10.5	31.5	91	240	29
R214319	125	1.4	48.5	3.7	2.2	1.75	33500	22	5.5	0.88	0.025	27000	43	0.35	10600	410	4.1	3750	10.5	29.5	57	380	35
R214320	190	1.4	70	4.4	3.2	2	43300	22	6	1.15	0.025	21800	48.5	0.65	11900	500	5.5	10600	9	32	74	490	33.5
R214321	77	0.3	26.5	0.48	0.35	0.38	63600	17.5	0.55	0.13	0.025	1550	3.3	0.08	3800	290	1.8	1200	9.5	2.2	115	75	5
R214322	97	0.5	41.5	2.1	1.2	0.56	34100	21	3.7	0.47	0.025	1950	30	0.2	4350	55	3.1	3600	9	23	21	200	17
R214323	150	0.2	54	2.5	1.4	0.9	45200	28	6.5	0.5	0.025	700	60	0.2	1500	65	5.5	2450	12	39.5	40	240	25.5
R214324	160	0.2	76	6	3.8	1.65	32200	25.5	8	1.4	0.025	5800	62	0.66	3100	550	4.4	2450	11	37.5	59	270	54
R214325	125	0.5	71	6	3.5	2.1	34600	23	7.5	1.4	0.025	21700	57	0.5	3600	500	4.4	3250	11.5	34	80	370	43
R214326	155	1.3	36	4.8	2.9	2.4	36400	23.5	7.5	1.15	0.025	27500	60	0.46	7350	600	5.5	3600	10.5	36	85	340	30.5
R214327	160	1.4	94	4.2	2.7	2	39500	25	6	1.05	0.025	27700	47	0.45	11200	550	4.9	3900	11.5	33	96	320	30
R214328																							
R214329	110	0.6	20.5	2	1.15	0.88	14200	21.5	4.7	0.43	0.025	3150	66	0.2	5000	65	4.5	3500	9.5	28	25	190	25.5
R214330	230	0.4	53	1.8	1.05	1.65	36500	25.5	5.5	0.34	0.025	17000	49	0.18	1500	50	6	3200	10.5	39	38	410	27.5
R214331	155	2.8	53	1.85	1.1	1.55	50100	23	4.3	0.39	0.025	18100	45	0.19	4000	105	8.5	2900	9.5	28.5	76	270	31.5
R214332	165	2	40	5.5	3.5	3.1	39700	23	7.5	1.35	0.025	25600	58	0.61	9550	950	4.3	3450	9.5	32	67	300	32
R214333	210	2	36.5	5.5	3.3	2.6	47000	24.5	7	1.3	0.025	28000	52	0.49	13200	650	7	3400	10	36.5	89	300	29.5
R214334	160	1	97	4.6	2.9	2.6	37000	19.5	6.5	1.15	0.025	19100	51	0.49	8600	410	6.5	5600	8	33.5	88	210	32
R214335	155	1	46	5.5	3.6	2.4	41800	24.5	7.5	1.4	0.025	14600	57	0.58	13000	550	4.9	13400	11.5	41.5	50	350	29
R214336	26	1	19.5	1	0.7	0.51	9350	29	1.25	0.26	0.025	3400	9.5	0.14	8500	70	2.9	3650	8.5	7	16	110	11.5
R214337	49	0.8	8.5	0.57	0.35	0.18	6450	9.5	1.3	0.13	0.025	2100	11.5	0.07	2400	35	1.6	1500	6.5	9.5	16	175	9
R214338	78	0.3	8.5	1.4	0.9	0.83	6300	15.5	2.7	0.32	0.025	9600	31.5	0.18	1600	45	1.4	1600	7.5	18.5	21	290	16.5
R214339	39	0.3	13	1.8	1.15	1.4	7050	17	2.6	0.44	0.025	11800	27.5	0.21	1300	25	0.6	1350	7	15	19	105	21
R214340	100	1.6	15	2.5	1.3	1.25	9850	21	3.3	0.47	0.025	15200	39	0.2	4950	60	0.6	2300	5.5	26	30	250	23
R214341	120	2.8	35.5	3.5	1.9	1.6	24300	22.5	4.4	0.66	0.025	20500	57	0.3	8100	165	1.9	2900	7	36.5	53	320	23.5
R214342	145	2.3	53	5	2.9	2.1	46100	26.5	5.5	1	0.025	20200	61	0.43	12300	460	3.1	7300	9	41	80	470	29.5
R214343	135	1.8	43.5	3.6	2.1	1.35	37800	21.5	3.9	0.73	0.025	15800	42	0.32	14700	550	1.8	10400	8.5	28	55	330	25
R214344	95	2.2	39.5	2.9	1.75	1.25	52400	19	3.2	0.61	0.025	18100	35.5	0.26	10300	550	2.2	8250	6.5	22	53	280	22
R214345	52	1.9	94	4.1	2.2	1.6	59200	26.5	3.8	0.81	0.05	11900	23.5	0.29	9800	1100	1.6	23900	8.5	20	61	950	17.5
R214346	72	1.4	25.5	1.35	0.8	0.65	24100	22.5	1.25	0.27	0.025	3350	13	0.15	5600	120	3.5	3150	9.5	8.5	22	70	11.5
R214347	120	0.9	7.5	0.51	0.3	0.16	8400	10	0.75	0.1	0.025	2800	9.5	0.06	2500	25	2.5	1800	5	6.5	10	20	12.5
R214348	105	0.2	9	1.4	0.7	0.73	6200	16	2.9	0.23	0.1	12200	54	0.11	900	20	3.1	2000	8	27	22	220	41

Appendix Table A9.1: Chemical data.

Number	Cr	Cs	Cu	Dy	Er	Eu	Fe	Ga	Gd	Ho	In	K	La	Lu	Mg	Mn	Mo	Na	Nb	Nd	Ni	P	Pb
R214349	170	2.5	25.5	3.4	1.75	1.85	24300	21.5	5	0.61	0.1	20600	85	0.24	6550	200	3.4	5000	8	37	44	500	32
R214350	185	1	40.5	4.1	2.3	1.55	39900	22	4.2	0.8	0.025	22600	44	0.35	12000	430	3	13100	9	29	43	330	21
R214351	250	1.7	70	5.5	3.1	1.9	49500	23	4.8	1.1	0.025	16800	47.5	0.48	13100	500	4.7	16800	8	33	67	370	24.5
R214352	165	1	25.5	4.5	2.7	1.55	36600	20.5	4.1	0.94	0.025	13700	42	0.45	12400	470	3.9	15900	7.5	28.5	33	350	20
R214353	91	0.3	22.5	0.46	0.3	0.26	67900	17.5	0.35	0.1	0.025	1550	2.9	0.06	4000	290	1.8	1300	8.5	1.8	125	60	6.5
R214354	100	0.6	16.5	1.15	0.8	0.44	10000	14	0.9	0.26	0.025	2250	8.5	0.16	4600	55	4.5	2650	11.5	6	13	65	7
R214355	72	2.1	20	0.77	0.5	0.26	10300	24.5	0.75	0.16	0.05	6050	12	0.11	4350	35	3.7	3200	9	6	8	90	10.5
R214356	170	0.4	27	0.71	0.45	0.29	9900	8.5	1.1	0.14	0.025	4400	15	0.08	1100	35	4.7	1300	5	9.5	10	75	17
R214357	110	0.8	13.5	5	2.3	2.3	7750	24	7	0.85	0.05	19500	77	0.28	2850	30	3.4	2200	8.5	48.5	24	270	27
R214358	95	1.8	200	4.9	2.5	1.45	121000	30.5	3.8	0.95	0.1	11000	26	0.34	4650	700	1	2950	9.5	19.5	160	260	15
R214359	29	1.3	96	7.5	3.8	2.5	137000	25	6.5	1.4	0.1	9400	43	0.52	6650	1400	0.8	5350	8	34.5	230	220	10.5
R214360	38	1.3	99	7.5	3.8	2.6	135000	25.5	7	1.5	0.1	7700	48.5	0.49	6650	600	0.9	13400	8	39	180	500	10
R214361	49	0.6	15.5	1	0.7	0.34	8050	12.5	0.85	0.22	0.025	1900	8	0.14	4850	30	4	2150	8	5.5	12	30	6.5
R214362	38	2.2	21	0.65	0.45	0.25	9550	21.5	0.7	0.14	0.025	7250	11	0.09	4900	30	1.2	3100	8.5	5.5	8	65	16.5
R214363	79	0.9	32	0.72	0.45	0.26	7650	9	1.1	0.14	0.025	3050	14	0.09	1700	40	1.9	1350	6.5	10	8	25	16.5
R214364	180	1.6	14	3.4	1.55	1.9	7850	22.5	5	0.57	0.1	20500	55	0.19	2500	30	3	2700	7.5	44	29	260	29.5
R214365	180	1.1	13.5	2.3	1.05	0.91	6500	15.5	3.7	0.38	0.05	12300	46	0.14	2800	30	6	1350	5.5	32	24	145	19
R214366	175	2	33	2.9	1.55	1.2	11600	18	4.1	0.53	0.025	22100	42.5	0.24	6650	45	4.7	2250	7	33	26	200	26
R214367	270	2.1	67	3.7	1.7	2.5	27400	26	5	0.62	0.05	27400	55	0.22	8050	145	3.6	7100	9	38.5	52	400	29.5
R214368	200	0.9	37.5	4	2.4	1.8	30300	18.5	4.6	0.8	0.025	21500	53	0.37	11600	430	2.7	17300	7.5	36	40	400	33
R214369	240	0.9	55	3.8	2.2	1.6	34800	20	4.5	0.75	0.025	17200	49	0.34	11700	370	4.2	17700	7.5	36.5	33	280	28.5
R214370	76	0.6	18.5	1.4	1	0.6	9350	13	1.15	0.32	0.025	2050	9.5	0.2	7100	40	4.7	2550	12.5	7	15	55	10.5
R214371	74	1.4	16.5	0.71	0.45	0.23	11700	28.5	1	0.14	0.025	5100	13	0.09	6200	35	3.1	3750	9	8	11	80	11
R214372	250	0.1	10.5	1.3	0.8	0.36	9700	14	2.2	0.25	0.025	5000	22.5	0.13	1400	25	2.2	2050	8.5	20	17	75	13.5
R214373	270	1.3	62	2.7	1.35	1.9	44600	23.5	5.5	0.44	0.05	15400	135	0.2	3300	45	4.7	3850	10.5	44	54	460	43
R214374	210	1.3	28.5	4	2.2	1.55	36700	20.5	4.3	0.8	0.025	24300	39.5	0.32	12800	370	1.1	10400	8.5	29.5	41	330	23
R214375	185	0.7	22	4.9	2.9	1.7	35100	19	4.6	1	0.025	17700	44.5	0.45	13000	410	5	15100	7.5	31.5	29	270	27
R214376	170	0.9	39.5	3.5	2.1	1.45	33900	20	4.2	0.72	0.025	15200	43.5	0.33	11800	350	5.5	13900	8.5	30.5	29	270	22.5
R214377	185	0.8	13	3.2	1.95	1.45	36600	19	3.1	0.67	0.025	23400	32	0.31	15100	500	1.7	18500	7.5	20.5	22	360	22
R214378	110	0.8	30.5	3.9	2.3	1.6	37000	21.5	3.8	0.82	0.025	19300	36.5	0.37	13900	500	1.3	22300	9	25	28	320	20.5
R214379	50	0.6	15.5	1	0.7	0.39	8850	12	0.9	0.22	0.025	1600	7	0.13	4550	35	3.5	2250	9.5	5.5	13	45	6.5
R214380	35	2.3	18	0.71	0.5	0.26	9450	21	0.8	0.15	0.025	5250	12	0.1	5700	35	1.9	3550	7	5.5	10	50	13.5
R214381	75	1.8	33	1.35	0.9	0.4	17900	13.5	2	0.27	0.1	5700	24	0.16	4600	50	2.4	2650	9.5	16	15	55	21.5
R214382	83	0.4	14	2.9	1.45	1.55	7700	18.5	4.3	0.51	0.1	10800	51	0.21	1950	60	1.7	1200	7.5	34	24	80	22
R214383	100	1	25	3.7	1.85	2	16200	20.5	5.5	0.65	0.05	20500	62	0.24	3850	110	1.4	1150	6.5	44	29	105	10
R214384	190	1.6	96	3.6	1.7	1.8	25500	27.5	3.8	0.58	0.025	22600	40	0.26	8400	360	1.5	1250	6.5	48.5	61	105	46.5
R214385	145	2	62	2.9	1.35	1.5	26600	20.5	3.2	0.46	0.025	10300	34.5	0.21	7800	185	1.6	2450	5	41	68	115	26
R214386	195	2.4	88	3.6	1.75	1.8	32500	22	3.7	0.61	0.025	9000	36.5	0.28	10600	240	1.1	4650	5	44.5	76	135	26.5
R214387	230	1.4	57	3.8	1.9	1.9	37900	20	4	0.64	0.025	11800	42	0.3	14600	650	1.2	10200	6	47	100	340	25.5
R214388	550	4.3	58	4	2	2.3	49700	17	4	0.69	0.025	8200	34.5	0.31	37700	950	1.1	14900	5	44.5	330	1200	25
R214389	120	0.3	30	0.47	0.3	0.5	58700	19	0.35	0.09	0.025	1700	3.2	0.06	3800	350	1.6	1200	8	3.3	150	85	8.5
R214390	170	0.6	16.5	1.15	0.65	0.83	14100	19.5	1	0.22	0.025	1850	9	0.13	4000	60	2.8	1100	9.5	10.5	33	70	13.5
R214391	125	0.9	19.5	1.05	0.6	0.39	8500	30.5	0.95	0.19	0.025	2550	10	0.13	5950	25	3	1200	11.5	10.5	24	40	16.5
R214392	145	2	23	1.3	0.75	0.54	16200	16	1.2	0.23	0.05	6400	14	0.15	4950	65	2	1000	7.5	14.5	20	65	17.5
R214393	360	0.2	14	1.35	0.65	0.5	5200	6	2.1	0.21	0.025	2400	24.5	0.1	650	50	3.4	310	5	30	24	40	18.5
R214394	240	0.3	21	8.5	3.2	4.1	6150	24.5	11	1.2	0.1	15000	110	0.31	1500	115	1.8	750	7.5	125	36	350	31.5
R214395	270	1.6	43	4.9	2.2	2.9	13400	23.5	6.5	0.75	0.025	9800	70	0.27	3550	370	1.8	1100	7	84	57	320	35.5
R214396	350	2.4	64	4.6	2.2	2.3	31000	26	5.5	0.77	0.025	6850	52	0.34	16000	430	1.5	800	7.5	66	175	230	23.5
R214397	390	2	62	4.1	2.1	2.2	32700	24.5	4.6	0.71	0.025	8000	46	0.32	15400	600	1.9	2350	8	54	185	280	28.5
R214398	440	1.7	65	4.4	2.3	2.3	34900	25	4.6	0.78	0.025	17500	47.5	0.38	17200	750	2.3	6300	7.5	52	165	380	29.5
R214399	430	1.8	46.5	3.8	1.9	2.4	32500	20.5	4.7	0.63	0.025	12800	49.5	0.28	18300	800	1.8	7550	7	58	165	1400	22
R214400	115	0.4	14.5	1.1	0.6	0.58	12000	9.5	0.85	0.19	0.025	1400	7.5	0.12	2000	65	2.2	600	9.5	9	43	80	9.5
R214401	61	1.4	16	1.3	0.7	0.52	10300	27	1.4	0.23	0.025	3200	13	0.13	3600	35	1.4	550	8	15.5	36	75	12.5
R214402	125	1.4	15	1.3	0.75	0.54	9750	12.5	1.4	0.22	0.05	5150	16.5	0.14	2450	55	1.5	460	7	16.5	44	110	22.5
R214403	150	0.3	44.5	2.7	1.3	1.65	22100	14	6	0.39	0.025	7550	89	0.16	1000	180	2.1	490	5.5	92	90	750	34
R214404	380	4	93	4.6	2.2	3.3	59700	25	6.5	0.75	0.05	22400	68	0.32	7300	1550	1.5	950	14.5	77	240	2050	32

Appendix Table A9.1: Chemical data.

Number	Cr	Cs	Cu	Dy	Er	Eu	Fe	Ga	Gd	Ho	In	K	La	Lu	Mg	Mn	Mo	Na	Nb	Nd	Ni	P	Pb
R214405	210	1.8	59	5.5	2.6	3.5	66400	23.5	6.5	0.89	0.025	14000	70	0.4	11800	500	1	1450	8.5	81	115	350	32
R214406	210	1	62	3.9	1.9	2.6	49000	23	5.5	0.63	0.025	35600	57	0.29	8150	550	1.3	1450	7.5	73	100	230	37.5
R214407	200	1.4	60	4	2.1	2.5	66200	24	4.9	0.68	0.025	14200	48.5	0.33	12700	410	0.8	3200	7	55	125	210	29.5
R214408	260	0.9	64	3.9	1.9	2.3	72900	23.5	4.3	0.65	0.025	15500	42.5	0.3	20500	650	2.2	13300	8	48.5	135	350	27.5
R214409	145	0.4	15.5	0.77	0.45	0.48	31000	15	0.65	0.15	0.025	2700	6.5	0.1	3250	65	3.7	2500	7.5	6.5	14	75	12
R214410	125	1	15.5	0.77	0.45	0.3	10500	28	0.75	0.14	0.025	5600	9.5	0.1	4750	35	2.2	2850	8	8.5	8	60	13
R214411	175	0.5	16	0.73	0.4	0.3	10200	9	1.05	0.12	0.025	4350	14	0.07	2550	70	3.3	1850	6	14	12	60	16.5
R214412	260	0.2	19.5	3.2	1.65	1.35	12900	16	8	0.44	0.05	10900	90	0.22	1600	55	2.9	1250	9	130	29	280	44
R214413	230	1	48	3.6	1.75	1.9	24400	25	6.5	0.55	0.05	19800	70	0.25	2250	90	3.6	1950	9.5	89	35	400	34
R214414	320	2.8	105	5.5	2.7	2.7	63100	24.5	6	0.91	0.025	29300	58	0.43	10800	550	2.3	4250	8	72	91	430	27
R214415	240	0.9	52	5.5	2.9	2.6	52200	25	9.5	0.89	0.025	30100	93	0.4	13400	500	4.1	16000	8	145	79	380	39.5
R214416	250	0.5	41.5	3.9	2.1	2.7	55700	20	4.4	0.68	0.025	24300	44	0.33	11500	500	3.2	18600	6.5	49	57	300	25
R214417	200	0.4	15	1.1	0.65	0.68	15400	4.9	0.9	0.21	0.025	1350	6.5	0.12	2900	110	3.5	1450	9	9	12	60	7
R214418	91	0.6	15.5	0.64	0.4	0.24	10900	33	0.6	0.12	0.025	3100	6.5	0.08	4850	40	3.5	2700	11.5	6	6	40	11
R214419	165	0.5	14	0.64	0.35	0.29	7350	10	0.95	0.11	0.025	2750	11	0.07	1900	45	3	1100	5.5	12.5	8	45	14.5
R214420	200	0.2	19.5	2.4	1.3	1.65	8750	16	4.7	0.37	0.025	10300	93	0.21	1150	45	3.4	1100	6.5	65	16	480	43
R214421	200	0.2	88	1.95	1	2.1	33300	19.5	4.3	0.29	0.05	24600	83	0.14	1350	50	3.1	2300	8	58	24	650	39
R214422	310	1	110	4.7	2.5	2.9	60000	24.5	7	0.78	0.05	27000	93	0.39	7400	400	2.1	7200	8.5	85	44	600	32
R214423	250	1.2	60	5.5	2.7	2.8	52500	21	6	0.92	0.025	25700	50	0.39	14500	480	1.4	13200	7	65	110	240	26.5
R214424	105	0.3	30	0.51	0.3	0.53	92700	18	0.4	0.1	0.025	1850	3.1	0.07	3800	320	1.6	1350	8	3.5	115	70	6
R214426	21	0.7	120	1.3	0.75	0.91	14100	5.5	1.35	0.26	0.025	2950	12.5	0.11	8400	50	0.9	1150	3.5	13.5	11	95	10.5
R214427	23	0.4	1400	1.2	0.8	0.48	6750	8.5	1	0.27	0.025	2700	11	0.17	6400	20	4.8	2650	8	10	13	60	12.5
R214428	18	0.7	33.5	0.73	0.55	0.3	5900	20.5	0.55	0.17	0.025	2150	8.5	0.13	3250	20	2.9	2350	10	6	4	40	8
R214429	18	1.2	74	0.49	0.35	0.28	7200	46.5	0.5	0.1	0.025	5150	9.5	0.07	4650	25	1.1	2950	6.5	6	5	50	16.5
R214430	26	3.9	33	0.76	0.5	0.37	11300	24	0.8	0.16	0.05	10100	15	0.11	5900	20	0.9	3850	9.5	9.5	5	55	25.5
R214431	23	3	42.5	0.77	0.5	0.38	11700	20	0.85	0.16	0.05	10800	15.5	0.12	6450	25	0.8	3700	8	10	6	60	23
R214432	28	3.2	38.5	0.94	0.65	0.46	14700	23	1	0.2	0.05	10900	18.5	0.14	6450	35	1.1	3900	9.5	12.5	8	70	22.5
R214433	36	3.2	54	1	0.65	0.44	19400	25.5	1.05	0.2	0.15	8550	19	0.14	5250	30	2.1	3350	9	11.5	10	65	21.5
R214434	40	0.3	48	0.66	0.4	0.36	5850	7	1.25	0.11	0.025	2650	19.5	0.08	800	30	0.9	800	5.5	17.5	6	40	16.5
R214435	58	0.3	38	3.1	1.7	1.35	7050	16	5	0.55	0.025	8550	63	0.24	1800	30	1.2	1800	8	67	13	90	43.5
R214436	94	0.4	37.5	1.7	0.9	1.05	22500	22	2.6	0.3	0.05	20400	52	0.14	3000	35	3.6	3050	6	32.5	26	165	41.5
R214437	86	1.7	21.5	3.3	1.55	2.5	8100	26	5.5	0.54	0.1	32200	67	0.2	2700	25	1.5	2800	6.5	67	23	185	36
R214438	92	4	25.5	3.1	1.4	2.5	8000	23.5	5.5	0.47	0.025	31600	87	0.17	5500	25	1.6	3150	6.5	65	21	210	48
R214439	110	1.5	53	2.5	1.25	1.75	12800	21.5	4.7	0.41	0.1	24100	87	0.16	3550	40	4.1	2000	5	57	19	170	44.5
R214440	105	2	43.5	2.8	1.45	1.85	10200	20	4.4	0.48	0.025	29300	58	0.21	6150	30	1.8	2800	6	51	14	165	33.5
R214441	87	2.5	60	2.5	1.35	1.7	9200	18.5	3.7	0.44	0.025	28800	47.5	0.2	7050	45	0.5	2900	6.5	43.5	15	150	33
R214442	600	10	135	4.1	2.3	2.6	57900	16.5	3.9	0.84	0.025	15600	36	0.34	63200	550	1.3	18900	5.5	35.5	600	1100	45

Appendix Table A9.1: Chemical data.

Number	Pr	Rb	S	Sb	Se	Sm	Sr	Tb	Te	Th	Ti	Tl	Tm	U	V	W	Y	Yb	Zn
units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
techique	icpms	icpms	icpoes	icpms	icpms	icpms	icpoes	icpms	icpms	icpms	icpoes	icpms	icpms	icpms	icpoes	icpms	icpms	icpms	icpms
detn limit	0.05	0.1	500	0.5	0.5	0.02	2	0.02	0.2	0.02	10	0.1	0.05	0.02	2	0.1	0.05	0.05	0.5
R208913	1.65	22	<500	<0.5	<0.5	1.05	31	0.14	<0.2	5.5	2050	<0.1	0.05	0.36	41	0.4	5.5	0.45	22.5
R208914	1.7	21	<500	<0.5	<0.5	1.05	27	0.15	<0.2	6	2250	<0.1	0.05	0.36	48	0.4	5.5	0.45	22.5
R208915	2.1	26	<500	<0.5	<0.5	1.25	32.5	0.19	<0.2	7	2250	0.1	0.1	0.44	53	0.5	7.5	0.6	26
R208916	2.2	26.5	<500	<0.5	<0.5	1.35	35.5	0.2	<0.2	7	2300	0.1	0.1	0.4	50	0.5	7.5	0.65	26
R208917	2.1	23.5	<500	<0.5	<0.5	1.3	34.5	0.19	<0.2	7	2200	0.1	0.1	0.39	53	0.5	7	0.6	22.5
R208918	2.4	24	<500	<0.5	<0.5	1.5	46	0.23	<0.2	7	2750	0.1	0.1	0.51	61	0.8	8.5	0.75	21.5
R208919	2.2	29	<500	<0.5	<0.5	1.4	31.5	0.21	<0.2	7	2350	0.1	0.1	0.44	53	0.6	7.5	0.65	28.5
R208920	2.3	26	<500	<0.5	<0.5	1.4	36.5	0.2	<0.2	7	2300	0.2	0.1	0.44	52	0.6	8	0.65	28
R208921	1.8	23	<500	<0.5	<0.5	1.15	32	0.17	<0.2	5.5	2050	0.1	0.1	0.37	46	0.5	7	0.55	21.5
R208922	2.3	24	<500	<0.5	<0.5	1.45	33.5	0.2	<0.2	6.5	2150	0.2	0.1	0.41	49	0.5	7	0.6	23
R208923	2	24	<500	<0.5	<0.5	1.3	36.5	0.19	<0.2	6.5	2200	0.1	0.1	0.47	58	0.5	7	0.6	24.5
R208924	2.4	27.5	<500	<0.5	<0.5	1.5	51	0.22	<0.2	8.5	2400	0.2	0.1	0.49	69	0.2	9	0.75	27.5
R208925	6.5	98	3300	<0.5	<0.5	3.6	185	0.53	<0.2	15.5	3350	0.5	0.3	1.25	100	2.5	24	1.9	76
R208926	2.3	23.5	<500	<0.5	<0.5	1.45	38.5	0.2	<0.2	7	2500	0.2	0.1	0.47	51	0.6	7.5	0.65	26
R208927	2.1	20.5	<500	<0.5	<0.5	1.25	30.5	0.17	<0.2	5.5	2200	<0.1	0.1	0.35	46	0.4	6	0.55	23
R208928	2.1	23.5	<500	<0.5	<0.5	1.25	41.5	0.18	<0.2	6	2150	0.2	0.1	0.42	50	0.6	7	0.55	21
R208929	2.3	24	<500	<0.5	<0.5	1.4	46	0.2	<0.2	6.5	2450	0.3	0.1	0.51	53	0.5	7.5	0.65	24
R208930	2.3	22.5	<500	<0.5	<0.5	1.4	61	0.2	<0.2	7	2500	0.2	0.1	0.49	64	0.4	8.5	0.7	22.5
R208931	2.3	22	<500	<0.5	<0.5	1.45	69	0.21	<0.2	6.5	2300	0.1	0.1	0.49	70	0.5	8.5	0.7	19.5
R208932	2.7	24	<500	<0.5	<0.5	1.65	81	0.24	<0.2	7	2600	0.1	0.1	0.58	66	0.6	9	0.8	21.5
R208933	2.6	23	<500	<0.5	<0.5	1.6	85	0.23	<0.2	8	2100	0.2	0.1	0.55	76	0.5	9	0.7	22
R208934	2.8	23.5	<500	<0.5	<0.5	1.75	87	0.26	<0.2	7	2200	0.1	0.1	0.55	69	0.5	9.5	0.75	20.5
R208935	3.2	25	<500	<0.5	<0.5	2	99	0.27	<0.2	8	2050	0.2	0.15	0.63	65	0.4	10.5	0.8	23
R208936	2.8	25.5	<500	<0.5	<0.5	1.7	96	0.26	<0.2	7	2150	0.2	0.15	0.59	63	0.4	10	0.85	22
R208937	3.8	19.5	500	<0.5	0.5	2.1	145	0.29	<0.2	10.5	1750	0.1	0.15	0.97	57	0.5	11	0.9	21
R208938	10.5	1.2	1050	<0.5	<0.5	3.9	130	0.53	<0.2	26.5	5850	<0.1	0.25	1.55	190	0.4	12.5	1.8	39
R208939	7	19	700	<0.5	0.5	3.9	190	0.4	<0.2	25.5	1550	0.1	0.15	2	52	0.5	12.5	0.9	23
R213512	6.5	17.5	800	<0.5	0.5	3	165	0.37	<0.2	20.5	2050	0.1	0.15	1.7	69	0.6	11.5	1.05	26.5
R213513	8	10	1000	<0.5	<0.5	3.7	185	0.43	<0.2	23	2200	<0.1	0.2	2.5	78	0.7	10.5	1.3	27.5
R213514	1.55	24.5	1350	<0.5	1	0.22	350	0.16	<0.2	4.3	1550	<0.1	0.1	1.95	42	0.5	6.5	0.55	20
R213515	1.3	15	1600	<0.5	1	<0.02	340	0.13	<0.2	2.8	1000	<0.1	0.05	2.1	32	0.2	5.5	0.4	15
R213516	1.35	14	600	<0.5	0.5	0.77	240	0.14	<0.2	2.9	1000	<0.1	0.05	0.53	27	0.3	5	0.45	11
R213517	1.7	30	900	<0.5	0.5	0.78	360	0.17	<0.2	1.4	1550	<0.1	0.1	2.6	48	0.9	5	0.55	23
R213518	2.2	25	1200	<0.5	1	0.66	390	0.2	<0.2	5	1700	<0.1	0.1	2.1	52	0.3	7.5	0.6	17.5
R213519	1.85	21	1600	<0.5	0.5	0.06	460	0.17	<0.2	3.9	1250	<0.1	0.1	1.9	38	0.3	6.5	0.5	15.5
R213520	2.9	1.4	1050	<0.5	<0.5	0.47	135	0.31	<0.2	48.5	4950	<0.1	0.15	2.6	750	1	9	1.05	7
R213521	2.7	1.5	950	<0.5	<0.5	0.05	165	0.27	<0.2	25.5	6250	<0.1	0.15	1.4	210	1.3	9.5	1.05	8.5
R213522	2	5	700	<0.5	<0.5	1.25	155	0.26	<0.2	37	4450	<0.1	0.15	2.7	420	1.1	8	0.9	7.5
R213523	1.9	20.5	1350	<0.5	1	0.28	290	0.22	<0.2	9	1650	<0.1	0.1	2.5	125	0.4	8	0.65	13.5
R213524	1.45	9	1150	<0.5	<0.5	0.61	290	0.18	<0.2	2.4	1000	<0.1	0.1	0.61	18	0.5	9	0.6	11.5
R213525	4.9	12.5	<500	1.5	1	3.3	41	0.5	0.5	80	9850	0.2	0.25	2.1	950	1.9	17	1.5	81
R213526	1.05	0.9	850	<0.5	<0.5	<0.02	51	0.2	<0.2	5	12500	<0.1	0.2	1.6	48	0.5	10	1.45	12
R213527	0.9	0.6	550	<0.5	<0.5	<0.02	23	0.23	<0.2	14.5	16100	<0.1	0.25	1.7	135	1.7	11.5	1.85	10.5
R213528	1	1	<500	<0.5	<0.5	0.11	24	0.2	<0.2	8	9850	<0.1	0.2	1.5	56	0.6	9.5	1.55	9.5
R213529	0.5	0.3	1050	<0.5	<0.5	<0.02	50	0.09	<0.2	7	5800	<0.1	0.1	0.85	64	1.5	3.8	0.7	2
R213530	0.35	0.8	<500	<0.5	<0.5	0.15	1.3	0.03	<0.2	1.15	800	<0.1	<0.05	0.15	11	0.3	0.7	0.1	2.5
R213545	4.1	14.5	900	<0.5	1	3.4	240	0.32	<0.2	9	3400	0.1	0.2	2.3	92	1.6	13.5	1.2	31.5
R213546	2.8	12.5	900	<0.5	0.5	2.4	230	0.22	<0.2	6	3400	0.1	0.15	1.8	88	1.4	8	0.9	15
R213547	1.5	8.5	600	<0.5	<0.5	1.3	220	0.13	<0.2	4.4	3800	<0.1	0.1	1.55	45	1	5	0.7	24.5
R213548	1.2	7	600	<0.5	<0.5	1	165	0.11	<0.2	4.9	5750	<0.1	0.1	1.45	44	1.4	5	0.8	17.5
R213549	0.5	5.5	750	<0.5	<0.5	0.42	67	0.06	<0.2	3.8	6850	<0.1	0.1	0.89	54	2.8	3.6	0.55	22
R213550	0.55	2.4	500	<0.5	1	0.49	48.5	0.09	<0.2	4.8	10100	<0.1	0.15	1.4	76	4.8	5.5	1.1	21.5
R213551	3.3	18.5	950	<0.5	0.5	2.7	300	0.26	<0.2	7	1850	0.2	0.15	1.9	49	0.7	10	1	25.5

Appendix Table A9.1: Chemical data.

Number	Pr	Rb	S	Sb	Se	Sm	Sr	Tb	Te	Th	Ti	Tl	Tm	U	V	W	Y	Yb	Zn
R213552	4.1	16.5	600	<0.5	1	3.1	200	0.3	<0.2	8.5	2550	0.1	0.2	1.75	115	1	10	1.15	22
R213553	2.2	9.5	550	<0.5	0.5	1.85	200	0.19	<0.2	5.5	3500	<0.1	0.15	1.55	69	1.3	7.5	0.9	23
R213554	1.85	9	600	<0.5	0.5	1.55	155	0.17	<0.2	5.5	5700	<0.1	0.15	1.35	73	1.4	7.5	0.9	16.5
R213555	1	8	<500	<0.5	0.5	0.81	93	0.11	<0.2	4.5	6500	<0.1	0.1	1.15	94	1.9	5.5	0.75	18.5
R213556	1.1	8.5	1000	<0.5	<0.5	0.81	200	0.1	<0.2	4.2	6100	<0.1	0.1	1.1	89	2	5	0.75	21
R213557	2.9	9.5	750	<0.5	1	2.9	150	0.3	<0.2	8	3550	<0.1	0.2	1.15	105	1.7	10.5	1.3	16
R213558	2.1	10.5	850	<0.5	0.5	1.9	170	0.18	<0.2	5	2800	<0.1	0.15	1.1	67	1.1	7.5	0.85	13
R213559	0.8	5.5	<500	<0.5	<0.5	0.68	105	0.08	<0.2	3.5	4400	0.1	0.1	0.82	39	1.1	4	0.55	25
R213560	1.15	7.5	<500	<0.5	<0.5	1.05	105	0.13	<0.2	5.5	6150	0.1	0.15	1.05	48	0.8	6.5	0.9	29
R213561	0.55	4	<500	<0.5	<0.5	0.51	66	0.08	<0.2	4.9	9000	<0.1	0.1	0.77	47	2.9	4.8	0.8	20
R213562	1.1	4.7	<500	0.5	<0.5	0.84	79	0.13	<0.2	6	11000	<0.1	0.15	1.05	69	3.1	7	1.2	15.5
R213563	5.5	41.5	700	<0.5	0.5	4	130	0.36	<0.2	10	4150	0.2	0.2	1	82	1.3	13.5	1.4	40
R213564	3.4	13.5	<500	<0.5	<0.5	2.3	105	0.2	<0.2	10	3800	0.1	0.15	0.83	63	1.4	8.5	0.9	25.5
R213565	2.7	2.9	<500	<0.5	<0.5	1.8	33.5	0.18	<0.2	6.5	3850	<0.1	0.1	0.53	23	4	7.5	0.75	12
R213566	1.5	1.1	<500	<0.5	<0.5	1.25	28.5	0.15	<0.2	8.5	6500	<0.1	0.15	0.82	36	3.2	7	1.05	21
R213567	4.1	3.5	<500	0.5	<0.5	3	43.5	0.34	<0.2	10.5	11800	<0.1	0.3	1.15	92	3.5	15.5	2.1	18
R213568	6	16.5	<500	0.5	<0.5	4.5	59	0.5	<0.2	10	10900	0.1	0.35	1.1	90	2.7	21.5	2.4	28.5
R213569	5.5	44	550	<0.5	<0.5	4	105	0.38	<0.2	11	3700	0.2	0.25	0.85	80	1.1	14.5	1.45	53
R213570	3.5	13.5	<500	<0.5	<0.5	2.7	100	0.26	<0.2	12.5	4200	0.1	0.2	0.95	75	1.4	10	1.15	52
R213571	1.55	3.5	<500	<0.5	<0.5	1.35	48	0.15	<0.2	11.5	4700	<0.1	0.15	0.88	36	2.4	6	0.9	24.5
R213572	3	3.2	<500	<0.5	<0.5	2.1	35.5	0.25	<0.2	4.8	7000	<0.1	0.25	0.82	48	2.7	12	1.55	20.5
R213573	1.3	2.1	<500	<0.5	<0.5	0.94	38.5	0.11	<0.2	7	5900	<0.1	0.15	0.87	38	2.7	6	0.95	19
R213574	5	21.5	<500	<0.5	<0.5	4.8	220	0.59	<0.2	6.5	5850	0.1	0.4	1.2	61	2.5	22	2.7	34
R213575	1.1	3.6	<500	<0.5	<0.5	1.25	69	0.12	<0.2	6.5	3800	<0.1	0.1	1.05	63	1.3	5	0.85	27.5
R213576	0.95	3.4	1100	<0.5	<0.5	0.78	185	0.08	<0.2	7	2800	<0.1	0.1	1.2	40	1.4	4.3	0.6	15.5
R213577	1.2	3.1	<500	<0.5	<0.5	0.92	68	0.11	<0.2	7.5	4050	<0.1	0.1	0.75	35	1.6	4.9	0.85	12.5
R213578	1.5	2.9	550	<0.5	<0.5	0.92	49.5	0.11	<0.2	6.5	8900	<0.1	0.15	0.74	64	2.2	5.5	0.9	16
R213579	2.6	7.5	700	<0.5	<0.5	1.75	59	0.19	<0.2	6.5	7800	<0.1	0.2	0.78	55	4	9.5	1.4	28
R213580	6	26.5	<500	<0.5	<0.5	3.6	82	0.32	<0.2	7	6300	0.1	0.2	0.8	73	1.9	14	1.35	22.5
R213581	2.1	18.5	1350	<0.5	0.5	2	550	0.16	<0.2	3.8	1250	0.1	0.1	1.85	29	0.4	7	0.6	24.5
R213582	2.6	16	1200	<0.5	<0.5	2.4	450	0.21	<0.2	6	1850	0.1	0.15	1.9	40	0.6	8.5	0.8	19
R213583	1.7	5.5	650	<0.5	<0.5	1.35	230	0.15	<0.2	3.6	3050	<0.1	0.15	1.3	39	0.9	7.5	0.9	18
R213584	0.95	3.9	950	<0.5	<0.5	0.8	130	0.11	<0.2	4.8	5250	<0.1	0.15	1.1	105	3.1	5.5	0.9	16
R213585	1.05	7.5	850	<0.5	0.5	0.71	600	0.11	<0.2	6.5	11200	<0.1	0.15	2	140	3.6	6.5	1.2	18
R213586	1.95	16	550	<0.5	<0.5	1.25	54	0.14	<0.2	7.5	9650	<0.1	0.2	1.75	125	5	7	1.35	29.5
R213587	2.6	11.5	1150	<0.5	<0.5	2.3	400	0.18	<0.2	4.7	2150	<0.1	0.1	2	37	0.9	6.5	0.75	21.5
R213588	4.9	7.5	750	<0.5	<0.5	4.1	320	0.4	<0.2	8.5	3250	<0.1	0.25	1.65	43	1.3	12.5	1.5	24
R213589	4.2	5.5	<500	<0.5	<0.5	3.4	210	0.35	<0.2	5.5	2850	<0.1	0.25	1.1	71	1.2	14.5	1.65	13
R213590	0.7	2	<500	<0.5	<0.5	0.57	41	0.1	<0.2	5.5	6900	<0.1	0.1	0.98	87	2.9	3.7	0.65	14
R213591	0.8	2	<500	<0.5	<0.5	0.6	29.5	0.12	<0.2	7.5	9550	<0.1	0.1	0.94	90	3.1	4.8	0.85	7
R213592	0.9	3.4	<500	<0.5	<0.5	0.67	32.5	0.13	<0.2	9.5	11800	<0.1	0.15	1.2	82	6	5.5	1	10.5
R213593	3.1	4.7	<500	1	2.5	2.7	22.5	0.44	0.6	12.5	3600	0.1	0.25	2.3	600	12.5	12.5	1.5	320
R213594	2.1	14	1100	<0.5	<0.5	1.9	440	0.24	<0.2	4.5	1800	0.1	0.1	1.8	42	0.7	7.5	0.7	13.5
R213595	1.45	8.5	800	<0.5	<0.5	1.3	430	0.17	<0.2	3.3	2350	0.1	0.1	1.4	35	0.7	6	0.6	8
R213596	1.8	6.5	<500	<0.5	<0.5	1.35	135	0.21	<0.2	8	7100	0.1	0.15	1.2	94	2.6	7	1.15	27
R213597	1.35	9	850	0.5	<0.5	0.91	61	0.16	<0.2	8.5	12000	<0.1	0.15	1.1	125	4.1	6.5	1.1	20
R213598	1.4	9	<500	<0.5	<0.5	0.91	40	0.15	<0.2	8.5	8300	<0.1	0.15	0.89	84	2.8	5	0.95	9.5
R213599	1.45	17.5	750	<0.5	0.5	0.91	42	0.13	<0.2	7	4750	0.1	0.1	0.98	77	2.2	4.5	0.75	7
R213600	2.2	11.5	1050	<0.5	<0.5	1.8	550	0.23	<0.2	5	1850	0.1	0.1	2.7	32	0.7	6.5	0.7	20
R213601	3.7	11	750	<0.5	<0.5	3.1	320	0.47	<0.2	9.5	6500	0.1	0.25	1.7	66	1.9	15	1.75	18
R213602	1.95	11	<500	<0.5	<0.5	1.35	100	0.22	<0.2	8.5	8500	<0.1	0.15	1.4	105	2.6	8	1.2	22
R213603	2.1	26	1250	<0.5	<0.5	1.35	125	0.19	<0.2	7.5	7100	0.1	0.15	1.2	97	2.9	6	1	28.5
R213604	1.2	24	550	<0.5	<0.5	0.76	34.5	0.09	<0.2	2.6	3050	0.2	0.05	0.7	55	1.3	2.4	0.45	12
R213605	1.65	22	650	<0.5	<0.5	1	33	0.11	<0.2	4.4	3250	0.2	0.05	0.63	51	1.3	3	0.45	17
R213606	1.6	9	1400	<0.5	<0.5	1.6	470	0.19	<0.2	4.4	2950	<0.1	0.1	2	37	1.3	6	0.7	11.5
R213607	2.2	12	550	<0.5	<0.5	1.8	230	0.28	<0.2	8.5	5750	0.1	0.15	1.5	57	1.8	9	1.1	32

Appendix Table A9.1: Chemical data.

Number	Pr	Rb	S	Sb	Se	Sm	Sr	Tb	Te	Th	Ti	Tl	Tm	U	V	W	Y	Yb	Zn
R213608	1.9	16.5	900	0.5	<0.5	1.35	170	0.2	<0.2	8.5	10200	0.1	0.15	1.45	125	3.5	7	1.25	24.5
R213609	1.55	18.5	<500	<0.5	<0.5	1	51	0.15	<0.2	7	7300	0.2	0.15	1	105	3.4	5.5	0.9	15
R213610	1.7	22.5	550	<0.5	<0.5	1	32.5	0.13	<0.2	3.6	3400	0.2	0.1	0.61	57	1.3	3.4	0.6	8.5
R213611	1.8	23	800	<0.5	<0.5	1	32.5	0.11	<0.2	3.9	3150	0.2	0.1	0.63	58	2	2.9	0.55	10.5
R213612	1.05	8.5	2050	<0.5	<0.5	0.88	420	0.12	<0.2	7	2250	<0.1	0.05	2.6	43	0.7	3.8	0.45	12
R213613	1.05	4.8	1200	<0.5	<0.5	1	120	0.17	<0.2	8	6600	<0.1	0.15	1.2	55	3.5	6	1.1	16
R213614	0.75	7.5	550	<0.5	0.5	0.6	49	0.12	<0.2	6.5	7750	0.1	0.1	1.1	61	7.5	4.4	0.85	17
R213615	0.9	10.5	500	<0.5	0.5	0.61	56	0.09	<0.2	3.5	3650	<0.1	0.05	0.63	67	1.7	2.5	0.5	15.5
R213616	1.55	18	<500	<0.5	1.5	0.95	36.5	0.11	<0.2	4.8	2800	0.1	0.05	0.59	68	1.5	3.1	0.5	16.5
R213617	1.6	29	500	<0.5	1	0.96	40.5	0.12	<0.2	5	3500	0.2	0.1	0.67	89	1.9	3.7	0.65	19
R213618	1.95	24	850	<0.5	<0.5	1.4	290	0.19	<0.2	6	2400	0.2	0.1	1.55	56	0.8	6	0.65	14.5
R213619	1.8	19.5	1050	<0.5	0.5	1.25	155	0.18	<0.2	6	2800	0.2	0.1	1.1	85	1.3	6	0.7	14
R213620	2.2	14.5	<500	<0.5	1	1.4	41	0.15	<0.2	10	3250	0.1	0.1	0.91	140	2.7	4.1	0.6	12.5
R213621	3.4	7.5	<500	<0.5	<0.5	2.2	20.5	0.16	<0.2	14.5	4150	<0.1	0.05	0.84	45	2.9	2.8	0.45	13
R213622	3.9	4.1	<500	<0.5	<0.5	2.5	18	0.16	<0.2	17.5	3200	<0.1	0.05	0.77	28	1.9	2.5	0.35	11
R213623	4.3	13.5	800	<0.5	<0.5	3	31.5	0.24	<0.2	24	3650	0.1	0.1	1.5	120	1.3	6	0.9	24.5
R213624	3.7	12.5	1250	<0.5	<0.5	3.3	290	0.35	<0.2	10.5	4300	0.2	0.2	1.75	63	1.6	9.5	1.25	17.5
R213625	11	14	550	<0.5	<0.5	7	150	1.25	<0.2	17.5	3100	0.2	0.55	1.7	80	1.1	37	3.3	15
R213626	7	12	6350	<0.5	<0.5	4.4	65	0.53	<0.2	21	3200	0.1	0.3	2	110	1.6	11.5	2	15.5
R213627	5	6.5	2550	<0.5	<0.5	3.3	30	0.28	<0.2	17.5	4500	<0.1	0.15	1.3	130	1.8	6	0.95	16.5
R213628	7	7	1600	<0.5	<0.5	4.4	24	0.35	<0.2	18	5150	<0.1	0.15	1.35	150	1.7	6.5	1.05	16.5
R213629	10.5	18	3150	<0.5	1	6	195	0.44	<0.2	25	6350	0.1	0.15	1.8	200	1.7	7.5	1.05	22.5
R213630	3.3	18	2100	<0.5	<0.5	2.5	350	0.29	<0.2	10	2100	0.2	0.1	1.9	54	0.5	7	0.8	19.5
R213631	5	13	3150	<0.5	0.5	3.6	270	0.35	<0.2	17	2900	0.2	0.15	1.7	88	0.4	7.5	0.85	16
R213632	12.5	6	16800	<0.5	0.5	9	210	1.5	<0.2	24	3400	0.2	0.7	2.9	150	0.5	42	4.4	19.5
R213633	8.5	4.7	4000	<0.5	1	5.5	28	0.38	<0.2	27	5850	0.1	0.1	2.1	220	0.9	5.5	0.8	26
R213634	7.5	4.6	1700	<0.5	1.5	4.8	17.5	0.33	<0.2	23.5	5200	<0.1	0.1	2	220	1	4	0.75	22
R213635	16	16.5	950	<0.5	1.5	9.5	91	0.4	<0.2	45	7600	0.1	0.1	2.5	410	1.2	5.5	0.9	41.5
R213636	6	36.5	1250	<0.5	0.5	3.7	210	0.3	<0.2	14	7800	0.3	0.15	2.2	370	0.7	9.5	1	35
R213637	6	21	850	<0.5	0.5	3.7	84	0.33	<0.2	13	3350	0.3	0.2	1.85	110	0.9	10	1.25	36.5
R213638	8	8.5	650	<0.5	0.5	5	46	0.24	<0.2	21	4200	0.1	0.1	1.85	150	1.3	3.9	0.65	27.5
R213639	18	4.7	3050	<0.5	2	11	33.5	0.48	<0.2	56	6200	0.1	0.15	3.1	200	1.3	6.5	1.05	32.5
R213640	10	3.7	2950	<0.5	3	6	25	0.31	<0.2	28	9450	<0.1	0.1	2.5	450	1.1	4.9	0.8	49.5
R213641	12	5.5	1200	<0.5	1.5	7	10	0.39	<0.2	24.5	8500	<0.1	0.1	2.4	500	1.3	6	0.9	31.5
R213642	1.1	8.5	900	1.5	1.5	0.99	13.5	0.11	<0.2	30	6450	<0.1	0.1	5.5	300	14	2.7	0.55	24
R213643	5.5	45.5	750	<0.5	<0.5	3.7	220	0.34	<0.2	11.5	3550	0.3	0.2	2.1	145	1	10	1.25	36
R213644	10.5	34.5	650	<0.5	<0.5	5.5	210	0.39	<0.2	18.5	6150	0.3	0.15	2	140	0.8	10	1.1	49.5
R213645	9.5	6	5250	<0.5	<0.5	6	105	0.57	<0.2	14	5200	0.1	0.3	2	160	0.9	21	2.1	19.5
R213646	6.5	14.5	11400	<0.5	<0.5	4.1	40	0.26	<0.2	17.5	5150	<0.1	0.15	1.95	150	1.3	7	1.1	18.5
R213647	7.5	25	6150	<0.5	<0.5	4.5	24.5	0.25	<0.2	18	4850	0.1	0.1	1.65	145	1	6.5	0.85	17.5
R213648	8.5	26	4050	<0.5	1	5	23.5	0.26	<0.2	25	4950	0.1	0.1	1.6	190	1.1	6.5	0.9	24
R213649	4.2	30	1500	<0.5	<0.5	3	280	0.25	<0.2	8.5	2600	0.2	0.15	2.4	105	0.6	7.5	1	28.5
R213650	8.5	22	650	<0.5	<0.5	5	130	0.3	<0.2	21	5650	0.2	0.1	2.2	160	0.8	7.5	0.85	29
R213651	11.5	4.8	<500	<0.5	0.5	7	67	0.66	<0.2	19	6450	0.2	0.35	2.4	240	0.7	22.5	2.5	25
R213652	10.5	4.9	800	<0.5	1	6	28	0.35	<0.2	22.5	6850	<0.1	0.15	2.1	280	1.2	8	1.25	27
R213653	9.5	16.5	550	<0.5	1	6	23.5	0.44	<0.2	20	6950	0.1	0.25	2.1	300	2.1	10.5	1.75	35.5
R213654	8	12.5	1650	<0.5	<0.5	4.9	500	0.47	<0.2	18	5650	<0.1	0.3	2.5	190	2.8	14	2.1	33
R213655	3.5	31	900	<0.5	<0.5	2.5	230	0.25	<0.2	7	2750	0.2	0.15	2.1	85	0.6	8.5	0.95	26.5
R213656	5.5	45	<500	<0.5	<0.5	3.7	145	0.39	<0.2	11.5	4200	0.3	0.2	1.45	165	0.9	15.5	1.45	35
R213657	12.5	24.5	<500	<0.5	0.5	8	100	1.05	<0.2	21.5	5100	0.2	0.6	2.5	270	0.9	40.5	4.1	33
R213658	12	6.5	<500	<0.5	0.5	7	29.5	0.56	<0.2	23	6800	0.1	0.35	2.3	240	0.9	15	2.3	21
R213659	12.5	12.5	<500	<0.5	0.5	7	20	0.42	<0.2	22	5950	<0.1	0.2	2.1	170	1	9.5	1.5	14.5
R213660	12.5	11.5	<500	<0.5	0.5	7	22.5	0.41	<0.2	26	6500	<0.1	0.2	2.2	185	0.9	9.5	1.35	18.5
R213661	7	27.5	700	<0.5	<0.5	5	210	0.37	<0.2	18.5	3350	0.2	0.2	2.3	110	0.7	11.5	1.25	29
R213662	9.5	14	<500	<0.5	<0.5	6	170	0.36	<0.2	18	3850	0.2	0.15	2.2	110	0.6	8.5	1.2	35.5
R213663	12	9	<500	<0.5	<0.5	7	135	0.73	<0.2	13.5	4600	0.2	0.45	2.5	125	0.6	22.5	3	43

Appendix Table A9.1: Chemical data.

Number	Pr	Rb	S	Sb	Se	Sm	Sr	Tb	Te	Th	Ti	Tl	Tm	U	V	W	Y	Yb	Zn
R213664	8	8.5	<500	<0.5	<0.5	5.5	51	0.57	<0.2	9.5	5150	0.2	0.4	1.65	160	1	19	2.6	39.5
R213665	13.5	9.5	<500	<0.5	<0.5	8	45	0.77	<0.2	16	6100	0.2	0.45	1.9	210	1.1	25	3.3	58
R213666	15	6.5	<500	<0.5	0.5	9	38	0.89	<0.2	19.5	6250	0.1	0.55	2.2	220	1.3	26.5	4	58
R213667	3.4	23	950	<0.5	<0.5	2.8	300	0.23	<0.2	6.5	2250	0.1	0.15	2.3	69	0.5	7	0.85	16
R213668	4.3	35.5	850	<0.5	<0.5	3	220	0.22	<0.2	10.5	3450	0.2	0.1	2.1	97	0.6	7.5	0.85	20.5
R213669	6	31	550	<0.5	<0.5	4.2	98	0.43	<0.2	11	4100	0.2	0.25	1.8	135	0.9	16.5	1.8	21
R213670	11.5	17	<500	<0.5	<0.5	6.5	87	0.48	<0.2	16	6050	0.2	0.25	1.85	165	1.3	11.5	1.65	22
R213671	9.5	11.5	<500	<0.5	<0.5	5.5	52	0.32	<0.2	17	5400	0.1	0.15	1.75	145	1.2	7	1.1	20
R213672	7	13.5	<500	<0.5	<0.5	4.3	28	0.31	<0.2	18	5050	0.1	0.15	2.6	130	1.5	7.5	1.15	14.5
R213673	2.4	21	1250	<0.5	<0.5	2.1	550	0.16	<0.2	6	1850	0.1	0.1	1.95	68	0.5	6	0.6	30
R213674	4.7	43	9150	<0.5	<0.5	3.4	420	0.33	<0.2	8.5	2500	0.3	0.2	2.3	94	0.5	13.5	1.3	22.5
R213675	6	61	9050	<0.5	0.5	3.7	145	0.25	<0.2	10	3900	0.4	0.15	2.6	135	1.1	6.5	1	18.5
R213676	5.5	55	950	<0.5	<0.5	3.6	86	0.2	<0.2	15	4600	0.4	0.1	1.6	155	1.9	5	0.75	20.5
R213677	8	94	<500	<0.5	0.5	4.8	140	0.25	<0.2	20	5950	0.6	0.1	1.4	165	1.6	5.5	0.85	16
R213678	9	110	<500	<0.5	0.5	5.5	125	0.27	<0.2	27.5	4900	0.7	0.1	1.4	130	2.1	6	0.8	25
R213679	3.3	49	1600	<0.5	<0.5	2.4	500	0.2	<0.2	9.5	2200	0.3	0.1	2.3	105	0.6	6	0.75	28
R213680	9	82	1350	<0.5	0.5	6.5	240	1.05	<0.2	17.5	2500	0.6	0.6	1.75	160	0.8	32.5	3.4	39.5
R213681	8	94	2000	<0.5	1	5	120	0.6	<0.2	29.5	3800	0.9	0.3	2.2	280	1.7	13.5	1.65	40
R213682	7.5	120	4900	<0.5	1	4.3	195	0.35	<0.2	31.5	3750	1.1	0.15	2.2	250	2.6	6	0.9	44.5
R213683	5	135	1300	<0.5	2	2.9	130	0.23	<0.2	20.5	4100	1.3	0.1	1.7	175	2.4	4.6	0.65	45
R213684	7.5	175	3050	<0.5	3	4.3	220	0.33	<0.2	25	5150	1.3	0.15	1.6	180	2.1	5.5	0.9	65
R213685	3.7	37.5	1600	<0.5	0.5	2.4	320	0.2	<0.2	8.5	1500	0.3	0.1	1.7	44	0.8	5	0.55	7
R213686	3.7	46	900	<0.5	<0.5	2.5	220	0.32	<0.2	7	1850	0.3	0.15	1.35	65	0.9	8	0.8	5.5
R213687	3.4	45	26200	<0.5	<0.5	2.1	150	0.28	<0.2	8	2100	0.3	0.15	1.15	95	1.4	6	0.75	7.5
R213688	3.8	51	7550	<0.5	<0.5	2.3	50	0.24	<0.2	10	2200	0.3	0.15	1.25	75	1.7	6	0.75	10
R213689	3.7	105	650	<0.5	<0.5	2.4	30	0.22	<0.2	9.5	4150	0.7	0.15	0.96	110	1.7	4.7	0.8	12
R213690	4.7	82	700	<0.5	<0.5	3.1	34	0.25	<0.2	11.5	3900	0.5	0.15	0.87	105	1.1	5.5	0.9	7
R213691	2.6	105	<500	8	<0.5	1.4	52	0.16	<0.2	4.2	1200	0.6	0.1	0.84	80	3.5	5	0.65	13.5
R213692	6	12	13700	<0.5	<0.5	4.4	220	0.66	<0.2	14.5	2950	0.3	0.45	1.6	97	1	21.5	2.3	12.5
R213693	9.5	5	11500	<0.5	1.5	6	155	0.48	<0.2	23.5	5450	0.2	0.25	2.5	250	1.1	10.5	1.4	23.5
R213694	6.5	4.3	2250	<0.5	1.5	3.9	350	0.24	<0.2	20	5050	<0.1	0.1	1.6	250	1.5	3.8	0.7	19.5
R213695	10	3.7	1850	<0.5	1	6.5	41	0.34	<0.2	21	8350	<0.1	0.15	2	250	1.4	4.5	0.85	30.5
R213696	8	2.2	1850	<0.5	2.5	5	24.5	0.31	<0.2	16.5	9350	<0.1	0.15	1.9	280	1.8	4.8	0.95	54
R213697	9	8	1000	<0.5	1	5.5	9	0.27	<0.2	13.5	4850	<0.1	0.1	1.35	135	2	4.3	0.75	32
R213698	4.2	11.5	2150	<0.5	1	2.2	270	0.22	<0.2	7.5	2100	0.2	0.1	1.75	49	0.6	5.5	0.65	9.5
R213699	6.5	13.5	1900	<0.5	0.5	3.9	185	0.49	<0.2	11	2700	0.2	0.2	1.35	68	0.6	12.5	1.15	19.5
R213700	9.5	6.5	800	<0.5	<0.5	5.5	59	0.45	<0.2	15	3350	0.2	0.2	1.45	120	0.8	10	1.25	9
R213701	10	7	600	<0.5	<0.5	6	22	0.26	<0.2	20	4250	<0.1	0.1	1.5	165	1.9	4.6	0.6	7.5
R213702	12.5	9.5	650	<0.5	0.5	8	24	0.33	<0.2	25	5450	<0.1	0.1	1.35	150	2.1	5	0.7	13.5
R213703	8.5	10.5	650	<0.5	1	5	13.5	0.29	<0.2	19.5	4200	<0.1	0.1	1.45	110	2.5	5	0.6	9.5
R213704	6	18.5	800	<0.5	<0.5	3.6	230	0.3	<0.2	10.5	2600	0.9	0.1	1.85	61	1	6.5	0.7	12
R213705	6	26	1550	<0.5	0.5	3.1	175	0.3	<0.2	10	3000	0.3	0.15	1.2	105	0.7	8.5	0.85	16
R213706	7.5	18	1300	<0.5	0.5	4.4	74	0.49	<0.2	12.5	3800	0.3	0.25	1.2	130	1.1	16	1.65	15
R213707	11	12.5	500	<0.5	0.5	6.5	23.5	0.28	<0.2	31.5	4700	0.2	0.1	1.85	165	1.4	4.2	0.55	17
R213708	12.5	11.5	600	<0.5	1	7.5	22.5	0.32	<0.2	24.5	5800	0.2	0.1	1.55	175	2.1	4.1	0.6	16
R213709	14	16.5	600	<0.5	1.5	8.5	23	0.4	<0.2	34	7200	0.2	0.1	2.2	230	3.2	4.5	0.7	18.5
R213710	5.5	17.5	1100	<0.5	1.5	3.1	280	0.37	<0.2	7.5	1950	0.3	0.15	2.1	64	0.9	10	0.9	19
R213711	10	10	1250	<0.5	0.5	6	230	0.64	<0.2	10	3500	0.3	0.25	1.35	96	6.5	19.5	1.5	7.5
R213712	7	9	1350	<0.5	1	4.6	120	0.49	<0.2	9	3900	0.3	0.3	1.3	160	1.9	13	1.55	15.5
R213713	9	10	550	<0.5	1	5.5	36	0.29	<0.2	19	3900	0.2	0.1	1.3	145	4	5	0.6	17.5
R213714	7.5	17	<500	<0.5	0.5	4.6	54	0.19	<0.2	16	5200	0.2	<0.05	1.15	125	1.8	2.8	0.4	17
R213715	9	32	<500	<0.5	1	5.5	81	0.25	<0.2	22	5650	0.3	0.1	1.25	175	1	3.2	0.55	15.5
R213716	3.8	19	1050	<0.5	1	2.5	310	0.33	<0.2	5.5	2550	0.2	0.15	1.4	71	0.6	11	1	18.5
R213717	6.5	19	1350	<0.5	<0.5	4.2	270	0.33	<0.2	11	2600	0.2	0.15	1.45	74	0.5	10	0.9	13.5
R213718	7.5	13	850	<0.5	<0.5	4.8	185	0.43	<0.2	12	2600	0.2	0.15	1.4	80	0.4	10.5	1	14.5
R213719	9	6	550	<0.5	0.5	5	65	0.23	<0.2	20.5	4150	0.2	0.1	1.25	95	0.8	4.3	0.45	11.5

Appendix Table A9.1: Chemical data.

Number	Pr	Rb	S	Sb	Se	Sm	Sr	Tb	Te	Th	Ti	Tl	Tm	U	V	W	Y	Yb	Zn
R213720	20.5	11	650	<0.5	<0.5	12.5	33.5	0.4	<0.2	67	5250	0.2	0.05	1.8	105	1.3	3.9	0.4	6
R213721	18	32	700	<0.5	0.5	11	66	0.34	<0.2	52	6250	0.3	0.05	1.85	115	1.7	3.4	0.45	7
R213722	4.5	22.5	3100	<0.5	0.5	2.9	320	0.43	<0.2	7	4250	0.3	0.2	1.55	72	2.6	12	1.4	16
R213723	3.6	18	2650	<0.5	1.5	2.5	310	0.31	<0.2	7	3350	0.2	0.15	1.1	61	1.7	10	0.85	12.5
R213724	3.3	13.5	1150	<0.5	0.5	1.8	140	0.2	<0.2	4.8	3600	0.2	0.1	0.62	73	1.7	7	0.65	12.5
R213725	4.5	11	850	0.5	<0.5	3.2	135	0.26	<0.2	11	3550	0.2	0.15	1	80	2	7.5	0.85	10
R213726	5	7	500	<0.5	<0.5	3.7	97	0.26	<0.2	9.5	3750	0.1	0.15	1	78	1.4	7.5	0.8	9
R213727	9.5	6.5	<500	<0.5	<0.5	6.5	59	0.36	<0.2	20.5	4300	0.1	0.15	1.4	100	1.4	7.5	0.75	10.5
R213728	3.4	16	1700	<0.5	1.5	2	260	0.33	<0.2	8.5	2950	0.2	0.2	1.85	83	1	9.5	1.25	15
R213729	6	17	1350	<0.5	0.5	4.6	270	0.51	<0.2	11.5	3400	0.2	0.3	1.7	90	1.1	16	1.6	14
R213730	7.5	15	650	<0.5	0.5	6	220	0.58	<0.2	11.5	3050	0.2	0.3	1.3	97	0.8	16	1.75	13.5
R213731	7.5	16	<500	<0.5	<0.5	5.5	87	0.45	<0.2	13.5	3800	0.2	0.25	1.15	91	0.9	12.5	1.4	12.5
R213732	14	15	<500	<0.5	<0.5	10	62	0.37	<0.2	46	4500	0.2	0.1	1.65	100	1.5	4.3	0.65	5
R213733	7.5	12.5	550	<0.5	<0.5	5	58	0.24	<0.2	21	6000	0.2	0.1	1.75	105	1.4	4.2	0.55	10.5
R213734	3.6	26	<500	<0.5	<0.5	2.6	35.5	0.27	<0.2	11	3400	0.2	0.15	0.59	91	0.5	7	0.85	26.5
R213735	3.5	24.5	<500	<0.5	<0.5	2.6	36.5	0.27	<0.2	10	3750	0.2	0.15	0.6	89	0.5	6.5	0.85	27.5
R213736	4.7	42	<500	<0.5	<0.5	3.5	52	0.4	<0.2	11.5	4050	0.4	0.25	0.79	100	0.9	11.5	1.3	45
R213737	5	38.5	<500	<0.5	<0.5	3.9	54	0.41	<0.2	10.5	3950	0.3	0.2	0.69	83	0.7	11	1.35	42.5
R213738	2.4	18.5	<500	<0.5	<0.5	1.7	27.5	0.17	<0.2	8	2650	0.1	0.1	0.5	62	0.4	4.7	0.6	25.5
R213739	2.4	19.5	<500	<0.5	<0.5	1.65	30	0.18	<0.2	7	2900	0.2	0.1	0.53	53	0.5	4.9	0.65	24
R213740	0.7	4.9	1200	<0.5	1	0.06	150	0.09	0.2	4.7	7800	<0.1	0.05	1.35	250	2.8	2.9	0.5	20
R213741	3.4	30	<500	<0.5	<0.5	2.1	40.5	0.26	<0.2	9.5	3500	0.2	0.15	0.73	85	0.6	7.5	0.9	31.5
R213742	3.4	28	<500	<0.5	<0.5	2.5	35.5	0.25	<0.2	9	3300	0.2	0.15	0.66	62	0.6	6.5	0.85	28.5
R213743	3.5	27.5	<500	<0.5	<0.5	2.4	48.5	0.27	<0.2	9	4250	0.2	0.15	0.64	64	0.8	8	0.9	34.5
R213744	3.3	23	<500	<0.5	<0.5	2.3	45	0.28	<0.2	8	4250	0.2	0.15	0.67	74	0.8	7	0.95	31.5
R213745	4.1	27.5	<500	<0.5	<0.5	3.1	94	0.31	<0.2	10	3800	0.2	0.2	0.75	75	0.7	8	1	30
R213746	3.1	28	<500	<0.5	0.5	2.3	120	0.25	<0.2	7	3050	0.2	0.15	0.58	52	0.5	7.5	0.85	30
R213747	3.5	22	<500	<0.5	<0.5	2.4	41.5	0.26	<0.2	9.5	4150	0.2	0.15	0.76	81	0.9	8	1	26
R213748	4.5	26.5	<500	<0.5	<0.5	3.1	42	0.34	<0.2	11.5	5100	0.2	0.2	0.94	96	1.2	9	1.15	31
R213749	4.8	29	<500	<0.5	0.5	3.5	66	0.39	<0.2	11	5400	0.2	0.25	0.97	78	1.2	10.5	1.45	35
R213750	3.8	32.5	<500	<0.5	<0.5	2.7	53	0.32	<0.2	10	3450	0.2	0.2	0.62	91	0.6	8.5	1.05	39
R213751	3.8	25.5	<500	<0.5	<0.5	2.7	41	0.27	<0.2	10.5	2900	0.2	0.15	0.65	94	0.6	7.5	0.95	33.5
R213752	2.8	23.5	<500	<0.5	<0.5	2	33	0.2	<0.2	8.5	2900	0.2	0.1	0.49	61	0.5	6	0.7	40
R213753	2.7	18.5	<500	<0.5	<0.5	1.9	26	0.18	<0.2	8	2350	0.1	0.1	0.52	56	0.4	4.8	0.6	22
R213754	2	12.5	<500	<0.5	<0.5	1.25	19.5	0.11	<0.2	5.5	2100	<0.1	0.05	0.34	43	0.3	3.1	0.4	15.5
R213755	3	14.5	<500	<0.5	<0.5	1.95	26	0.16	<0.2	7.5	2300	0.1	0.1	0.51	49	0.4	3.9	0.5	29
R213756	2.8	23.5	650	<0.5	1	1.8	240	0.18	<0.2	7	1850	0.2	0.1	0.79	53	0.4	5.5	0.6	24
R213757	3.6	24	<500	<0.5	<0.5	2.5	47	0.26	<0.2	9	3700	0.2	0.15	0.6	56	0.9	7	0.9	30.5
R213758	4.1	30	550	<0.5	<0.5	3	180	0.32	<0.2	9.5	3200	0.3	0.2	1.15	55	0.7	9.5	1.15	39
R213759	3.6	25.5	<500	<0.5	0.5	2.6	115	0.26	<0.2	8.5	4650	0.2	0.15	0.78	59	1.2	8.5	0.95	29
R213760	3.2	25	<500	<0.5	0.5	2.2	73	0.27	<0.2	8	5700	0.2	0.2	0.81	63	2	9	1.2	32.5
R213761	3.3	21.5	<500	<0.5	0.5	2.1	66	0.35	<0.2	9	5050	0.2	0.25	0.77	67	1.7	10	1.25	27
R213762	3.4	24.5	<500	<0.5	<0.5	2.4	36	0.32	<0.2	10.5	5800	0.2	0.2	0.85	77	1.5	8	1.3	27
R213763	2.8	20.5	<500	<0.5	<0.5	1.9	27.5	0.19	<0.2	9.5	5550	0.1	0.15	0.64	66	1.2	6	0.85	27
R213764	2.1	17	<500	<0.5	<0.5	1.55	26	0.19	<0.2	7	3800	0.1	0.15	0.56	60	0.9	5.5	0.85	18
R213765	2.5	14.5	1300	<0.5	2	1.65	430	0.33	<0.2	3	1400	0.1	0.15	0.51	27	0.3	13.5	0.85	14.5
R213766	3.6	19.5	1350	<0.5	1	2.4	350	0.29	<0.2	5.5	2450	0.1	0.15	2.5	73	0.4	18.5	0.65	20.5
R213767	1.5	20	1250	<0.5	1.5	0.94	370	0.16	<0.2	2.7	1400	0.1	0.1	1.2	26	0.2	9.5	0.5	25
R213768	1.95	19.5	1300	<0.5	1.5	1.7	350	0.22	<0.2	4.2	1750	0.2	0.1	1.25	39	0.2	10.5	0.55	17
R213769	1.6	12.5	1400	<0.5	1.5	0.9	340	0.17	<0.2	1.95	1200	0.1	0.1	0.81	23	0.2	10	0.55	15
R213770	1.1	11	1450	<0.5	2.5	0.36	470	0.12	<0.2	2.2	1150	<0.1	0.05	1.2	20	0.2	6	0.35	9
R213771	1.35	9	1250	<0.5	1.5	0.19	470	0.17	<0.2	3.1	2400	0.1	0.1	1.35	27	0.6	8	0.7	11.5
R213772	1.65	17	2000	<0.5	2	0.41	410	0.15	<0.2	4.4	1700	0.1	0.1	3.4	32	0.2	7	0.45	19
R213773	2.2	23.5	1300	<0.5	1.5	0.76	410	0.21	<0.2	4.5	2200	0.2	0.1	2.8	43	0.4	9.5	0.6	18.5
R213774	2.1	17.5	1350	<0.5	1.5	1	320	0.23	<0.2	4.1	2550	0.1	0.1	0.91	54	0.3	12.5	0.6	17
R213775	2.4	20	1150	<0.5	2	1.8	340	0.25	<0.2	5	1400	0.1	0.15	1.45	31	0.2	12.5	0.75	24.5

Appendix Table A9.1: Chemical data.

Number	Pr	Rb	S	Sb	Se	Sm	Sr	Tb	Te	Th	Ti	Tl	Tm	U	V	W	Y	Yb	Zn
R213776	1.5	23	1450	<0.5	1.5	0.63	340	0.16	<0.2	3.9	1450	0.1	0.05	3.3	40	0.2	7	0.4	35.5
R213777	4	40	1100	<0.5	1	2.7	310	0.33	<0.2	8.5	2750	0.2	0.2	2.3	98	0.4	18	0.9	30
R213778	2.2	17	1000	<0.5	1	1.5	310	0.25	<0.2	5	3650	0.2	0.15	1.5	55	0.5	16.5	1	28
R213779	3.2	20	1050	<0.5	1.5	2.3	290	0.34	<0.2	6	2350	0.2	0.15	1.4	56	0.3	18.5	0.9	22
R213780	2	12.5	700	<0.5	1.5	1.35	300	0.21	<0.2	2.6	1000	0.1	0.1	0.38	24	0.1	11	0.5	8.5
R213781	3	33	650	<0.5	1	2.1	195	0.23	<0.2	8	2300	0.2	0.1	0.94	67	0.2	15	0.75	22.5
R213782	1.9	14.5	850	<0.5	1.5	1.45	460	0.19	<0.2	3.9	1000	0.2	0.1	0.68	20	0.1	9	0.55	12.5
R213783	2.3	42	1750	<0.5	1.5	<0.02	470	0.23	<0.2	8	1500	0.3	0.1	1.9	57	0.2	8	0.6	21
R213784	1.6	24	1300	<0.5	2	1	460	0.14	<0.2	3.8	1250	0.1	0.05	1.5	31	0.2	8	0.5	20
R213785	4.8	7.5	800	<0.5	0.5	3.6	250	0.27	<0.2	22.5	4450	0.2	0.15	2.1	140	0.3	18	1.05	20
R213786	2.9	11	900	<0.5	0.5	1.6	280	0.13	<0.2	7.5	2500	0.1	0.05	1.5	48	0.3	6	0.35	10
R213787	3	17	1200	<0.5	1.5	1.5	340	0.26	<0.2	8.5	2250	0.2	0.1	1.2	59	0.7	14	0.7	14
R213788	2.7	8	1300	<0.5	2	1.35	310	0.17	<0.2	6.5	1950	0.1	0.1	1.3	83	0.7	7	0.45	7.5
R213789	5	21	1100	<0.5	1	2.8	290	0.27	<0.2	15	3000	0.2	0.1	1.3	65	0.3	13.5	0.75	15
R213790	3.1	12	1250	<0.5	2	0.88	340	0.38	<0.2	9	6050	0.1	0.2	1.75	59	1.1	19	1.3	21
R213791	3.7	22.5	1000	<0.5	2	3.2	390	0.36	<0.2	4.7	1400	0.2	0.2	0.68	30	0.2	20	0.9	17
R213792	0.85	8.5	<500	1	1	0.94	16.5	0.1	0.2	29	9100	<0.1	0.05	5	750	7.5	3.4	0.4	37.5
R213793	0.2	0.6	<500	<0.5	<0.5	<0.02	14.5	0.05	<0.2	1.45	3800	<0.1	<0.05	0.47	17	0.5	1.95	0.25	3.5
R213794	0.7	0.7	<500	<0.5	<0.5	0.29	12.5	0.1	<0.2	2.1	4300	<0.1	0.05	0.64	15	0.4	3.9	0.45	6
R213795	0.45	1.2	<500	<0.5	<0.5	<0.02	20	0.09	<0.2	3.3	5000	<0.1	0.05	0.72	42	0.7	4.3	0.45	8.5
R213796	0.6	0.7	<500	0.5	<0.5	<0.02	19.5	0.11	<0.2	2.3	5400	<0.1	0.1	0.83	21	0.7	5.5	0.55	6.5
R213797	1.7	0.9	<500	<0.5	<0.5	1.65	17.5	0.25	<0.2	7	5750	<0.1	0.15	2.8	250	0.9	10.5	0.95	13.5
R213798	0.9	0.8	<500	<0.5	<0.5	0.34	19.5	0.13	<0.2	4	4900	<0.1	0.1	1.1	67	0.8	7	0.65	12
R213799	0.95	0.9	<500	<0.5	<0.5	0.53	23	0.15	<0.2	6	5400	<0.1	0.1	1.15	77	0.6	8	0.85	7
R213800	1.15	1.6	650	<0.5	<0.5	<0.02	32.5	0.17	<0.2	3.2	7700	<0.1	0.1	1.25	58	0.9	9.5	0.8	13.5
R213801	1.4	1.4	1050	<0.5	<0.5	1.4	43.5	0.29	<0.2	8.5	13100	<0.1	0.3	1.9	110	1.9	17.5	1.85	20
R213802	1.7	1.6	900	<0.5	<0.5	1.5	62	0.26	<0.2	5.5	7250	<0.1	0.15	1.35	64	1.3	12	0.95	15.5
R213803	1.05	1.1	800	<0.5	<0.5	0.67	45	0.18	<0.2	4.5	8300	<0.1	0.1	1.15	75	1.1	9.5	0.8	7.5
R213804	1.55	1.2	850	<0.5	<0.5	0.93	63	0.26	<0.2	8	11000	<0.1	0.2	1.95	105	0.9	13	1.25	17.5
R213805	2.1	1.6	600	<0.5	<0.5	1.8	56	0.27	<0.2	7.5	11700	<0.1	0.25	1.65	81	1.5	16	1.6	15
R213806	2.8	2.1	650	<0.5	<0.5	3	47.5	0.32	<0.2	9	11500	<0.1	0.3	2.1	88	1.8	16.5	1.7	21
R213807	2	1.3	550	<0.5	<0.5	1.25	41.5	0.28	<0.2	6.5	17800	<0.1	0.2	1.95	69	1	19	1.6	19.5
R213808	2.9	1.4	600	<0.5	<0.5	2.7	45.5	0.37	<0.2	6.5	13000	<0.1	0.25	1.95	72	1	22.5	1.55	38.5
R213809	3.2	1.4	650	<0.5	<0.5	2.5	46.5	0.46	<0.2	6.5	15200	<0.1	0.3	1.95	100	1.4	21.5	1.75	21
R213810	2.9	1.6	<500	1	<0.5	2.2	39.5	0.34	<0.2	6.5	10400	<0.1	0.2	1.25	58	1.2	19.5	1.55	36
R213811	3.4	0.8	<500	0.5	<0.5	2.3	26	0.43	<0.2	6.5	10700	<0.1	0.25	1.25	73	1.7	17.5	1.65	43
R213812	1.5	9	700	<0.5	1.5	1.1	280	0.2	<0.2	2.6	950	<0.1	0.1	0.34	21	0.2	11	0.6	22
R213813	2.3	10	650	<0.5	1.5	1.3	230	0.31	<0.2	2.2	950	0.2	0.15	0.43	18	0.4	11.5	0.7	14
R213814	2.9	10	1100	<0.5	1	2	390	0.34	<0.2	3.6	900	0.2	0.15	0.76	19	0.5	11	0.95	20
R213815	4.2	1.6	<500	<0.5	<0.5	2.5	43	0.55	<0.2	16	15800	0.2	0.45	2.4	135	4.6	25	2.7	30.5
R213816	2.7	1.1	<500	<0.5	<0.5	2	26.5	0.51	<0.2	11	13700	<0.1	0.3	1.65	81	3.9	22.5	2.8	20
R213817	2.2	0.7	<500	<0.5	<0.5	1.85	27	0.54	<0.2	14.5	19700	<0.1	0.35	2.1	110	4.6	25.5	3.5	34
R213818	1.9	1.6	<500	<0.5	<0.5	1	29.5	0.43	<0.2	10.5	13400	<0.1	0.35	1.7	79	3.5	20.5	3	28
R213819	1.5	1.2	650	<0.5	<0.5	0.69	32.5	0.32	<0.2	9.5	17900	<0.1	0.3	1.75	99	4.7	19.5	2.1	27.5
R213820	1.85	0.8	<500	<0.5	<0.5	0.9	23	0.47	<0.2	15.5	14600	<0.1	0.4	2.8	140	3.6	18	3.3	27.5
R213821	1.55	0.7	<500	<0.5	<0.5	1.05	23.5	0.44	<0.2	13	15400	<0.1	0.3	2.5	130	3.6	16	3.2	21.5
R213822	1.1	0.6	600	<0.5	<0.5	0.68	24.5	0.31	<0.2	15.5	17000	<0.1	0.25	2.8	140	5.5	11.5	2.4	18
R213823	1.1	1	600	<0.5	<0.5	0.74	26.5	0.29	<0.2	10	11400	<0.1	0.25	2.4	110	4.4	12.5	2.4	21.5
R213824	3.3	110	<500	8	<0.5	1.8	70	0.17	<0.2	5.5	1550	0.8	0.15	1.15	88	4.2	6	0.8	9.5
R213825	3.8	3.8	<500	1	2.5	2.7	33	0.34	0.4	56	4650	0.1	0.2	1.6	700	1.2	9.5	1.2	13.5
R213826	4.7	4.9	550	0.5	2	4	110	0.46	0.3	34.5	4000	<0.1	0.25	1.5	420	1.2	11.5	1.5	17.5
R213827	4.5	4.9	<500	0.5	1.5	3.1	36.5	0.46	0.3	39.5	4600	<0.1	0.3	1.65	470	1.3	12	1.45	15.5
R213828	4.9	8	<500	0.5	1.5	3.9	35	0.51	0.3	41	5600	0.1	0.3	2.3	550	1.5	13.5	1.75	15.5
R213829	3.2	3.4	<500	1	1	2.8	68	0.44	0.2	35	5150	<0.1	0.3	2.5	420	1.8	11	1.75	14
R213830	3.1	2.1	500	1	1	2.8	47.5	0.45	0.2	38	6200	<0.1	0.25	3.5	600	1.6	11	1.5	20.5
R213831	2.6	4.1	800	0.5	1	2.4	230	0.35	<0.2	10.5	4550	<0.1	0.2	1.05	115	1.4	11.5	1.2	21.5

Appendix Table A9.1: Chemical data.

Number	Pr	Rb	S	Sb	Se	Sm	Sr	Tb	Te	Th	Ti	Tl	Tm	U	V	W	Y	Yb	Zn
R213832	3	4.9	850	0.5	1	1.95	200	0.42	<0.2	17	7050	<0.1	0.25	1.5	200	1.8	13.5	1.75	23.5
R213833	6.5	4.3	600	2	2	5.5	71	0.71	0.3	61	6850	<0.1	0.35	1.75	850	1.8	16	2.4	26.5
R213834	9	3.4	800	2	2.5	7.5	87	0.83	0.5	65	5550	0.1	0.4	2.1	1150	1.7	17	2.5	23.5
R213835	6	9	850	0.5	1.5	4.7	200	0.68	<0.2	28.5	3050	<0.1	0.3	1.1	370	0.8	19	1.65	18.5
R213836	9.5	7.5	600	1	2	8	88	0.94	0.3	57	5250	0.2	0.45	2	600	1.7	18	2.6	24
R213837	7.5	7	<500	1.5	2	5.5	66	0.65	0.4	72	4150	0.1	0.35	1.95	800	3.4	15.5	1.95	22
R213838	5.5	8.5	650	1.5	1.5	4.3	200	0.62	0.4	63	3200	0.2	0.25	1.65	700	1.1	14	1.7	26.5
R213839	2.6	6	900	<0.5	1.5	1.6	230	0.26	<0.2	20	4300	0.1	0.15	1.15	220	2	9.5	1.1	15.5
R213840	3.8	5	<500	<0.5	1	2.9	69	0.43	<0.2	16.5	8800	<0.1	0.35	1.85	155	5.5	17	2	27.5
R213841	4.5	4.3	750	<0.5	2	3.6	340	0.55	<0.2	31.5	9200	<0.1	0.25	1.9	175	4.1	17.5	2.2	30.5
R213842	3	2.9	800	<0.5	1.5	2.2	220	0.34	<0.2	19	10600	<0.1	0.25	1.6	230	2.6	15.5	1.9	28
R213843	3	2.4	<500	<0.5	1	2.4	88	0.43	<0.2	17.5	11200	<0.1	0.35	1.65	165	2.2	20	2.4	26
R213844	2.6	4	<500	<0.5	1.5	2.2	120	0.38	<0.2	20.5	9400	<0.1	0.3	1.5	195	2	18	1.9	21.5
R213845	1.95	2.5	<500	0.5	1	1.4	45.5	0.37	<0.2	25	13900	0.1	0.3	2.2	270	5.5	13.5	2.7	27
R213846	3.5	2.1	<500	0.5	1	3	49.5	0.58	<0.2	39.5	10600	0.1	0.4	3.9	470	3.6	16	2.8	18.5
R213847	2	3.4	<500	0.5	1.5	1.65	16	0.35	0.6	10.5	3900	0.1	0.2	2.1	700	13.5	11	1.3	310
R213848	2.5	5	<500	<0.5	<0.5	1.8	44.5	0.24	<0.2	14	1700	<0.1	0.1	0.5	160	0.8	5	0.75	20.5
R213849	3.3	6	<500	0.5	0.5	2.2	23	0.34	<0.2	19	2550	<0.1	0.15	0.64	280	0.9	9	1.05	18
R213850	2.6	8	<500	<0.5	0.5	1.8	30	0.24	<0.2	16.5	2700	<0.1	0.1	0.54	290	0.6	9	0.8	19.5
R213851	1.35	2.3	<500	<0.5	<0.5	0.93	10	0.15	<0.2	7	1350	<0.1	0.05	0.27	105	0.3	3.5	0.4	11.5
R213852	1.25	2.8	<500	<0.5	<0.5	0.69	9.5	0.13	<0.2	6	1150	<0.1	0.05	0.28	69	0.3	2.9	0.35	20.5
R213853	2.6	2.7	<500	<0.5	<0.5	1.95	12.5	0.21	<0.2	14	1600	<0.1	0.1	0.55	155	0.6	4.8	0.65	22.5
R213854	1.95	2.6	<500	<0.5	<0.5	1.4	11	0.17	<0.2	12	1750	<0.1	0.1	0.44	155	0.5	4.1	0.55	17
R213855	1.75	3	<500	<0.5	0.5	1.2	71	0.19	<0.2	8.5	1600	<0.1	0.1	0.41	125	0.3	5.5	0.55	14
R213856	1.7	3.2	<500	<0.5	0.5	1.1	69	0.16	<0.2	7	1800	<0.1	0.1	0.51	100	0.4	5.5	0.5	12.5
R213857	3	4.4	<500	<0.5	<0.5	2.2	18.5	0.28	<0.2	15	2100	<0.1	0.1	0.73	210	0.5	6.5	0.85	17.5
R213858	3.8	4.9	<500	<0.5	0.5	2.6	35	0.36	<0.2	19	2450	<0.1	0.15	0.75	260	0.9	9	0.9	18.5
R213859	2.8	4.8	<500	<0.5	0.5	1.8	35	0.23	<0.2	12.5	2050	<0.1	0.1	0.65	220	0.4	8	0.65	15.5
R213860	3.6	4.9	<500	<0.5	0.5	2.7	24	0.3	<0.2	22.5	2300	<0.1	0.15	0.72	240	0.7	8	0.9	14.5
R213861	3.1	4.8	<500	<0.5	0.5	2.1	20	0.29	<0.2	20.5	2350	<0.1	0.15	0.89	230	0.7	7	0.9	22.5
R213862	2.5	4.1	<500	<0.5	0.5	1.95	17	0.26	<0.2	20	2050	<0.1	0.1	0.57	230	0.6	6	0.75	20.5
R213863	3.4	4.8	<500	<0.5	0.5	2.1	28	0.25	0.2	24	2100	<0.1	0.15	0.78	230	0.7	6.5	0.7	18
R213864	3.4	9	<500	<0.5	1	2.3	135	0.29	<0.2	15.5	1700	<0.1	0.15	0.68	125	0.5	7	0.8	23
R213865	2.2	11.5	<500	<0.5	<0.5	1.1	35	0.15	<0.2	8.5	1400	<0.1	0.05	0.45	82	0.6	5	0.5	17.5
R213866	2	7.5	<500	<0.5	<0.5	1.4	55	0.15	<0.2	8	1500	<0.1	0.05	0.32	69	0.6	4.8	0.4	21.5
R213867	1.75	3.5	<500	<0.5	<0.5	1.1	37.5	0.16	<0.2	6.5	1400	<0.1	0.05	0.47	68	0.5	4.3	0.5	13.5
R213868	1.3	2.8	<500	<0.5	<0.5	0.86	17.5	0.11	<0.2	6.5	1200	<0.1	0.05	0.29	69	0.4	3	0.3	12
R213869	1.2	5.5	<500	<0.5	<0.5	0.81	18.5	0.12	<0.2	9	1750	<0.1	0.05	0.34	125	0.7	3.4	0.4	15
R213870	1.3	2	<500	<0.5	<0.5	0.83	10	0.12	<0.2	9	1250	<0.1	0.05	0.28	87	0.5	3.1	0.4	80
R213871	9.5	7.5	750	1	2.5	7.5	96	0.9	0.4	55	5100	<0.1	0.45	2	900	1.6	19.5	2.7	25.5
R213872	8	8.5	700	1.5	2.5	8	83	0.77	0.5	61	5050	0.1	0.35	2.5	950	2.3	16	2.6	44
R213873	0.2	2.8	936	0.04	0.04	0.12	44	0.02	0.02	0.3	118	0.03	0.004	0.03	1.7	0.05	0.5	0.04	6
R213874	0.2	1.3	975	0.03	0.06	0.14	59	0.01	0.01	0.3	138	0.02	0.006	0.03	1.9	0.06	0.5	0.05	5
R213875	0.3	2.3	1499	0.03	0.13	0.23	36	0.02	0.01	0.5	213	0.03	0.013	0.04	3.0	0.06	0.8	0.07	9
R213877	0.2	1.4	1279	0.04	0.08	0.16	42	0.02	0.02	0.4	145	0.03	0.004	0.05	1.9	0.08	0.6	0.06	9
R213878	0.2	1.8	1123	0.04	0.07	0.13	49	0.01	0.01	0.3	148	0.03	0.004	0.03	1.9	0.09	0.5	0.04	7
R213879	0.2	2.0	1180	0.04	0.08	0.16	44	0.02	0.02	0.4	148	0.02	0.004	0.10	2.0	0.23	0.5	0.05	6
R213880	0.1	1.7	1038	0.03	0.06	0.10	55	0.01	0.01	0.2	118	0.02	0.003	0.02	1.6	0.06	0.3	0.03	5
R213881	0.1	1.9	974	0.04	0.04	0.09	39	0.01	0.02	0.2	110	0.01	0.004	0.02	1.3	0.05	0.3	0.03	4
R213882	0.3	2.5	1008	0.04	0.08	0.19	56	0.02	0.02	0.4	189	0.02	0.008	0.04	2.8	0.15	0.7	0.07	6
R213883	0.3	3.7	1223	0.04	0.09	0.22	65	0.02	0.02	0.5	215	0.03	0.009	0.05	3.1	0.16	0.8	0.08	6
R213884	0.3	3.3	1022	0.04	0.09	0.21	54	0.02	0.02	0.5	234	0.03	0.009	0.05	2.9	0.12	0.7	0.07	7
R213885	0.6	5.1	2057	0.07	0.14	0.43	68	0.05	0.03	1.1	474	0.05	0.027	0.09	6.5	0.30	1.6	0.15	11
R213886	0.4	2.9	893	0.04	0.04	0.27	28	0.03	0.02	0.6	263	0.04	0.018	0.05	3.7	0.12	1.0	0.10	8
R213887	0.3	2.0	943	0.04	0.04	0.19	54	0.02	0.02	0.4	171	0.03	0.008	0.04	2.3	0.15	0.7	0.06	6
R213888	0.5	3.5	1298	0.05	0.11	0.34	44	0.04	0.02	0.9	338	0.04	0.022	0.07	4.6	0.26	1.3	0.12	9

Appendix Table A9.1: Chemical data.

Number	Pr	Rb	S	Sb	Se	Sm	Sr	Tb	Te	Th	Ti	Tl	Tm	U	V	W	Y	Yb	Zn
R213889	0.2	1.7	1104	0.05	0.09	0.17	29	0.02	0.02	0.4	136	0.02	0.005	0.03	2.0	0.18	0.6	0.05	7
R213890	0.3	2.0	1474	0.04	0.08	0.19	50	0.02	0.02	0.4	180	0.02	0.008	0.04	2.4	0.19	0.7	0.06	8
R213891	0.3	1.5	1233	0.04	0.04	0.18	28	0.02	0.02	0.4	159	0.02	0.008	0.04	2.5	0.22	0.7	0.06	7
R213892	0.4	2.3	1155	0.04	0.07	0.30	31	0.03	0.01	0.7	257	0.03	0.014	0.06	3.7	0.36	1.0	0.09	9
R213893	0.4	1.8	1081	0.04	0.04	0.28	70	0.03	0.02	0.7	242	0.03	0.015	0.06	3.3	0.41	0.9	0.09	9
R213894	0.5	3.3	874	0.04	0.07	0.39	58	0.04	0.01	1.0	363	0.04	0.022	0.09	5.5	0.64	1.3	0.13	8
R213895	0.5	2.7	1075	0.05	0.05	0.36	45	0.04	0.02	0.9	318	0.04	0.019	0.08	4.9	0.45	1.2	0.12	9
R213896	0.4	2.3	950	0.04	0.04	0.26	41	0.03	0.02	0.6	190	0.03	0.008	0.05	2.8	0.46	0.8	0.07	7
R213897	0.5	2.2	1051	0.04	0.04	0.35	55	0.04	0.02	0.9	306	0.03	0.017	0.08	4.5	0.61	1.2	0.12	8
R213898	0.2	1.8	858	0.03	0.06	0.16	54	0.02	0.01	0.4	138	0.03	0.006	0.04	2.3	0.38	0.5	0.05	5
R213899	0.3	1.6	1121	0.04	0.04	0.19	43	0.02	0.02	0.5	161	0.03	0.008	0.04	2.5	0.32	0.6	0.06	8
R213900	0.2	1.5	867	0.04	0.04	0.14	34	0.01	0.01	0.3	125	0.03	0.004	0.03	1.6	0.19	0.4	0.04	5
R213901	0.2	2.0	1193	0.04	0.04	0.17	35	0.02	0.01	0.4	169	0.03	0.007	0.04	2.4	0.27	0.6	0.06	7
R213902	0.2	1.7	1025	0.03	0.06	0.14	41	0.02	0.01	0.3	133	0.02	0.006	0.03	2.0	0.24	0.5	0.05	6
R213959	2.3	10	650	0.5	<0.5	2.9	56	0.31	<0.2	14.5	12400	0.1	0.3	2.5	140	4.2	15	2.4	25
R213960	4.1	23.5	550	<0.5	0.5	3.2	230	0.38	<0.2	7	2550	0.2	0.2	0.75	54	0.7	18	1.25	26
R213961	4	25.5	550	<0.5	0.5	3.1	220	0.35	<0.2	8	2300	0.2	0.2	0.83	64	0.6	14	1.15	25.5
R213962	2.7	18	2300	<0.5	1	3.9	480	0.24	<0.2	4.5	1350	0.1	0.15	0.85	40	0.5	12	0.8	24.5
R213963	3.4	20.5	1750	<0.5	<0.5	3.5	470	0.29	<0.2	4.9	2250	0.2	0.15	2	73	0.8	15.5	1.1	16
R213964	2.7	20.5	1700	<0.5	<0.5	2.9	450	0.23	<0.2	5.5	1550	0.2	0.15	2	53	0.5	10	0.8	15.5
R213965	3.6	27	1400	<0.5	<0.5	3.1	450	0.32	<0.2	8.5	2400	0.2	0.2	2.1	91	0.9	16.5	1.2	18.5
R213966	4.4	29.5	1250	<0.5	<0.5	3.3	500	0.33	<0.2	7.5	1600	0.2	0.2	2.3	50	0.6	14	1.25	19
R213967	3.8	15.5	950	<0.5	<0.5	3.3	340	0.37	<0.2	16.5	4850	0.2	0.25	3.2	230	1.6	16.5	1.7	14.5
R213968	5	10.5	650	<0.5	<0.5	4.1	115	0.35	<0.2	17	5400	0.1	0.2	2.4	200	1.6	13	1.5	12
R213969	6.5	7.5	<500	<0.5	0.5	4.6	89	0.43	<0.2	17.5	6100	0.1	0.25	2.7	260	1.7	15	1.8	11.5
R213970	5.5	21	550	<0.5	<0.5	3.2	330	0.23	<0.2	11.5	3300	0.2	0.1	1.55	61	0.8	8	0.8	19.5
R213971	6.5	10	600	<0.5	1	4.3	135	0.28	<0.2	13	4050	0.2	0.15	1.6	125	1.1	9	0.95	11.5
R213972	7	6	<500	<0.5	<0.5	3.8	61	0.25	<0.2	13.5	5200	0.2	0.1	1.2	78	1.4	8.5	0.85	10.5
R213973	7	8	<500	<0.5	1	4.4	130	0.28	<0.2	14	4000	0.2	0.15	0.92	92	1.2	9	0.9	12
R213974	8	11.5	<500	<0.5	<0.5	5.5	57	0.6	<0.2	12	4150	0.2	0.3	1.05	86	2	22.5	2	12
R213975	9	2.6	<500	<0.5	<0.5	6	120	0.29	<0.2	26.5	2900	0.2	0.1	1.65	30	1.1	8	0.75	22.5
R213976	4.3	1.6	600	1	1	4.7	70	0.48	<0.2	42	4100	<0.1	0.3	7.5	700	1.6	9.5	1.9	4.5
R213985																			
R213986	3.7	26.5	1100	<0.5	0.5	2.5	270	0.24	<0.2	9.5	2600	0.2	0.15	1.2	53	1.5	9	0.9	28
R213987	3.8	11	850	<0.5	<0.5	2.6	310	0.17	<0.2	10.5	2400	0.3	0.1	2.1	58	0.6	5.5	0.5	14
R213988	2.9	19	1300	<0.5	<0.5	2.2	230	0.2	<0.2	9	2850	0.2	0.1	1.6	51	1.9	9	0.75	24.5
R213989	2.3	10.5	1350	<0.5	<0.5	1.8	490	0.15	<0.2	5	1250	0.2	0.1	3	31	0.5	5.5	0.55	9
R213990	2.6	12.5	850	<0.5	<0.5	1.65	330	0.12	<0.2	7	2100	0.3	0.05	1.45	56	0.7	4.8	0.35	5
R213991	5.5	13.5	1500	<0.5	<0.5	4.4	330	0.3	<0.2	12.5	2900	0.4	0.15	1.85	93	0.9	9	0.9	18.5
R213992	4.8	13	1050	<0.5	<0.5	3.3	240	0.29	<0.2	10	2600	0.4	0.15	1.2	85	0.8	10	0.85	12.5
R213993	6	12.5	1100	<0.5	0.5	4.7	260	0.38	<0.2	22	2450	0.3	0.15	1.9	130	0.8	11	1	24.5
R213994	5	14.5	1050	<0.5	<0.5	3.3	250	0.22	<0.2	12	2250	0.4	0.1	1.35	98	0.8	7	0.65	14.5
R213995	8	25	17200	<0.5	0.5	6	230	0.92	<0.2	14	3000	0.3	0.55	1.65	145	0.7	34	3.6	18.5
R213996	9	22.5	900	<0.5	<0.5	6.5	175	0.96	<0.2	19	3200	0.4	0.55	1.65	135	0.8	43	3.6	17
R213997	7.5	20	2550	<0.5	1	5.5	110	0.76	<0.2	21	3050	0.3	0.5	1.8	320	0.9	32	3.2	42
R213998	8.5	20.5	8650	<0.5	<0.5	5.5	115	0.63	<0.2	21.5	3250	0.3	0.35	1.7	150	1.4	27	2.4	17
R213999	11	46.5	1000	<0.5	1	6	35.5	0.38	<0.2	34.5	5650	0.3	0.15	3.7	330	0.8	9	1.1	30.5
R214000	5	16.5	1250	<0.5	<0.5	3	500	0.17	<0.2	16	2450	0.3	0.05	1.85	81	1.3	5	0.5	9.5
R214001	2.4	5.5	500	1	2	2	21	0.27	0.4	11	3050	0.1	0.2	2.4	650	10.5	13	1.3	340
R214036	3.3	25	<500	<0.5	<0.5	2.2	165	0.23	<0.2	7.5	2700	0.2	0.1	0.88	42	0.6	8.5	0.75	30
R214038	2.7	21	1000	<0.5	0.5	1.8	380	0.19	<0.2	5.5	1350	0.2	0.1	1.9	31	0.4	7	0.6	13.5
R214037	3.3	32.5	750	<0.5	<0.5	2.4	280	0.22	<0.2	9.5	1500	0.4	0.1	2	42	0.5	9	0.65	10.5
R214039	3.2	22	850	<0.5	<0.5	2.2	320	0.24	<0.2	8	1900	0.2	0.1	1.9	53	0.6	11.5	0.7	13
R214040	3.8	17	5300	<0.5	<0.5	2.5	390	0.24	<0.2	9	900	0.2	0.1	2.6	27	0.4	9	0.6	13.5
R214041	9	20.5	800	<0.5	<0.5	5	76	0.43	<0.2	19	3500	0.3	0.1	3.2	78	0.6	9.5	0.7	13
R214042	7.5	17	2650	<0.5	<0.5	4.5	165	0.42	<0.2	17.5	3000	0.3	0.15	2.8	72	0.5	11.5	0.85	17

Appendix Table A9.1: Chemical data.

Number	Pr	Rb	S	Sb	Se	Sm	Sr	Tb	Te	Th	Ti	Tl	Tm	U	V	W	Y	Yb	Zn
R214043	9.5	18.5	950	<0.5	<0.5	6.5	61	0.66	<0.2	23.5	3350	0.3	0.25	2.9	89	0.6	24.5	1.55	9
R214044	6	21	750	<0.5	<0.5	3.4	145	0.39	<0.2	11.5	2250	0.3	0.2	2	65	0.8	16	1.15	9
R214045	5.5	31	<500	<0.5	<0.5	3.1	84	0.32	<0.2	15	2200	0.5	0.15	2.5	60	1.2	13.5	0.9	11
R214046	7.5	51	<500	<0.5	<0.5	5	41	0.71	<0.2	13	2100	0.5	0.35	2	90	1.2	28.5	2.2	13
R214047	7	47.5	550	<0.5	<0.5	4	68	0.46	<0.2	14.5	2800	0.5	0.2	2.6	105	0.9	18	1.35	13
R214048	6.5	47	600	<0.5	0.5	4.1	42	0.31	<0.2	16.5	2950	0.4	0.1	2.5	145	1.3	9	0.8	16
R214049	3.7	19.5	144000	<0.5	<0.5	2.2	950	0.16	<0.2	9	1850	0.1	0.05	1	61	0.6	4.4	0.45	4
R214050	3.9	82	<500	<0.5	0.5	3	40.5	0.3	<0.2	12.5	3800	0.8	0.15	2.1	83	1.7	11.5	1	6.5
R214071	1.8	19	1600	<0.5	0.5	1.95	600	0.13	<0.2	4.2	1450	0.3	0.05	2.2	35	0.4	4.8	0.5	15.5
R214072	2.1	29	1300	<0.5	0.5	1.9	550	0.14	<0.2	6	1800	0.3	0.1	2.4	46	0.5	5.5	0.6	17.5
R214073	2.6	31	1300	<0.5	0.5	2.2	650	0.16	<0.2	6.5	1650	0.3	0.1	2	46	0.5	6.5	0.6	16
R214074	3.3	42	1050	<0.5	0.5	2.5	550	0.23	<0.2	10.5	2100	0.4	0.15	1.65	78	0.6	8	0.9	28
R214075	2.5	31	1350	<0.5	0.5	1.85	700	0.16	<0.2	7.5	2000	0.3	0.1	1.75	69	0.5	7	0.65	21.5
R214076	4.6	48.5	850	<0.5	0.5	3.3	320	0.29	<0.2	11	2800	0.4	0.15	1.35	82	0.7	15	1.1	22
R214077	6	58	800	<0.5	0.5	4.6	270	0.34	<0.2	16.5	3800	0.7	0.2	1.8	98	0.7	15	1.25	27.5
R214078	6.5	43	73300	<0.5	0.5	4.4	850	0.47	<0.2	12.5	2100	0.5	0.25	1.25	88	0.7	23.5	1.5	18
R214079	18.5	130	<500	<0.5	2	16	175	2.3	<0.2	46.5	3100	1.6	1.55	2.3	300	1.2	92	9.5	46
R214080	6	150	<500	<0.5	1.5	4.2	160	0.22	<0.2	37.5	3500	2.4	0.1	1.85	250	0.4	6	0.7	44.5
R214081	5.5	82	28400	<0.5	1.5	3.8	170	0.3	<0.2	31.5	3000	1.5	0.2	2.2	230	1.1	10.5	1.25	36
R214082	4.9	68	82200	<0.5	1	3.1	250	0.18	<0.2	20.5	2200	0.9	0.1	2.3	125	0.8	5	0.6	21.5
R214083	7	175	1550	<0.5	1.5	4.8	180	0.27	<0.2	33.5	3500	2.2	0.15	2.9	250	0.4	7	0.95	52
R214084	7	150	6950	<0.5	1.5	4.5	170	0.25	<0.2	30.5	3250	2.2	0.1	2.7	240	0.5	6	0.8	52
R214085	6.5	78	11800	<0.5	0.5	4.2	4100	0.2	<0.2	20.5	3900	1.4	0.1	2	95	0.4	4.6	0.6	24
R214086	3	25	700	<0.5	1	2.4	210	0.23	<0.2	7	2600	0.2	0.15	0.85	69	0.5	9.5	0.9	23
R214087	2.1	18.5	1500	<0.5	1	2.2	430	0.16	<0.2	3.5	1300	0.1	0.1	2.5	36	0.3	7.5	0.6	15
R214088	1.85	19.5	1850	<0.5	1	2.1	500	0.14	<0.2	4	1350	0.1	0.1	3.7	37	0.4	6	0.6	17
R214089	2.8	39	1000	<0.5	<0.5	2.1	350	0.2	<0.2	7	2300	0.3	0.1	2.7	61	0.7	10	0.8	30
R214090	2.6	32	1000	<0.5	<0.5	1.95	340	0.21	<0.2	6.5	2350	0.2	0.15	2	72	0.6	9	0.85	25.5
R214091	2.9	36.5	950	<0.5	<0.5	2.1	400	0.22	<0.2	8	2500	0.3	0.15	1.65	73	0.7	9	0.95	33.5
R214092	2.6	31.5	900	<0.5	<0.5	1.95	320	0.2	<0.2	8.5	4250	0.3	0.15	1.7	83	1.1	10	0.95	33.5
R214093	2.8	29	1300	<0.5	<0.5	2.7	380	0.22	<0.2	9.5	3650	0.3	0.15	1.7	91	1	9.5	0.95	29.5
R214094	3.7	31.5	1300	<0.5	<0.5	3.3	430	0.31	<0.2	8	2300	0.3	0.15	1.8	71	0.7	13	1.1	34.5
R214095	4.8	29	1250	<0.5	<0.5	4.1	330	0.34	<0.2	15	3650	0.3	0.2	1.8	94	0.8	12.5	1.25	25
R214096	5	17.5	850	<0.5	<0.5	3.7	230	0.26	<0.2	17.5	4550	0.3	0.15	1.8	115	0.6	9.5	0.9	22.5
R214097	5	17	650	<0.5	<0.5	3.6	170	0.27	<0.2	16.5	4750	0.3	0.15	1.55	120	0.6	8.5	1	26.5
R214098	6	10.5	650	<0.5	<0.5	4.5	150	0.27	<0.2	20.5	4750	0.3	0.15	1.75	110	0.4	8	0.95	19.5
R214099	4	20	650	<0.5	<0.5	3.6	120	0.28	<0.2	15	4150	0.3	0.15	1.3	110	1	9	1.1	10.5
R214100	6	4.4	900	<0.5	<0.5	3.8	23.5	0.24	<0.2	27	5550	<0.1	0.1	1.9	160	0.5	8.5	0.95	18
R214101	3.5	26	1450	<0.5	<0.5	2.8	270	0.21	<0.2	13	2850	0.3	0.1	2.1	77	0.6	7.5	0.75	21
R214102	6	7.5	<500	<0.5	<0.5	4.5	62	0.24	<0.2	26.5	4300	0.2	0.1	1.25	105	0.4	6	0.8	12
R214103	2.7	72	<500	9	<0.5	1.8	60	0.14	<0.2	6.5	700	0.7	0.1	1.15	82	3	5.5	0.75	3.5
R214104	2.5	26	750	<0.5	0.5	2.2	290	0.22	<0.2	9	2200	0.2	0.15	1.15	51	0.6	9.5	0.85	28
R214105	1.35	12	2000	<0.5	1	2.7	470	0.11	<0.2	5.5	1250	0.1	0.05	3.8	39	0.5	5	0.5	12
R214106	1.3	14	1500	<0.5	1	1.45	480	0.12	<0.2	6	1300	0.1	0.1	4.9	30	0.6	6	0.6	10
R214107	2.3	20.5	1500	<0.5	<0.5	2.6	490	0.22	<0.2	7	1650	0.2	0.15	3.7	50	0.5	10.5	0.9	26.5
R214108	2.3	26	1350	<0.5	<0.5	2.4	460	0.22	<0.2	9	2100	0.2	0.15	2.6	55	0.7	10.5	1	26.5
R214109	1.9	11	1100	<0.5	<0.5	1.95	430	0.2	<0.2	11	2800	0.1	0.15	2.1	47	0.8	8.5	0.9	9
R214110	2.5	14.5	1400	<0.5	<0.5	2.6	600	0.28	<0.2	8.5	2000	0.2	0.15	1.7	36	0.6	13	1.1	13.5
R214111	0.5	3.8	<500	<0.5	<0.5	0.62	83	0.07	<0.2	16.5	4150	<0.1	0.1	0.8	26	1.1	3.5	0.6	5
R214112	4	17.5	1400	<0.5	<0.5	3.9	650	0.45	<0.2	9.5	1700	0.2	0.25	2.1	31	0.7	23.5	1.7	15
R214113	1.6	4.3	<500	<0.5	<0.5	1.5	66	0.2	<0.2	15.5	4750	<0.1	0.15	0.78	40	1.2	9.5	1.1	5.5
R214114	0.7	7	650	<0.5	<0.5	0.68	36.5	0.1	<0.2	9	4450	<0.1	0.1	0.84	61	1.2	3.3	0.6	16.5
R214115	0.45	6.5	550	<0.5	<0.5	0.44	28.5	0.07	<0.2	10.5	5500	<0.1	0.05	0.84	80	1.4	2.8	0.55	10
R214116	0.55	2	<500	<0.5	<0.5	0.77	35.5	0.11	<0.2	11	10600	0.2	0.15	1.45	63	3.4	5	1.05	13
R214117	0.9	17	<500	<0.5	0.5	0.64	48.5	0.07	<0.2	5	4050	<0.1	0.05	0.7	71	1.1	2.7	0.5	9
R214118	3.2	15	<500	0.5	1.5	3.5	95	0.4	<0.2	35.5	5050	0.1	0.25	1.95	380	1.4	9.5	1.8	17.5

Appendix Table A9.1: Chemical data.

Number	Pr	Rb	S	Sb	Se	Sm	Sr	Tb	Te	Th	Ti	Tl	Tm	U	V	W	Y	Yb	Zn
R214119	2.2	19	<500	<0.5	<0.5	2.4	28	0.21	<0.2	8	4400	0.1	0.15	1	105	1	6	0.9	29.5
R214120	1.55	14.5	2050	<0.5	1	2.3	320	0.13	<0.2	2.4	1250	0.1	0.05	1.9	29	0.3	4.4	0.4	18
R214121	2.8	12.5	1450	<0.5	<0.5	2.4	290	0.19	<0.2	4.4	1950	0.1	0.1	2.3	42	0.5	4.9	0.65	11.5
R214122	1.15	8.5	1650	<0.5	<0.5	1.3	290	0.1	<0.2	2.1	1150	<0.1	0.05	3.8	43	0.4	3	0.35	15.5
R214123	0.9	6.5	1550	<0.5	<0.5	1.25	290	0.08	<0.2	1.95	1100	<0.1	0.05	3.9	35	0.4	2.5	0.3	6.5
R214124	3.2	9.5	1050	<0.5	<0.5	3.1	280	0.28	<0.2	4.9	2050	0.1	0.15	2.4	39	0.6	9	0.9	11.5
R214125	2.3	5	750	<0.5	<0.5	2.5	240	0.27	<0.2	3.9	1750	<0.1	0.15	1.15	27	0.5	8	0.85	6
R214126	3	5.5	800	<0.5	<0.5	2.4	290	0.23	<0.2	4.4	1700	<0.1	0.1	1.4	25	0.5	6.5	0.7	6.5
R214127	4.9	4.4	900	<0.5	<0.5	4.2	330	0.37	<0.2	4.8	2100	<0.1	0.15	1.25	29	0.6	8.5	1	4.5
R214128	3.3	4.4	750	<0.5	<0.5	2.7	270	0.24	<0.2	4.9	2300	<0.1	0.1	1.65	31	0.5	6	0.75	15
R214129	2.9	4.1	1000	<0.5	<0.5	2.5	380	0.22	<0.2	3	1050	<0.1	0.1	1.4	22	0.3	4.8	0.55	4
R214130	3.3	2.5	700	<0.5	<0.5	3.1	260	0.33	<0.2	4.2	2300	<0.1	0.15	1.3	33	0.5	7.5	0.9	3
R214131	4.1	3.2	650	<0.5	<0.5	4	260	0.42	<0.2	3.9	3300	<0.1	0.2	1.35	43	0.7	10.5	1.4	4
R214132	3.6	2.9	500	<0.5	<0.5	2.8	230	0.24	<0.2	2.1	2450	<0.1	0.15	1.15	24	0.5	6	0.85	6
R214133	3.4	4.7	<500	<0.5	<0.5	3.4	165	0.33	<0.2	4.2	2600	0.1	0.2	1.25	37	0.9	9	1.4	4.5
R214134	1.1	3.6	<500	<0.5	<0.5	0.99	28	0.1	<0.2	3.4	2700	<0.1	0.1	0.54	25	0.6	3.6	0.6	5
R214135	3.1	14	1200	<0.5	<0.5	3.1	300	0.29	<0.2	5	1600	0.1	0.15	1.85	63	0.4	8.5	0.9	15.5
R214136	3	21.5	1700	<0.5	<0.5	3.2	270	0.3	<0.2	3.8	1750	0.4	0.15	1.45	45	0.4	8.5	0.9	16.5
R214137	1.65	5.5	950	<0.5	<0.5	1.65	210	0.18	<0.2	2.5	1850	0.2	0.1	1.8	31	0.6	6	0.7	6
R214138	0.55	6.5	1350	0.5	<0.5	0.68	110	0.06	<0.2	4.7	9000	<0.1	0.05	1.5	270	3.1	2.3	0.35	21
R214139	1.5	9.5	1200	<0.5	<0.5	2.1	230	0.16	<0.2	2.5	1450	0.1	0.1	2.6	37	0.4	6	0.55	11
R214140	1.95	12.5	1100	<0.5	<0.5	2.3	200	0.22	<0.2	3.7	1600	0.2	0.1	2.6	47	0.4	8	0.7	8.5
R214141	1.35	12	1150	<0.5	<0.5	1.5	260	0.13	<0.2	3.5	1700	0.2	0.05	2.6	40	0.4	4.7	0.45	23.5
R214142	1.9	13	1450	<0.5	<0.5	2.1	320	0.18	<0.2	5	1500	0.1	0.1	3	56	0.4	5.5	0.6	22.5
R214143	4	22.5	650	<0.5	0.5	3.9	120	0.38	<0.2	8	3450	0.4	0.2	1.85	160	0.8	12	1.1	16
R214144	4.5	14	900	<0.5	<0.5	4.7	105	0.39	<0.2	5	6350	0.1	0.2	0.97	94	1.4	11.5	1.2	18
R214145	1.1	8.5	500	<0.5	<0.5	1.4	73	0.13	<0.2	3.4	4250	<0.1	0.1	0.71	89	1	4	0.55	12.5
R214146	1.35	14.5	1400	<0.5	<0.5	2.2	270	0.11	<0.2	3.3	3500	<0.1	0.05	0.94	60	0.8	3.3	0.45	10
R214147	0.85	8.5	600	<0.5	<0.5	0.89	170	0.09	<0.2	2.8	5050	<0.1	0.05	1.15	56	0.9	3.6	0.5	9.5
R214148	0.2	0.7	<500	<0.5	<0.5	0.39	17.5	0.04	<0.2	1.2	4800	<0.1	0.05	0.48	13	0.8	1.8	0.35	9
R214149	1.45	10.5	900	<0.5	<0.5	1.35	320	0.13	<0.2	3.4	3250	0.1	0.1	1.5	48	0.9	4.2	0.55	11.5
R214150	1.05	7	<500	<0.5	<0.5	1.05	140	0.11	<0.2	3.7	3700	<0.1	0.1	1.5	43	0.9	4.6	0.55	12
R214151	0.4	2.3	<500	<0.5	<0.5	0.49	30.5	0.07	<0.2	2.6	5750	<0.1	0.05	1.15	20	0.9	2.8	0.55	11
R214152	0.25	0.7	<500	<0.5	<0.5	0.3	10.5	0.05	<0.2	1.75	4950	<0.1	0.05	0.69	11	0.8	2	0.4	11
R214153	1.7	10.5	1000	<0.5	0.5	2	220	0.17	<0.2	6.5	2250	<0.1	0.1	2.1	100	0.8	5	0.6	11.5
R214154	0.7	3	500	<0.5	<0.5	1.1	59	0.07	<0.2	2.3	2500	<0.1	0.05	1.6	28	0.6	2.7	0.3	5
R214155	0.3	0.8	<500	<0.5	<0.5	0.42	17	0.05	<0.2	2.1	4350	<0.1	0.05	0.49	26	1.2	1.8	0.3	6
R214156	1.6	1.5	<500	<0.5	<0.5	1.1	5.5	0.08	<0.2	1.45	350	<0.1	<0.05	0.22	2	0.3	1.6	0.15	7
R214157	1.45	6.5	1350	<0.5	<0.5	1.35	310	0.12	<0.2	3.5	1100	<0.1	0.05	1.85	24	0.4	4.3	0.4	11.5
R214158	3.1	7.5	850	<0.5	0.5	2.9	190	0.3	<0.2	17	2550	<0.1	0.15	1.55	250	4.7	8	1.05	19.5
R214159	2.5	2.3	<500	<0.5	<0.5	2.6	36	0.29	<0.2	3.5	11600	<0.1	0.25	1.4	64	2.7	12	1.75	19
R214160	2.8	1.2	<500	<0.5	<0.5	2.9	28.5	0.35	<0.2	6.5	10500	<0.1	0.25	1.4	68	2.3	12.5	1.85	20.5
R214161	5.5	9.5	700	<0.5	1	5.5	69	0.68	0.3	20.5	7300	0.1	0.5	2.6	340	22.5	19	3.4	125
R214162	5	2.5	<500	<0.5	<0.5	3.7	25.5	0.34	<0.2	4.9	4250	<0.1	0.15	0.84	56	1.3	9	1	20
R214163	1.2	0.9	<500	<0.5	<0.5	0.87	5	0.08	<0.2	1.6	800	<0.1	<0.05	0.19	6	0.4	2.1	0.2	5
R214164	4.1	1.6	650	1.5	<0.5	4.6	58	0.47	<0.2	8.5	13900	<0.1	0.35	1.8	96	3	18	2.3	30.5
R214165	2.7	1.2	650	<0.5	<0.5	3.5	56	0.33	<0.2	5.5	12800	<0.1	0.25	1.65	59	2.4	13	1.9	33
R214166	7.5	7	1400	1.5	2.5	8	97	0.59	0.4	55	4600	0.2	0.25	2	950	1.4	12.5	1.75	37.5
R214167	1.5	4.5	3050	1.5	<0.5	1.05	29.5	0.12	<0.2	2.4	370	0.2	0.05	0.89	17	0.5	2.6	0.4	67
R214168	7	8	900	1	2	7	98	0.57	0.2	46	3650	0.2	0.3	2.4	550	1.2	12.5	1.8	42.5
R214169	4.4	3	<500	<0.5	<0.5	4	36.5	0.45	<0.2	5.5	6100	<0.1	0.25	1.4	76	1.9	14	1.8	40.5
R214170	2.9	0.9	800	<0.5	<0.5	3.6	59	0.32	<0.2	3.8	9350	<0.1	0.25	1.35	42	2.4	11.5	1.65	16
R214171	2.4	1.9	<500	<0.5	<0.5	2.2	23.5	0.21	<0.2	4.4	800	<0.1	0.1	0.4	45	0.3	7	0.65	11.5
R214172	1.25	1.5	<500	<0.5	<0.5	1	11	0.08	<0.2	3	1450	<0.1	<0.05	0.3	9	0.6	2.3	0.25	12
R214173	4	4.3	1250	1	3	4.9	88	0.36	0.4	71	5500	0.3	0.2	1.9	850	3.1	9.5	1.2	45.5
R214174	4.1	6.5	950	<0.5	0.5	3.8	230	0.42	<0.2	15	7850	<0.1	0.25	1.65	140	2.7	13.5	1.8	28.5

Appendix Table A9.1: Chemical data.

Number	Pr	Rb	S	Sb	Se	Sm	Sr	Tb	Te	Th	Ti	Tl	Tm	U	V	W	Y	Yb	Zn
R214175	3.5	1.9	<500	<0.5	<0.5	3.7	53	0.43	<0.2	9	16400	<0.1	0.35	2	110	5	17.5	2.5	31
R214176	4.6	1.3	<500	<0.5	<0.5	4.6	42.5	0.59	<0.2	12.5	19500	<0.1	0.45	2.1	125	5.5	22.5	3.3	52
R214177	2.3	8	1550	<0.5	<0.5	2.2	550	0.26	<0.2	3.9	2300	0.1	0.15	1.2	27	0.9	11	0.95	22
R214178	0.65	1.7	<500	<0.5	<0.5	0.5	5.5	0.04	<0.2	1.6	340	<0.1	<0.05	0.26	2	0.4	1.1	0.1	11.5
R214179	2.5	8	1300	<0.5	<0.5	1.75	470	0.18	<0.2	3.8	1750	<0.1	0.1	1.55	38	2.5	5	0.6	16.5
R214180	5.5	15.5	650	<0.5	2	5.5	97	0.6	0.4	18	2950	0.1	0.35	2.1	440	49	15	2.4	115
R214181	3.1	2.1	<500	<0.5	<0.5	3.1	37.5	0.36	<0.2	4.8	10900	<0.1	0.3	1.55	76	2.3	13	1.95	35.5
R214182	5.5	8.5	1000	1	2	5.5	170	0.48	0.3	44	3350	0.1	0.25	2.2	650	9.5	11	1.55	41
R214183	0.7	2.5	<500	<0.5	<0.5	0.61	6	0.06	<0.2	0.96	250	<0.1	<0.05	0.38	2	0.3	1.7	0.15	15
R214184	1.8	1.6	<500	<0.5	<0.5	2.2	42	0.22	<0.2	3	6600	<0.1	0.15	1	27	2	9	1.1	55
R214185	3.6	7	900	0.5	1	4.5	88	0.39	<0.2	19.5	5100	<0.1	0.25	1.5	400	1.6	12	1.5	40.5
R214186	2.6	7	1450	<0.5	<0.5	2.1	500	0.24	<0.2	5.5	1500	<0.1	0.15	1.5	34	0.9	10	1	20.5
R214187	6	9	1300	1	1.5	6.5	145	0.56	0.2	36.5	3300	0.1	0.3	2	750	1.1	12	1.9	31.5
R214188	0.85	3.4	500	<0.5	<0.5	1.2	91	0.08	<0.2	2.6	3100	<0.1	0.05	1.7	41	0.9	3.1	0.4	13.5
R214189	2.4	6	550	1	1.5	2.4	24	0.31	0.5	14	3450	0.1	0.2	2.8	700	13	12	1.35	370
R214190	0.5	4.5	1300	0.25	0.5	0.53	120	0.05	0.1	3.5	7400	0.05	0.025	0.98	230	3	2.1	0.3	21
R214191	3	17.5	900	0.25	0.5	2.6	210	0.19	0.1	9.5	3300	0.2	0.1	1.2	130	2.3	6	0.75	19.5
R214192	6.5	22.5	550	0.25	0.25	4.4	59	0.22	0.1	19.5	5750	0.2	0.05	1.35	155	2.4	4.3	0.5	13
R214193	9	115	250	0.25	0.25	6	130	0.5	0.1	22.5	4800	1.2	0.25	1.55	200	4.1	13	1.45	40
R214194	6	50	250	0.25	0.25	4.3	140	0.39	0.1	11	6250	0.5	0.25	0.77	175	1.1	11	1.4	38.5
R214195	10	115	250	0.25	0.25	7	270	0.71	0.1	19	4150	0.7	0.4	1.6	140	2	24	2.5	115
R214196	8.5	81	250	0.25	0.25	5.5	240	0.46	0.1	14.5	3350	0.6	0.25	1.15	80	1.4	14	1.65	82
R214197	3.5	12.5	650	0.25	0.25	2.9	105	0.2	0.1	9.5	4600	0.1	0.15	1	100	4.1	6	0.85	22
R214198	6	37.5	250	0.25	0.25	4.2	105	0.2	0.1	15.5	4050	0.3	0.05	1.15	77	4.4	4.7	0.4	16
R214199	6.5	130	250	0.25	0.25	4.8	175	0.31	0.1	16.5	3850	1	0.15	1.5	130	3.8	7.5	0.95	42
R214200	10	110	250	0.25	0.25	7	270	0.69	0.1	15.5	4150	0.7	0.4	1.2	115	5	21.5	2.5	63
R214201	10.5	120	250	0.25	0.25	7	260	0.65	0.1	17.5	4700	0.7	0.4	1.65	125	6.5	24	2.4	82
R214202	5	16	900	0.25	1	4	220	0.33	0.1	12	5000	0.2	0.2	1.3	150	1.2	12	1.2	17
R214203	7.5	8	600	0.25	1	4.9	39.5	0.23	0.1	21	5700	0.05	0.05	1.3	135	1.8	3.5	0.45	19
R214204	8	68	500	0.25	0.5	5	115	0.26	0.1	27.5	4700	0.6	0.1	1.4	125	1.3	4.6	0.6	32.5
R214205	10.5	105	250	0.25	0.25	6.5	210	0.4	0.1	23.5	5350	0.8	0.2	1.7	160	1.3	8.5	1.45	83
R214206	10.5	100	250	0.25	0.25	6.5	230	0.76	0.1	18.5	5550	0.7	0.55	2	170	4.7	28.5	3.4	120
R214207	11.5	93	250	0.25	0.25	7.5	300	0.82	0.1	24	4500	0.5	0.5	1.95	115	2.7	38.5	3.1	95
R214208	4.5	56	700	0.25	0.5	3.2	130	0.18	0.1	14	4450	0.5	0.1	1	170	1.9	5	0.55	22
R214209	5	125	700	0.25	1.5	3.6	140	0.2	0.1	19.5	3850	0.8	0.1	1.25	190	4.6	4.5	0.65	57
R214210	7	110	800	0.25	0.5	4.8	260	0.24	0.1	16.5	3900	0.6	0.1	1.15	135	1.6	4.4	0.7	80
R214211	7.5	125	250	0.25	0.25	5.5	330	0.41	0.1	13.5	4500	0.7	0.3	1.95	115	3	12	1.9	87
R214212	9.5	100	250	0.25	0.25	7	320	0.88	0.1	14	4050	0.5	0.6	1.45	105	1.8	40.5	3.8	96
R214213	8.5	11.5	600	0.25	0.5	5.5	105	0.38	0.1	25.5	4250	0.2	0.15	1.85	115	1.6	9.5	1.1	15.5
R214214	10.5	18	600	0.25	0.5	7	37.5	0.35	0.1	28.5	5600	0.1	0.15	1.95	165	1.6	5.5	0.95	71
R214215	10	95	550	0.25	0.5	7	120	0.56	0.1	15	5000	0.8	0.3	2	170	4	13.5	2.1	155
R214216	12	135	250	0.25	0.25	8.5	300	1.05	0.1	17	5050	0.7	0.65	1.3	155	6.5	41.5	4.1	120
R214217	11.5	135	250	0.25	0.25	8	320	0.74	0.1	21	3900	0.7	0.4	1.4	130	9	23.5	2.6	105
R214218	7	97	250	0.25	0.25	5.5	210	0.56	0.1	11.5	5300	0.7	0.3	1.3	180	1.3	18	1.8	110
R214219	0.6	5.5	1350	0.25	1	0.67	150	0.06	0.1	4	7900	0.05	0.05	1.15	230	3.2	2.8	0.4	17.5
R214220	8	14.5	550	0.25	1	5	21	0.25	0.1	24	5450	0.1	0.1	1.7	105	8.5	4.7	0.6	13
R214221	8.5	15.5	1300	0.25	2.5	5.5	47	0.28	0.1	25.5	5650	0.1	0.1	1.9	145	4.2	5	0.75	34.5
R214222	22.5	40.5	1000	0.25	0.5	16	76	0.71	0.1	84	8850	0.3	0.2	4.6	195	5	10	1.45	200
R214223	14	145	500	0.25	0.5	10	170	0.79	0.1	32.5	6550	2.5	0.45	2.6	220	2.1	24	2.8	195
R214224	10.5	150	250	0.25	0.25	7.5	180	0.72	0.1	21.5	6550	1.1	0.4	2	220	2.8	27	2.5	115
R214225	9	93	1650	0.25	0.25	6	290	0.57	0.1	14	4100	0.6	0.35	1.1	110	3.3	18.5	2.3	67
R214226	9.5	125	4600	0.25	0.5	6.5	270	0.46	0.1	23.5	4300	0.7	0.3	1.15	130	7	13.5	1.85	69
R214227	6.5	115	2050	0.25	0.25	5	240	0.39	0.1	17.5	3550	0.7	0.25	1.25	89	4.2	15.5	1.55	53
R214228	8	120	2450	0.25	0.25	5.5	280	0.35	0.1	22	3800	0.7	0.2	1.3	93	7	11.5	1.2	68
R214229	6.5	140	1000	0.25	0.25	5	220	0.41	0.1	16	5200	1	0.25	1.5	155	22	14.5	1.45	155
R214230	7	95	250	0.25	0.25	5	220	0.47	0.1	15.5	4150	0.6	0.3	1.7	105	6.5	17.5	1.9	77

Appendix Table A9.1: Chemical data.

Number	Pr	Rb	S	Sb	Se	Sm	Sr	Tb	Te	Th	Ti	Tl	Tm	U	V	W	Y	Yb	Zn
R214231	8	135	250	0.25	0.25	6	210	0.56	0.1	17.5	3950	1.1	0.3	1.5	145	3.8	19.5	1.95	98
R214232	8.5	120	250	0.25	0.25	6.5	230	0.64	0.1	15.5	4450	0.9	0.4	1.55	150	1.8	21.5	2.4	97
R214233	9	69	250	0.25	0.25	6.5	340	0.52	0.1	21	3550	0.6	0.3	1.55	120	6	14.5	1.8	98
R214234	6.5	9.5	12400	0.25	1	4.5	70	0.29	0.1	21	3400	0.2	0.1	1.65	115	2.1	7	0.6	36.5
R214235	10.5	23	1350	0.25	2	6.5	72	0.42	0.1	30	3200	0.2	0.1	2.4	140	2.3	7	0.95	38.5
R214236	9.5	84	250	0.25	0.5	6.5	33	0.59	0.1	18	2700	0.5	0.3	2	72	3.5	19	2.2	42.5
R214237	15.5	72	250	0.25	0.5	11.5	125	1.25	0.1	27	5700	3	0.6	2.6	140	2.7	33.5	4	370
R214238	14.5	90	250	0.25	1	10	135	0.95	0.1	23.5	4350	1.7	0.45	2.6	120	1.8	29.5	2.9	160
R214239	16.5	110	250	0.25	1	11.5	73	1.05	0.1	47.5	1650	0.8	0.45	2.3	125	2.1	27	3	79
R214240	7	68	250	0.25	0.5	5.5	56	0.56	0.1	12	1500	0.5	0.25	1.4	92	1.4	17.5	1.65	80
R214241																			
R214242	9.5	97	250	0.25	0.25	7	160	0.74	0.1	14.5	4300	0.7	0.4	1.8	130	2.4	23	2.7	100
R214243	9	81	700	0.25	0.25	7	145	0.73	0.1	17.5	4650	0.6	0.4	1.8	155	2.2	27	2.8	96
R214244	5.5	155	250	0.25	0.5	6	750	0.59	0.1	8	5750	1	0.3	1.1	155	2.4	21.5	2.1	78
R214245	7.5	90	1400	0.25	0.5	6	175	0.5	0.1	17.5	2750	0.7	0.25	2.5	89	3	15.5	1.9	87
R214246	5	99	1850	0.25	0.5	4.8	250	0.45	0.1	11	2650	0.8	0.25	1.65	77	2.2	14	1.6	67
R214247	7.5	84	1300	0.25	1	5.5	240	0.54	0.1	12	3150	0.6	0.3	1.35	100	1.8	16	1.95	90
R214248																			
R214249	10	53	3000	0.25	2	6.5	90	0.41	0.1	28.5	2800	0.5	0.1	2.9	110	1.8	7	0.95	51
R214250	11.5	110	900	0.25	0.5	8	165	0.49	0.1	23	4750	1	0.15	2	155	1.8	7.5	1.15	110
R214251																			
R214252																			
R214253																			
R214254																			
R214255	0.75	4.8	1400	0.25	1	0.88	150	0.08	0.1	4	8000	0.05	0.05	1.45	230	3.3	2.9	0.5	29.5
R214256	4.2	41	8300	0.25	1	3.4	250	0.31	0.1	11.5	3100	0.4	0.15	1.65	140	2.2	11	1.2	27.5
R214257																			
R214258	7	115	1050	0.25	1.5	5	100	0.33	0.1	24	3600	0.8	0.15	2.1	125	3.1	8	0.95	54
R214259	10.5	78	250	0.25	0.5	7.5	96	0.6	0.1	23.5	3750	0.7	0.25	3.5	85	1.3	15	1.95	94
R214260	11	99	250	0.25	0.5	8	89	0.86	0.1	26.5	3200	0.8	0.45	2.9	110	2.3	28	2.8	78
R214261	10	135	250	0.25	0.5	7.5	100	0.69	0.1	21.5	2850	1.1	0.35	1.8	135	3.2	21	2.4	100
R214262	9.5	130	250	0.25	0.25	7	105	0.67	0.1	17.5	3200	1.1	0.3	2	135	14.5	19	2	105
R214263																			
R214264	4.4	41.5	1250	0.25	0.5	3.4	240	0.31	0.1	10.5	2100	0.3	0.15	1.75	99	0.9	12.5	1.2	37.5
R214265	7.5	84	950	0.25	0.5	5.5	73	0.42	0.1	21.5	2650	0.6	0.2	1.5	115	1.4	10.5	1.65	19
R214266	5.5	105	900	0.25	0.25	4.2	47.5	0.28	0.1	19	2800	1.9	0.15	1.35	145	1.2	7.5	0.95	30
R214267	8.5	110	550	0.25	1.5	6	51	0.52	0.1	16	3000	2	0.25	2.1	145	1.9	11	1.65	125
R214268	11.5	105	250	0.25	0.5	8.5	155	0.97	0.1	17.5	3050	1.3	0.5	1.7	130	1.5	27.5	3.3	220
R214269	7.5	78	250	0.25	0.25	5.5	195	0.65	0.1	12	3500	0.8	0.4	1.45	110	2.1	22.5	2.9	110
R214270	5	21	600	0.25	0.5	4.1	105	0.36	0.1	15.5	3200	0.2	0.2	1.7	125	1.4	12	1.35	26
R214271	6.5	37.5	1400	0.25	0.5	5	36	0.31	0.1	20	4100	0.3	0.1	1.7	135	1.6	6.5	0.9	40
R214272	10.5	55	750	0.25	2	7	99	0.49	0.1	18.5	3500	1.2	0.2	2.3	155	24.5	9	1.4	145
R214273	10.5	86	250	0.25	0.25	8	150	0.86	0.1	16.5	3000	1.1	0.4	2.3	145	1.7	26	2.9	160
R214274	9	70	250	0.25	0.25	6.5	180	0.66	0.1	17	3600	0.7	0.35	1.5	135	1.4	21	2.3	92
R214275	9.5	75	250	0.25	0.25	7	195	0.76	0.1	14	3750	0.6	0.4	1.65	120	1.9	23	2.8	84
R214276	9	76	250	0.25	0.25	7	160	0.76	0.1	15	3900	0.7	0.4	1.55	145	1.5	22.5	2.7	115
R214283																			
R214284	0.6	4.3	1350	0.25	1	0.74	140	0.06	0.1	3.6	7100	0.05	0.025	1.35	230	3	2.3	0.3	25.5
R214285	6	13	1250	0.25	1	4.7	82	0.48	0.1	17.5	5500	0.2	0.25	1.75	170	1.1	15	1.6	43
R214286	9.5	3.5	1350	0.25	0.5	7	220	0.45	0.1	27	7800	0.05	0.2	2.3	195	1.8	9	1.35	47.5
R214287	13	23	550	0.25	0.5	9	86	0.98	0.1	20.5	5650	0.4	0.5	2.2	145	1.6	25.5	3.6	105
R214288	13.5	39	250	0.25	0.25	10	125	1.05	0.1	24	4750	0.5	0.45	1.9	130	1.6	25	3.1	105
R214289	11	76	250	0.25	0.25	8.5	75	0.92	0.1	17	5500	1.6	0.4	1.65	180	2	25	2.8	120
R214290	9.5	77	250	0.25	0.25	7.5	82	0.8	0.1	17.5	4750	1.2	0.4	1.5	130	1.8	24	2.9	115
R214291	8	76	250	0.25	0.25	6.5	185	0.63	0.1	18.5	5050	0.8	0.35	1.55	120	2.1	20	2.5	71
R214292	8.5	68	250	0.25	0.25	7	250	0.72	0.1	18	5000	0.7	0.4	1.7	110	2	22.5	2.9	66

Appendix Table A9.1: Chemical data.

Number	Pr	Rb	S	Sb	Se	Sm	Sr	Tb	Te	Th	Ti	Tl	Tm	U	V	W	Y	Yb	Zn
R214293	11	75	800	0.25	0.25	8	420	0.69	0.1	23	4300	0.7	0.4	1.65	105	3.2	22	2.7	120
R214294	10.5	65	250	0.25	0.25	7	380	0.63	0.1	19	4100	0.7	0.35	1.4	100	2.4	19	2.5	105
R214295	12.5	10.5	2950	0.25	0.25	7.5	195	0.6	0.1	27	5750	0.05	0.35	2.1	155	1	16.5	2.4	33.5
R214296	13	29	5850	0.25	1	7	270	0.4	0.1	31	6550	0.2	0.15	1.45	180	0.8	8	1.1	41.5
R214297	15.5	55	4350	0.25	0.5	9.5	270	0.52	0.1	43.5	6600	0.5	0.2	1.7	170	0.9	10	1.45	105
R214298	11	91	550	0.25	0.5	8	140	0.8	0.1	17	5600	1.3	0.45	1.75	185	2.5	23	2.9	180
R214299	15.5	91	250	0.25	0.25	11.5	160	1.15	0.1	35	4150	1.3	0.75	1.8	115	1.6	36.5	5	125
R214300	10.5	67	250	0.25	0.25	7.5	200	0.78	0.1	18	5450	0.7	0.5	1.35	135	1.3	24	3.5	98
R214301	10	55	250	0.25	0.25	7	270	0.76	0.1	18	5300	0.7	0.5	1.3	125	1.1	25.5	3.3	91
R214302	9.5	96	250	0.25	0.25	6.5	300	0.66	0.1	16.5	4450	0.7	0.45	1.35	110	2	21	3	85
R214303	10	110	250	0.25	0.25	7	410	0.71	0.1	18.5	4700	0.8	0.45	1.5	105	1	22.5	3	93
R214304	11	110	800	0.25	0.25	7.5	460	0.67	0.1	21	5550	0.7	0.4	1.7	125	2.7	21	2.6	105
R214305	6	29.5	2500	0.25	0.5	4.4	92	0.33	0.1	21.5	4750	0.3	0.2	1.85	140	1.2	10.5	1.55	47.5
R214306	9.5	31	1750	0.25	0.25	6.5	17	0.35	0.1	40.5	5300	0.2	0.15	1.55	115	1.4	8	1.2	40
R214307	11	37	800	0.25	1.5	7.5	36.5	0.54	0.1	30	5650	0.3	0.25	2.2	155	3.4	12	1.85	140
R214308																			
R214309																			
R214310	11.5	58	250	0.25	0.25	8	91	0.85	0.1	27	4300	1.9	0.5	2.6	94	2	28.5	3.4	72
R214311	8.5	100	250	0.25	0.25	6	93	0.56	0.1	20.5	4750	2.2	0.35	1.85	130	1.9	17	2.5	93
R214312	10.5	135	250	0.25	0.25	7.5	135	0.61	0.1	28.5	4900	2.3	0.35	1.7	130	1.7	18.5	2.5	90
R214313	8	16.5	2200	0.25	0.25	5.5	74	0.36	0.1	26	4950	0.2	0.2	2	150	1.6	9.5	1.25	48.5
R214314	10	30	800	0.25	1	6.5	54	0.34	0.1	35	7000	0.2	0.15	2.1	155	1.7	6.5	0.95	56
R214315	11.5	49.5	600	0.25	0.25	7.5	70	0.53	0.1	23.5	5750	0.5	0.3	2.4	130	1.9	12.5	2.1	91
R214316	11	58	250	0.25	0.25	8.5	95	0.9	0.1	34	4850	2.1	0.55	2.6	125	2.4	26	3.5	150
R214317	10	76	250	0.25	0.25	7.5	91	0.88	0.1	24.5	5650	0.7	0.55	2.3	120	2.1	33	3.6	120
R214318	11	100	250	0.25	0.25	8	81	0.72	0.1	28.5	4950	2.2	0.45	2.4	145	2.5	24.5	2.9	125
R214319	8.5	135	250	0.25	0.25	6	88	0.6	0.1	20	5100	1.5	0.35	2	145	3.4	19.5	2.4	135
R214320	9.5	115	250	0.25	0.25	7	130	0.68	0.1	24	5100	1.3	0.6	1.7	145	3.1	24.5	4.2	120
R214321	0.65	6.5	1450	0.25	0.5	0.8	160	0.07	0.1	4	8050	0.1	0.05	1.25	230	2.4	2.8	0.5	28.5
R214322	6.5	12	2250	0.25	1	4.5	110	0.37	0.1	16.5	4500	0.2	0.2	1.75	140	0.9	9.5	1.4	40
R214323	13.5	4.3	1450	0.25	1	8.5	200	0.54	0.1	38	6150	0.05	0.2	2.4	190	2.3	9.5	1.5	71
R214324	13.5	20.5	500	0.25	0.25	9	40	0.93	0.1	34	5650	0.8	0.65	2.3	155	1.9	29.5	4.7	150
R214325	11	68	250	0.25	0.25	8	99	0.92	0.1	23	5750	0.8	0.55	2.6	135	1.4	33.5	3.6	130
R214326	12	140	250	0.25	0.25	9	97	0.81	0.1	35.5	5300	1.8	0.45	2.5	145	8.5	25	3.2	110
R214327	9.5	145	250	0.25	0.25	7	91	0.68	0.1	24.5	5550	1.9	0.45	2.6	150	1.6	25.5	3	160
R214328																			
R214329	9.5	17.5	1350	0.25	0.25	6	155	0.4	0.1	22	5000	0.2	0.2	1.75	120	1.2	8.5	1.4	30
R214330	11	59	1200	0.25	0.5	8	105	0.4	0.1	37	5800	0.5	0.15	1.85	180	1.7	6.5	1.25	57
R214331	8	120	2100	0.25	0.25	6	95	0.36	0.1	21	5250	1.2	0.2	1.65	160	1.7	7.5	1.3	90
R214332	11	155	250	0.25	0.25	8	110	0.84	0.1	20.5	5400	1.5	0.6	2.1	155	2.5	26	4.2	105
R214333	10	160	250	0.25	0.25	7.5	115	0.84	0.1	25	5450	1.5	0.5	1.75	160	1.8	34	3.4	120
R214334	9.5	110	250	0.25	0.25	7	100	0.72	0.1	16.5	4100	1.6	0.5	1.8	115	2.1	23.5	3.3	97
R214335	11.5	88	250	0.25	0.25	8.5	200	0.89	0.1	26	5600	1.1	0.6	1.85	130	2.3	29	4	145
R214336	1.9	21.5	1800	0.25	0.25	1.65	290	0.15	0.1	4.5	4050	0.2	0.15	1.3	85	1.2	6	0.9	27.5
R214337	2.6	16	250	0.25	0.25	1.75	20	0.11	0.1	10	2700	0.1	0.05	0.63	39	1.8	2.8	0.5	36.5
R214338	5.5	32.5	1850	0.25	0.25	3.6	36	0.24	0.1	13.5	4100	0.2	0.15	0.81	83	2	6.5	1.2	46.5
R214339	4.7	56	550	0.25	0.25	3.5	61	0.29	0.1	6.5	3700	0.4	0.2	0.99	75	4.5	9.5	1.4	31
R214340	7	78	250	0.25	0.25	5.5	115	0.44	0.1	12	3400	0.8	0.2	1.25	105	2.2	12.5	1.3	90
R214341	10	145	250	0.25	0.25	7	220	0.6	0.1	18	3700	1	0.3	1.4	130	2.5	16	1.95	110
R214342	12	140	250	0.25	0.25	8.5	360	0.86	0.1	20.5	4550	1	0.4	1.95	140	2.6	26.5	2.8	125
R214343	7.5	84	250	0.25	0.25	6	180	0.58	0.1	17.5	4150	0.8	0.3	1.7	115	2.5	18.5	2.1	92
R214344	6	115	250	0.25	0.25	4.9	150	0.47	0.1	19	3450	0.6	0.25	1.7	94	3	16.5	1.7	83
R214345	4.8	61	2250	0.25	0.25	5.5	370	0.64	0.1	7.5	10400	0.5	0.3	1.2	260	1.2	20	1.95	155
R214346	2.3	28	900	0.25	1	2.3	125	0.2	0.1	7.5	4700	0.2	0.15	1.35	140	5.5	7	0.9	19
R214347	1.8	18.5	1300	0.25	0.25	1.3	23	0.09	0.1	6.5	2700	0.1	0.05	0.58	53	2.9	2.4	0.4	6.5
R214348	7.5	37.5	5850	0.25	0.25	5	87	0.31	0.1	21	4250	0.3	0.1	2	97	2.7	5	0.7	18.5

Appendix Table A9.1: Chemical data.

Number	Pr	Rb	S	Sb	Se	Sm	Sr	Tb	Te	Th	Ti	Tl	Tm	U	V	W	Y	Yb	Zn
R214349	13.5	130	750	0.25	0.25	8	360	0.64	0.1	20	4500	1.2	0.25	1.9	190	3.2	15	1.6	61
R214350	8	120	250	0.25	0.25	6	240	0.65	0.1	17	4950	0.9	0.35	1.75	140	2	21	2.3	93
R214351	9	105	250	0.25	0.25	7	260	0.81	0.1	21	4600	1	0.45	1.95	155	2.6	26	3.2	120
R214352	7.5	70	250	0.25	0.25	6	230	0.66	0.1	15.5	4200	0.7	0.4	1.65	110	1.9	24	2.9	74
R214353	0.5	6.5	1450	0.25	0.5	0.68	140	0.06	0.1	3.8	8350	0.05	0.05	1.3	230	3.1	2.8	0.4	15.5
R214354	1.6	13	500	0.25	0.25	1.6	83	0.16	0.1	5.5	6850	0.1	0.15	1.15	83	2.4	6.5	1	12.5
R214355	1.75	42	1950	0.25	0.5	1.2	55	0.12	0.1	4.2	3900	0.2	0.1	0.95	88	1.9	4	0.7	11
R214356	2.6	20.5	550	0.25	0.25	2	27.5	0.13	0.1	9	3150	0.1	0.05	0.93	67	2.8	3.4	0.5	8.5
R214357	16	84	250	0.25	0.25	11.5	93	0.96	0.1	27	4450	0.7	0.3	1.9	80	1.4	20.5	1.95	31
R214358	4.9	68	550	0.25	0.5	4.9	52	0.72	0.1	8.5	16200	0.5	0.35	2.2	360	3.1	22	2.4	260
R214359	8.5	44.5	250	0.25	0.5	8.5	93	1.15	0.1	5.5	11200	0.6	0.55	1.15	250	2.2	32.5	3.6	260
R214360	9.5	46.5	250	0.25	1	9	200	1.2	0.1	6	11200	0.3	0.55	1.5	280	2	38.5	3.3	240
R214361	1.5	11.5	700	0.25	0.25	1.35	210	0.15	0.1	5	5250	0.1	0.1	1.6	93	1.4	5.5	0.85	10.5
R214362	1.65	40.5	5000	0.25	0.5	1.15	140	0.1	0.1	3.2	3700	0.2	0.1	0.78	76	1.9	3.2	0.6	11
R214363	2.6	19	750	0.25	0.25	1.9	35	0.13	0.1	8.5	3500	0.1	0.05	0.97	53	4.4	3.3	0.55	10.5
R214364	12	75	250	0.25	0.25	9	115	0.66	0.1	25	4550	0.9	0.2	2.2	115	5.5	14.5	1.3	95
R214365	9	61	250	0.25	0.25	6	43.5	0.46	0.2	22	3550	0.5	0.15	1.8	79	8	9.5	0.9	25.5
R214366	9	140	250	0.25	0.25	7	97	0.53	0.1	23.5	3750	1.1	0.2	2.1	145	4.7	13.5	1.55	56
R214367	10.5	150	250	0.25	0.5	8.5	200	0.7	0.1	21.5	5400	1.4	0.2	2	250	3.6	13.5	1.5	105
R214368	10	110	250	0.25	0.25	7	280	0.67	0.1	18	4400	1	0.35	2.1	125	5.5	18.5	2.5	89
R214369	9.5	105	250	0.25	0.25	7.5	300	0.62	0.1	25	4050	0.6	0.35	1.75	110	3.5	20	2.3	74
R214370	1.75	13	1900	0.25	0.25	1.95	400	0.2	0.1	7	6800	0.1	0.15	1.8	86	2.4	8	1.2	28
R214371	2.3	24	2800	0.25	0.5	1.55	46.5	0.13	0.1	6	4950	0.2	0.1	0.87	96	3.2	3.5	0.6	12
R214372	5	15.5	600	0.25	0.25	3.8	29.5	0.25	0.1	23.5	5250	0.2	0.1	1.5	115	2.7	6	0.85	17.5
R214373	15.5	75	3050	0.25	0.25	8	290	0.56	0.1	36	5800	0.9	0.2	2.6	280	2.2	10	1.35	63
R214374	8	135	250	0.25	0.25	6.5	160	0.67	0.1	17.5	5000	1	0.3	2.1	130	1.8	22	2.2	105
R214375	8.5	88	250	0.25	0.25	6.5	220	0.76	0.1	13	4300	0.6	0.45	1.55	105	1.6	24	3	75
R214376	8.5	78	250	0.25	0.25	6	170	0.6	0.1	17.5	4300	0.7	0.3	2.1	105	2.2	19.5	2.1	81
R214377	5.5	99	250	0.25	0.25	4.5	185	0.49	0.1	10.5	4950	0.7	0.3	1.25	125	1.3	18	2	67
R214378	6.5	97	750	0.25	0.25	5.5	210	0.61	0.1	11.5	4850	0.6	0.35	1.45	125	1.6	22	2.4	78
R214379	1.4	9.5	1850	0.25	0.25	1.4	125	0.15	0.1	4.9	5950	0.1	0.1	1.15	80	3.1	6	0.85	12
R214380	1.7	35	1300	0.25	0.25	1.2	48	0.11	0.1	3.6	3250	0.2	0.1	1.2	82	2.4	3.7	0.6	13
R214381	4.5	37.5	250	0.25	0.25	3.1	41.5	0.24	0.1	17	5150	0.2	0.15	2.3	150	2.6	7	1	29.5
R214382	9	44	250	0.25	0.25	7	31.5	0.55	0.1	25	4500	0.3	0.2	1.9	100	3.4	12	1.4	23
R214383	13	120	250	0.25	0.25	8.5	39	0.71	0.1	34	4250	0.7	0.25	1.6	140	3.4	16.5	1.7	49.5
R214384	8.5	115	250	0.25	0.25	6.5	61	0.48	0.1	27	3900	0.9	0.25	2	155	2.7	17.5	1.85	135
R214385	7	50	250	0.25	0.25	5.5	100	0.4	0.1	20	3200	1	0.2	1.7	120	2.4	14.5	1.45	130
R214386	7.5	45	250	0.25	0.5	6	120	0.48	0.1	19	3750	0.9	0.3	1.5	115	2.2	18.5	1.95	120
R214387	8.5	42	250	0.25	0.5	6.5	210	0.51	0.1	18	4650	0.8	0.3	1.9	135	2.6	21.5	2	105
R214388	7	38.5	1950	0.25	0.5	6.5	500	0.53	0.1	13	5350	0.9	0.3	1.1	150	2.1	22.5	2.2	86
R214389	0.55	6	1500	0.25	0.25	0.98	240	0.05	0.1	4.5	10200	0.05	0.05	1.4	270	2.9	3.3	0.4	30
R214390	1.8	11.5	250	0.25	0.25	2.1	115	0.14	0.1	9.5	6000	0.1	0.1	0.94	70	46.5	8	0.9	25
R214391	1.85	14	250	0.25	0.25	1.5	81	0.13	0.1	5.5	7750	0.2	0.1	0.75	82	3.3	6.5	0.85	24
R214392	2.7	35	250	0.25	0.25	2.1	68	0.16	0.1	7.5	5250	0.3	0.15	0.98	185	2.7	6.5	0.95	23
R214393	5	9	250	0.25	0.25	3.6	27.5	0.22	0.1	16.5	3950	0.1	0.1	1	41	3.2	7	0.7	18.5
R214394	23	50	250	0.25	0.25	17	100	1.3	0.1	29	5500	0.4	0.4	1.95	105	1.4	37.5	2.5	34.5
R214395	15	43	250	0.25	0.25	10.5	145	0.73	0.1	24.5	5100	1.1	0.3	2.2	160	1.3	25.5	1.95	75
R214396	11	37.5	250	0.25	0.25	8.5	67	0.65	0.1	30.5	5850	1.2	0.35	1.9	185	1.4	24	2.4	180
R214397	9	47	250	0.25	0.25	7.5	110	0.55	0.1	30.5	5900	1.3	0.35	2.3	170	1.4	26.5	2.2	135
R214398	9.5	87	4750	0.25	0.5	7.5	230	0.59	0.1	19.5	5850	1.1	0.4	1.8	175	1.6	26.5	2.7	115
R214399	10	61	5400	0.25	0.25	7.5	320	0.54	0.1	17	5500	0.9	0.3	1.25	135	1.9	21	2	83
R214400	1.55	7.5	250	0.25	0.25	1.6	60	0.13	0.1	7	7200	0.1	0.1	0.82	75	6.5	6.5	0.8	22.5
R214401	2.7	20.5	250	0.25	0.25	2.1	55	0.18	0.1	4	5750	0.2	0.1	0.69	96	2	7	0.85	21
R214402	3	25.5	250	0.25	0.25	2.3	49.5	0.17	0.1	9	5900	0.2	0.15	0.9	96	2.7	7.5	0.95	27.5
R214403	16.5	24	250	0.25	0.25	10.5	240	0.52	0.1	65	4400	0.8	0.15	2.3	110	2.3	13.5	1.15	80
R214404	13.5	105	250	0.25	0.5	10.5	850	0.68	0.1	23	11100	1.7	0.3	3	270	2	27	2.2	260

Appendix Table A9.1: Chemical data.

Number	Pr	Rb	S	Sb	Se	Sm	Sr	Tb	Te	Th	Ti	Tl	Tm	U	V	W	Y	Yb	Zn
R214405	14.5	51	250	0.25	0.5	11	210	0.78	0.1	17	6750	1.2	0.4	2.1	145	1.4	29	2.7	200
R214406	12.5	80	250	0.25	0.25	10	155	0.59	0.1	47.5	5800	1.1	0.3	2.6	115	2.3	22.5	2	165
R214407	9.5	51	650	0.25	1	8	150	0.58	0.1	24.5	5700	1.1	0.35	3.5	145	1.5	23	2.2	145
R214408	8	44.5	7600	0.25	1.5	6.5	240	0.53	0.1	18.5	7000	0.8	0.3	4.3	140	2.6	22	2.1	120
R214409	1.2	6.5	600	0.25	0.25	1.25	85	0.09	0.1	5.5	6800	0.1	0.1	0.71	66	1.7	4.9	0.65	23
R214410	1.6	19.5	250	0.25	0.25	1.1	54	0.1	0.1	3.9	5700	0.2	0.1	0.71	51	2	4.5	0.65	24.5
R214411	2.6	10	250	0.25	0.25	1.8	29	0.11	0.1	8	4750	0.1	0.05	0.74	40	4	3.6	0.5	18
R214412	22.5	25	250	0.25	0.25	15	115	0.65	0.1	105	7850	0.3	0.2	2.5	85	3	13	1.5	34.5
R214413	15.5	41	250	0.25	0.5	10.5	210	0.6	0.1	58	7450	0.7	0.25	3.7	140	2.2	18	1.8	60
R214414	13	125	250	0.25	1	9.5	330	0.74	0.1	24.5	6900	1.5	0.45	2.2	175	1.9	32.5	3	195
R214415	24	105	250	0.25	0.25	16.5	250	0.95	0.1	105	6600	1.4	0.4	2.7	145	1.9	32	2.8	160
R214416	8.5	58	250	0.25	0.5	7	300	0.53	0.1	17.5	5700	1	0.3	1.7	120	1.4	20.5	2.3	92
R214417	1.45	5.5	1100	0.25	0.25	1.75	165	0.13	0.1	5.5	6700	0.05	0.1	1.3	48	2	6.5	0.8	24
R214418	1.15	11.5	700	0.25	0.25	0.87	52	0.07	0.1	3.5	8650	0.1	0.1	0.83	59	2.4	4	0.6	23
R214419	2.2	10	500	0.25	0.25	1.55	28	0.1	0.1	6	4400	0.1	0.05	0.71	35	2.5	3.6	0.45	18
R214420	13.5	22	250	0.25	0.25	7	340	0.39	0.1	24	5950	0.2	0.2	1.6	58	2.1	12	1.45	29.5
R214421	12	41.5	250	0.25	1	7	500	0.35	0.1	21	6550	0.5	0.15	2.2	105	1.3	9.5	0.95	72
R214422	16.5	76	250	0.25	1.5	10	430	0.72	0.1	26	6700	1.2	0.35	2.6	185	1.4	23	2.7	87
R214423	11.5	88	250	0.25	0.25	9	250	0.76	0.1	22.5	5350	1.2	0.4	1.65	130	1.3	28	2.8	140
R214424	0.6	5	1300	0.25	0.25	1.05	210	0.06	0.1	4.8	10400	0.05	0.05	1.4	240	2.9	3.4	0.45	33
R214426	2.5	14	2650	15.5	0.25	2.6	600	0.18	0.1	6.5	2050	0.1	0.1	1.7	53	0.7	8	0.65	14.5
R214427	2	8	600	0.25	0.25	1.6	155	0.15	0.1	6	6650	0.05	0.15	1.4	115	1.9	7	0.95	18
R214428	1.25	10	650	0.25	0.25	1	35.5	0.09	0.1	6.5	7550	0.05	0.1	1.75	91	2.3	4.3	0.75	18
R214429	1.25	19	5250	0.25	0.25	0.95	46.5	0.07	0.1	4.7	3350	0.1	0.05	0.64	52	1.9	3	0.4	9
R214430	2.1	46	13700	0.25	0.5	1.4	62	0.1	0.1	4.6	4450	0.3	0.1	0.91	83	1.5	4.1	0.65	17.5
R214431	2.1	43	12300	0.25	0.5	1.45	62	0.11	0.1	5	4500	0.2	0.1	0.89	97	1.7	4.2	0.65	20
R214432	2.7	50	5400	0.25	0.25	1.75	91	0.13	0.1	6.5	5450	0.3	0.1	1.1	105	2.5	5	0.8	26
R214433	2.6	44.5	3100	0.25	0.5	1.7	75	0.13	0.1	8.5	5900	0.3	0.15	1.35	170	4.7	5.5	0.85	34
R214434	3.5	7.5	1000	0.25	0.25	2.3	27.5	0.12	0.1	12	3950	0.05	0.05	1.05	42	4.1	2.8	0.4	17
R214435	13	22	1050	0.25	0.25	9	51	0.54	0.1	30	5450	0.2	0.25	2	75	5	13	1.4	31
R214436	6.5	47	1050	0.25	0.25	4.6	110	0.28	0.1	25	4600	0.4	0.15	1.95	180	4.1	8.5	0.85	41
R214437	13.5	94	600	0.25	0.25	9.5	125	0.58	0.1	31	4650	0.8	0.2	2.1	115	4.7	15.5	1.2	40
R214438	13.5	120	700	0.25	0.25	9	145	0.58	0.1	21	4550	1.1	0.2	1.8	96	4.5	11	1.05	55
R214439	12	88	550	0.25	0.25	8	85	0.48	0.6	37	3900	0.7	0.15	2.7	190	6.5	11	1.05	45
R214440	10.5	120	550	0.25	0.25	7.5	105	0.46	0.3	29.5	4300	1.2	0.2	2.1	125	5	13	1.3	70
R214441	9	105	600	0.25	0.25	6.5	125	0.41	0.1	20	4400	0.9	0.2	1.75	91	4.2	12	1.15	69
R214442	6.5	105	250	0.25	0.25	6.5	440	0.55	0.1	7	4750	0.7	0.35	0.7	115	1.7	25	2	160

Appendix Table A9.2: Additional gold analyses in ppb.

Number	Sample_id	Type Code	Zone	E	N	from	to	av depth	Au	Au	Au
R214002	GC038-6	silcrete	53	363332	6693762	0.00	0.01	0.005	24	54	
R214003	GC038-7	silcrete	53	363332	6693762	0.00	0.01	0.005	18	48	
R214004	GC038-1	silcrete	53	363332	6693762	0.00	0.01	0.005	8	12	14
R214005	GC038-4	silcrete	53	363332	6693762	0.00	0.01	0.005	34	126000	
R214006	GC038-3	silcrete	53	363332	6693762	0.00	0.01	0.005	31		
R214007	GC041-1	quartz	53	363332	6693762	0.00	0.01	0.005	<5	<5	
R214008	GC041-2	quartz	53	363332	6693762	0.00	0.01	0.005	<5	<5	
R214009	GC041-9	quartz	53	363332	6693762	0.00	0.01	0.005	<5	<5	
R214010	GC041-11	quartz	53	363332	6693762	0.00	0.01	0.005	<5	<5	
R214011	GC041-7	quartz	53	363332	6693762	0.00	0.01	0.005	<5		
R214012	GC037-10	silcrete	53	363332	6693762	0.00	0.01	0.005	113	176	
R214013	GC037-8	silcrete	53	363332	6693762	0.00	0.01	0.005	9	16	
R214014	GC037-6	silcrete	53	363332	6693762	0.00	0.01	0.005	26	32	48
R214015	GC037-5	silcrete	53	363332	6693762	0.00	0.01	0.005	297	426	
R214016	GC037-1	silcrete	53	363332	6693762	0.00	0.01	0.005	<5	5.4	
R214017	GC123LVC-1	silcrete	53	363411	6693656	0.00	0.01	0.005	11		
R214018	GC123LVC-2	silcrete	53	363411	6693656	0.00	0.01	0.005	84		
R214019	GC123LVC-3	silcrete	53	363411	6693656	0.00	0.01	0.005	<5		
R214020	GC123LVC-4	quartz	53	363411	6693656	0.00	0.01	0.005	15		
R214021	GC123LVC-5	silcrete	53	363411	6693656	0.00	0.01	0.005	253		
R214022	GC128LVC-1	silcrete	53	363243	6693831	0.00	0.01	0.005	<5		
R214023	GC128LVC-2	silcrete	53	363243	6693831	0.00	0.01	0.005	<5		
R214024	GC128LVC-3	silcrete	53	363243	6693831	0.00	0.01	0.005	<5		
R214025	GC128LVC-6	silcrete	53	363243	6693831	0.00	0.01	0.005	199		
R214026	GC128LVC-5	silcrete	53	363243	6693831	0.00	0.01	0.005	<5		
R214027	GC39-1	silcrete	53	363332	6693762	0.00	0.01	0.005	464	5470	
R214028	GC39-2	silcrete	53	363332	6693762	0.00	0.01	0.005	10	10	
R214029	GC39-3	silcrete	53	363332	6693762	0.00	0.01	0.005	379	804	
R214030	GC39-4	silcrete	53	363332	6693762	0.00	0.01	0.005	<5		
R214031	GC39-5	silcrete	53	363332	6693762	0.00	0.01	0.005	<5		
R214032	GC122N-1	calcrete	53	363452	6693628	0.00	0.01	0.005	501		
R214033	GC122N-2	calcrete	53	363452	6693628	0.00	0.01	0.005	1070	1080	
R214034	GC122N-3	calcrete	53	363452	6693628	0.00	0.01	0.005	524		
R214035	GC122N-4	calcrete	53	363452	6693628	0.00	0.01	0.005	554	591	
R213977	GCP129E1	pit	53	363216	6693869	0.20	0.40	0.3	22		
R213978	GCP129E2	pit	53	363216	6693869	0.40	0.70	0.55	9.5		
R213979	GCP129E2A	pit	53	363216	6693869	0.60	0.60	0.6	5.5		
R213980	GCP129E3	pit	53	363216	6693869	1.30	1.30	1.3	10		
R213981	GCP129-W1	pit	53	363216	6693869	0.15	0.25	0.2	13.5		
R213982	GCP129-W2	pit	53	363216	6693869	0.50	0.70	0.6	35		
R213983	GCP129-W3	pit	53	363216	6693869	0.90	1.10	1	110		
R213984	GCP129-W4	pit	53	363216	6693869	1.30	1.45	1.375	75		
R214051	GCP122-E1	pit	53	363452	6693628	0.20	0.40	0.3	380		
R214052	GCP122-E2	pit	53	363452	6693628	0.40	0.60	0.5	730		
R214053	GCP122-E3	pit	53	363452	6693628	0.60	0.80	0.7	785		
R214054	GCP122-E4	pit	53	363452	6693628	0.80	1.00	0.9	610		
R214055	GCP122-E5	pit	53	363452	6693628	1.00	1.20	1.1	740		
R214056	GCP122-E6	pit	53	363452	6693628	1.20	1.40	1.3	420		
R214057	STD 9	standard							62		
R214058	GCP122-2E1	pit	53	363452	6693628	0.10	0.20	0.15	35		
R214059	GCP122-2E2	pit	53	363452	6693628	0.20	0.30	0.25	330		
R214060	GCP122-2E3	pit	53	363452	6693628	0.30	0.40	0.35	700		
R214061	GCP122-2E4	pit	53	363452	6693628	0.40	0.60	0.5	710		
R214062	GCP122-2E5	pit	53	363452	6693628	0.60	0.70	0.65	520		
R214063	GCP122-2E6	pit	53	363452	6693628	0.70	0.80	0.75	220		
R214064	GCP122-W1	pit	53	363452	6693628	0.10	0.20	0.15	900		
R214065	GCP122-W2	pit	53	363452	6693628	0.20	0.30	0.25	1010		
R214066	GCP122-W3	pit	53	363452	6693628	0.30	0.40	0.35	920		
R214067	GCP122-W4	pit	53	363452	6693628	0.40	0.50	0.45	2310		
R214068	GCP122-W5	pit	53	363452	6693628	0.50	0.70	0.6	1320		
R214069	GCP122-W6	pit	53	363452	6693628	0.70	0.80	0.75	680		
R214070	GCP122-W7	pit	53	363452	6693628	0.80	0.90	0.85	340		

Appendix A9.3: Water, iodide and cyanide extractable gold in ppb.

Number	Sample_id	Type Code	Drill Hole	Zone	E	N	from	to	av depth	Au (water)	Au (iodide)	Au (cyanide)	Au (total)
R213551	GC100A	upper regolith	GC100	53	364186	6692861	0.00	1.00	0.5	0.38	1.67	1.22	3.27
R213552	GC100B	upper regolith	GC100	53	364186	6692861	1.00	2.00	1.5	0.14	1.21	0.99	2.34
R213553	GC100C	upper regolith	GC100	53	364186	6692861	2.00	3.00	2.5	0.32	1.38	0.47	2.17
R213554	GC100D	upper regolith	GC100	53	364186	6692861	3.00	4.00	3.5	0.22	0.88	1.10	2.20
R213555	GC100E	upper regolith	GC100	53	364186	6692861	4.00	5.00	4.5	0.26	0.57	1.65	2.48
R213556	GC100F	upper regolith	GC100	53	364186	6692861	5.00	6.00	5.5	0.16	0.45	1.58	2.19
R213563	GC102A	upper regolith	GC102	53	364141	6692931	0.00	1.00	0.5	0.17	1.12	1.26	2.54
R213564	GC102B	upper regolith	GC102	53	364141	6692931	1.00	2.00	1.5	0.12	1.70	0.65	2.47
R213565	GC102C	upper regolith	GC102	53	364141	6692931	2.00	3.00	2.5	0.18	0.98	0.76	1.92
R213566	GC102D	upper regolith	GC102	53	364141	6692931	3.00	4.00	3.5	0.09	1.58	0.64	2.32
R213567	GC102E	upper regolith	GC102	53	364141	6692931	4.00	5.00	4.5	0.12	8.16	2.22	10.51
R213568	GC102F	upper regolith	GC102	53	364141	6692931	5.00	6.00	5.5	0.26	9.04	2.14	11.44
R213575	GC104A	upper regolith	GC104	53	364093	6693027	0.00	1.00	0.5	0.21	1.88	1.48	3.57
R213576	GC104B	upper regolith	GC104	53	364093	6693027	1.00	2.00	1.5	0.46	2.42	1.30	4.19
R213577	GC104C	upper regolith	GC104	53	364093	6693027	2.00	3.00	2.5	0.22	3.17	1.01	4.40
R213578	GC104D	upper regolith	GC104	53	364093	6693027	3.00	4.00	3.5	0.18	2.75	0.72	3.65
R213579	GC104E	upper regolith	GC104	53	364093	6693027	4.00	5.00	4.5	0.30	3.86	1.30	5.46
R213580	GC104F	upper regolith	GC104	53	364093	6693027	5.00	6.00	5.5	0.56	4.84	2.14	7.54
R213587	GC106A	upper regolith	GC106	53	364035	6693094	0.00	1.00	0.5	0.62	3.98	1.76	6.36
R213588	GC106B	upper regolith	GC106	53	364035	6693094	1.00	2.00	1.5	0.62	4.40	2.02	7.03
R213589	GC106C	upper regolith	GC106	53	364035	6693094	2.00	3.00	2.5	0.34	2.47	1.67	4.48
R213590	GC106D	upper regolith	GC106	53	364035	6693094	3.00	4.00	3.5	0.34	0.59	2.00	2.92
R213591	GC106E	upper regolith	GC106	53	364035	6693094	4.00	5.00	4.5	0.16	0.58	1.75	2.48
R213592	GC106F	upper regolith	GC106	53	364035	6693094	5.00	6.00	5.5	0.61	0.80	3.06	4.46
R213600	GC108A	upper regolith	GC108	53	363955	6693144	0.00	1.00	0.5	1.15	6.88	2.91	10.94
R213601	GC108B	upper regolith	GC108	53	363955	6693144	1.00	2.00	1.5	0.16	1.47	1.52	3.15
R213602	GC108C	upper regolith	GC108	53	363955	6693144	2.00	3.00	2.5	0.24	0.65	1.95	2.84
R213603	GC108D	upper regolith	GC108	53	363955	6693144	3.00	4.00	3.5	0.18	0.57	1.24	1.99
R213604	GC108E	upper regolith	GC108	53	363955	6693144	4.00	5.00	4.5	0.08	0.25	0.67	1.00
R213605	GC108F	upper regolith	GC108	53	363955	6693144	5.00	6.00	5.5	-0.04	0.28	0.40	0.64
R213612	GC110A	upper regolith	GC110	53	363862	6693215	0.00	1.00	0.5	0.44	3.25	1.89	5.58
R213613	GC110B	upper regolith	GC110	53	363862	6693215	1.00	2.00	1.5	0.32	0.65	0.20	1.17
R213614	GC110C	upper regolith	GC110	53	363862	6693215	2.00	3.00	2.5	0.32	0.51	1.16	1.99
R213615	GC110D	upper regolith	GC110	53	363862	6693215	3.00	4.00	3.5	0.16	0.32	1.44	1.92
R213616	GC110E	upper regolith	GC110	53	363862	6693215	4.00	5.00	4.5	0.10	0.50	0.42	1.01
R213617	GC110F	upper regolith	GC110	53	363862	6693215	5.00	6.00	5.5	0.06	0.58	0.48	1.11
R213624	GC112A	upper regolith	GC112	53	363781	6693237	0.00	1.00	0.5	0.55	2.23	2.56	5.34
R213625	GC112B	upper regolith	GC112	53	363781	6693237	1.00	2.00	1.5	0.33	1.22	1.43	2.98
R213626	GC112C	upper regolith	GC112	53	363781	6693237	2.00	3.00	2.5	0.26	0.68	1.36	2.31
R213627	GC112D	upper regolith	GC112	53	363781	6693237	3.00	4.00	3.5	0.24	0.37	0.93	1.54
R213628	GC112E	upper regolith	GC112	53	363781	6693237	4.00	5.00	4.5	0.19	0.28	0.78	1.24
R213629	GC112F	upper regolith	GC112	53	363781	6693237	5.00	6.00	5.5	0.12	0.28	0.96	1.36
R213636	GC114A	upper regolith	GC114	53	363719	6693312	0.00	1.00	0.5	3.32	20.88	5.88	30.08
R213637	GC114B	upper regolith	GC114	53	363719	6693312	1.00	2.00	1.5	1.93	10.04	6.92	18.89
R213638	GC114C	upper regolith	GC114	53	363719	6693312	2.00	3.00	2.5	1.69	1.98	7.60	11.27
R213639	GC114D	upper regolith	GC114	53	363719	6693312	3.00	4.00	3.5	1.22	0.94	4.76	6.92
R213640	GC114E	upper regolith	GC114	53	363719	6693312	4.00	5.00	4.5	0.55	0.67	3.41	4.63
R213641	GC114F	upper regolith	GC114	53	363719	6693312	5.00	6.00	5.5	0.45	0.75	2.00	3.20
R213649	GC116A	upper regolith	GC116	53	363657	6693390	0.00	1.00	0.5	1.58	6.20	3.65	11.43
R213650	GC116B	upper regolith	GC116	53	363657	6693390	1.00	2.00	1.5	0.29	4.24	1.54	6.06
R213651	GC116C	upper regolith	GC116	53	363657	6693390	2.00	3.00	2.5	0.58	2.20	1.65	4.43
R213652	GC116D	upper regolith	GC116	53	363657	6693390	3.00	4.00	3.5	0.36	0.59	1.21	2.16
R213653	GC116E	upper regolith	GC116	53	363657	6693390	4.00	5.00	4.5	0.30	0.42	1.07	1.80
R213654	GC116F	upper regolith	GC116	53	363657	6693390	5.00	6.00	5.5	0.34	0.78	1.62	2.74
R213661	GC118A	upper regolith	GC118	53	363592	6693465	0.00	1.00	0.5	0.40	2.51	2.41	5.31
R213662	GC118B	upper regolith	GC118	53	363592	6693465	1.00	2.00	1.5	0.57	4.36	1.78	6.71
R213663	GC118C	upper regolith	GC118	53	363592	6693465	2.00	3.00	2.5	0.59	6.60	1.66	8.85
R213664	GC118D	upper regolith	GC118	53	363592	6693465	3.00	4.00	3.5	0.16	2.82	0.95	3.94
R213665	GC118E	upper regolith	GC118	53	363592	6693465	4.00	5.00	4.5	0.14	0.93	0.54	1.60
R213666	GC118F	upper regolith	GC118	53	363592	6693465	5.00	6.00	5.5	0.16	1.22	0.47	1.85
R213673	GC120A	upper regolith	GC120	53	363521	6693542	0.00	1.00	0.5	3.63	24.08	14.20	41.91
R213674	GC120B	upper regolith	GC120	53	363521	6693542	1.00	2.00	1.5	1.55	7.72	8.40	17.67
R213675	GC120C	upper regolith	GC120	53	363521	6693542	2.00	3.00	2.5	0.84	1.83	7.52	10.19
R213676	GC120D	upper regolith	GC120	53	363521	6693542	3.00	4.00	3.5	0.61	1.42	5.28	7.31
R213677	GC120E	upper regolith	GC120	53	363521	6693542	4.00	5.00	4.5	0.31	0.73	4.72	5.76
R213678	GC120F	upper regolith	GC120	53	363521	6693542	5.00	6.00	5.5	0.36	0.62	1.44	2.42
R213679	GC121A	upper regolith	GC121	53	363490	6693580	0.00	1.00	0.5	3.67	35.24	22.76	61.67
R213680	GC121B	upper regolith	GC121	53	363490	6693580	1.00	2.00	1.5	2.00	45.20	36.32	83.52
R213681	GC121C	upper regolith	GC121	53	363490	6693580	2.00	3.00	2.5	1.29	3.83	9.20	14.32

Appendix A9.3: Water, iodide and cyanide extractable gold in ppb.

Number	Sample_id	Type Code	Drill Hole	Zone	E	N	from	to	av depth	Au (water)	Au (iodide)	Au (cyanide)	Au (total)
R213682	GC121D	upper regolith	GC121	53	363490	6693580	3.00	4.00	3.5	0.66	2.06	9.08	11.80
R213683	GC121E	upper regolith	GC121	53	363490	6693580	4.00	5.00	4.5	0.64	1.46	7.08	9.18
R213684	GC121F	upper regolith	GC121	53	363490	6693580	5.00	6.00	5.5	0.42	1.27	3.74	5.43
R213685	GC122A	upper regolith	GC122	53	363452	6693628	0.00	1.00	0.5	49.60	436.00	347.60	833.20
R213686	GC122B	upper regolith	GC122	53	363452	6693628	1.00	2.00	1.5	34.64	656.00	2444.00	3134.64
R213687	GC122C	upper regolith	GC122	53	363452	6693628	2.00	3.00	2.5	12.72	163.20	1068.00	1243.92
R213688	GC122D	upper regolith	GC122	53	363452	6693628	3.00	4.00	3.5	9.72	31.20	520.00	560.92
R213689	GC122E	upper regolith	GC122	53	363452	6693628	4.00	5.00	4.5	7.24	26.20	436.00	469.44
R213690	GC122F	upper regolith	GC122	53	363452	6693628	5.00	6.00	5.5	7.68	246.00	1976.00	2229.68
R213692	GC123A	upper regolith	GC123	53	363411	6693656	0.00	1.00	0.5	10.68	44.40	80.00	135.08
R213693	GC123B	upper regolith	GC123	53	363411	6693656	1.00	2.00	1.5	3.18	15.52	33.68	52.38
R213694	GC123C	upper regolith	GC123	53	363411	6693656	2.00	3.00	2.5	0.94	4.16	30.68	35.78
R213695	GC123D	upper regolith	GC123	53	363411	6693656	3.00	4.00	3.5	1.87	7.60	61.20	70.67
R213696	GC123E	upper regolith	GC123	53	363411	6693656	4.00	5.00	4.5	1.32	6.40	21.32	29.04
R213697	GC123F	upper regolith	GC123	53	363411	6693656	5.00	6.00	5.5	0.44	2.08	3.16	5.67
R213698	GC124A	upper regolith	GC124	53	363354	6693679	0.00	1.00	0.5	8.60	58.40	61.60	128.60
R213699	GC124B	upper regolith	GC124	53	363354	6693679	1.00	2.00	1.5	5.00	48.40	53.60	107.00
R213700	GC124C	upper regolith	GC124	53	363354	6693679	2.00	3.00	2.5	2.78	7.32	30.20	40.30
R213701	GC124D	upper regolith	GC124	53	363354	6693679	3.00	4.00	3.5	1.50	3.79	27.84	33.13
R213702	GC124E	upper regolith	GC124	53	363354	6693679	4.00	5.00	4.5	1.94	3.44	19.84	25.23
R213703	GC124F	upper regolith	GC124	53	363354	6693679	5.00	6.00	5.5	1.10	1.55	8.64	11.29
R213710	GC126A	upper regolith	GC126	53	363300	6693752	0.00	1.00	0.5	3.88	36.92	42.80	83.60
R213711	GC126B	upper regolith	GC126	53	363300	6693752	1.00	2.00	1.5	4.68	17.48	62.12	84.28
R213712	GC126C	upper regolith	GC126	53	363300	6693752	2.00	3.00	2.5	2.84	5.84	17.68	26.36
R213713	GC126D	upper regolith	GC126	53	363300	6693752	3.00	4.00	3.5	1.06	1.90	9.24	12.19
R213714	GC126E	upper regolith	GC126	53	363300	6693752	4.00	5.00	4.5	0.53	1.64	6.60	8.77
R213715	GC126F	upper regolith	GC126	53	363300	6693752	5.00	6.00	5.5	0.24	0.95	3.14	4.32
R213722	GC128A	upper regolith	GC128	53	363243	6693831	0.00	1.00	0.5	2.24	9.88	15.08	27.20
R213723	GC128B	upper regolith	GC128	53	363243	6693831	1.00	2.00	1.5	3.44	16.24	29.56	49.24
R213724	GC128C	upper regolith	GC128	53	363243	6693831	2.00	3.00	2.5	1.38	29.92	21.88	53.18
R213725	GC128D	upper regolith	GC128	53	363243	6693831	3.00	4.00	3.5	1.59	26.24	72.40	100.23
R213726	GC128E	upper regolith	GC128	53	363243	6693831	4.00	5.00	4.5	1.28	42.40	35.24	78.92
R213727	GC128F	upper regolith	GC128	53	363243	6693831	5.00	6.00	5.5	0.85	36.44	27.92	65.21
R213765	GC100N	calcrete		53	364186	6692861	0.00	0.50	0.25	0.72	1.91	1.26	3.89
R213767	GC105N	calcrete		53	364076	6693061	0.00	0.50	0.25	2.26	5.00	3.01	10.27
R213768	GC106N	calcrete		53	364035	6693094	0.00	0.50	0.25	1.30	5.08	6.12	12.50
R213769	GC107N	calcrete		53	363996	6693124	0.00	0.50	0.25	1.50	6.56	3.47	11.53
R213770	GC108N	calcrete		53	363955	6693144	0.00	0.50	0.25	1.35	6.12	4.12	11.59
R213771	GC109N	calcrete		53	363913	6693167	0.00	0.50	0.25	1.84	6.40	2.90	11.14
R213772	GC110N	calcrete		53	363862	6693215	0.00	0.50	0.25	1.93	3.80	3.09	8.82
R213773	GC111N	calcrete		53	363823	6693210	0.00	0.50	0.25	1.09	5.28	3.94	10.31
R213774	GC112N	calcrete		53	363781	6693237	0.00	0.50	0.25	3.53	5.84	3.19	12.56
R213775	GC113N	calcrete		53	363753	6693275	0.00	0.50	0.25	7.12	19.28	12.20	38.60
R213776	GC114N	calcrete		53	363719	6693312	0.00	0.50	0.25	3.61	12.92	8.60	25.13
R213777	GC115N	calcrete		53	363687	6693346	0.00	0.50	0.25	2.14	14.12	7.20	23.46
R213778	GC116N	calcrete		53	363657	6693390	0.00	0.50	0.25	1.77	5.67	2.85	10.29
R213779	GC117N	calcrete		53	363625	6693428	0.00	0.50	0.25	1.19	3.60	2.45	7.24
R213780	GC118N	calcrete		53	363592	6693465	0.00	0.50	0.25	1.90	4.32	2.38	8.60
R213781	GC119N	calcrete		53	363559	6693501	0.00	0.50	0.25	1.70	5.92	1.85	9.47
R213782	GC120N	calcrete		53	363521	6693542	0.00	0.50	0.25	9.00	46.40	9.44	64.84
R213783	GC121N	calcrete		53	363490	6693580	0.00	0.50	0.25	19.16	48.40	12.24	79.80
R213784	GC122N	calcrete		53	363452	6693628	0.00	0.50	0.25	45.60	600.00	1556.00	2201.60
R213785	GC123N	calcrete		53	363411	6693656	0.00	0.50	0.25	6.32	34.32	16.84	57.48
R213786	GC124N	calcrete		53	363354	6693679	0.00	0.50	0.25	21.28	86.80	76.00	184.08
R213787	GC125N	calcrete		53	363332	6693717	0.00	0.50	0.25	4.64	15.72	9.00	29.36
R213788	GC126N	calcrete		53	363300	6693752	0.00	0.50	0.25	7.56	33.12	21.36	62.04
R213789	GC127N	calcrete		53	363269	6693790	0.00	0.50	0.25	8.48	20.36	27.52	56.36
R213790	GC128N	calcrete		53	363243	6693831	0.00	0.50	0.25	1.76	9.64	21.36	32.76
R213791	GC129N	calcrete		53	363216	6693869	0.00	0.50	0.25	4.28	10.76	5.96	21.00
R213794	GC100LVC	silcrete (+4#)		53	364186	6692861	0.00	0.01	0.005	0.13	0.28	0.21	0.62
R213795	GC101LVC	silcrete (+4#)		53	364146	6692880	0.00	0.01	0.005	0.14	0.51	2.08	2.73
R213796	GC102LVC	silcrete (+4#)		53	364141	6692931	0.00	0.01	0.005	0.07	0.23	-0.20	0.10
R213797	GC103LVC	silcrete (+4#)		53	364136	6692982	0.00	0.01	0.005	0.08	0.46	1.09	1.64
R213798	GC104LVC	silcrete (+4#)		53	364093	6693027	0.00	0.01	0.005	0.08	0.67	1.06	1.80
R213799	GC105LVC	silcrete (+4#)		53	364076	6693061	0.00	0.01	0.005	0.13	0.56	0.81	1.50
R213800	GC106LVC	silcrete (+4#)		53	364035	6693094	0.00	0.01	0.005	0.09	0.34	0.40	0.83
R213801	GC107LVC	silcrete (+4#)		53	363996	6693124	0.00	0.01	0.005	0.06	0.22	0.20	0.48
R213802	GC108LVC	silcrete (+4#)		53	363955	6693144	0.00	0.01	0.005	0.08	0.26	0.29	0.63
R213803	GC109LVC	silcrete (+4#)		53	363913	6693167	0.00	0.01	0.005	0.05	0.17	0.22	0.44

Appendix A9.3: Water, iodide and cyanide extractable gold in ppb.

Number	Sample_id	Type Code	Drill Hole	Zone	E	N	from	to	av depth	Au (water)	Au (iodide)	Au (cyanide)	Au (total)
R213804	GC110LVC	silcrete (+4#)		53	363862	6693215	0.00	0.01	0.005	-0.04	0.19	-0.20	-0.05
R213805	GC111LVC	silcrete (+4#)		53	363823	6693210	0.00	0.01	0.005	0.06	0.19	-0.20	0.05
R213806	GC112LVC	silcrete (+4#)		53	363781	6693237	0.00	0.01	0.005	0.07	0.21	0.65	0.92
R213807	GC113LVC	silcrete (+4#)		53	363753	6693275	0.00	0.01	0.005	0.06	0.22	0.40	0.68
R213808	GC114LVC	silcrete (+4#)		53	363719	6693312	0.00	0.01	0.005	0.07	0.91	0.24	1.23
R213809	GC115LVC	silcrete (+4#)		53	363687	6693346	0.00	0.01	0.005	0.08	1.09	0.70	1.87
R213810	GC116LVC	silcrete (+4#)		53	363657	6693390	0.00	0.01	0.005	-0.04	0.56	0.22	0.74
R213811	GC117LVC	silcrete (+4#)		53	363625	6693428	0.00	0.01	0.005	-0.04	0.38	0.41	0.75
R213812	GC118LVC	calcrete (+4#)		53	363592	6693465	0.00	0.01	0.005	0.42	0.76	0.56	1.74
R213813	GC119LVC	calcrete (+4#)		53	363559	6693501	0.00	0.01	0.005	1.92	1.28	1.38	4.58
R213814	GC120LVC	calcrete (+4#)		53	363521	6693542	0.00	0.01	0.005	1.69	1.72	1.51	4.92
R213815	GC121LVC	silcrete (+4#)		53	363490	6693580	0.00	0.01	0.005	0.16	4.72	37.68	42.56
R213816	GC122LVC	silcrete (+4#)		53	363452	6693628	0.00	0.01	0.005	0.20	4.32	13.72	18.24
R213817	GC123LVC	silcrete (+4#)		53	363411	6693656	0.00	0.01	0.005	0.20	15.72	70.40	86.32
R213818	GC124LVC	silcrete (+4#)		53	363354	6693679	0.00	0.01	0.005	0.26	3.09	32.92	36.28
R213819	GC125LVC	silcrete (+4#)		53	363332	6693717	0.00	0.01	0.005	0.34	11.36	52.00	63.70
R213820	GC126LVC	silcrete (+4#)		53	363300	6693752	0.00	0.01	0.005	0.24	4.12	5.76	10.12
R213821	GC127LVC	silcrete (+4#)		53	363269	6693790	0.00	0.01	0.005	0.08	7.92	9.28	17.28
R213822	GC128LVC	silcrete (+4#)		53	363243	6693831	0.00	0.01	0.005	0.31	3.33	43.60	47.24
R213823	GC129LVC	silcrete (+4#)		53	363216	6693869	0.00	0.01	0.005	0.06	0.42	1.10	1.58

APPENDIX 10

Appendix 10: Identification of a single wood fragment from the Gawler Craton, South Australia.

MINES and ENERGY RESOURCES SOUTH AUSTRALIA

REPORT BOOK 97/53

IDENTIFICATION OF A SINGLE WOOD FRAGMENT FROM THE GAWLER CRATON, SOUTH AUSTRALIA

by

Andrew Rowett
Mineral Provinces

NOVEMBER 1997

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DEPARTMENT OF MINES AND ENERGY RESOURCES
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IDENTIFICATION OF A SINGLE WOOD FRAGMENT FROM THE GAWLER CRATON, SOUTH AUSTRALIA.

Rowett A.I.

Analysis of a single wood sample from a silicified low energy, poorly sorted, sandy, fluvial horizon within an apparent palaeovalley on the Gawler Craton is identified as a member of the Podocarpaceae, with a possible affinity to the genus *Phyllocladus*. The specimen is considered to be no older than Cretaceous, however, associated palynological and palaeobotanical data from the Eucla and Polda Basins would suggest a latest Eocene - Late Miocene age.

INTRODUCTION

A single silicified wood fragment was submitted for xylotomical analyses by Mr Malcolm Sheard, Team Leader, Regolith Terranes Project Team. The reasonably well preserved specimen was recovered from an apparent palaeovalley on the Gawler Craton.

METHODS

Observed patterning on one end of the specimen suggested the presence of possible growth rings and that some cellular structure had been preserved. To determine whether the state of preservation was enough to make an identification possible, at least to the family level and possibly to genus, three thin sections were required, a transverse, radial longitudinal and tangential longitudinal sections. By sectioning the specimen in this way the cellular arrangement can be viewed both in cross-section, i.e. across the wood, and longitudinal section, i.e. down through the wood. Two longitudinal sections are required if the features of both the wood fibres (tracheids) and ray cells are to be observed.
The sections were mounted on a 50x100mm microscope sides, then ground to a thickness of 30μ and covered with a glass coverslip.
Wood structure analysis was undertaken using a Zeiss Photomicroscope III.
Videovue and Paintshop Pro Image Capture software was used in conjunction with Corel Draw 5 to produce the following plates

Although the mineralization produced considerable distortion and disruption to the cellular structure, an identification to a plant family was possible. The poor preservation of intracellular features made only a tentative generic identification possible.

DESCRIPTION

Descriptions are based on the terminology and format used by Greguss (1955).

T.S. Wood rays evident. (Figures 1-2). Growth rings distinctive (Figure 3). No Wood parenchyma, Resin ducts evident. Tracheids in cross-section angular (4-6 sided)(Figure 4); bordered pits 1-2 (rarely 3) seriate, mainly opposite; no spiral thickening.
R.L.S. Cross-fields 1-2 large pits, possibly dacrydioid, pinioid (Figure 5).
T.L.S. Rays homogeneous, uniseriate 1 - 20 cells high (Figure 6).

IDENTIFICATION

Distinct growth rings, no wood parenchyma, no spiral thickening, opposite bordered pits, tracheids angular cross-section, uniseriate rays are indicative of Podocarpaceae.

Absence of wood parenchyma, number and type of bordered pits, cross field and height of rays suggest a possible affinity with *Phyllocladus.*

Phyllocladus no longer exists on mainland Australia, with only a single species *Phyllocladus aspleniifolius var. aspleniifolius,* a tree up to 10 metres tall, found in cool temperate rainforest and wet sclerophyll forests in Tasmania (Churchill and Dodson 1980) (Figures 11 & 12). The unique features of the genus are the phylloclades (leaves), which are considered to have evolved from the fusion, in one plane, of lateral branches and leaves (Quinn 1987,1988). The phylloclades are thick, robust with serrated lobes. The overall leaf-shape is quite variable. The genus is represented by six other species in New Guinea, New Zealand, Borneo, the Philippines and the Moluccas.

FOSSIL RECORD

The Australian macrofossil record for *Phyllocladus* is restricted to Tertiary occurrences mainly in Victoria and Tasmania where they are relatively common (Hill 1989). Leaf compressions are known from the Oligocene of Morwell (Deane 1925, Cookson and Pike 1954), and Yallourn Open Cut (Hill 1989), Victoria and leaf impressions from Sentinel Rock, Victoria (Deane 1904). In Tasmania, organic fossil leaf material has been recovered from the Late Pliocene - Early Pleistocene Regatta Point, Late Oligocene Little Rapid River (Figure 10), Oligocene Pioneer and Middle - Late Eocene Loch Aber localities (Hill 1989).
In the Eucla Basin, a single dispersed cuticle parataxon (OR5 003) from the latest Eocene Pidinga Formation (Ooldea Range 6, 56.0m) has been identified as having a possible affinity to *Phyllocladus*.
Fossil wood is known from two localities in Victoria, stumps in Upper Pliocene soils near Hamilton, Victoria (Gill 1964) and the described wood *Phyllocladoxylon annulatus* (Patton 1958) from Oligocene coal at Yallourn Open Cut in the Gippsland Basin.

The microfossil record is far more extensive, ranging from the Lower Cretaceous (Cookson and Pike 1954) through to the late Quaternary, 1100B.P. (Churchill and Dodson, 1980). The trisaccate pollen grain *Trichotomosulcites subgranulatus* (Figure 9) identified as having a probable affinity to *Phyllocladus* is known from as far back as the Lower Cretaceous in south-eastern, South Australia, i.e. Comaum No.2 (Harris 1964). This species is synonymous with *Trisaccites micropterus* (Cookson and Pike 1954), *Trisaccites microsaccatus* (Couper 1960) and *Podosporites microsaccatus* (Dettmann 1986). *Phyllocladidites paleogenicus* (Figure 8) encompasses all Tertiary pollen grains of the *Phyllocladus*-type. Both palynomorphs often occur together in Tertiary palynofloras throughout southeastern and central Australia.

AGE

The fossil record suggests that the specimen is either Cretaceous or Tertiary in age.

The discovery of the wood sample on the Gawler Craton, within an apparent palaeovalley, closely associated with a silicified layer of poorly sorted, sandy, fluvial sediment would indicate the specimen, which is reasonably well preserved, had not travelled very far. This would tend to suggest that it has not been weathered out of older Cretaceous sediments, i.e. Bulldog Shale, found some distance to the north within the Eromanga Basin, but of a local source and therefore Tertiary in age. Palynological and dispersed cuticle evidence from the Eucla and Polda Basins would support this age (Table 1).
Trichotomonosulcites subgranulatus, Phyllocladidites paleogenicus and ?*Phyllocladus* cuticle are present in the Middle - latest Eocene sediments of the Pidinga Formation in the Eucla Basin and Middle - Late Eocene sediments of the Pidinga Formation and Early - Middle Miocene sediments of the Garford Formation within the Polda Basin indicating that *Phyllocladus* grew within and/or near to both depocentres during this time. With both the Pidinga and Garford Formations associated with palaeochannels that drained off surrounding uplands including the Gawler Craton (Alley & Benbow 1989, Alley & Beecroft 1993), it may also be concluded that the wood specimen is probably of the same age and derived from the same source vegetation.

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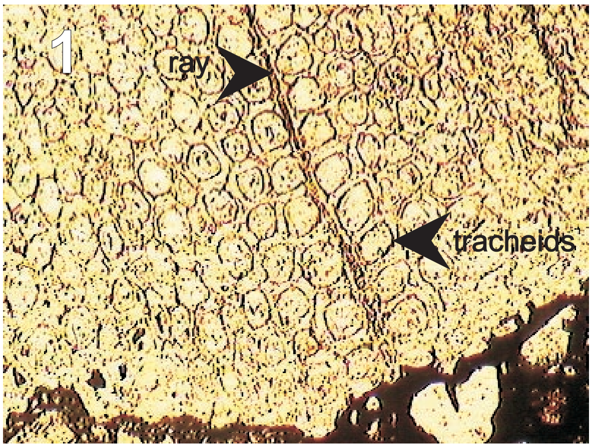
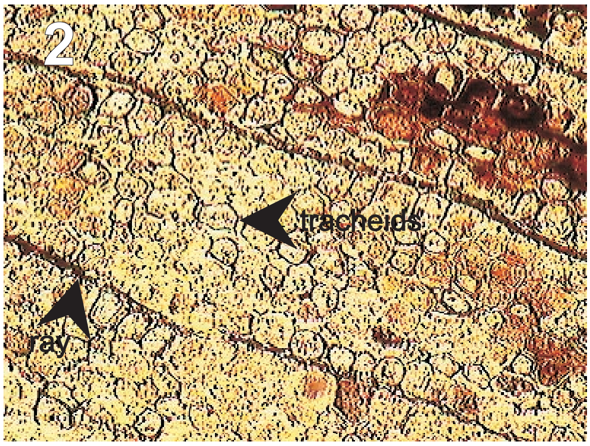
TABLE 1 Occurrences of *Phyllocladus* - related fossils from Tertiary localities within the Eucla and Polda Basins.

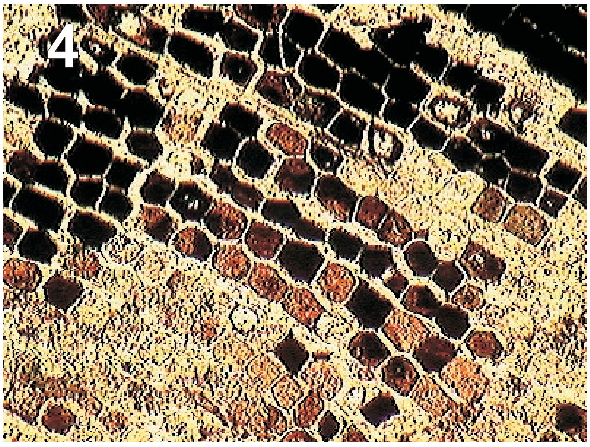
Drillhole	Macro/Micro Fossil	Location	Formation	Age
Pidinga Bore		Eucla Basin	Pidinga	Middle - Late Eocene
Ooldea Range 6	*Phyllocladidites paleogenicus, Trichotomosulcites subgranulatus* OR5 003 *?aff. Phyllocladus*	Eucla Basin	Pidinga	late Middle Eocene - early Late Eocene
Wilkinson 1	*T. subgranulatus*	Eucla Basin	Pidinga	latest Eocene
CRAE 2	*P. paleogenicus*	Eucla Basin	Pidinga	Middle - Late Eocene
Zanthus 6	*P. paleogenicus*	Eucla Basin	Pidinga	Late (latest) Eocene
Nullarbor 6	*P. paleogenicus*	Eucla Basin	Pidinga	Middle Eocene
Malbooma 1	*P. paleogenicus*	Eucla Basin	Pidinga	Middle Eocene
DH6/BM036		Polda Basin	Pidinga	Middle-Late Eocene
E04-1	*T. subgranulatus*	Polda Basin	Pidinga	Middle Eocene
Port Kenny A	*P. paleogenicus*	Polda Basin	Pidinga	Middle Eocene
Port Kenny B	*P. paleogenicus*	Polda Basin	Pidinga	Middle Eocene
LDH 41,	*P. paleogenicus*	Polda Basin	Pidinga	Late Eocene
P/N23068	*P. paleogenicus, T. subgranulatus*	Polda Basin	?Pidinga	?Early Oligocene
VB07	*P. paleogenicus, T. subgranulatus*	Polda Basin	Garford	Early-Middle Miocene
VB09	*T. subgranulatus*	Polda Basin	Pidinga	?Middle Eocene
VB10		Polda Basin	Pidinga	?Middle Eocene



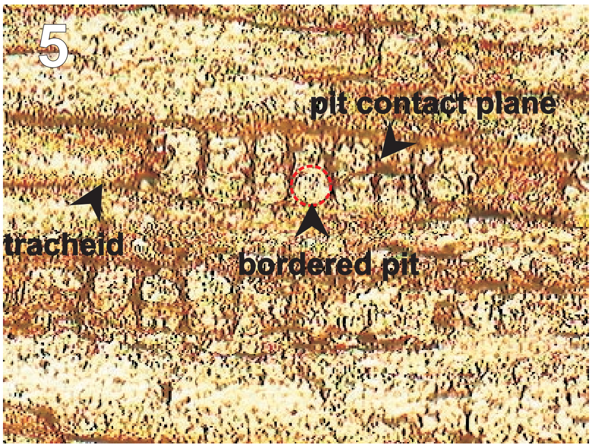


Two transverse sections showing angular tracheids in cross-section with dark staining, thin radially arranged wood rays. 80x

Transverse section showing a single growth ring (between arrows), marked by the narrowing of the latewood cells, succeeded by the larger early wood cells. 80x

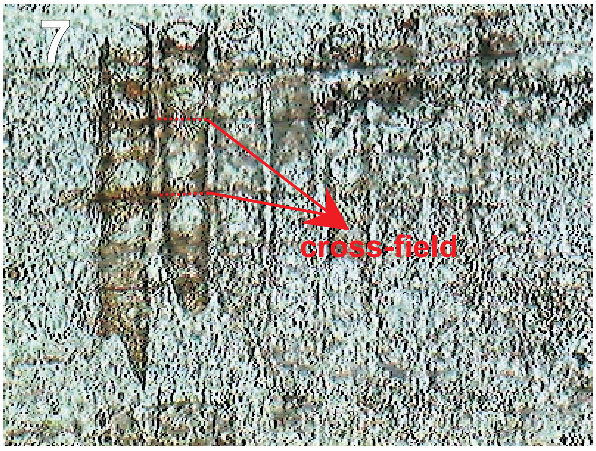


Transverse view showing angular cross-section of tracheids. Tracheids are arranged in uniseriate radial rows. 80x



Radial longitudinal section showing bordered pits (...) in the long wall of a tracheid.The two circular pits are oppositely arranged across the width of the tracheid. The contact plane between pit pairs appears as a dark band. 200x

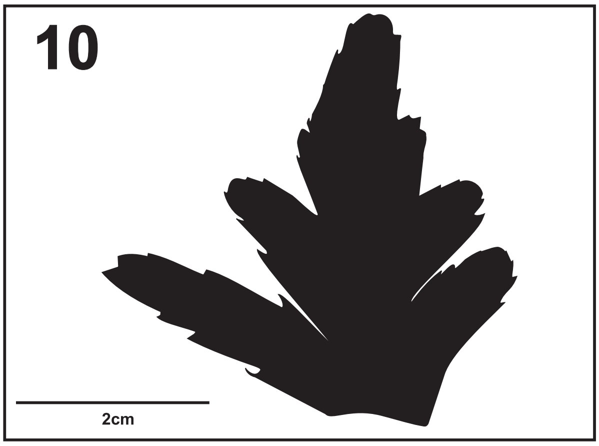
Tangential longitudinal section showing uniseriate, homogeneous wood ray, 8 cells high. Ray cells are barrel-shaped. 200x



Radial longitudinal section with number of cross-fields showing 1-2 pits with circular apertures, i.e. dacryioid pitting. 200x

Phyllocladidites paleogenicus **500x**
CRAE 2, 39 - 40m, Pidinga Formation

Trichotomosulcites subgranulatus 500x
CRAE 2, 39 - 40m, Pidinga Formation.



Late Oligocene fossil leaflet of Phyllocladus aberensis, Little Rapid River, Tasmania (drawn from Hill 1989)

Figure 11:*Phyllocladus aspleniifolius*

Figure 12: *P.aspleniifolius* (front three trees) in western Tasmania.