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REGOLITH STUDIES AT THE BOOMERANG GOLD PROSPECT, CENTRAL GAWLER CRATON, SOUTH AUSTRALIA

M. J. Lintern, M. J. Sheard, and G. Gouthas

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DISCLAIMER

EXECUTIVE SUMMARY

The Boomerang Gold Prospect is located 650 km NW of Adelaide in undifferentiated Proterozoic rocks incorporated within Archaean Harris Greenstone Belt mafic lithologies of the Gawler Craton. The prospect was originally discovered using calcrete geochemistry and is situated beneath a gypseous and calcareous dune on the edge of a saline drainage system bordering the Great Victoria Desert. Little regional relief exists, but dunes covering basement highs provide local relief up to 5 m. Vegetation is sparse and dominated by low open woodland of *Acacia* and *Casuarina* with an understorey of chenopods and other drought-tolerant plants; the area is heavily grazed. The climate is arid with rainfall of about 150 mm per annum falling mostly in the winter.

Drilling of Au in calcrete anomalies has revealed widespread sub-economic Au mineralisation at or near the weathering front. Host lithotypes include quartzo-feldspathic gneissic rocks, foliated granite (partly chlorite and epidote altered), and relatively undeformed coarse-grained mafic rocks. Gold in bedrock is largely associated with quartz veining, commonly in altered and brecciated zones. Lead, Cu, Ni and Zn appear to be associated with some mineralised zones.

Two regolith traverses or sections were investigated at Boomerang. Two zones of mineralisation (Zones 1 and 2) are crossed by the N-S regolith section. At Zone 1, Au concentrations increase with depth to the bottom of hole and form a 600 m wide anomaly. Another dispersion halo (200 m), albeit much weaker and beneath the palaeochannel, is related to quartz veining and is associated with Zone 2 mineralisation. Gold in calcrete is locally anomalous (>10 ppb) over Zone 1 mineralisation reaching a concentration of 26 ppb but the highest Au concentration (35 ppb) occurs in the northern part of the regolith line over thick, barren palaeochannel sediments, and corresponds with a similar anomaly in (calcareous) coarse lag. The soil is calcareous over Zone 1 mineralisation and is also anomalous in Au reaching concentrations of 3 ppb. Samples from 0-1 m are weakly anomalous in Au (maximum of 6 ppb) over mineralisation, as are several 0-1 m and calcrete samples in the northern part of the traverse. Samples from 1-6 m show no Au anomalism over mineralisation which may be due to dilution by gypsum.

Pearl bluebush (*Maireana sedifolia*) leaves and small branches do not delineate mineralisation well. Samples range in concentration from 0.15-1.2 ppb Au (mean 0.34 ppb), with the two most Au-rich samples (1.2 and 0.9 ppb) located at either ends of the traverse. For *Acacia*, sampling was restricted to the southern part of the traverse over the gysum dune. As with *Maireana*, *Acacia* bark and phyllodes showed little variation in concentration (bark 0.17-0.9, mean 0.31; phyllodes 0.05-0.45, mean 0.27 ppb). Assessing *Acacia* parts for use as sample media was not possible due to limited distribution over mineralisation only.

Several other elements associated with mineralisation are anomalous in the overlying saprolite, including Cd, Ag, As, Cr, Cu, In, Ni, Pb, Sb and Zn. The most notable of these is Pb, which has a broader footprint (>800 m) than Au and extends (>100 ppm) to near the surface (3-4 m) in the southern part of the line. The other metals are not anomalous in the top 6 m of regolith.

The Boomerang study highlights the difficulty of exploring in terrain covered by recent wind blown gypseous materials. Of the materials studied, calcrete (and possibly soil) provide the only viable geochemical sample media to locate mineralisation in this area. In this type of terrain, exploration should target calcrete initially, then drilling of the best targets with cuttings analysed for Au and pathfinder elements, including Pb and As.

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REGOLITH STUDIES AT THE BOOMERANG GOLD PROSPECT, CENTRAL GAWLER CRATON, SOUTH AUSTRALIA

1. INTRODUCTION

The Boomerang Gold Prospect report completes a series of preliminary studies of the regolith geology and geochemistry in the Gawler and Curnamona Cratons of South Australia. The purpose of these studies is to assist exploration companies in understanding metal dispersion, assessing metal concentrations, recognising regolith materials about mineralised prospects. Other studies as part of this series include Au and base metal prospects at, for example, Birthday, Challenger, ET, Earea Dam, Golf Bore, South Hilga, Adelaide Hills, Moonta, Mt Gunson, Olary area. A summary and synthesis of these and other projects is contained in Lintern (2004).

2. SITE DESCRIPTION

2.1 Location and physiography

The Boomerang Gold Prospect is 10 km SW of Tarcoola and 650 km NW of Adelaide in undifferentiated Proterozoic rocks incorporated within Archaean Harris Greenstone Belt mafic lithologies of the central Gawler Craton (Figure 1). The prospect was originally discovered by Grenfell Mining NL in 1995 (EL 2413) using calcrete geochemistry and is situated beneath a gypseous and calcareous dune on the edge of a saline drainage system bordering the Great Victoria Desert. Little regional relief exists, but dunes covering basement highs provide local relief up to 5 m. Vegetation is sparse and dominated by low open woodland of *Acacia* and *Casuarina* with an understorey of chenopods and other drought-tolerant plants; the area is heavily grazed. The climate is arid with rainfall of ~150 mm per annum falling mostly in the winter. Two regolith traverses or sections across mineralisation that partly cross a broad palaeochannel were investigated (Figure 2).

2.2 Local geology and mineralisation

Regional exploration utilising calcrete sampling defined several surficial Au anomalies (Figure 2). Subsequent targeting of these anomalies using aircore, RC and diamond drilling have revealed widespread sub-economic Au mineralisation at or near the weathering front. Host lithotypes include quartzo-feldspathic gneissic rocks, foliated granite (partly chlorite and epidote altered), and relatively undeformed coarse-grained mafic rocks. Some of the altered mafic rocks have been assigned to the Harris Greenstone Belt, a complex Archaean rock sequence that includes serpentinised komatiites, komatiitic basalts and pillow basalts with associated epiclastics and meta-sedimentary units (Hoatson *et al*., 2002; Davies, 2002). Gold in bedrock is largely associated with quartz veining, commonly in altered and brecciated zones. Lead, Cu, Ni and Zn appear to be associated with some mineralised zones (Table 1). Note that deeper drill holes are suffixed BG while shallow (0-6 m) drill holes are suffixed GB. Drill holes with the same number were located within a few metres on one another.

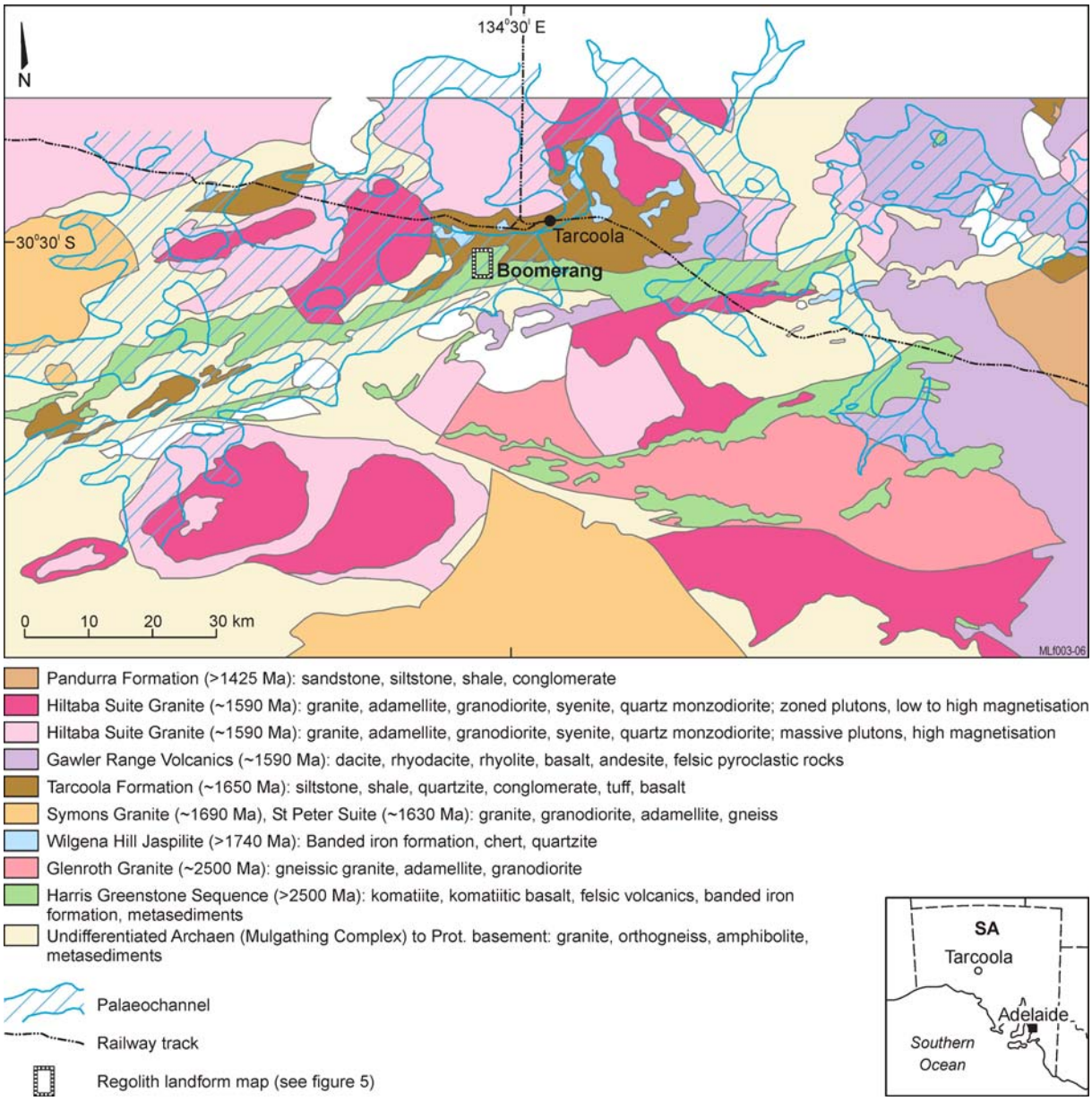

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Table 1: Selected drillhole intervals with elevated Au and associated base metal concentrations.

Drillhole	Interval (m)	Analyses (ppm except Au, in ppb)	Regolith type
BG47	48-52	Au (1700), Cr (1000), Cu (125), Pb (500), Ni (550), Zn (1500).	saprolite
BG30	44-48	Au (1300), Cu (115).	saprolite
BG47	44-48	Au (1200), Cu (110).	saprolite
BG46	44-48	Au (860), Cr (1150), Ni (750),	saprolite
BG44	44-48	Au (650) no other data	saprolite
BG47	52-54	Au (630), Ni (600) Pb (550), Zn (1100).	saprolite
BG46	20-24	Au(470), W (43).	saprolite
BG47	32-36	Au (450), Pb (1200).	saprolite
BG46	48-51	Au (417), Cr (1150), Ni (490).	saprolite
DD3	139-140	Au (3850), Ag (4.5), As (280), Cr (700), Pb (1200), Zn (900).	bedrock
DD3	140-141	Au (580), Ag (14), Cr (850), Pb (9900), Zn (550).	bedrock

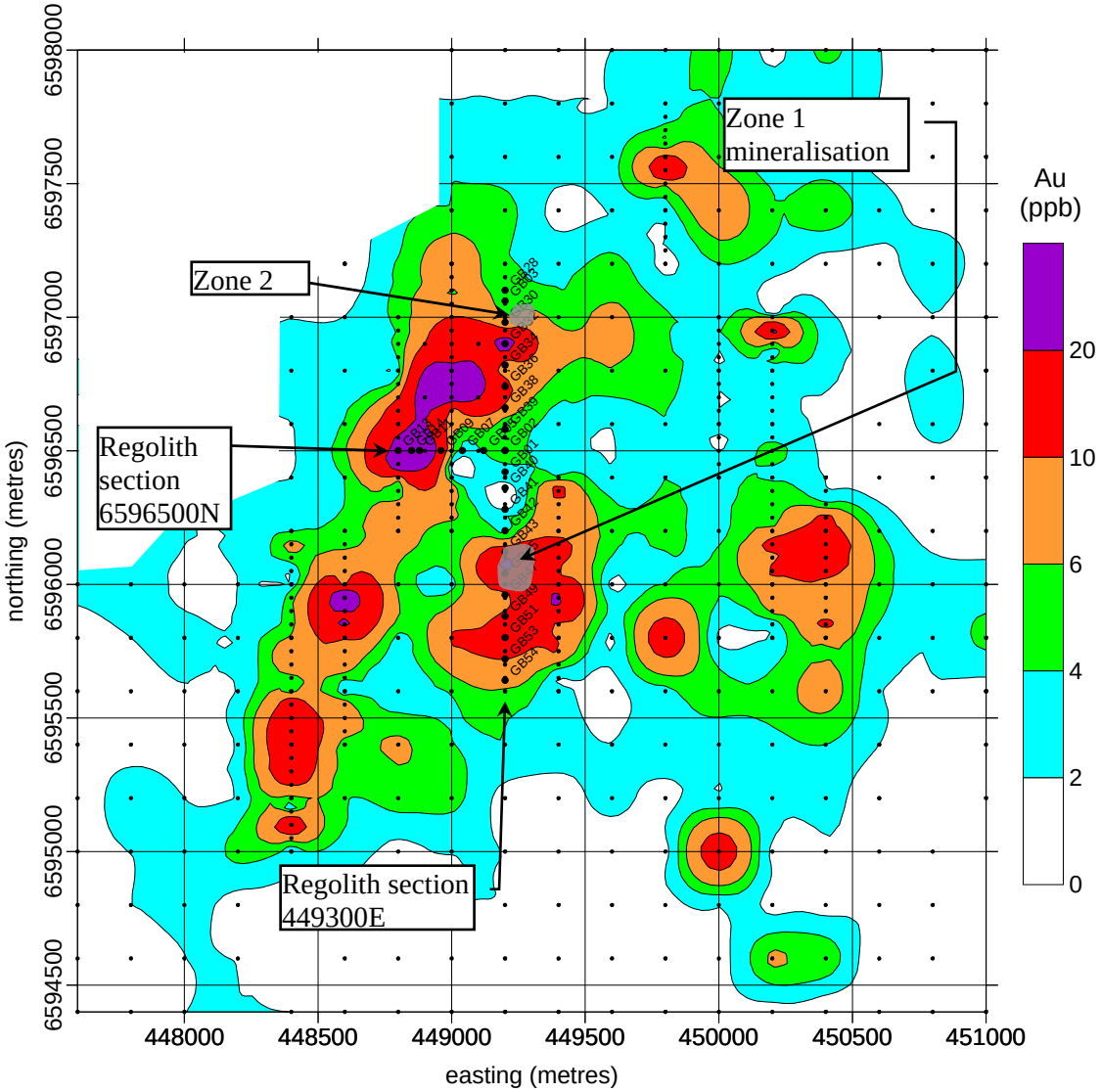


Figure 2: Boomerang Gold Prospect showing two intersecting sections selected for detailed study (0-6 m drill holes labelled), contoured calcrete Au anomalies, mineralisation (greyed areas) and calcrete sample locations. Raw calcrete data supplied by Grenfell Mining NL.

2.3 *In situ* regolith stratigraphy

Introduction. Descriptions are made from regolith and bedrock materials from section 449200E (Figure 2, drillholes BG/GB 28 to 54) and are limited in scope due to the variable depth of drilling: nine drillholes penetrated bedrock, three stopped just short of the weathering front, ten penetrated only to or just into saprock, and three penetrated only as far as saprolite.

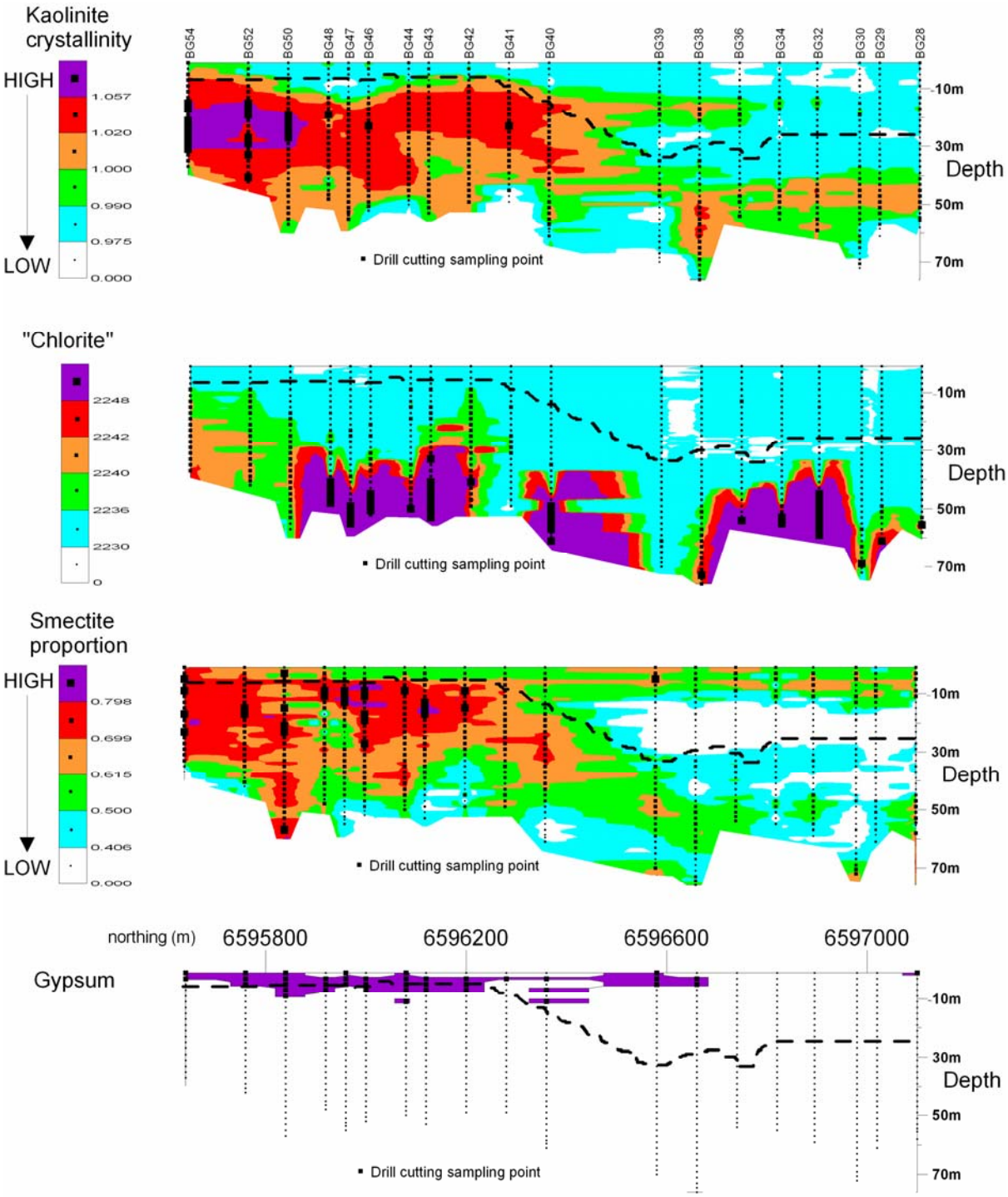
Bedrock. Rock types include: granite, medium- to coarse-grained and variably foliated; granite-epidote altered, medium- to coarse-grained; felsic gneiss with hornblende, medium- to coarse-grained; chloritic gneiss, medium-grained; and mafic rocks, chlorite and actinolite altered, fine-grained. Some chlorite minerals were detected by PIMA (Figure 3). There are abundant quartz veins, on millimetre to centimetre thickness scales, although larger forms occur elsewhere on the tenement. Vein quartz ranged from colourless, bluish- grey to dark grey.

Saprock. Brown and yellow Fe staining is commonly present on, or forming coatings to, fractures and sometimes permeates the more weathered mineral components. Saprock ranges in thickness from <1 m to >6 m.

Lower Saprolite. Lower saprolite is commonly clay-rich and usually darker coloured (grey-brown to brown or greenish) and firmer than upper saprolite. Darker hues are due to derivation from mafic or ultramafic protolith. Lower saprolite retains relict primary texture and tectonic fabric in coarser grained materials and varies in thickness from <1 m to ~30 m. Some variation appears to be related to lithotype change or attributed to tectonic fracturing; however, the large thickness at BG50 is not well understood.

Upper Saprolite. Upper saprolite is clay-rich, sometimes quartz grit bearing, commonly whitish but may also be partly reddish to brown if megamottles are present. Material density, stiffness and hardness are usually much less than in the lower saprolite. Upper saprolite bulk colours are pale grey-brown to pale brownish and may be nearly white near the top. Darker hues are due to derivation from mafic or ultramafic protolith. Upper saprolite retains relict texture and tectonic fabric in coarser grained materials, although clay formation and hydration-induced volume changes may have caused some distortions to any relict features. This sub-zone represents the most consistently thick weathering unit over much of the section, ranging from ~16 m to >30 m, averaging ~26 m. Within the palaeochannel area it has been partially eroded and incised where >5-10 m of material may have been stripped.

Pedolith. Mostly clayey to clay-rich, grey-brown to brownish but also has strong reds and strong browns where mottling is present. All relict primary textures and tectonic fabrics have been obliterated by pedogenesis yielding a new pedogenic fabric with associated oxide-sesquioxide colourings and overprinting cements. The pedolith may have a thin ferruginous capping, that is commonly arenose (fine-grained siliceous grit with Fe-oxide-oxyhydroxide and silica cements and void infill). The Fe-capping seems to form a persistent, thin coherent dark brown to red-brown horizon (Figure 4). Pedolith thickness ranges from <1 m to >2 m. Some silicification was noticed near the pedolith-saprolite boundary in drillhole GB53 and along most of the E-W section near the pedolith top (Figure 4). Quartz veining may persist well up into the pedolith. Veins range from millimetres to centimetres in thickness. Vein quartz ranged from colourless to grey, dark grey and rare bluish grey; occasional bluish or dark grey zoned equivalents were also observed. The pedolith is preserved from south of drillhole BG54 to north of drillhole BG40 where it is eroded off at the palaeochannel edge. Thickness ranges from approximately 4 - 10 m.



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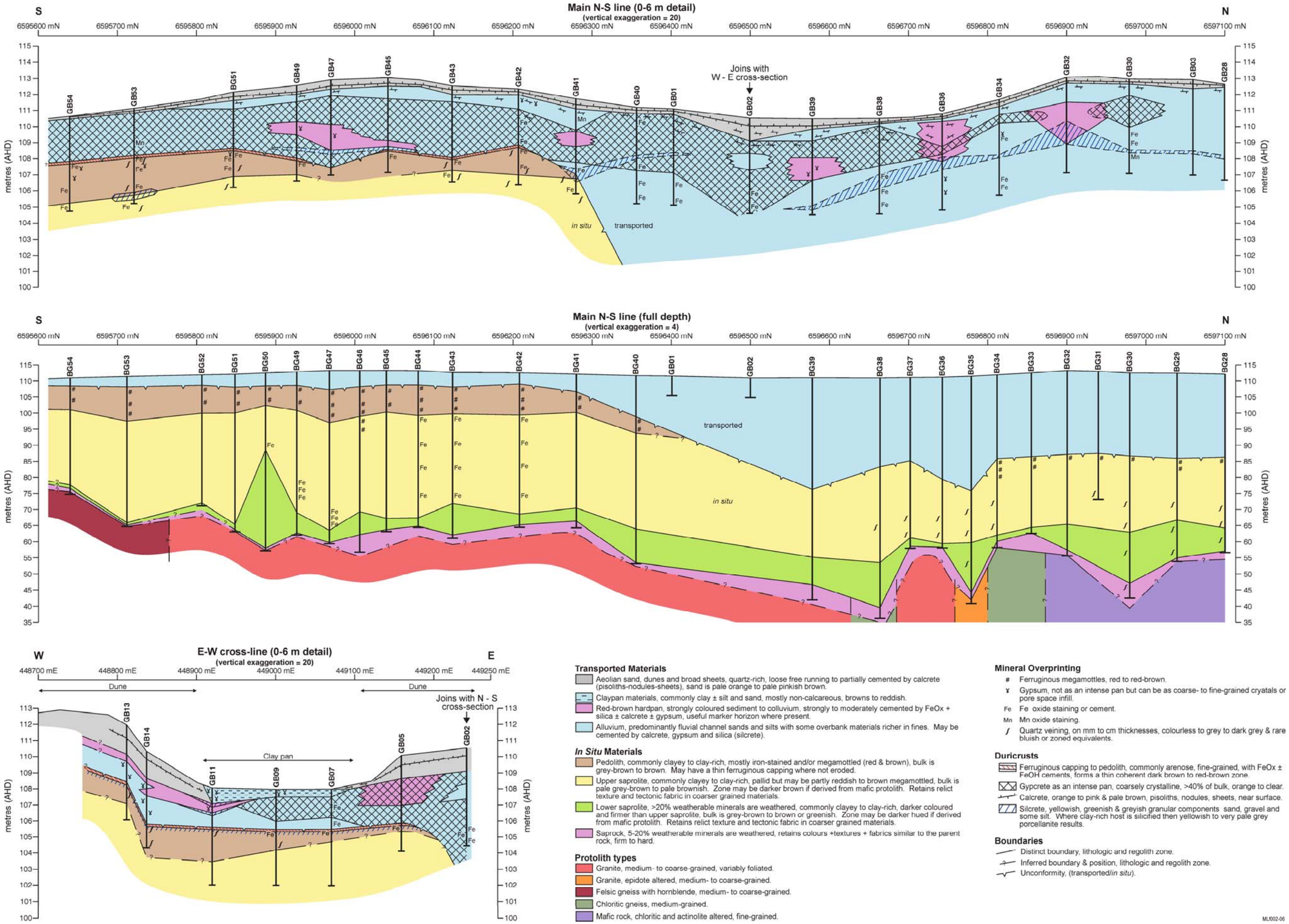


Figure 4: Sections through Boomerang Gold Prospect showing regolith units, drill holes and overprinting units.

2.4 Transported regolith materials

Introduction. The base of the transported regolith is comprised of Palaeogene to Neogene fluvial channel gravel, sand, silt plus clay, and with some finer grained overbank equivalents away from the main palaeochannel; these are overlain or partially interdigitate with a discontinuously present red-brown hardpan; inturn, this is overlain by ubiquitous orange to pink siliceous aeolian sand (dunes and sandplain). The upper 4-6 m of the transported materials profile may be indurated by a variety of cements forming calcrete, gypcrete and silcrete, with varying degrees of intergrain void infill. The palaeochannel clay fraction includes poorly crystalline kaolinite and smectite (Figure 3), the latter being more common towards the channel infill upper third. Mixed layer clays may also occur. Over the southern half of regolith section 449200E (Figure 4), transported materials range from 4 m to 7 m in thickness and are dominated by aeolian sand or fluvial deposits of clay, sand and gravel. Greater thicknesses of cover (up to 35 m) occur over the northern part of the section. Palaeochannel infill is dominated by clayey quartz sand with minor gravel in the lower third but is predominantly clay-rich with very minor silt, sand and gravel in the upper two thirds. Clay uniformity and its overall structureless presentation in the upper part suggests those clays may have formed predominantly by chemical precipitation rather than by a primary fluvial sedimentary process.

Alluvium occurs predominantly as fluvial sand, silt and clay – in mixtures or as more discrete well-sorted grain-dominant bands to lenses. Away from the palaeochannel there are overbank materials richer in fines than sand and gravel. The alluvium is cemented by gypsum and in places by silica (silcrete ± porcelanite). It is also possible that some calcrete cementation also occurs in the upper 3 m. Manganese as black stains and spots were observed in the alluvium in drillholes GB53 and GB30.

Red-brown hardpan is a widespread Pleistocene unit in the Gawler Craton, being a richly coloured colluvial sediment, strongly to moderately cemented by Fe oxides, silica, calcrete and/or gypsum. Red-brown hardpan can form a useful marker horizon where present. Along the drillhole study lines this unit is discontinuous and is restricted to the upper 1-4 m.

Claypan materials (0-1 m thick) occur in a depression on the E-W drill cross line (Figure 4). Claypans commonly comprise clay and/or silt and fine sand, mostly non-calcareous, browns to reddish or greyish, only a few exhibit evaporitic mineral crusts (halite and/or gypsum). Thin aeolian sand on claypan materials occur where sandplain is invading playas via wind action, usually on the western side of playas.

Aeolian sand forms both distinct dunes and broader sandplains and consists of pale orange to pale pinkish brown, well-sorted, quartz-rich, fine- to medium-grained sand in a loose to partially cemented form. Aeolian sand grains are distinctly different from those of the underlying alluvium as they have frosted surfaces, are uniformly sorted and display a distinct surficial orange Fe-staining. The dominant grain cement is calcrete and this can be in the form of pisoliths or nodules or more massive sheets. Minor gypsum cementation may also be present, however this is more common in the underlying units. Along the study lines, aeolian sand ranges up to 3 m deep but across the tenement it may attain a thickness at dune crests of 4-5 m (see section 2.5).

Gypcrete is most abundant forming an intense pan of coarsely crystalline gypsum in interlocking rosettes or as densely interlocking ‘fish tail’ gypsum crystal-rich horizons where individual crystals are many centimetres long (Figure 3). It may form >40% of the pan’s bulk and crystals range in colour from orange to clear and it also occurs as isolated coarse- to fine-grained cryatals or pore space linings and infill within sandy to silty strata.

Calcrete forms the second most abundant near surface duricrust, comprising pisoliths or nodules to more massive sheets ~0.3-0.5 m thick that may just subcrop or be located at depths of 0.5-1.0 m. It is generally coloured pale yellow-brown to pale pink or pale red-brown. Calcrete nodules have been transported by burrowing animals and tree-root throws (Figure 6).

Silcrete occurs deeper in the 0-6 m section where it forms thin bars and thicker silicified horizons – mostly within the sandier alluvium. Colours range from yellowish to greenish to greyish. Enclosed granular components include quartz sand, gravel and some silt. Where a clay-rich host is silicified then yellowish to very pale grey porcelanite has formed.

2.5 Regolith landforms

Introduction. Detailed colour aerial photography (1:20000) was flown in December 1998. This stereo photo coverage provided an excellent base for regolith map compilation and interpretation (Figure 5). Detailed field work was carried out along the drill lines, some dunes and around prospector's workings, but only reconnaissance work was attempted for the remainder of the area mapped. Mapping style has been constrained by the limited regolith surface expression.

The area is generally of low relief with low rises where sand dunes and lunettes occur. Ephemeral lakes are plentiful and usually occupy topographic low areas. Basement outcrop (either weathered or fresh) and natural sections of the regolith are absent. Vegetation is generally sparse although trees and some shrubs are more densely clustered along dune crests and around some clay pans. Vegetation consists of scattered trees (*Acacia*, *Eucalyptus*, *Casuarina*, with rare *Santalum acuminatum*) with an understory of shrubs including *Cassia*, *Atriplex*, *Ptilotus*, *Maireana*, *Heterodendrum* and *Eremophila* (Figure 6).

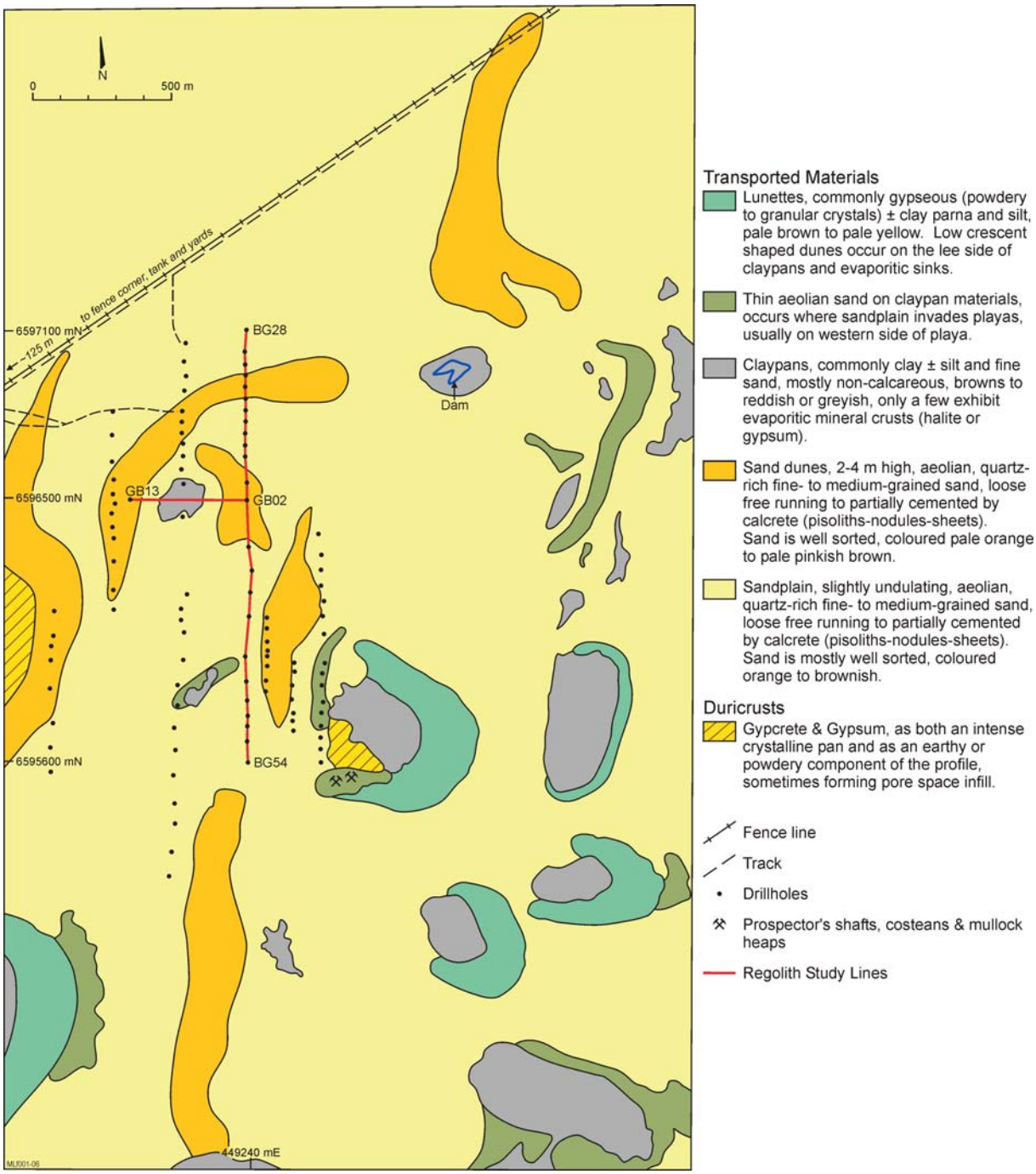
Transported units predominate. Around some ephemeral lake shores, very localised erosional units consist of partial deflated gypseous dunes and lunettes, karstic gypcrete where deflating soil has exposed sub-cropping gypcrete to the effects of rain, and/or sand forming in-wash from adjoining dunes to the lake shore sediment.

Lunettes and claypans. Lunettes are commonly gypseous (powdery to granular crystal fragments) with pale brown to pale yellow clay parna and silt,. The most common form of lunette is a low crescent shaped dune on the lee (eastern) side of claypans and evaporitic sinks. Lunettes commonly have eroding (via deflation and dissolution) lake side flanks. Exposed and eroding surfaces can exhibit localised meso- and micro-karstic features (Figure 6, rillen and joint widening). Several generations of lunettes exist with the oldest being the most indurated and eroded.

Sand dune. Sand dunes are 2-4 m high, aeolian, and consist of quartz-rich fine- to medium-grained (well sorted) materials that are frosted and orange stained. The sand is loose, free running to partially cemented by calcrete (as pisoliths, nodules, or sheets) and coloured pale orange to pale pinkish brown.

Sandplain. The sandplain landform is slightly undulating and consists of similar material to that found in the sand dunes. In profile, the sandplain includes weakly developed soil horizons that may be silty or clayey with depth. Near claypans and lunettes, the sandplain may be partially gypcreted, may be siltier and is commonly a paler colour.

Gypcrete pans. Gypcrete forms an intense crystalline pan, an earthy or powdery component of the profile, and, sometimes, pore space infill. Gypsum below ~1 m is commonly coarsely crystalline (fish-tail crystals up to 150 mm long) making up <40% of bulk, either as orange, grey, or clear crystals. Earthy or powdery soil forms are widespread in this area, especially near playas and/or gypseous lunettes. This form, where exposed to rainfall, is commonly thinly crusted and may exhibit a micro-karstic surface (rillen).



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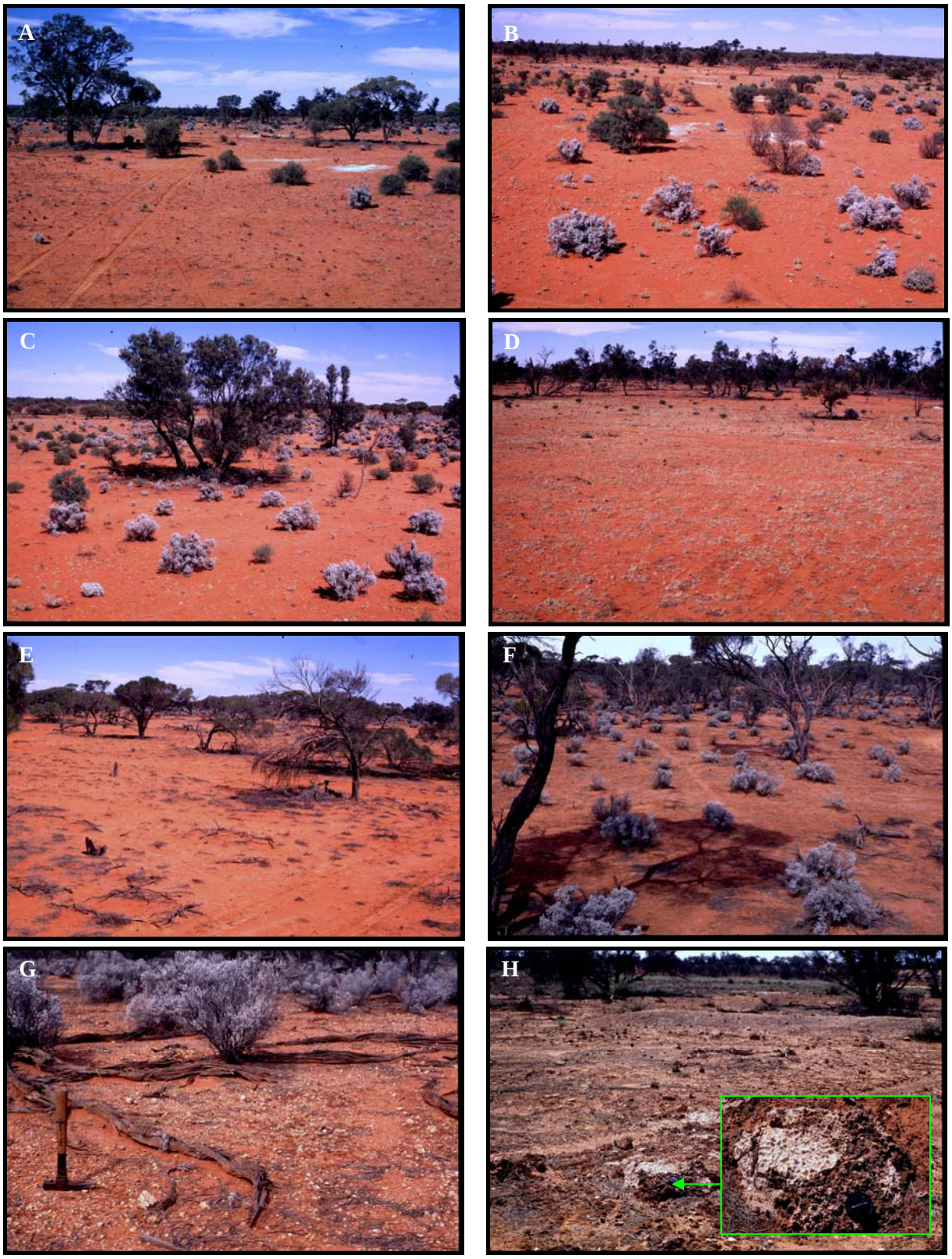

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2.6 Prospector's workings

There are two small undocumented prospector's workings, located near the southern end of the sampling traverse (Figure 5) and 1.5 km NNE of this. Both occur on exposed gypcrete developed within thin transported cover. The localised occurrence of white to pale grey vein quartz chunks, (>200 mm diameter) as surface float, probably lured the prospectors to these sites. A series of costeans to ~2 m depth and from 10-25 m long, now partly collapsed, radiate out from central shafts. Pits to ~2 m depth also occur. The shafts are ~1.5 m wide and are square sectioned, possibly sunk to depths of ~10 m but are now partially collapsed.

Mullock heaps around the shafts contain abundant vein quartz, similar to the surface float, plus chlorite altered quartz-feldspar rock resembling a coarse-grained granite apophysis (pegmatite) where the unaltered feldspar is yellow to pale orange and the quartz white to grey. The shafts expose a >2 m thick gypcrete profile where densely packed 'fish-tail' crystals exceed 200 mm in length. Pedolith-saprolite is exposed in the shaft walls. Pallid saprolite fragments occur abundantly within the mullock heaps, as do green-grey-yellow fragments of chloritic granite plus chloritic pegmatite and grey vein quartz, often with adhering pegmatite host minerals.

3. LANDSCAPE EVOLUTION

3.1 Regional landscape evolution

3.1.1 Palaeozoic to Mesozoic

Landscape development in this area has generally involved exhumation, deep weathering, erosion, and sedimentation with some later landscape inversion, desert dune encroachment and duricrust development (Daly, 1985, 1986; Parker, 1995; Drexel and Preiss, 1995; Sheard and Robertson, 2004). Substantial glaciation of this part of South Australia took place during the Permian. All previous deep weathering profiles and many sedimentary deposits were removed during those glaciations, leaving fluvio-glacial sediments in depocentres like the Mulgathing Trough WNW of Tarcoola (Hibburt, 1995). Rifting within Gondwana to form the separate continental masses of Australia and Antarctica began in the Early Jurassic due to an emerging geo-tectonic regime which led to rift and intracratonic basin formation along the southern edge to, or on, the Australian land mass (Krieg, 1995). Remnant Mesozoic deposits are quite limited in this area and are entirely absent from Boomerang.

3.1.2 Early-Middle Cainozoic (Palaeogene to early Neogene)

Continued rifting between Antarctica and Australia initiated marine transgressions into the southern marine basins and the Gawler Craton via large river systems where sedimentation continued into the early Neogene. These transgressions changed the existing drainage-erosion regimes and influenced climatic patterns further inland (Alley and Lindsay, 1995). As Australia gradually drifted north, the climate warmed and rainfall increased, promoting more rapid rock weathering and additional fluvial erosion. Significant river systems drained the Gawler Craton to the west and southwest in the Central Gawler Craton area (Hou *et al*., 2000; Hou, 2004). However, this region maintained a relatively low topographic relief (v:h =1:2000; pers. comm. B. Hou, Geological Survey, PIRSA, 2004; Hou *et al*. 2000, 2003a). Sediments generally have slopes of $<1^{o}$ although local perturbations around palaeochannel edges and protruding basement rises yield slopes of >1:5 and associated sedimentary slopes of $>10^{o}$. Palaeochannels were dominated by sand during the Eocene but become progressively dominated by silt to clay in the Miocene. This was due to minor uplift in the Barton-Ooldea debouchment area of the eastern Eucla Basin that reduced topographic gradients even further (Hou *et al*., 2000, 2003a, b, c).

Palaeogene to Neogene vegetation for this part of the Gawler Craton ranged from meso-mega-thermal angiosperm-gymnosperm mixed rainforest to meso-thermal conifer dominant rainforest (Benbow *et al*., 1995a). During the late Eocene and again in the late Miocene to early Pliocene, broad-scale pedogenic silicification of the landscape yielded extensive silcrete duricrusts (up to 3 m thick) on

exposed surfaces (Benbow *et al*., 1995b). Commonly silcretes are complex, where the surface has been repeatedly overprinted, but, where sedimentation has separated the silicification episodes, silcretes are generally of a simpler form (Benbow *et al*., 1995b; Lintern and Sheard 1999; Mason and Mason, 1998).

3.1.3 Late Cainozoic (late Neogene-Quaternary)

The climate became more arid during the Pliocene, causing the earlier river systems on the Gawler Craton to dry up and become silted. Strings of ephemeral playas and clay pans mark the original fluvial traces (Hou *et al*. 2000; Hou, 2004). Erosion during the Pliocene to Quaternary has cut back from lower, less competent ground towards the generally higher silcrete armoured surfaces, leading to the formation of small scarps standing <5 to 50 m above the surrounding plains (to the north of Boomerang Prospect). Increasing aridity and strong winds during the Pleistocene developed extensive aeolian dune fields over much of Central Australia. Siliceous sands from the Great Victoria Desert, west of Tarcoola, gradually invaded parts of the Central Gawler Craton (Callen and Benbow, 1995). During that time, and continuing today, there was an influx of aeolian carbonate dust, derived from extensive coastal shelf bryozoan-rich carbonates exposed to erosion during each Pleistocene glacial low sea stand. Pedogenic modification, and the actions of meteoric water, have reformed the carbonate dust into calcrete (Phillips and Milnes, 1988; Lintern and Butt, 1993; Belperio, 1995; Lintern, 1997). Gypsum is common in the landscape and mostly derives from sulphate-rich dusts of ephemeral lake evaporites through wind action on desiccating lake floor crusts. A great deal of this soil-subsoil hosted gypsum has been modified by meteoric water and pedogenic processes into a coarsely crystalline duricrust. Vegetation adapted to the increasing aridity by becoming sclerophyll dominant, sparse and of moderate to low stature. The modern vegetation is sensitive to grazing pressure. Where the vegetation has been removed or overgrazed, there is no regeneration and the landscape is eroding and/or deflating.

3.2 Localised landscape evolution

Landscape evolution for the Boomerang Prospect area is typical of the Harris Greenstone and Central Gawler Craton Domains. Deep weathering of the crystalline basement has proceeded since the end of the Permian glacial erosion (which cut back to fresh rock) and continues today. Weathering rates are hard to quantify and are dependant on primary lithotype, degree of deformation, fracturing, porosity, climate, vegetation and exposure time. Along the main section the deepest weathering profile coincides with the southern side of the palaeochannel where gneissic rocks are pervasively chlorite altered (Figure 4).

A relatively complete *in situ* regolith profile (protolith to pedolith) is preserved over the southern half of the Boomerang prospect. This indicates that relief and associated erosion were both quite low up to the development of the Cainozoic palaeochannel. A ferruginous duricrust has formed in the upper pedolith but it is relatively thin, involves only a low percentage of Fe and is not as intensely developed nor as thick as laterite or ferricrete elsewhere e.g. in Western Australia. Its presence suggests lengthy landscape stability during the late Mesozoic to early Cainozoic.

Locally, the study area is relatively flat, but ~10 km NE there is a prominent outcrop of Archaean to Proterozoic rocks forming the Tarcoola Ridge, a potential source for coarse-grained clastic sediment that covers the surrounding plains. Within the basement, ultramafic to mafic greenstones of the Harris Greenstone Belt are generally more deeply weathered than the surrounding granites and metamorphic rocks. Both continuous and discontinuous valleys have been preferentially eroded into the weathered greenstones and have become subsequently infilled with sediment from the weathered basement and eroding Phanerozoic sediments (Hou, 2004; Sheard and Robertson, 2004) (Figure 1). A strong and persisting linkage between palaeochannel and the weathered greenstone subcrop is evident for the northern most greenstone belt (>85% match, Figure 1). More easily eroded weathered greenstones have allowed palaeodrainage to preferentially carve out a significant valley system over some hundreds of kilometres and in places is up to ~20 km wide. Sediment infill reaches thicknesses of >80 m within the palaeochannel segments (Figure 7). On the present day land surface the

palaeochannel is indicated by a broad sinuous, but weak, topographic low containing chains of evaporite encrusted playas. The palaeochannel trace shows all of the Boomerang prospect lies within the palaeochannel, but drilling evidence indicates that the southern part of Boomerang prospect formed an island within the large palaeochannel. The southern edge of the palaeochannel is not well constrained and/or is quite complex at a local scale.

Palaeochannel infill is dominated by clayey quartz sand with minor gravel in the lower third but is predominantly clay-rich with very minor silt, sand and gravel in the upper two thirds. Work by Hou *et al*. (2000; 2003a, b) and Hou (2004) indicates that this palaeochannel is part of the Kingoonya Palaeochannel drainage system that underwent at least two marine transgressions during the Eocene and Miocene high sea stands (Figure 7). The Eocene portion often has a low content of fines and can be coarse-grained, while the Miocene portion tends to be clay-rich and poor in coarse clastic grains. Clays of the Miocene portion are often uniform in character, structureless, poorly bedded, and commonly smectite- or illite-rich, suggesting chemical precipitation rather than sedimentary deposition. A drier climate since Miocene times has reduced surface water flows to an extent where rivers ceased and their channels were over run by Quaternary sediments and aeolian sands. Pedogenic silicification has cemented intervals of the sedimentary pile and selected portions of the *in situ* basement saprolith into silcrete bands during the late Palaeogene to Neogene.

Aeolian, fluvial, lacustrine and erosive processes have all been operating in this area for a considerable time. The modern drainage pattern can run counter to the palaeodrainage systems and is commonly subdued where terminal points form at ephemeral lakes, claypans or drainage sinks. Aeolian sands invaded several times during the Pleistocene, producing a variety of dune and sandplain landforms. Some dunes have cross-cut pre-existing drainage lines, thereby initiating playa lake formation, or have invaded pre-existing lakes and over run playa associated lunettes. Deflation of lake and claypan floors has produced parna, seed gypsum and silts that now form lunettes in the lee of most playas, while distally, aeolian gypsum has led to gypcrete formation in the broader landscape soils and subsoil.

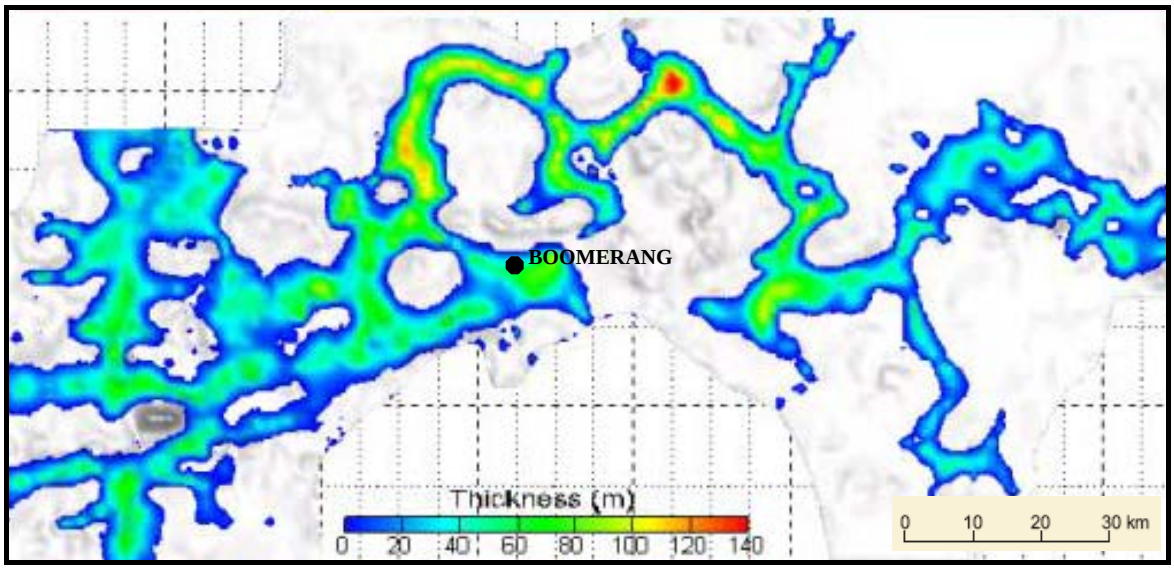

Figure 7: Palaeochannel sediment infill thicknesses on a regional DEM background (after Gray, 2003, written communication; Hou 2004).

4. GEOCHEMICAL SAMPLING AND ANALYSIS

4.1 Sample collection

Geochemical sampling was undertaken at 27 sites on two sections: a long (1460 m) N-S section on 449200E (20 sites) and a short (400 m) E-W section on 6596500N (7 sites) (Figure 5). The longer

section corresponds with earlier air core drilling that had intersected two zones of mineralisation (termed here Zones 1 and 2).

RAB samples (n=162, 1-3 kg, ~80 m spacing) were collected at one metre depth intervals from 0-6 m. The first 10 cm of the surface soil was removed prior to drilling to reduce the possibility of contamination caused by previous activity.

Soils (n=27, 0-5 cm) weighing 1-2 kg were collected using geological pick and plastic dustpan from uncontaminated ground within the vicinity of the drill hole samples, at ~80 m spacing along the traverses.

Fine (n=27, 0.5-2 mm) and coarse (n=27, >2 mm) surface lag samples (0-1 kg) were collected using a plastic dustpan and brush within the vicinity of the drill hole samples, at ~80 m spacing along the traverse.

Vegetation (n=26) samples were collected from the long traverse only including 14 pearl bluebush (*Maireana sedifolia*, leaves and branches), and 6 samples each of phyllodes and bark samples from *Acacia*. The most widespread of the plant species, *M. sedifolia* was only present over part of the traverse.

4.2 Sample preparation and analyses

4.2.1 Mineral samples

Topsoil and 0-6 m samples were pre-prepared in the laboratory by weighing, mixing 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. Lag samples were washed through a coarse then fine sieve retaining the +2 mm and +0.5 mm size fractions, respectively. Approximately 60 g of pulverised air core cuttings material from the earlier drilling programme was analysed for the same 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 and DIBK extraction for Au (1 ppb).

4.2.2 Vegetation samples

Vegetation samples were processed in 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^{o}C for at least 24 hours, to prevent smearing during grinding. The samples were then re-weighed and step-wise-ashed using the following programme: 4 hours at 200^{o}C, 4 hours at 400^{o}C and then 15 hours at 550^{o}C before being re-weighed. Ashed material (5 g)

was sent for AAS (Au), ICPOES and ICPMS analysis as described above for mineral samples, with data reported as dry weight.

5. GEOCHEMICAL RESULTS

5.1 Gold

Two zones of mineralisation (Zones 1 and 2) are crossed by the N-S section. At Zone 1, Au concentrations increase with depth to the bottom of hole and form a 600 m wide anomaly (Table 1). Another dispersion halo (200 m), albeit much weaker and beneath the palaeochannel, is related to quartz veining and is associated with Zone 2 mineralisation.

Gold concentrations in the upper 0-6 m of regolith (soil, lag and calcrete) range from 33 ppb in calcrete to <1 ppb in all materials. Gold in calcrete is locally anomalous (>10 ppb) over Zone 1 mineralisation, reaching a concentration of 26 ppb. However, the highest Au concentration (35 ppb) occurs in the northern part of the regolith line over thick, barren palaeochannel sediments, and corresponds with a similar anomaly in (calcareous) coarse lag. These northern anomalous samples are located on an arcuate (dune) ridge that is anomalous in Au and extends to the south west 300 m; this area probably requires further drilling since mineralisation has not been detected here (Figure 5). The soil is calcareous over Zone 1 mineralisation and is also anomalous (>1 ppb) in Au, reaching concentrations of 3 ppb. Samples from 0-1 m are weakly anomalous (>1 ppb) in Au (maximum of 6 ppb) over mineralisation as are several 0-1 m and calcrete samples in the northern part of the traverse. Samples from 1-6 m show no Au anomalism over mineralisation, possibly due to dilution by gypsum. Fine lag Au concentrations are all below detection.

Maireana leaves and small branches are not particularly useful at delineating mineralisation (Figure 8) since samples show little variation in concentration (range 0.15-1.2, mean 0.34 ppb Au). The two most Au-rich *Maireana* samples (1.2 and 0.9 ppb) are located at either ends of the traverse and are associated with Au-calcrete anomalies, the former coincident with Zone 1 mineralisation. For *Acacia*, sampling was restricted to the southern part of the traverse over the gysum dune. As with *Maireana*, *Acacia* bark and phyllodes showed little variation in concentration (bark 0.17-0.9, mean 0.31 ppb; phyllodes 0.05-0.45, mean 0.27 ppb). Assessing *Acacia* parts for use as sample media was not possible due to limited distribution over mineralisation and adjacent areas only.

5.2 Elements associated with mineralisation (Ag, As, Cd, Cr, Cu, In, Ni, Pb, Sb and Zn)

Several other elements associated with mineralisation and anomalous in overlying saprolite include Ag, As, Cd, Cr, Cu, In, Ni, Pb, Sb and Zn. The most notable of these is Pb, which has a broader footprint (>800 m) than Au and extends beyond the southern extent of the studied section (Figure 9). Anomalous Pb (>100 ppm) extends to near the surface (3-4 m) in the southern part of the line. Correcting for Fe content further focusses the As anomaly over mineralisation in the saprolite (Figure 10). The other metals are not anomalous in the upper 0-6 m regolith (including soil, lag and calcrete) although Ag, Cd and Sb are below detection.

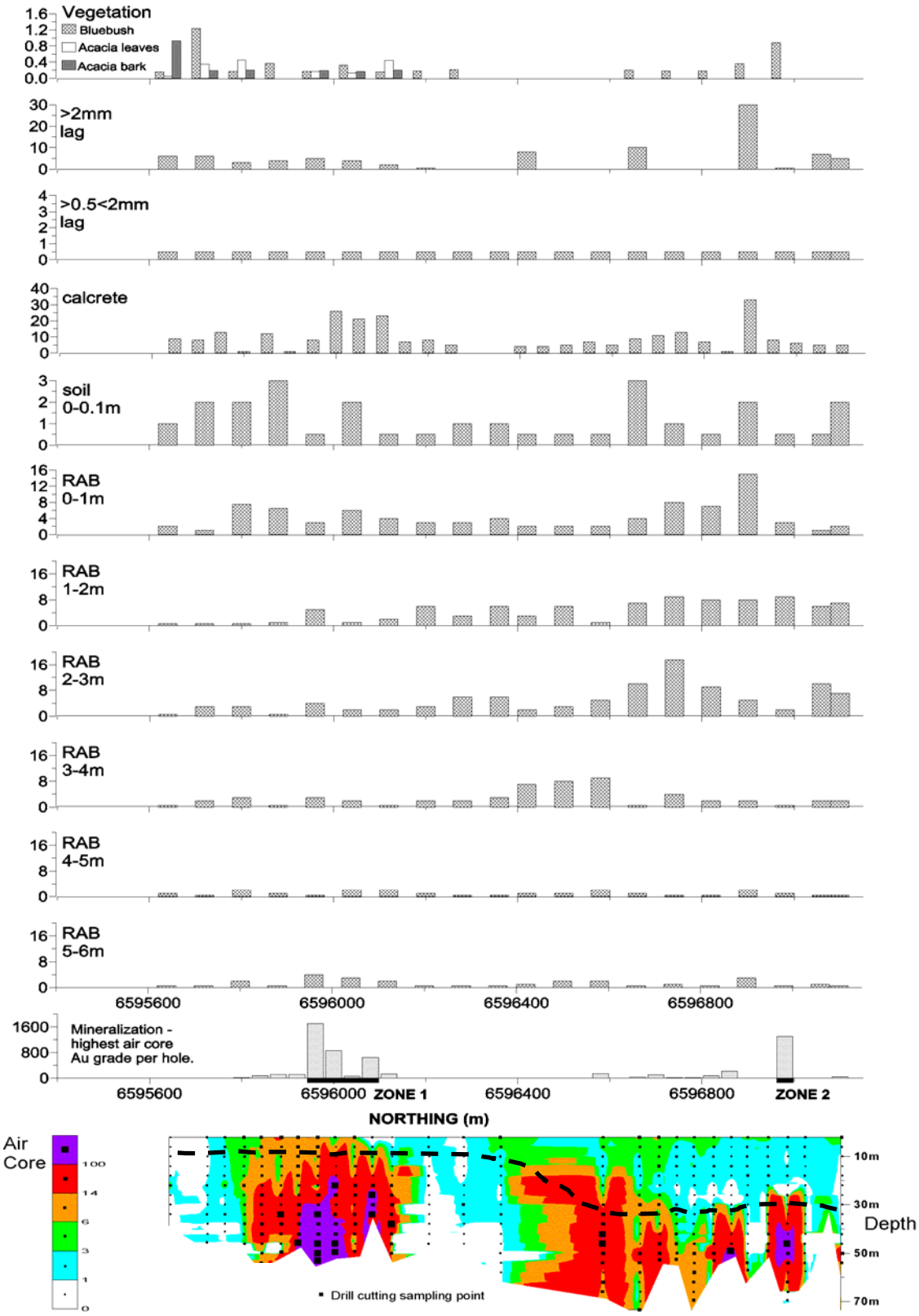

Figure 8: Gold regolith geochemistry at Boomerang prospect (449200N). Data in ppb. See Figure 2 for location of section. Dashed line indicates unconformity.

5.3 Other metals

Bismuth (Figure 11), W, U, Nb, Ti, Mo and Ag (see Appendix) are anomalous in the palaeochannel and may reflect higher concentrations of these elements in country rock, or they have been physically

(e.g. as ilmenite, rutiel, and/or anatase) and/or chemically mobilised and preferentially concentrated in the palaeochannel.

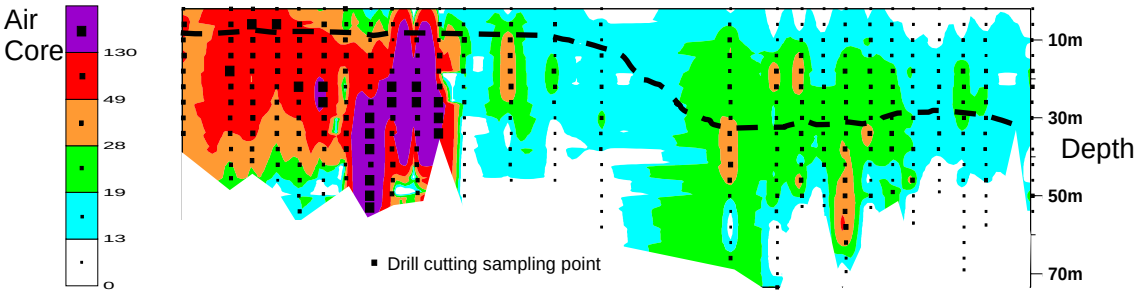

Figure 9: Lead (ppm) distribution at Boomerang (449200N). Dashed line indicates unconformity.

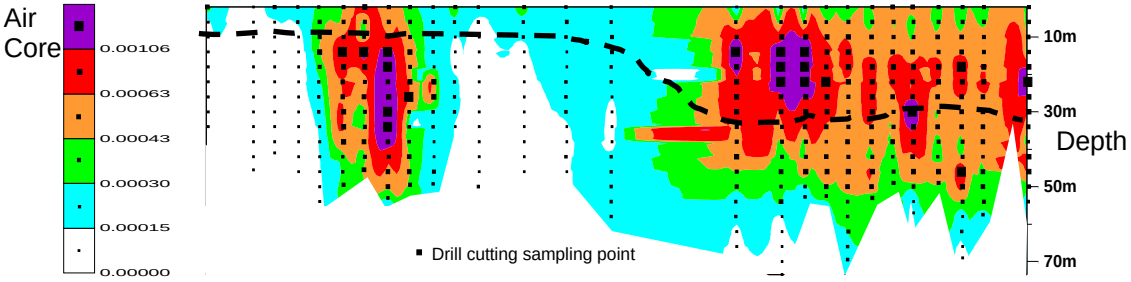

Figure 10: Arsenic distribution (corrected for Fe content) at Boomerang (449200N). Dashed line indicates unconformity.

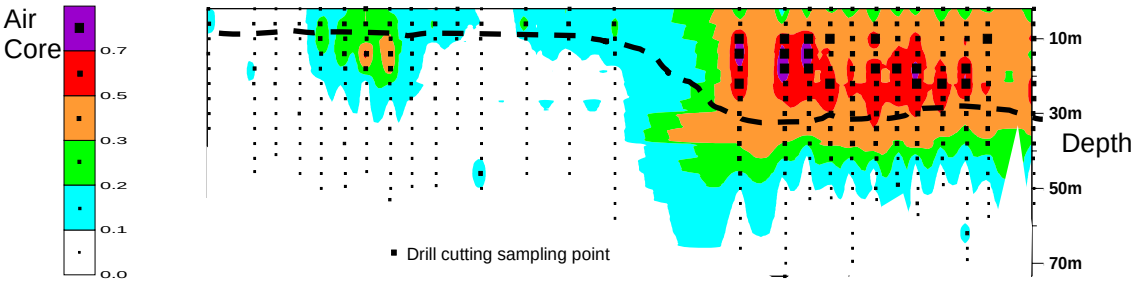

Figure 11: Bismuth (ppm) distribution at Boomerang (449200N). Dashed line indicates unconformity.

6. DISCUSSION

Many calcrete Au anomalies (as defined by the 10 and 20 ppb isohyets) are present at Boomerang (Figure 2). There is an association between the Au anomalies in calcrete and mineralisation at Zone 1 (Figure 8), but, other anomalous concentrations are only weakly associated with known mineralisation, if at all, and require further investigation (Figure 2). Higher Au concentrations in calcrete may be associated with weakly anomalous saprolite located under thin transported material or the Au may have been transported by fluvial or aeolian activity. Detailed microscope studies of drill hole material, as undertaken in this project, from other parts of the prospect (and outside the scope of this study) are required to fully understand the 3D architecture of the regolith and hence to better interpret the origin of specific calcrete anomalies.

Whilst the surficial regolith expression of Au above mineralisation is reflected in calcrete (and partly in soil), its tenor in other surficial regolith materials may be diluted by the presence of gypsum. Some

Au in gypsum was found at the Challenger Gold Deposit and concentrations were lower when compared with calcrete and saprolite (Lintern and Sheard, 1999). A systematic study at Challenger was not undertaken as gypsum was restricted in its occurrence. Studies on possible Pb incorporation in calcrete have been undertaken at Bou Grine Pb-Zn deposit in Tunisia and different conclusions were noted. Leduc (1986) suggested that it was not necessary to avoid calcrete when sampling while Guedria *et al*. (1989) indicates that Pb concentrations were reduced by the presence of calcrete and recommended that sampling beneath the hard calcrete layer was better.

In the deeper regolith, leaching of Au in the upper part of the saprolite has lead to a zone of depletion in Au, but supergene processes have led to a broader footprint of mineralisation in the deeper saprolite. Pathfinder elements have not been entirely leached from the saprolite. Lead and As may provide better vectors to mineralisation than Au if drill cuttings are used as a sample medium.

The Boomerang study highlights the difficulty in exploring in terrain covered by recent wind blown materials. Of the materials studied, calcrete (and possibly soil) provide the only viable geochemical sample media to locate mineralisation in this area. These anomalies and adjacent ground should then be drilled and cuttings analysed for Au and a range of other pathfinder elements, including Pb and As.

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Aerial photographs from over the Boomerang Au Prospect were obtained by the South Australian Department of Environment Heritage and Aboriginal Affairs – Resource Information Group, at the request of the South Australian Geological Survey (Survey 5594/Photos: 017-019, scale ~1:20,000, and are held by the Geological Survey).

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APPENDICES

9. APPENDICES

Appendix A1: Logs of the regolith 0-6 m drill cuttings

REGOLITH LINE OF HOLES – LOGS

SYMBOLS & METHODS USED IN DESCRIPTIONS

Colours: – standard Munsell Color Notation & Soil Charts (Munsell Color, 1975) plus word colours of Kelly and Judd (1976) – as used and modified by Sheard and Bowman (1996).

(d) = DRY sample colour description.
(w) = MOIST sample colour description.

Textures: of fines and granular materials, follow those described in Northcote (1979).

Mineralogy: Preliminary identifications were undertaken in the field with a hand lens. Follow-up detail was carried out on both dry samples and wet-sieved samples, using a binocular microscope. Samples were wet sieved using a nylon 475 µm aperture sieve to retain the coarser fraction.

Carbonate acid reaction: through observation of 10% HCl dripped onto cuttings, indicative of calcite presence only.
0 = no reaction
1 = moderate reaction
2 = strong reaction.

Drill site Locations & Elevations: Data collected using a Sokkia Differential GPS (AGD66 UTM)

References

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..

Munsell Color, 1975. *Munsell Soil Color Charts*. Munsell Color, Baltimore, Maryland, United States of America.

Northcote, K.H., 1979. *A Factual Key for the Recognition of Australian soils*. 4th Edition. Rellim Technical Publications, Adelaide. (pp. 26-28).

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. (pp. 118-125).

Hole: GB28, **Main Regolith Line.**
Location: 53J, 449200.8 E, 6597100 N.
Elevation: 112.75 m.
Site: flat and sparsely vegetated.
Vegetation: *Acacia*, *Maireana sedifolia*, *Heterodendrum oleaefolium*, chenopods.
Soil: sandy.
Calcrete: earthy to pisolitic to nodular to platy-pan.
Logged by: M.J. Sheard.

Sample #	Depth (m)	Description
GB28A	0-1	UNWASHED: acid reaction = 1, brownish silty sand & minor calcrete (d), texture – loamy sand to sandy loam, brownish orange; (w) (5YR5.5/7). WASHED: calcrete fragments as medium to coarse sand & silt (10-15%), quartz sand – dominantly orange-stained grains (~1 mm) subangular to subrounded (aeolian), occasional larger well rounded grains (fluvial), clear – milky coloured. Coarse grains – translucent to slightly milky. Rare while relict feldspar grains (kaolinitic) + dark mineral grains (1-2%) angular to subrounded and some rounded. Few softer ferruginous sandstone fragments (1-3 mm) & rounded by drilling process; other ?lithics present. Overall character – transported.
GB28B	1-2	UNWASHED: acid reaction = 2, brownish silty sand & abundant calcrete nodules (d), texture – silty sand to sandy silt, moderate orange; (w) (5YR6/7). WASHED: calcrete fragments – buff coloured (1-8 mm) and as sand to silt grains (25-30%), carbonate is cementing quartz sand. Quartz grains: medium-coarse, translucent to slightly milky, subrounded to rounded (fluvial). Also, quartz sand – dominantly orange-stained grains (~1 mm) subangular to subrounded (aeolian). Trace of heavy opaque grains & lithic grains –rounded to subangular. Mature & immature fluvial sands. Overall character – transported.
GB28C	2-3	UNWASHED: acid reaction = 2, brownish fine sandy loam and grey sandy clay & calcrete (d), texture – sandy loam & light clay as a banded interval, moderate orange & pinkish grey; (w) (5YR6/7 & 5YR8/2). WASHED: calcrete fragments, buff coloured. Gypcrete cementing sand – fragments & blocks, translucent, some vein forms also present. Sand as above, more lithic grains than above. Overall character – transported.
GB28D	3-4	UNWASHED: acid reaction = 0, pale creamy grey silty clay (d), texture – silty light clay, yellowish grey; (w) (2.5Y7/2). WASHED: small quantity of grainy material in washed sample. Quartz sand – mostly white, subangular to well rounded, medium to coarse-grained. Rare angular lithic fragments with bluish quartz. Ferruginous sandstone fragments. Overall character – transported.
GB28E	4-5	UNWASHED: acid reaction = 0, pale brown silty clay (d), texture – sandy clay to clayey sand, light brown; (w) (7.5YR6/5). WASHED: more sample than zone above, dominantly quartz sand – white to milky fine to medium-grained, subrounded to well rounded (fluvial). Sand to gravel fragments – angular (2-10 mm). Coloured quartz (<1%). Lithic fragments (~5%) – gneissic & other fine-grained metamorphic rocks. Ferruginous sandstone fragments as above. Silcrete fragments (2-5 mm) enclosing fine-grained rounded quartz. Overall character – transported.
GB28F	5-6	UNWASHED: acid reaction = 0, very pale brownish grey silty sand (d), texture – fine sandy loam, yellowish grey; (w) (10YR7/2). WASHED: sand as above but much less of it, more lithic fragments, some large ferruginous silcrete fragments (7-12 mm) – these appear to be broken pebbles. Grains of iron-rich material and dark mineral grains. Quartz grains mostly white but pink – yellow – orange – bluish & greenish also occur (rounded). Overall character – transported.

Hole: GB03, **Main Regolith Line.**
Location: 53J, 449238 E, 6597060 N.
Elevation: 112.8 m.
Site: flat, sparsely vegetated.
Vegetation: *Acacia*, *Maireana sedifolia*, *Heterodendrum oleaefolium*, chenopods.
Soil: sandy.
Calcrete: pisolitic to nodular to platy-pan.
Logged by: M.J. Sheard.

Sample #	Depth (m)	Description
GB03A	0-1	UNWASHED: acid reaction = 1, brownish silty sand & minor calcrete nodules (d), texture – loamy sand, brownish orange; (w) (5YR5/7). WASHED: Pinkish calcrete pisoliths (2-5 mm) and nodule fragments (4-6 mm) cementing fine to medium sand (~5%), quartz sand – dominantly orange-stained grains (~1 mm) subangular to subrounded (~ 40%, aeolian), ubiquitous larger well rounded to subangular quartz sand grains (~50%, fluvial) white – grey & clear-milky coloured. Rare while relict feldspar grains (kaolinitic) + dark mineral grains (1-2%) + lithic grains (1-2%) – all angular to subrounded and some rounded. Overall character – transported.
GB03B	1-2	UNWASHED: acid reaction = 2, pale brownish silty material & abundant calcrete nodules (d), texture – silty light clay, moderate orange; (w) (5YR6/6). WASHED: Pinkish & yellowish calcrete as nodule and pan fragments (4-6 mm) cementing coarse fluvial sand; quartz sand – dominantly coarse well rounded to subangular grains + gravel clasts (~80%, fluvial) white – grey & clear – milky coloured. Downhole contamination by aeolian sand. Rare while relict feldspar grains (kaolinitic) + dark mineral grains (1-2%) + lithic grains (1-2%) all angular to subrounded and some rounded. Overall character – transported.
GB03C	2-3	UNWASHED: acid reaction = 2, brownish fine sandy clay, abundant calcrete nodules (d), texture – medium clay + sand, moderate orange; (w) (5YR6/6). WASHED: clastic material as per interval above + ubiquitous crystalline gypsum, honey coloured & cementing alluvium, fragments to 6 mm; rare fragments of while relict feldspar grains (~2 mm, kaolinitic) + less dark mineral & lithic grains than in interval above. Some downhole calcrete nodule contamination. Overall character – transported.
GB03D	3-4	UNWASHED: acid reaction = 0, pale brownish clay + pale grey clay (d), texture – medium clay & light clay, moderate orange & yellowish grey; (w) (5YR6/6 & 2.5Y8/2). WASHED: Less granular matter than interval above, mostly fine- to medium-grained quartz sand (>80%), rounded to subangular, white – grey – milky & water-clear + similar quartz as rounded to subangular gravel (~5%) + fragments of silcrete (~2%) khaki coloured, cementing fine-grained near black sand (silcrete fragments to 6 mm); kaolinitic feldspar grains more common than above interval (2-3%). Overall character – transported.
GB03E	4-5	UNWASHED: acid reaction = 0, pale yellowish brown sand (d), texture – loamy clay, yellowish brown; (w) (10YR6/5). WASHED: More granular matter than interval above, mostly fine- to coarse-grained quartz sand (>80%), rounded to subangular, white – greyish & water-clear + rounded to subangular fine gravel (~5%) + fragments of silcrete as above (~2%) yellowish (to 6 mm) + FeOx lumps (8 mm) yellow-rimmed with red interiors; chloritic quartz grains (~1%) black opaque grains to 1 mm (~1%). Overall character – transported.
GB03F	5-6	UNWASHED: acid reaction = 0, pale grey sandy clay, hard setting (d), texture – sandy medium clay, yellowish brown; (w) (10YR8/2). WASHED: Less granular matter than interval above, mostly fine- to medium-grained quartz sand (>80%), rounded to angular, white – pink & red-stained + similar quartz as rounded to subangular fine gravel (~5%) + fragments of FeOx (~2%) yellow & dark brown; kaolinitic feldspar grains more common than above interval (10%); chloritic quartz grains (~1%). Overall character – transported.

Hole: GB30, **Main Regolith Line.**
Location: 53J, 449210 E, 6596980 N.
Elevation: ~113 m.
Site: flat.
Vegetation: few *Acacia*, *Maireana sedifolia*, *Casuarina*, chenopods.
Soil: sandy clay.
Calcrete: nodular.
Logged by: M.J. Sheard.

Sample #	Depth (m)	Description
GB30A	0-1	UNWASHED: acid reaction = 1, orange brown sand & calcrete nodules (d), texture – loamy sand, greyish reddish orange; (w) (2.5YR5/7). WASHED: calcrete fragments – ubiquitous creamy to brownish (~50%), carbonate cements fine to medium-grained quartz sand. Quartz grains, well rounded – milky – bluish (<1-3 mm). Quartz also as angular fragments, white – grey – water-clear vein-sourced material & some with tiny black mineral inclusions. Note: rounded and angular quartz in approx equal proportions and many exhibit an orange ferruginous staining. Dark mineral grains, angular to rounded (<1%, <1-1.0 mm). Overall character – transported.
GB30B	1-2	UNWASHED: acid reaction = 2, orange brown sand & calcrete nodules (d), texture – silty clay & fine sand, brownish orange; (w) (5YR6/7). WASHED: calcrete fragments ubiquitous – as above (~30%). Gypsum as cleavage and gypcrete aggregate fragments common (~35%) mineral is water-clear – milky – cream – pale orange coloured. Remainder is quartz – white – milky – water-clear, rounded to angular grains (1-3 mm). Only trace amounts of dark mineral grains. Overall character – transported.
GB30C	2-3	UNWASHED: acid reaction = 2, orange sandy clay & calcrete (d), texture – sandy clay, sticky, greyish reddish orange; (w) (2.5YR5/7). WASHED: calcrete fragments rare, some gypcrete fragments (10-15%). Bulk is quartz grains – mostly rounded with some subrounded to angular, colours & sizes as above. Dark mineral grains (3%, <1-2 mm) some are very dark quartz, rare greenish quartz – opaque – jasper-like. Overall character – transported.
GB30D	3-4	UNWASHED: acid reaction = 0, orange-brown clay + pale yellowish grey clay, hard setting (d), texture – light-medium clay, sticky, light brown & yellowish grey; (w) (5YR6/6 & 5Y7.5/2). WASHED: mostly quartz, rounded to angular, most rounded to subangular – clear, grey (dark & pale) milky & orange-stained. Some jasper & porcelanite fragments. Fragments of ferruginous fine-grained material, relict ?lithics or ferricrete (2-3%). Overall character – transported with thin ? groundwater ferricrete bands.
GB30E	4-5	UNWASHED: acid reaction = 0, orange-brown clay + pale yellowish grey clay, hard setting, + some coarse sand (d), texture – light-medium clay, sticky light brown & yellowish grey; (w) (5YR6/6 & 5Y7.5/2). WASHED: mostly quartz fragments & grains as fine to coarse-grained sand and granule sizes, white – yellow – orange – grey – bluish & milky with some water-clear grains containing minute black & dark greenish (?chlorite) mineral inclusions. Gypsum (~5%) & trace of calcrete – contamination from above. Some felsic-lithic clasts & granules. Some silcrete fragments (<5%, 1-2 x 3-5 mm) pale cream & with conchoidal fracture. Majority of grains are rounded to subrounded – fluvial. Overall character – transported.
GB30F	5-6	UNWASHED: acid reaction = 0, pale yellowish grey clay with reddish streaks or mottles, hard setting (d), texture – medium clay, sticky, yellowish grey & strong brown &; (w) (5Y7.5/2 & 2.5YR4/8). WASHED: as above but only 1/3 of granular matter present & only a trace of silcrete fragments (<1 mm) with MnOx dendrites on some fracture surfaces. No gypsum, trace of calcrete – sand sized grains. Overall character – transported.

Hole: GB32, **Main Regolith Line.**
Location: 53J, 449200 E, 6596900 N.
Elevation: ~113 m.
Site: crest of low dune, arcs to the west & becomes more prominent.
Vegetation: few *Acacia*, *Maireana sedifolia*, *Casuarina*, chenopods.
Soil: clayey sand.
Calcrete: abundant nodules, nodule aggregates, pisoliths & platy-pan.
Logged by: M.J. Sheard.

Sample #	Depth (m)	Description
GB32A	0-1	UNWASHED: acid reaction = 2, red-brown sand & calcrete nodules (d), texture – clayey sand, greyish reddish orange; (w) (2.5YR5.5/6). WASHED: calcrete nodules, pink to brownish (4-12 mm) encapsulating aeolian sand, & platy pan fragments – cream coloured (calcrete ~50% of sieved bulk). Quartz grains: orange-stained aeolian frosted sand, fine- to medium-grained (~15%); + red-brown hard pan fragments (~25%) partly silicified clay matrix with carbonate cementing alluvium-colluvium. Other grain s: quartz sand, fine- to coarse-grained, rounded to subangular (~10%). Overall character – transported.
GB32B	1-2	UNWASHED: acid reaction = 2, red-brown sand & calcrete nodules (d), texture – clayey sand, greyish reddish orange; (w) (2.5YR5.5/6). WASHED: calcrete as platy pan fragments, cream coloured (~30%) developed in fluvial sand. Red-brown hard pan fragments (~50%) partly silicified clay matrix with carbonate cementing alluvium-colluvium. Other grains: quartz sand, fine- to coarse-grained, rounded to subangular (~10%) grey to translucent + some milky to white. Overall character – transported.
GB32C	2-3	UNWASHED: acid reaction = 2, red-brown sand & calcrete nodules (d), texture – clayey sand, greyish reddish orange; (w) (2.5YR5.5/6). WASHED: Red-brown hard pan fragments, as in above interval but more silicified and no carbonate cement, has black MnOx staining. Other grains: yellow porcelanite & grey silcrete fragments (2-3%); + quartz sand, fine- to coarse-grained, rounded to subangular (~10%) grey to translucent + milky – white + quartz gravel, fine-grained, angular-rounded . Overall character – transported.
GB32D	3-4	UNWASHED: acid reaction = 0, brown clay (d), texture – fine sandy clay loam, light brown; (w) (5YR6/6). WASHED: Much reduced granular material. Some red-brown hard pan fragments, as in above interval, encapsulating fluvial sand. Other grains: yellow porcelanite & grey silcrete fragments (2-3%); + quartz sand, fine- to coarse-grained, rounded to subangular (~10%) grey – translucent + milky – white; + quartz gravel, fine-grained (3-5 mm) subangular-rounded; + sub-mm black grains (~1%) + lithics (~1%). Overall character – transported.
GB32E	4-5	UNWASHED: acid reaction = 0, reddish mottled or streaked pallid clay (d), texture – fine sandy clay loam, yellowish grey & strong brown; (w) (2.5Y7/2 & 2.5YR3/8). WASHED: Less granular material than above interval. Red-brown hard pan fragments persist (down hole contamination ?). Other grains: quartz sand, fine- to coarse-grained, rounded to subangular (>85%) grey – translucent + milky – white; + quartz gravel (2%), fine-grained, angular-rounded. Overall character – transported.
GB32F	5-6	UNWASHED: acid reaction = 0, reddish mottled or streaked pallid clay (d), texture – fine sandy clay loam, yellowish grey & strong brown; (w) (2.5Y7.5/2 & 2.5YR4/8). WASHED: Less granular material than above interval. Red-brown hard pan fragments persist (~30% of sieved bulk, down hole contamination ?). Other grains: quartz sand and gravel as in above interval; + yellowish porcelanite & grey silcrete fragments persisting (~1%); + lithics and black sub-mm grains (~2%). Overall character – transported.

Hole: GB34, **Main Regolith Line.**
Location: 53J, 449242 E, 6596878 N.
Elevation: 112.777 m.
Site: dune slope.
Vegetation: *Maireana sedifolia, Acacia,* boxthorn.
Soil: clayey sand.
Calcrete: nodules to platy-pan.
Logged by: M.J. Sheard.

Sample #	Depth (m)	Description
GB34A	0-1	UNWASHED: acid reaction = 2, red-brown clayey sand & calcrete nodules (d), texture – clayey sand, greyish reddish orange; (w) (2.5YR5/6). WASHED: some calcrete – brownish & gypcrete-calcrete intergrowth fragments + gypcrete. Quartz (~30-40% of sample) fine to coarse-grained sand + some rounded granules (3-4 mm). Most grains are well rounded to subrounded – milky – grey – water-clear, some have yellowish – orange surface staining, some with dark orange staining (~ 1 mm, well rounded & frosted grains – aeolian grains). Dark mineral grains (<1%, ~1 mm). Overall character – transported.
GB34B	1-2	UNWASHED: acid reaction = 2, brownish sandy clay & calcrete nodules (d), texture – fine sandy clay loam, light brown; (w) (5YR6/6). WASHED: calcrete nodule fragments (25%) gypcrete cementing sand grains (35%). Silcrete granules (elongated) well rounded (<1%, 2-4 mm), pale creamy colour. Quartz grains (35-40%) sand to granules, well rounded, white – creamy – orange – water-clear & some dark orange-stained frosted aeolian grains. Relict lithic fragments (1-2%) – some dark & some pale felsic lithotypes. Overall character – transported.
GB34C	2-3	UNWASHED: acid reaction = 1, reddish mottled or streaked pallid clay (d), texture – fine sandy clay loam, yellowish grey & strong brown; (w) (2.5Y7/2 & 2.5YR3/8). WASHED: mostly quartz sand & granules with well rounded to subrounded water worn grains, white – grey – milky – water-clear – Fe-stained – yellow (citrine) – rare bluish. Some grey & water-clear grains with minute black inclusions. Ironstone fragments, dark brown & containing fine-grained quartz. Rare silcrete fragments & rounded grains thereof. Rare calcrete fragments (nodular) & some gypcrete fragments (3-4 mm). Overall character – transported.
GB34D	3-4	UNWASHED: acid reaction = 0, reddish mottled or streaked pallid clay (d), texture – fine sandy clay loam, yellowish grey & strong brown; (w) (2.5Y7/2 & 2.5YR3/8). WASHED: mostly water worn quartz sand & granules (1-3 mm) white – clear, rare coloured grains, yellow – bluish – pink (rose qtz) – brownish & some with black micro-inclusions. Large ferricrete chunk (8 x 12 mm). Silcrete fragments, creamy & enclosing fine-grained grey quartz grains. Overall character – transported.
GB34E	4-5	UNWASHED: acid reaction = 0, brownish mottled or streaked pale greenish clay, hard setting (d), texture – fine sandy clay loam, greyish greenish yellow & moderate yellowish brown; (w) (7.5Y7/2 & 10YR5/3). WASHED: very little sample after washing ~1 gram. Mostly water worn quartz, well rounded to subrounded fine to medium-grained sand & some granules (3-5 mm) water-clear – white + ~30% reddish throughout or surface stained, some bluish – dark grey. Black – dark brown opaque minerals (~5%). Overall character – transported.
GB34F	5-6	UNWASHED: acid reaction = 0, brownish mottled or streaked pale greenish clay, hard setting (d), texture – fine sandy clay loam, greyish yellow & strong brown; (w) (5Y7/2 & 2.5YR4/8). WASHED: as in above interval but more coloured grains but still only ~1 gram of washed granular sample. Ferricrete present as rounded granules & fragments. Overall character – transported.

Hole: GB36, **Main Regolith Line.**
Location: 53J, 449220 E, 6596740 N.
Elevation: ~111 m.
Site: swale.
Vegetation: *Acacia*, *Maireana sedifolia*, boxthorn, *Atriplex*.
Soil: sandy clay.
Calcrete: nodular to platy-pan.
Logged by: M.J. Sheard.

Sample #	Depth (m)	Description
GB36A	0-1	UNWASHED: acid reaction = 2, orange-brown silty sand (d), texture – loamy sand, strong brown; (w) (2.5YR4/7). WASHED: calcrete – orange to red-brown nodules and pan fragments (25%); & red-brown hardpan fragments (20%) clay matrix cementing quartz sand, fine- to medium-grained, rounded to angular & mostly greyish translucent, hardpan has some carbonate cement. Quartz grains: ~ 1 mm, well rounded & frosted grains – aeolian (~15%) + fluvial sand where most grains are well rounded to subrounded (~40%). Overall character – transported.
GB36B	1-2	UNWASHED: acid reaction = 2, brown clayey sand & calcrete nodules (d), texture – clayey sand, brownish orange; (w) (5YR5/7). WASHED: calcrete & red-brown hardpan fragments as in above interval but overall granular material is much reduced. Pale orange – water-clear –translucent crystalline gypsum and gypcrete mats (~20%). Quartz grains: fluvial sand, white – cream – grey – water-clear, fine- to coarse-grained (~50%) most grains are well rounded – subangular + fine-grained gravel, rounded – angular; + rare lithics & sub-mm black grains. Overall character – transported.
GB36C	2-3	UNWASHED: acid reaction = 1, orange-brown loam & calcrete (d), texture – loam, brownish orange; (w) (5YR5/7). WASHED: rare red-brown hardpan fragments as in above interval but overall granular material is much reduced. Quartz grains: fluvial sand (90%) pinkish – milky – water-clear – grey, fine- to coarse-grained, most grains are rounded – subrounded; + rare greenish cream porcelanite & greyish silcrete fragments (~2%); + some sub-mm black grains. Overall character – transported.
GB36D	3-4	UNWASHED: acid reaction = 0, pallid clay with brown streaks (d), texture – light clay, greyish yellow & light brown; (w) (5Y7.5/2 & 5YR6/6). WASHED: much less granular material than in above unit. Predominantly quartz sand, fluvial (90%) pink – milky – water-clear – grey, fine- to coarse-grained, some bluish & zoned quartz granules (~1%) most grains are rounded – subrounded – subangular; + 5% as fine-grained gravel; + greenish cream porcelanite & greyish silcrete fragments (~2%); + yellowish gypsum crystals (~5%) + some sub-mm black grains. Overall character – transported.
GB36E	4-5	UNWASHED: acid reaction = 0, pallid clay, reddish mottled-streaked (d), texture – light clay, greyish yellow & strong brown; (w) (5Y7.5/2 & 2.5YR4.5/7). WASHED: very little granular material. Predominantly quartz sand, fluvial (90%) white – water-clear (~80%), fine- to medium-grained, most grains are rounded – subrounded – subangular; + some orange aeolian sand (down-hole contamination); + 5% as bluish & dark grey zoned vein quartz clasts; + greenish cream porcelanite & greyish silcrete fragments (~2%); + yellowish gypsum crystals (~5%) + 0.5-1.5 mm black organic grains (5%) + some sub-mm black grains. Overall character – transported.
GB36F	5-6	UNWASHED: acid reaction = 0, pallid clay, reddish mottled-streaked (d), texture – light clay, greyish yellow & strong brown; (w) (5Y7.5/2 & 2.5YR4.5/7). WASHED: very little granular material. Mostly as per 4-5 m interval, black organic grains persist (~1%). Overall character – transported.

Hole: GB38, **Main Regolith Line.**
Location: 53J, 449236 E, 6596665 N.
Elevation: 110.562 m.
Site: flat.
Vegetation: Mulga woodland *Acacia*, *Maireana sedifolia*, boxthorn.
Soil: sandy clay, **lag** of calcrete & chalcedony.
Calcrete: earthy to pisolitic to nodular to platy.
Logged by: M.J. Sheard.

Sample #	Depth (m)	Description
GB38A	0-1	UNWASHED:. acid reaction = 1, orange-brown silty sand & some calcrete (d), texture – loamy sand, brownish orange; (w) (5YR5.5/7). WASHED: dominated by quartz grains, well rounded to subangular, medium to coarse-grained. Most grains are translucent, some water-clear, many are orange-stained. Other colours present, white – grey & rare bluish. Dark coloured opaque grains (<1%), trace of charcoal or degraded wood fragments + one piece of rusty fencing wire where quartz sand grains are cemented into the rust sheath (anthropogenic material). Overall character – transported.
GB38B	1-2	UNWASHED: acid reaction = 2, orange silty sand & calcrete nodules (d), texture – loamy sand, brownish orange; (w) (5YR5.5/7). WASHED: sand as above, Gypcrete fragments (20-30%) calcrete present – mostly as an intimate intergrowth with gypcrete but also as coatings & grains. Relict dark coloured lithic grains (1-2%, <1-3 mm), these are Fe-stained yellowish. Overall character – transported
GB38C	2-3	UNWASHED: acid reaction = 1, orange silty sand & some calcrete (d), texture – gritty loam, brownish orange; (w) (5YR5.5/7). WASHED: sand as above. Gypcrete now dominant (50-60%). Trace of silcrete fragments, fine-grained (<1%). Overall character – transported
GB38D	3-4	UNWASHED: acid reaction = 0, red-brown clay (d), texture – gritty light clay, brownish orange; (w) (2.5YR5/8). WASHED: marked reduction in granular matter, very little gypsum. Mostly water worn quartz grains as per 0-1 M. + some rounded to subangular silcrete fragments & grains (1-3 mm) bright yellow & cream. Some Fe-stained relict lithic clasts. Overall character – transported
GB38E	4-5	UNWASHED: acid reaction = 0, red-brown & pallid clay (d), texture – gritty light clay, brownish orange & greyish yellow; (w) (2.5YR5/8 & 5Y7/2). WASHED: less washed material than above, mostly well rounded quartz sand, fine to coarse-grained + some angular to well rounded granules (to 3 mm). Several ferricrete clasts (4 mm) with entrapped quartz sand & smaller grains. Some zoned quartz grains, white – bluish & water-clear. Overall character – transported.
GB38F	5-6	UNWASHED: acid reaction = 0, pallid clay with some brown streaks (d), texture – light clay, semi-sticky, greyish yellow & light yellowish brown; (w) (5Y7.5/2 & 10YR7/4). WASHED: very little granular material, mostly quartz, rounded to subangular – clear & orange stained dominate + some more bluish than above & more white grains or fragments than interval above. Ferricrete as small grains to 1 mm and fragments (2 x 7 & 12 mm). Overall character – transported.

Hole: GB39, **Main Regolith Line.**
Location: 53J, 449243 E, 6596578 N.
Elevation: 110.531 m.
Site: flat, slight rise to south.
Vegetation: mulga woodland *Acacia* and *Casuarina*.
Soil: sandy clay.
Calcrete: pisolithic to nodular.
Logged by: M.J. Sheard.

Sample #	Depth (m)	Description
GB39A	0-1	UNWASHED: acid reaction = 1, orange-brown sand & calcrete nodules (d), texture – loamy sand, brownish orange; (w) (5YR5.5/7). WASHED: quartz grains: ~60% is orange stained frosted aeolian sand, fine- to medium-grained; ~40% is fluvial sand, rounded to subangular, medium to coarse-grained, most grains are white – translucent. Some dark coloured opaque grains (<1%) & rare sand sized calcrete fragments also occur. Overall character – transported.
GB39B	1-2	UNWASHED: acid reaction = 2, pale orange coarse fluvial sand & calcrete nodules (d), texture – sand, moderate orange; (w) (5YR6/7). WASHED: as per interval above but with crystalline gypsum: yellowish & translucent (~30%) with crystals and mat fragments. ~80% of sand is fluvial in origin. Sub-mm black grains (~1-2%). Overall character – transported.
GB39C	2-3	UNWASHED: acid reaction = 1, pale orange fluvial sand & some calcrete (d), texture – loamy sand, brownish orange; (w) (5YR5/8). WASHED: ~50% quartz grains as fluvial sand (as in the above intervals); + ~45% as yellowish gypsum crystal rosettes and mat fragments; + red-brown hardpan fragments consisting of a silicified clay matrix cementing fluvial sands; + rare cream calcrete fragments. Overall character – transported.
GB39D	3-4	UNWASHED: acid reaction = 0, brown silty sand (d), texture – clayey sand, brownish orange; (w) (5YR5/8). WASHED: ~50% quartz grains as fluvial sand (as in the above intervals); + ~45% as yellowish gypsum crystal rosettes and mat fragments; + red-brown hardpan fragments consisting of a silicified clay matrix cementing fluvial sands; + rare cream calcrete fragments. Overall character – transported.
GB39E	4-5	UNWASHED: acid reaction = 0, as above + brown & pallid clay (d), texture – as above + medium clay, sticky, brownish orange + light brown & greyish yellow; (w) (5YR5/8 + 5YR6/6 & 2.5Y7/4). WASHED: much less granular matter. Fragments of gypcreted fluvial quartzose sands + rare fragments of red-brown hardpan. ~90% is fluvial sand, rounded to subangular, fine- to coarse-grained + some fine-grained gravel, rounded to subangular; + sub-mm black grains (~1-2%) & lithics as rounded grains (~1%). Overall character – transported.
GB39F	5-6	UNWASHED: acid reaction = 0, brown & pallid clay (d), texture – light clay, semi-sticky, greyish yellow & light brown; (w) (5Y7.5/2 & 5YR6/6). WASHED: much less granular matter than interval above. >95% fluvial quartz sands, rounded – subangular, fine- to coarse-grained, white – grey –pink – Fe-stained – bluish – dark blue + some fine-grained gravel, rounded – subangular; + sub-mm black grains (~1%) & lithics as rounded grains (~2%) + yellowish porcelanite & greyish silcrete fragments-grains. Overall character – transported.

Hole: GB02, **Main Regolith Line.** [Join point with Westerly Cross Line]
Location: 53J, 449239 E, 6596504 N.
Elevation: 110.493 m.
Site: flat, but dune crest occurs to the west, between this site and GB05.
Vegetation: mulga *Acacia* and *Casuarina* woodland, few *Maireana sedifolia*.
Soil: sandy clay.
Calcrete: pisolitic to nodular.
Logged by: M.J. Sheard.

Sample #	Depth (m)	Description
GB02A	0-1	UNWASHED: acid reaction = 0, red-brown sandy clay (d), texture – light sandy clay loam, strong brown; (w) (2.5YR4/7). WASHED: predominantly quartz sand, medium- to coarse-grained, subrounded – rounded fluvial. Orange-stained uniformly sorted sand, aeolian. Rare calcrete grains, sand sized. Rare charcoal grains, rare lithic grains, subrounded to angular, chloritic (green). Overall character – transported.
GB02B	1-2	UNWASHED: acid reaction = 1, pale brown silty sand & calcrete nodules (d), texture – loamy sand, moderate orange; (w) (5YR6/8). WASHED: sand as above with less than half being aeolian. Crystalline gypsum as plates, aggregates & cleavage fragments – translucent to pale orange or orange-stained. Calcrete nodule fragments & intimately intergrown with gypsum. Charcoal & organic fragments present. Overall character – transported.
GB02C	2-3	UNWASHED: acid reaction = 0, pale brown silty sand (d), texture – loamy sand, moderate orange; (w) (5YR6/8). WASHED: some calcrete (more than above). Quartz sand (as above). Some lithic fragments with greenish chlorite inclusions (?after biotite) angular – subrounded. Overall character – transported.
GB02D	3-4	UNWASHED: acid reaction = 0, pale brown clayey sand & coarsely crystalline gypsum (d), texture – clayey sand, brownish orange; (w) (5YR5/8). WASHED: sand as above with rounded fine-grained quartz, fluvial. Gypsum as cement to sand, aggregates & large cleavage blocks (5-10 mm). Overall character – transported.
GB02E	4-5	UNWASHED: acid reaction = 0, brown streaked pallid clay (d), texture – light clay, sticky, yellowish grey & greyish reddish orange; (w) (2.5Y8/2 & 2.5YR5/7). WASHED: sand, coarse-grained, subangular to subrounded, Fe-stained. Gypsum (80%) crystalline plates & cleavage fragments – translucent – water-clear, some is orange-stained. Fe-psammite – dark reddish brown or yellow. Overall character – indeterminate.
GB02F	5-6	UNWASHED: acid reaction = 0, brown streaked pallid clay (d), texture – light clay, sticky, yellowish grey & greyish reddish orange; (w) (2.5Y8/2 & 2.5YR5/7). WASHED: quartz sand, subrounded to rounded, orange-stained, coarse-grained. Lithic fragments with white carbonate cement. Gypsum plates & crystal fragments (20%). Fe-psammite fragments as above, some more quartz-rich & some chloritic, subangular. Overall character – transported, fluvial + some ?*in-situ*, possibly intersected near 6 m depth.

Hole: GB01, **Main Regolith Line.**
Location: 53J, 449245 E, 6596403 N.
Elevation: 111.172 m.
Site: flat.
Vegetation: mulga *Acacia* and *Casuarina* woodland, *Atriplex*.
Soil: sandy clay.
Calcrete: nodular.
Logged by: M.J. Sheard.

Sample #	Depth (m)	Description
GB01A	0-1	UNWASHED: acid reaction = 2, pale brown silty sand & calcrete nodules (d), texture – loamy sand, brownish orange; (w) (5YR5/7). WASHED: quartz sand, subrounded to rounded, orange-stained well sorted aeolian material (25%). Calcrete nodule fragments abundant (~50%). Gypsum crystals, plates & cleavage fragments (25%). Fe-rich lithics (~1%). Green siliceous mineral grains (?silicified chlorite) <1%. Overall character – transported.
GB01B	1-2	UNWASHED: acid reaction = 1, pale brown silty sand & some calcrete nodules (d), texture – loamy sand, moderate orange; (w) (5YR6/8). WASHED: ubiquitous gypsum & gypcrete – honey coloured, this is in intimate intergrowth with calcrete (25-30%) + some nodule fragments. Quartz, bulk of washed sample, medium to coarse-grained and well rounded (fluvial) white – milky – clear – some grey, orange staining on many grains (0.5-3 mm). Dark Fe-rich lithic grains (<1 mm, ,1%). Charcoal & organic fragments (~1%). Overall character – transported.
GB01C	2-3	UNWASHED: acid reaction = 1, pale brown silty sand & some calcrete nodules (d), texture – loamy sand, brownish orange; (w) (5YR5/8). WASHED: gypcrete (~50% of washed sample) mostly as coarse sand and fine gravel sized fragments. Quartz, as in interval above but more angular than rounded grains. Black mineral grains, angular (~1%, <1 mm). A few charcoal grains persisting. Rare ?silcrete fragments (<1 mm) cream & reddish. Overall character – transported.
GB01D	3-4	UNWASHED: acid reaction = 0, brown silty sand & coarsely crystalline gypsum (d), texture – clayey sand, light brown; (w) (5YR5/6). WASHED: gypcrete as large chunks (~15 mm, 25-30%). Quartz as in interval above, rounded grains persist. Lithics: fine-grained mineral complexes, greenish to greyish (1-2%). Overall character – transported.
GB01E	4-5	UNWASHED: acid reaction = 0, brown flecked-streaked pallid clay (d), texture – light-medium clay, sticky, yellowish grey & brownish orange; (w) (2.5Y8/2 & 5YR5/8). WASHED: granular material much reduced. Less gypsum (~10%). Bulk is mostly quartz, rounded – angular, fine to coarse-grained & a few granules (~3 mm) white – milky – grey – water-clear – rare bluish, some very dark coloured, some with black inclusions. Some grains are Fe-stained dark brown. Trace of black mineral grains, angular. Some quartz crystal fragments seen with no sign of abrasion. Overall character – transported, fluvial, but may also include some *in-situ* material.
GB01F	5-6	UNWASHED: acid reaction = 0, brown flecked-streaked pallid clay (d), texture – light-medium clay, sticky, yellowish grey & brownish orange; (w) (2.5Y8/2 & 5YR5/8). WASHED: small amount of granular material. Mostly quartz, rounded to angular in ~50:50 mix, water-clear – orange-stained – orange – yellow – rare grey – milky & white (0.25-1.5 mm). Rounded Fe-psammite clast (4 mm) + smaller grains. Very angular & lenticular black mineral grains. Overall mixed character – some transported & some *in-situ* suggesting boundary within this interval.

Hole: GB40, **Main Regolith Line.**
Location: 53J, 449241 E, 6596356 N.
Elevation: 111.229 m.
Site: flat area on gentle rise, cross-cutting access track just south of site.
Vegetation: mulga *Acacia* and *Casuarina* woodland, *Eremophila scoparia*.
Soil: sandy clay.
Calcrete: earthy to nodular to platy.
Logged by: M.J. Sheard.

Sample #	Depth (m)	Description
GB40A	0-1	UNWASHED: acid reaction = 1, orange silty sand & minor calcrete (d), texture – clayey sand, brownish orange; (w) (5YR5/8). WASHED: orange-stained well rounded quartz sand (0.5-1 mm) – aeolian (~25%). Gypsum grains (~25%) translucent – milky & mostly orange coloured. Quartz, well rounded to subrounded, water-clear – white – orange-stained & grey (1-2 mm). Occasional rounded ferricrete clast. Rare dark organic grains. Overall character – transported.
GB40B	1-2	UNWASHED: acid reaction = 2, brown sandy loam & calcrete nodules (d), texture – light sandy clay loam, moderate orange; (w) (5YR5.5/7). WASHED: calcrete fragments + grains – brownish (~20%). Gypcrete fragments & gypsum grains (~5%). Remainder is mostly quartz as rounded to subrounded grains (<1-2 mm) white – clear – grey – zoned & orange-stained. Black angular to rounded grains (<1%). Overall character – transported.
GB40C	2-3	UNWASHED: acid reaction = 2, brown sandy loam & calcrete nodules (d), texture – sandy clay loam, moderate orange; (w) (5YR6/7). WASHED: gypcrete as cm-sized fragments & smaller grains (20-30%), calcrete intimately intergrown with gypsum. Calcrete nodule fragments (15-20%). Quartz sand, well rounded to subangular, medium to coarse-grained, milky – clear – white – grey. Black mineral grains (1%). Relict dark brown lithic fragments & grains (<1%). Overall character – transported.
GB40D	3-4	UNWASHED: acid reaction = 1, brown sandy loam & some calcrete (d), texture – sandy clay loam, moderate orange; (w) (5YR6/7). WASHED: as above + occasional fragments of red jasper (?silcrete) + fragments of ferricrete – dark brown & yellow (5-11 mm) cementing fine-grained quartz sand. Some calcrete fragments. Overall character – transported.
GB40E	4-5	UNWASHED: acid reaction = 0, brown streaked pallid clay (d), texture – light clay, sticky, yellowish grey & moderate orange; (w) (5Y7.5/2 & 5YR6/7). WASHED: marked reduction in granular matter, mostly quartz, rounded to subrounded, white – clear – pale yellow – pink (rose qtz) & some stained by dark Fe matter, fine to coarse-grained + granules to 4 mm. Platy ferruginous fragments, yellow – brown (~25%). Overall character – transported.
GB40F	5-6	UNWASHED: acid reaction = 0, dark brown streaked pallid clay (d), texture – light clay, sticky, yellowish grey & moderate brown; (w) (5Y7.5/2 & 5YR4/3). WASHED: only a trace of granular matter (<0.5 gm). Mostly quartz, rounded to angular, white – water-clear – bluish & translucent zoned – yellowish. Dark grains, mostly angular (30%), dark Fe-rich matter adheres to some of the quartz grains. Overall character – transported.

Hole: GB41, **Main Regolith Line.**
Location: 53J, 449256 E, 6596280 N.
Elevation: 111.795 m.
Site: flat area on gentle southerly rise, cross-cutting access track just north of site.
Vegetation: mulga *Acacia* and *Casuarina* woodland, edge of *Maireana sedifolia* shrubland.
Soil: sandy clay.
Calcrete: pisolitic to nodular.
Logged by: M.J. Sheard.

Sample #	Depth (m)	Description
GB41A	0-1	UNWASHED: acid reaction = 1, orange silty sand & calcrete nodules (d), texture – clayey sand, brownish orange; (w) (2.5YR5/8). WASHED: quartz sand: ~60% orange-stained sand, frosted well rounded grains (0.5-1 mm) aeolian; + 35% fluvial sand, fine- to coarse-grained, rounded to subangular, white – grey – milky – dark – water-clear. Some calcrete pisoliths & fragments (~2%) mostly orange coloured. Dark lithic grains (1-3%). Overall character – transported.
GB41B	1-2	UNWASHED: acid reaction = 2, pale brown silty sand & calcrete nodules (d), texture – fine sandy loam, moderate orange; (w) (2.5YR6/8). WASHED: pink calcrete nodules & fragments (~20%) with black MnOx spotting. Quartz sand: ~40% orange-stained sand, frosted well rounded grains (0.5-1 mm) aeolian; + 30% fluvial sand, fine- to coarse-grained, rounded to subangular, white – grey – milky – dark – water-clear; + fine-grained quartz gravel (~5%). Dark lithic grains (1-3%). Overall character – transported.
GB41C	2-3	UNWASHED: acid reaction = 1, as above + red-brown clay + some calcrete (d), texture – light sandy clay, strong brown; (w) (2.5YR4/6). WASHED: calcrete nodules persist (~15%); + yellow-orange translucent gypsum crystals, rosettes & mats (~15%); + red-brown hardpan fragments with silicified clay matrix binding fluvial sand (25%); + fluvial sand, fine- to coarse-grained, rounded to subangular, white – grey – milky – dark – water-clear (>40%); + minor fine-grained quartz gravel. Overall character – transported.
GB41D	3-4	UNWASHED: acid reaction = 0, red-brown clay (d), texture – silty clay, greyish reddish orange; (w) (2.5YR5/7). WASHED: much reduced granular material than above interval. ~50% is pale yellow translucent gypsum crystals, rosettes & mats; + ~50% fluvial sand, fine- to coarse-grained, rounded to subangular, white – cream – milky – bluish – dark grey; + <1% sub-mm black mineral grains. Some lithic gravel to 5 mm (<1%). Overall character – transported.
GB41E	4-5	UNWASHED: acid reaction = 0, pale brown clay (d), texture – sticky medium clay, light reddish brown; (w) (2.5YR6/5). WASHED: small amount of granular material. Quartz sand as per above interval (~50%), fine-grained white quartz gravel (10%). Lithics: porcelanite, yellow (5%) + dark red – black FeOx grains & fragments (<1-5 mm, ~35%) some of the FeOx material adheres to the larger quartz gravel & platy vein quartz fragments, ?pedolith. Overall character – transported on ? *in situ*.
GB41F	5-6	UNWASHED: acid reaction = 0, dark reddish clay + black lithic fragments (d), texture – light clay, moderate reddish brown; (w) (2.5YR4/4). WASHED: small amount of granular material. Quartz sand as per above interval (~30%) + more platy vein quartz fragments (10%) dark reddish. Lithics: porcelanite, yellow (5%) + grey silcrete fragments & grains (5%) + dark red – black FeOx grains & fragments (<1-5 mm, ~50%, ?pedolith-saprolith); + 2 chunks (18 x 10 x 6 mm) of weathered aphanitic mafic basement, Overall character – ?thin transported on *in situ* basement.

Hole: GB42, **Main Regolith Line.**
Location: 53J, 449244 E, 6596206 N.
Elevation: 112.41 m.
Site: flat area on slightly higher ground.
Vegetation: mulga *Acacia* woodland, and *Maireana sedifolia* understory.
Soil: calcareous sandy clay, **Lag:** abundant calcrete, quartz & chalcedony.
Calcrete: nodular.
Logged by: M.J. Sheard.

Sample #	Depth (m)	Description
GB42A	0-1	UNWASHED: acid reaction = 1-2, pale brown silty sand & calcrete nodules (d), texture – sandy loam, brownish orange; (w) (5YR5/7). WASHED: nodular calcrete fragments (~30%) – pinkish, cream and pale brownish., cementing fine to medium-grained quartz sand. Some honey coloured gypsum grains & fragments (~7%, 1-2 mm). Quartz, rounded to subangular, fine- to coarse-grained + gravels (2.5 mm) white – clear – orange-stained – orange – milky & rare grey. Charcoal & dark organic grains (~1%) + dark mineral grains (~1%). Overall transported character – transported.
GB42B	1-2	UNWASHED: acid reaction = 2, orange clay & calcrete nodules (d), texture – silty loam, moderate orange; (w) (5YR6/7). WASHED: as interval above but more gypsum present (~20%). Nodular calcrete fragments (~30%). Some rounded grains of Fe-psammite (~1%). Overall character – transported.
GB42C	2-3	UNWASHED: acid reaction = 1, orange silty sand + gypsum crystals (d), texture – sandy clay loam, brownish orange; (w) (5YR5/7). WASHED: gypcrete (~40%), grains, fragments & aggregates. Remainder is mostly quartz: fine- to coarse-grained sand + some granules to 4 mm. Rounded to subrounded to angular grains, white – clear – orange-stained – orange – grey – rare bluish & very dark. Black mineral grains, angular (~1%, ~1 mm). Rare saprolitic relict lithic grains having cream kaolin grains within a dark Fe-stained fine-grained host (<1%). Overall character – transported fluvial with some ?*in-situ* component.
GB42D	3-4	UNWASHED: acid reaction = 0, brown sandy clay + gypsum crystals (d), texture – sandy light clay, brownish orange; (w) (5YR5/7). WASHED: mostly gypcrete (80%) as crystal & aggregate fragments & grains, clear & honey coloured. Quartz as in above interval, subrounded – subangular – angular, + few more rounded granules (3-4 mm). Well rounded lithic granules (2 x 4 mm) of fine-grained psammite. Fragments of platy vein quartz with adhering micaceous host rock (1-2%, 2-4 mm). Mixed character overall, sample swamped by gypsum overprint, possibly penetrated pedolith (? *in situ*).
GB42E	4-5	UNWASHED: acid reaction = 0, brown silty clay + abundant gypsum crystals (d), texture – silty light clay, brownish orange; (w) (5YR5/7). WASHED: very little granular matter. Mostly quartz, predominantly angular with some rounded, white – clear – grey – brown-stained – yellow – composite – bluish – dark grey. Some thin vein forms, platy with adhering micaceous host lithotype on flat surfaces (?pedolith). Saprolitic grains & fragments with kaolinitic grain relicts after feldspar. Some kaolinite grains after feldspar (~1.5 mm). Dark Fe-rich mineral fragments (~7%). Overall character is *in situ* material.
GB42F	5-6	UNWASHED: acid reaction = 0, brown silty clay + gypsum crystals (d), texture – silty light clay, brownish orange; (w) (5YR5/7). WASHED: slightly more sample than 4-5 m. Saprolite fragments, some pink-purple – reddish – creamy – white. Kaolinite fragments (35%, <1-10 mm). Reddish – brown relict lithics (25%, <1-10 mm). Yellow & brown relict lithics (25%, <1-10 mm). All these have formed from a fine-grained protolith. Quartz, angular fragments (~15%) white – milky – water-clear – grey – rose – bluish & yellow- or brown-stained. A number of fragments have thin-vein morphology. Overall character is *in-situ* basement.

Hole: GB43, **Main Regolith Line.**
Location: 53J, 449245 E, 6596124 N.
Elevation: 112.532 m.
Site: flat area atop rise.
Vegetation: mulga *Acacia* and *Casuarina* woodland with *Maireana sedifolia* understory.
Soil: sandy to clayey.
Calcrete: nodules & pisoliths.
Logged by: M.J. Sheard.

Sample #	Depth (m)	Description
GB43A	0-1	UNWASHED: acid reaction = 2, pale brown clayey sand & abundant calcrete nodules (d), texture – clayey sand, brownish orange; (w) (5YR5/7). WASHED: calcrete nodules & pisoliths (to ~10 mm, ~5%) – pinkish, cream and pale brownish., cementing fine to medium-grained quartz sand. Quartz sand (~25%) aeolian, orange stained, rounded to subangular, frosted grains, fine- to medium-grained, + fluvial quartz sand (~55%), rounded to subangular, fine- to coarse-grained, white – grey – water-clear – milky – cream; + porcelanite fragments & grains (~1%); + dark mineral grains (~1%). Overall transported character – transported.
GB43B	1-2	UNWASHED: acid reaction = 2, pale brown silty sand & abundant calcrete nodules (d), texture – loamy sand, brownish orange; (w) (5YR5/7). WASHED: predominantly gypcrete (~80% of washed bulk), pale yellow translucent crystals & fragments or rosettes & red-brown gypcrete as platy fragments (in ratio 1:2 of crystals to plates), may be an intensely gypcreted red-brown hardpan. Some pink & cream calcrete pisoliths & fragments. Remainder is fluvial quartz as in interval above. Dark mineral grains, well rounded to subangular (~1-2%, ~1 mm). Overall character – transported.
GB43C	2-3	UNWASHED: acid reaction = 1, pale brown sand, + gypsum crystals (d), texture – loamy sand, moderate orange; (w) (5YR5.5/7). WASHED: predominantly gypcrete (~80% of sieved bulk), pale yellow translucent crystals & bladed fragments or rosettes & red-brown gypcreted clayey sand as platy fragments (1-30 mm), an intensely gypcreted red-brown hardpan. Granules of yellow porcelanite (1-2%). <20% as fluvial quartz sand, rounded to angular, fine- to course-grained, white – grey – milky – water-clear. Overall character – transported.
GB43D	3-4	UNWASHED: acid reaction = 1, pale brown sand, + gypsum crystals (d), texture – clayey sand, brownish orange; (w) (5YR5/8). WASHED: predominantly gypsum crystals (~70%) water-clear – yellowish – orange translucent, some aggregates & rosettes. ~30% as fluvial quartz sand as in interval above, including chloritic quartz grains & dark opaques (~1-2%). Overall character – transported.
GB43E	4-5	UNWASHED: acid reaction = 0, reddish clay + abundant gypsum crystals (d), texture – silty clay, strong brown; (w) (2.5YR4.5/7). WASHED: very little granular matter. Mostly quartz, predominantly angular with some rounded, white – clear – grey – brown-stained – yellow – composite bluish – dark grey, + angular gravel sized lithic grains with yellow-brown FeOH + coatings or rinds (?pedolith). Saprolitic grains & fragments with kaolinitic-sericitic grain relicts after feldspar. Some kaolinite grains after feldspar (~1.5 mm). Dark Fe-rich mineral fragments (~7%). Overall character – transported + *in-situ*.
GB43F	5-6	UNWASHED: acid reaction = 0, pallid clay with reddish mottles (d), texture – light clay, yellowish grey & strong brown; (w) (5Y7/2 & 2.5YR3/6). WASHED: slightly more sample than 4-5 m. Saprolite fragments – some pink-purple – reddish – creamy – white. Kaolinite fragments (8%). Angular gravel sized lithic fragments with yellow FeOH + red FeOx coatings or rinds (?pedolith, >50%, 10 x 8 x 2 mm), these have formed from a fine-grained protolith. Quartz: angular platy vein fragments (~20%) + some rounded clasts (~15%, ?down-hole contamination) white – milky – water-clear – grey – rose – bluish & yellow or brown-stained. Overall character is *in-situ*.

Hole: GB45, **Main Regolith Line.**
Location: 53J, 449247 E, 6596042 N.
Elevation: 113.126 m.
Site: slightly inclined ground near top of rise.
Vegetation: mulga *Acacia* and *Casuarina* woodland with *Maireana sedifolia* understory.
Soil: calcareous sandy clay, abundant calcrete nodules on surface.
Calcrete: pisoliths-nodular near surface, subsurface is platy pan.
Logged by: M.J. Sheard.

Sample #	Depth (m)	Description
GB45A	0-1	UNWASHED: acid reaction = 2, pale brown sandy clay & abundant calcrete nodules (d), texture – light sandy clay, greyish reddish orange; (w) (2.5YR5/6). WASHED: pink & cream calcrete as pisoliths, nodules, nodule aggregates & platy pan fragments (~10 mm, ~25% of sieved bulk). Quartz sand (~15%) aeolian, orange stained, rounded to subangular, frosted grains, fine- to medium-grained, + fluvial quartz sand (~55%), rounded – subangular, fine- to coarse-grained, white – grey – water-clear – milky – cream; + lithics: porcelanite & silcrete granules (~1%) & chloritic quartz + irregular shaped vein quartz fragments (1%); + black organic grains (1-2%) + dark mineral grains (~1%). Overall character – transported.
GB45B	1-2	UNWASHED: acid reaction = 2, pale brown sandy clay & abundant calcrete nodules + gypsum crystals (d), texture – loamy sand, light brown; (w) (5YR5/6). WASHED: predominantly gypcrete (~80% of sieved bulk), yellow – orange – cream translucent crystals & fragments or rosettes & platy mat fragments. Some pink & cream calcrete pisoliths & fragments. Remainder is fluvial quartz as in interval above. Overall character – transported.
GB45C	2-3	UNWASHED: acid reaction = 2, pale brown silty sand & abundant calcrete nodules + gypsum crystals (d), texture – loamy sand, moderate orange; (w) (5YR6/6). WASHED: predominantly gypcrete (~80% of sieved bulk), yellow – orange –cream translucent crystals & fragments or rosettes & platy mat fragments. Bladed crystal fragments are longer than in interval above. Some pink & cream calcrete pisoliths & fragments (down-hole contamination). Remainder is fluvial quartz as in interval above. Overall character – transported.
GB45D	3-4	UNWASHED: acid reaction = 1, pale brown sand + gypsum crystals (d), texture – silty sand, light brown; (w) (5YR5/6). WASHED: predominantly gypcrete (~70% of sieved bulk), yellow – orange - cream translucent bladed crystals & fragments or rosettes & platy mat fragments. >20% of granular matter is fluvial quartz, as in interval above, contains 1-2% as lithics: chalcedony, jasper, silcrete & composite grains. Overall character – transported.
GB45E	4-5	UNWASHED: acid reaction = 0, red-brown clay + gypsum crystals (d), texture – silty light clay, moderate orange; (w) (5YR6/6). WASHED: much less granular matter than above interval. Some gypsum fragments, as in above interval; + red-brown hardpan fragments (~20%) with red-brown clay & silica cementing fluvial sand grains. ~75% of sieved sample is fluvial quartz sand, fine- to course-grained to fine-grained gravel, white – clear – pink – milky. Dark lithics (<0.5%); + dark FeOH stained grit aggregates (?pedolith). Overall character: transported on *in situ*.
GB45F	5-6	UNWASHED: acid reaction = 0, pallid clay, red flecked (d), texture – light clay, yellowish grey & greyish reddish orange; (w) (5Y7.5/2 & 2.5YR5/6). WASHED: even less granular matter than interval above. Mostly as per interval above but with much more dark red FeOx & yellow – brown FeOH stained lithics (Fe-pedolith capping). Overall character – *in situ*.

Hole: GB47, **Main Regolith Line.**
Location: 53J, 449242 E, 6595971 N.
Elevation: 112.96 m.
Site: flat area on slightly sloping ground.
Vegetation: mulga *Acacia* and *Casuarina* woodland with *Maireana sedifolia* understory.
Soil: calcareous sandy clay.
Calcrete: pisoliths, nodular & nodule aggregates.
Logged by: M.J. Sheard.

Sample #	Depth (m)	Description
GB47A	0-1	UNWASHED: acid reaction = 2, orange silty sand & abundant calcrete nodules (d), texture – loamy sand, brownish orange; (w) (5YR5/8). WASHED: dominantly pinkish calcrete pisoliths, nodules, nodule aggregates & fragments, cements aeolian sand (~90% of sieved bulk). Quartz sand: aeolian (~5%), orange-stained, rounded – subangular, frosted grains, fine- to medium-grained, + fluvial quartz sand (~5%), rounded to subrounded, medium- to coarse-grained, water-clear – white – milky – grey. Overall character – transported.
GB47B	1-2	UNWASHED: acid reaction = 1, orange clayey sand & calcrete nodules (d), texture – clayey sand, brownish orange; (w) (5YR5/8). WASHED: predominantly gypcrete (~80% of sieved bulk), yellow-orange-cream translucent crystals & fragments or rosettes & platy mat fragments, gypsum cements fluvial quartz sand. Some pink & cream calcrete pisoliths & fragments. ~15% as fluvial quartz, similar to interval above. Dark lithic grains (<1%) + 5% as down-hole contamination (calcrete nodules). Overall character – transported.
GB47C	2-3	UNWASHED: acid reaction = 1, orange clayey sand & calcrete + gypsum crystals (d), texture – clayey sand, brownish orange; (w) (2.5YR5.5/7). WASHED: as in above interval + some red-brown hardpan fragments with red-brown clay & silica cementing fluvial sand grains + dark brown FeOH stained fragments (~1%, ?pedolith). Overall character: transported on ? *in situ*.
GB47D	3-4	UNWASHED: acid reaction = 2, pale orange silty sand & calcrete + gypsum crystals (d), texture – loamy sand, moderate orange; (w) (5YR6/7). WASHED: as in above interval + but with more red-brown hardpan fragments. Overall character: indeterminate.
GB47E	4-5	UNWASHED: acid reaction = 2, pale orange clayey sand & calcrete + gypsum crystals (d), texture – sandy clay, moderate orange; (w) (5YR7/8). WASHED: mostly yellow – orange gypsum crystal & rosette fragments + water-clear bladed crystal fragments to 15 mm long; + quartz sand, fine- to course-grained & mostly subrounded – angular with some lithics (porcelanite & silcrete <1%). Overall character: dominantly transported but swamped by gypsum overprint & is possibly indeterminate.
GB47F	5-6	UNWASHED: acid reaction = 2, reddish clay & calcrete + gypsum crystals (d), texture – light clay, brownish orange; (w) (5YR5.5/7). WASHED: much less particulate matter then above interval. Mostly gypsum crystals, rosettes & large bladed crystal fragments, very little quartz or lithics. Down-hole contamination evident (calcrete) Overall character: indeterminate, interval swamped by gypsum overprint.

Hole: GB49, **Main Regolith Line.**
Location: 53J, 449243 E, 6595927 N.
Elevation: 112.539 m.
Site: flat.
Vegetation: mulga *Acacia* and *Casuarina* woodland with *Maireana sedifolia* understory.
Soil: calcareous sandy clay.
Calcrete: pisoliths, nodules, nodule aggregates & sheet-pan.
Logged by: M.J. Sheard.

Sample #	Depth (m)	Description
GB49A	0-1	UNWASHED: acid reaction = 2, pale orange silty sand & abundant calcrete nodules (d), texture – sandy loam, brownish orange; (w) (5YR5/8). WASHED: ubiquitous pinkish calcrete pisoliths, nodules, & cream sheet calcrete fragments, both types cement aeolian sand (~45% of sieved bulk). Quartz sand: aeolian (~20%), orange-stained, rounded – subangular, frosted grains, fine- to medium-grained, + fluvial quartz sand (~30%), rounded – subrounded, fine- to coarse-grained, water-clear – white – milky – grey; + fluvial quartz gravel, fine-grained. Rare black fibrous organic particles ? carbonised. Overall character – transported.
GB49B	1-2	UNWASHED: acid reaction = 2, pale orange silty sand & abundant calcrete nodules + crystalline gypsum (d), texture – sandy loam, brownish orange; (w) (5YR5/8). WASHED: calcrete as per above interval + nodular aggregates (~30%); + red-brown & orange – yellow gypsum as crystals, rosettes & crystal aggregate mats (~60%); + fluvial sand to fine gravel as per above interval (~10%). Overall character – transported.
GB49C	2-3	UNWASHED: acid reaction = 2, pale yellow-brown silty sand & calcrete nodules + crystalline gypsum (d), texture – sandy loam, brownish orange; (w) (5YR5.5/7). WASHED: gypcrete (~80%) mostly orange – yellow – water-clear but with some red-brown hardpan cementing fluvial sand; fluvial sand as per 0-1 m interval (~15%); + down-hole contamination as calcrete nodules (~5%); + rare yellowish porcelanite grains and greenish grey silcrete fragments. Overall character – transported.
GB49D	3-4	UNWASHED: acid reaction = 1, pale yellow-brown silty sand & some calcrete + crystalline gypsum (d), texture – light sandy clay loam, brownish orange; (w) (5YR5.5/7). WASHED: 90% gypsum, ~1/3 as per 2-3 m + 2/3 as large crystals, water-clear – zoned translucent & yellowish or milky; + quartz sand-grit (~5%) with some yellowish porcelanite grains. Overall character is indeterminate.
GB49E	4-5	UNWASHED: acid reaction = 1, pallid clay with brown flecks, no visible calcrete or gypsum (d), texture – light-medium clay, yellowish grey & strong brown; (w) (5Y7/2 & 2.5YR4/8). WASHED: much reduced granular component than above intervals. Gypsum crystals in as above interval + some aggregates (20%); + vein quartz fragments (~70%); FeOH-FeOx fragments (1-3 mm) irregular-angular (~2%); + pale yellow porcelanite fragments to 2 mm; + dark brown FeOH stained water-clear quartz fragments or with goethitic rinds (>5%) + rare bluish grey quartz grains. Overall character – ?*in situ* basement.
GB49F	5-6	UNWASHED: acid reaction = 0, pallid clay with brown flecks (d), texture – light clay, yellowish grey & strong brown; (w) (5Y7/2 & 2.5YR4/8). WASHED: very little granular matter. Similar to interval 4-5 m but with more of the Fe-stained quartz grains and some bluish quartz fragments; + rare black angular sub-mm grains. Interval possibly represents a thin ferruginous pedolith on saprolite. Overall character – *in situ* basement.

Hole: GB51, **Main Regolith Line.**
Location: 53J, 449249 E, 6595847 N.
Elevation: 111.912 m.
Site: flat area on flank of small rise.
Vegetation: mulga *Acacia* and *Casuarina* woodland with *Maireana sedifolia* understory.
Soil: sandy clay, **Lag:** rare white vein quartz.
Calcrete: nodules, pisoliths & sheet-pan.
Logged by: M.J. Sheard.

Sample #	Depth (m)	Description
GB51A	0-1	UNWASHED: acid reaction = 2, orange silty sand & abundant calcrete nodules (d), texture – loamy sand, brownish orange; (w) (5YR5/7). WASHED: smaller quantity of particular matter for this interval than in holes to the north. Mostly quartz: sand, aeolian (<10%), orange-stained, rounded to subangular, frosted grains, fine- to medium-grained; + fluvial quartz sand – fine gravel (~70%) rounded – subangular, water-clear – white – milky & grey; + angular vein quartz fragments (2-5 mm); + pink – cream calcrete pisoliths & sheet calcrete fragments (~10% of sieved bulk); + organic fragments (wood). Overall character – transported.
GB51B	1-2	UNWASHED: acid reaction = 1, pale pinkish sand & calcrete nodules + crystalline gypsum (d), texture – loamy sand, light brown; (w) (7.5YR6/5). WASHED: >85% gypsum: orange-stained rosettes & crystalline mats + pale yellow – water-clear large crystals & fragments; + sand as per 0-1 m; + minor down-hole contamination (calcrete + charcoal fragments). Overall character – indeterminate.
GB51C	2-3	UNWASHED: acid reaction = 1, pale grey-brown sand & calcrete + crystalline gypsum (d), texture – sandy clay loam, light brown & greyish yellow; (w) (7.5YR6/5 & 5Y7/3). WASHED: >95% gypsum as large fish-tail twin crystals & fragments, milky – pale grey + crystal mats; + gypcreted pallid clay; + claycrete & quartz sand grains (~5%). Overall character – indeterminate.
GB51D	3-4	UNWASHED: acid reaction = 2. As above + greyish clay with brown streaks + gypsum, no visible calcrete (d), texture – light clay, yellowish grey & dark orange yellow &; (w) (5Y7/2 & 7.5YR6/6). WASHED: as per 2-3 m interval but gypsum reduced to ~85%; + black FeOx fragments & stained quartz; + yellow FeOH material (~10%) + unstained quartz grains including some bluish fragments, mostly angular. Overall character – ?*in situ* basement.
GB51E	4-5	UNWASHED: acid reaction = 0, pallid clay with brown streaks (d), texture – light clay, yellowish grey & dark orange yellow &; (w) (5Y7/2 & 7.5YR6/6). WASHED: much reduced granular matter than in interval above. Gypsum as above (~30%); + angular vein quartz fragments (~50%) clear – milky – white & some dark bluish; + FeOx stained quartz fragments with yellow to dark brown goethite fragments (~15%); + lithics: quartz grit-stone fragments & relict composite crystalline basement fragments. Ferruginous pedolith, within *in situ* basement.
GB51F	5-6	UNWASHED: acid reaction = 0, pallid clay with brown streaks (d), texture – light clay, yellowish grey & strong brown &; (w) (5Y7/2 & 2.5YR4/6). WASHED: much reduced granular matter than 4-5 interval. Gypsum crystalline fragments as in above interval (~15%); + quartz fragments, clear – milky – Fe-stained (~35%) + some rare dark bluish grit; + dark red & dark brown FeOx-FeOH fragments (~30%); + pallid – yellow – orange – brown clay-rich weathered basement fragments including fine-grained quartz grit (~20%). Provenance: ferruginous pedolith to ? upper saprolite. Overall character – *in situ* basement.

Hole: GB53, **Main Regolith Line.**
Location: 53J, 449246 E, 6595711 N.
Elevation: 111.105 m.
Site: flat.
Vegetation: mulga *Acacia* and *Casuarina* woodland with *Maireana sedifolia* understory.
Soil: sandy clay.
Calcrete: nodules.
Logged by: M.J. Sheard.

Sample #	Depth (m)	Description
GB53A	0-1	UNWASHED: acid reaction = 2, orange silty sand & abundant calcrete nodules + crystalline gypsum (d), texture – loamy sand, brownish orange; (w) (5YR5/7). WASHED: pinkish calcrete pisoliths & nodules (~10%). Dominantly gypsum, creamy – pale yellow – water-clear crystals, rosettes & gypcrete (~70%); + Quartz sand: aeolian (~10%), orange stained, rounded to subangular, frosted grains, fine- to medium-grained; + quartz grit (~10%): + black organic fragments (?charcoal). Overall character – transported.
GB53B	1-2	UNWASHED: acid reaction = 2, pale pinkish sand & calcrete nodules + crystalline gypsum (d), texture – loamy sand, light brown; (w) (7.5YR6/5). WASHED: >95% gypsum as large fish-tail twin crystals & fragments, milky – pale grey + crystal mats + some orange-stained crystals; + gypcreted pallid clay; + claycrete & quartz sand grains (~5%). Overall character – indeterminate.
GB53C	2-3	UNWASHED: acid reaction = 1, pale grey-brown sand & calcrete + crystalline gypsum (d), texture – sandy clay loam, light brown & greyish yellow; (w) (7.5YR6/5 & 5Y7/3). WASHED: gypsum as per interval 1-2 m (~40%); + pallid claycrete (gypseous cement) with black MnOx dendritic growths on fractures and as 3D structures in matrix (~40%); + vein quartz fragments, white – grey – milky & dark grey – dark bluish (~15%); + composite lithic fragments of relict crystalline basement (~5%). Overall character – indeterminate overlying *in situ* basement.
GB53D	3-4	UNWASHED: acid reaction = 1, pallid clay with brown streaks + gypsum, no visible calcrete (d), texture – light clay, yellowish grey & dark orange yellow; (w) (5Y7/2 & 7.5YR6/6). WASHED: much reduced granular matter than above. Dominantly gypsum crystals & gypcrete, pale yellow – water-clear (~60%); + relict lithic fragments as composite quartz-kaolinitic K-feldspar rock with Fe-staining (~30%); + vein quartz fragments, clear – milky – grey – bluish (~10%). Pedolith, *in situ* basement.
GB53E	4-5	UNWASHED: acid reaction = 0-1, pallid clay with brown streaks (d), texture – light clay, yellowish grey & dark orange yellow; (w) (5Y7/2 & 7.5YR6/6). WASHED: gypsum as per interval above (~25%); + vein quartz fragments, clear – white – yellow – grey – Fe-stained (~25%); + red FeOx stained highly weathered basement fragments (~25%); + yellow & red Fe-rich capping fragments (~15%); + composite quartz-rich relict rock commonly with Fe-staining (~10%). Pedolith, *in situ* basement.
GB53F	5-6	UNWASHED: acid reaction = 0-1, near white clay with reddish streaks & mottles (d), texture – light clay, light grey & light reddish brown; (w) (N9/- & 2.5YR5/5). WASHED: greyish quartz fragments & grains, some white to pink, all are angular (~25%); + white kaolinitic fragments that are partly silicified (~30%); + dark red FeOx fragments (~35%); + yellow FeOH fragments (~10%). Pedolith-saprolith, *in situ* basement.

Hole: GB54, **Main Regolith Line.**
Location: 53J, 449248 E, 6595640 N.
Elevation: 110.677 m.
Site: flat, southern end of drill line.
Vegetation: mulga *Acacia* and *Casuarina* woodland with rare *Santalum acuminatum*.
Soil: sandy clay.
Calcrete: nodules to platy-pan.
Logged by: M.J. Sheard.

Sample #	Depth (m)	Description
GB54A	0-1	UNWASHED: acid reaction = 2, pale orange silty sand & calcrete nodules + crystalline gypsum (d), texture – loamy sand, brownish orange; (w) (5YR5/7). WASHED: ubiquitous crystalline gypsum & cleavage fragments – translucent to cloudy (~70%). Some calcrete as nodule & plate fragments (5-10%). Quartz sand, fine to medium-grained, orange-stained – rounded frosted aeolian (5-10%). Overall character – cemented transported.
GB54B	1-2	UNWASHED: acid reaction = 1-2, mostly fish-tail gypsum crystals as a thick zone, texture not appropriate, colours: pale greys. WASHED: dominantly crystalline gypsum (~90). Calcrete as nodule fragments (~2%). Black mineral grains (~1-2%) fine-grained, angular. Gypsum overprint has swamped original host mineralogy.
GB54C	2-3	UNWASHED: acid reaction = 1, mostly fish-tail gypsum crystals as a thick zone, texture not appropriate, colours: pale greys. WASHED: dominantly crystalline gypsum as above. Some calcrete grains. Quartz sand, fine to medium-grained, orange-stained, rounded frosted aeolian (5% contamination from above). Black to dark brown grains Fe-rich. Host material character is indeterminate.
GB54D	3-4	UNWASHED: acid reaction = 1, pale brown & pallid clay + some gypsum, no visible calcrete (d), texture – light clay, greyish yellow & light yellowish brown; (w) (2.5Y7/3 & 10YR7/6). WASHED: dominantly crystalline gypsum (~90) some large crystal plates. Fe-stained psammite, some with a micro-box work structure, fragments (~2%, 3-10 mm). Rare calcrete nodule fragments & rare orange-stained sand as above (down hole contamination). Host material character is indeterminate.
GB54E	4-5	UNWASHED: acid reaction = 1, dark red-brown ferruginous zone with some clay (d), texture – sandy clay loam, moderate brown + light brown + moderate reddish brown; (w) (5YR3/3+ 5YR5/4 + 2.5Y4/4). WASHED: reduction in gypsum (5%) & some calcrete contamination from above. Bulk fragments (1-15 mm). Dark red ferruginous material, some is sandy with dark grey – black zones. Fe-stained psammite plates & fragments. Fe-rich material (80%) of bulk fragments. Quartz, angular grains & fragments, grey – white – water-clear. Relict granulitic lithic fragments – kaolinitic, siliceous & felsic. Some siliceous fragments resemble silcrete (3-5 mm). Overall material has an *in-situ* saprolitic character with ? pedolith Fe-capping.
GB54F	5-6	UNWASHED: acid reaction = 0-1, white to grey clay with reddish streaks & mottles (d), texture – light clay, white, light grey + moderate brown; (w) (N10/-,N7/- & 5YR4/4). WASHED: very little granular material, mostly white kaolinitic fragments (1-15 mm) enclosing quartz grains, many fragments have a relict lithic felsic-granulite texture. Fe-psammite fragments, dark red – yellow-brown – yellow. Fe-rich dark fragments (10-15%) Angular quartz grains, white – grey – water-clear. Overall character – *in-situ*, saprolitic basement.

Hole: GB05, **Westerly cross line**
Location: 53J, 449157 E, 6596511 N.
Elevation: 110.146 m.
Site: gently sloping flank-sand apron of dune / sandy edge of claypan.
Vegetation: *Acacia*, *Cassia*, *Maireana sedifolia* and other low shrubs.
Soil: sandy clay.
Calcrete: platy & uncommon pisoliths
Logged by: M.J. Sheard.

Sample #	Depth (m)	Description
GB05A	0-1	UNWASHED: acid reaction = 1, orange silty sand (fine- to course-grained) & some calcrete nodules (d), texture – loamy sand, brownish orange; (w) (5YR5/7). WASHED: predominantly orange stained quartz sand, uniformly sorted, aeolian, frosted fine- to medium-grained. Some calcrete as thin plates, + gypsum as crystal fragments & small plates, + black organic flakes. Overall character – transported.
GB05B	1-2	UNWASHED: acid reaction = 1, orange silty sand (fine- to course-grained) & some calcrete nodules (d), texture – loamy sand, brownish orange; (w) (5YR5/7). WASHED: dominantly gypsum as orange crystalline aggregates & rosettes to pan-mat fragments (~50%), + dark red-brown gypseous hardpan with clay and gypsum binders cementing fluvial sand, fine- to coarse-grained, mostly quartz (~20%), + fluvial gravel, subrounded & rare subangular (~25%), + dark lithic grains (1-2%), + black organic fragments. Overall character – transported.
GB05C	2-3	UNWASHED: acid reaction = 2, orange silty sand (fine- to course-grained) & calcrete nodules + crystalline gypsum (d), texture – clayey sand, brownish orange; (w) (5YR5/7). WASHED: as per interval above with gypsum : sand = 50:50. Overall character – transported.
GB05D	3-4	UNWASHED: acid reaction = 2, orange silty sand (fine- to course-grained) & calcrete nodules + crystalline gypsum (d), texture – clayey sand, brownish orange; (w) (5YR5/7). WASHED: 85% is pale orange to water clear gypsum as crystal twins and rosettes (mm-cm sizes), + white vein quartz fragments, angular (~5% mm-cm sizes), + fluvial quartz grains, milky-clear-grey, fine- to coarse-grained, rounded to subangular. Overall character – mixed provenance.
GB05E	4-5	UNWASHED: acid reaction = 1, brown & pallid clay, no visible calcrete, some gypsum crystals (d), texture – light clay, sticky, brownish orange & yellowish grey; (w) (5YR5/7 & 5Y7/2). WASHED: much less particulate matter than above interval, predominantly gypsum crystal fragments & gypcrete as above, + 1-2% of dark brown FeOx or FeOH mineral fragments, angular, + ~5% of highly weathered crystalline basement, composite lithics. Overall character – probably *in situ*.
GB05F	5-6	UNWASHED: acid reaction = 0, pallid silty clay (d), texture – light clay ? silty, light grey; (w) (N9/-). WASHED: very little particulate matter. Mostly quartz (large down hole contamination %), + chloritic grains, + dark brown FeOx or FeOH mineral grains, angular, + silicified pallid saprolite-pedolith as kaolinitic-rich material containing fine quartz grit. Overall character – *in situ* basement, weathered.

Hole: GB07, **Westerly cross line**
Location: 53J, 449074 E, 6596507 N.
Elevation: 107.963 m.
Site: flat, claypan.
Vegetation: low claypan shrubs and grasses.
Soil: silty clay.
Calcrete: scant pisoliths & earthy coatings.
Logged by: M.J. Sheard.

Sample #	Depth (m)	Description
GB07A	0-1	UNWASHED: acid reaction = 1, orange clayey fine sand & some calcrete pisoliths (d), texture – light sandy clay loam, brownish orange; (w) (5YR5/6). WASHED: limited particulate matter, orange stained quartz sand, uniformly sorted, aeolian, frosted fine- to medium-grained (~25%), + fluvial quartz sand, rounded to subrounded to angular, clear-white-milky-grey-dark bluish (~70%), + rare fragments of yellowish grey silcrete to 3 mm + rare white angular to subrounded gravel to 5 mm, + some pale orange gypsum crystals to 5 mm. Overall character – transported.
GB07B	1-2	UNWASHED: acid reaction = 1, orange silty fine sand + abundant crystalline gypsum (d), texture – fine sandy loam, brownish orange; (w) (5YR5/7). WASHED: dominantly gypsum as orange to water-clear crystal twins, crystalline aggregates & rosettes to pan-mat fragments, all paler than in above interval, + some fluvial sand, fine- to coarse-grained, mostly quartz (~25%), + dark brown ferruginous grains (<1%). Overall character – transported.
GB07C	2-3	UNWASHED: acid reaction = 0, brownish grey clay with brown flecks, + gypsum crystals (d), texture – medium clay, sticky, dark greyish yellow & light brown; (w) (2.5Y6/4 & 7.5YR5/5). WASHED: reduced particulate matter. As in interval above, but gypsum is paler and has more water-clear forms, the dark brown ferruginous grains are more numerous and larger (~10%) & several fragments are just Fe-coated or stained silicified pallid clay-rich material containing fine-grained quartz grit (pedolith-saprolith). Overall character – *in situ* basement.
GB07D	3-4	UNWASHED: acid reaction = 0, pallid clay with brown flecks (d), texture – light clay, sticky, yellowish grey & strong brown; (w) (5Y7/2 & 5YR4/8). WASHED: very little particulate matter. As in above interval but more FeOx stained and coated quartz fragments, mostly angular, many fragments are in-part silicified kaolinite-rich saprolite with fine-grained quartz grit. Overall character – *in situ* basement.
GB07E	4-5	UNWASHED: acid reaction = 0, pallid clay with brown flecks (d), texture – light clay, sticky, yellowish grey & strong brown; (w) (5Y7/2 & 5YR4/8). WASHED: very little particulate matter. Similar to interval above. Overall character – *in situ* basement.
GB07F	5-6	UNWASHED: acid reaction = 0, pallid clay with brown flecks (d), texture – light clay, sticky, yellowish grey & moderate reddish brown; (w) (5Y7/2 & 2.5YR4/5). WASHED: even less particulate matter than above intervals, ~25% is FeOx grains & fragments + angular composite quartz-mineral lithics with relict granulite texture-fabric, fragments up to 5 mm. Overall character – *in situ* basement.

Hole: GB09, **Westerly cross line**
Location: 53J, 449001 E, 6596503 N.
Elevation: 107.97 m.
Site: flat**,** claypan centre, cross-cutting access track just west of site.
Vegetation: low claypan shrubs <0.5 m high and grasses.
Soil: clay, severe surface cracking evident.
Calcrete: scant pisoliths & earthy coatings.
Logged by: M.J. Sheard.

Sample #	Depth (m)	Description
GB09A	0-1	UNWASHED: acid reaction = 1, orange clayey fine sand & some calcrete pisoliths (d), texture – light sandy clay loam, strong brown; (w) (5YR4/8). WASHED: dominantly fluvial quartz sand, rounded to subangular, medium- to coarse-grained, white-grey-milky (~55%), + calcrete pisolith fragments, pale yellow (~30%) + orange stained quartz sand, uniformly sorted, aeolian, frosted fine- to medium-grained (~15%), + water-clear gypsum crystal fragments (10%). Overall character – transported.
GB09B	1-2	UNWASHED: acid reaction = 0, orange fine sandy clay + crystalline gypsum (d), texture – sandy light clay, brownish orange; (w) (5YR5/8). WASHED: 50:50 mix of fluvial quartz as above and water-clear gypsum crystals, rosettes & gypcrete, + rare bluish vein quartz (to 2 mm) + dark FeOx granules (1%) + pale khaki silcrete fragments (2-3 mm) & rare black sub-mm grains. Overall character – transported.
GB09C	2-3	UNWASHED: acid reaction = 0, brown clay + minor crystalline gypsum (d), texture – sandy light clay, strong brown; (w) (5YR4/7). WASHED: Much reduced particulate matter. 50% fluvial quartz, white, fine- to coarse-grained, + brown FeOH/Ox stained quartz, mostly angular (25%) + FeOx grains & fragments, angular (10%) + gypsum crystal fragments (10%) + composite crystalline basement granules to 4 mm (~5%) + rare greenish silcrete fragments (2 mm). Overall character – mixed: transported & *in situ*.
GB09D	3-4	UNWASHED: acid reaction = 0, pallid clay with brown flecks (d), texture – light clay, sticky, pale grey & strong yellowish brown; (w) (N9/- & 7.5YR5/7). WASHED: very little particulate matter. Dominantly quartz, angular to rounded, fine- to coarse-grained, + brown FeOH stained quartz grains, fine- to medium-grained, + black & brown FeOx grains (sub-mm) + rare composite quartz with dark minerals as vein fragments. Overall character – probably *in situ* ? pedolith where boundary possibly just above this interval.
GB09E	4-5	UNWASHED: acid reaction = 0, pallid clay with reddish flecks (d), texture – light clay, sticky, pale bluish grey & greyish reddish orange; (w) (5B7/1 & 2.5YR6/6). WASHED: very little particulate matter. Similar to interval above but provenance difficult to assign. Overall character – indeterminate ? *in situ*.
GB09F	5-6	UNWASHED: acid reaction = 0, pallid clay with brown flecks (d), texture – light clay, sticky, light grey & moderate orange; (w) (N6.5/- & 5YR6/6). WASHED: very little particulate matter. Similar to interval above but provenance difficult to assign. Overall character – indeterminate ? *in situ*.

Hole: GB11, **Westerly cross line**
Location: 53J, 448919 E, 6596504 N.
Elevation: 108.176 m.
Site: gently sloping, western edge of claypan, cross-cutting access track just east of site.
Vegetation: low shrubs and grasses.
Soil: silty clay.
Calcrete: earthy coatings
Logged by: M.J. Sheard.

Sample #	Depth (m)	Description
GB11A	0-1	UNWASHED: acid reaction = 1, orange clay, some earthy carbonate + abundant crystalline gypsum (d) texture – light clay, strong brown; (w) (5YR4/6). WASHED: dominantly fluvial quartz sand, rounded to subangular, fine- to coarse-grained, white-grey-milky & includes some fine-grained quartz gravel (~50%), + orange stained quartz sand, uniformly sorted, aeolian, frosted fine- to medium-grained (~15%), + water-clear gypsum crystals, plates & rosettes (25%).+ yellow-green porcelanite & silcrete fragments (~8%) + angular blue-grey vein quartz fragments with sub-mm black grain inclusions (~2%). Overall character – transported.
GB11B	1-2	UNWASHED: acid reaction = 0, brown gypseous clay + abundant crystalline gypsum (d) texture – light sandy clay loam, light brown; (w) (5YR5/6). WASHED: reduced amount of particulate matter. dominantly quartz polymict grains, sand, angular to rounded, fine- to coarse-grained, white-grey-milky & includes some fine-grained gravel with poly-lithic grains (~60%), + grey to blue-grey angular vein quartz fragments, + FeOx/OH clasts to 2 mm, + yellowish to greyish porcelanite & silcrete fragments. Overall character – indeterminate.
GB11C	2-3	UNWASHED: acid reaction = 0, brownish grey gypseous clay with brown streaks (d) texture – light clay, sticky, light yellowish brown & brownish orange; (w) (10YR7/5 & 2.5YR5/7). WASHED: much reduced particulate matter. Quartz: ~1/3 is fluvial as per above intervals, 2/3 is of angular vein type as sand-grit & one chunk to 6 mm is vuggy (white) + some FeOx grains, sub-mm to 2 mm + some silcrete fragments + carbonised plant stems. Overall character – indeterminate to ? *in situ*.
GB11D	3-4	UNWASHED: acid reaction = 0, pallid clay with brown stains & pink flecks (d), texture – light clay, sticky, yellowish grey, moderate orange & greyish reddish orange; (w) (2.5Y7/1, 5YR6/8 & 2.5YR5/6). WASHED: very little particulate matter. Quartz, water-clear to white (60%), + brown Fe-stained quartz grit (20%), + FeOx fragments to 3 mm (~15%), + greenish silcrete fragments (1-2%), + sub-mm black grains (2-3%). Overall character – ? *in situ*.
GB11E	4-5	UNWASHED: acid reaction = 0, pallid clay with reddish flecks (d), texture – light clay, sticky, pale bluish grey & greyish reddish orange; (w) (5B7/1 & 2.5YR6/6). WASHED: <1/3 gm of particulate matter. Mostly as per interval above but angular FeOx fragments now ~30%. Overall character – *in situ*.
GB11F	5-6	UNWASHED: acid reaction = 0, pallid clay with brown flecks (d), texture – light clay, sticky, light grey & moderate orange; (w) (N6.5/- & 5YR6/6). WASHED: <1/3 gm of particulate matter. Mostly as per interval above but angular ratio of quartz:FeOx fragments now ~55:45. Overall character – *in situ*.

Hole: GB14, **Westerly cross line**
Location: 53J, 448836 E, 6596508 N.
Elevation: 110.374 m.
Site: sloping area, dune eastern flank ~half way up.
Vegetation: *Acacia* woodland, *Maireana sedifolia* and other low shrubs.
Soil: sandy to sandy clay.
Calcrete: abundant nodules.
Logged by: M.J. Sheard.

Sample #	Depth (m)	Description
GB14A	0-1	UNWASHED: acid reaction = 1-2, orange sandy clay, calcrete nodules (d) texture – light sandy clay loam, brownish orange; (w) (5YR5/8). WASHED: abundant calcrete nodule fragments (~35%), + orange stained quartz sand, uniformly sorted, aeolian, frosted fine- to medium-grained (~30%), + fluvial quartz sand, rounded to subangular, medium- to coarse-grained, white-grey (~30%), + sub-mm black grains (~5%). Overall character – transported.
GB14B	1-2	UNWASHED: acid reaction = 2, orange sandy clay, calcrete nodules (d) texture – sandy clay, moderate orange; (w) (2.5YR5.5/7). WASHED: calcrete (large nodules) and sand as per interval above + gypsum crystal mats & plates (~20%) + some red-brown hardpan fragments (~5%) + silcrete fragments (<1%). Overall character – transported.
GB14C	2-3	UNWASHED: acid reaction = 2, orange clay, calcrete nodules (d) texture – light clay, brownish orange; (w) (2.5YR5/7). WASHED: calcrete nodules (down hole contamination) and sand as per 0-1 m interval, with gypsum crystal mats & plates (~20%) + some red-brown hardpan fragments (~5%) + silcrete fragments (<1%). Overall character – transported.
GB14D	3-4	UNWASHED: acid reaction = 1, orange silty clay (d) texture – light clay, brownish orange; (w) (2.5YR5/7). WASHED: mostly fluvial quartz sand (as per above intervals) + some aeolian sand & calcrete fragments (down hole contamination). Overall character – transported.
GB14E	4-5	UNWASHED: acid reaction = 0-1, pallid clay with brown streaks (d), texture – light clay, yellowish grey & brownish orange; (w) (5Y7/2 & 5YR5/8). WASHED: quartz: ~1/2 is fluvial grains, ~1/2 is angular vein fragments (total is ~75%) + FeOx/OH-rich fragments, dark brown to yellow & yellow-brown (~20%) + pale yellow & cream porcelanite (~2%) + bluish to near black vein quartz with tiny black inclusions (~3%). Overall character – *in situ* (?pedolith).
GB14F	5-6	UNWASHED: acid reaction = 1, pallid clay with red-brown streaks (d), texture – light clay, yellowish grey & greyish reddish orange; (w) (5Y7/2 & 2.5YR6/6). WASHED: quartz: mostly angular vein fragments (some are vuggy) + ~1/4 as fluvial grains (down hole contamination) total quartz ~70% + FeOx/OH-rich fragments, dark brown to yellow & yellow-brown (~25%) + pale yellow & cream porcelanite (~2%) + bluish to near black vein quartz with tiny black inclusions (~3%). Overall character – *in situ* (pedolith).

Hole: GB13, **Westerly cross line**
Location: 53J, 448875 E, 6596504 N.
Elevation: ~112 m.
Site: near dune crest, end of cross line, near 2 company drilled RC holes ~3 m apart.
Vegetation: *Acacia* woodland, *Maireana sedifolia* and other low shrubs.
Soil: sandy with some clay.
Calcrete: abundant nodules & pisoliths, some are angular.
Logged by: M.J. Sheard.

Sample #	Depth (m)	Description
GB13A	0-1	UNWASHED: acid reaction = 1, orange silty clay, calcrete nodules (d) texture – light sandy clay loam, brownish orange; (w) (2.5YR5/7). WASHED: dominantly quartz: orange stained quartz sand, uniformly sorted, aeolian, frosted fine- to medium-grained (~50%), + fluvial quartz sand, rounded to subangular, medium- to coarse-grained, white-grey-milky-water clear with some fine-grained gravel (~40%), + pale orange calcrete nodule and pisolith fragments developed within aeolian sand (~5%), + trace of sub-mm black grains. Overall character – transported.
GB13B	1-2	UNWASHED: acid reaction = 0, orange sandy clay (d) texture – loam fine sandy, brownish orange; (w) (2.5YR5/7). WASHED: materials as per above interval, aeolian quartz (30%), fluvial sand (45%) fluvial quartz gravel (~10%) calcrete nodule & sheet fragments (~5%) + red-brown hardpan fragments (~5%) + orange gypsum crystals (~5%). Overall character – transported.
GB13C	2-3	UNWASHED: acid reaction = 1, yellowish brown clay & some calcrete nodules (d) texture – light clay, moderate orange; (w) (5YR6/6). WASHED: reduced particulate matter. Dominantly fluvial quartz sand as in above intervals (~80%) + yellowish porcelanite fragments to 4 mm (~10%) + lithic grains (~5%) + sub-mm black grains (~3%) + blue-milky zoned & dark blue vein quartz fragments (~2%). Dominantly transported character but may include weathered basement contact.
GB13D	3-4	UNWASHED: acid reaction = 0, pallid clay with yellow-brown streaks (d), texture – light-medium clay, yellowish grey & strong brown; (w) (5Y7/2 & 7.5YR4/6). WASHED: reduced particulate matter, materials as per interval above + a few Fe-cemented fragments to 4 mm, dark red-brown + larger vein quartz fragments. Provenance ?*in situ*.
GB13E	4-5	UNWASHED: acid reaction = 0-1, pallid clay with red-brown flecks (d), texture – light clay, sticky, yellowish grey, greyish reddish orange & strong brown; (w) (5Y7/2, 10YR5/6 & 7.5YR4/6). WASHED: very reduced particulate matter. Mostly angular quartz grit, white & water-clear with rare bluish & grey fragments, fine- to coarse-grained, ~10% are Fe-stained, + sub-mm black grains (~1%). Overall character – *in situ* (?pedolith).
GB13F	5-6	UNWASHED: acid reaction = 1, pallid clay with minor pink flecks (d), texture – light clay, sticky, yellowish grey, greyish reddish orange & strong brown; (w) (5Y7/1 & 10YR5/6). WASHED: only 1/3 gm of particulate matter, similar to interval above, fine- to medium-grained, and Fe-stained quartz to ~40%, + some relict lithics to 2 mm. Overall character – *in situ* (?pedolith).

Appendix A2: Distribution and concentrations of elements in the regolith and vegetation

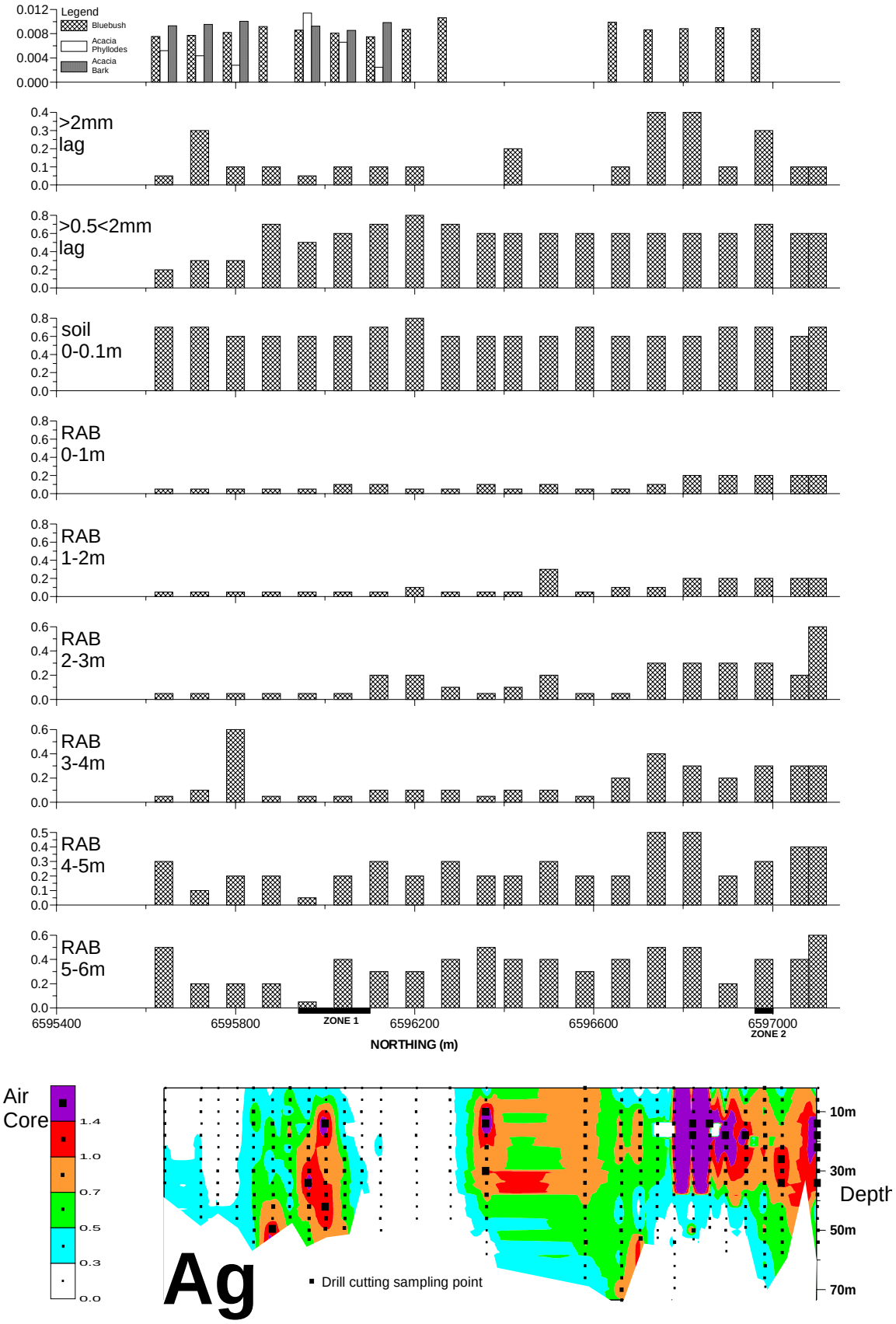


Figure A2.1: Ag distributions in vegetation and regolith components.
Data in ppm. Black rectangles (Zones 1-2) locate mineralisation.

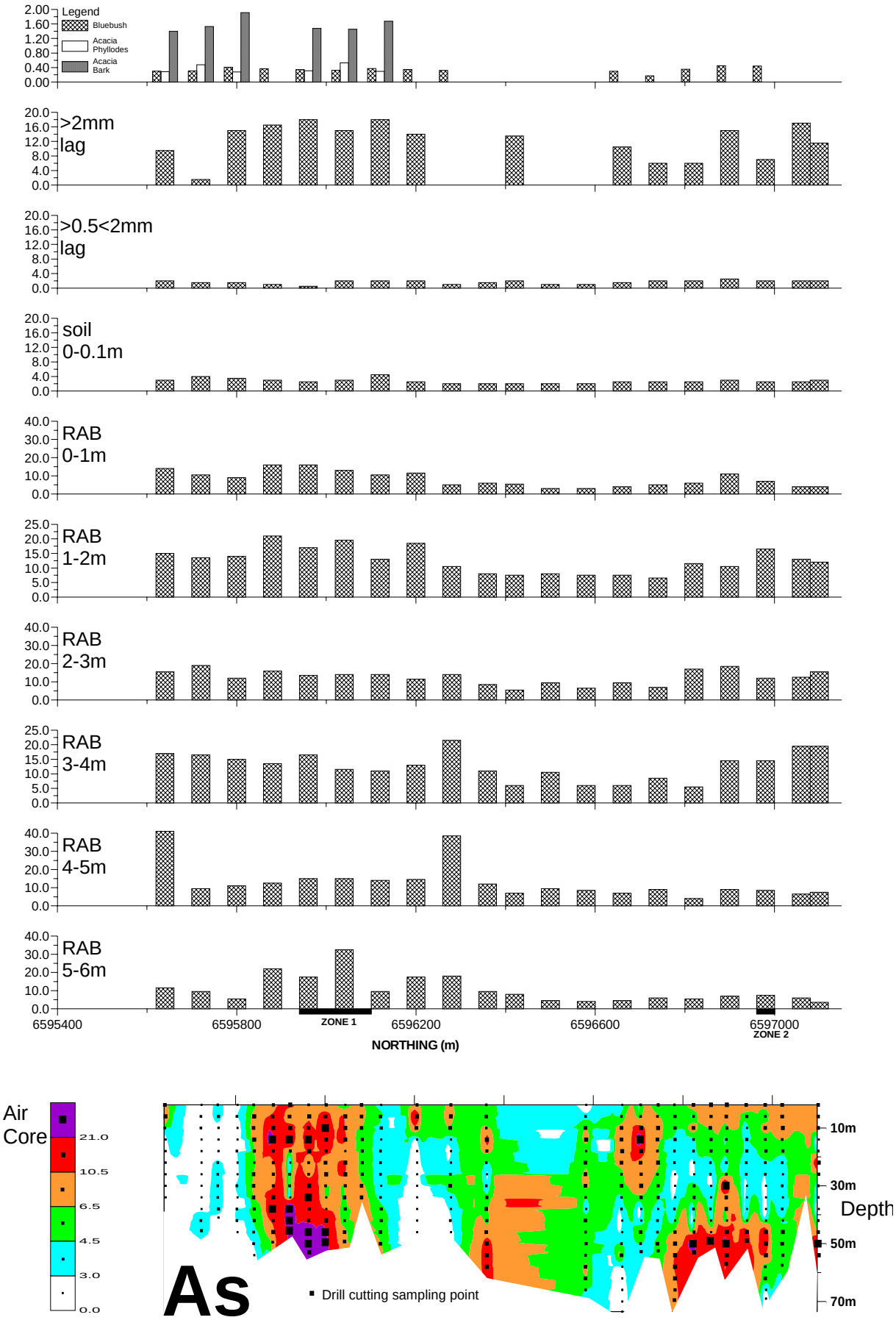


Figure A2.2: As distributions in vegetation and regolith components.
Data in ppm. Black rectangles (Zones 1-2) locate mineralisation.

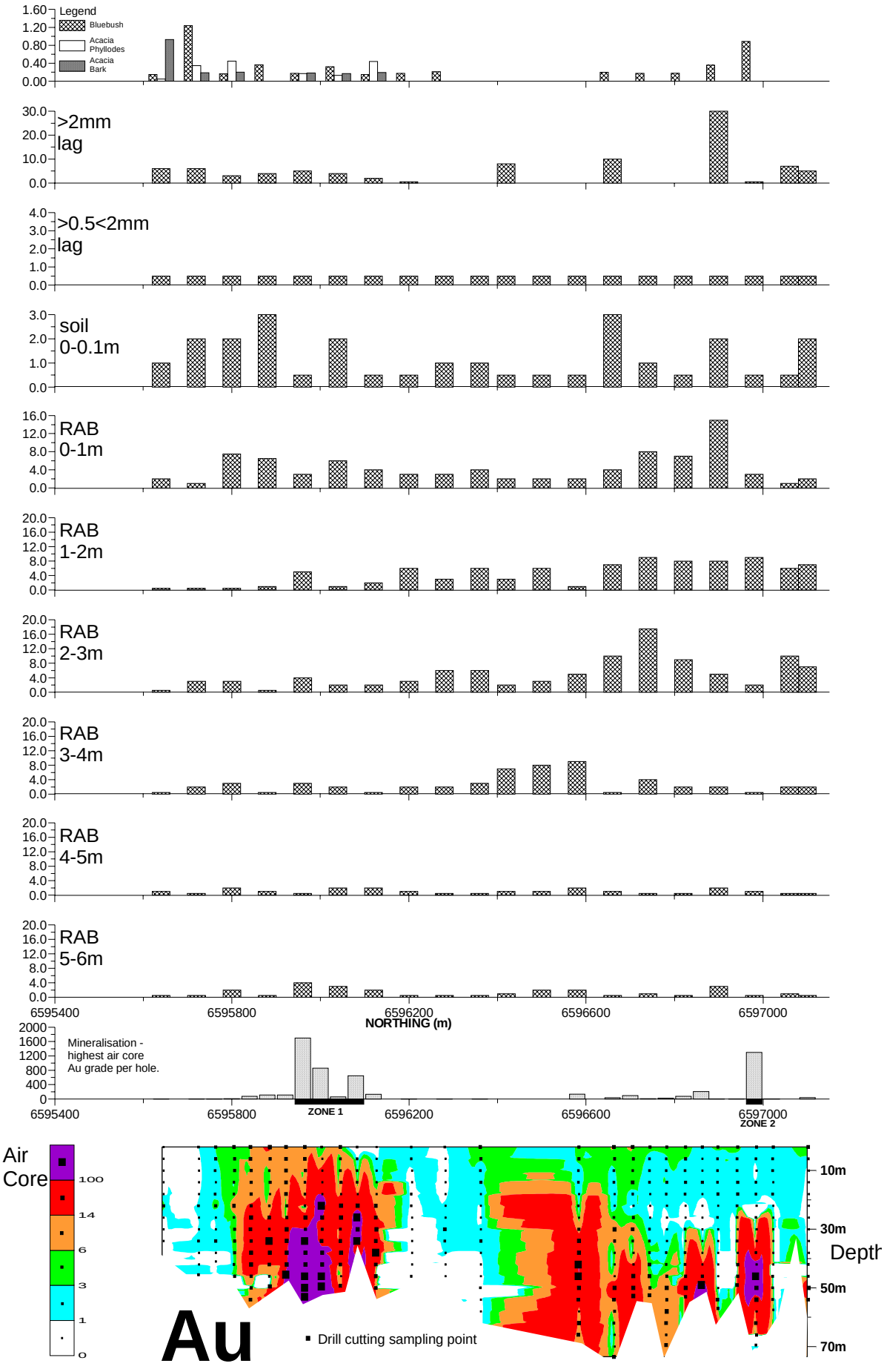


Figure A2.3: Au distributions in vegetation and regolith components. Data in ppb. Black rectangles (Zones 1-2) locate mineralisation.

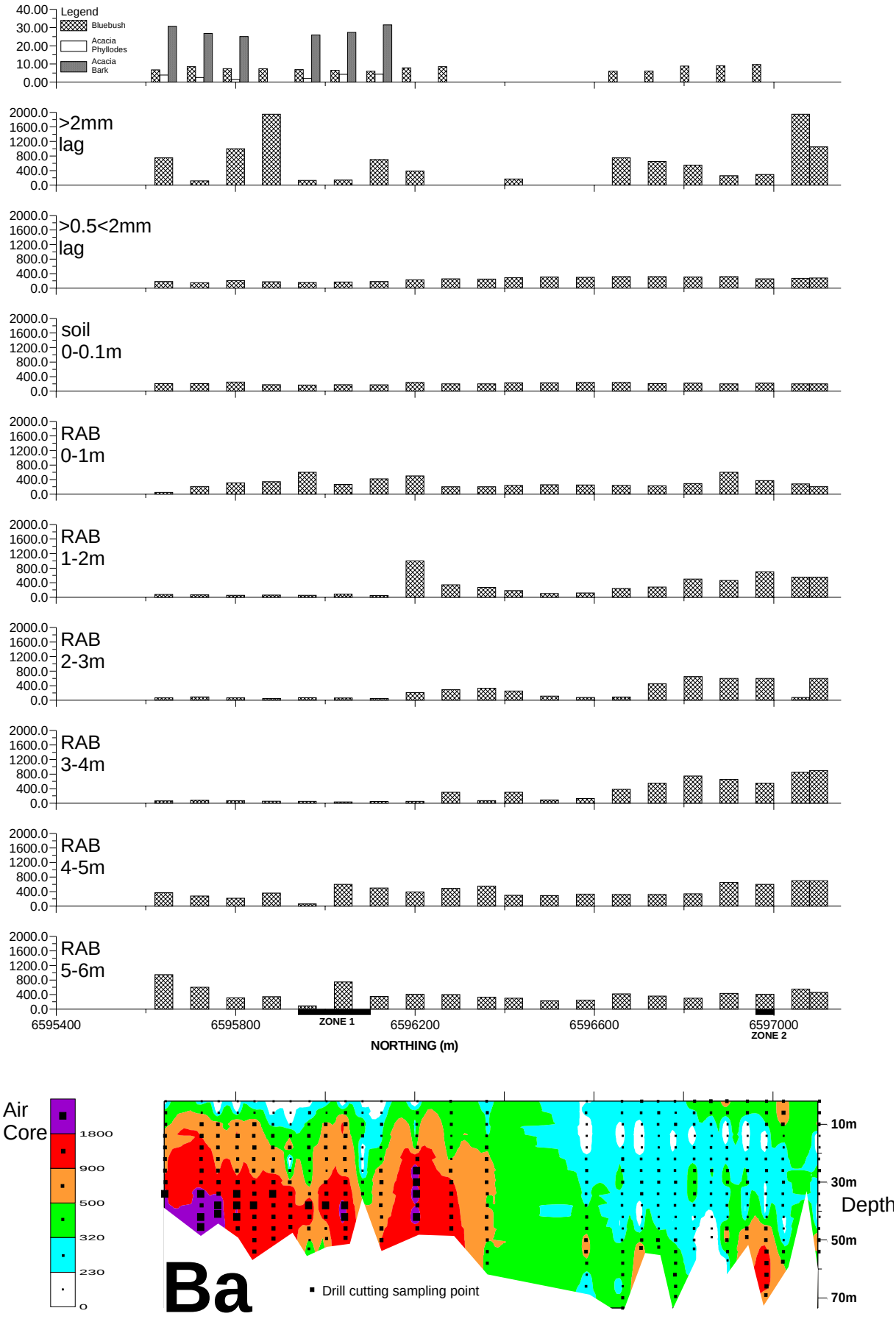


Figure A2.4: Ba distributions in vegetation and regolith components.
Data in ppm. Black rectangles (Zones 1-2) locate mineralisation.

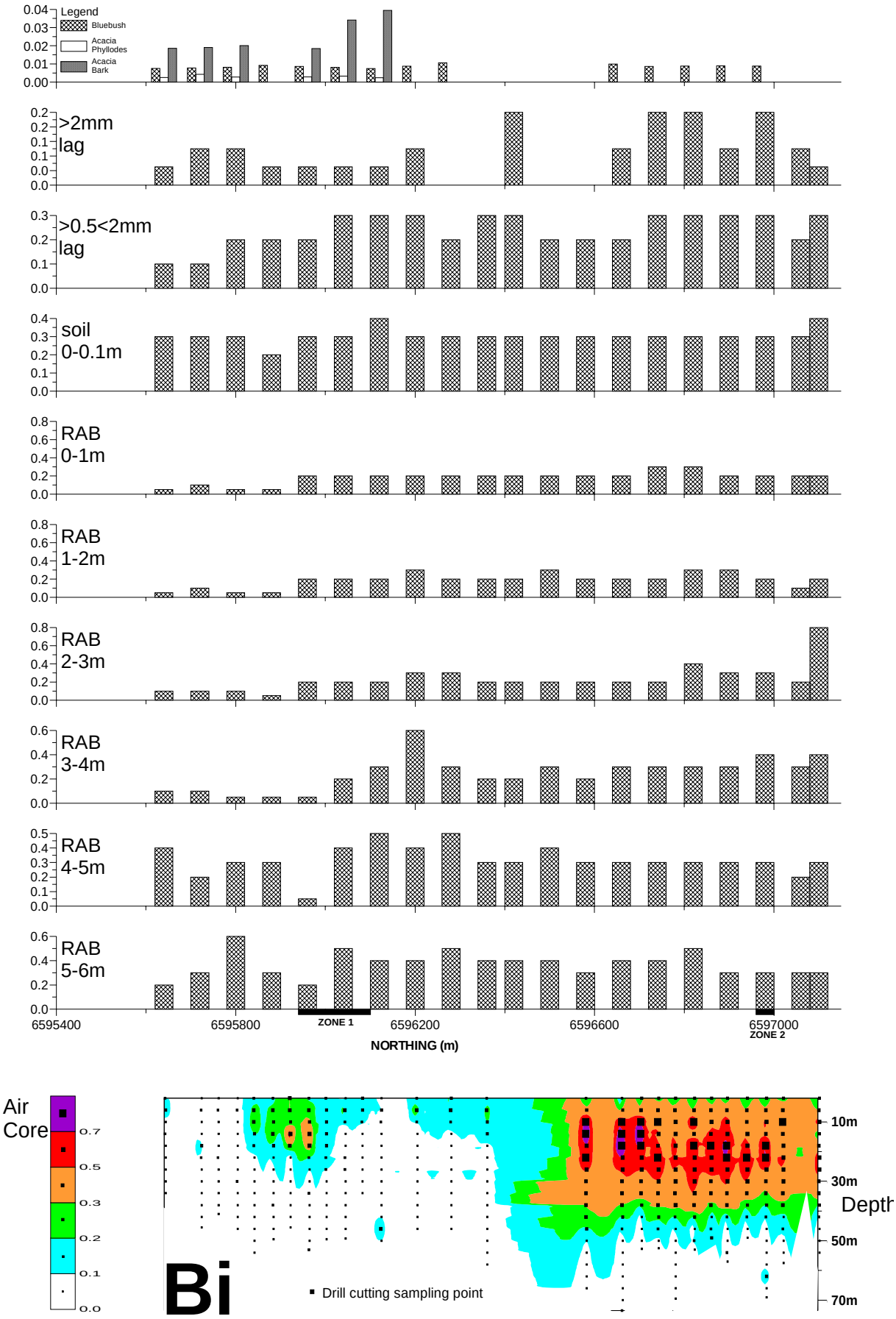


Figure A2.5: Bi distributions in vegetation and regolith components.
Data in ppm. Black rectangles (Zones 1-2) locate mineralisation.

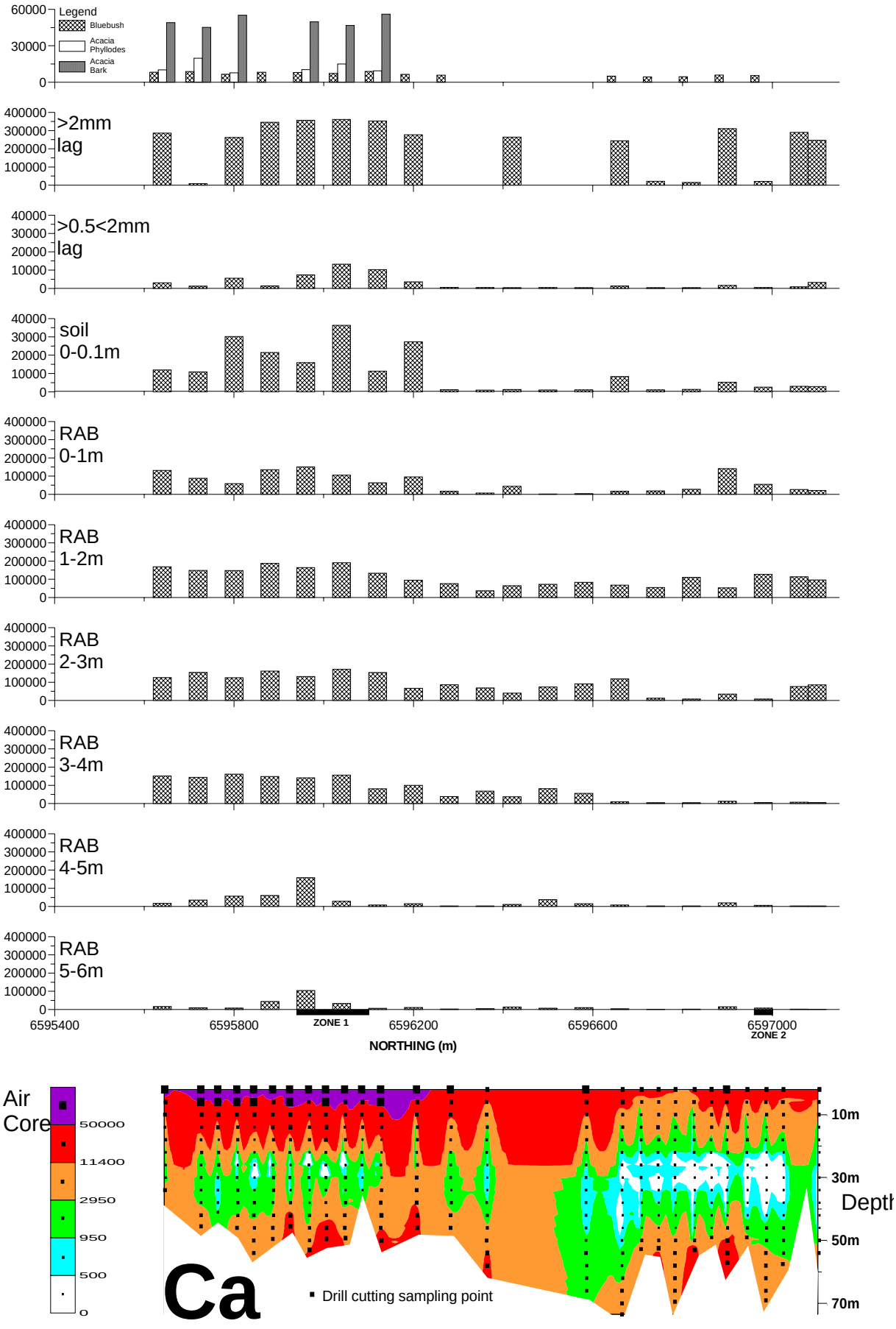


Figure A2.6: Ca distributions in vegetation and regolith components.
Data in ppm. Black rectangles (Zones 1-2) locate mineralisation.

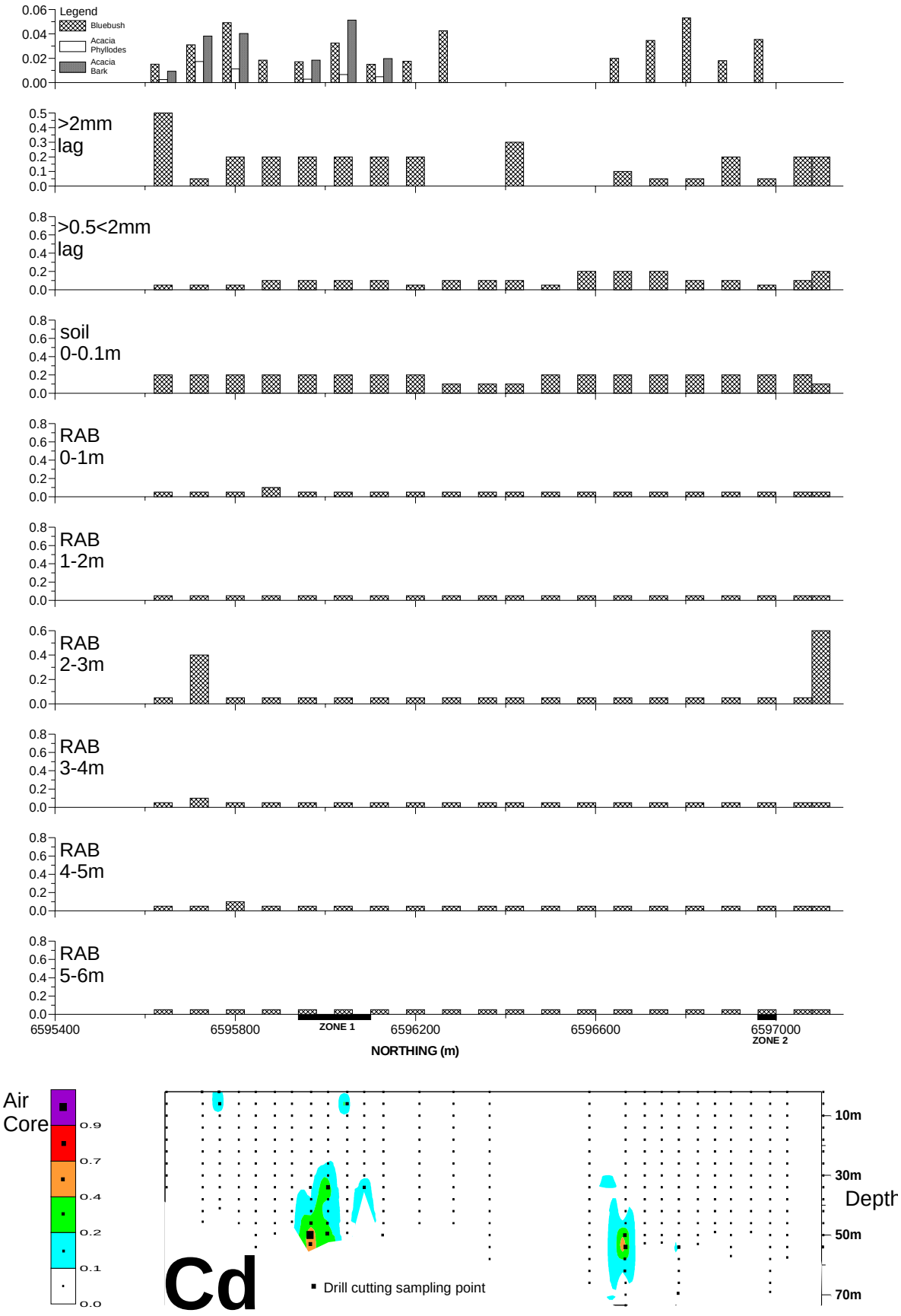


Figure A2.7: Cd distributions in vegetation and regolith components.
Data in ppm. Black rectangles (Zones 1-2) locate mineralisation.

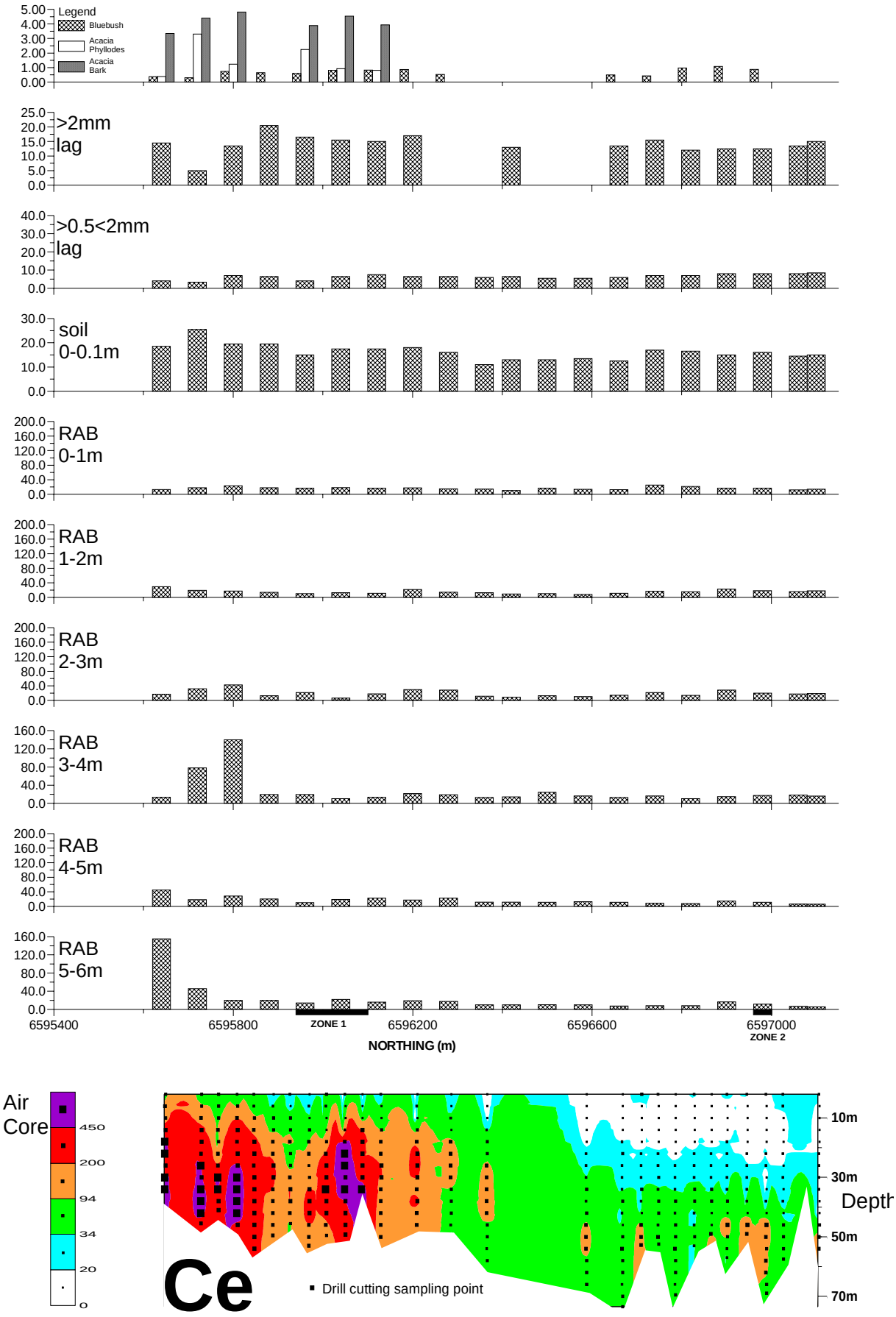


Figure A2.8: Ce distributions in vegetation and regolith components.
Data in ppm. Black rectangles (Zones 1-2) locate mineralisation.

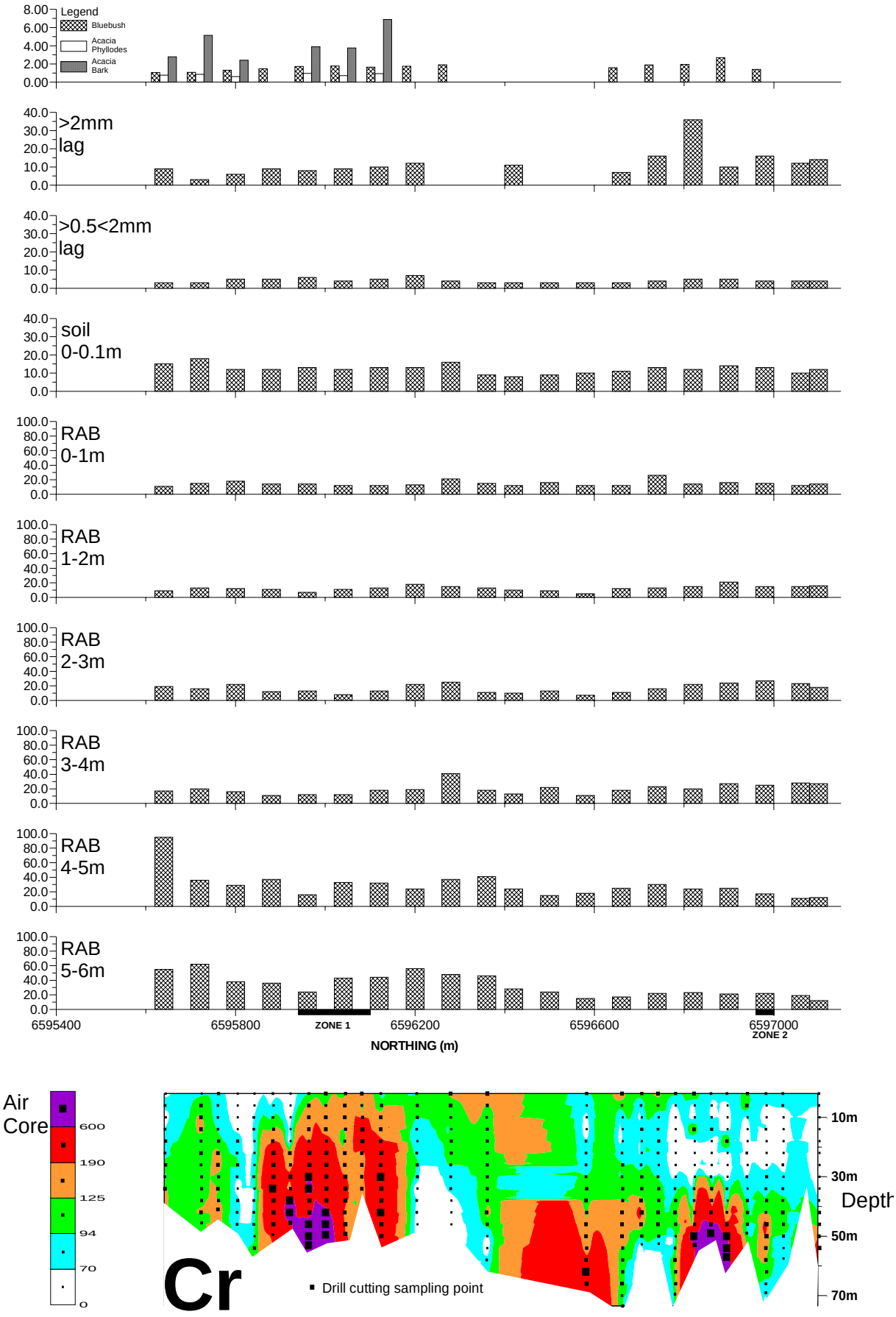
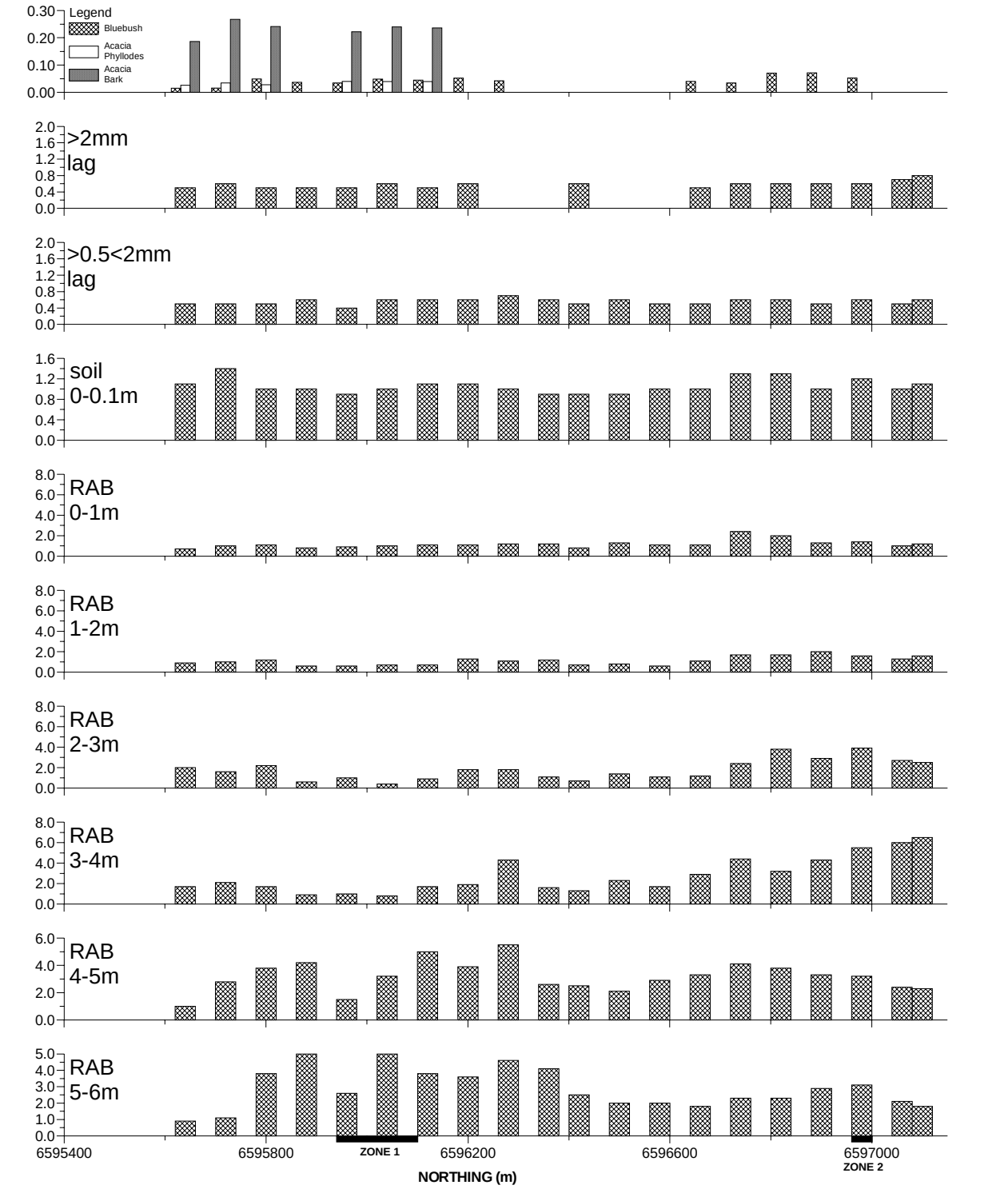


Figure A2.9: Cr distributions in vegetation and regolith components.
Data in ppm. Black rectangles (Zones 1-2) locate mineralisation.



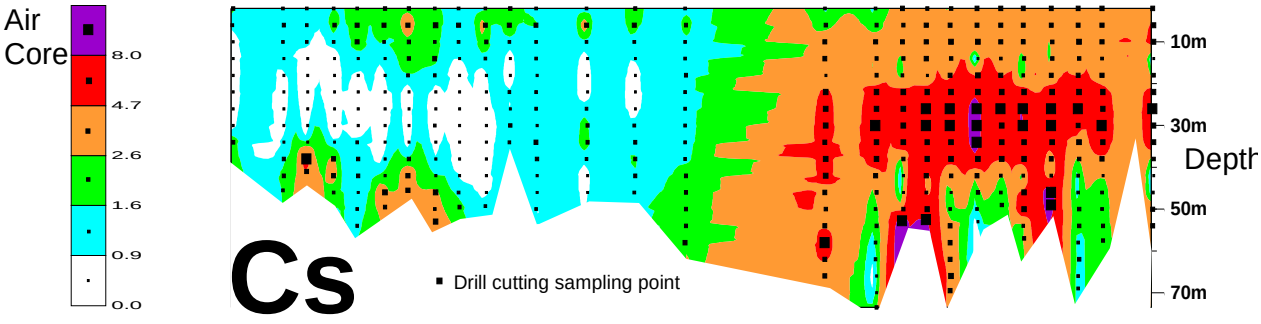
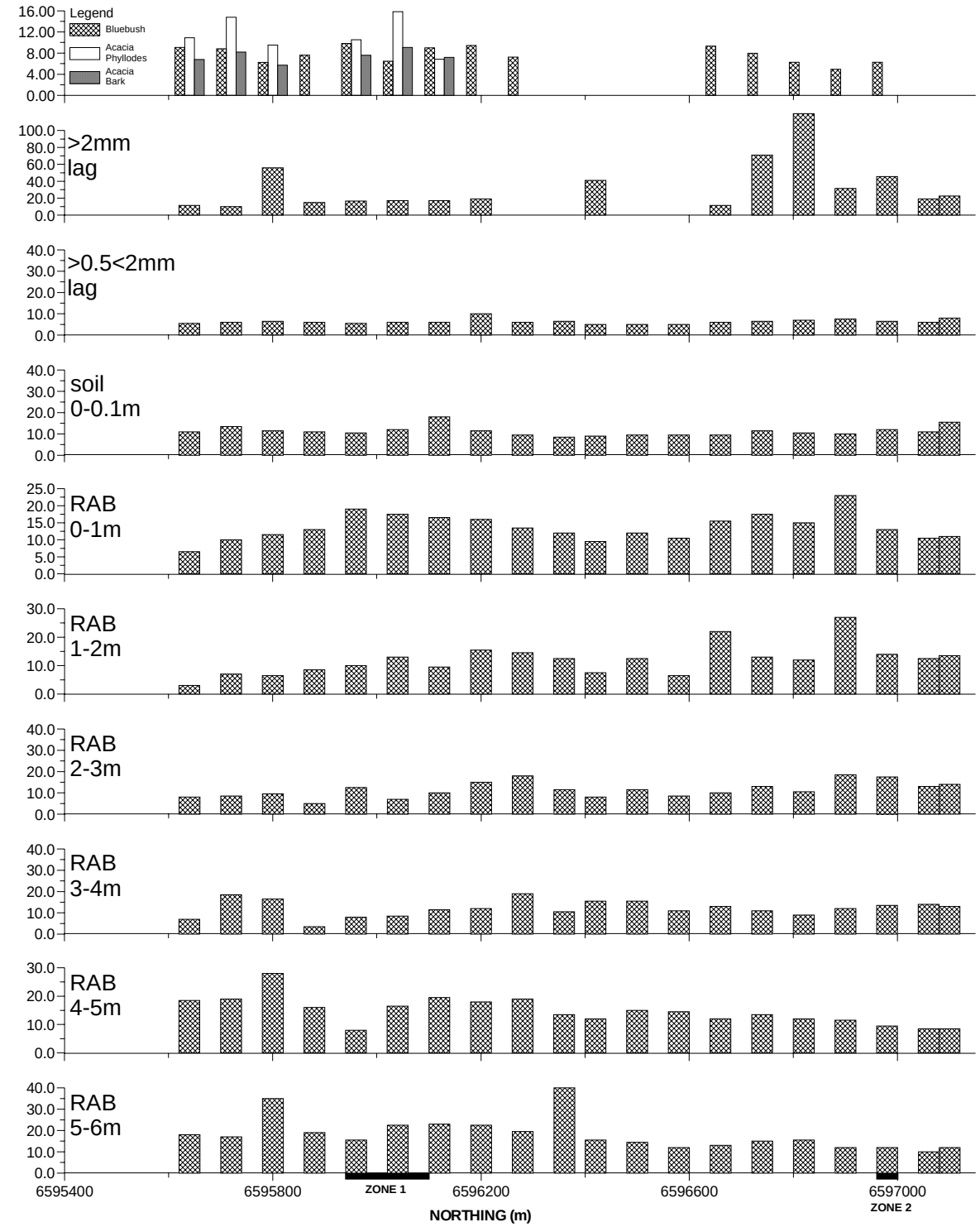


Figure A2.10: Cs distributions in vegetation and regolith components.
Data in ppm. Black rectangles (Zones 1-2) locate mineralisation.



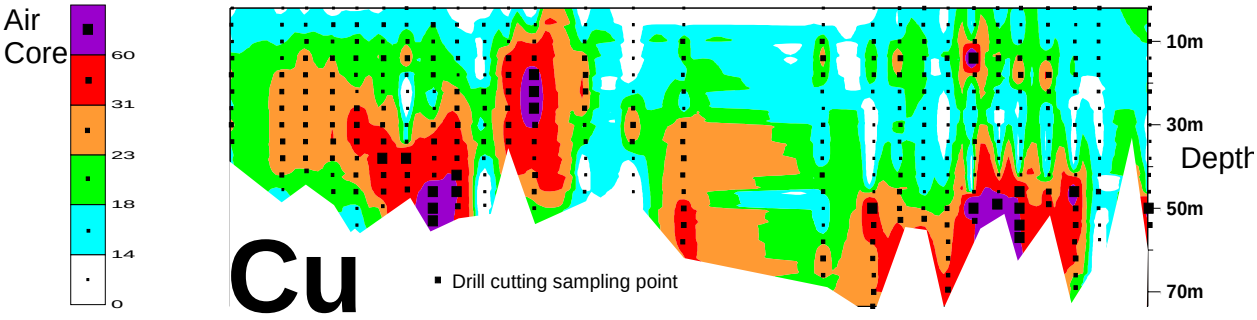
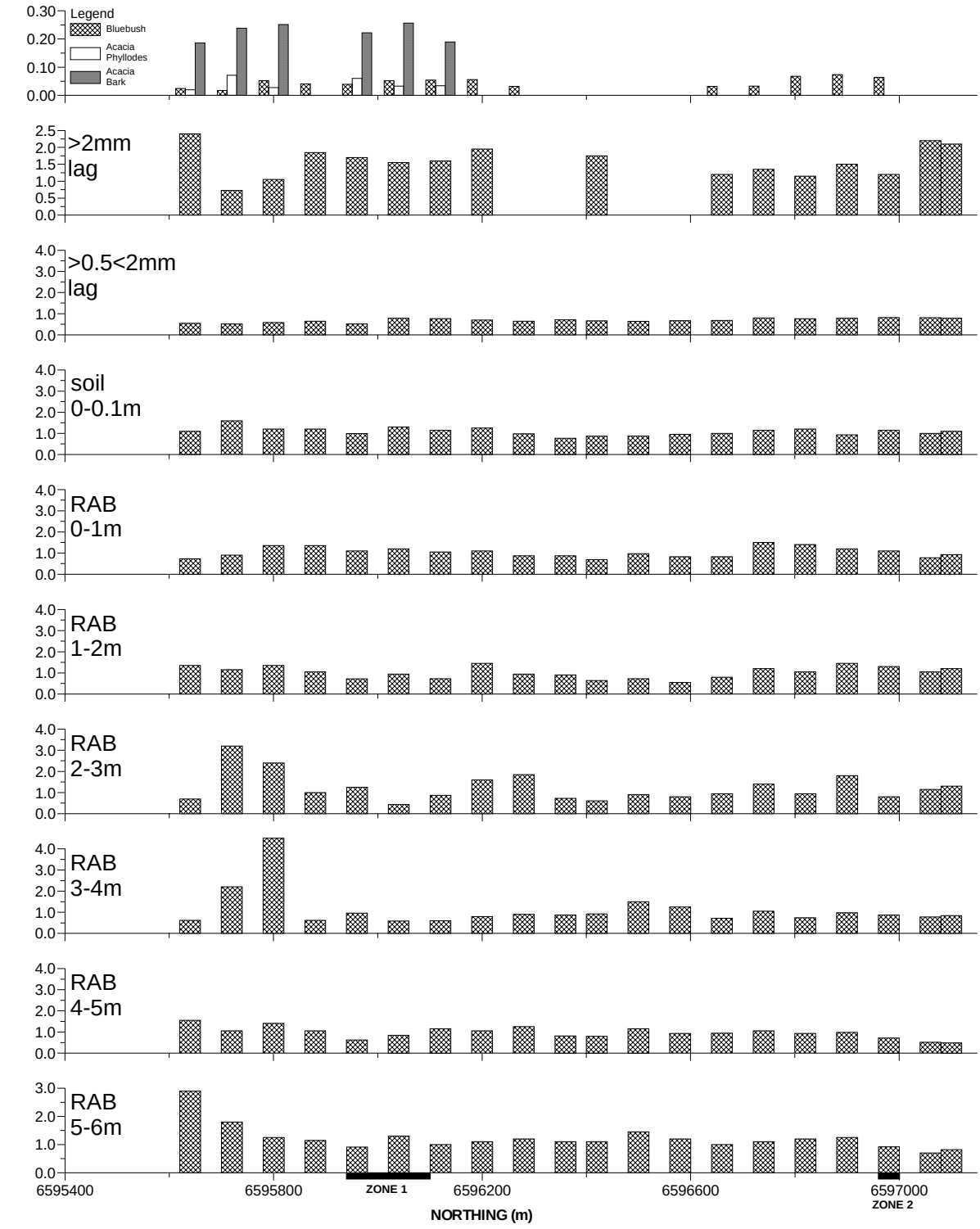


Figure A2.11: Cu distributions in vegetation and regolith components.
Data in ppm. Black rectangles (Zones 1-2) locate mineralisation.



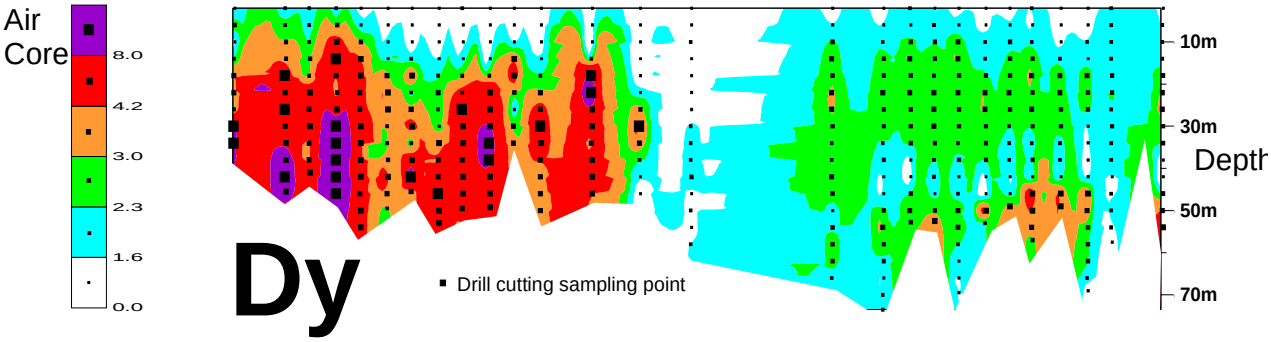


Figure A2.12: Dy distributions in vegetation and regolith components.
Data in ppm. Black rectangles (Zones 1-2) locate mineralisation.

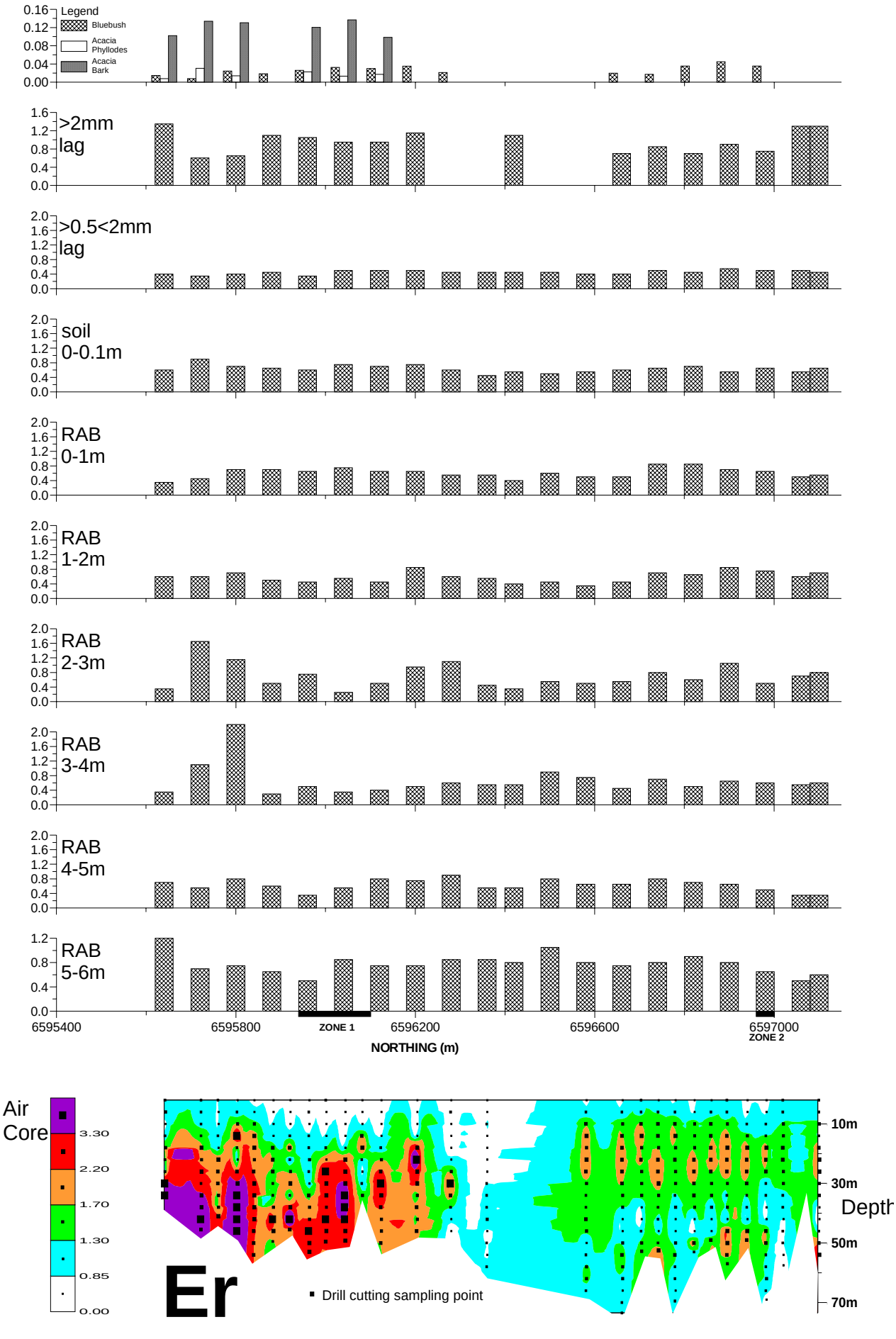


Figure A2.13: Er distributions in vegetation and regolith components.
Data in ppm. Black rectangles (Zones 1-2) locate mineralisation.

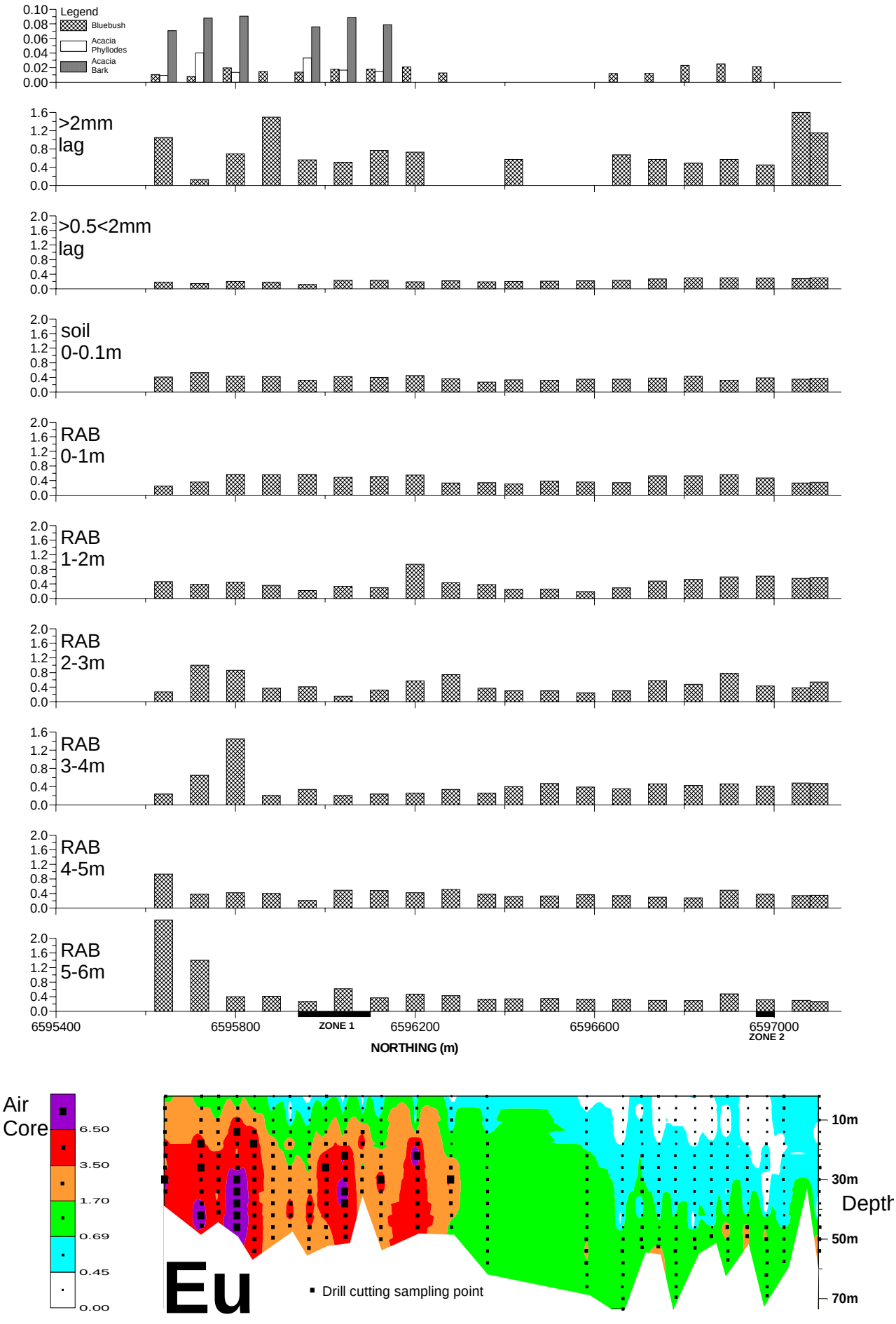


Figure A2.14: Eu distributions in vegetation and regolith components.
Data in ppm. Black rectangles (Zones 1-2) locate mineralisation.

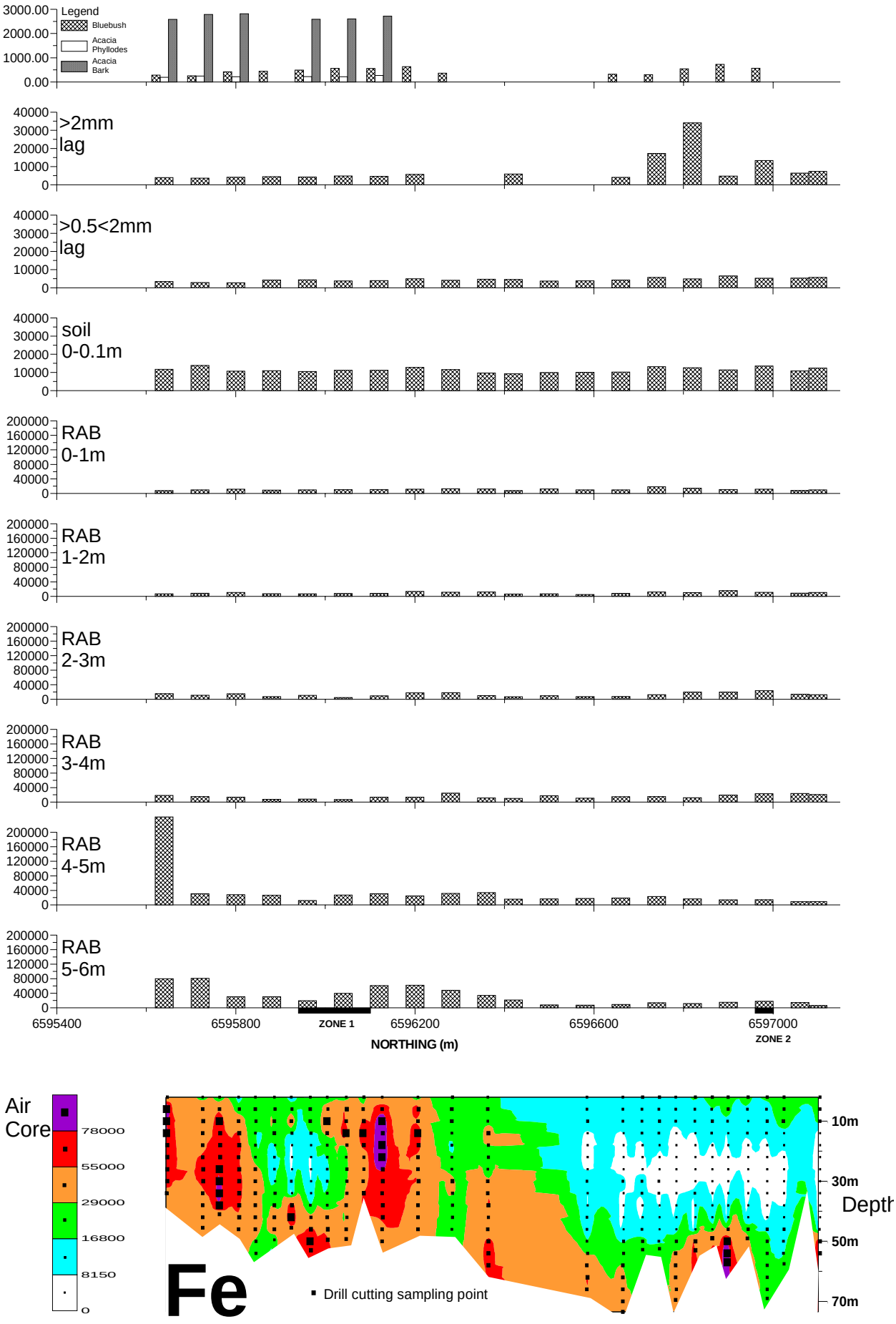


Figure A2.15: Fe distributions in vegetation and regolith components.
Data in ppm. Black rectangles (Zones 1-2) locate mineralisation.

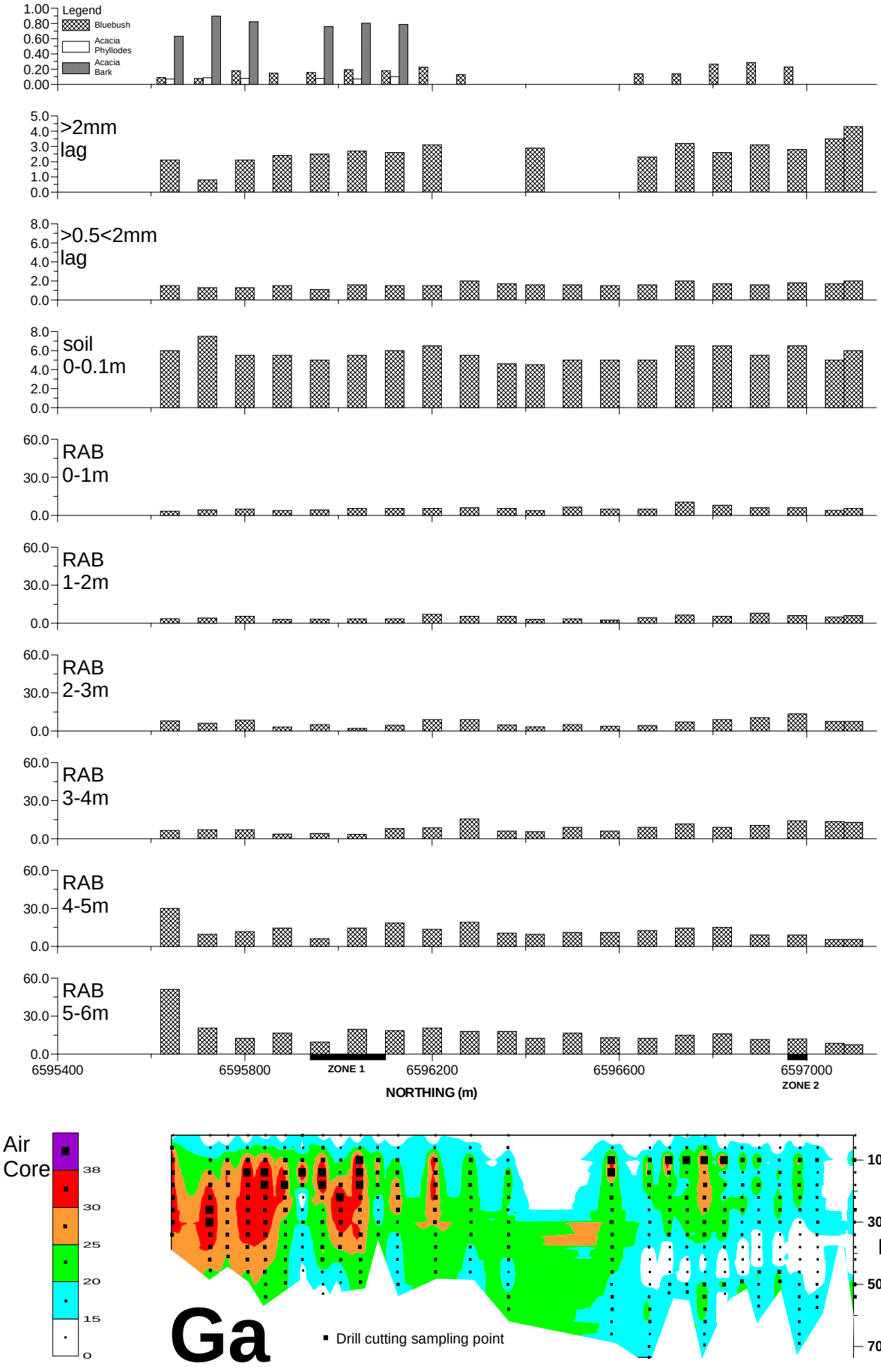


Figure A2.16: Ga distributions in vegetation and regolith components.
Data in ppm. Black rectangles (Zones 1-2) locate mineralisation.

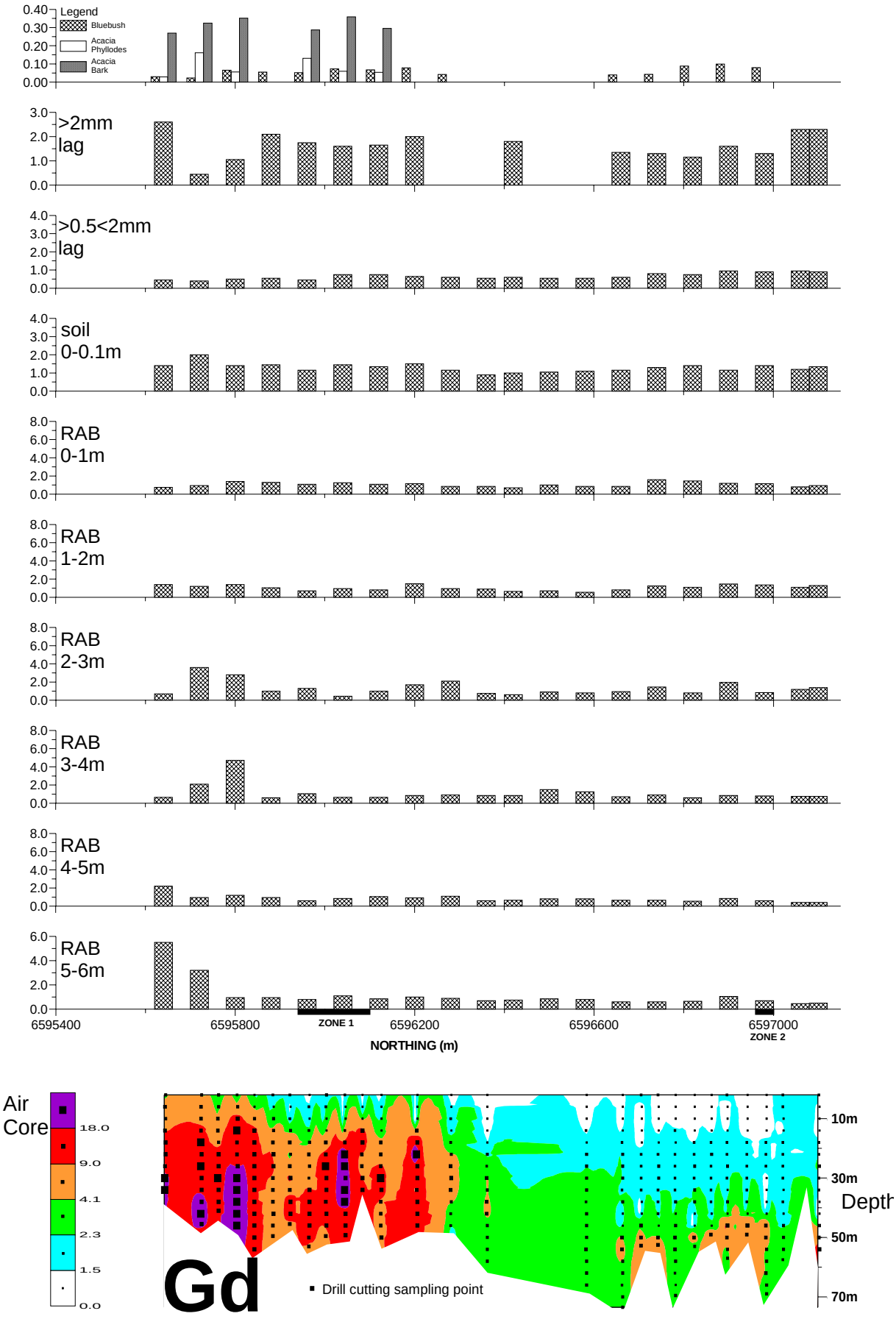
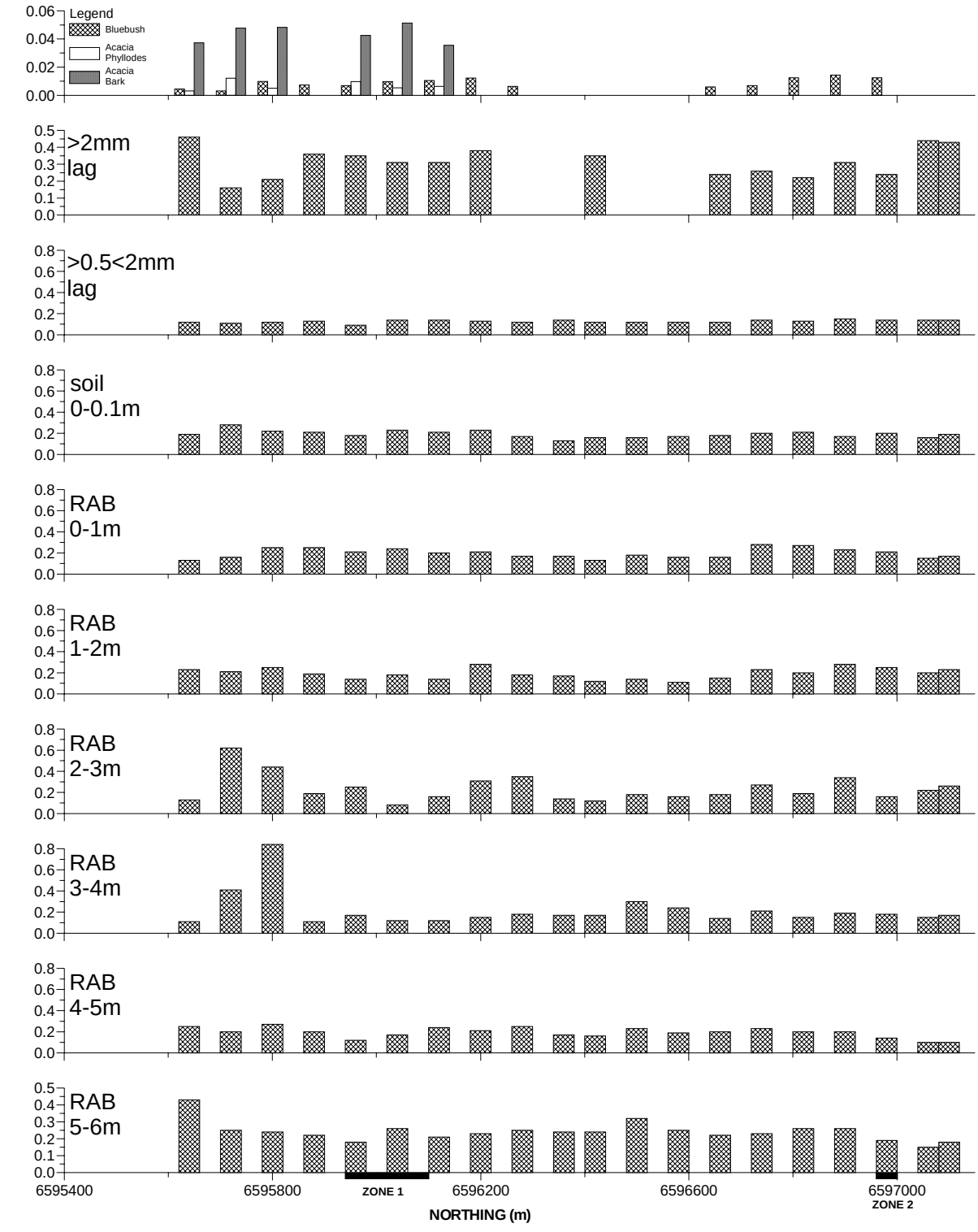


Figure A2.17: Gd distributions in vegetation and regolith components.
Data in ppm. Black rectangles (Zones 1-2) locate mineralisation.



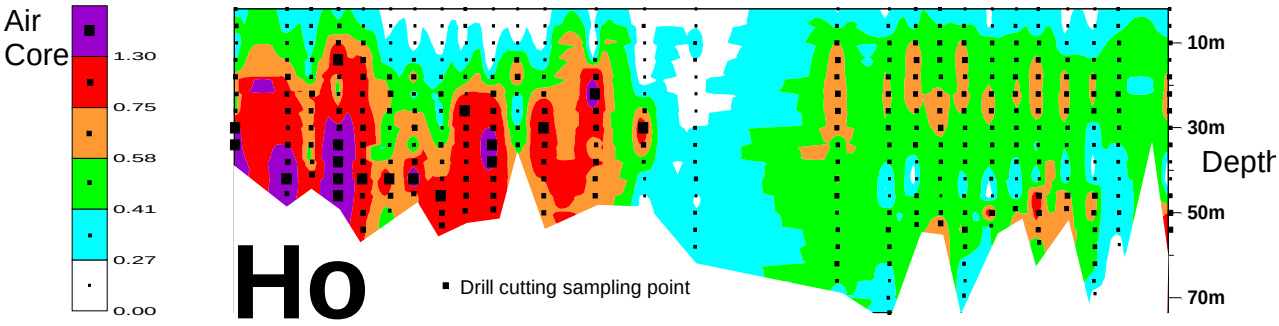


Figure A2.18: Ho distributions in vegetation and regolith components.
Data in ppm. Black rectangles (Zones 1-2) locate mineralisation.

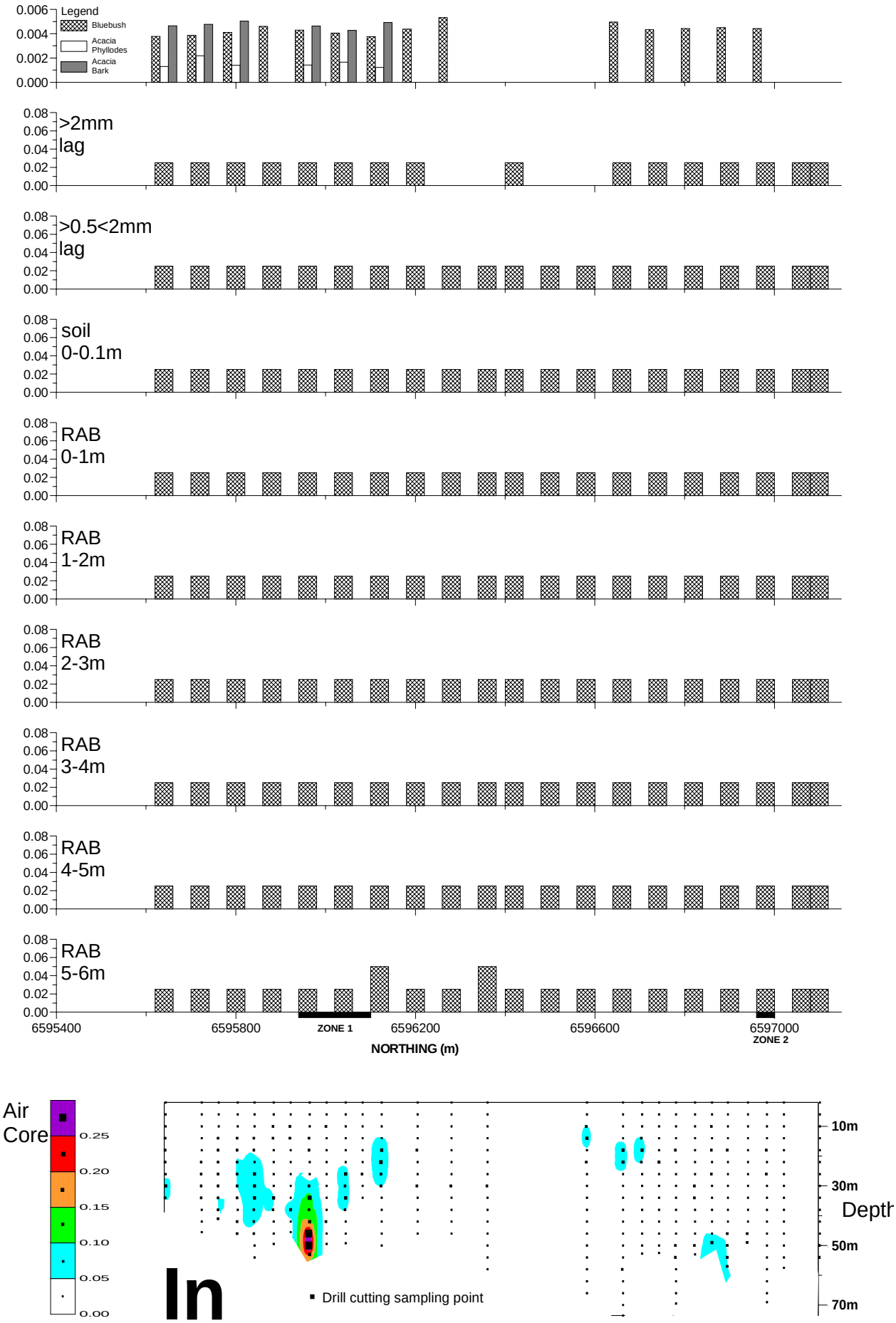


Figure A2.19: In distributions in vegetation and regolith components.
Data in ppm. Black rectangles (Zones 1-2) locate mineralisation.

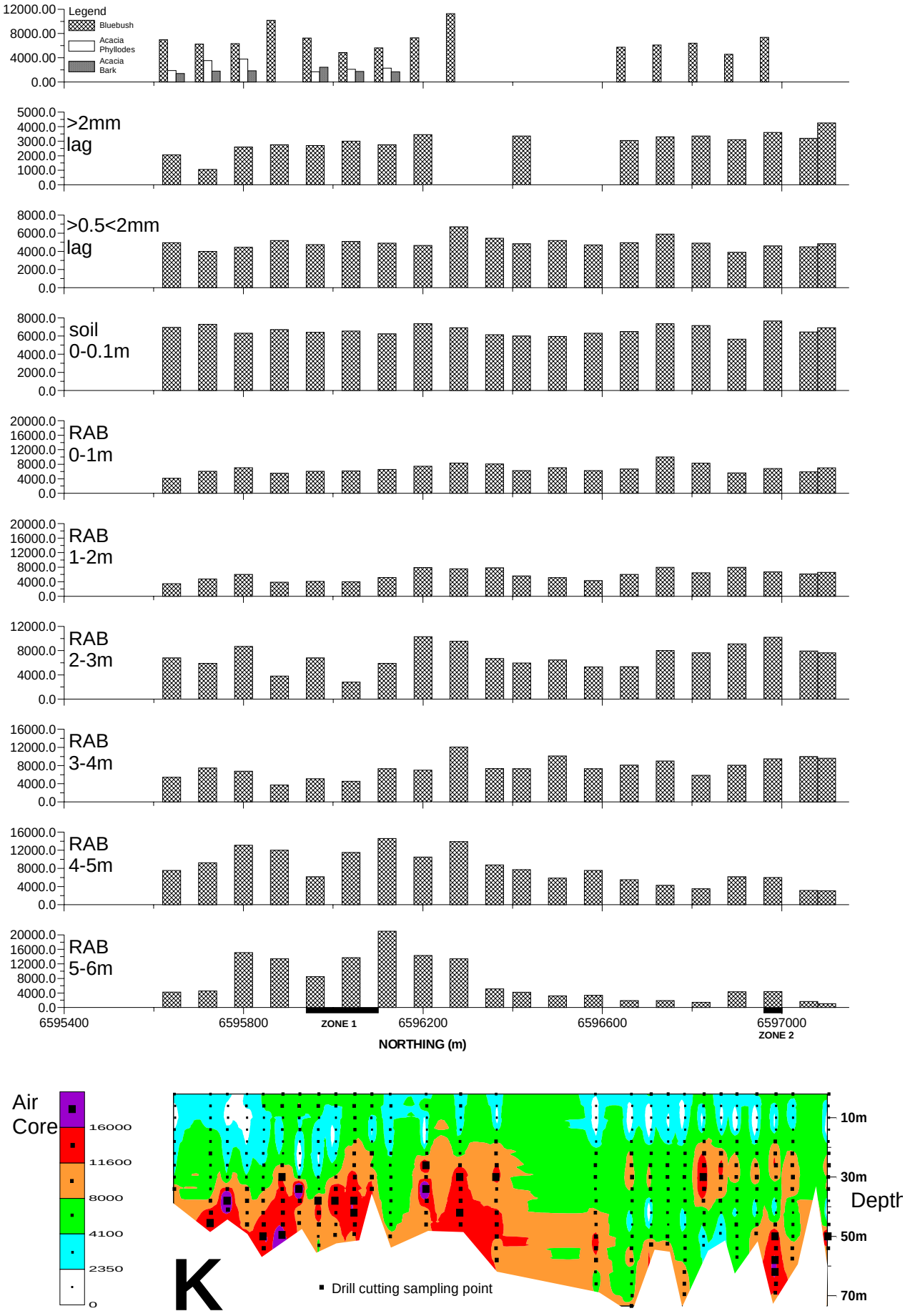


Figure A2.20: K distributions in vegetation and regolith components.
Data in ppm. Black rectangles (Zones 1-2) locate mineralisation.

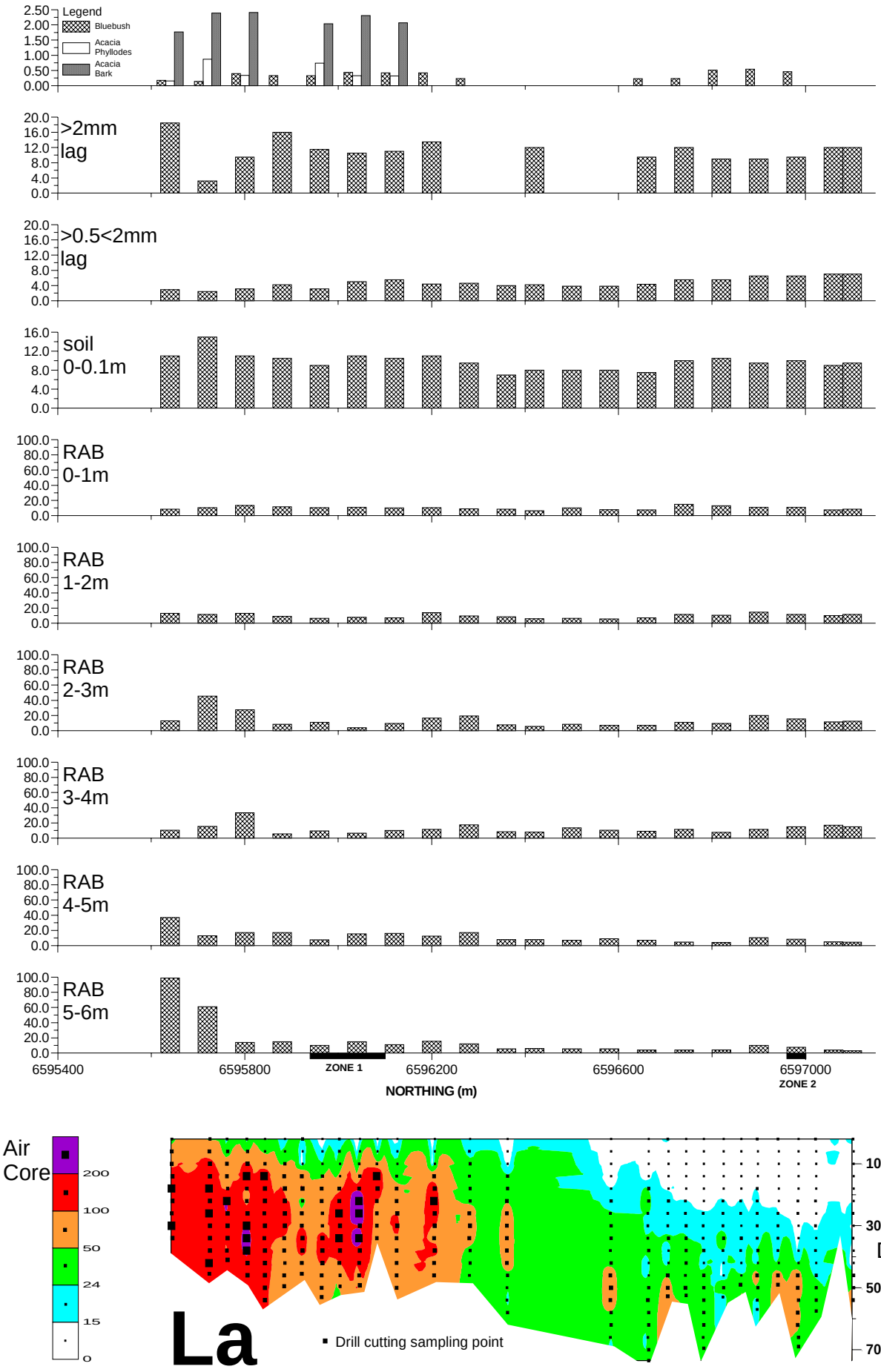


Figure A2.21: La distributions in vegetation and regolith components.
Data in ppm. Black rectangles (Zones 1-2) locate mineralisation.

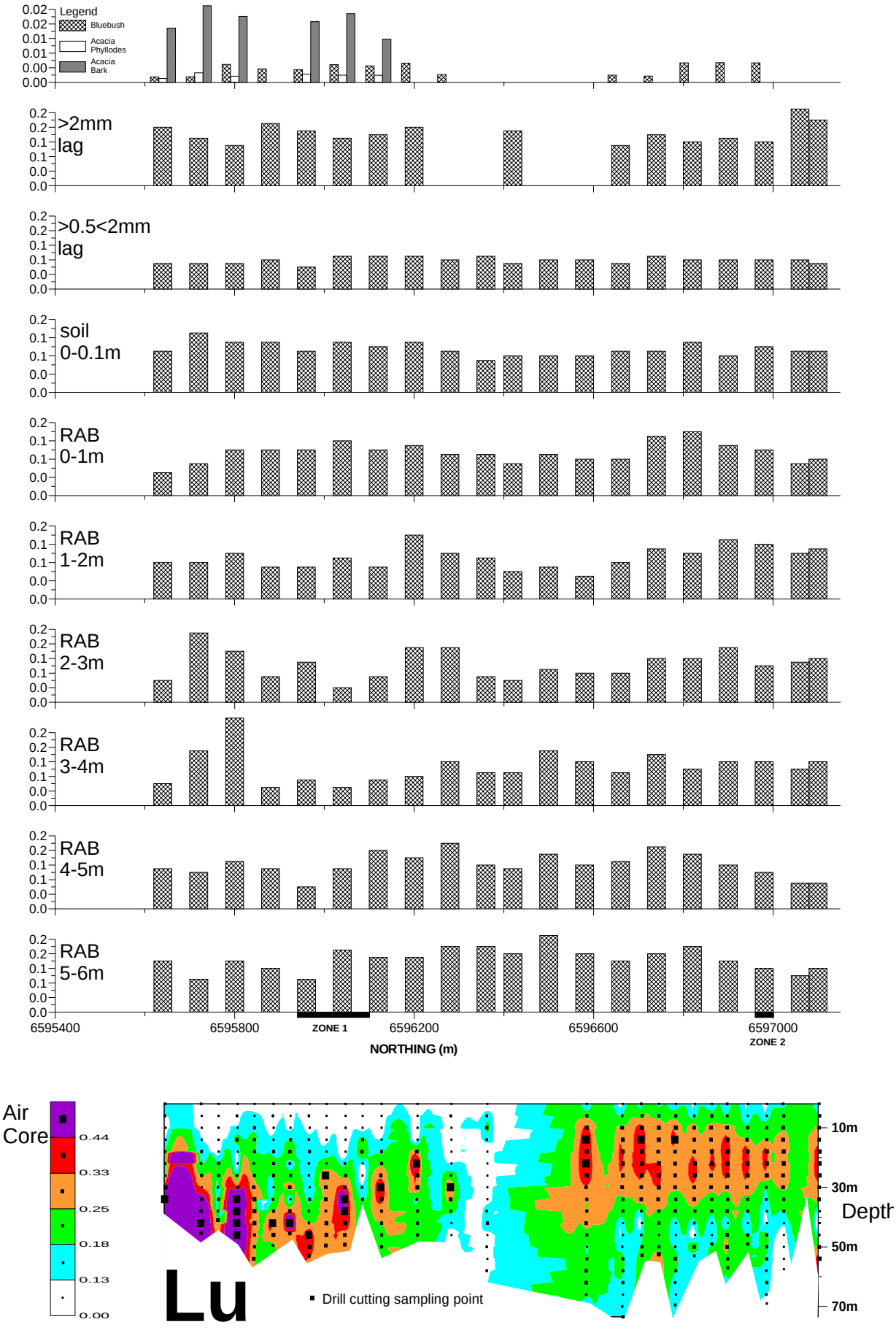


Figure A2.22: Lu distributions in vegetation and regolith components.
Data in ppm. Black rectangles (Zones 1-2) locate mineralisation.

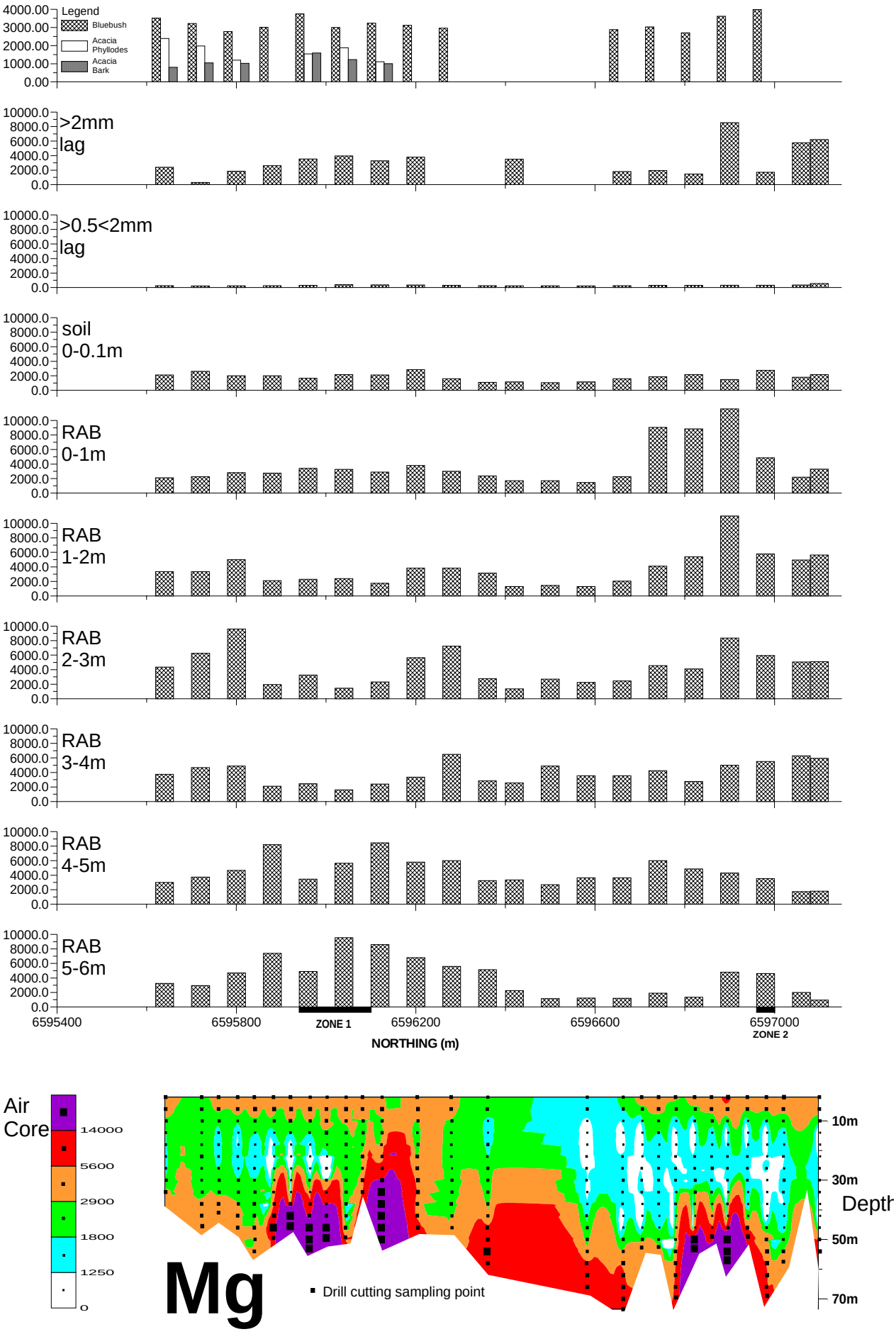


Figure A2.23: Mg distributions in vegetation and regolith components.
Data in ppm. Black rectangles (Zones 1-2) locate mineralisation.

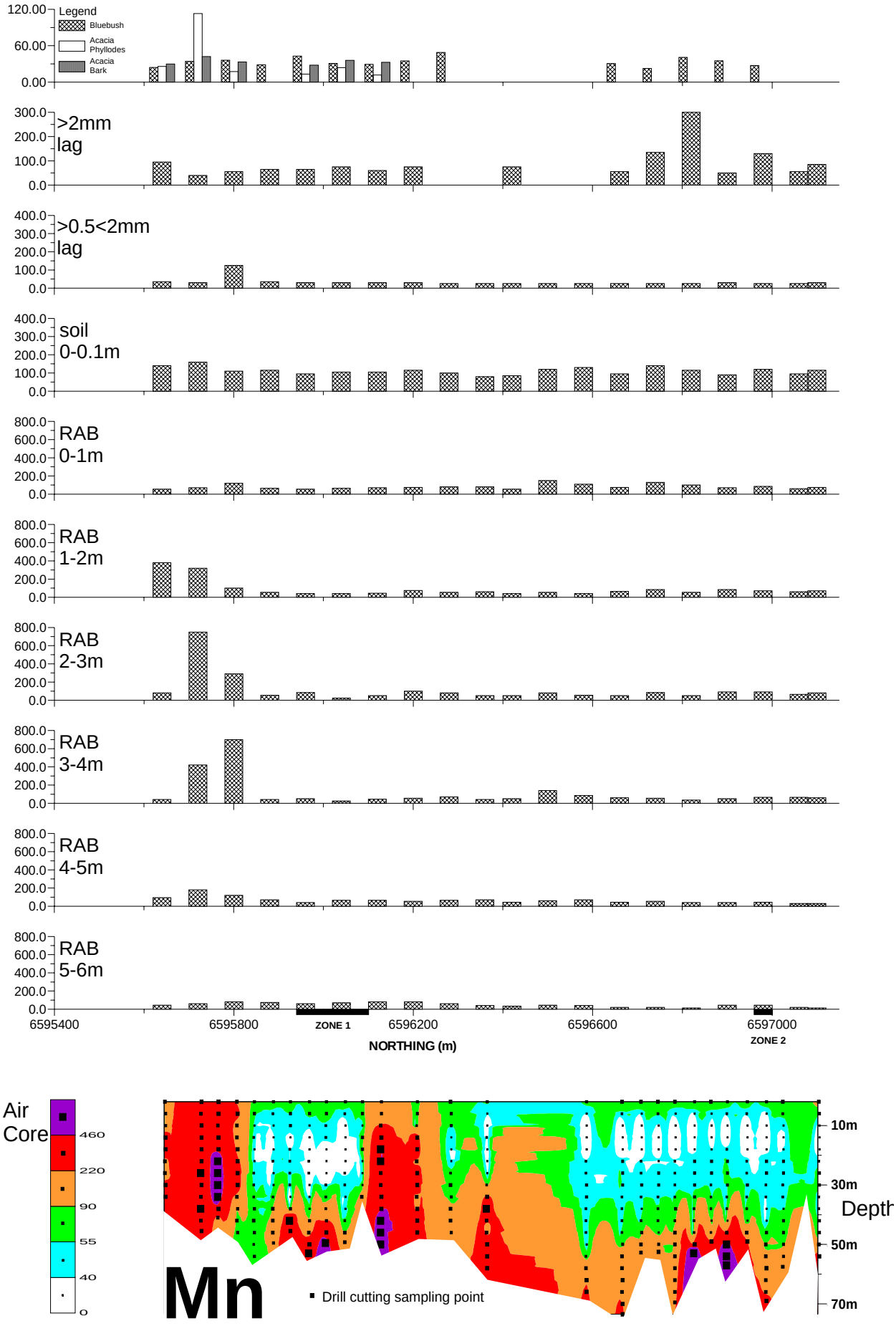


Figure A2.24: Mn distributions in vegetation and regolith components.
Data in ppm. Black rectangles (Zones 1-2) locate mineralisation.

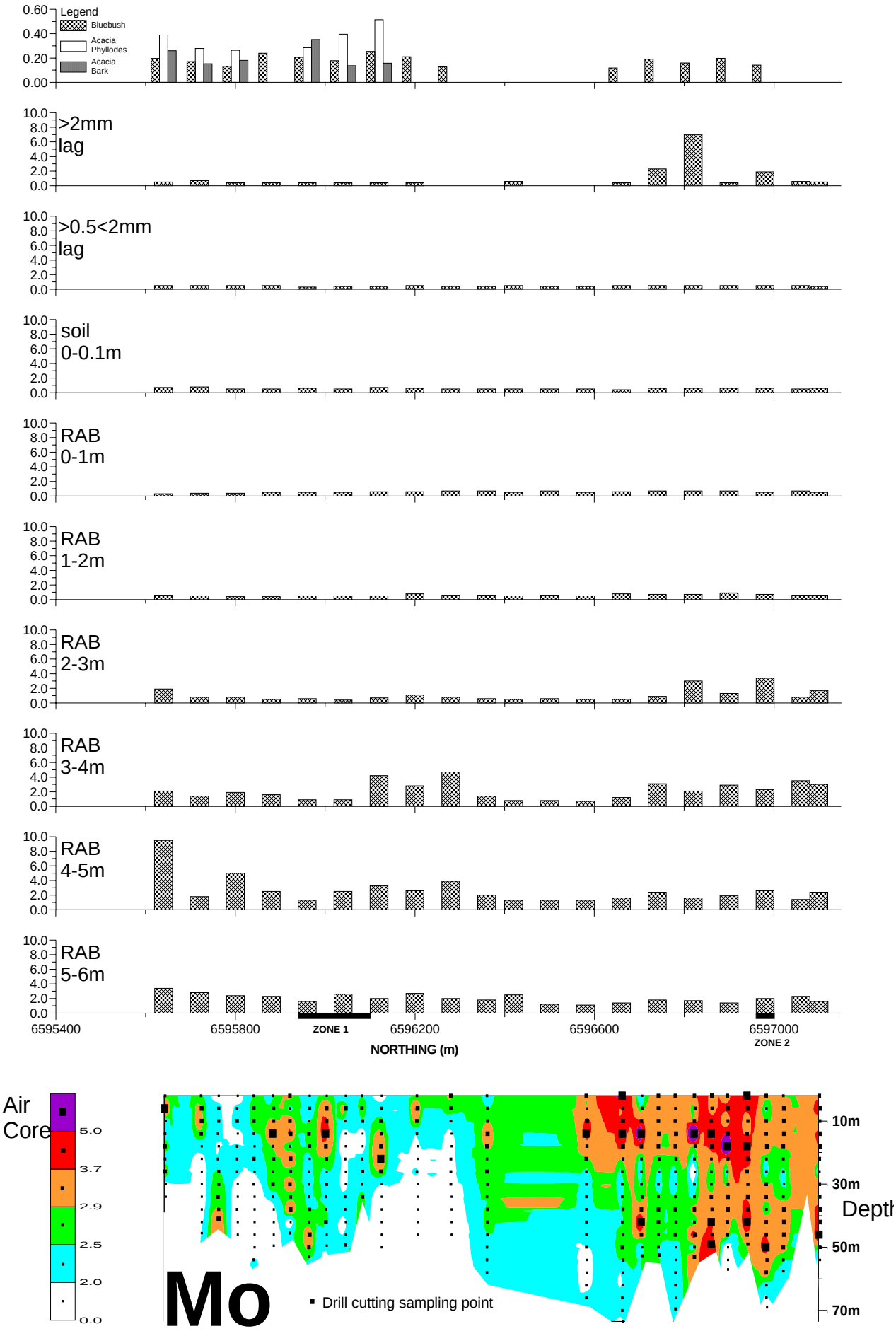


Figure A2.25: Mo distributions in vegetation and regolith components. Data in ppm. Black rectangles (Zones 1-2) locate mineralisation.

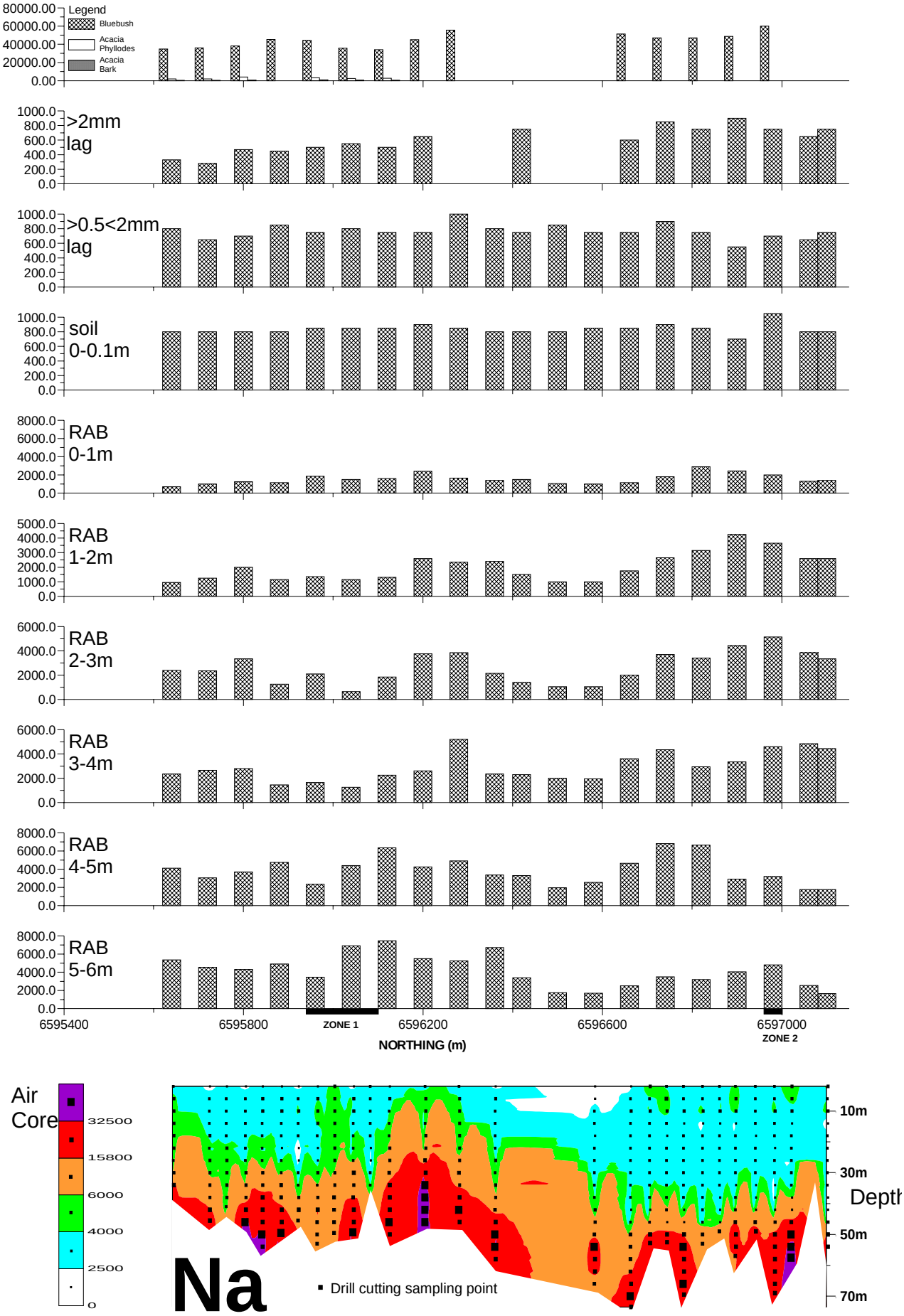
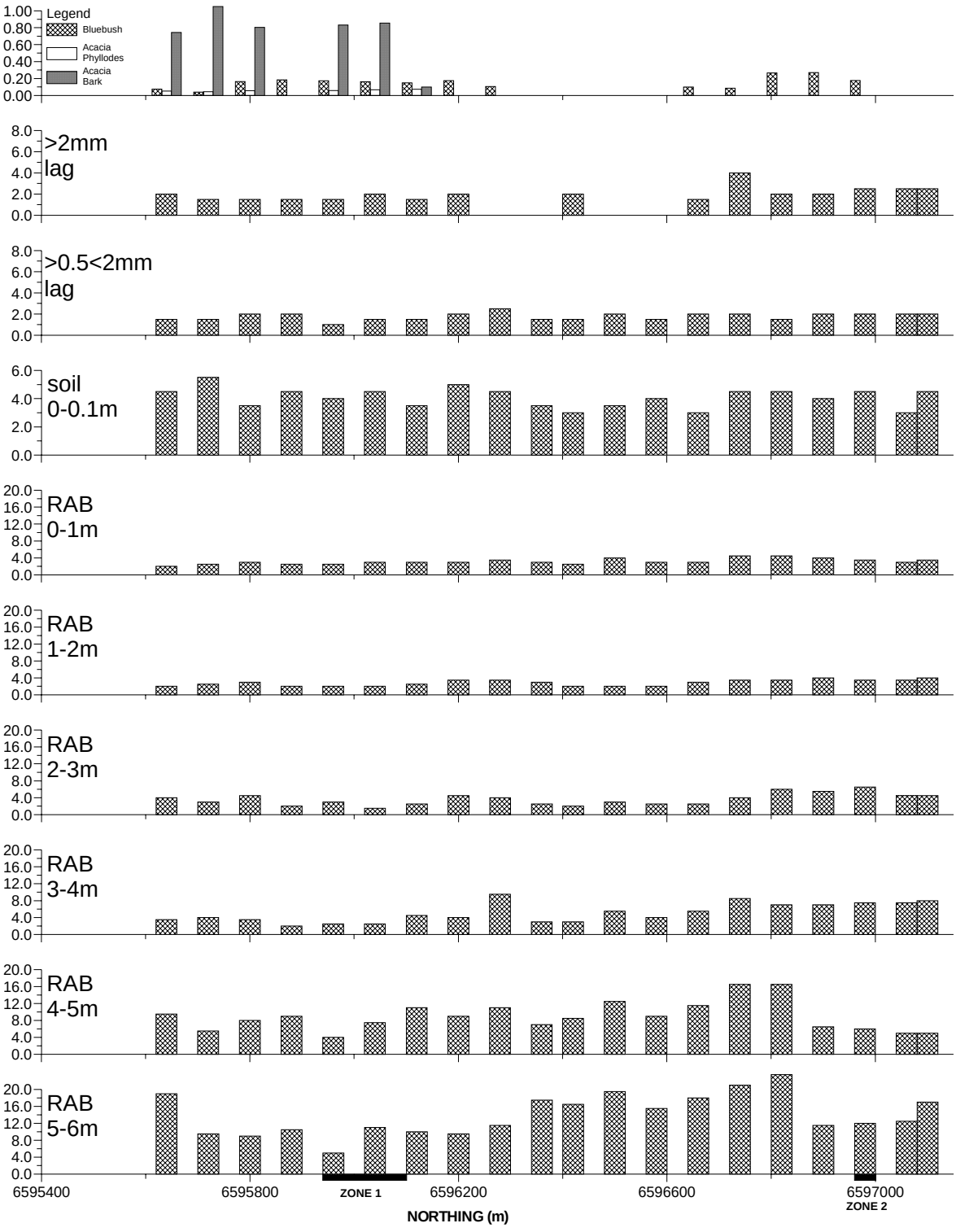


Figure A2.26: Na distributions in vegetation and regolith components. Data in ppm. Black rectangles (Zones 1-2) locate mineralisation.



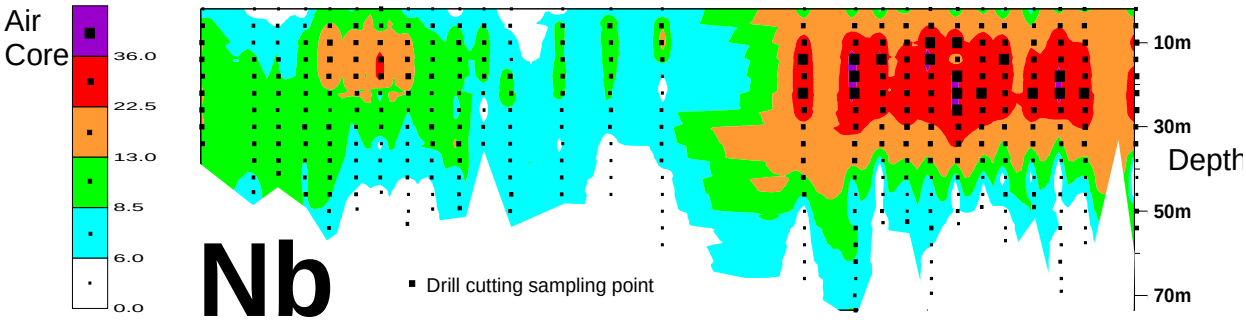


Figure A2.27: Nb distributions in vegetation and regolith components.
Data in ppm. Black rectangles (Zones 1-2) locate mineralisation.

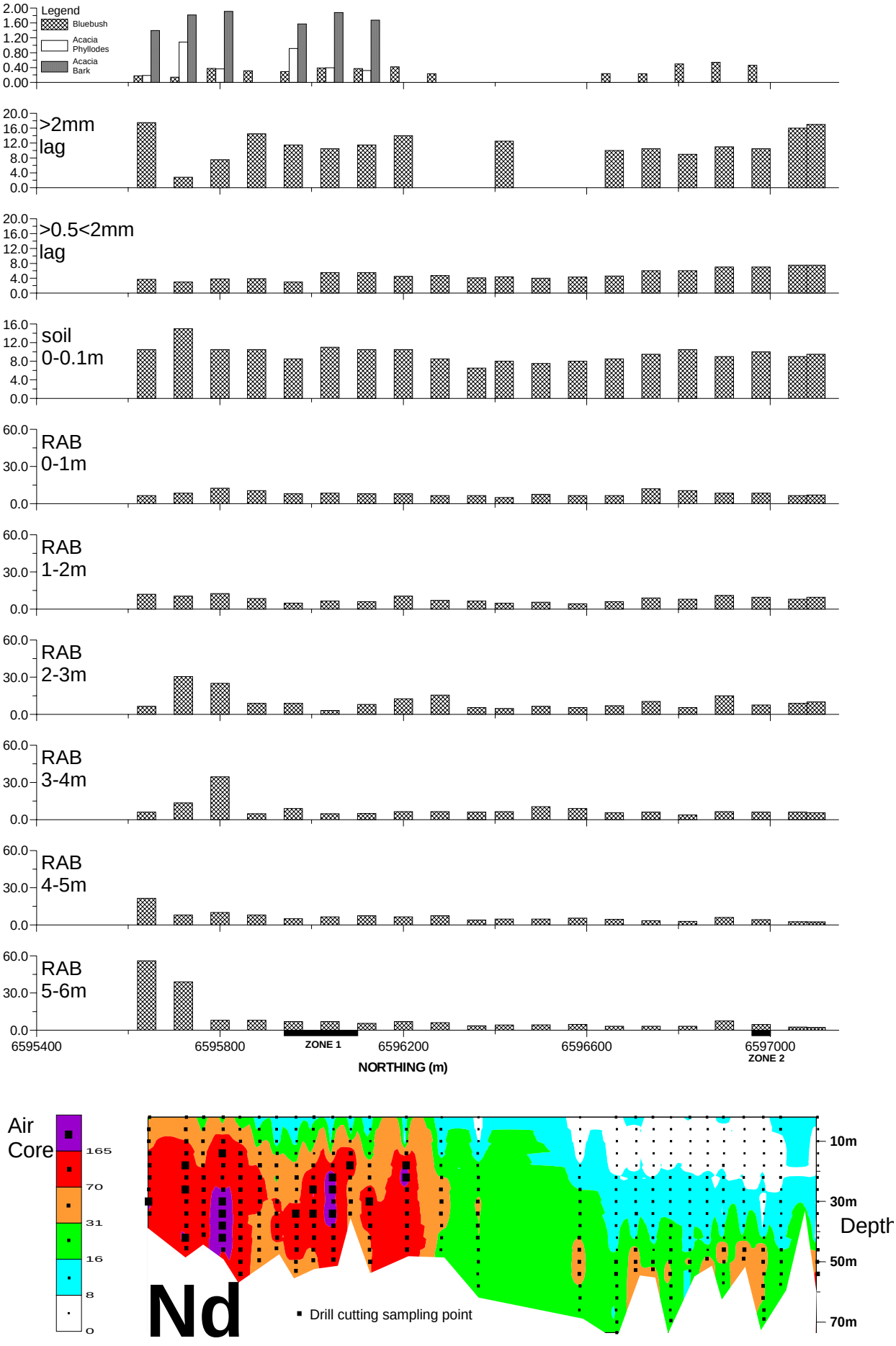
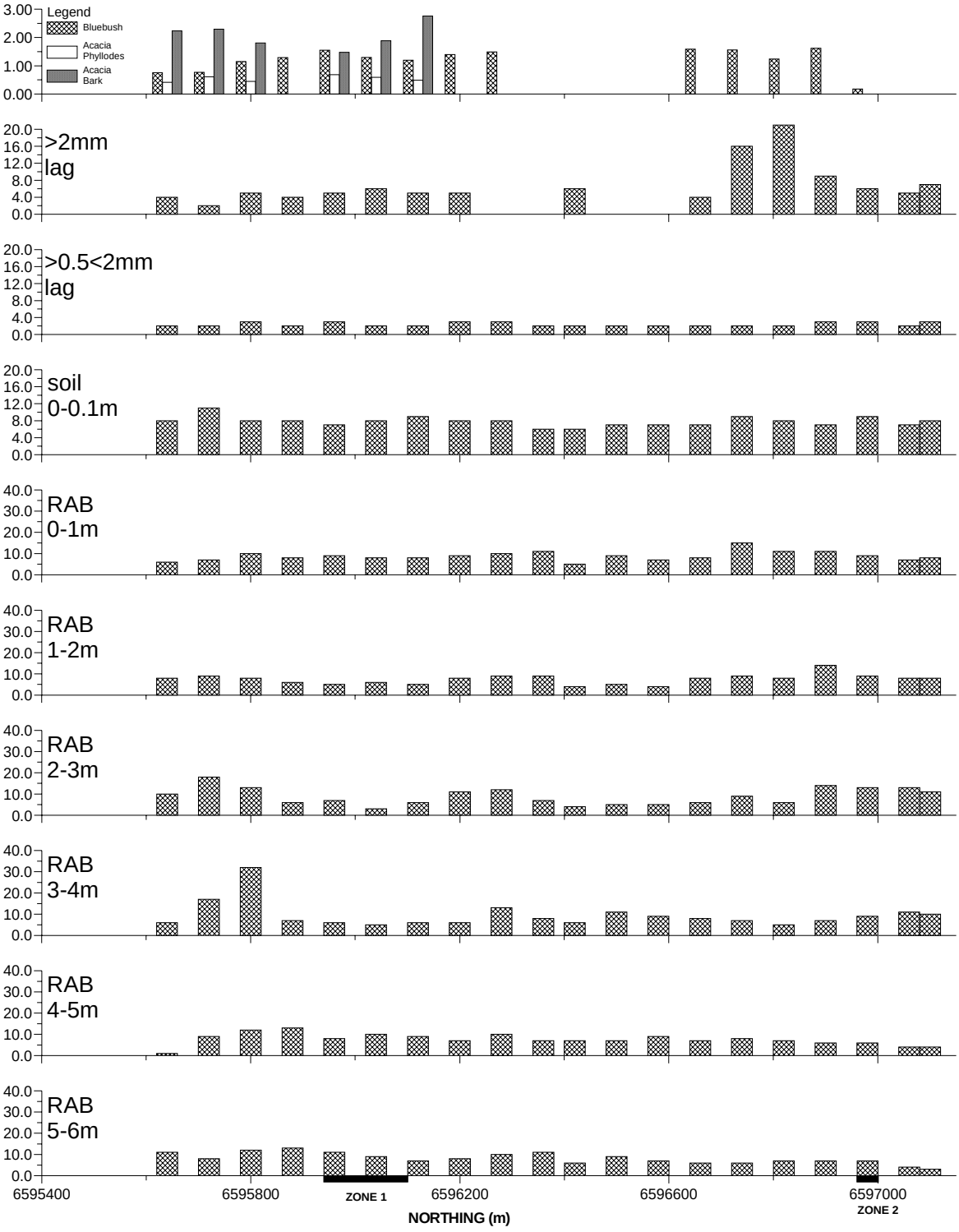


Figure A2.28: Nd distributions in vegetation and regolith components.
Data in ppm. Black rectangles (Zones 1-2) locate mineralisation.



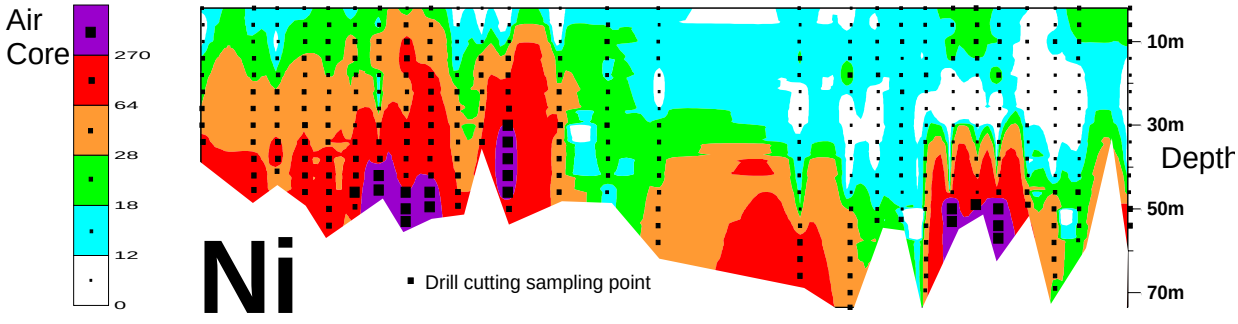


Figure A2.29: Ni distributions in vegetation and regolith components.
Data in ppm. Black rectangles (Zones 1-2) locate mineralisation.

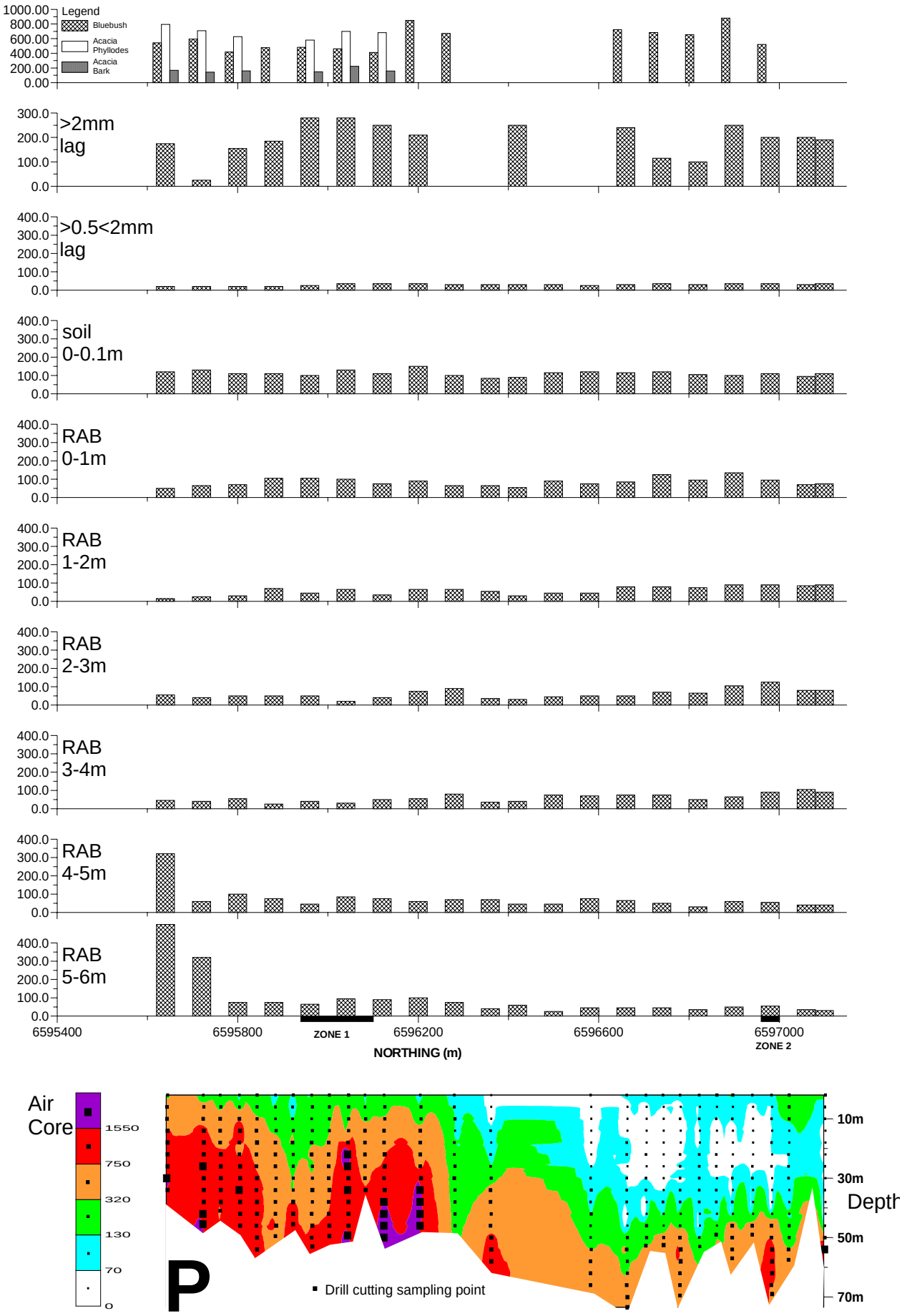


Figure A2.30: P distributions in vegetation and regolith components. Data in ppm. Black rectangles (Zones 1-2) locate mineralisation.

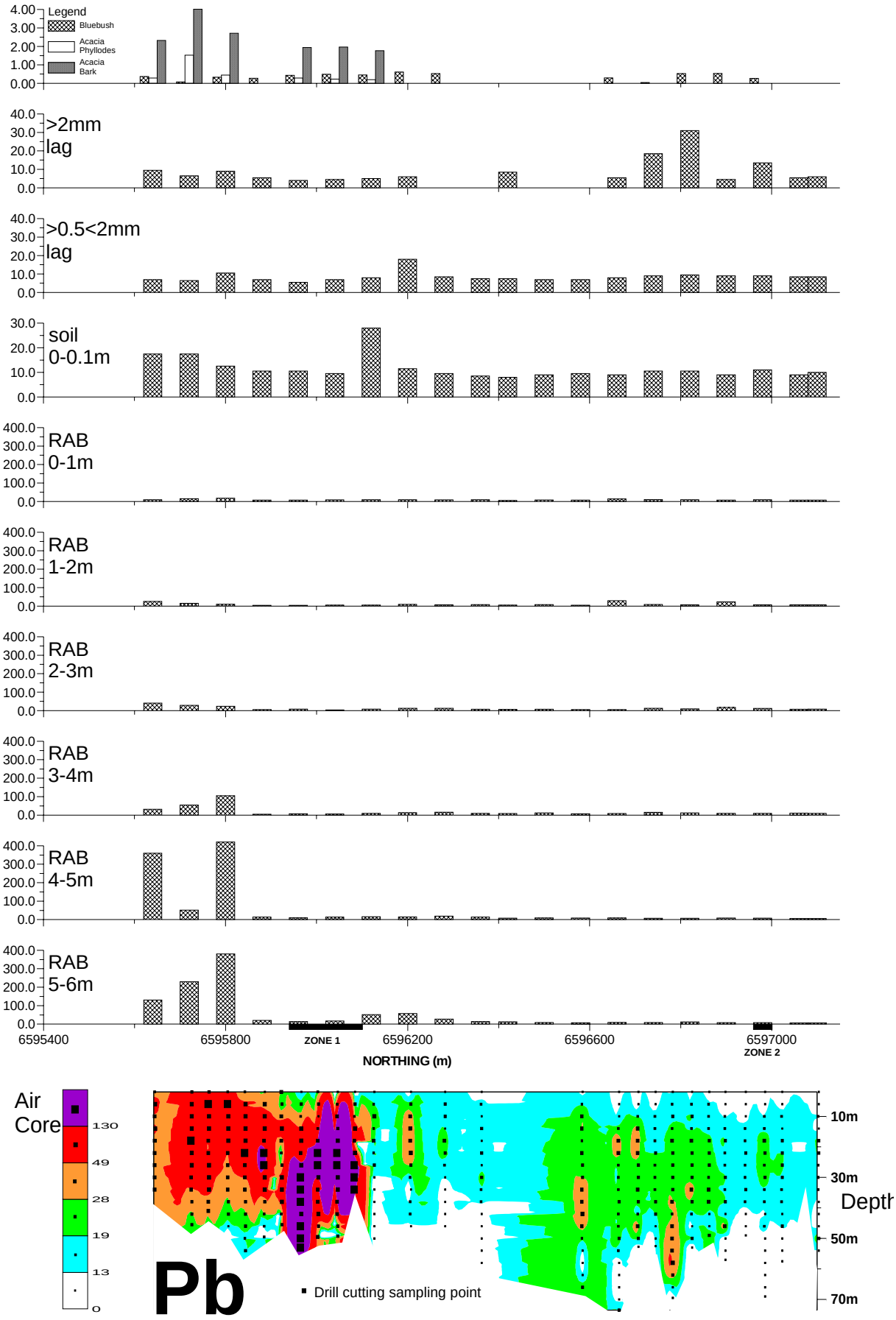


Figure A2.31: Pb distributions in vegetation and regolith components.
Data in ppm. Black rectangles (Zones 1-2) locate mineralisation.

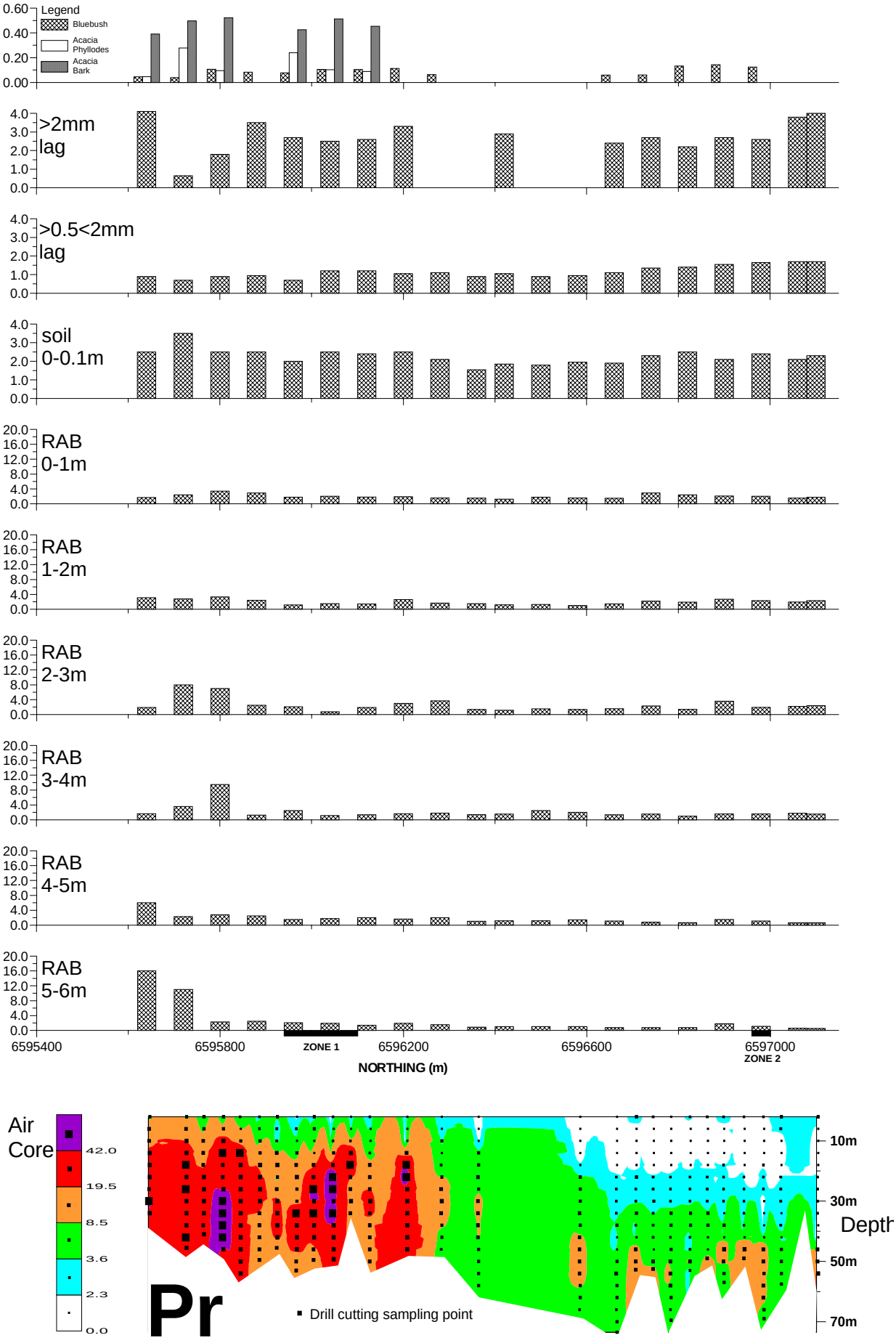


Figure A2.32: Pr distributions in vegetation and regolith components.
Data in ppm. Black rectangles (Zones 1-2) locate mineralisation.

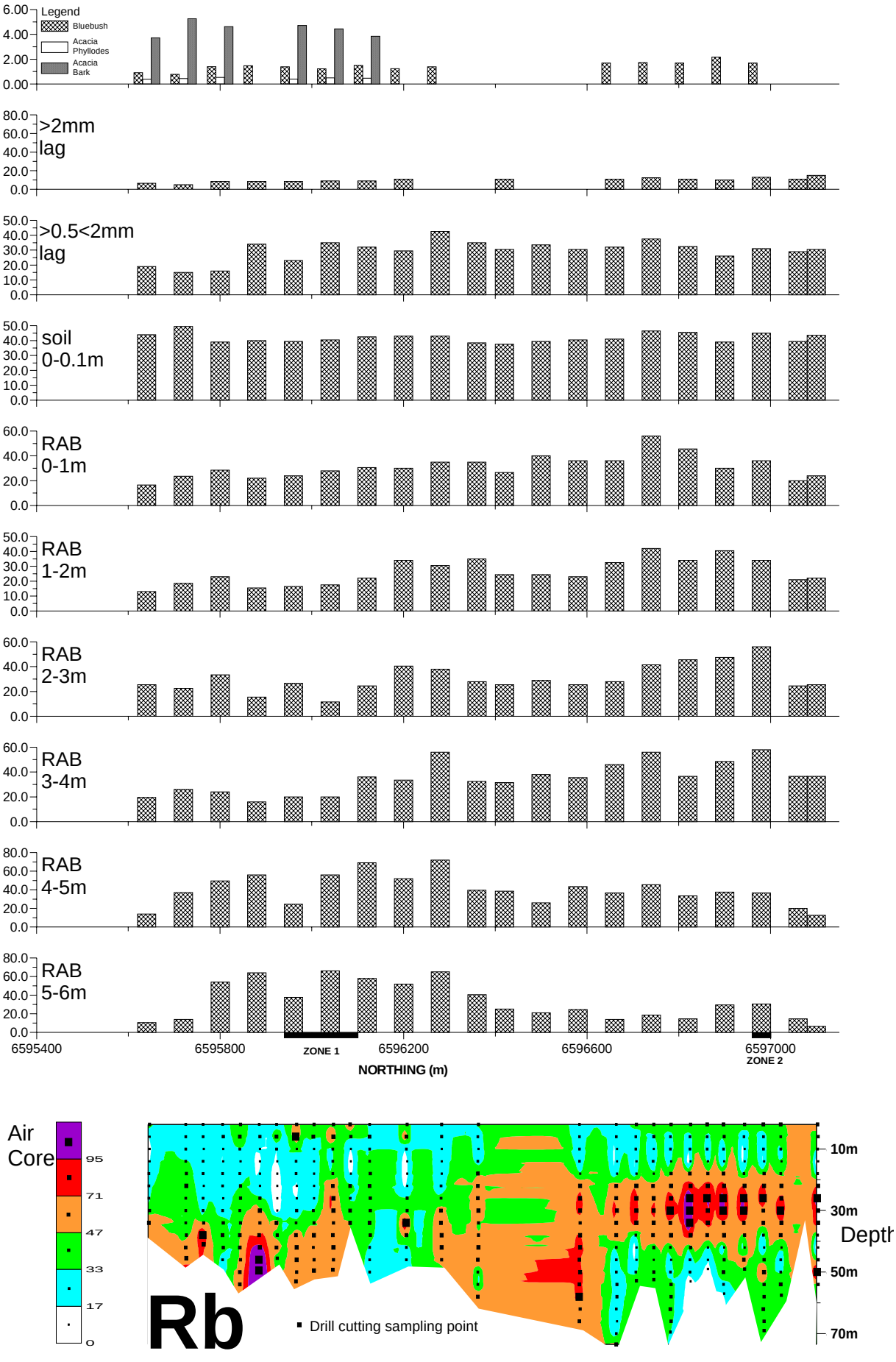


Figure A2.33: Rb distributions in vegetation and regolith components.
Data in ppm. Black rectangles (Zones 1-2) locate mineralisation.

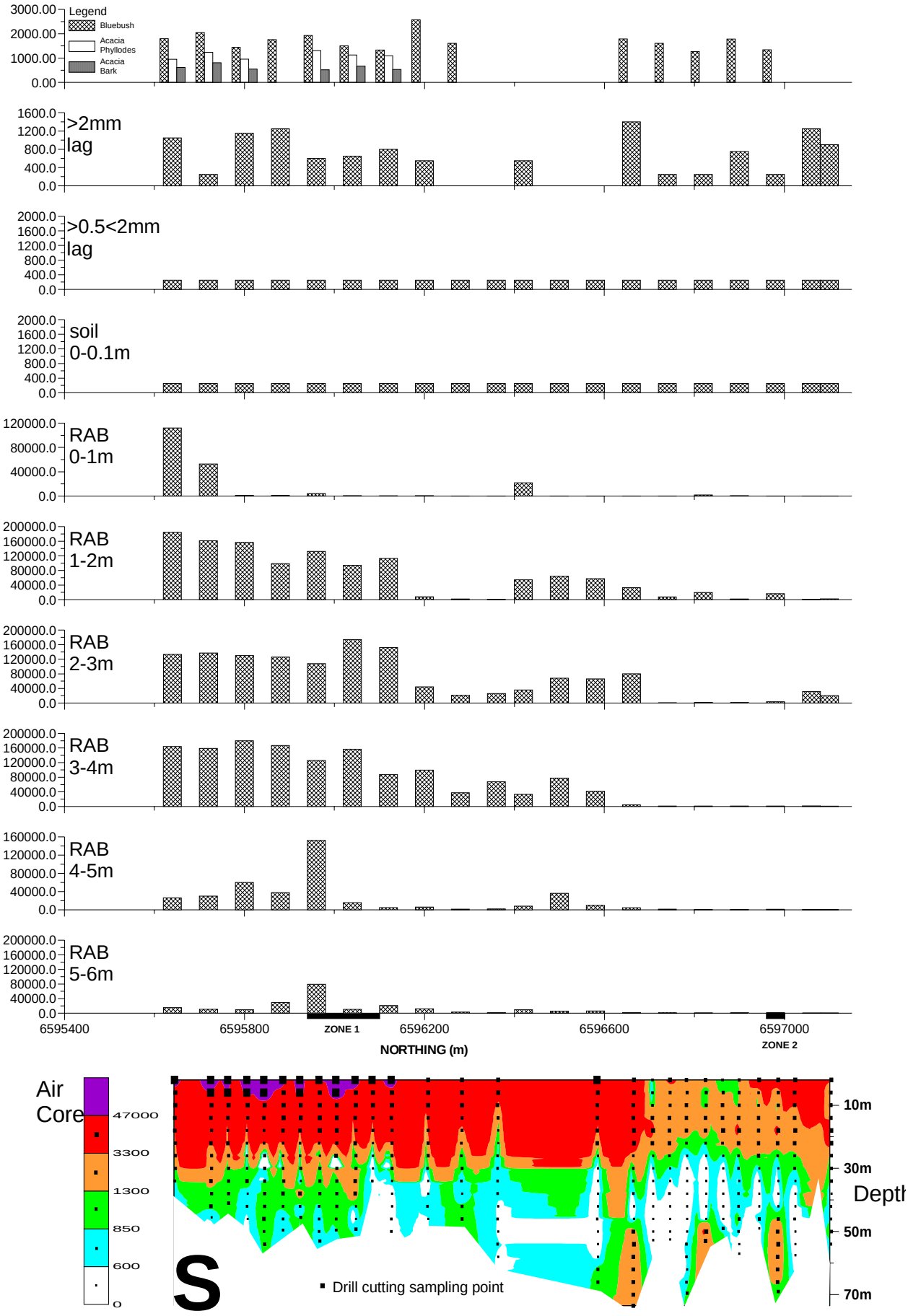


Figure A2.34: S distributions in vegetation and regolith components.
Data in ppm. Black rectangles (Zones 1-2) locate mineralisation.

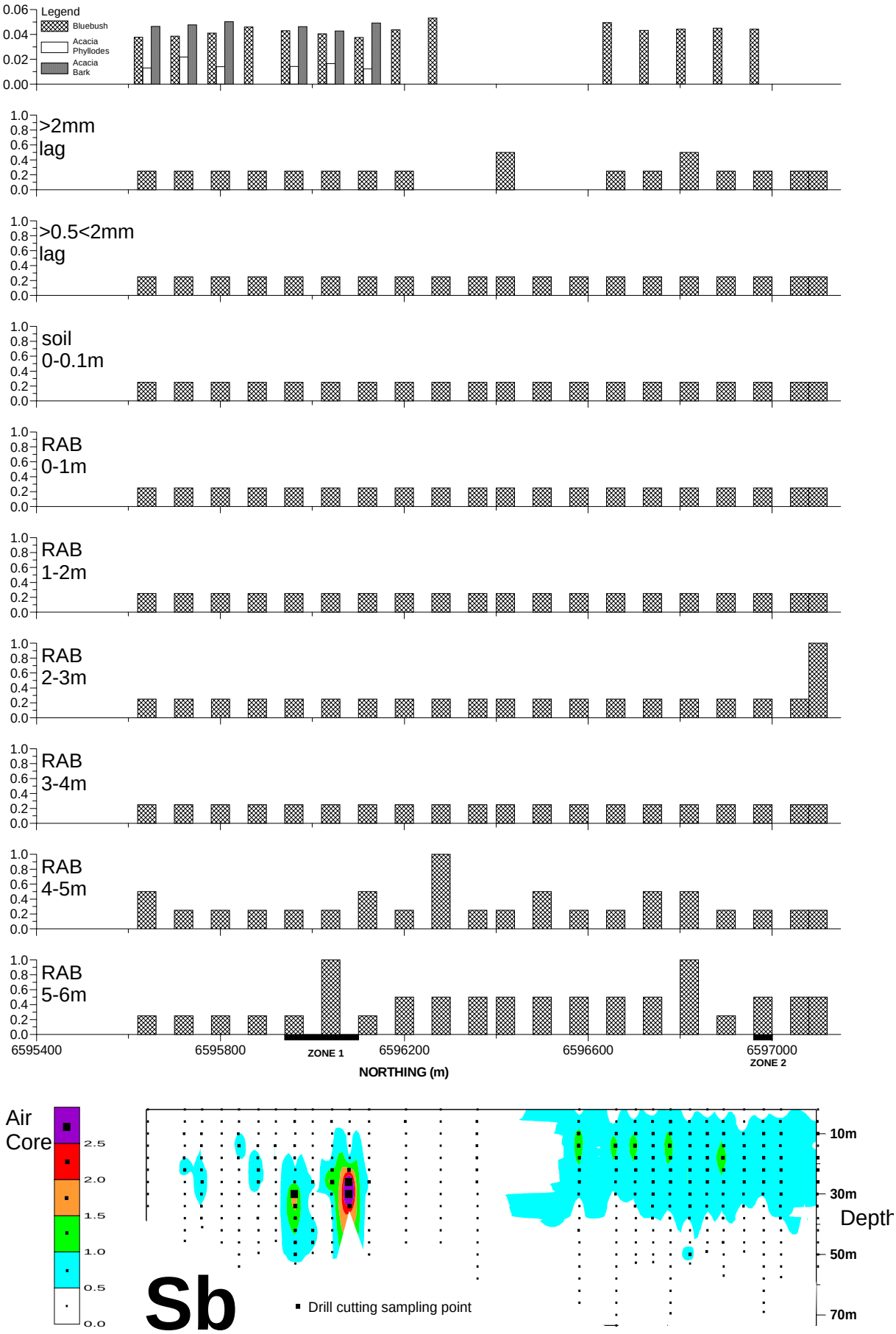


Figure A2.35: Sb distributions in vegetation and regolith components.
Data in ppm. Black rectangles (Zones 1-2) locate mineralisation.

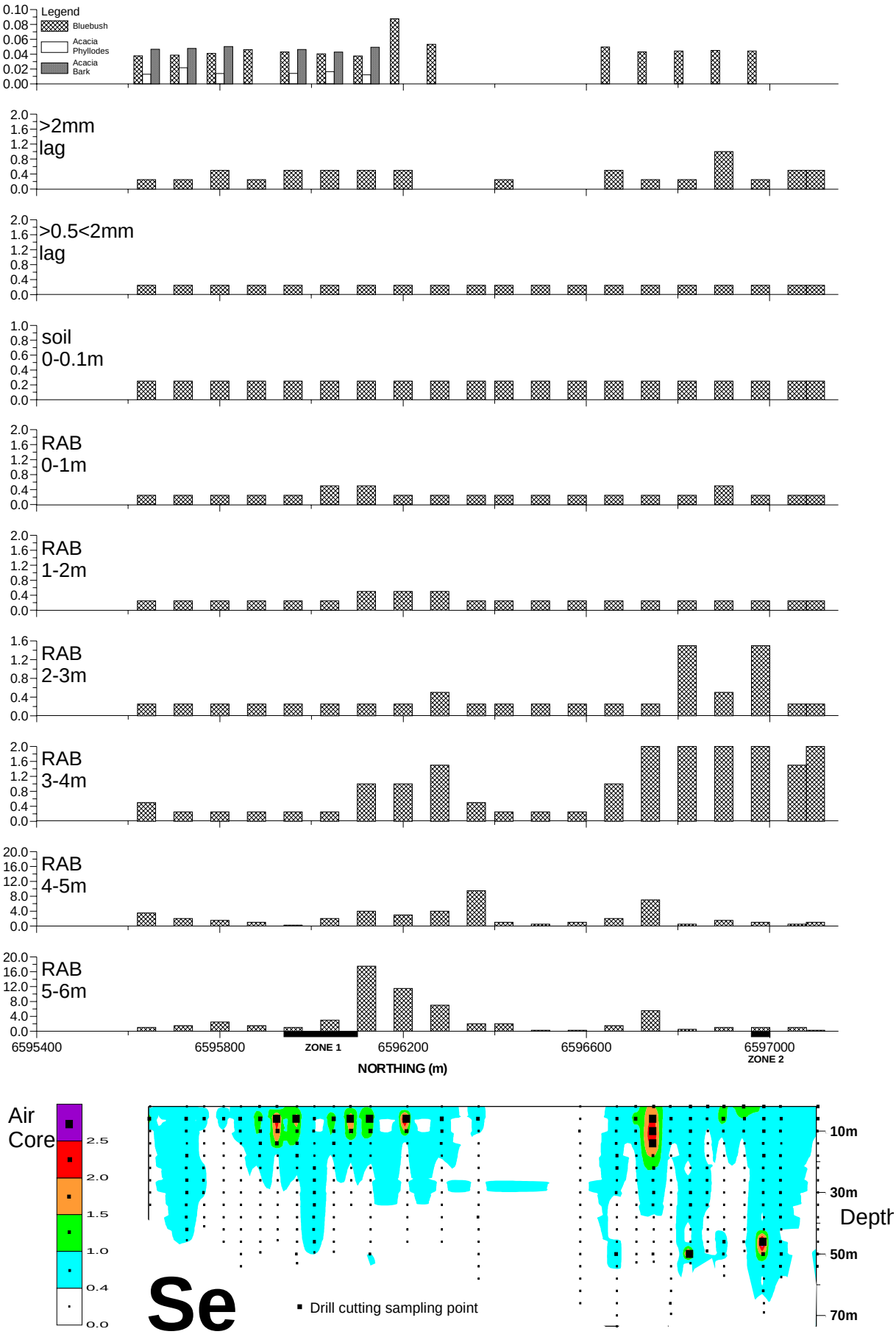


Figure A2.36: Se distributions in vegetation and regolith components.
Data in ppm. Black rectangles (Zones 1-2) locate mineralisation.

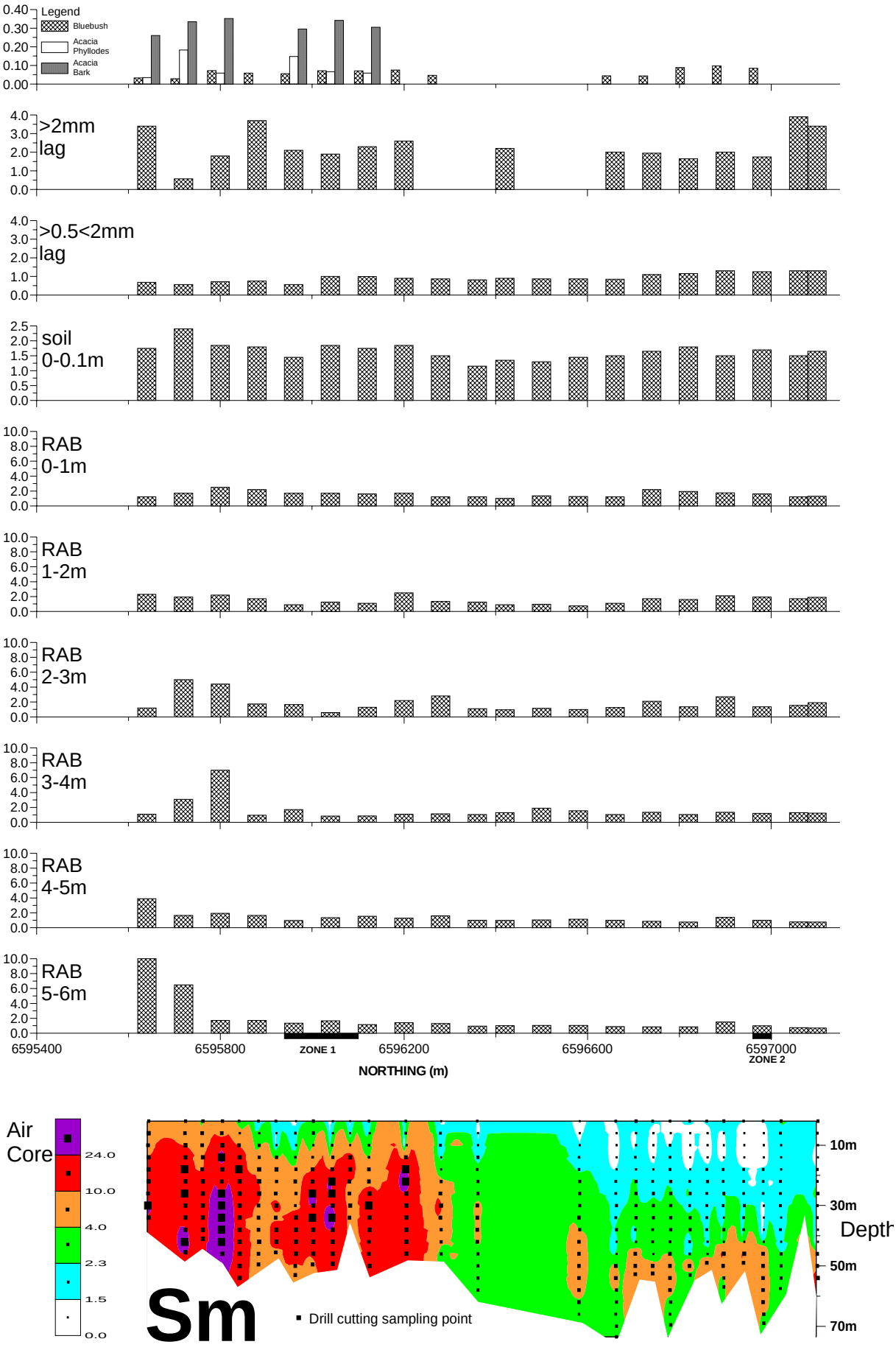


Figure A2.37: Sm distributions in vegetation and regolith components. Data in ppm. Black rectangles (Zones 1-2) locate mineralisation.

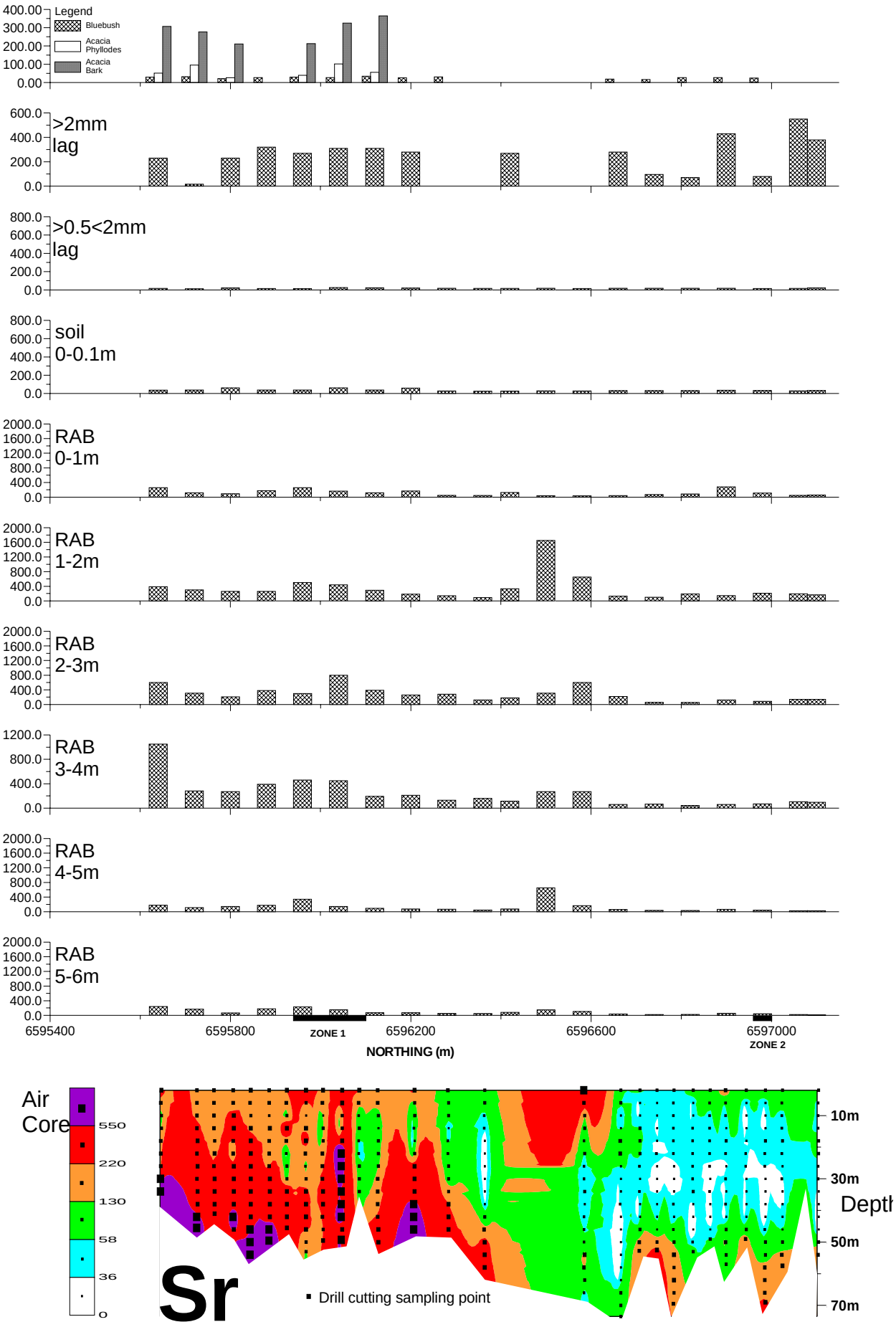


Figure A2.38: Sr distributions in vegetation and regolith components. Data in ppm. Black rectangles (Zones 1-2) locate mineralisation.

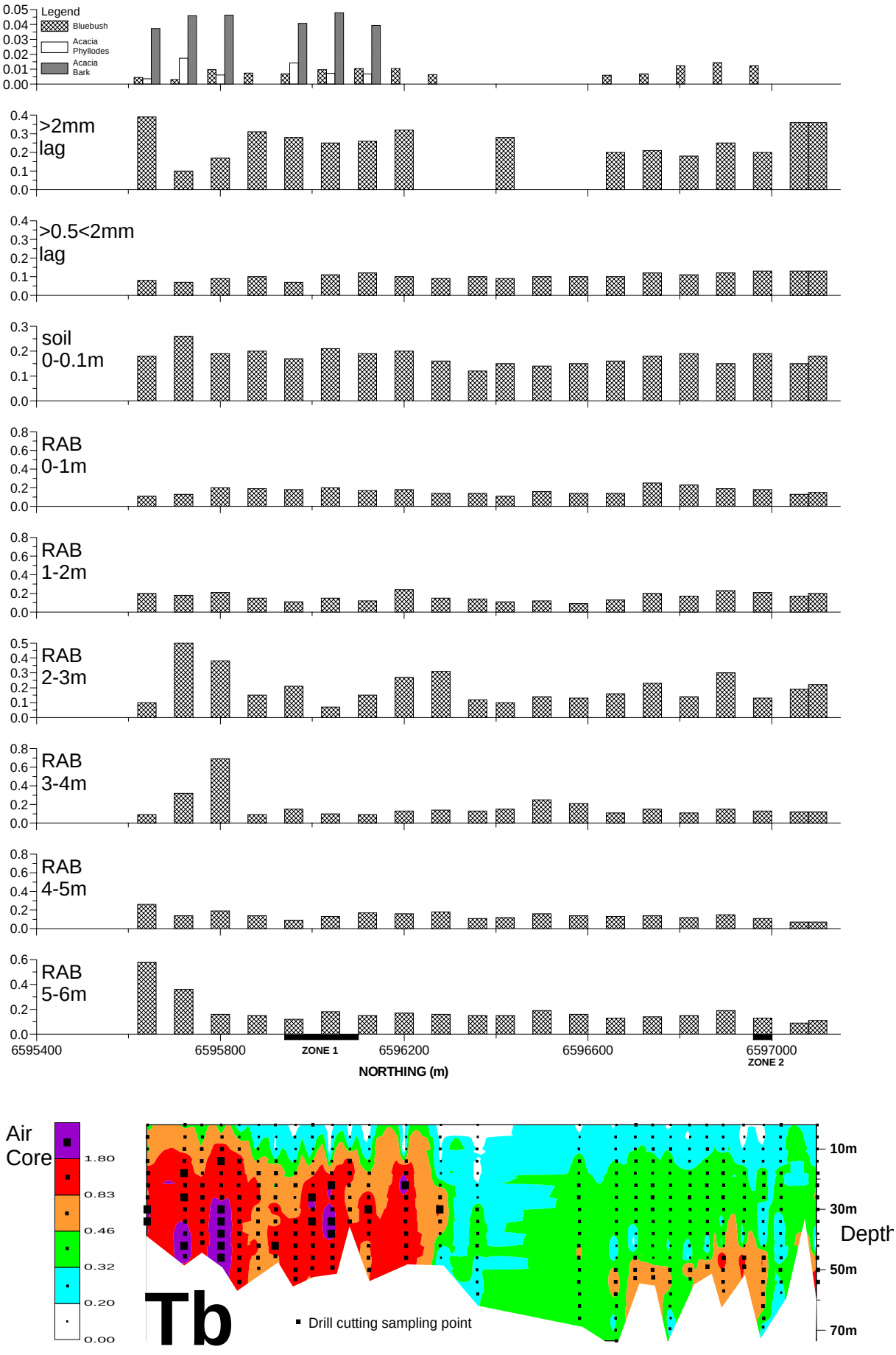


Figure A2.39: Tb distributions in vegetation and regolith components.
Data in ppm. Black rectangles (Zones 1-2) locate mineralisation.

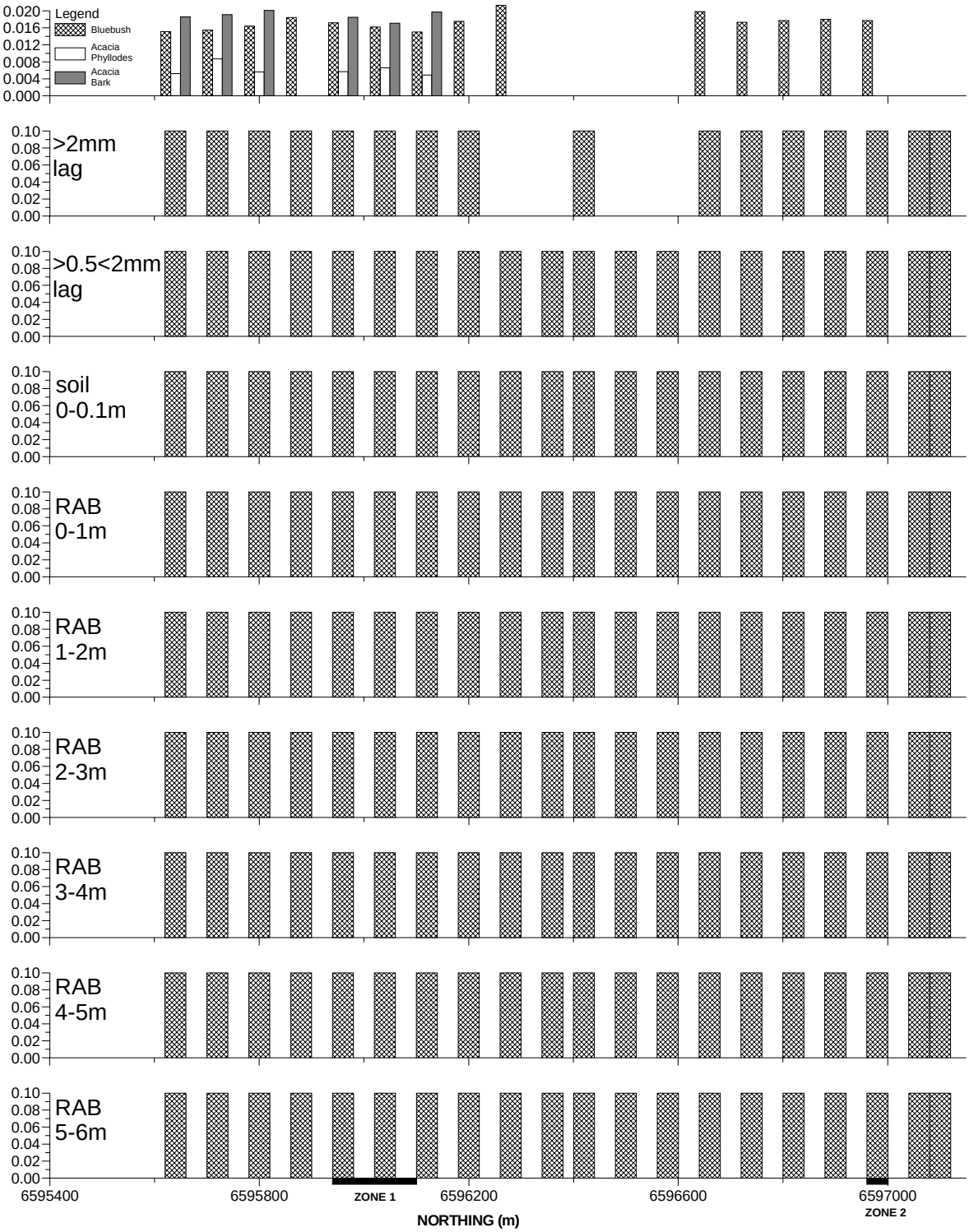


Figure A2.40: Te distributions in vegetation and regolith components.
Data in ppm. Black rectangles (Zones 1-2) locate mineralisation.
Note all drill cutting data were below detection (0.2 ppm) and so were not plotted.

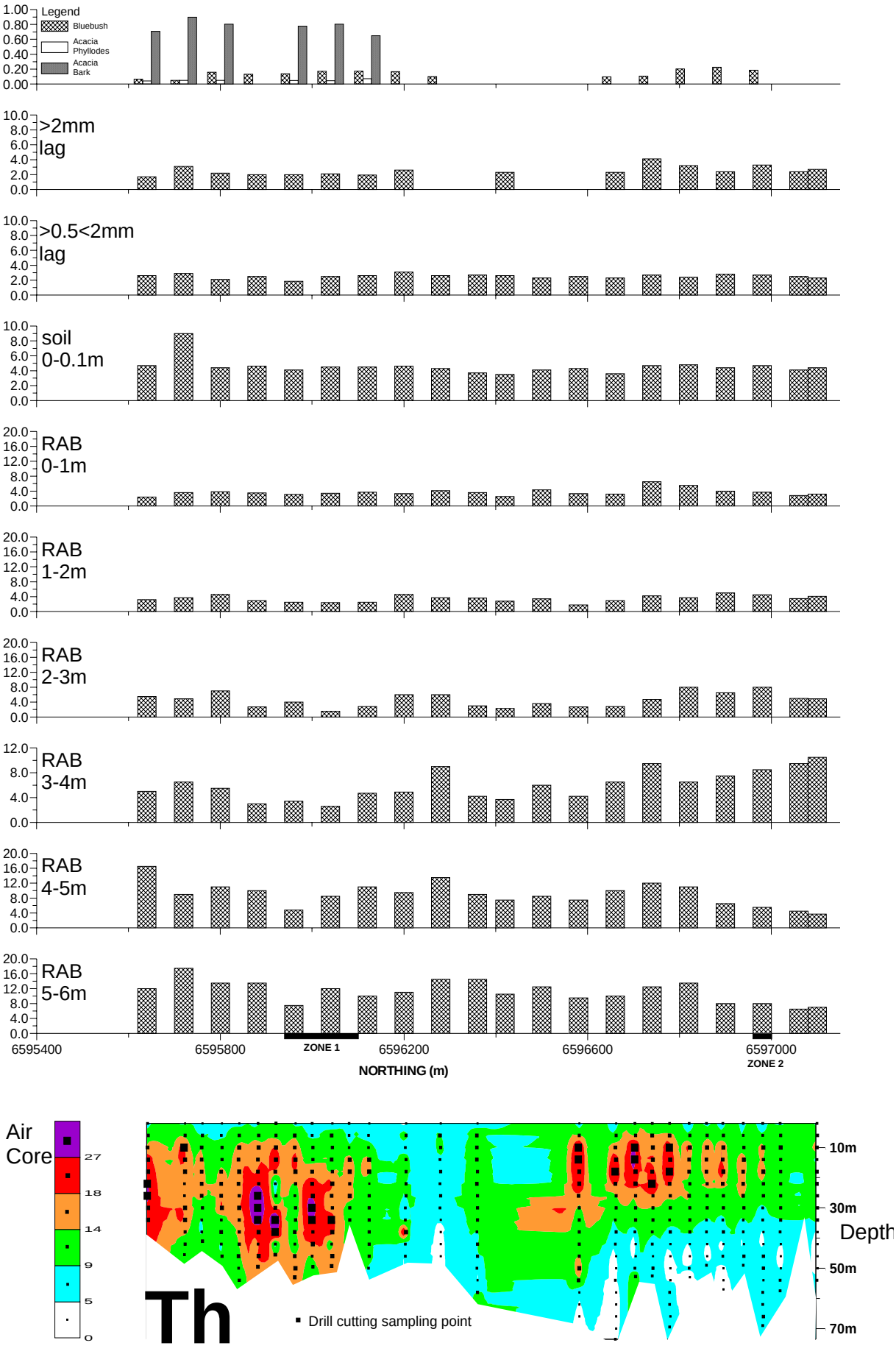


Figure A2.41: Th distributions in vegetation and regolith components.
Data in ppm. Black rectangles (Zones 1-2) locate mineralisation.

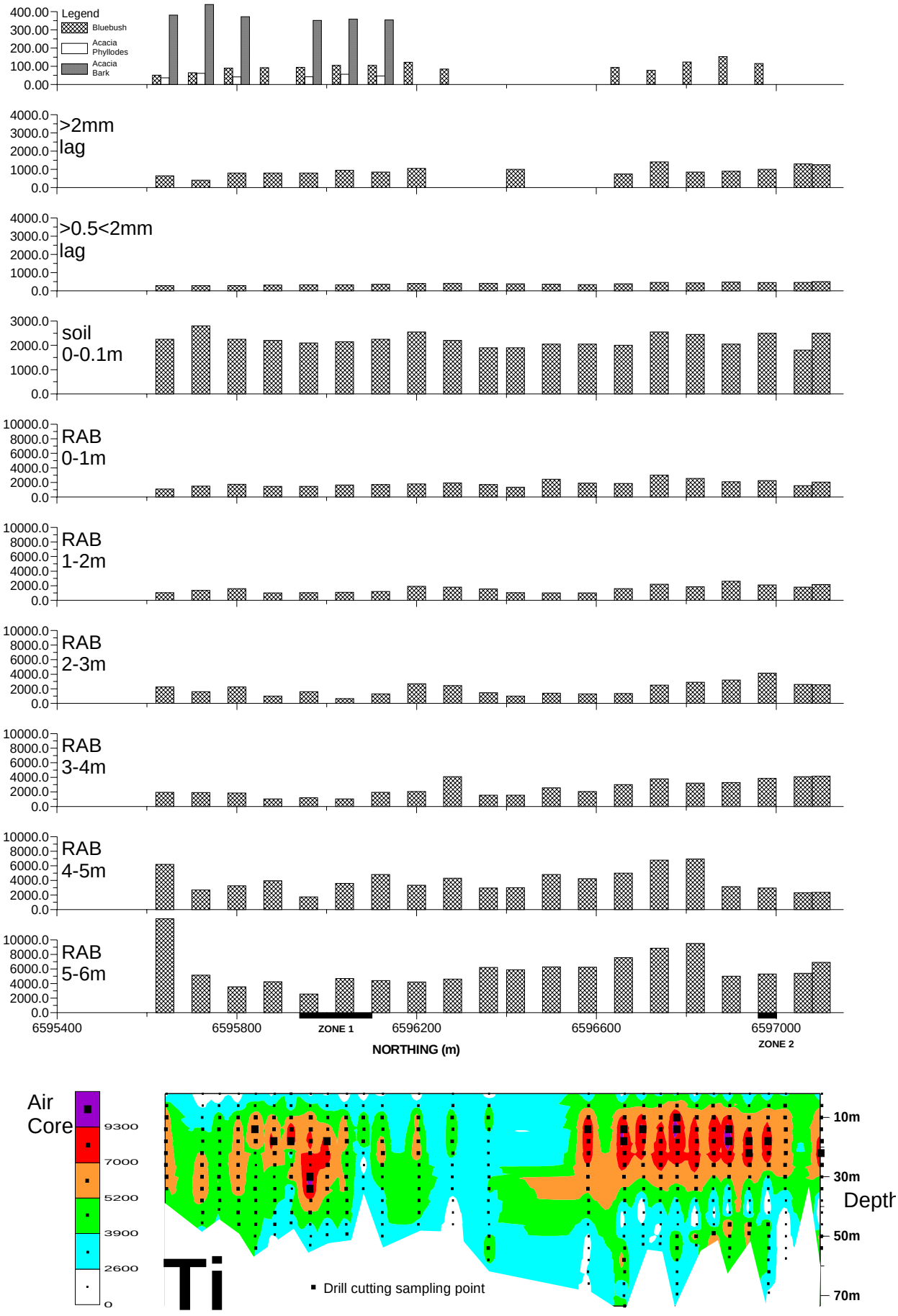


Figure A2.42: Ti distributions in vegetation and regolith components.
Data in ppm. Black rectangles (Zones 1-2) locate mineralisation.

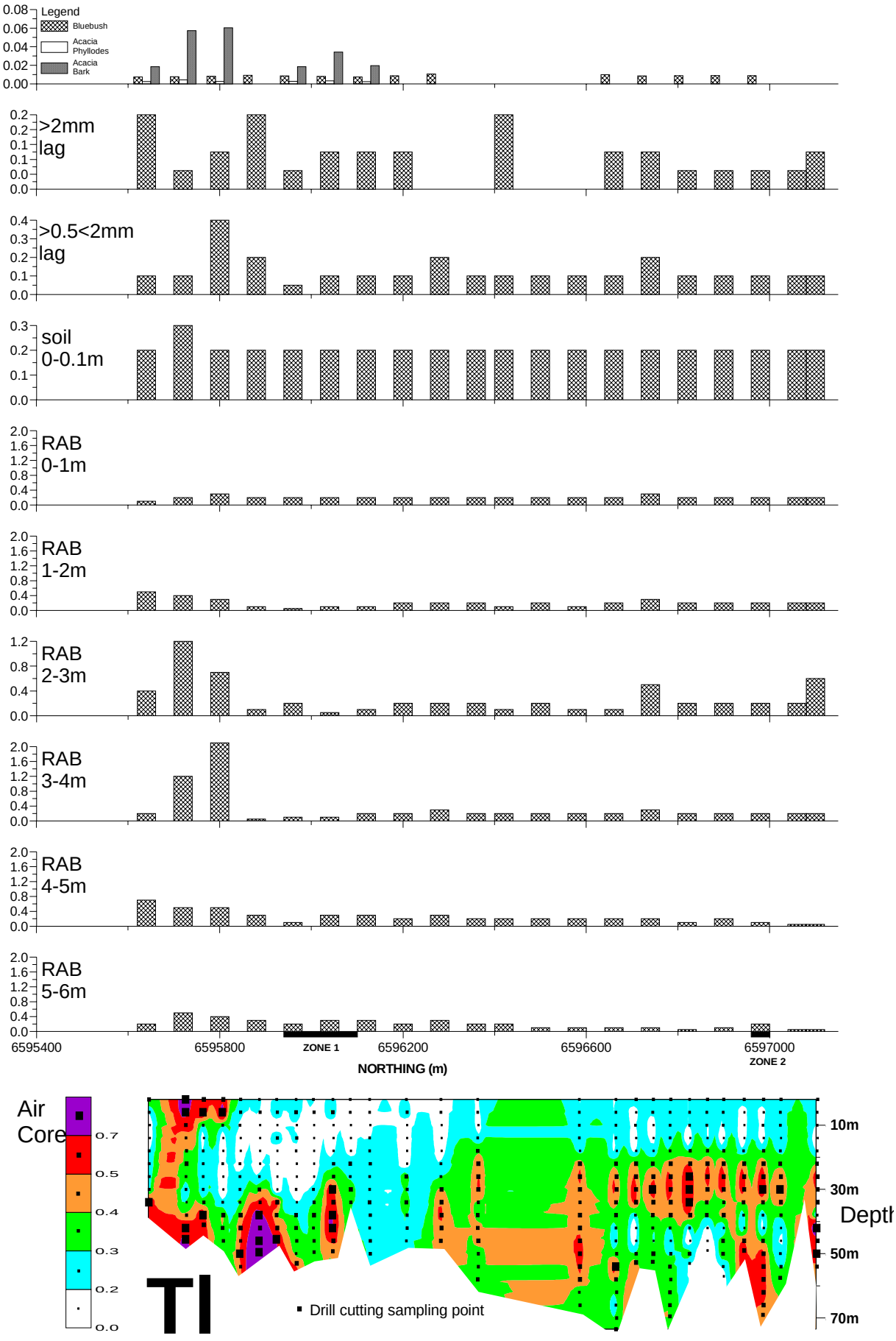


Figure A2.43: Tl distributions in vegetation and regolith components.
Data in ppm. Black rectangles (Zones 1-2) locate mineralisation.

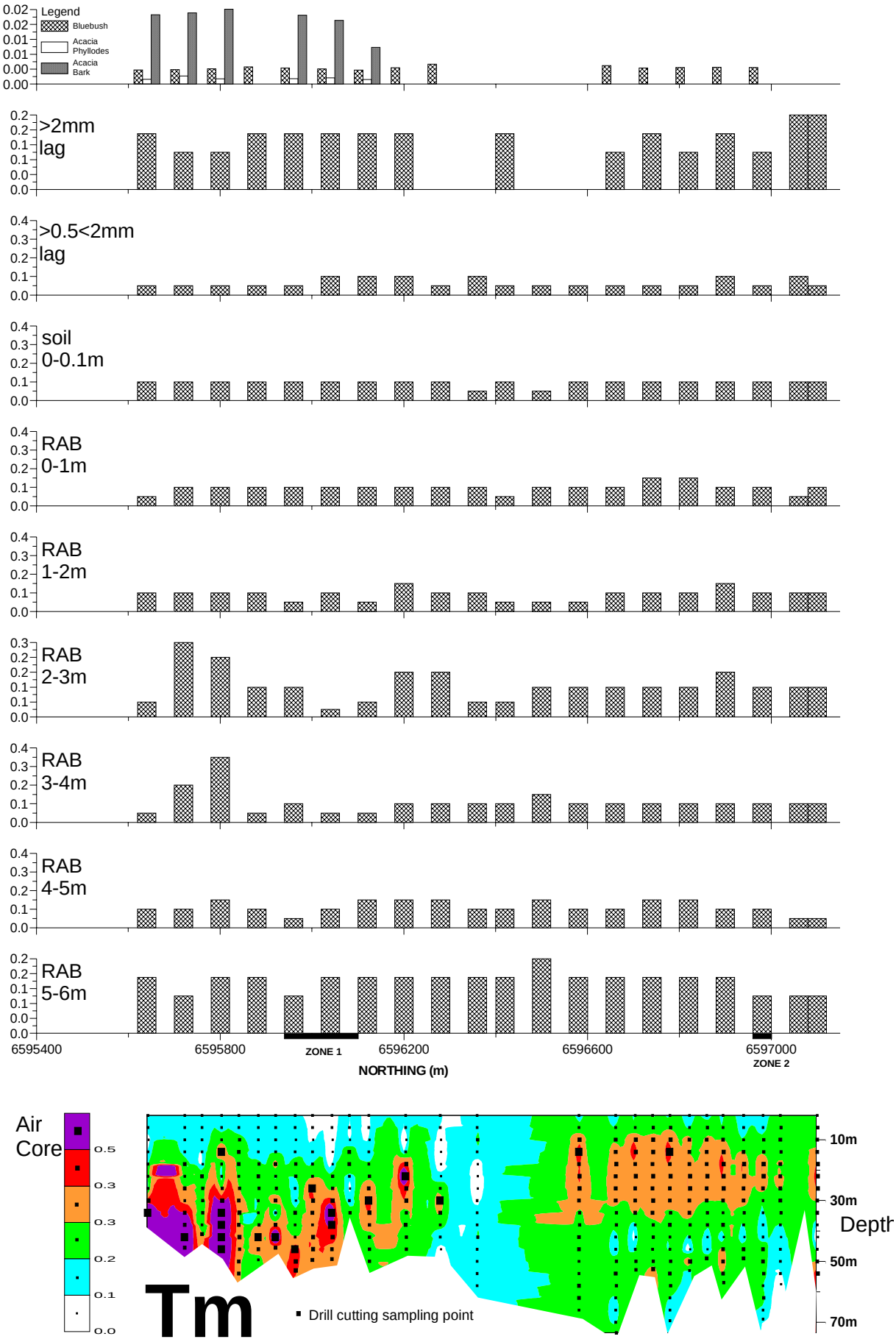


Figure A2.44: Tm distributions in vegetation and regolith components.
Data in ppm. Black rectangles (Zones 1-2) locate mineralisation.

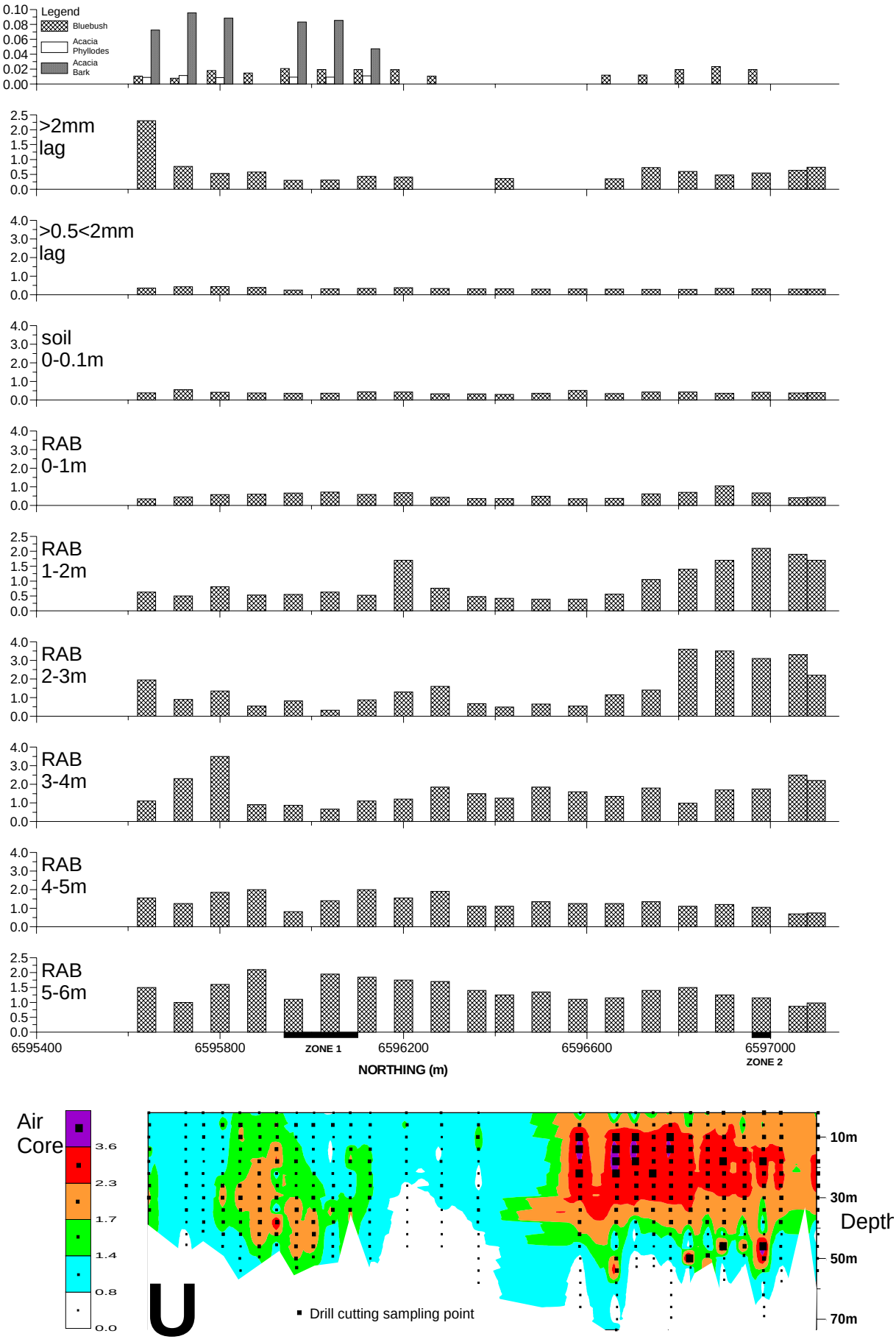


Figure A2.45: U distributions in vegetation and regolith components.
Data in ppm. Black rectangles (Zones 1-2) locate mineralisation.

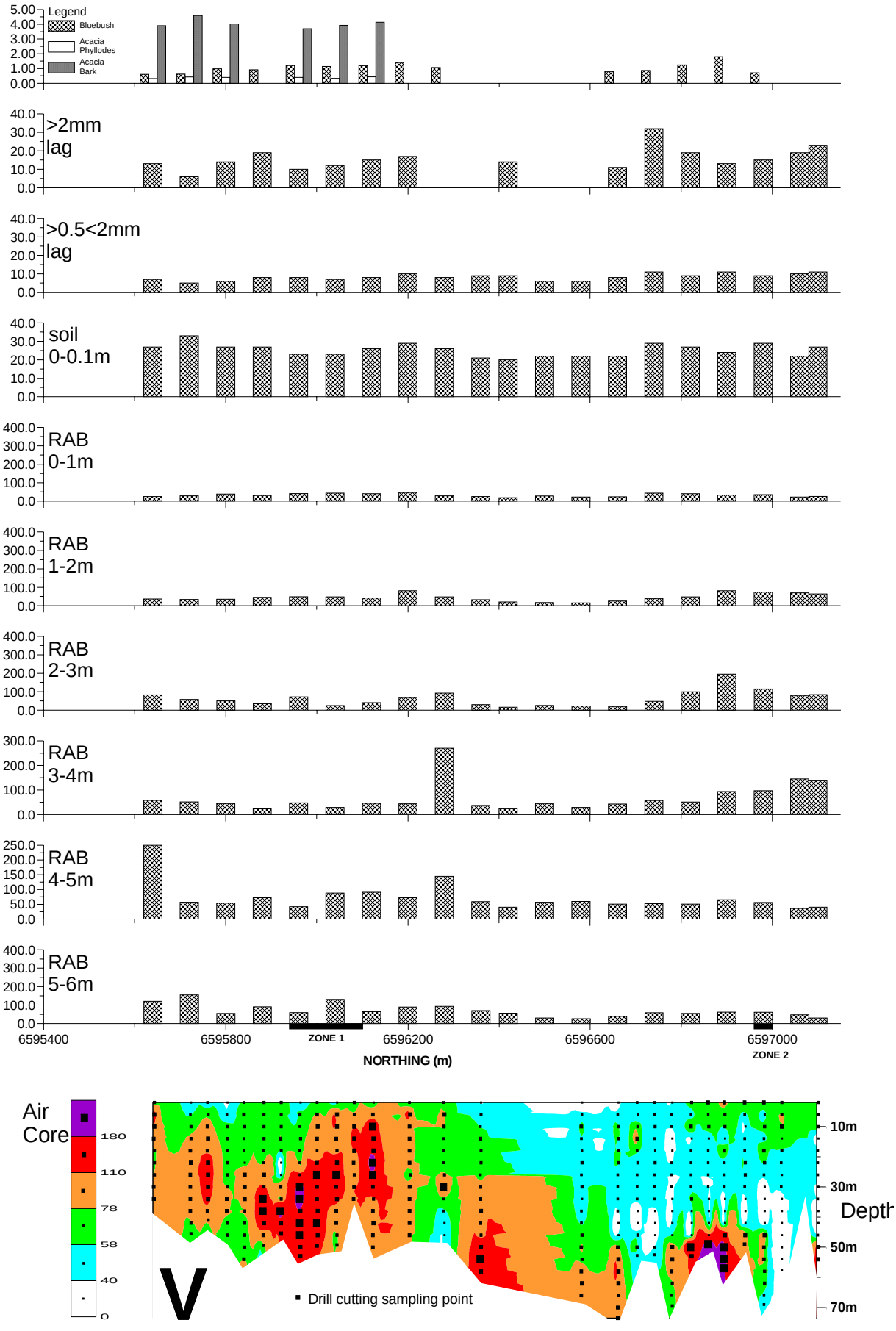


Figure A2.46: V distributions in vegetation and regolith components.
Data in ppm. Black rectangles (Zones 1-2) locate mineralisation.

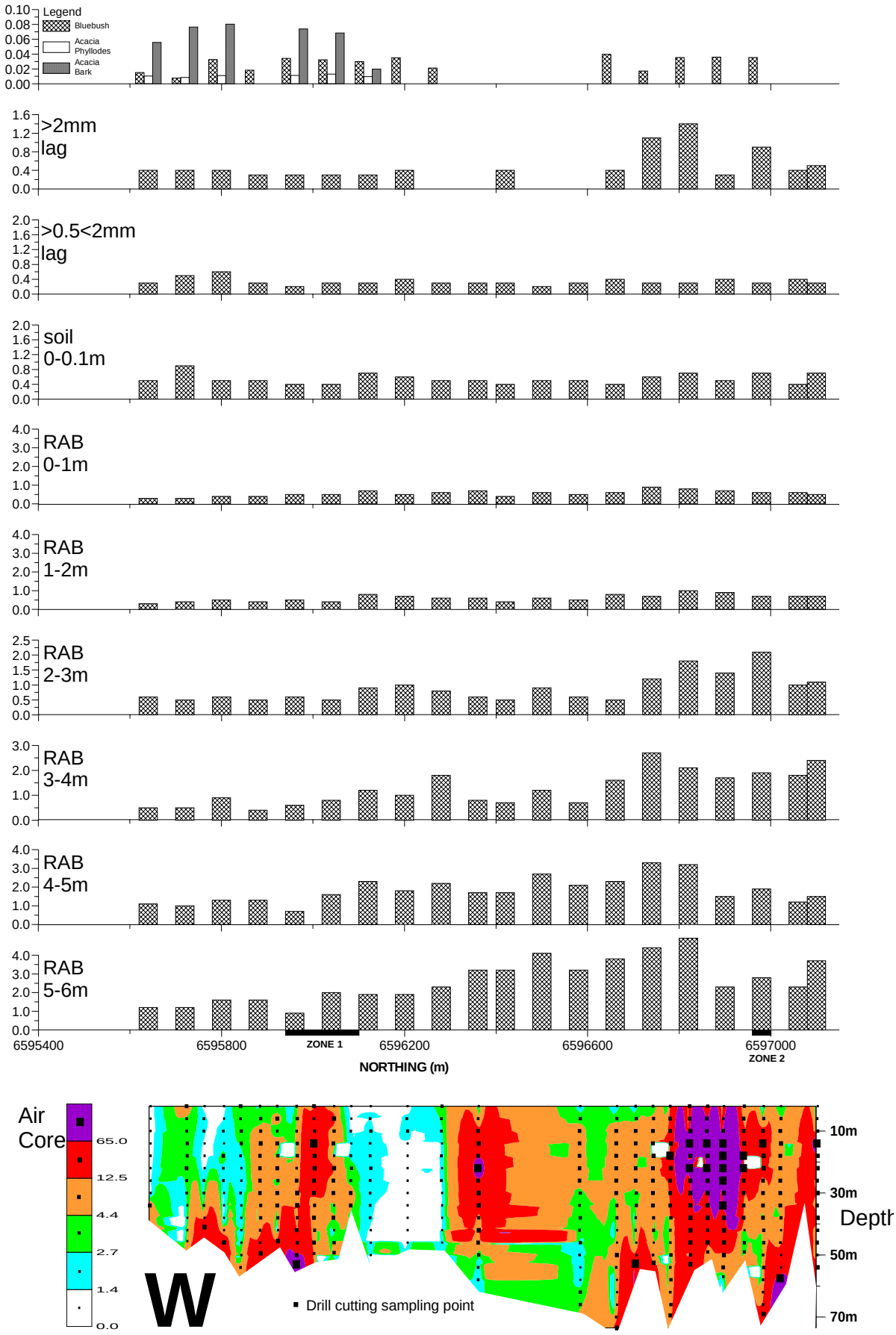


Figure A2.47: W distributions in vegetation and regolith components. Data in ppm. Black rectangles (Zones 1-2) locate mineralisation.

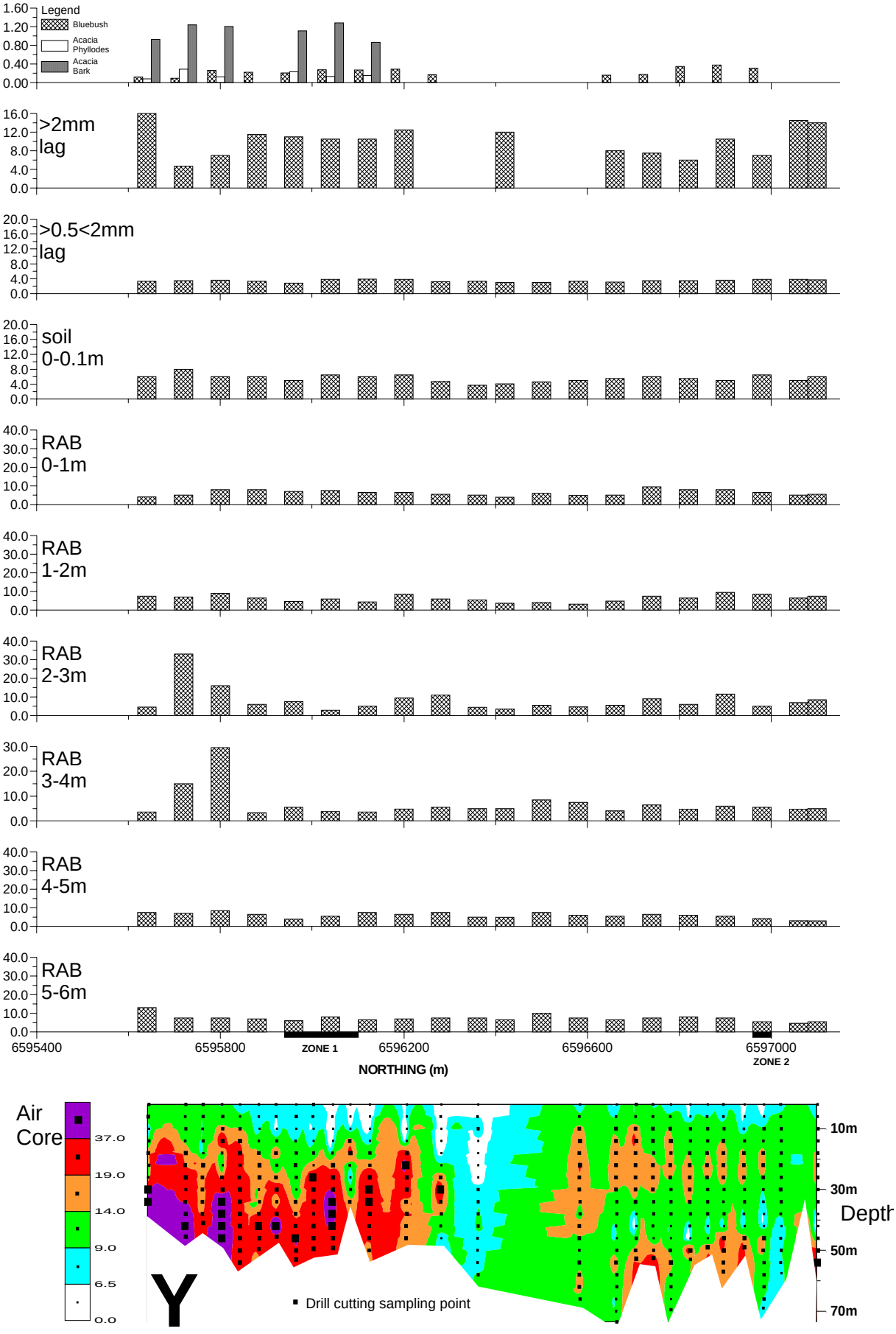


Figure A2.48: Y distributions in vegetation and regolith components.
Data in ppm. Black rectangles (Zones 1-2) locate mineralisation.

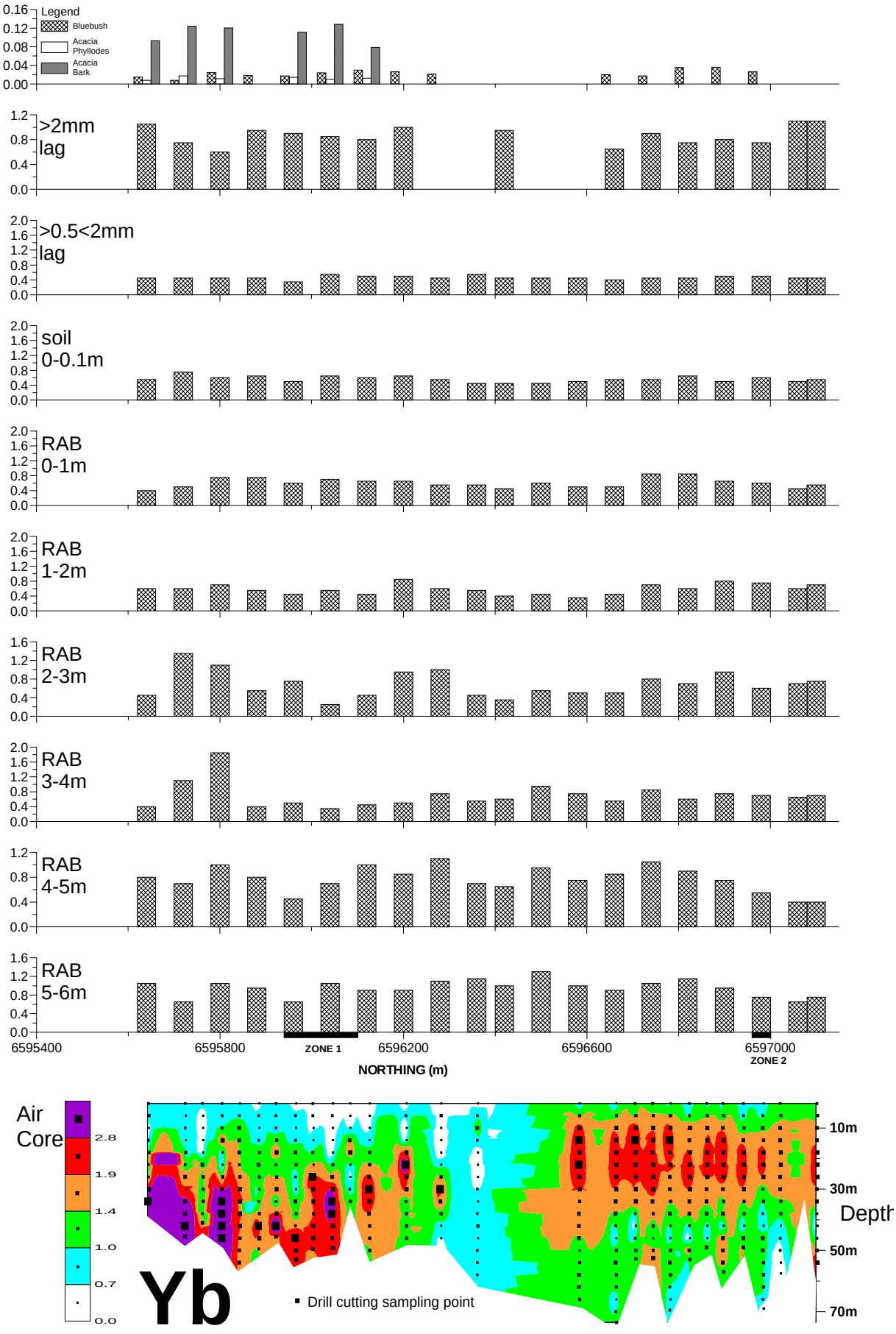


Figure A2.49: Yb distributions in vegetation and regolith components.
Data in ppm. Black rectangles (Zones 1-2) locate mineralisation.

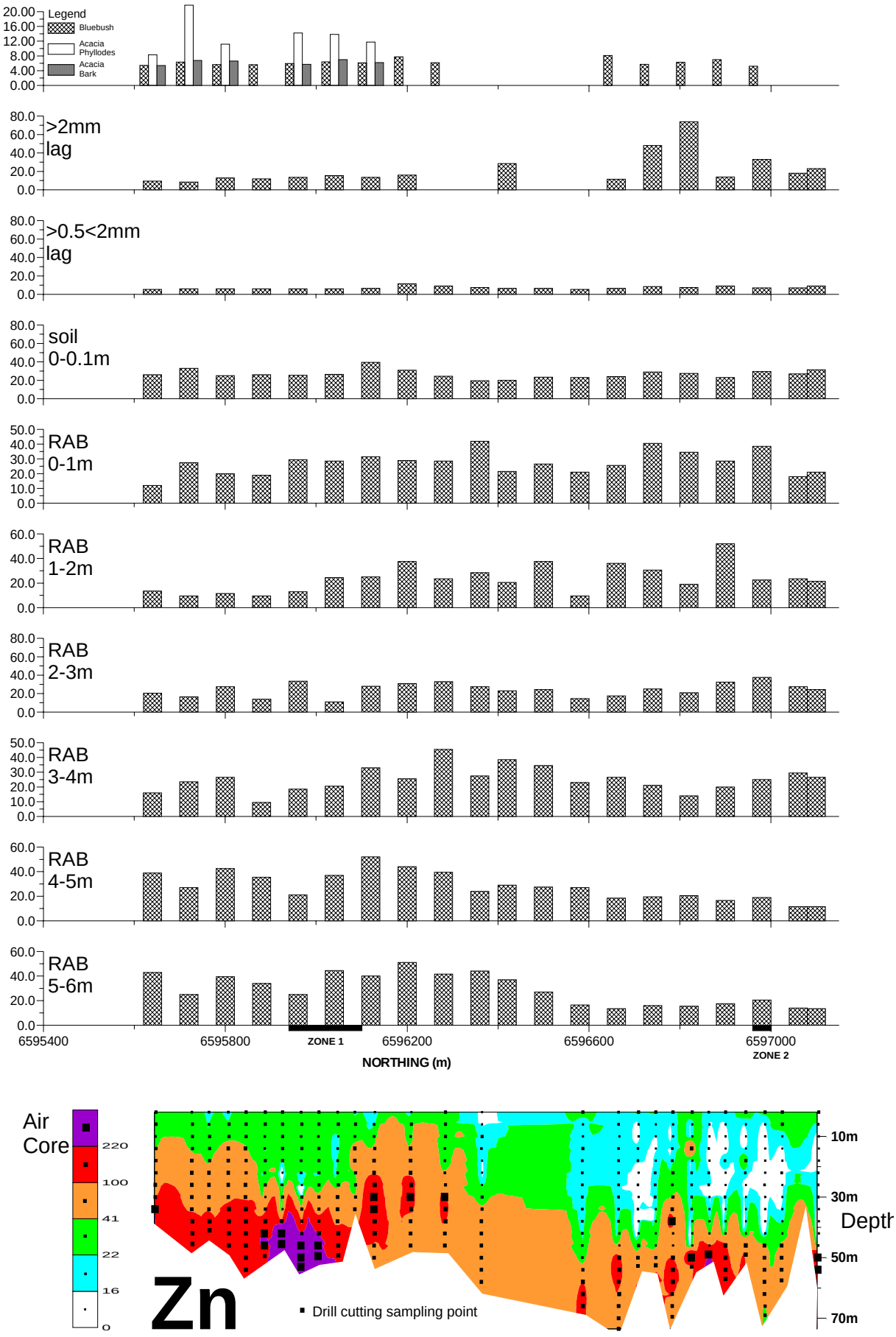


Figure A2.50: Zn distributions in vegetation and regolith components.
Data in ppm. Black rectangles (Zones 1-2) locate mineralisation.