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MINERALOGY AND GEOCHEMISTRY OF THE LIGHTS OF ISRAEL GOLD MINE, DAVYHURST, WESTERN AUSTRALIA

G.B. Douglas, I.D.M. Robertson and C.R.M. Butt

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(CSIRO Division of Exploration Geoscience Report 393R, 1993.
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CRC LEME is an unincorporated joint venture between The Australian National University, University of Canberra, Australian Geological Survey Organisation and CSIRO Exploration and Mining
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RESEARCH ARISING FROM CSIRO/AMIRA REGOLITH GEOCHEMISTRY PROJECTS 1987-1993

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

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

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

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

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

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

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

This report (CRC LEME Open File Report 55) is a Second impression (second printing) of CSIRO, Division of Exploration Geoscience Restricted Report 393R, first issued in 1993, which formed part of the CSIRO/AMIRA Project P241A.

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PREFACE

The CSIRO - AMIRA projects P241 and 241A "Gold and Associated Elements in the Regolith - Dispersion Processes and Implications for Exploration" include in their overall objectives the development of improved geological and geochemical methods for mineral exploration that will facilitate the location of blind, concealed or deeply weathered gold deposits. The study reported herein addresses these objectives by examining the vertical and lateral distribution of over 30 elements, including gold, in the partly truncated regolith present over mineralization at the Lights of Israel mine, Davyhurst. Recent open-cut mining has provided the opportunity to study complete lateritic regoliths in a detail not previously possible. This investigation is one of a number of such studies carried out in Projects 241 and 241A in a range of different geomorphological and geological settings in the Yilgarn Block. A thorough investigation of the geochemistry and mineralogy of the soil and lag was also conducted and has been reported separately.

C.R.M. Butt
Project Leader

June 1993.

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ABSTRACT

The dispersion of gold and 32 other elements in the lateritic regolith has been studied at the Lights of Israel gold mine, Davyhurst. The Au mineralization occurs primarily within a westerly dipping biotite schist within tholeiitic metabasalts that have been metamorphosed to amphibolite facies. The mineralized sequence has been variably weathered and has been truncated to the upper saprolite, and is partially concealed beneath a thin (1 m) residual soil which has received minor input from surrounding granitoid terrain. Two hundred and sixty-one samples from near the surface, within the saprolite and from the fresh rock have been analyzed to examine the element distribution throughout the entire remaining weathering profile. The elements associated with Au mineralization appear to be S, W, As, Sb and Mo, but these have low mean concentrations *i.e.* S (0.3 %), W (2.9 ppm), As (5.5 ppm), Sb (0.6 ppm) and Mo (3.6 ppm) compared to other Au mineralization in the Yilgarn Block.

The Au distribution in the regolith is typical of the southern Yilgarn Block with a patchy dispersion within the regolith and a distinct geochemical anomaly associated within pedogenic carbonates. A zone of apparently secondary Au enrichment occurs approximately 30 m below the surface and is accompanied by minor enrichments in a number of other elements including rare earths (La, Ce, Y), and base and transition metals (Fe, Mn, Co, Cu, Zn, Ni). There is little evidence of the zone of leaching in the upper saprolite horizons that is commonly reported from other deposits. The unweathered metabasalts, saprolites, near surface samples, soils and, to a lesser extent, biotite schists can be discriminated geochemically using Zr-Ti-Cr plots.

There are several implications for exploration for Au and other commodities. In general, the data presented in this report support the contention that at local to subregional scales, Au is one of the best indicators of Au mineralization, despite (or perhaps because of) its chemical mobility during weathering. The principal proviso is that sampling must take into account the distribution of Au in the regolith, as exemplified by Lights of Israel and numerous other sites in the Yilgarn Block.

1 INTRODUCTION

The Lights of Israel gold deposit, owned by Bardoc Gold Pty., Ltd., is about 2 km north-east of Davyhurst at 120° 39' 45"E and 30° 01' 40"S (Figure 1). Pre-production ore reserves of 415 000 tonnes at 4.2 g/t were outlined (Hellsten *et al.*, 1990). Description of the deposit and mineralization is given in Section 3.1. This present study complements a detailed investigation of the petrography, mineralogy and geochemistry of soil and lag overlying the deposit conducted by Robertson and Tenhaeff (1992). The research in this report integrates previous studies of the surface geology, geomorphology and the geochemistry of surface materials (soil and lag) with the geology and the geochemistry of the underlying mineralized rock.

Lights of Israel is south of the Menzies Line, in an area where the surface is dominated by large eucalypts and soils rich in carbonates. Its regolith has been truncated within the upper saprolite and it is overlain by a thin, largely residual soil. The site contrasts with the apparently sulphide-rich mineralization of Beasley Creek, which lies in the more arid Northeastern Goldfields, north of the Menzies Line, in an area dominated by acacias, hardpan and only patchily-developed calcretes (Robertson and Churchward, Robertson, 1989, Robertson, 1990, Robertson, 1991) and the Mt. Percy Mine near Kalgoorlie which is dominated by lateritic and pisolitic calcareous soils developed on a veneer of lateritic duricrust that preserves an almost complete lateritic regolith some 50-70 m thick (Butt, 1991).

2 STUDY METHODS

2.1 Sampling

The objective of the sampling programme was to obtain a representative suite of soil and subsurface (saprolite and fresh rock) samples to illustrate the vertical and lateral distribution of a range of elements developed over Au mineralization and its wall rocks. Two sections over the mineralized zone, 1200N and a composite section, 940N-1050N using a combination of eight subsections (Figure 2) have been studied, with soil collected from the 1200N section only. A total of 12 soil and 261 pit samples were collected. Soil samples (*ca.* 1kg) were collected from a depth of 25-250 mm . The location of soil samples is given in Figure 2 .

Saprolite and fresh rocks were sampled by ditchwitch from the pit floor as mining progressed. Consequently, many of the samples are composites. Delays in the instigation of, and irregularities in, the sampling program caused a number of significant breaks in the sample pattern, resulting in the samples being restricted to three bands between 0-2 m (RLs 455-457; *soils* - section 1200N only, *surficial samples* from the top 1 m), 7-37 m (RLs 420-450, *saprolite samples*) and 42-62 m (RL's; 395-415, *unweathered rock*). The location of samples is given in Figure 2.

2.2 Sample preparation and analysis

All saprolite and rock samples were dried (<40°C), jaw crushed, and a sample taken for reference. The remaining material was riffle split and a minimum of 100 g extracted for grinding to less than 75 μm. The sample analysis and preparation methods are similar to those used for soil samples (Robertson and Tenhaeff, 1992). Detection limits are given in Appendix 1 and the geochemical data are tabulated in Appendix 2 and given in the data disk (Appendix 5).

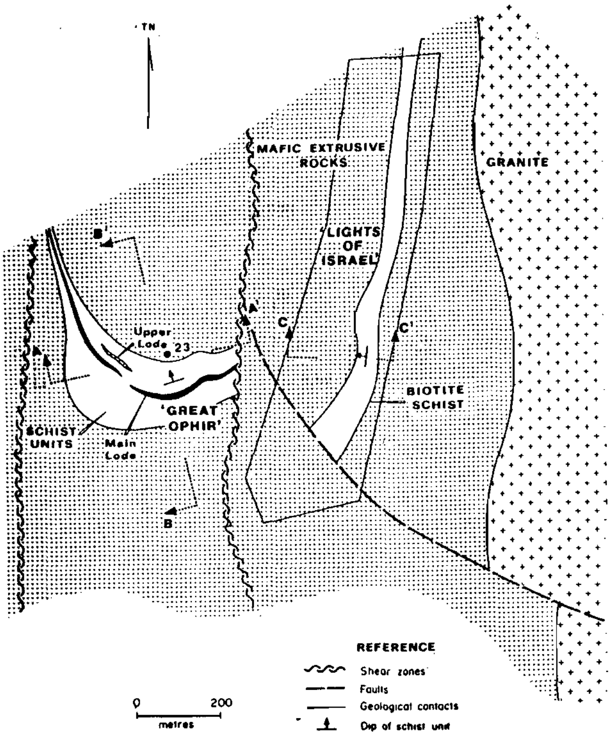


Figure 1. Geological map of the Lights of Israel Gold Mine study area, Davyhurst (after Hellsten *et al.*, 1990)

Samples were analysed as follows:

A. Neutron activation analysis (INAA), 30 g sample (Becquerel Laboratories Pty. Ltd.): As, Au, Ce, Co, Cr, La, Mo, Sb, W.

B. X-Ray fluorescence (XRF(p)) on pressed powders, using a Philips PW1220C by the methods of Norrish and Chappell (1977) and Hart (1989), with Fe determined for matrix correction (CSIRO): Ba, Ce, Cu, Ga, Ge, Mn, Nb, Ni, Pb, Rb, Sr, V, Y, Zn, Zr.

C. X-Ray fluorescence (XRF(f)) of fused discs (0.7 g sample and 6.4 g Li borate) using a Philips PW1480 instrument by the method of Norrish and Hutton (1969) (CSIRO): Si, Al, Fe, Mg, Ca, Na, K, Ti, P, Ba, Ce, Co, Cr, Cu, Ga, La, Nb, Ni, Pb, Rb, Sr, V, Y, Zn, Zr.

D. Inductively coupled plasma emission spectrometry (ICP-ES) on a Hilger E-1000 following fusion of 0.25 g samples with Li metaborate and solution in dilute HNO_3 (CSIRO): Si, Al, Fe, Mg, Ca, Ti, Ba, Be, Cr, Cu, Mn, Ni, V, Zr.

A number of elements were analysed by more than one technique (Ba, Cr, Ce, Fe, Rb, Zr). The duplicate sets of data were compared and there was satisfactory agreement between the methods; the final data set was chosen on the sensitivity of the techniques. The suffixes ".i", ".f", ".x" and ".n" to the element symbols in Figures and Tables (*e.g.*, Ba.x, Au.n) indicates analysis by ICP fusion, XRF powder, XRF fusion and INAA respectively. The precision of the data was monitored by replicate analyses of in-house standards.

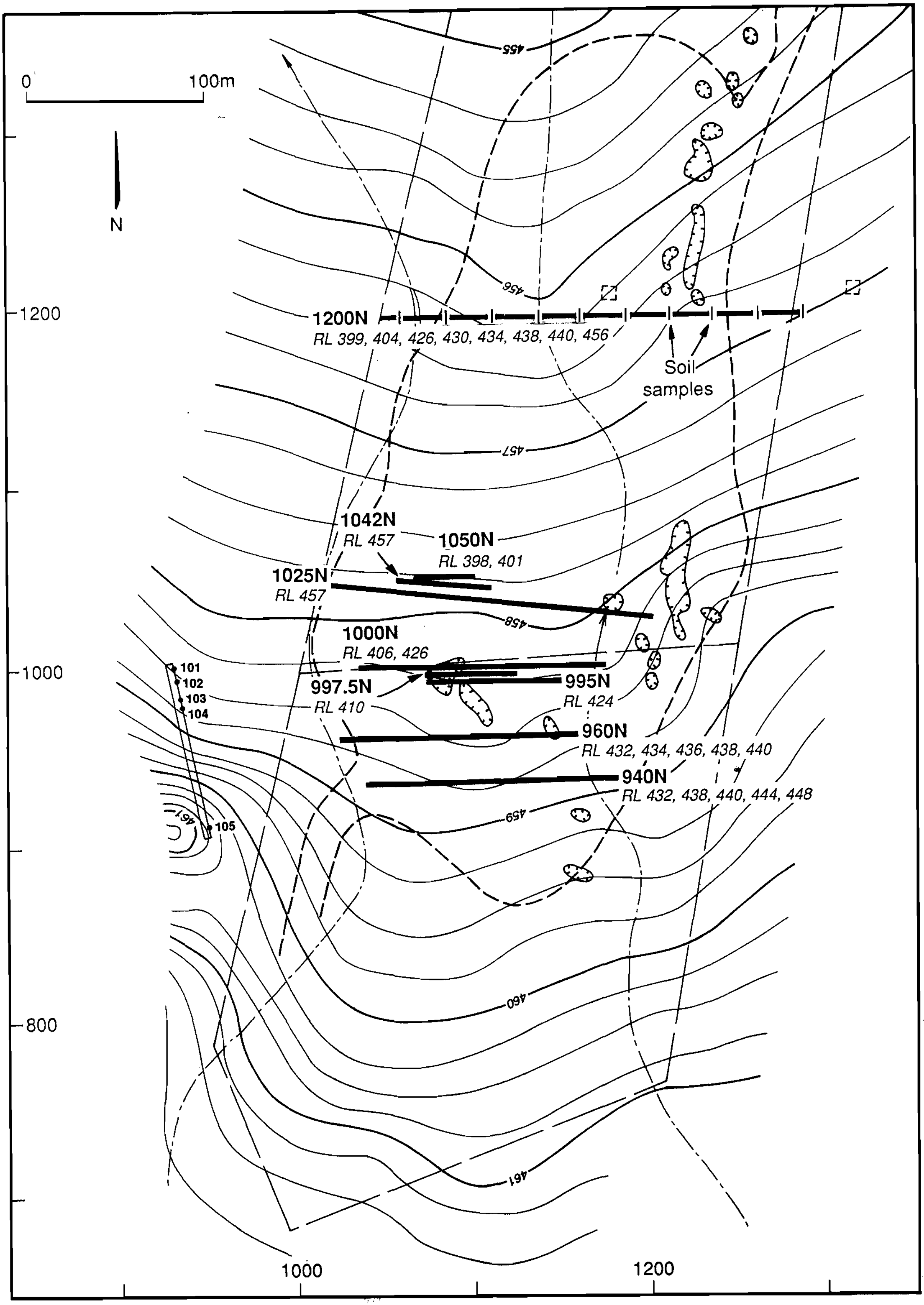


Figure 2: Location of soil and pit samples, Lights of Israel

2.3 XRD analysis

All soil samples (Robertson and Tenhaeff, 1992) and pit samples (this report) were examined by XRD, using a Philips PW1050 diffractometer, fitted with a graphite crystal diffracted beam monochromator using CuKα radiation. Each sample was scanned over the range 5-65° 2θ at a speed of 1°2θ/min and data were collected at 0.02° 2θ intervals. Mineralogical compositions were determined by comparison with JCPDS files and laboratory standards.

3 GEOLOGY AND GEOMORPHOLOGY

3.1 Geology

The sub-surface geology, as determined by Bardoc Gold Pty., Ltd., largely from percussion drilling, is illustrated in Figure 3. The mineralized zone is a strongly laminated plagioclase-biotite-amphibole schist, some 15-20 m thick (>0.5 g/t Au), which dips at 10-40° to the west and strikes north-northeast for over a kilometre (Figure 3). At its southern end, it appears to be truncated by a north-west trending fault; the mineralized zone thins to the north, where its Au grade declines. Within it are two sub-parallel, high-grade zones (>2 g/t Au). Where fresh, it is a low-sulphide deposit with sulphide contents of 1-3% (pyrite and traces of chalcopyrite) and the abundances of pathfinder elements (As, W, base metals) are low (Hellsten *et al.,* 1990). The mineralized zone does not outcrop at all, except in old stopes, and is variably weathered to 40-50 m depth. No map of the pit geology was available at the time of writing this report, although mining had been completed.

The wall rocks are tholeiitic metabasalts, now metamorphosed to amphibolite facies, with minor interflow sediments and dolerite, which have been intruded by felsic dykes and small quartz-tourmaline veinlets. Intrusive granitoids lie 200-400 m to the east. This suite of rocks comprises the Eastern Sequence of the Coolgardie-Mount Ida segment of the Norseman-Wiluna Greenstone Belt and also contains the nearby Great Ophir and Golden Eagle Au deposits (Figure 1), which are separated from the Lights of Israel deposit by a large arcuate fault and one of many north-trending shear zones.

3.2 Geomorphology and regolith

The Lights of Israel mine site is located on a very gently undulating erosional plain. Here low, smooth, broadly convex crests rise some 2 m above shallow, broad swales and associated drainage floors. The area is mantled by open eucalypt woodland with shrubs of bluebush. The eastern part of the mine site is on a slight rise and the axis is drained to the north by a small stream. The area of the mine site forms a very shallow valley that slopes gently (<1:100) to the north. The total relief is about 7 m. Two small streams are incised very slightly into this surface. Old stopes (*ca.* 1900's) show the outline of the subcrop of the mineralization.

The weathering profile has been truncated to below the mottled zone and a new, residual soil has developed from saprolite (Robertson and Tenhaeff, 1992). Parts of the soil have been eroded and minor fluvial material has been subsequently deposited. The wallrocks to the mineralisation are variably weathered to 20-30 m depth, the thickness of saprock varies considerably and blocks of saprock are enclosed in brownish saprolite. Weathering penetrates much deeper where mineralisation occurs within the mineralized biotite schist.

The upper part of the regolith is a friable, red earth (clay loam to light clay) with soft carbonate from about 200 to 700 mm depth. Beneath this, the carbonate is largely confined to discrete pockets which are absent below 1.5 m. Under the swales, the soil is underlain by a red, plastic clay that merges with saprolite at about 2-4 m. Beneath the low rises, this soil profile merges laterally to a light-brown, calcareous earth and with depth to saprolite within 1 m of the surface.

Drilling in the area to the east of the pit (1000N, 1100E; 1150N, 1120E) indicated water at a depth of 48-52 m. Analysis of the groundwater indicated a salinity about 1.5 times that of seawater; only amoderately saline for this part of the Yilgarn Block.

Accurate identification of the origin of many of the pit samples obtained from the pit was difficult. Some samples appeared to be misplaced, being considerably fresher than confining lithologies. This may be due to the extensive shearing of the lithologies (Section 3.1). These samples were discarded. A combination of hand lens examination, mineralogy and trace element geochemistry (Zr-Ti-Cr plots, Section 5.1) was used to discriminate the biotite schist and metabasalt (amphibolite). Near surface samples (*ca.* RL 457) were considerably weathered and could not be classified using the above criteria. Cross-sections of the interpreted geology along section 1200N and the composite section 940N-1050N are shown in Figures 3A and 3B.

3.3 Soil

All the Archaean rocks at the Lights of Israel mine site were deeply weathered to saprolites and completely mantled by soil and lag . The west-dipping lode subcropped along the eastern side of the mine site and was marked by a line of small shafts and stopes in which the ore zone, biotite-kaolinite-quartz schist, was exposed between walls of weathered mafic schist. These stopes and shafts also exposed the soil profile. The surface had a scattering of fine, Fe-rich lag underlain by about 600 mm of structureless, carbonate-rich, brown soil with small, ferruginous nodules. This soil contained a few, small, white, fibrous, curled crystals of halite, with admixed clay, gypsum and Fe oxides. Below this was a discontinuous gypsiferous horizon that consisted of coarse, decussate gypsum crystals, 5-20 mm in size, in a red-brown clay, overlying a carbonate-free soil and saprolite. A surface to 1 m ditchwitch trench, along section 1200N, showed that gypsum was abundant in the soil from 1165-1280E but it was apparently absent west of 1165E.

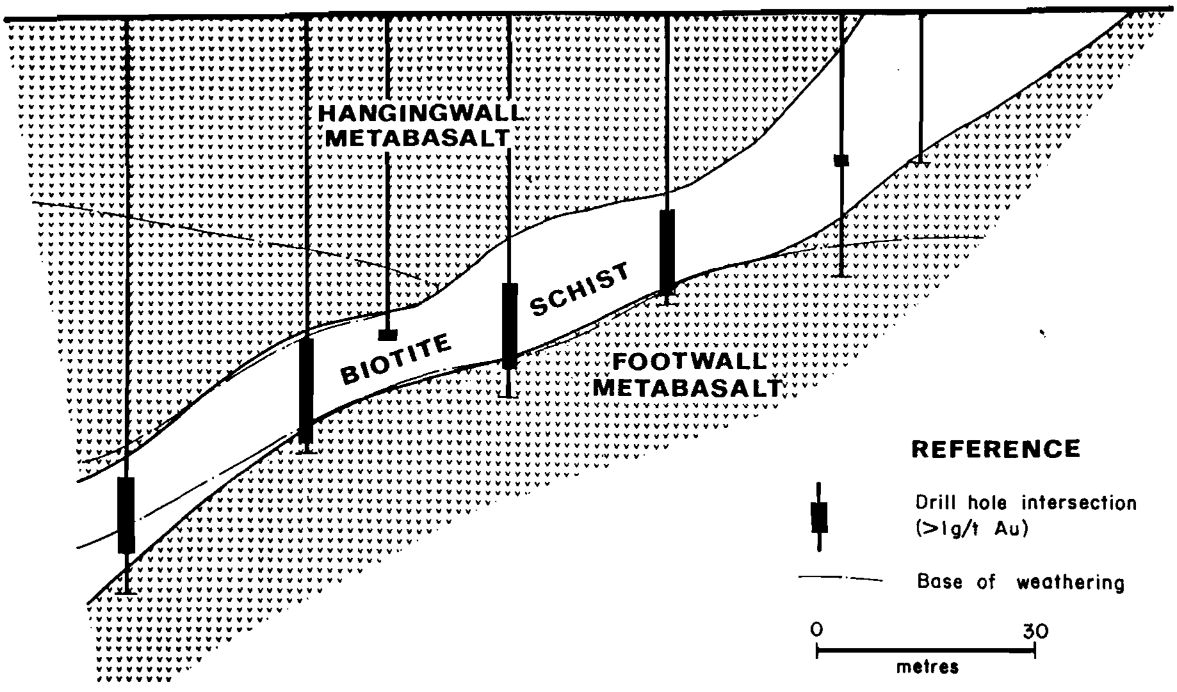


Figure 3. Cross section, looking north, of the Lights of Israel Gold Deposit (after Hellsten *et al.*, 1990)

4 MINERALOGY

4.1 Soil mineralogy

Overall, the mineralogy of the soil was found to be more complex than that of Beasley Creek or Mt. Percy. It is a mixture of quartz, kaolinite, smectite, Fe oxides (hematite, goethite, and minor maghemite), sericite, calcite, gypsum, minor anatase and K-feldspar. The complete soil shows a progressive decrease in its kaolinite content and an increase in the abundance of mica (sericite) and calcite from west to east along the soil traverse. The calcite content is reflected by high soil pH. The soil mineralogy at the Lights of Israel deposit has been discussed by Robertson and Tenhaeff (1992).

4.2 Mineralogy and petrography of fresh rock and saprolite

4.2.1 Petrography

Three samples from the Lights of Israel pit (1180N, 1150E, 45 m; 1110N, 1100E, 43 m; 1050E, 1100N, 59 m) were examined petrographically and to determine the metamorphic grade. All three samples consisted of a fine grained, schistose aggregate of quartz, feldspar and elongate actinolite grains and minor opaque minerals. The metamorphic grade is amphibolite facies, with minor retrogression to the greenschist facies and the rocks are metabasalts.

4.2.2 Mineralogy

The three main horizons between 0-2 m, 7-37 m and 42-62 m, namely soils and surficial samples, saprolite and unweathered rock, respectively, were examined to determine the effect of weathering. Locations of samples used for XRD mineralogical identification are given in Figures 4a and b and the results are given in Table 1.

The mineralogy of the near surface samples (0-2 m) and the soil (see Robertson and Tenhaeff, 1992 for full details) reflects the intense weathering that these materials have undergone. The main mineralogical constituents are: quartz, calcite, goethite, kaolinite and traces of hematite, plagioclase, chlorite and gypsum. As noted by Robertson and Tenhaeff (1992), the development of carbonate is not limited to the soil (Section 4.1). Near the surface, carbonate forms skins on saprolite blocks; at the base of this carbonate zone, crystals of gypsum occur sporadically,.

Saprolite mineralogy (7-37 m) is typical of weathered mafic to intermediate rocks and consists of quartz, plagioclase, actinolite, chlorite, smectite, kaolinite, illite and traces of goethite and hematite. The different degrees of weathering of the lithologies within the saprolite are illustrated by the mineralogies of samples 1169 and 1207, (Table 1) which, although from the same section (940N) and depth, (17 m), have mineral assemblages reflecting near-fresh and highly weathered states, respectively. Furthermore the presence of smectite (metabasalt) and/or illite (biotite schist) are thought to indicate the precursor lithologies (*e.g.*, samples 1170 and 1202, Table 1). The use of mineralogy, in conjunction with geochemistry, to differentiate between the major lithologies is discussed in detail in Section 4.3.

The fresh amphibolites at the base of the pit consist of quartz, plagioclase, actinolite and minor calcite. Traces of smectite, kaolinite, illite and goethite, however, suggest some weathering has occurred. Unfortunately, no unweathered biotite schist was sampled.

Table 1. Mineralogy of Lights of Israel pit samples

SAMPLE	DEPTH	QUARTZ	PLAGIOCLASE	ACTINOLITE	CHLORITE	SMECTITE	KAOLINITE	ILLITE	GOETHITE	HEMATITE	CALCITE	GYPSUM	ROCKTYPE	REGOLITH
1317	1	+	tr	-	-	-	-	-	tr	tr	+	tr	?	SOIL
1334	1	+	-	-	-	-	+	-	tr	tr	+	-	?	SOIL
1356	1	+	tr	-	-	-	+	-	tr	-	+	tr	?	SOIL
1369	1	+	tr	-	tr	-	+	-	tr	tr	+	tr	?	SOIL
1156	17	+	-	-	-	-	+	tr	tr	-	-	-	BS	SAP
1169	17	+	+	+	+	+	-	-	-	-	-	-	MB	SAP
1170	17	+	+	-	-	+	tr	-	tr	-	-	-	MB/BS	SAP
1202	17	+	tr	-	tr	-	+	tr	tr	tr	-	-	?	SAP
1203	17	+	-	-	-	-	+	-	+	tr	-	-	?	SAP
1207	17	+	-	-	-	-	+	-	+	tr	-	-	?	SAP
1213	17	+	-	-	tr	-	tr	tr	tr	tr	-	-	?	SAP
1226	21	+	-	-	-	-	+	-	+	tr	-	-	?	SAP
1229	25	+	-	-		-	+	tr	tr	-	-	-	?	SAP
1106	27	+	+	+	+	+	-	-	-	-	-	-	MB	SAP
1111	31	tr	+	+	+	+	-	-	tr	-	-	-	MB	SAP
1122	31	+	tr	-	-	-	+	+	tr	-	-	-	BS	SAP
1245	33	+	+	+	-	-	-	-	tr	-	-	-	MB	SAP
1151	47	+	+	-	-	+	tr	+	-	-	-	-	MB	FRESH
1272	56	+	+	+	-	tr	tr	-	tr	-	-	-	MB	FRESH
1278	58	+	+	+	-	tr	tr	+	-	-	+	-	MB	FRESH
1281	59	+	+	+	-	-	-	-	tr	-	-	-	MB	FRESH

+ abundant tr trace -absent

MB:- metabasalt; BS:-biotite schist; SAP:-saprolite; SOIL:-soil or surficial samples
FRESH:-unweathered rock; ?:-unassigned

4.3 Lithological discrimination

One of the objectives of the CSIRO/AMIRA Projects P241 and P241A has been to develop geochemical and other criteria for distinguishing lithologies. Successful lithological discrimination within the regolith depends on the presence of distinctive elements that are immobilized within resistant minerals. The most commonly used discrimination of weathered igneous rocks is that based on Ti/Zr ratios or Ti-Zr binary plots, with Cr contents used to distinguish mafic from ultramafic rocks (Hallberg, 1984).

Weathering, especially in the top 30 m of the regolith, has made it difficult to differentiate biotite schist from metabasalt, as all evidence of diagnostic primary mineralogy had been destroyed. The mineralogy of near-surface samples (e.g., quartz, kaolinite, goethite) reflect the intensity of and the ultimate products of weathering. Therefore, the nature of the precursor rocks could not be determined by mineralogy alone. Smectite, derived from weathering of actinolite, was used, where it occurred, in combination with trace element geochemistry, to differentiate between saprolitic biotite schist and metabasalt. Above a depth of approximately 7 m, all smectite is converted to kaolinite. A summary of the mineralogy of the pit samples is given in Table 1 and is discussed in Section 4.2.2.

A combination of trace element geochemistry, using two and three dimensional plots of Zr-Ti-Cr (Figures 5 and 6) and mineralogy was used to interpret the geology of sections 940N-1050N and 1200N (Figures 4a, 4b). Although 2-D scattergrams of Zr and Ti could partially differentiate lithologies and, in particular, the surficial samples and soils, from the saprolite and unweathered rock (Figure 5a, 5b), 3-D plots are better to differentiate surficial samples, soils and unweathered rock (Figure 6a, 6b). Discrimination of metabasalt from biotite schist is difficult as the biotite schist field overlaps with the metabasalt field but, in general, has higher Ti, Zr and, possibly, Cr concentrations.

The high relative concentrations of Zr in the surficial samples (particularly the soils) seem to reflect the extreme weathering near the surface coupled with a minor aeolian input from surrounding granitoid terrain. The absence of any samples of unweathered biotite schist also complicated interpretation as there was no fresh end member material with which to compare geochemically. The lack of satisfactory separation of the biotite schist from the metabasalt may reflect shearing, alteration of rock types, inclusion of felsite dykes in the sample but, most likely, composite sampling by the ditchwitch. Mineralogy, principally the presence or absence of smectites, was used in combination with the element plots, to distinguish between the biotite schist and metabasalt.

5 GEOCHEMISTRY

5.1 Data display

The element distributions from the two pit cross-sections (940N-1050N and 1200N) and soils (section 1200N only) are shown as symbol plots in Appendix 3. The plot-sybol intervals were selected on the basis of the principal populations evident in the histograms of the whole data set contained in Appendix 4. The complete geochemical analysis for each sample is given in Appendix 2. The data for each element were power-transformed (Box and Cox, 1964) and a correlation matrix was produced (Table 2). Different aspects of the distribution of some elements (*e.g.,* Au, As) are shown by emphasizing different populations, and, for these, two symbol plots were produced. Elements having similar geochemical affinities are described together. A comparative table of the ranges, means and standard deviations of all the elements is given in Table 3.

5.2 Major elements: Fe, Si, Al

These elements are commonly the principal residual products of deep chemical weathering, occurring as the oxides and oxyhydroxides (goethite, hematite, gibbsite, quartz, hyalite) or as aluminosilicates (kaolinite, halloysite, allophane). Each is, in general, enriched in the mid to lower saprolite, due to residual concentration following the leaching of other components, particularly Ca and Mg. Due to closure, their abundances and distributions are generally interdependent.

Iron is concentrated (>22% Fe_2O_3) in the saprolite (7-32 m, RL 425-450), and in the surficial samples (particularly the soils) especially on the western side of the pit. Iron in the saprolite occurs predominantly within remnant ferromagnesian minerals such as actinolite and as Fe oxides, goethite and hematite; Fe concentrations in the saprolite are greater on the composite section (940N-1050N) than on 1200N. In the surficial samples, Fe occurs as Fe oxides. The apparent depletion of Fe in the surficial samples around 1225E, on section 1200N is probably due to dilution by pedogenic carbonates.

Silicon abundances vary widely in the fresh rock and saprolite (42->58% SiO_2), where it occurs principally in both ferromagnesian and aluminosilicate minerals. Quartz is an important component of most lithologies, including ultramafic rocks, in which it occurs as an alteration product, or as quartz veins. Silicon is particularly depleted in the surficial samples on the composite section 940N-1050N and section 1200N, rarely exceeding 48% SiO_2 whereas, the soils, on section 1200N are relatively enriched in Si (generally 48-58% SiO_2).

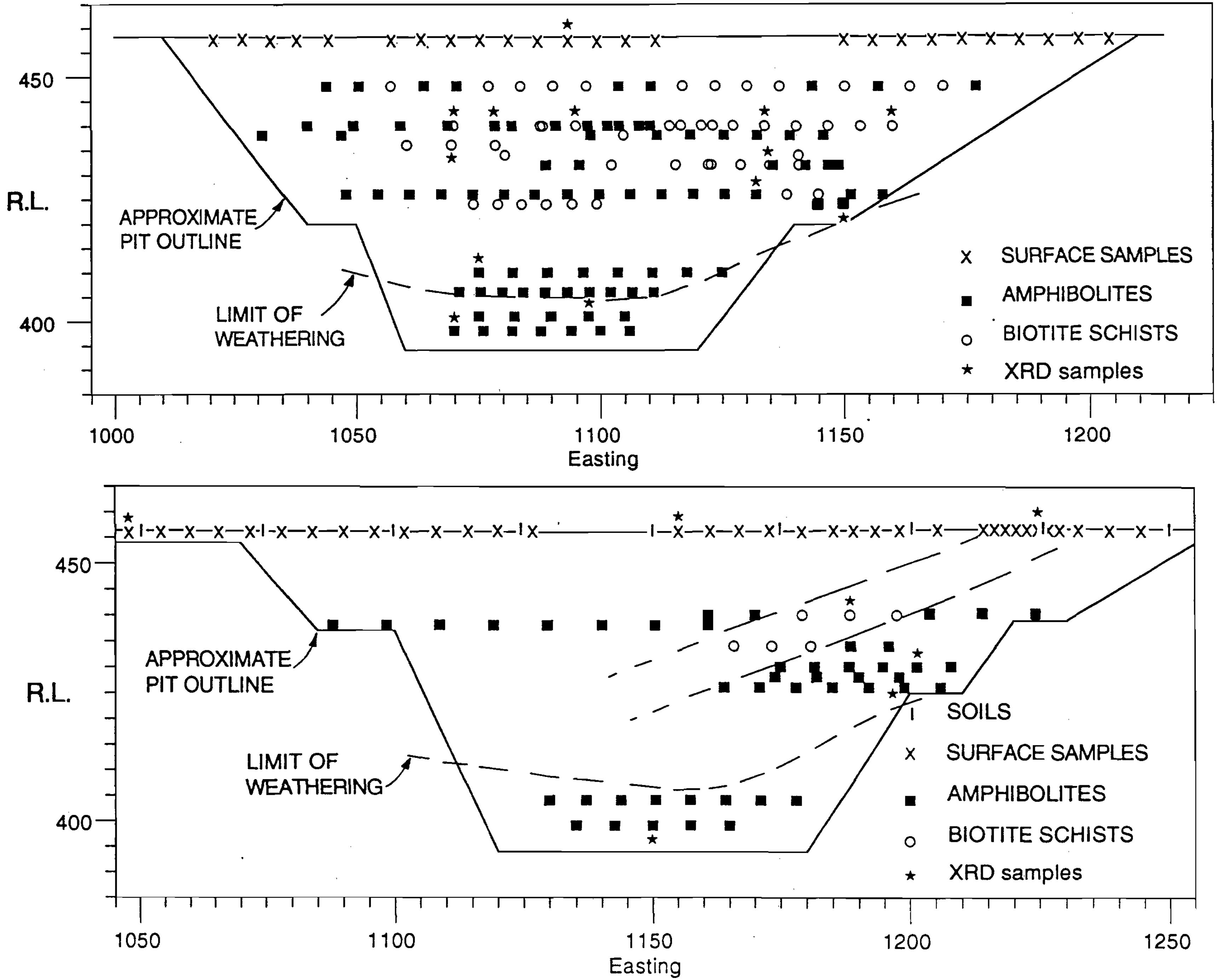
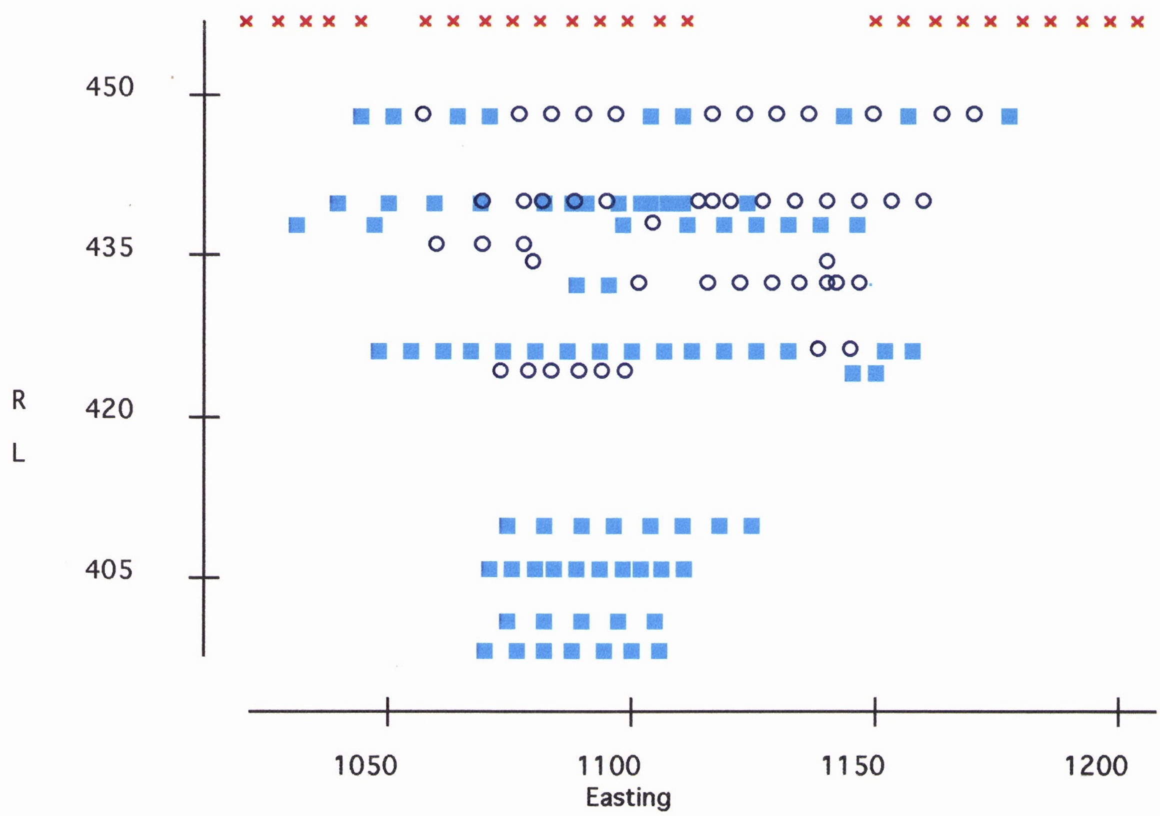


Figure 4a and 4b: Interpreted geology of the cross sections 940N-1050N (a) and 1200N (b) from the Lights of Israel Gold Mine

(a)



(b)

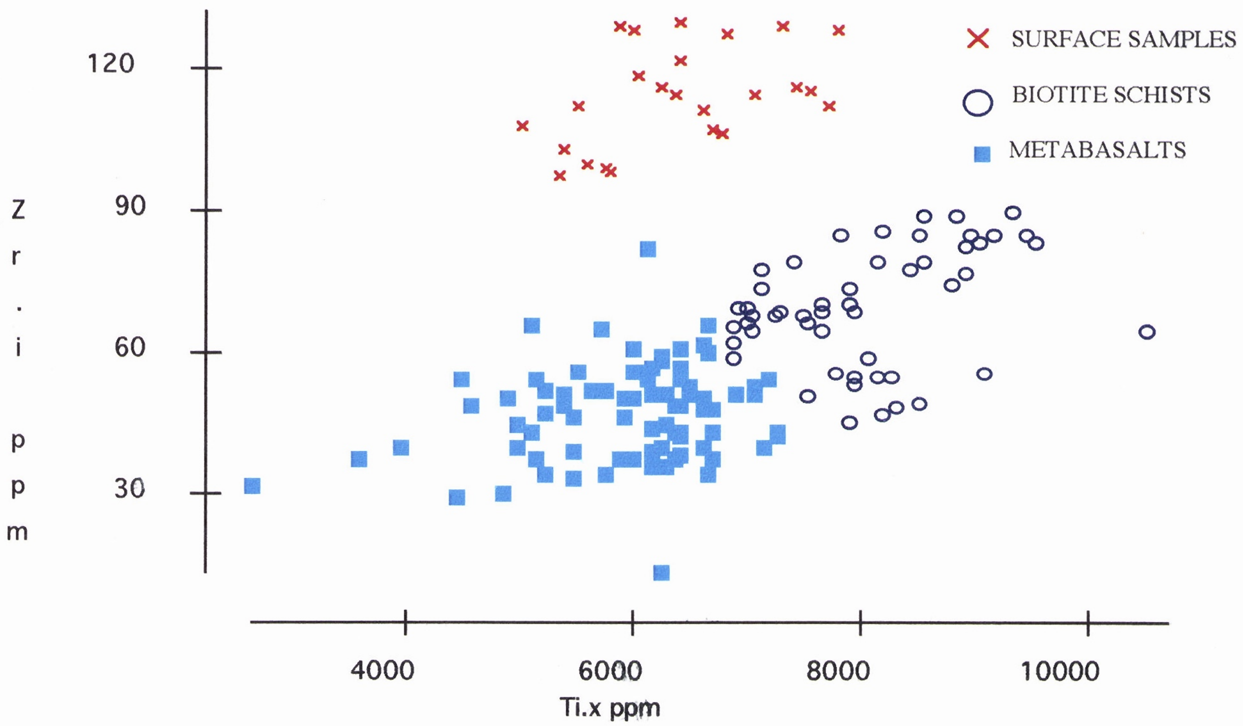
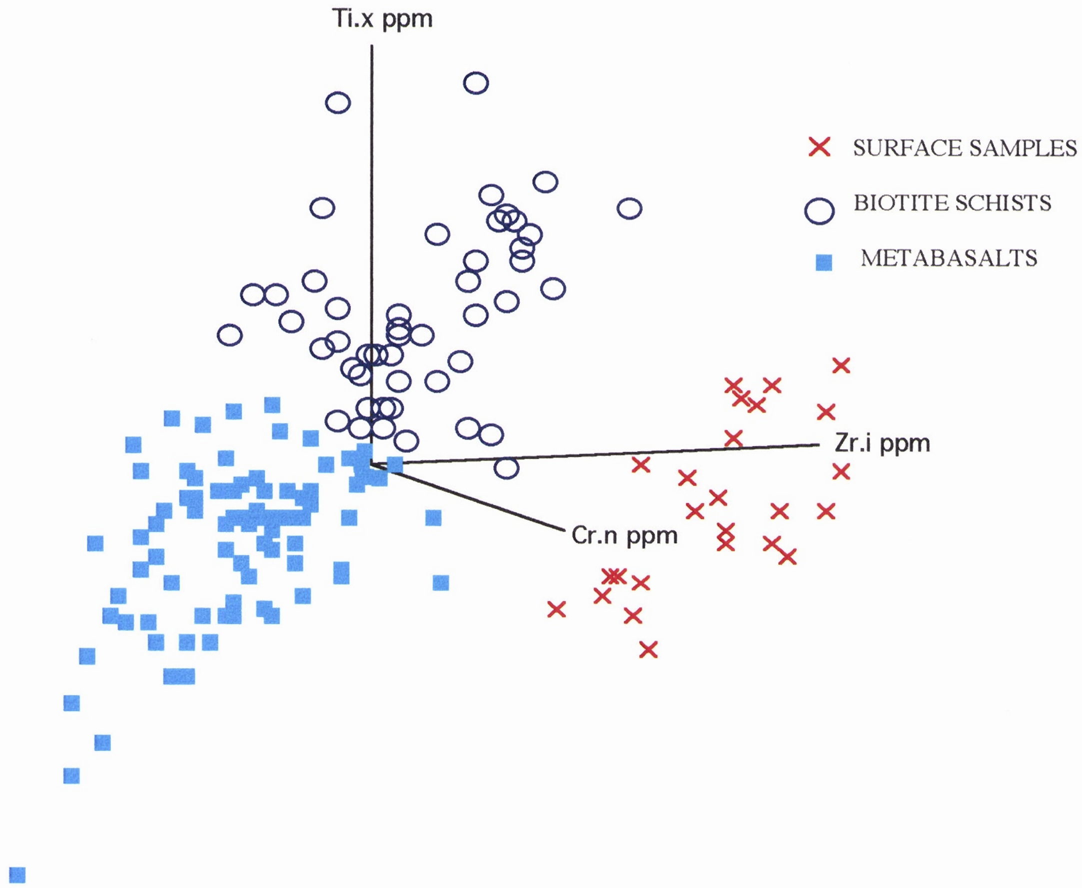


Figure 5 (a): Plot of RL vs. Easting and,
(b): Zr vs. Ti scatterplot
for Lights of Israel samples, lines 940N-1050N



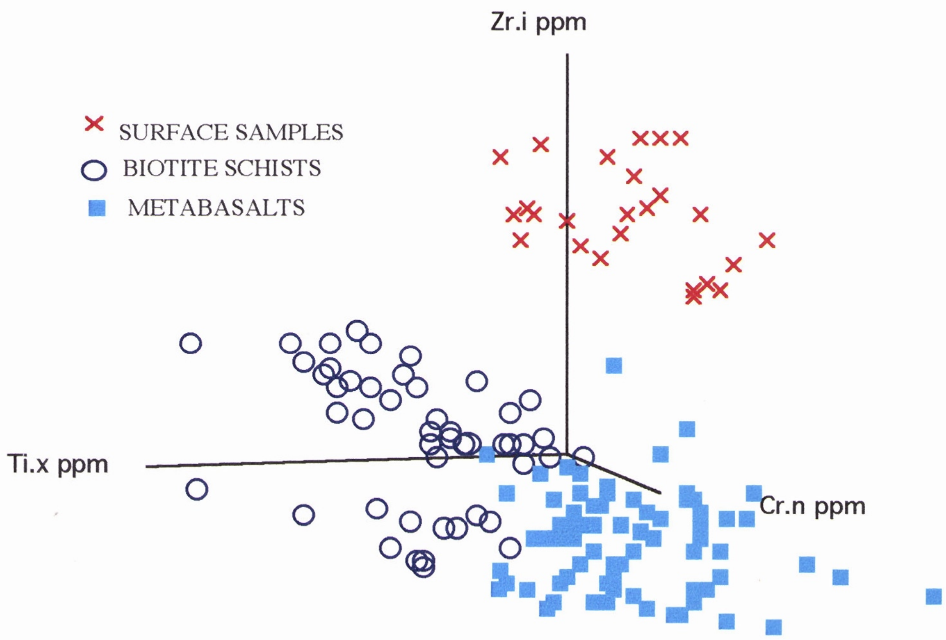
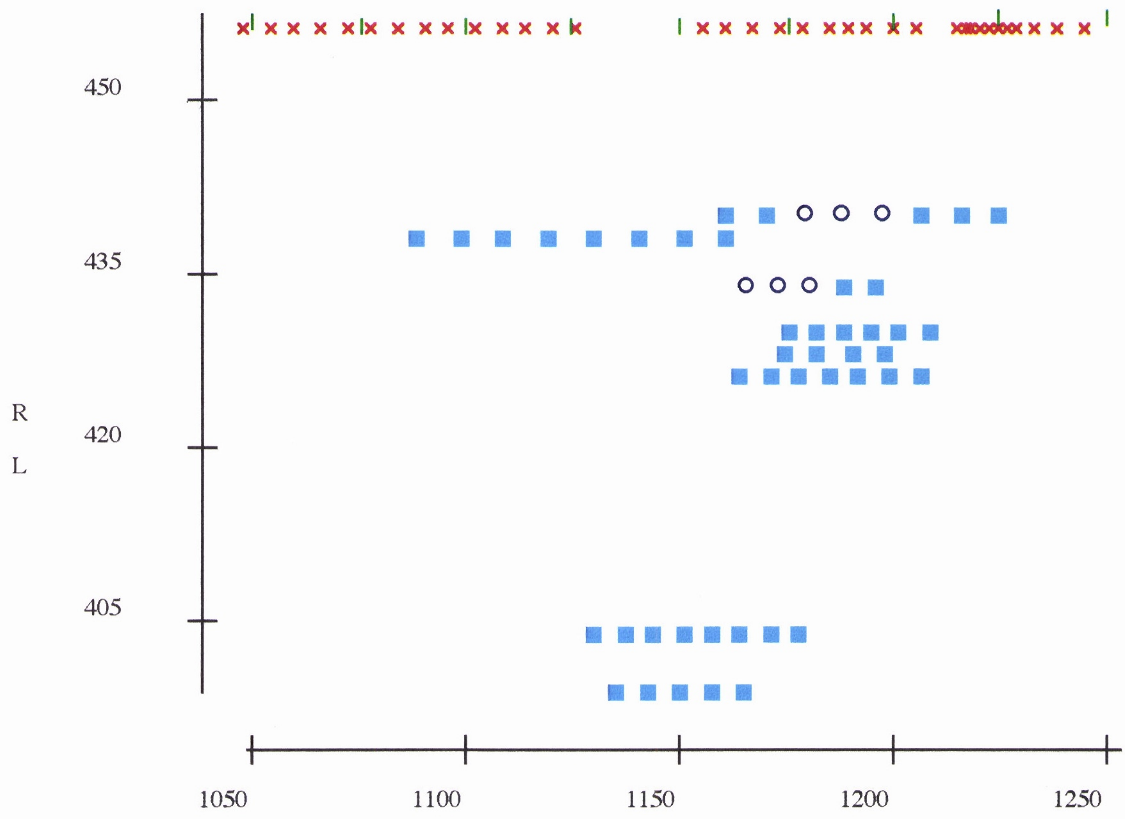


Figure 5(c): 3-D scatterplots from Lights of Israel, lines 940N-1050N

(a)



(b)

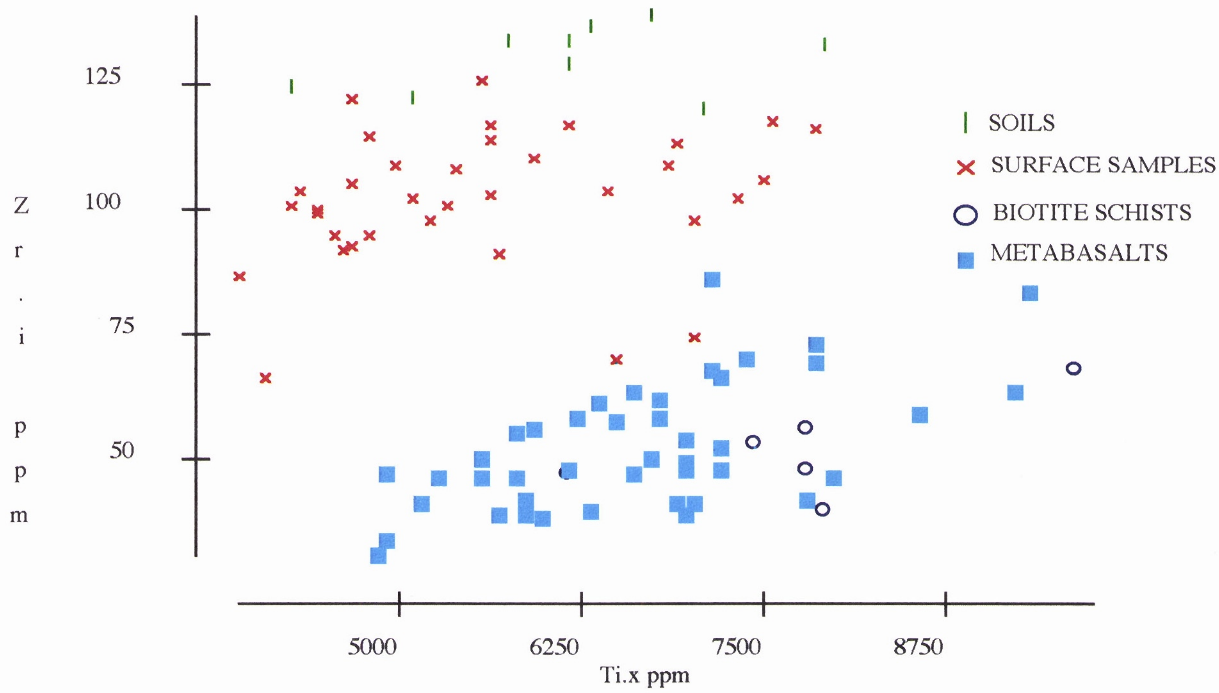
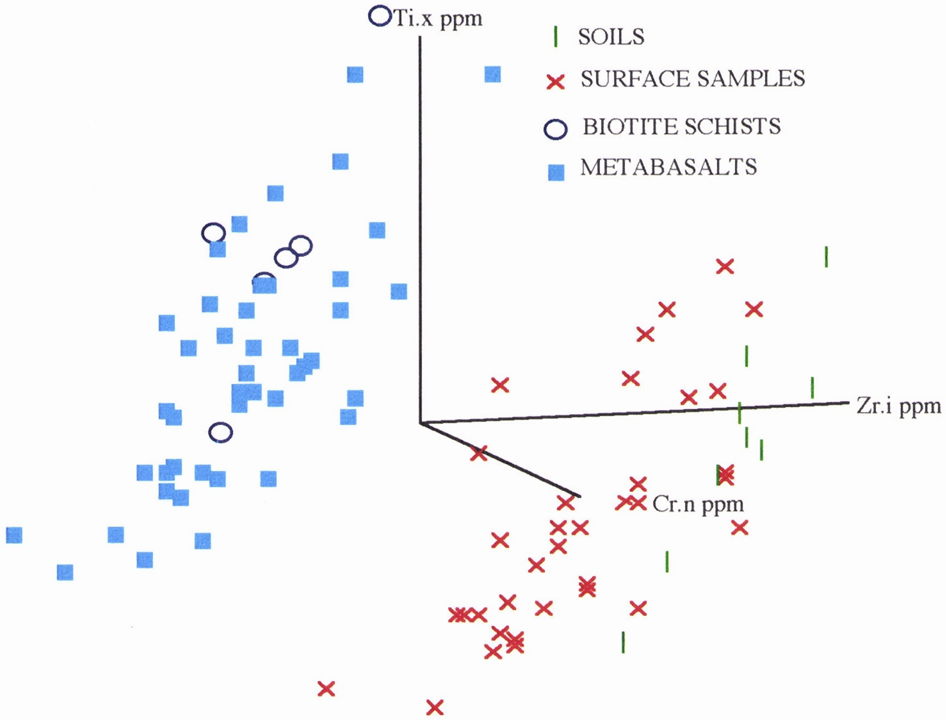


Figure 6 (a): Plot of RL vs. Easting and,
(b): Zr vs. Ti scatterplot
for Lights of Israel samples, line 1200N



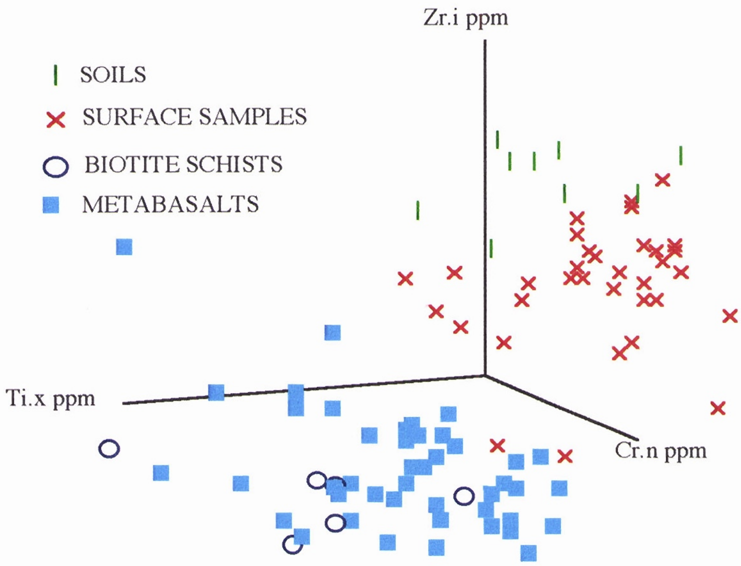


Figure 6 (c): 3-D Zr-Ti-Cr scatterplots from Lights of Israel, line 1200N

Aluminium is present in aluminosilicates (plagioclase, actinolite, kaolinite) with the highest concentrations (>20% Al_2O_3) within the saprolite (7-32 m, RL 425-450), especially in the composite section 940N-1050N.

5.3 Alkaline earth elements: Mg, Ca, Sr, Ba

The distribution of alkaline earth elements throughout the regolith at Lights of Israel, particularly Ca, is characteristic of the region. It has particular significance, given the association between carbonate alteration and mineralization in many Archaean Au deposits and the enrichment of gold in horizons containing pedogenic carbonate (Butt *et al.*, 1991; Lintern, 1989). The generally coherent behaviour of the alkaline earth elements is reflected in their correlation (Table 2).

Magnesium is abundant (generally >5.5% MgO) in the unweathered basement rocks, probably occurring within amphiboles (actinolite). It has been strongly leached from the upper saprolite, with concentrations rarely exceeding 1% MgO. Minor concentrations of Mg (ca. 2% MgO) may be present in the soils and surficial samples, probably co-precipitated with Ca carbonates.

Calcium concentrations decrease upwards through the regolith, ranging from (0-11% CaO) in the fresh rock to <1% in much of the saprolite. Localized enrichments of Ca (8-16% CaO) occur in the mid saprolite, probably due to incomplete weathering, and high concentrations (>11% CaO) are present in the soils, precipitated as pedogenic carbonate. Calcium is present in feldspar, actinolite and as calcite in the fresh rocks, throughout the regolith as calcite and as calcite and gypsum in the soils.

Strontium has a similar distribution to Ca, although it may also be significantly enriched not only in the surficial samples, but also in the saprolite and fresh rocks, commonly exceeding 200 ppm Sr.

Barium is abundant throughout the entire saprolite and unweathered rocks; it is probably contained within clays, with concentrations generally exceeding 1000 ppm Ba. It is depleted in the surficial samples and soil samples, with concentrations rarely exceeding 200 ppm Ba. It appears that, during weathering and the decomposition of feldspar, which ultimately weathers to kaolinite, Ba is not incorporated into pedogenic carbonates as with Ca and Mg. The strong correlation of Ba and Rb (r^2=0.61, Table 2) also implies that Ba (and Rb) are associated in feldspar and/or micas within the saprolite and unweathered rocks.

5.4 Elements associated with mineralization: Au, S, Sb, As, W, Mo

Primary mineralization within the Yilgarn Block is commonly associated with sulphides and minor enrichments of one or more elements such as As, Sb, W, Bi, Mo, Te and Ag. Mineralization at Lights of Israel generally has low concentrations of these elements, although the distribution plots (Appendix 3) and statistical correlations (Table 2) suggest minor enrichment of As (max. 56 ppm), W (max. 15.2 ppm) and Mo (max. 10.3 ppm). There is, however, no direct correspondence between the distribution of these elements and Au.

The Au distribution on both sections is characteristic of many deposits in the region. The distribution is patchy, even at the generally close interval used in this study. This reflects inhomogeneities in both primary and secondarily dispersed Au, as well as the presence of coarse, particulate Au. The principal features of the distribution patterns are as follows:

1. There is a widespread zone of Au enrichment close to the surface and within the soil. A significant proportion of the Au is associated with pedogenic carbonate. Samples that contain the

Table 2: Correlation matrix of power-transformed elements from soils and pit samples, Lights of Israel.

	SiO2.l	Al2O3.l	Fe2O3.x	MgO.l	CaO.l	Na2O.x	TiO2.x	P2O5.l	S.x	LOI	As.n	Au.n	Ba.x	Be.l	Ce.n	Co.n	Cr.n	Cu.x	Ga.x	Ge.x	La.n	Mn.x	Mo.n	Nb.x	Ni.x	Pb.x	Rb.x	Sb.n	Sr.x	V.x	W.n	Y.x	Zn.x	Zr.l
SiO2.l																																		
Al2O3.l	-0.02																																	
Fe2O3.x	-0.50	0.27																																
MgO.l	0.14	-0.19	-0.58																															
CaO.l	-0.28	-0.63	-0.44	0.55																														
Na2O.x	0.24	-0.14	-0.42	0.37	0.18																													
TiO2.x	-0.12	0.79	0.32	-0.31	-0.59	-0.33																												
P2O5.l	0.11	-0.22	-0.49	0.18	0.57	0.20	-0.32																											
S.x	-0.38	-0.29	0.04	-0.29	0.24	0.08	-0.34	-0.23																										
LOI	-0.63	-0.17	0.28	-0.45	0.13	-0.51	-0.07	-0.38	0.42																									
As.n	-0.26	-0.31	0.27	-0.26	0.14	-0.18	-0.09	-0.25	0.41	0.37																								
Au.n	0.13	-0.17	-0.17	0.00	-0.11	0.33	-0.32	-0.10	0.25	-0.01	0.11																							
Ba.x	0.22	0.00	-0.15	0.27	-0.13	0.29	-0.17	0.08	0.04	-0.21	-0.04	0.48																						
Be.l	0.13	0.10	0.07	-0.02	-0.24	-0.04	0.05	0.01	-0.11	-0.06	-0.02	0.31	0.24																					
Ce.n	-0.23	-0.39	-0.10	0.12	0.51	-0.12	-0.33	0.24	0.20	0.37	0.33	0.15	-0.05	0.19																				
Co.n	0.08	0.26	0.03	0.24	-0.19	0.04	0.10	0.15	-0.24	-0.13	-0.24	0.23	0.38	0.48	0.24																			
Cr.n	-0.36	0.27	0.36	-0.49	-0.16	-0.34	0.46	-0.38	0.02	0.32	0.24	-0.34	-0.32	-0.15	0.13	-0.07																		
Cu.x	0.00	0.48	0.28	-0.18	-0.59	0.06	0.30	-0.30	-0.01	-0.07	-0.08	0.54	0.33	0.28	-0.19	0.35	-0.07																	
Ga.x	0.03	0.69	0.47	-0.44	-0.72	-0.07	0.71	-0.47	-0.24	-0.11	-0.12	0.06	0.04	0.14	-0.37	0.07	0.34	0.55																
Ge.x	-0.01	0.22	0.08	0.05	-0.22	-0.12	0.22	-0.06	-0.10	-0.02	0.02	-0.02	0.05	0.01	-0.10	0.13	-0.02	0.18	0.13															
La.n	-0.33	-0.43	0.09	-0.11	0.40	-0.22	-0.31	0.00	0.30	0.53	0.48	0.13	-0.05	0.21	0.83	0.15	0.22	-0.20	-0.31	-0.13														
Mn.x	-0.02	-0.30	-0.20	0.56	0.40	0.21	-0.41	0.55	-0.13	-0.17	-0.08	0.29	0.33	0.25	0.50	0.48	-0.30	0.05	-0.26	-0.05	0.33													
Mo.n	-0.06	-0.17	-0.02	-0.03	0.19	0.09	-0.13	0.06	0.10	0.19	0.15	0.13	0.00	-0.01	0.42	0.21	0.28	-0.07	-0.11	-0.21	0.30	0.08												
Nb.x	-0.29	-0.21	0.22	-0.33	0.25	-0.22	-0.02	-0.12	0.31	0.40	0.40	-0.29	-0.34	-0.19	0.28	-0.34	0.35	-0.39	-0.06	-0.12	0.37	-0.09	0.11											
Ni.x	0.07	0.47	0.11	0.19	-0.37	-0.02	0.26	0.06	-0.37	-0.15	-0.29	0.18	0.39	0.38	-0.02	0.28	-0.01	0.49	0.22	0.19	-0.03	0.31	-0.02	-0.42										
Pb.x	-0.17	-0.32	0.18	-0.48	0.12	-0.11	-0.14	-0.31	0.32	0.42	0.50	0.08	-0.34	0.00	0.55	-0.30	0.50	-0.15	0.03	-0.21	0.43	-0.09	0.20	0.47	-0.42									
Rb.x	0.09	0.00	0.04	0.06	-0.18	-0.04	-0.09	-0.04	0.12	0.06	0.23	0.16	0.61	0.16	0.07	0.28	-0.14	0.30	-0.10	0.14	0.14	0.13	-0.06	-0.07	0.28	-0.23								
Sb.n	-0.24	-0.10	0.23	-0.16	0.12	-0.21	0.02	-0.10	0.09	0.28	0.36	-0.12	-0.06	0.04	0.23	-0.07	0.27	-0.17	-0.09	-0.11	0.37	-0.04	0.13	0.21	-0.08	0.15	0.10							
Sr.x	0.03	-0.51	-0.53	0.42	0.62	0.42	-0.66	0.35	0.24	0.01	-0.06	0.38	0.37	0.06	0.36	0.09	-0.36	-0.19	-0.44	-0.26	0.29	0.52	0.21	-0.03	-0.07	0.11	-0.02	-0.05						
V.x	-0.40	0.24	0.83	-0.57	-0.38	-0.27	0.51	-0.53	0.05	0.26	0.34	0.00	-0.11	0.05	0.04	-0.03	0.61	0.35	0.59	0.05	0.20	-0.15	0.07	0.28	0.03	0.35	-0.04	0.19	-0.37					
W.n	0.11	-0.01	-0.06	0.12	-0.09	0.17	-0.04	0.02	0.07	-0.13	0.27	0.41	0.32	0.08	0.06	0.11	-0.07	0.32	0.08	0.19	-0.01	0.08	0.23	-0.20	0.09	-0.12	0.22	0.04	0.06	0.05				
Y.x	-0.07	-0.08	-0.15	0.38	0.23	-0.07	-0.14	0.35	-0.14	0.07	0.01	0.26	0.21	0.44	0.61	0.60	-0.19	0.14	-0.19	0.08	0.59	0.62	0.08	-0.18	0.51	-0.11	0.16	0.07	0.26	-0.08	0.09			
Zn.x	0.05	0.42	0.24	0.14	-0.41	0.02	0.28	0.05	-0.26	-0.25	-0.12	0.21	0.49	0.27	-0.20	0.50	-0.13	0.59	0.36	0.24	-0.17	0.25	-0.14	-0.35	0.64	-0.45	0.41	-0.11	-0.17	0.16	0.21	0.30		
Zr.l	-0.40	-0.18	0.37	-0.46	0.20	-0.37	0.05	-0.25	0.35	0.51	0.51	-0.24	-0.38	-0.14	0.41	-0.38	0.49	-0.28	0.00	-0.08	0.57	-0.12	0.01	0.69	-0.39	0.57	-0.02	0.35	-0.09	0.44	-0.16	-0.05	-0.34	

Example	Significance
-0.03	<95%
0.10 (boxed)	95%-99%
0.15 (heavy box)	99%-99.9%
0.77 (shaded)	>99.9%

ELEMENT	MINIMUM	MAXIMUM	MEAN	STD. DEV.
SiO_2.i	33.2	77.7	47.2	6.0
Al_2O_3.i	6.1	26.8	14.2	3.1
Fe_2O_3.x	9.3	36.9	16.7	4.4
MgO.i	<0.004	7	2.6	2.0
CaO.i	<0.007	16.4	4.3	4.0
Na_2O.x	<0.007	9.7	1.6	1.6
TiO_2.x	0.4	1.8	1.1	0.2
P_2O_5.i	<0.005	0.12	0.04	0.03
S.x	<0.005	3.6	0.3	0.6
TOTAL	79.0	99.0	87.9	3.9
LOI	1.0	21.0	12.1	3.9
As.n	<2	56.0	5.5	6.3
Au.n	2	25385	1363	2791
Ba.x	8	6108	848	987
Be.i	0.0	7.0	0.5	1.0
Ce.n	0.2	137.5	14.8	15.4
Co.n	11.2	555.3	54.6	52.4
Cr.n	76.7	490	241	63
Cu.x	57	476	160	67
Ga.x	11	33	20	4
Ge.x	<3	4.0	1.1	0.9
La.n	0.6	36.5	9.1	7.7
Mn.x	166	8349	1093	791
Mo.n	0.7	10.3	3.6	1.8
Nb.x	0.0	10.0	3.6	2.1
Ni.x	61	877	140	82
Pb.x	0.0	26.0	3.8	3.8
Rb.x	1.0	136.0	26.8	19.5
Sb.n	0.1	3.8	0.6	0.5
Sr.x	4	285	130	66
V.x	202	669	376	105
W.n	0.3	15.2	2.9	2.2
Y.x	3	224	27	32
Zn.x	39	373	111	53
Zr.i	14	153	71	30

Table 3: Compilation of minimum, maximum, mean and standard deviation for Lights of Israel saprolite, basement and soil samples. Major elements in %, trace elements ppm, except Au (ppb)

most Au, especially at or near the surface and in the soils, are particularly calcareous. This is consistent with findings elsewhere in the southern Yilgarn Block, namely that pedogenic carbonate horizons are an important site for Au enrichment (e.g., Lintern, 1989; Butt, 1991).

2. Gold is not as strongly depleted as from the upper saprolite in other areas of the Yilgarn Block. Exploration drill logs and assays indicate that there are sporadic high values in the mineralized zone through this interval. Some of this Au may occur in quartz veins and be protected from weathering.

3. An apparent zone of absolute Au enrichment, with concentrations generally greater than 2 ppm Au, occurs approximately 30 m below the surface. Mineralogical analysis shows that the host rocks are moderately weathered metabasalts and that the mineralization is likely to be secondary, by analogy with other southern Yilgarn Au deposits (Butt, 1991). Although the mineralization has a shallow dip, there may also have been some lateral dispersion of Au into the wallrocks.

Sulphur. Sulphur is present in sulphides, dominantly pyrite, in the unweathered rocks but concentrations rarely exceed 0.8% in these sections. Sulphur has been leached throughout the saprolite (<0.2% S) but is sharply enriched in the soils (>2% S), occurring principally as thin horizons of gypsum (Robertson and Tenhaeff, 1992).

Antimony. The mean concentration of Sb is very low (0.6 ± 0.5 ppm) compared with some other Au deposits in the region (*e.g.*, Mt. Percy; mean 10 ± 13.5 ppm) and the distribution is somewhat erratic, with both the highest (maximum 3.8 ppm) and lowest (minimum <0.1 ppm) concentrations distributed randomly throughout the saprolite. A general enrichment of Sb is, however, present in the surficial samples and, in broad terms, the overall distribution of Sb is similar to that of Fe_2O_3, suggesting scavenging of Sb by goethite. This relationship is also supported by statistical analysis (Table 2).

Arsenic. Similar to Sb, As exhibits a somewhat random distribution, with a general enrichment within surficial samples, also probably due to scavenging by Fe oxides. Although, in general, the mean concentrations of As are low (5.5 ± 6.3 ppm, Table 3) compared to other mineralized areas within the Yilgarn Block, locally high concentrations (*ca.* 50 ppm) occur and these are related to mineralized saprolite and fresh rock.

Tungsten. The W abundance is low (mean 2.9 ± 2.2 ppm, Table 3) and rarely exceeds 10 ppm (maximum 16 ppm). The highest W concentrations occur in the saprolite and the fresh rock and the distribution is broadly similar to that of Au and As, particularly in the soils. Tungsten appears to have been leached from the upper saprolite and soils, with abundances generally below detection (5 ppm). There may be some dilution by pedogenic carbonate.

Molybdenum. Molybdenum has a similar distribution to that of W, As and Au. Some elevated concentration (>5 ppm) occur at or near the surface and these correspond to enrichments of Au. In general, Mo abundances are low (maximum 10.3 ppm, mean 3.6 ppm, Table 3) and are erratically distributed throughout the saprolite and fresh rock.

5.5 Alkalis: Na, Rb

The distribution of alkalis throughout the regolith at Lights of Israel is characteristic of weathered horizons in the Yilgarn Block. They have been strongly leached from the surface due to the weathering of micas and feldspars.

Sodium. Sodium is present in plagioclase and perthite in unweathered rocks and it is progressively leached from the lower and middle saprolite. Its distribution resembles that of Sr, except that Sr is enriched in pedogenic carbonates at the surface. Sporadic elevated concentrations of Na in the soils and surficial samples (up to 5.5% as Na_2O) are probably due to halite. Robertson and Tenhaeff (1992) described curly halite crystals in the soil.

Rubidium. The distribution of Rb is controlled by the distribution of micas. Increased concentrations of Rb on section 1200N suggest derivation from a Rb-enriched phyllic alteration halo around the mineralization (Robertson and Tenhaeff, 1992). This enrichment of Rb, however, is not apparent in the composite section 940N-1050N.

5.6 Base and transition metals: Pb, Cu, Zn, Co, Ni, Mn

These elements are considered together because of their similar geochemical behaviour in weathering environments and similar distribution patterns. Each of these base and transition metals tend to be leached under acid, reducing conditions and precipitated under alkaline, oxidizing conditions. Manganese is most strongly influenced by redox changes. In general, all of these metals are leached from the upper horizons of the regolith and are patchily enriched, together or separately, deeper in the regolith. The closest associations are between Zn, Ni and Co; co-precipitation of Co and Ni with secondary Mn oxides is a common feature in lateritic profiles in the Yilgarn Block. In general, there is a higher overall concentration of base and transition metals on the composite section 940N-1050N than on section 1200N.

Lead. The abundance of Pb is very low in both the unweathered rocks and saprolite. Sporadic high concentrations (max. 26 ppm) occur in the upper saprolite and soils; the mean concentration in soils is 8.6 ppm. The increased abundance may be due to either relative enrichment or to a transported component in the soil.

Copper and zinc. Copper and Zn display a similar distribution pattern in that they are enriched in the ferruginous zones of the mid saprolite, relative to the fresh rock and strongly depleted from the soils. This close inter-relationship is also indicated by the highly significant correlation between these two elements ($r^2 = 0.59$, Table 2). Copper and Zn probably occur as sulphides in fresh rock and have been scavenged by Fe oxides in the saprolite.

Cobalt and nickel. Cobalt and Ni have a very similar distribution pattern to that of Cu and Zn, but both, particularly Ni, are most concentrated within the lower saprolite (*ca.* 32 m, RL 425) probably within relict ferromagnesian minerals or within the clays and Fe oxides derived from them. There is also a close association of Co and Ni with Mn, particularly in the lower saprolite, suggesting co-precipitation at an active or former redox interface.

Manganese. Manganese has a similar distribution to Ni and Co, although there is significant surface concentrations of Mn (max. 2500 ppm) in the soils on section 1200N. The increased surface concentrations of Mn are probably due to the presence of Fe rich granules which is rich in Mn (Robertson and Tenhaeff, 1992). There is also a close relationship between Mn and Mg within the saprolite and the fresh rocks, implying that these metals (with Ni and Co) are hosted by the same primary ferromagnesian minerals and are released together on weathering.

5.7 Lithophile transition elements: Cr, Ti, V

These elements commonly accumulate residually in lateritic regoliths, particularly the ferruginous horizons. This is true, in varying degrees, at Lights of Israel, although there is no ferruginous zone. However, there are lesser concentrations in the eastern parts of both sections (east of *ca.*

1150E). There is substantial enrichment of Ti and, on section 940N-1050N, of V in saprolite relative to the fresh rock.

The usefulness of Ti-Cr plots (in combination with Zr) in differentiating between the biotite schist, metabasalt, soils and near surface samples was discussed in Section 4.3.

Chromium. Chromium is relatively enriched in the soils and upper saprolite. At the surface, the enrichment of Cr is related to ferruginous lag which contains elevated concentrations of Cr (Robertson and Tenhaeff, 1992). Chromium accumulation in the upper saprolite may be due to its incorporation into neo-formed clays (*e.g.*, kaolinite).

Titanium. Titanium has restricted mobility during weathering; many of its host minerals are very stable and Ti is chemically mobile only in very acid environments. Titanium thus accumulates residually in the regolith. Much of the concentration of Ti probably occurs as residual accumulation of primary and/or secondary Ti minerals or in Fe oxides derived from ilmenite.

Vanadium. The distribution of V is similar to that of both Ti and Cr in that it is enriched, relative to the unweathered basement rocks, in both the saprolite and surficial samples. This similar behaviour for all three lithophile transition elements is reflected in their highly significant inter-correlation (Table 2). The accumulation of V is similar residual accumulation and/or incorporation in neo-formed minerals during episodes of ferruginization.

5.8 Immobile elements: Zr, Nb

These elements generally exhibit little mobility in the weathering environment due to their similar geochemical characteristics. Zircon is probably the principal host mineral for both of these elements and hence the stability of zircon determines their distribution and dispersion in the weathering environment. One of the most distinctive features of these elements is their accumulation at or near the surface.

Zircon. Within the upper 1-2 m of the surface, Zr concentrations invariably exceed 120 ppm and range up to 153 ppm. Within the saprolite and unweathered basement, Zr concentrations only once exceed 100 ppm and are generally less than 50 ppm. The enrichment of Zr in the soils at Lights of Israel may be due to either two processes or by a combination of both (most likely):

1. Residual, or relative, accumulation, by leaching of more mobile components, during isovolumetric weathering;

2. Accumulation of introduced material (e.g., by wind or sheetwash) enriched in Zr, from adjacent granites.

Niobium. Niobium exhibits an almost identical distribution to Zr, in that it is consistently enriched in surficial horizons, particularly in section 1200N. However, within the composite section 940N-1050N, there are sporadic enrichments throughout the saprolite and unweathered basement samples. Given the generally low concentrations of Nb (maximum 10 ppm, mean 3.6 ± 2.1 ppm, Table 3), its erratic distribution throughout the saprolite and fresh rock, and its chemical immobility, it is probable that the concentrations at depth are primary and not due to weathering.

5.9 Rare earth elements: Y, La, Ce

Yttrium is grouped with the rare earth elements (REE) because of its similar geochemical behaviour to the heavy REE. The distributions for all REE are similar and suggest that both the light (La, Ce) and heavy (Y) REE behave coherently and thus can be discussed together. There are two main features in the distribution of the REE, namely enrichment at or near the surface, and strong accumulation of REE at about 35 m depth (*ca.* RL 425).

The accumulation of REE at the surface is due to *in situ* relative enrichment as a result of isovolumetric weathering and is, in part, due to accumulation of heavy mineral phases, in particular Zr, in introduced, material. The very similar distribution pattern at or near the surface and a close statistical relationship (Table 2) indicates that much of the REE are included in zircon.

The consistent accumulation of REE at 32 m (*ca.* RL 425) is probably due to leaching of the upper saprolite and co-precipitation with Fe and, in particular, with Mn oxides which also occur here. The saprolitic REE enrichment is similar to that observed at Mt. Percy, where it is associated with a porosity boundary in the lower saprolite.

5.10 Other elements: Ga, Ge, Be

Gallium. The occurrence and distribution of Ga generally follows those of Al and Fe^{3+}. Thus, in unweathered igneous rocks, Ga is concentrated particularly in feldspars, some amphiboles, chlorites and micas, substituting for Al. There is some minor enrichment of Ga in the surface and soils relative to the fresh rock, but the greatest enrichment occurs within the saprolite. Indeed the distribution throughout the saprolite is similar to that of Al, with some correlation between the two elements (r^2=0.69, Table 2).

Germanium. The Ge concentrations in the soil, saprolite and fresh rocks at Lights of Israel are very low. There is no evidence for any enrichment or depletion in the regolith.

Beryllium. Although Be concentrations are low (range 0-7 ppm, mean 0.5 ± 1.0 ppm) a subtle enrichment of Be occurs within the saprolite at 32 m (*ca.* RL 425). In the absence of Be minerals such as beryl, the chemistry of Be is probably determined by the weathering of phases such as feldspars in which it may be a trace constituent. During weathering of large volumes of feldspar, trace amounts of Be may become mobile. The enrichment of Be at 32 m (*ca.* RL 425) is similar to that of Mn, Co, Zn and REE.

5.11 Loss on ignition (LOI)

Loss on ignition. Loss on ignition (LOI, calculated as 100%-total of major elements) has been used as a general guide to the degree of weathering within the surface and saprolite, with LOI increasing with increased weathering and formation of hydrous clays and Fe oxyhydroxides. The highest LOI is at the surface, generally exceeding 15%. Within the saprolite, the LOI is generally in the range 11-15%, and the unweathered rocks clearly differentiated by their low LOI (ca. 0-11%). This distribution of LOI corresponds, in general terms, to the limit of weathering (Figures 4a and b) estimated from examination of pit samples.

6 DISCUSSION AND CONCLUSIONS

6.1 Element distributions and regolith evolution

6.1.1 Introduction

The geochemical data presented here are consistent with many of the general features established for the evolution of the regolith in semi-arid regions of the southern Yilgarn Block. The regolith is considered to have developed over a very long period, probably since at least the mid-Mesozoic, during which it has been subjected to several major changes of climate. Two climatic episodes have been of particular importance. These were, firstly, the humid, mostly warm to sub-tropical climates of the Cretaceous to mid-Miocene and, secondly, the drier climates since the Miocene. The former humid climates may have been equivalent to those prevailing in the present wetter savannas and gave rise to extensive, deep lateritic weathering. The later arid to semi arid climates, which still prevail, have resulted in a general lowering of water-tables and changes to, and slowing of, chemical weathering.

The distribution of each element in the regolith is related to the different weathering processes that prevailed during the principal climatic regimes. In general, only the processes that refer to past regimes of long duration or to extreme or recent regimes have had a significant effect, and this is evident in the data from Lights of Israel. Thus, many of the dominant geochemical (and mineralogical) characteristics of the regolith can be related to the development of the lateritic profile under humid conditions of higher water-tables, whereas others are due to later events related more to arid environments with lower water-tables and may be still active. The features produced by these later events appear as modifications of the pre-existing profile and tend to be reflected more by the minor components of the regolith.

6.1.2 Lateritic weathering under humid tropical climates

The characteristics commonly associated with lateritic weathering are:

1. *Oxidation of sulphides*

Sulphur is strongly leached from the deepest levels of the regolith at Lights of Israel and appears to be the element most susceptible to weathering. This observation is consistent with the conclusion that sulphides are some of the most unstable minerals in oxidizing environments, rarely persisting into the weathering zone except as supergene phases such as marcasite, chalcocite and violarite, none of which has been observed at Lights of Israel. The other elements released by oxidation of the sulphides (Fe, Cu, Zn, Pb, As, Sb) may be either leached or retained in secondary minerals such as Fe oxyhydroxides. However, other minerals also act as primary hosts of these metals, so the fate of sulphide-derived components cannot readily be determined.

2. *Strong leaching of alkalis and alkaline earths*

This applies particularly to Na, Ca and Sr, which are hosted mainly by readily weatherable minerals such as plagioclase (Na, Ca, Sr), and are reduced to very low concentrations throughout the regolith. The other alkali metals (*e.g.*, Rb) are generally less strongly leached because they are hosted principally by resistant muscovite, which may become appreciably weathered only in lateritic duricrust. However, at Lights of Israel, the biotite host is weatherable so that Rb (and K) are strongly leached. Magnesium differs from other alkaline earths as it is hosted by relatively resistant ferromagnesian phases such as actinolite and is retained in the lower to mid saprolite. Accordingly, the Mg concentration only falls to very low levels ($<1\%$ Mg) in the upper saprolite, where all ferromagnesian minerals have been weathered. Barium, which is principally contained within feldspar, is relatively enriched within the saprolite as a result of feldspar decomposition and by leaching from the surface and may be re-precipitated as secondary barite.

3. *Retention of less mobile major elements as stable secondary minerals*

One of the principal characteristics of lateritic weathering profiles is the tendency for their chemical and mineralogical compositions to be dominated by the three elements Si, Al and Fe. These are in the form of kaolinite, quartz, iron oxides (hematite and goethite) and, in places, gibbsite. The former three dominate the secondary mineral assemblages at Lights of Israel over all lithologies. The distribution of several minor and trace elements (*e.g.*, Cr, Ga, V, As and, possibly, Au) are controlled wholly, or in part, by the distributions of the major elements. In addition, many resistate and immobile elements also tend to accumulate with Fe oxides in the upper horizons although, for most, no chemical interactions are involved and may simply represent sorting during weathering and transport of overburden. The regolith is increasingly kaolinized towards the surface, with soils commonly dominated by kaolinite (Robertson and Tenhaeff, 1992). The ferruginous horizon, if ever present at Lights of Israel, has since been removed.

4. *Retention and accumulation of immobile elements and stable minerals*
The distributions of Rb, Zr, Nb, W, REE, Ti and V relate wholly or in part to their inertness during weathering, which is due to their chemical immobility (*e.g.*, V, Ti) and/or to the stability of their host minerals (*e.g.*, Zr in zircon, Ti in rutile and anatase). Their abundances tend to increase upwards throughout the profile due to the gradual loss of other components, with marked accumulation within the soils and surficial samples within which lateral dispersion by colluvial action has taken place during the course of profile evolution. Vanadium and some Ti, released during weathering, have become immobilized by precipitation with Fe oxides or as anatase (Ti). The accumulation of REE in the lower saprolite is probably related to mobility under more acid conditions (see Section 6.1.3).

The distribution of the remaining elements, particularly Co, Cu, Mn and Ni are also characteristic of lateritic environments in that they have been strongly leached from the upper horizons of the regolith. In contrast to the transition metals, however, Pb appears to be concentrated in the soils and surficial samples.

6.1.3 Weathering under semi-arid and arid climates

Characteristics commonly associated with weathering under arid conditions are those related to the excess of evaporation over precipitation, which result in the accumulation of otherwise soluble weathering products in the regolith. The most important of these are the alkali and alkaline earth metals, which concentrate in the groundwaters and precipitate as carbonates, sulphates, halides and other salts. In lateritic profiles, this results in the paradoxical accumulation of these highly mobile components in an otherwise highly leached regolith. This is well exemplified at Lights of Israel, where there is a marked concentration of Ca, Sr and, to a lesser extent, Mg and Ba, as pedogenic carbonates and sulphates. In addition, halite is abundant within the soil. The presence of smectitic and illitic clays as intermediate weathering products and minor silicification are also typical of arid weathering environments.

The distribution of Au at Lights of Israel has two characteristics that can be attributed to processes occurring under post-lateritic, probably arid conditions:

1. Lateral dispersion of Au in the mid to upper saprolite;

2. Concentration of Au in pedogenic calcretes.

Lateral dispersion of Au is a common feature in the Yilgarn Block and may be ascribed to the mobilization of metals as halide (principally chloride) complexes under acid, oxidizing conditions in arid climates (Mann, 1984; Butt, 1989). In contrast to many other Au deposits in the Yilgarn Block, however, there is little evidence of a zone of leaching in the upper saprolite horizons such as at Mt. Percy (Butt, 1991). The accumulation of Au in pedogenic carbonates is a phenomenon as yet only reported from Western Australia (e.g., Butt, 1987; Lawrance, 1988; Glasson *et al.*, 1988; Lintern, 1989; Lintern and Scott, 1990) but which is probably characteristic of arid zones elsewhere. The phenomenon seems to be related to cycling of Au and Ca by vegetation (Butt, 1987; Lintern, 1989).

The absolute enrichment of the REE in the lower saprolite is an unusual feature that has also been recognized at Mt. Percy (Butt, 1991). By analogy with the distribution of Au, it may be ascribed to mobilization under arid conditions with re-precipitation at a water-table, redox front or porosity barrier, related to a water-table.

6.2 Implications for Exploration

6.2.1 Introduction

The multi-element dispersion patterns revealed by this study have several implications for exploration for Au, as well as providing some ancillary data of relevance to exploration for other commodities. In general, the data presented in this report support the contention that, at local to sub-regional scales, Au itself is one of the best indicators of Au mineralization, despite (or perhaps because of) its chemical mobility during weathering. The principal proviso to this observation is that sampling must take into account the distribution of Au in the regolith, as exemplified by Lights of Israel and numerous other sites in the Yilgarn Block.

6.2.2 Soils and lateritic materials

Lights of Israel represents yet another example of the surface expression of Au mineralization being enhanced by the association of Au with pedogenic carbonates. These sites, mostly investigated during the course of this project include:

1. Full profile preserved: Bardoc (Freyssinet and Butt, 1988); Callion (Glasson *et al.*, 1988; Llorca, 1989); Mt. Percy (Butt, 1991); Mulline (Lintern and Butt, 1991); Zuleika (Lintern and Butt, 1992).

2. Profile partly truncated: Bounty (Lintern, 1989); Panglo (Lintern and Scott, 1990); Lights of Israel (this report; Robertson and Tenhaeff, 1992).

3. Profile truncated and overlain by transported overburden: Mt. Pleasant (Lawrance and Butt, 1992); Panglo (Lintern and Scott, 1990); Mulgarrie (Gray, 1992); Zuleika (Lintern and Butt, 1992).

The association between Au and surficial, pedogenic carbonates seems to be prevalent throughout the southern Yilgarn Block, south of the Menzies Line (Butt *et al.*, 1991).

Mineralization is also indicated by higher concentrations of other ore associated elements in the surface horizons, principally W, Sb and As. However, these elements do not appear to have wider or more consistent dispersion haloes than Au and abundances at Lights of Israel are less in comparison to other deposits.

6.2.3 *Saprolite*

Gold is present throughout the saprolite at abundances broadly similar to those in fresh rock. The distribution of other ore-associated elements is also generally consistent with the Au mineralization. However, depletion is less marked at Lights of Israel than at other sites and resembles the situation near by at Callion (Glasson *et al.*, 1988), where there is only minor depletion below the lateritic horizon. Within the saprolite, elements associated with Au mineralization *e.g.*, W, Sb, As, also have a similar distribution to Au but abundances are low and similar to those in fresh rock.

6.3 Lithological discrimination

Geochemical identification of the fresh parent rocks from their weathering products depends largely on the presence of diagnostic immobile elements or elements immobilized in resistant minerals. Ratios and plots of Ti, Zr and Cr contents are commonly effective in discriminating between major lithological groupings, whether fresh or moderately weathered, although distinctions *within* groups may have to rely on specific geochemical characteristics. It is possible, on the basis of three-dimensional Ti-Zr-Cr plots, to differentiate soils and heavily weathered uppermost saprolite from mid to lower saprolite and unweathered basement samples. Furthermore, possible inputs to the soil from nearby granite can be identified. Although less clear, perhaps due to the effects of homogenization caused by weathering and deformation (shearing), the biotite schist could be, at least in part, discriminated from its metabasalt host. The assignment of biotite schists were further confirmed by mineralogy and careful logging.

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APPENDIX 1

ANALYTICAL DETECTION LIMITS

ELEMENT	DETECTION LIMIT	METHOD
SiO_2 (wt%)	0.2	ICP
Al_2O_3 (wt%)	0.04	ICP
Fe_2O_3 (wt%)	0.03	ICP
MgO (wt%)	0.004	ICP
CaO (wt%)	0.007	ICP
Na_2O (wt%)	0.007	ICP
TiO_2 (wt%)	0.003	ICP
P_2O_5 (wt%)	0.005	ICP
S (wt%)	0.005	XRF
As (ppm)	2	INAA
Au (ppm)	0.005	INAA
Ba (ppm)	15	XRF
Be (ppm)	3	INAA
Ce (ppm)	2	INAA
Co (ppm)	1	INAA
Cr (ppm)	5	INAA
Cu (ppm)	3	XRF
Ga (ppm)	4	XRF
Ge (ppm)	3	XRF
La (ppm)	0.5	INAA
Mn (ppm)	3	XRF
Mo (ppm)	5	INAA
Nb (ppm)	3	XRF
Ni (ppm)	10	XRF
Pb (ppm)	3	XRF
Rb (ppm)	3	XRF
Sb (ppm)	0.2	INAA
Sr (ppm)	3	XRF
V (ppm)	10	XRF
W (ppm)	3	INAA
Y (ppm)	3	XRF
Zn (ppm)	3	XRF
Zr (ppm)	5	ICP

APPENDIX 2

TABULATED SAPROLITE AND SOIL GEOCHEMISTRY

SHID	Easting	Northing	RL	SiO2.i	Al2O3.i	Fe2O3.x	MgO.i	CaO.i	Na2O.x	TiO2.x	P2O5.i	S.x	LOI
101	1208	1200	430	48.80	14.98	14.15	3.96	4.92	0.04	1.20	0.08	0.01	11.86
102	1201	1200	430	49.80	15.45	13.87	4.39	6.43	0.08	1.23	0.08	0.01	8.67
103	1195	1200	430	46.80	14.02	13.58	5.93	8.69	2.14	1.13	0.07	0.00	7.64
104	1188	1200	430	47.76	13.77	13.73	5.23	8.10	1.95	1.12	0.09	0.00	8.25
105	1182	1200	430	47.72	15.15	13.30	5.81	9.77	2.10	1.08	0.09	0.00	4.98
106	1175	1200	430	45.90	14.47	13.44	5.48	8.36	1.98	1.16	0.10	0.00	9.11
107	1206	1200	426	49.68	13.73	15.30	4.18	4.35	0.06	1.17	0.08	0.01	11.45
108	1199	1200	426	46.12	12.70	16.73	4.56	4.16	0.07	1.31	0.10	0.01	14.25
109	1192	1200	426	54.58	13.76	14.87	2.26	0.92	0.08	1.13	0.03	0.01	12.36
110	1185	1200	426	53.51	14.49	15.01	4.33	0.67	1.06	1.10	0.06	0.03	9.74
111	1178	1200	426	49.23	15.02	14.44	5.16	3.72	1.84	1.20	0.09	0.04	9.26
112	1171	1200	426	44.47	13.74	13.15	5.34	6.73	0.06	0.98	0.10	0.01	15.42
113	1164	1200	426	47.72	13.29	12.87	4.85	6.90	2.21	1.05	0.08	0.01	11.03
114	1158	1000	426	54.07	13.71	15.01	3.40	1.35	0.01	1.07	0.06	0.02	11.30
115	1152	1000	426	49.76	15.63	16.01	3.69	0.75	0.05	1.08	0.04	0.04	12.94
116	1145	1000	426	49.25	17.23	15.58	2.86	0.11	1.11	1.28	0.00	0.04	12.54
117	1139	1000	426	49.23	16.69	16.44	2.22	0.78	2.70	1.26	0.02	0.05	10.61
118	1132	1000	426	45.39	12.84	25.59	2.50	0.29	1.33	1.03	0.10	0.06	10.87
119	1126	1000	426	42.25	13.48	25.73	3.61	0.27	0.91	1.06	0.05	0.03	12.60
120	1119	1000	426	44.44	14.09	21.16	2.78	0.50	2.16	1.01	0.06	0.13	13.68
121	1113	1000	426	48.16	14.57	17.73	3.63	0.73	2.55	1.12	0.06	0.08	11.37
122	1106	1000	426	52.66	14.72	15.44	3.15	0.84	3.51	1.06	0.06	0.11	8.45
123	1100	1000	426	53.26	14.42	17.73	0.82	0.18	6.31	1.05	0.04	0.11	6.08
124	1093	1000	426	49.34	13.53	18.59	1.30	0.27	4.63	0.90	0.04	0.04	11.37
125	1087	1000	426	47.89	14.06	19.02	2.44	0.62	0.08	1.07	0.04	0.03	14.76
126	1080	1000	426	50.90	14.79	16.44	2.39	0.70	0.13	1.07	0.05	0.01	13.52
127	1074	1000	426	50.97	14.45	17.87	1.45	0.49	0.13	1.08	0.06	0.06	13.44
128	1067	1000	426	54.19	14.43	14.15	1.69	0.59	5.37	1.03	0.02	0.13	8.40
129	1061	1000	426	49.21	13.93	13.44	4.48	3.67	5.53	0.99	0.07	0.03	8.65
130	1054	1000	426	45.77	12.68	13.01	4.94	4.33	5.12	0.91	0.02	0.05	13.17
131	1048	1000	426	49.30	13.95	14.15	3.72	2.80	5.44	0.99	0.02	0.01	9.61
132	1196	1200	434	53.62	14.77	15.30	1.24	0.38	3.63	1.16	0.02	0.06	9.83
133	1189	1200	434	57.38	13.69	14.01	1.54	0.57	2.04	0.98	0.01	0.06	9.72
134	1181	1200	434	49.57	15.49	15.44	3.87	0.76	0.92	1.24	0.00	0.05	12.66
135	1174	1200	434	50.24	17.69	14.58	1.70	1.48	0.04	1.30	0.03	0.03	12.91
136	1166	1200	434	47.73	17.62	15.01	1.61	1.18	1.55	1.32	0.03	0.05	13.90
137	1081	960	434	42.65	21.14	21.87	0.37	0.00	0.15	1.43	0.01	0.12	12.26
138	1141	960	434	42.96	19.62	19.59	2.35	0.12	0.56	1.39	0.04	0.08	13.29
139	1047	960	438	49.79	16.96	15.73	0.69	0.13	5.03	1.21	0.01	0.06	10.40
140	1031	960	438	52.83	14.29	15.73	1.78	1.60	2.59	1.03	0.02	0.03	10.10
141	1125	997.5	410	60.22	11.89	12.30	3.72	3.08	4.27	0.85	0.03	0.01	3.64
142	1118	997.5	410	45.68	11.32	12.44	6.74	7.11	3.86	0.90	0.04	0.02	11.90
143	1111	997.5	410	44.38	10.63	12.15	6.36	7.44	4.56	0.83	0.04	0.01	13.60
144	1104	997.5	410	51.99	13.35	12.87	4.64	3.54	4.42	0.96	0.07	0.05	8.11
145	1096	997.5	410	52.77	14.42	14.01	3.84	2.02	4.59	1.08	0.06	0.04	7.17
146	1089	997.5	410	44.03	12.43	12.30	6.09	5.84	4.69	0.87	0.05	0.05	13.66
147	1082	997.5	410	50.16	13.42	13.73	5.48	3.80	2.94	1.00	0.07	0.03	9.38
148	1075	997.5	410	58.04	12.09	11.01	4.84	3.65	3.14	0.75	0.10	0.01	6.38
149	1225	1200	440	49.77	15.15	17.59	1.13	0.49	1.42	1.20	0.00	0.08	13.18
150	1216	1200	440	48.68	15.03	18.73	0.78	0.44	0.05	1.47	0.02	0.03	14.77
151	1207	1200	440	48.34	15.61	18.16	1.16	0.54	2.03	1.19	0.00	0.09	12.89
152	1198	1200	440	57.12	13.96	16.73	0.98	0.10	1.52	1.03	0.03	0.09	8.45
153	1188	1200	440	43.98	16.05	20.73	2.15	0.01	0.41	1.30	0.00	0.11	15.26

SHID	Easting	Northing	RL	As.n	Au.n	Ba.x	Be.i	Ce.n	Co.n	Cr.n	Cu.x	Ga.x	Ge.x	La.n	Mn.x
101	1208	1200	430	3	6	407	0	12	43	231	107	17	2	7	763
102	1201	1200	430	1	7	317	0	3	38	214	84	17	2	4	999
103	1195	1200	430	0	2	326	0	4	47	238	93	16	1	4	1067
104	1188	1200	430	1	5	139	0	9	49	315	96	18	3	3	1265
105	1182	1200	430	0	2	116	0	6	26	232	75	20	2	2	1239
106	1175	1200	430	0	17	113	0	9	40	226	100	16	1	5	1053
107	1206	1200	426	1	85	278	0	11	75	196	177	19	1	7	1236
108	1199	1200	426	2	159	577	1	18	69	152	201	19	2	11	1710
109	1192	1200	426	4	4156	936	3	13	52	223	183	23	0	12	1188
110	1185	1200	426	12	261	1879	1	7	69	204	178	17	3	5	724
111	1178	1200	426	19	145	3700	0	11	57	215	123	18	1	6	1224
112	1171	1200	426	2	15	531	0	11	55	207	103	16	1	5	1043
113	1164	1200	426	1	8	220	0	8	42	203	92	18	2	4	975
114	1158	1000	426	5	7049	1058	3	10	149	168	182	20	3	9	1944
115	1152	1000	426	4	822	842	4	16	110	79	247	19	1	9	2798
116	1145	1000	426	16	17806	1079	6	50	148	238	298	24	2	24	1545
117	1139	1000	426	6	9430	1129	6	62	191	227	281	23	1	36	1803
118	1132	1000	426	4	1896	1317	7	75	555	147	222	17	2	31	2580
119	1126	1000	426	1	506	1339	5	41	185	189	185	16	2	33	2162
120	1119	1000	426	4	1127	3109	2	7	69	179	171	18	2	9	1414
121	1113	1000	426	2	562	3609	0	8	127	204	208	19	2	6	1138
122	1106	1000	426	1	4142	4815	1	12	102	234	181	24	1	5	998
123	1100	1000	426	2	8178	3676	3	6	60	266	166	26	0	4	1639
124	1093	1000	426	3	3216	1882	0	9	94	234	188	21	0	5	4064
125	1087	1000	426	2	3759	2348	0	10	156	289	228	18	2	8	3567
126	1080	1000	426	1	5367	1521	3	16	92	215	217	22	0	13	2744
127	1074	1000	426	2	2714	3440	4	8	124	197	207	26	1	9	1661
128	1067	1000	426	2	4182	5763	2	11	92	208	197	28	1	7	1529
129	1061	1000	426	1	3390	1424	1	8	74	257	200	22	1	5	1447
130	1054	1000	426	1	5404	2356	0	8	63	252	174	25	0	4	1757
131	1048	1000	426	1	6428	466	0	7	67	211	213	25	0	5	2035
132	1196	1200	434	2	135	994	0	5	41	210	196	22	1	3	674
133	1189	1200	434	6	749	1336	0	3	39	198	152	20	2	2	406
134	1181	1200	434	56	13	1538	0	5	51	230	152	20	2	3	613
135	1174	1200	434	4	7	515	0	4	33	249	107	17	0	2	290
136	1166	1200	434	2	362	396	0	3	27	243	119	20	0	3	291
137	1081	960	434	10	591	128	1	1	27	268	321	29	1	2	306
138	1141	960	434	5	48	1049	1	11	100	255	271	23	2	2	1519
139	1047	960	438	1	651	824	2	7	74	290	226	30	2	3	2182
140	1031	960	438	1	208	480	0	7	40	198	166	20	1	4	611
141	1125	997.5	410	3	1635	628	1	5	45	153	196	21	1	4	1591
142	1118	997.5	410	2	2092	991	2	5	47	143	196	18	1	3	1470
143	1111	997.5	410	2	4239	429	0	6	61	180	191	18	0	5	1882
144	1104	997.5	410	2	6428	1334	1	7	64	197	171	19	2	5	1285
145	1096	997.5	410	2	5078	1076	3	10	66	220	192	23	1	4	1423
146	1089	997.5	410	1	4248	1337	1	7	46	170	164	20	1	3	1163
147	1082	997.5	410	1	1900	1253	0	9	66	183	169	21	1	4	1215
148	1075	997.5	410	2	1529	446	0	17	40	133	128	19	1	11	852
149	1225	1200	440	1	5	431	0	2	33	201	164	23	1	2	310
150	1216	1200	440	0	11	357	1	1	42	170	171	23	1	2	388
151	1207	1200	440	1	15	1363	1	1	32	189	167	25	0	3	628
152	1198	1200	440	5	293	1606	0	3	51	217	139	23	2	3	481
153	1188	1200	440	4	30	1135	0	1	74	269	209	20	3	2	631

LIGHTS OF ISRAEL - SAPROLITE

SHID	Easting	Northing	RL	Mo.n	Nb.x	Ni.x	Pb.x	Rb.x	Sb.n	Sr.x	V.x	W.n	Y.x	Zn.x	Zr.i
101	1208	1200	430	2	3	132	0	28	1	156	272	3	51	95	66
102	1201	1200	430	2	1	121	0	16	0	136	271	2	33	92	70
103	1195	1200	430	2	1	139	1	18	1	130	270	1	28	99	58
104	1188	1200	430	10	2	128	0	6	0	130	281	2	23	91	50
105	1182	1200	430	2	1	100	2	6	0	124	273	1	18	97	69
106	1175	1200	430	2	3	116	0	7	0	126	299	1	29	94	39
107	1206	1200	426	5	2	159	1	12	0	95	329	2	48	126	41
108	1199	1200	426	5	6	102	0	14	0	97	425	3	49	123	69
109	1192	1200	426	2	1	182	1	28	0	249	364	3	59	143	62
110	1185	1200	426	2	3	190	0	83	1	85	274	12	25	126	63
111	1178	1200	426	5	5	135	0	50	2	162	321	3	33	116	52
112	1171	1200	426	4	4	115	2	17	1	125	279	2	23	103	39
113	1164	1200	426	4	3	100	2	13	0	117	276	2	21	94	40
114	1158	1000	426	3	3	254	2	67	0	150	310	13	43	186	49
115	1152	1000	426	1	2	268	0	60	1	107	353	1	149	205	53
116	1145	1000	426	3	3	327	3	48	0	61	450	4	135	268	68
117	1139	1000	426	3	3	392	3	31	2	167	409	4	196	304	66
118	1132	1000	426	3	1	418	2	58	3	72	342	4	202	373	51
119	1126	1000	426	2	0	394	3	135	0	56	334	1	224	305	49
120	1119	1000	426	2	1	235	0	85	2	96	317	1	65	196	56
121	1113	1000	426	6	0	263	0	57	1	158	351	2	30	206	48
122	1106	1000	426	6	2	270	0	31	0	176	370	3	25	125	37
123	1100	1000	426	7	5	158	2	8	0	172	506	4	24	94	45
124	1093	1000	426	7	4	173	2	21	0	162	376	3	25	118	51
125	1087	1000	426	7	2	329	5	29	0	196	409	3	33	204	54
126	1080	1000	426	3	2	331	5	22	1	220	391	1	51	235	61
127	1074	1000	426	3	3	235	6	13	0	204	363	2	42	231	51
128	1067	1000	426	6	3	166	4	14	0	235	301	3	31	140	57
129	1061	1000	426	6	3	193	7	5	0	235	365	3	26	107	50
130	1054	1000	426	10	1	192	9	6	0	201	325	3	25	98	39
131	1048	1000	426	3	2	213	11	8	0	233	397	1	27	110	46
132	1196	1200	434	5	4	106	26	26	0	225	436	6	20	110	48
133	1189	1200	434	5	2	110	4	41	0	138	310	3	11	86	42
134	1181	1200	434	4	2	125	0	84	1	83	356	2	12	119	53
135	1174	1200	434	6	3	129	3	31	1	104	257	4	17	96	56
136	1166	1200	434	4	4	119	0	22	1	101	296	2	9	90	40
137	1081	960	434	2	3	147	9	19	0	6	503	3	10	139	88
138	1141	960	434	4	2	184	0	71	0	44	464	2	13	169	48
139	1047	960	438	7	2	147	5	20	0	192	492	4	11	80	42
140	1031	960	438	5	2	147	0	18	0	155	387	2	19	99	36
141	1125	997.5	410	2	4	112	1	22	0	201	283	9	16	87	43
142	1118	997.5	410	2	1	126	4	21	4	214	302	4	21	97	49
143	1111	997.5	410	6	0	139	8	11	0	196	307	3	25	98	40
144	1104	997.5	410	2	1	162	2	21	0	209	328	3	24	113	52
145	1096	997.5	410	6	6	154	3	16	0	216	388	4	23	129	51
146	1089	997.5	410	6	2	137	1	13	0	202	318	6	19	100	34
147	1082	997.5	410	5	5	130	2	44	0	225	340	2	20	106	37
148	1075	997.5	410	4	3	99	2	24	0	207	255	3	14	97	54
149	1225	1200	440	4	3	104	1	21	0	67	342	2	6	97	48
150	1216	1200	440	2	4	97	4	14	0	75	356	1	9	94	107
151	1207	1200	440	2	7	101	3	27	0	163	404	3	9	124	86
152	1198	1200	440	8	2	111	3	43	0	101	360	8	7	91	47
153	1188	1200	440	4	3	157	2	86	0	24	486	8	6	125	48

LIGHTS OF ISRAEL - SAPROLITE

SHID	Easting	Northing	RL	SiO2.i	Al2O3.i	Fe2O3.x	MgO.i	CaO.i	Na2O.x	TiO2.x	P2O5.i	S.x	LOI
154	1179	1200	440	43.37	20.72	18.73	3.06	0.18	0.39	1.61	0.00	0.06	11.88
155	1170	1200	440	47.21	17.95	17.01	1.10	0.83	1.06	1.54	0.00	0.07	13.23
156	1161	1200	440	51.95	16.47	17.30	1.23	0.91	1.19	1.43	0.00	0.06	9.46
157	1161	1200	438	45.13	19.28	15.15	1.90	0.44	0.02	1.33	0.00	0.02	16.72
158	1151	1200	438	47.54	15.48	14.87	3.34	3.83	0.03	1.30	0.07	0.01	13.53
159	1140	1200	438	48.60	15.08	13.58	3.96	5.18	0.06	1.24	0.10	0.01	12.19
160	1130	1200	438	57.20	14.56	14.58	0.98	0.13	1.45	1.00	0.01	0.07	10.02
161	1119	1200	438	47.68	13.48	12.15	5.44	8.06	1.88	0.97	0.07	0.00	10.27
162	1109	1200	438	48.71	13.07	12.58	4.51	5.95	0.05	1.08	0.07	0.00	13.98
163	1098	1200	438	46.71	15.02	13.58	4.20	5.41	0.05	1.16	0.07	0.01	13.79
164	1088	1200	438	46.18	13.68	13.44	5.20	6.97	0.05	1.10	0.07	0.01	13.30
165	1088	940	440	47.49	14.96	13.87	3.95	4.89	0.05	1.21	0.07	0.01	13.50
166	1078	940	440	49.26	15.50	14.01	4.03	5.13	0.06	1.18	0.06	0.01	10.76
167	1069	940	440	37.59	12.59	12.72	6.53	8.83	0.06	1.06	0.07	0.01	20.53
168	1059	940	440	45.87	14.92	13.73	4.69	6.39	0.05	1.18	0.09	0.01	13.07
169	1050	940	440	43.78	12.83	12.44	5.66	5.50	1.64	0.98	0.10	0.02	17.05
170	1040	940	440	44.21	14.04	13.15	4.81	5.86	0.03	1.10	0.05	0.02	16.73
171	1177	940	448	52.93	14.85	16.73	1.05	1.14	0.04	1.20	0.03	0.03	12.00
172	1170	940	448	49.35	16.41	17.16	0.87	1.19	1.57	1.32	0.01	0.06	12.06
173	1164	940	448	49.58	16.61	17.16	0.96	0.18	0.59	1.16	0.00	0.09	13.67
174	1157	940	448	57.70	14.75	15.15	0.65	0.04	0.41	1.11	0.00	0.09	10.10
175	1150	940	448	61.28	14.10	14.58	0.50	0.05	0.41	1.36	0.00	0.12	7.60
176	1144	940	448	50.54	13.86	23.45	0.80	0.06	0.34	1.07	0.00	0.13	9.75
177	1137	940	448	51.41	17.08	19.44	0.03	0.21	0.54	1.33	0.01	0.11	9.84
178	1130	940	448	37.24	22.19	25.88	0.02	0.00	0.18	1.58	0.00	0.11	12.80
179	1124	940	448	40.21	19.43	24.16	0.56	0.00	0.22	1.17	0.00	0.15	14.10
180	1117	940	448	42.98	21.12	21.73	0.46	0.28	0.45	1.35	0.01	0.09	11.53
181	1111	940	448	42.89	18.43	23.16	0.35	0.20	0.55	1.00	0.00	0.14	13.28
182	1104	940	448	44.56	17.91	23.16	0.35	0.04	0.62	1.18	0.01	0.12	12.05
183	1097	940	448	44.37	21.01	19.73	0.23	0.04	0.51	1.42	0.01	0.09	12.59
184	1091	940	448	47.58	19.12	18.30	1.81	0.01	0.39	1.19	0.00	0.09	11.51
185	1084	940	448	51.36	18.25	16.44	0.57	0.27	2.28	1.24	0.02	0.11	9.46
186	1077	940	448	52.86	16.69	14.87	1.00	0.72	2.34	1.17	0.00	0.08	10.27
187	1071	940	448	46.89	17.34	16.30	0.88	1.23	1.84	1.10	0.00	0.06	14.36
188	1064	940	448	50.37	16.77	14.87	0.79	0.82	2.43	1.07	0.02	0.06	12.80
189	1057	940	448	53.61	16.54	15.30	0.54	0.51	5.08	1.28	0.00	0.05	7.10
190	1051	940	448	47.74	12.99	12.01	5.65	7.27	2.34	0.92	0.03	0.02	11.04
191	1044	940	448	48.63	14.81	16.73	3.81	3.30	1.65	1.03	0.04	0.03	9.97
192	1082	960	440	52.69	16.23	14.44	0.83	0.35	4.11	1.10	0.00	0.05	10.20
193	1070	960	440	49.49	17.69	15.44	0.77	0.93	2.85	1.15	0.01	0.05	11.62
194	1123	940	440	48.91	14.99	13.44	5.24	8.49	2.35	1.19	0.10	0.01	5.29
195	1117	940	440	48.18	14.90	13.73	5.85	9.45	2.19	1.15	0.09	0.00	4.47
196	1110	940	440	63.85	11.03	12.72	1.06	0.46	2.57	0.91	0.01	0.04	7.35
197	1104	940	440	62.97	11.23	14.15	0.17	0.11	4.13	0.87	0.01	0.09	6.27
198	1097	940	440	77.69	6.10	9.29	0.57	0.05	1.45	0.44	0.00	0.04	4.36
199	1091	940	440	54.44	14.06	17.16	2.47	0.47	0.68	1.12	0.03	0.06	9.51
200	1160	960	440	47.54	20.60	17.87	0.00	0.00	0.36	1.49	0.00	0.13	12.01
201	1154	960	440	44.05	26.84	12.87	0.00	0.04	0.25	1.76	0.01	0.08	14.11
202	1147	960	440	50.92	16.34	19.87	0.00	0.00	0.34	1.15	0.00	0.12	11.26
203	1141	960	440	39.02	21.12	24.30	0.03	0.01	1.68	1.37	0.00	0.16	12.31
204	1134	960	440	37.21	17.45	31.60	0.30	0.02	0.30	1.47	0.00	0.15	11.51
205	1128	960	440	36.47	19.61	28.17	0.00	0.00	0.41	1.59	0.00	0.16	13.59
206	1121	960	440	41.82	17.12	26.45	0.22	0.03	0.27	1.33	0.00	0.14	12.62

SHID	Easting	Northing	RL	As.n	Au.n	Ba.x	Be.i	Ce.n	Co.n	Cr.n	Cu.x	Ga.x	Ge.x	La.n	Mn.x
154	1179	1200	440	48	7	1440	0	1	44	256	141	23	2	2	403
155	1170	1200	440	1	5	1585	0	2	44	257	108	21	1	1	226
156	1161	1200	440	3	5	1110	0	2	49	261	113	20	1	2	264
157	1161	1200	438	1	5	452	0	15	34	237	92	20	2	7	239
158	1151	1200	438	0	7	407	1	56	154	235	104	17	1	17	1257
159	1140	1200	438	1	6	318	0	5	40	224	99	17	2	3	1100
160	1130	1200	438	9	53	2094	0	1	30	258	106	23	2	2	254
161	1119	1200	438	1	5	117	0	5	31	202	71	16	2	3	789
162	1109	1200	438	1	5	121	0	2	17	216	89	17	1	3	856
163	1098	1200	438	1	7	200	0	17	126	231	97	17	1	11	959
164	1088	1200	438	1	5	373	0	8	57	232	95	19	2	5	1289
165	1088	940	440	1	6	431	0	15	158	240	87	18	2	9	1758
166	1078	940	440	1	2	124	0	16	51	249	88	18	2	6	905
167	1069	940	440	0	2	90	0	10	24	199	85	16	2	7	440
168	1059	940	440	1	7	209	0	9	67	266	82	17	1	6	1489
169	1050	940	440	1	5	177	0	8	65	200	102	16	1	6	1031
170	1040	940	440	0	6	226	0	60	219	217	97	15	2	21	1308
171	1177	940	448	3	7	71	0	3	23	209	182	25	1	2	262
172	1170	940	448	6	45	354	1	3	31	226	204	20	2	3	305
173	1164	940	448	28	329	1093	1	1	33	263	222	21	2	2	302
174	1157	940	448	14	581	541	1	0	49	252	208	23	0	2	321
175	1150	940	448	8	2416	1866	2	2	27	195	198	24	1	3	247
176	1144	940	448	5	378	482	1	1	52	281	256	17	1	2	308
177	1137	940	448	1	66	42	0	1	23	312	171	21	1	1	260
178	1130	940	448	1	12	132	0	1	30	397	211	27	0	1	278
179	1124	940	448	0	5	3967	0	1	24	361	176	23	1	8	694
180	1117	940	448	1	32	572	0	2	35	374	153	24	2	1	312
181	1111	940	448	0	5	1693	0	1	54	340	169	24	1	4	548
182	1104	940	448	1	13	426	0	3	55	341	166	24	1	2	525
183	1097	940	448	1	1193	900	0	1	34	369	154	25	0	2	347
184	1091	940	448	1	25	3069	1	1	36	281	194	26	3	2	468
185	1084	940	448	1	359	1046	0	3	45	237	208	28	1	5	592
186	1077	940	448	1	30	801	0	1	33	209	157	21	0	2	361
187	1071	940	448	1	9599	226	0	3	33	280	183	22	0	3	348
188	1064	940	448	1	9424	640	0	5	38	263	196	25	1	2	342
189	1057	940	448	1	2521	579	0	9	62	210	210	26	1	6	706
190	1051	940	448	1	63	310	0	5	21	233	130	16	1	3	778
191	1044	940	448	1	5	860	0	3	45	366	308	17	0	2	720
192	1082	960	440	1	3518	1505	1	1	38	248	190	27	1	3	800
193	1070	960	440	1	490	463	1	5	46	223	203	23	0	3	1081
194	1123	940	440	0	6	154	0	3	42	222	100	18	1	3	1195
195	1117	940	440	0	6	114	0	2	23	230	82	20	1	2	1301
196	1110	940	440	2	387	602	1	1	28	185	102	21	1	1	271
197	1104	940	440	4	281	584	1	1	14	186	109	25	2	2	453
198	1097	940	440	5	1512	669	0	1	11	96	67	11	2	1	340
199	1091	940	440	9	10	554	0	3	39	228	136	19	1	1	442
200	1160	960	440	3	660	35	1	2	22	310	349	29	2	1	318
201	1154	960	440	3	664	23	0	3	14	354	476	33	2	1	166
202	1147	960	440	2	2061	88	0	1	18	237	290	22	2	1	330
203	1141	960	440	3	20	13	1	1	19	268	328	31	3	1	261
204	1134	960	440	14	256	22	0	1	41	260	239	27	3	2	781
205	1128	960	440	2	63	31	1	0	24	112	263	29	2	1	552
206	1121	960	440	7	1627	8	0	1	48	257	282	23	0	2	837

SHID	Easting	Northing	RL	Mo.n	Nb.x	Ni.x	Pb.x	Rb.x	Sb.n	Sr.x	V.x	W.n	Y.x	Zn.x	Zr.i
154	1179	1200	440	2	4	131	0	91	2	42	368	2	5	120	68
155	1170	1200	440	4	4	132	0	31	1	73	322	2	5	94	63
156	1161	1200	440	5	4	127	2	42	1	76	353	3	4	98	59
157	1161	1200	438	4	1	145	0	34	1	48	202	2	30	88	46
158	1151	1200	438	2	1	191	0	22	0	117	266	1	131	98	42
159	1140	1200	438	4	4	112	0	16	0	124	272	2	15	81	52
160	1130	1200	438	2	4	90	3	46	0	90	354	6	3	84	38
161	1119	1200	438	4	1	92	0	7	1	108	224	2	21	85	46
162	1109	1200	438	2	3	98	1	12	0	110	245	1	13	79	57
163	1098	1200	438	5	2	171	1	21	1	121	266	2	54	93	49
164	1088	1200	438	5	6	149	0	18	1	107	312	3	35	102	47
165	1088	940	440	5	4	186	0	12	0	112	272	2	60	94	43
166	1078	940	440	2	6	160	0	8	0	117	293	1	42	86	64
167	1069	940	440	2	4	128	0	8	0	105	219	1	45	94	43
168	1059	940	440	5	3	152	2	7	0	118	264	3	28	86	51
169	1050	940	440	4	3	207	0	25	0	39	301	2	45	128	37
170	1040	940	440	2	3	207	0	11	0	87	281	1	98	94	50
171	1177	940	448	8	2	128	1	4	0	80	318	3	12	92	54
172	1170	940	448	5	3	157	2	13	1	98	381	2	9	120	45
173	1164	940	448	2	3	157	0	51	0	44	389	4	11	157	69
174	1157	940	448	2	3	114	0	40	0	16	338	1	10	213	66
175	1150	940	448	9	3	76	2	26	0	47	287	5	7	189	54
176	1144	940	448	8	4	113	5	31	0	32	411	2	9	183	43
177	1137	940	448	2	1	91	2	6	0	11	384	1	4	76	54
178	1130	940	448	2	2	102	1	7	2	4	477	2	6	89	84
179	1124	940	448	2	4	142	0	30	1	117	528	1	8	133	69
180	1117	940	448	4	2	122	0	24	1	38	390	2	5	122	58
181	1111	940	448	2	4	148	0	32	1	68	489	1	5	139	61
182	1104	940	448	6	3	149	0	23	1	16	460	2	7	144	53
183	1097	940	448	4	2	115	0	30	1	65	334	2	3	106	49
184	1091	940	448	2	4	113	0	136	0	66	344	2	5	250	77
185	1084	940	448	2	4	138	5	36	2	109	415	3	10	136	79
186	1077	940	448	2	3	108	2	32	0	133	334	1	5	80	66
187	1071	940	448	8	1	112	2	7	0	116	340	2	7	84	48
188	1064	940	448	6	3	195	2	12	0	132	326	2	7	105	38
189	1057	940	448	6	3	149	5	10	0	168	394	3	15	79	64
190	1051	940	448	2	3	114	0	16	1	119	256	1	19	90	56
191	1044	940	448	4	1	172	0	38	0	132	401	2	11	127	39
192	1082	960	440	2	4	150	7	27	0	184	386	1	8	114	62
193	1070	960	440	2	2	154	4	15	0	199	350	1	7	103	65
194	1123	940	440	2	3	120	0	11	1	140	300	2	19	93	40
195	1117	940	440	2	5	107	0	7	0	135	308	1	20	92	62
196	1110	940	440	2	2	81	4	22	0	169	279	1	4	82	33
197	1104	940	440	2	3	74	14	11	0	154	402	3	7	72	52
198	1097	940	440	1	1	64	3	18	0	59	207	2	5	39	32
199	1091	940	440	6	3	116	1	68	0	46	294	2	3	100	37
200	1160	960	440	2	2	96	3	4	0	4	534	3	13	97	82
201	1154	960	440	4	4	61	7	3	2	13	634	3	7	62	64
202	1147	960	440	2	5	95	4	6	1	14	409	5	10	109	65
203	1141	960	440	2	1	113	2	1	0	21	454	7	9	133	85
204	1134	960	440	2	5	175	0	2	1	39	483	3	16	173	74
205	1128	960	440	1	4	158	4	3	0	19	607	0	15	114	83
206	1121	960	440	2	4	166	0	2	1	18	455	1	11	93	68

SHID	Easting	Northing	RL	SiO2.i	Al2O3.i	Fe2O3.x	MgO.i	CaO.i	Na2O.x	TiO2.x	P2O5.i	S.x	LOI
207	1115	960	440	46.32	17.79	22.02	0.32	0.03	0.46	1.32	0.00	0.13	11.61
208	1108	960	440	65.20	11.70	14.15	0.58	0.04	0.33	0.86	0.00	0.08	7.06
209	1102	960	440	45.03	16.42	22.88	1.61	0.19	0.89	1.11	0.03	0.11	11.73
210	1095	960	440	44.61	17.22	21.30	1.84	0.04	0.59	1.32	0.00	0.09	12.99
211	1089	960	440	38.64	20.11	25.02	0.51	0.00	0.43	1.49	0.00	0.12	13.68
212	1082	960	440	51.39	18.63	14.87	0.11	0.27	0.56	1.52	0.00	0.08	12.57
213	1149	960	432	67.59	7.94	16.58	0.67	0.12	0.67	0.60	0.01	0.07	5.74
214	1142	960	432	40.64	21.19	21.73	0.74	0.14	0.57	1.56	0.00	0.11	13.32
215	1136	960	432	34.41	12.97	36.89	0.27	0.01	0.15	1.04	0.00	0.16	14.10
216	1129	960	432	45.56	17.63	21.02	1.83	0.10	0.39	1.31	0.02	0.12	12.03
217	1122	960	432	38.88	19.97	23.45	1.23	0.07	0.44	1.42	0.01	0.11	14.42
218	1116	960	432	37.82	16.21	28.88	0.34	0.05	0.72	1.22	0.00	0.29	14.47
219	1102	960	432	47.12	15.69	22.59	0.42	0.11	1.53	1.18	0.01	0.14	11.21
220	1096	960	432	57.99	14.77	15.30	0.08	0.07	4.03	1.00	0.05	0.07	6.64
221	1089	960	432	65.90	12.21	10.58	0.68	0.22	3.04	0.81	0.01	0.04	6.51
222	1079	960	436	46.26	18.94	21.30	0.78	0.01	0.28	1.30	0.05	0.11	10.96
223	1070	960	436	43.06	22.33	20.44	0.00	0.01	0.15	1.53	0.00	0.08	12.39
224	1061	960	436	38.96	24.39	20.73	0.10	0.02	0.18	1.48	0.00	0.10	14.04
225	1123	940	432	41.30	19.55	23.73	0.62	0.10	0.26	1.36	0.00	0.07	13.01
226	1129	940	432	39.99	19.66	24.59	1.29	0.04	0.20	1.38	0.01	0.11	12.73
227	1135	940	432	40.28	20.15	23.59	1.15	0.15	0.43	1.41	0.03	0.14	12.68
228	1141	940	432	42.20	20.37	22.02	1.04	0.53	0.59	1.43	0.03	0.12	11.67
229	1147	940	432	41.97	19.88	20.87	1.45	0.34	0.74	1.37	0.05	0.13	13.20
230	1198	1200	428	45.15	19.25	18.59	3.03	0.26	0.86	1.31	0.01	0.07	11.48
231	1190	1200	428	46.75	16.17	16.58	2.76	0.71	2.01	1.16	0.01	0.04	13.81
232	1182	1200	428	52.57	15.23	13.01	1.07	0.57	5.62	0.97	0.00	0.02	10.94
233	1174	1200	428	52.40	15.94	15.15	1.69	0.45	0.12	1.15	0.02	0.02	13.05
234	1146	940	438	51.17	15.47	14.15	1.47	0.45	5.09	1.03	0.02	0.02	11.12
235	1139	940	438	54.66	14.95	13.01	2.15	1.22	0.11	0.95	0.04	0.01	12.90
236	1132	940	438	47.31	13.69	13.01	3.89	3.41	4.54	0.91	0.03	0.01	13.20
237	1125	940	438	52.38	14.66	14.15	2.84	0.66	5.26	1.10	0.04	0.01	8.90
238	1119	940	438	52.43	14.35	14.58	2.81	1.25	4.60	1.05	0.04	0.01	8.88
239	1112	940	438	50.37	14.86	15.73	3.35	3.07	2.98	1.05	0.07	0.01	8.51
240	1105	940	438	50.06	15.50	13.30	5.89	9.66	2.32	1.19	0.09	0.00	1.99
241	1098	940	438	48.45	13.26	11.15	6.32	11.06	2.02	0.96	0.10	0.00	6.68
242	1150	995	424	47.78	14.79	13.01	6.68	10.61	2.36	1.11	0.08	0.00	3.58
243	1145	995	424	48.21	15.68	12.87	5.70	9.32	2.22	1.07	0.09	0.00	4.84
244	1099	995	424	51.88	16.14	15.01	2.45	0.18	0.97	1.26	0.02	0.02	12.07
245	1094	995	424	50.82	20.51	12.72	1.23	0.11	1.11	1.51	0.00	0.06	11.93
246	1089	995	424	45.72	21.52	16.01	1.14	0.09	1.14	1.50	0.00	0.06	12.82
247	1084	995	424	45.07	19.07	16.58	2.46	0.61	1.61	1.15	0.02	0.05	13.38
248	1079	995	424	49.21	16.58	17.01	2.83	0.90	0.05	1.21	0.00	0.04	12.16
249	1074	995	424	50.30	16.65	15.58	3.07	0.74	0.05	1.25	0.01	0.07	12.27
250	1111	1000	406	49.46	17.89	15.58	2.85	0.58	1.66	1.33	0.00	0.04	10.61
251	1107	1000	406	49.86	17.48	15.44	3.40	0.37	1.48	1.28	0.00	0.04	10.65
252	1102	1000	406	48.46	16.41	16.58	2.55	0.66	2.57	1.07	0.03	0.04	11.63
253	1098	1000	406	50.89	15.44	16.01	3.02	0.81	0.08	1.15	0.08	0.06	12.46
254	1093	1000	406	49.71	14.79	14.58	4.41	1.76	0.07	0.94	0.06	0.02	13.65
255	1089	1000	406	49.21	14.22	15.58	4.72	2.91	0.06	1.02	0.06	0.01	12.21
256	1084	1000	406	46.90	13.69	13.87	5.91	6.69	3.11	0.86	0.08	0.01	8.89
257	1080	1000	406	47.39	13.85	14.58	5.59	6.57	3.19	0.87	0.06	0.00	7.89
258	1075	1000	406	45.12	13.41	13.44	6.64	6.92	2.50	0.83	0.07	0.00	11.07
259	1071	1000	406	44.78	13.07	13.44	6.57	6.56	0.06	0.82	0.08	0.01	14.61

SHID	Easting	Northing	RL	As.n	Au.n	Ba.x	Be.i	Ce.n	Co.n	Cr.n	Cu.x	Ga.x	Ge.x	La.n	Mn.x
207	1115	960	440	5	103	142	0	1	29	256	232	31	1	3	604
208	1108	960	440	4	447	73	0	1	28	167	144	15	1	1	284
209	1102	960	440	3	57	338	2	2	69	199	245	22	0	4	709
210	1095	960	440	11	656	1065	0	2	49	251	204	25	1	2	649
211	1089	960	440	9	580	459	1	1	75	332	277	27	3	3	899
212	1082	960	440	3	467	148	0	3	26	258	135	27	1	1	232
213	1149	960	432	2	8066	545	1	1	45	117	123	13	1	2	533
214	1142	960	432	2	136	459	0	1	22	282	248	29	2	2	380
215	1136	960	432	1	2145	295	1	3	123	269	230	19	1	3	1305
216	1129	960	432	1	8	1252	0	0	16	89	180	25	2	1	441
217	1122	960	432	1	134	1252	0	1	26	321	201	28	2	2	477
218	1116	960	432	2	269	6108	1	1	55	355	295	29	1	6	1377
219	1102	960	432	2	12	1320	0	1	59	255	226	23	0	4	570
220	1096	960	432	1	96	382	2	3	28	239	170	31	0	2	377
221	1089	960	432	1	183	405	1	3	28	167	153	16	0	2	546
222	1079	960	436	7	25385	103	3	49	92	334	398	23	1	4	746
223	1070	960	436	3	202	42	1	137	56	262	284	29	3	2	1757
224	1061	960	436	3	454	136	0	29	32	248	372	29	2	1	697
225	1123	940	432	4	245	360	1	4	34	276	271	26	2	2	484
226	1129	940	432	4	19	379	0	2	91	278	256	23	1	2	541
227	1135	940	432	2	96	557	0	1	37	279	268	27	1	2	753
228	1141	940	432	4	147	455	1	4	82	270	244	25	2	3	795
229	1147	940	432	4	327	656	0	6	85	282	261	24	1	3	821
230	1198	1200	428	2	62	736	2	44	161	231	281	25	2	10	1600
231	1190	1200	428	1	2406	801	1	55	332	240	291	23	1	30	2500
232	1182	1200	428	1	15744	903	0	17	84	220	202	22	0	6	2856
233	1174	1200	428	1	3472	1518	4	70	191	267	261	24	0	24	8349
234	1146	940	438	1	9171	1230	2	34	325	224	256	24	0	20	6250
235	1139	940	438	1	3393	1292	2	13	59	220	170	20	1	9	1390
236	1132	940	438	1	3277	573	1	8	62	225	179	21	1	4	1689
237	1125	940	438	1	7981	443	1	6	58	216	193	24	3	4	1654
238	1119	940	438	1	5257	621	1	7	65	206	183	25	1	4	1786
239	1112	940	438	1	342	591	0	8	91	213	163	18	1	9	2019
240	1105	940	438	0	6	173	0	3	38	228	57	17	1	1	1314
241	1098	940	438	1	5	243	0	9	42	200	79	17	1	6	1265
242	1150	995	424	0	2	194	0	1	17	77	65	19	1	1	1344
243	1145	995	424	0	2	140	0	1	49	208	65	22	1	2	1445
244	1099	995	424	12	4149	406	0	14	93	329	235	23	2	30	812
245	1094	995	424	6	5846	717	1	14	31	279	304	28	1	27	287
246	1089	995	424	3	2974	507	1	18	73	285	401	29	3	23	373
247	1084	995	424	3	1864	1292	1	20	257	263	280	23	4	21	626
248	1079	995	424	5	5764	2123	2	27	195	251	217	20	2	17	713
249	1074	995	424	7	1071	4476	1	26	82	230	203	22	0	15	688
250	1111	1000	406	8	1477	1957	1	19	90	287	243	22	2	8	477
251	1107	1000	406	5	320	2063	0	7	38	239	232	20	2	4	603
252	1102	1000	406	3	451	1853	1	12	114	239	203	21	0	6	1994
253	1098	1000	406	1	2098	4456	0	11	121	280	229	21	1	7	1785
254	1093	1000	406	1	617	2104	1	8	45	201	193	20	2	4	1910
255	1089	1000	406	0	973	1822	0	9	37	216	193	19	3	4	2072
256	1084	1000	406	1	389	358	1	8	62	166	186	17	0	5	1499
257	1080	1000	406	1	225	313	0	12	73	188	209	18	2	5	1456
258	1075	1000	406	1	112	591	0	7	55	183	176	14	1	4	1074
259	1071	1000	406	0	300	390	0	9	52	174	182	17	2	4	1184

SHID	Easting	Northing	RL	Mo.n	Nb.x	Ni.x	Pb.x	Rb.x	Sb.n	Sr.x	V.x	W.n	Y.x	Zn.x	Zr.i
207	1115	960	440	2	6	117	5	9	0	29	501	4	8	94	73
208	1108	960	440	3	2	72	1	11	0	50	304	3	4	58	37
209	1102	960	440	4	2	161	2	25	0	133	480	2	9	141	34
210	1095	960	440	2	4	190	1	75	0	39	446	6	12	238	70
211	1089	960	440	2	4	207	0	36	0	9	489	4	16	280	76
212	1082	960	440	6	5	88	6	9	1	23	392	5	7	119	55
213	1149	960	432	2	1	111	2	26	1	34	244	2	9	150	37
214	1142	960	432	2	3	122	5	37	0	38	468	1	12	185	89
215	1136	960	432	4	0	176	8	35	0	8	550	2	13	265	14
216	1129	960	432	1	4	116	0	86	0	39	403	1	8	211	84
217	1122	960	432	2	3	128	2	68	0	40	450	3	7	184	84
218	1116	960	432	2	2	210	0	13	0	102	649	1	13	206	68
219	1102	960	432	2	4	167	5	25	0	117	473	1	8	159	67
220	1096	960	432	8	2	84	7	13	0	130	480	2	6	96	50
221	1089	960	432	2	2	93	4	21	0	101	254	2	4	74	30
222	1079	960	436	9	2	187	5	24	0	6	470	4	29	167	55
223	1070	960	436	2	3	74	8	3	0	6	539	1	7	77	84
224	1061	960	436	2	5	140	8	15	0	7	504	7	11	123	88
225	1123	940	432	2	4	174	2	31	0	19	479	6	13	151	79
226	1129	940	432	5	5	220	1	71	0	22	456	4	14	207	54
227	1135	940	432	2	3	191	5	40	1	26	473	5	16	165	77
228	1141	940	432	2	3	198	1	29	1	41	454	4	21	142	79
229	1147	940	432	5	2	184	3	49	0	41	464	2	17	159	46
230	1198	1200	428	2	4	200	0	82	0	59	431	3	53	176	73
231	1190	1200	428	7	0	299	0	55	0	134	405	3	166	230	54
232	1182	1200	428	3	5	147	6	16	0	243	323	1	26	80	55
233	1174	1200	428	3	0	213	6	17	0	234	385	2	146	125	41
234	1146	940	438	3	2	212	7	15	4	269	342	1	108	125	44
235	1139	940	438	2	0	174	5	21	2	225	296	6	23	104	65
236	1132	940	438	6	2	182	3	9	0	285	276	3	26	104	46
237	1125	940	438	3	1	194	5	9	0	180	425	3	26	117	40
238	1119	940	438	3	5	187	7	15	0	177	410	3	28	127	36
239	1112	940	438	5	2	211	1	15	0	152	280	3	45	133	51
240	1105	940	438	2	3	115	0	8	0	133	296	3	22	94	73
241	1098	940	438	4	2	103	0	8	1	117	250	2	39	83	34
242	1150	995	424	1	4	117	0	11	0	136	290	0	24	93	60
243	1145	995	424	2	6	109	0	5	0	142	285	1	19	87	57
244	1099	995	424	6	0	240	0	35	0	36	452	6	140	189	50
245	1094	995	424	2	1	205	4	28	1	39	527	10	170	208	83
246	1089	995	424	2	1	177	3	20	0	39	542	5	150	275	84
247	1084	995	424	6	3	877	0	35	0	90	402	3	122	352	58
248	1079	995	424	3	1	627	0	37	0	160	391	4	100	218	67
249	1074	995	424	2	2	526	0	44	0	143	403	1	75	171	67
250	1111	1000	406	2	1	256	0	53	0	103	414	2	34	179	53
251	1107	1000	406	2	3	219	0	57	1	62	388	4	22	143	70
252	1102	1000	406	6	2	226	0	48	2	114	376	3	37	145	56
253	1098	1000	406	7	2	278	0	38	0	178	429	3	32	142	51
254	1093	1000	406	2	2	274	0	36	0	188	325	3	24	132	52
255	1089	1000	406	2	2	181	0	67	0	189	317	3	22	117	82
256	1084	1000	406	2	3	148	2	11	1	137	293	1	22	106	54
257	1080	1000	406	5	1	139	0	10	1	131	295	3	23	105	47
258	1075	1000	406	5	0	150	0	22	0	165	305	2	20	103	45
259	1071	1000	406	2	1	139	3	15	0	151	269	3	21	99	50

SHID	Easting	Northing	RL	SiO2.i	Al2O3.i	Fe2O3.x	MgO.i	CaO.i	Na2O.x	TiO2.x	P2O5.i	S.x	LOI
260	1130	1200	404	46.92	13.74	15.15	6.50	9.01	3.34	1.04	0.08	0.17	4.05
261	1137	1200	404	46.93	12.91	13.87	6.45	7.60	3.66	1.03	0.07	0.01	7.47
262	1144	1200	404	48.69	12.95	14.15	5.96	6.02	3.15	0.99	0.06	0.04	7.99
263	1151	1200	404	48.83	11.55	12.15	5.95	6.38	3.34	0.93	0.07	0.04	10.76
264	1157	1200	404	60.04	9.89	11.01	4.23	2.89	4.66	0.82	0.06	0.06	6.34
265	1164	1200	404	48.88	10.60	11.29	5.82	6.01	3.91	0.81	0.03	0.03	12.61
266	1171	1200	404	50.33	11.28	12.30	6.05	6.18	3.34	0.86	0.07	0.07	9.53
267	1178	1200	404	51.91	12.04	11.58	5.59	5.48	3.85	0.82	0.05	0.21	8.47
268	1105	1050	401	52.70	11.34	10.87	5.68	5.58	3.81	0.76	0.07	0.13	9.07
269	1098	1050	401	51.85	13.81	11.72	5.43	4.76	3.98	0.85	0.12	0.05	7.43
270	1090	1050	401	46.94	14.42	13.30	6.20	11.23	2.34	1.07	0.09	0.13	4.28
271	1083	1050	401	46.92	14.16	13.44	6.35	11.01	2.30	1.04	0.10	0.15	4.54
272	1075	1050	401	47.06	13.34	13.15	6.14	9.49	5.25	1.02	0.09	0.32	4.14
273	1135	1200	399	44.75	12.02	12.72	5.76	8.85	3.97	0.95	0.07	0.59	10.32
274	1143	1200	399	45.57	12.67	12.72	5.87	9.44	5.00	0.93	0.06	0.66	7.08
275	1150	1200	399	48.92	12.40	12.72	5.72	8.05	9.74	0.88	0.08	0.47	1.01
276	1158	1200	399	48.15	12.49	13.73	5.81	7.55	5.23	1.06	0.08	0.38	5.53
277	1165	1200	399	43.82	12.41	15.73	6.22	6.66	4.79	1.19	0.09	0.37	8.73
278	1070	1050	398	58.28	9.24	9.86	5.54	5.43	3.42	0.66	0.04	1.03	6.50
279	1076	1050	398	49.63	10.62	10.72	6.97	7.39	2.79	0.74	0.06	0.71	10.36
280	1082	1050	398	47.31	14.18	13.87	7.00	5.92	2.59	1.00	0.06	0.21	7.87
281	1088	1050	398	47.71	14.53	13.73	6.26	4.25	2.98	1.04	0.07	0.12	9.31
282	1094	1050	398	50.65	14.39	13.44	4.96	2.63	2.77	1.02	0.07	0.12	9.95
283	1100	1050	398	48.16	15.22	13.87	6.49	10.76	2.80	1.12	0.11	0.07	1.40
284	1106	1050	398	47.56	12.23	12.72	5.91	9.70	2.68	1.04	0.10	0.58	7.48
285	1171	940	444	44.67	12.85	12.72	4.93	11.17	1.90	0.92	0.08	0.41	10.35
286	1165	940	444	46.70	13.09	13.73	6.01	9.72	1.77	1.01	0.09	0.21	7.67
287	1159	940	444	45.93	12.92	13.73	6.12	9.71	2.76	1.09	0.09	0.48	7.17
288	1153	940	444	49.01	14.44	12.01	5.29	7.20	4.80	0.87	0.07	0.03	6.28
289	1147	940	444	43.59	12.50	12.30	6.30	8.83	3.97	0.89	0.06	0.52	11.05
290	1141	940	444	51.14	12.75	10.87	4.93	6.97	4.50	0.81	0.05	0.61	7.38
291	1135	940	444	63.02	11.10	10.44	4.35	2.23	3.12	0.68	0.06	0.02	4.98
292	1129	940	444	58.52	11.69	10.72	3.86	3.60	3.77	0.75	0.05	0.23	6.81
293	1123	940	444	53.51	10.90	12.01	5.04	6.87	4.59	0.80	0.04	1.21	5.03
294	1117	940	444	47.13	13.22	14.30	6.09	9.62	3.47	1.00	0.07	0.17	4.93
295	1048	1200	456	43.25	12.41	17.44	1.49	6.49	0.65	0.93	0.02	0.57	16.75
296	1054	1200	456	37.81	10.56	21.16	1.50	9.26	0.43	0.95	0.03	0.08	18.22
297	1060	1200	456	36.24	10.63	23.45	1.45	8.60	0.38	1.25	0.02	0.05	17.94
298	1066	1200	456	43.40	11.78	23.30	1.15	4.28	0.14	1.15	0.00	0.04	14.76
299	1072	1200	456	36.78	10.14	29.17	1.01	4.87	0.17	1.17	0.04	0.04	16.62
300	1112	1042.5	457	46.95	13.64	24.59	0.91	2.69	0.24	1.22	0.02	0.03	9.71
301	1106	1043.5	457	42.01	12.11	22.59	0.89	4.26	0.25	1.24	0.01	0.02	16.62
302	1100	1044	457	40.22	11.64	26.02	0.84	3.75	0.24	1.29	0.00	0.03	15.97
303	1094	1044.5	457	42.10	11.56	24.45	1.19	4.90	0.23	1.18	0.01	0.08	14.30
304	1088	1045	457	39.85	11.46	24.30	1.33	5.12	0.39	1.24	0.00	0.04	16.26
305	1082	1045	457	41.41	11.66	21.02	1.53	6.39	0.32	1.10	0.02	0.15	16.40
306	1076	1046	457	42.78	11.83	21.16	1.37	5.84	0.42	1.13	0.02	0.24	15.21
307	1070	1046.5	457	43.33	12.41	23.02	2.03	6.38	0.45	1.07	0.02	0.07	11.22
308	1064	1047	457	43.45	12.25	21.02	1.59	3.86	0.59	1.07	0.03	0.19	15.95
309	1058	1047.5	457	43.50	12.29	24.59	1.41	3.43	0.43	1.30	0.00	0.06	12.99
310	1204	1025.5	457	43.63	11.79	23.16	1.95	5.03	0.48	1.26	0.02	0.03	12.65
311	1198	1026	457	39.97	11.85	17.44	1.11	9.97	0.80	0.96	0.02	0.71	17.17
312	1192	1026.5	457	35.32	10.71	20.16	1.23	10.52	0.78	0.97	0.03	1.17	19.11

SHID	Easting	Northing	RL	As.n	Au.n	Ba.x	Be.i	Ce.n	Co.n	Cr.n	Cu.x	Ga.x	Ge.x	La.n	Mn.x
260	1130	1200	404	2	243	647	0	9	65	175	175	20	0	5	1894
261	1137	1200	404	2	4251	596	0	9	51	159	177	18	1	5	1738
262	1144	1200	404	2	1701	756	1	8	55	166	177	19	1	5	1384
263	1151	1200	404	2	3798	1241	0	6	23	134	165	16	1	4	1489
264	1157	1200	404	4	6321	1803	2	6	42	93	137	16	0	3	1436
265	1164	1200	404	3	2516	998	0	5	51	153	134	20	0	5	1762
266	1171	1200	404	2	4368	1065	0	8	47	151	165	16	1	4	1507
267	1178	1200	404	3	2513	1341	1	5	25	146	140	20	1	4	1278
268	1105	1050	401	3	3108	979	0	8	21	145	144	18	1	5	1298
269	1098	1050	401	2	1418	751	1	16	39	137	125	18	0	11	1134
270	1090	1050	401	1	17	394	0	14	56	270	113	18	2	6	1629
271	1083	1050	401	2	80	674	0	15	60	284	120	15	0	7	1624
272	1075	1050	401	2	540	1757	0	9	51	193	128	16	0	5	1502
273	1135	1200	399	6	8943	2684	0	10	52	203	126	18	1	5	1611
274	1143	1200	399	9	1165	3599	0	7	51	182	144	18	0	5	1616
275	1150	1200	399	15	1409	2357	0	9	51	207	144	17	1	5	1536
276	1158	1200	399	11	631	3051	0	12	25	178	138	17	2	5	1542
277	1165	1200	399	5	1281	1930	0	15	28	154	189	18	2	7	1849
278	1070	1050	398	4	4328	648	1	5	22	131	155	18	2	3	1156
279	1076	1050	398	4	1358	1693	1	7	42	160	129	15	2	3	1545
280	1082	1050	398	7	999	2440	1	5	62	223	198	19	3	3	1420
281	1088	1050	398	16	1282	2224	1	3	30	219	260	18	2	3	1200
282	1094	1050	398	5	2269	2223	1	7	60	190	177	17	3	3	994
283	1100	1050	398	1	5	415	0	10	59	257	95	17	2	5	1545
284	1106	1050	398	0	274	3104	0	6	30	145	115	16	0	4	1768
285	1171	940	444	2	1017	2674	0	7	62	203	130	18	2	3	1757
286	1165	940	444	26	223	2100	0	7	57	195	147	20	1	3	1666
287	1159	940	444	2	2056	1933	0	6	54	187	169	17	1	4	1722
288	1153	940	444	1	541	1421	0	8	51	186	75	17	0	4	1516
289	1147	940	444	1	3363	1981	1	7	53	174	173	18	2	3	1946
290	1141	940	444	2	3528	1059	0	9	45	149	144	21	1	7	1529
291	1135	940	444	3	1142	1299	1	5	41	158	110	14	2	3	1409
292	1129	940	444	6	3066	1715	1	5	22	164	175	21	0	3	1143
293	1123	940	444	4	2816	648	0	5	50	150	167	18	0	3	1508
294	1117	940	444	1	183	645	0	9	56	169	157	16	2	5	1770
295	1048	1200	456	9	41	275	0	31	34	305	92	17	0	18	761
296	1054	1200	456	10	126	277	0	24	38	311	110	18	1	19	794
297	1060	1200	456	19	50	245	0	22	32	332	116	21	2	19	909
298	1066	1200	456	12	35	235	0	23	34	351	116	20	1	20	991
299	1072	1200	456	13	32	266	0	18	35	343	116	21	0	18	860
300	1112	1042.5	457	11	54	273	1	19	31	332	126	24	2	18	955
301	1106	1043.5	457	9	73	251	0	21	29	321	114	23	1	16	894
302	1100	1044	457	12	126	250	0	17	30	378	112	24	0	17	887
303	1094	1044.5	457	11	42	328	0	26	34	326	114	20	1	17	917
304	1088	1045	457	11	46	229	0	27	31	339	124	21	2	17	865
305	1082	1045	457	11	41	257	0	18	31	326	107	19	0	17	838
306	1076	1046	457	10	40	284	0	24	36	324	107	20	1	19	947
307	1070	1046.5	457	25	45	292	2	26	46	328	110	19	1	20	990
308	1064	1047	457	10	25	250	0	19	36	325	102	22	1	18	831
309	1058	1047.5	457	13	23	262	0	24	33	353	119	23	1	17	871
310	1204	1025.5	457	9	28	325	0	22	29	324	107	20	3	14	881
311	1198	1026	457	9	2126	292	0	18	37	293	134	20	2	15	653
312	1192	1026.5	457	9	1651	332	0	22	31	307	133	18	1	17	780

SHID	Easting	Northing	RL	Mo.n	Nb.x	Ni.x	Pb.x	Rb.x	Sb.n	Sr.x	V.x	W.n	Y.x	Zn.x	Zr.i
260	1130	1200	404	2	4	125	0	16	0	159	330	3	28	112	58
261	1137	1200	404	6	5	93	0	28	0	171	312	3	22	98	48
262	1144	1200	404	2	1	118	3	31	0	173	313	3	20	102	56
263	1151	1200	404	2	1	88	1	32	0	169	300	3	22	90	50
264	1157	1200	404	2	1	72	2	21	1	160	269	6	17	91	34
265	1164	1200	404	5	1	101	4	19	0	200	299	3	25	87	31
266	1171	1200	404	5	1	112	2	24	0	194	289	2	21	91	41
267	1178	1200	404	2	3	122	1	24	3	218	263	5	17	92	47
268	1105	1050	401	2	1	102	1	25	0	208	245	4	17	79	49
269	1098	1050	401	5	3	83	4	34	0	225	263	2	18	96	66
270	1090	1050	401	2	6	154	0	16	0	124	288	1	23	99	42
271	1083	1050	401	4	1	151	0	21	0	124	284	2	23	106	40
272	1075	1050	401	2	4	120	0	35	0	194	283	2	20	144	56
273	1135	1200	399	6	1	117	0	44	0	217	275	7	21	146	39
274	1143	1200	399	2	2	116	0	46	0	217	268	12	20	134	46
275	1150	1200	399	5	0	125	0	48	0	171	266	10	19	101	46
276	1158	1200	399	2	5	96	0	41	0	138	302	3	24	116	61
277	1165	1200	399	2	3	81	0	47	1	97	323	3	29	176	68
278	1070	1050	398	2	2	89	3	15	0	185	215	5	16	87	40
279	1076	1050	398	2	2	105	1	32	1	180	221	10	19	93	29
280	1082	1050	398	2	1	144	0	45	0	188	312	6	22	115	56
281	1088	1050	398	2	1	143	0	42	0	196	335	15	21	114	58
282	1094	1050	398	2	3	140	1	40	0	183	336	11	19	103	54
283	1100	1050	398	5	3	125	0	21	1	147	304	2	22	100	43
284	1106	1050	398	2	3	85	0	43	0	243	304	3	22	145	59
285	1171	940	444	5	3	135	1	47	0	221	297	3	20	130	46
286	1165	940	444	4	3	112	0	54	0	126	303	5	20	111	49
287	1159	940	444	5	2	92	0	44	0	216	309	2	23	128	42
288	1153	940	444	2	4	116	0	21	0	238	300	1	24	94	60
289	1147	940	444	2	3	117	1	24	0	176	293	5	20	94	46
290	1141	940	444	5	4	95	4	22	0	265	250	3	19	82	49
291	1135	940	444	2	1	121	0	27	0	97	231	10	16	80	28
292	1129	940	444	2	2	111	0	32	2	185	270	3	15	79	42
293	1123	940	444	5	2	102	0	8	0	262	307	2	18	91	39
294	1117	940	444	5	3	110	2	17	0	165	306	2	24	100	46
295	1048	1200	456	4	4	88	8	20	0	196	396	2	19	65	126
296	1054	1200	456	4	4	93	8	12	1	186	514	3	21	59	91
297	1060	1200	456	4	7	97	7	17	1	169	585	2	18	65	106
298	1066	1200	456	4	7	99	7	20	1	83	588	2	19	75	113
299	1072	1200	456	4	4	98	7	16	1	85	604	2	21	144	98
300	1112	1042.5	457	3	6	94	8	20	1	69	643	2	19	81	129
301	1106	1043.5	457	3	3	95	10	19	1	84	569	3	18	75	116
302	1100	1044	457	4	6	87	6	17	1	79	669	2	16	71	112
303	1094	1044.5	457	4	5	91	9	16	1	99	602	4	21	98	114
304	1088	1045	457	4	5	90	6	17	1	107	630	4	18	73	116
305	1082	1045	457	4	7	92	6	18	1	128	556	2	16	66	111
306	1076	1046	457	4	6	103	8	18	1	132	519	2	19	71	106
307	1070	1046.5	457	4	5	101	8	18	1	142	568	2	18	73	130
308	1064	1047	457	4	7	95	11	19	1	107	515	2	18	74	122
309	1058	1047.5	457	4	8	89	8	18	1	97	623	2	17	73	128
310	1204	1025.5	457	4	10	89	5	14	1	124	573	2	16	67	115
311	1198	1026	457	4	5	87	6	13	1	154	458	5	18	70	99
312	1192	1026.5	457	4	7	96	7	11	0	212	488	2	17	68	98

SHID	Easting	Northing	RL	SiO2.i	Al2O3.i	Fe2O3.x	MgO.i	CaO.i	Na2O.x	TiO2.x	P2O5.i	S.x	LOI
313	1186	1027	457	39.48	12.63	19.59	1.00	8.13	0.83	1.04	0.03	0.83	16.44
314	1180	1027.5	457	41.16	12.11	16.73	1.17	9.30	0.87	0.90	0.03	1.29	16.45
315	1174	1028	457	41.68	12.72	17.44	1.14	7.78	0.62	1.06	0.02	0.39	17.15
316	1168	1028.5	457	43.60	11.83	14.01	1.35	9.25	0.55	0.89	0.04	0.53	17.95
317	1162	1029	457	45.53	12.66	14.87	1.44	10.32	0.58	0.92	0.04	0.49	13.16
318	1156	1029.5	457	43.78	11.87	17.59	1.29	7.15	0.77	0.84	0.02	0.38	16.31
319	1150	1030	457	43.81	12.10	19.16	1.20	4.28	0.85	0.93	0.01	0.35	17.32
320	1045	1038	457	45.81	13.00	19.30	1.11	3.61	0.78	1.12	0.02	0.87	14.38
321	1038	1040	457	47.26	12.33	15.87	1.86	4.99	0.86	0.98	0.03	0.52	15.30
322	1033	1042	457	42.35	11.49	20.44	2.24	6.50	0.59	1.14	0.02	0.11	15.12
323	1027	1044.5	457	43.66	11.40	19.59	1.72	5.80	0.61	1.01	0.01	0.33	15.87
324	1021	1046.5	457	49.96	12.57	16.58	1.71	5.44	0.75	1.00	0.03	0.78	11.17
325	1189	1200	456	41.95	11.74	23.88	1.46	4.63	0.66	1.26	0.00	0.41	14.02
326	1194	1200	456	37.71	12.83	18.44	1.07	8.15	0.89	0.94	0.03	1.58	18.36
327	1200	1200	456	33.19	11.75	19.59	0.98	10.13	5.06	0.80	0.03	3.63	14.84
328	1206	1200	456	36.40	11.14	17.30	1.07	9.94	1.09	0.89	0.00	2.78	19.39
329	1215	1200	456	35.30	10.59	17.87	1.51	12.07	0.77	0.77	0.04	1.92	19.16
330	1217	1200	456	41.28	12.19	18.44	0.97	7.13	0.75	0.85	0.01	1.81	16.57
331	1219	1200	456	42.44	11.49	14.87	1.31	8.80	0.75	0.78	0.02	1.40	18.14
332	1221	1200	456	41.06	11.09	14.44	1.29	9.17	0.72	0.78	0.04	1.71	19.70
333	1223	1200	456	40.03	10.51	13.87	1.43	11.67	0.62	0.74	0.03	2.05	19.05
334	1225	1200	456	39.21	8.10	13.87	1.58	14.67	0.62	0.65	0.03	0.54	20.73
335	1227	1200	456	42.97	9.83	13.44	1.60	12.02	1.14	0.68	0.04	0.75	17.53
336	1229	1200	456	41.12	11.33	15.44	1.41	9.72	1.08	0.83	0.05	2.11	16.91
337	1233	1200	456	40.68	10.20	12.01	1.50	11.20	0.94	0.72	0.06	2.83	19.87
338	1239	1200	456	42.88	10.96	12.87	1.54	9.25	0.89	0.80	0.05	1.69	19.07
339	1245	1200	456	43.79	11.62	11.87	1.39	8.74	0.87	0.74	0.01	2.46	18.51
340	1251	1200	456	45.19	11.54	11.87	1.58	9.34	0.85	0.73	0.03	2.35	16.53
341	1257	1200	456	45.74	11.23	11.87	1.64	10.25	0.75	0.73	0.03	2.64	15.13
342	1263	1200	456	41.21	11.24	14.44	1.70	10.67	0.85	0.81	0.03	1.06	17.99
343	1269	1200	456	43.55	12.24	12.15	1.40	9.62	0.83	0.76	0.03	2.98	16.44
344	1275	1200	456	43.70	11.07	13.01	1.52	9.36	0.81	0.76	0.02	1.59	18.16
345	1281	1200	456	40.72	10.26	11.01	1.70	11.35	0.92	0.65	0.02	2.34	21.03
346	1287	1200	456	40.91	11.05	13.30	1.65	11.27	0.91	0.73	0.03	1.95	18.20
347	1155	1200	456	44.29	11.78	14.87	1.53	10.79	0.76	0.78	0.03	1.71	13.46
348	1161	1200	456	49.64	14.34	15.87	1.54	4.45	0.85	0.94	0.03	0.49	11.85
349	1167	1200	456	41.80	12.06	13.58	1.75	9.48	0.87	0.90	0.01	0.16	19.39
350	1173	1200	456	40.68	11.75	16.30	1.55	10.21	0.73	0.94	0.04	0.56	17.24
351	1179	1200	456	39.58	11.04	15.44	1.57	10.89	0.73	0.87	0.06	0.78	19.04
352	1185	1200	456	38.03	10.63	14.44	1.58	16.07	0.54	0.76	0.06	0.74	17.15
353	1078	1200	456	38.71	9.97	13.44	1.59	16.44	0.53	0.71	0.04	1.65	16.92
354	1084	1200	456	40.03	10.83	20.44	1.59	7.69	0.28	1.07	0.01	0.04	18.02
355	1090	1200	456	44.37	12.01	18.73	1.63	8.77	0.46	0.99	0.03	0.05	12.96
356	1096	1200	456	39.42	11.44	22.45	1.19	6.37	0.32	1.14	0.02	0.04	17.61
357	1102	1200	456	39.61	11.68	25.16	1.08	5.41	0.29	1.31	0.01	0.03	15.41
358	1108	1200	456	43.26	12.42	23.73	1.09	4.21	0.38	1.22	0.03	0.03	13.62
359	1114	1200	456	42.71	12.57	24.73	1.05	3.77	0.29	1.17	0.00	0.04	13.67
360	1120	1200	456	44.41	12.09	22.45	1.13	4.91	0.32	1.08	0.02	0.05	13.54
361	1126	1200	456	43.24	12.09	22.73	1.22	4.11	0.59	1.03	0.01	0.19	14.79

SHID	Easting	Northing	RL	As.n	Au.n	Ba.x	Be.i	Ce.n	Co.n	Cr.n	Cu.x	Ga.x	Ge.x	La.n	Mn.x
313	1186	1027	457	8	1412	325	0	26	32	311	131	19	0	17	690
314	1180	1027.5	457	10	1287	344	0	24	35	291	116	18	0	18	656
315	1174	1028	457	9	1095	470	0	23	35	290	119	17	1	16	619
316	1168	1028.5	457	6	772	514	0	20	35	250	109	15	0	16	670
317	1162	1029	457	6	459	503	0	18	35	249	114	16	0	16	767
318	1156	1029.5	457	8	415	387	0	28	41	282	104	18	0	18	722
319	1150	1030	457	10	219	278	0	22	44	282	105	18	3	17	836
320	1045	1038	457	9	161	361	0	18	39	279	109	20	0	16	814
321	1038	1040	457	7	29	267	0	25	31	297	83	19	1	15	803
322	1033	1042	457	9	38	313	0	25	32	358	92	17	0	16	894
323	1027	1044.5	457	9	25	284	0	25	32	297	107	19	1	16	789
324	1021	1046.5	457	8	32	272	0	23	34	285	91	19	0	18	795
325	1189	1200	456	11	31	290	0	30	36	353	108	23	1	19	867
326	1194	1200	456	12	269	315	0	26	22	258	133	19	0	16	520
327	1200	1200	456	18	332	286	0	19	26	244	135	16	0	15	533
328	1206	1200	456	11	318	279	0	25	25	264	102	16	0	18	765
329	1215	1200	456	11	490	218	0	23	26	216	131	15	0	14	597
330	1217	1200	456	16	362	227	0	20	26	240	113	17	0	13	612
331	1219	1200	456	12	472	285	0	23	32	231	102	15	1	17	816
332	1221	1200	456	9	519	297	0	24	28	231	108	15	2	16	844
333	1223	1200	456	10	607	266	0	26	30	231	103	14	1	19	944
334	1225	1200	456	9	1206	397	0	30	29	218	96	13	2	18	965
335	1227	1200	456	8	1012	290	0	33	32	224	95	13	0	20	964
336	1229	1200	456	8	657	330	0	24	35	251	127	16	0	18	889
337	1233	1200	456	7	584	225	0	27	31	210	113	14	0	19	945
338	1239	1200	456	8	391	243	0	30	28	222	111	15	1	20	965
339	1245	1200	456	7	315	269	0	27	31	212	106	16	1	18	810
340	1251	1200	456	6	230	282	0	33	29	223	105	16	0	19	866
341	1257	1200	456	6	185	228	0	33	33	208	107	12	1	21	946
342	1263	1200	456	8	184	277	0	38	39	235	126	15	1	22	918
343	1269	1200	456	6	128	188	0	29	30	222	115	14	2	18	786
344	1275	1200	456	7	137	190	0	33	31	242	122	14	0	22	874
345	1281	1200	456	6	132	208	0	34	36	220	108	13	1	23	908
346	1287	1200	456	7	140	215	0	34	33	227	122	15	0	22	958
347	1155	1200	456	9	115	233	0	32	33	234	127	15	2	22	996
348	1161	1200	456	7	85	250	0	21	38	260	95	17	2	15	715
349	1167	1200	456	6	156	365	0	28	37	246	88	15	1	17	659
350	1173	1200	456	7	161	295	0	28	33	255	102	16	1	17	644
351	1179	1200	456	5	172	302	0	20	29	221	98	16	0	15	630
352	1185	1200	456	6	307	346	0	22	26	207	90	13	1	16	621
353	1078	1200	456	7	313	375	0	25	29	203	93	15	0	19	737
354	1084	1200	456	8	49	233	0	24	28	402	107	19	0	15	768
355	1090	1200	456	11	55	317	0	18	32	291	103	17	0	15	840
356	1096	1200	456	10	45	334	0	18	31	341	120	22	0	16	786
357	1102	1200	456	26	48	307	0	23	29	341	125	22	2	17	866
358	1108	1200	456	10	52	256	0	17	34	335	132	20	0	17	887
359	1114	1200	456	10	48	227	0	29	32	338	123	23	1	18	988
360	1120	1200	456	12	76	230	0	27	31	341	124	21	0	19	911
361	1126	1200	456	11	83	292	0	25	31	338	104	20	1	17	807

SHID	Easting	Northing	RL	Mo.n	Nb.x	Ni.x	Pb.x	Rb.x	Sb.n	Sr.x	V.x	W.n	Y.x	Zn.x	Zr.i
313	1186	1027	457	9	6	102	7	15	1	148	477	2	17	60	116
314	1180	1027.5	457	4	6	91	9	15	0	178	409	1	18	59	103
315	1174	1028	457	10	6	102	4	16	1	165	420	2	18	62	114
316	1168	1028.5	457	3	4	102	6	19	1	162	325	2	16	61	97
317	1162	1029	457	3	5	96	6	20	0	184	336	1	17	67	112
318	1156	1029.5	457	7	4	100	9	18	1	205	368	2	20	72	108
319	1150	1030	457	4	5	107	10	17	1	120	410	2	18	92	100
320	1045	1038	457	4	5	98	9	18	1	128	458	2	19	95	107
321	1038	1040	457	4	7	82	8	24	1	138	358	2	15	66	129
322	1033	1042	457	4	5	88	8	19	1	173	506	2	15	62	127
323	1027	1044.5	457	4	3	91	9	19	1	163	481	3	19	65	118
324	1021	1046.5	457	3	5	89	5	22	1	137	392	1	18	61	128
325	1189	1200	456	4	8	101	8	18	1	113	600	7	19	64	118
326	1194	1200	456	5	7	81	5	16	1	164	453	6	19	71	117
327	1200	1200	456	4	5	82	5	16	1	167	517	3	17	64	95
328	1206	1200	456	4	5	77	11	19	1	163	442	2	16	56	101
329	1215	1200	456	4	5	79	3	16	1	213	346	4	16	59	92
330	1217	1200	456	4	4	81	4	18	1	147	367	2	14	63	102
331	1219	1200	456	4	8	83	8	24	0	152	305	2	17	65	105
332	1221	1200	456	3	7	87	9	24	0	172	312	1	18	67	93
333	1223	1200	456	3	4	87	10	22	0	221	315	2	19	64	99
334	1225	1200	456	4	6	79	8	19	0	274	311	2	19	56	87
335	1227	1200	456	4	5	84	9	22	0	229	316	2	22	59	66
336	1229	1200	456	4	6	93	9	22	0	207	368	3	20	71	109
337	1233	1200	456	4	5	83	9	24	0	260	268	2	20	66	104
338	1239	1200	456	4	8	89	11	26	1	195	301	1	20	62	115
339	1245	1200	456	4	5	91	8	25	0	172	262	2	20	61	100
340	1251	1200	456	4	5	91	8	25	0	170	257	2	22	62	81
341	1257	1200	456	3	6	94	8	27	0	224	257	1	24	60	115
342	1263	1200	456	4	4	105	13	22	1	248	310	2	27	63	106
343	1269	1200	456	4	7	96	6	24	0	169	259	2	23	61	80
344	1275	1200	456	4	5	101	8	24	0	197	291	2	25	61	112
345	1281	1200	456	4	6	94	8	25	0	224	231	2	25	61	107
346	1287	1200	456	4	5	104	8	23	1	183	294	2	24	63	73
347	1155	1200	456	4	5	105	9	24	1	179	342	1	25	64	122
348	1161	1200	456	3	7	95	7	20	1	128	335	1	18	70	114
349	1167	1200	456	4	7	92	7	20	0	192	301	2	24	57	108
350	1173	1200	456	4	8	90	7	18	1	178	363	2	19	65	103
351	1179	1200	456	3	5	87	6	20	1	169	313	1	19	63	98
352	1185	1200	456	3	5	78	5	18	1	221	285	1	19	83	95
353	1078	1200	456	3	6	77	5	19	0	251	309	1	21	79	101
354	1084	1200	456	4	6	108	6	17	1	131	492	2	18	63	104
355	1090	1200	456	3	4	95	8	17	1	164	451	3	17	67	110
356	1096	1200	456	4	6	96	8	18	1	132	578	3	17	65	109
357	1102	1200	456	4	6	97	11	16	1	110	637	3	18	76	116
358	1108	1200	456	4	4	97	4	16	1	94	604	2	17	78	102
359	1114	1200	456	4	4	99	10	20	1	76	599	3	18	80	74
360	1120	1200	456	4	8	92	6	20	1	84	553	3	17	76	70
361	1126	1200	456	4	7	90	8	14	1	107	540	2	17	72	117

SHID	Easting	Northing	RL	SiO2.i	Al2O3.i	Fe2O3.x	MgO.i	CaO.i	Na2O.x	TiO2.x	P2O5.i	S.x	LOI
565	1050	1200	456.5	43.31	18.45	13.87	1.32	1.65	0.23	1.05	0.07	0.08	19.16
566	1075	1200	456.3	49.77	13.92	23.88	0.66	0.59	0.24	1.32	0.06	0.04	8.95
567	1100	1200	456.3	50.55	15.79	18.44	1.02	0.78	0.21	1.12	0.04	0.03	11.36
568	1125	1200	456.1	54.90	11.74	22.45	0.56	0.44	0.22	1.18	0.05	0.03	7.96
569	1150	1200	456.1	54.46	13.62	16.30	1.10	1.01	0.27	1.03	0.06	0.03	11.32
570	1175	1200	456.3	49.75	13.93	14.15	1.44	4.17	0.31	0.96	0.06	0.04	14.31
571	1200	1200	456.6	47.88	9.98	15.30	1.50	7.45	0.83	0.85	0.05	0.04	15.47
572	1225	1200	456.8	48.98	9.55	11.58	1.75	8.96	0.76	0.71	0.05	0.07	16.80
573	1250	1200	456.8	47.78	9.87	21.02	1.27	5.22	0.20	1.03	0.05	0.02	12.80
574	1275	1200	456.9	49.97	10.32	16.73	1.41	5.44	0.23	0.84	0.05	0.04	14.13
575	1300	1200	457.1	48.50	9.99	13.15	1.63	7.95	0.36	0.73	0.05	0.04	16.74
576	1325	1200	457.2	50.42	9.63	14.30	1.61	7.18	0.19	0.76	0.06	0.03	14.97
577	1060	1925	453	57.18	13.70	14.44	1.37	0.59	0.65	0.91	0.05	0.02	10.17
578	850	600	463	48.21	12.05	26.59	0.63	0.48	0.18	1.49	0.04	0.02	9.90

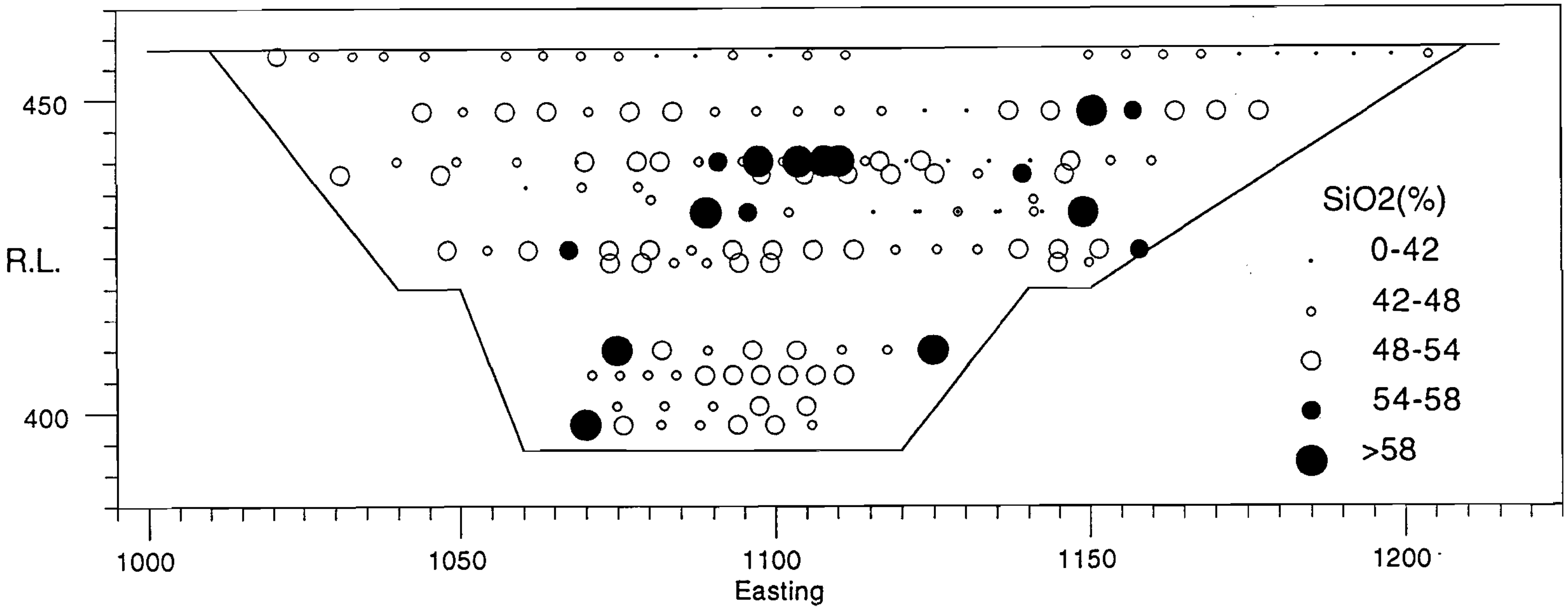
SHID	Easting	Northing	RL	As.n	Au.n	Ba.x	Be.i	Ce.n	Co.n	Cr.n	Cu.x	Ga.x	Ge.x	La.n	Mn.x
565	1050	1200	456.5	6	36	188	n/a	28	34	256	110	23	1	14	1251
566	1075	1200	456.3	9	9	230	n/a	29	33	355	114	24	1	16	1220
567	1100	1200	456.3	7	29	212	n/a	32	32	313	116	24	2	11	1209
568	1125	1200	456.1	9	22	180	n/a	26	28	338	104	20	1	9	989
569	1150	1200	456.1	11	226	248	n/a	30	33	280	115	20	1	18	1369
570	1175	1200	456.3	6	68	238	n/a	32	33	254	110	20	1	9	1306
571	1200	1200	456.6	10	223	204	n/a	34	23	259	106	17	2	17	1124
572	1225	1200	456.8	7	360	159	n/a	32	26	207	112	14	1	13	1339
573	1250	1200	456.8	9	59	199	n/a	43	32	307	123	22	0	23	1727
574	1275	1200	456.9	7	41	180	n/a	43	30	273	131	19	1	26	1609
575	1300	1200	457.1	6	49	172	n/a	41	32	262	127	15	1	18	1661
576	1325	1200	457.2	7	32	184	n/a	44	35	253	130	15	1	24	1743
577	1060	1925	453	6	5	200	n/a	36	41	242	104	20	1	25	1674
578	850	600	463	8	9	265	n/a	21	26	490	80	24	0	10	760

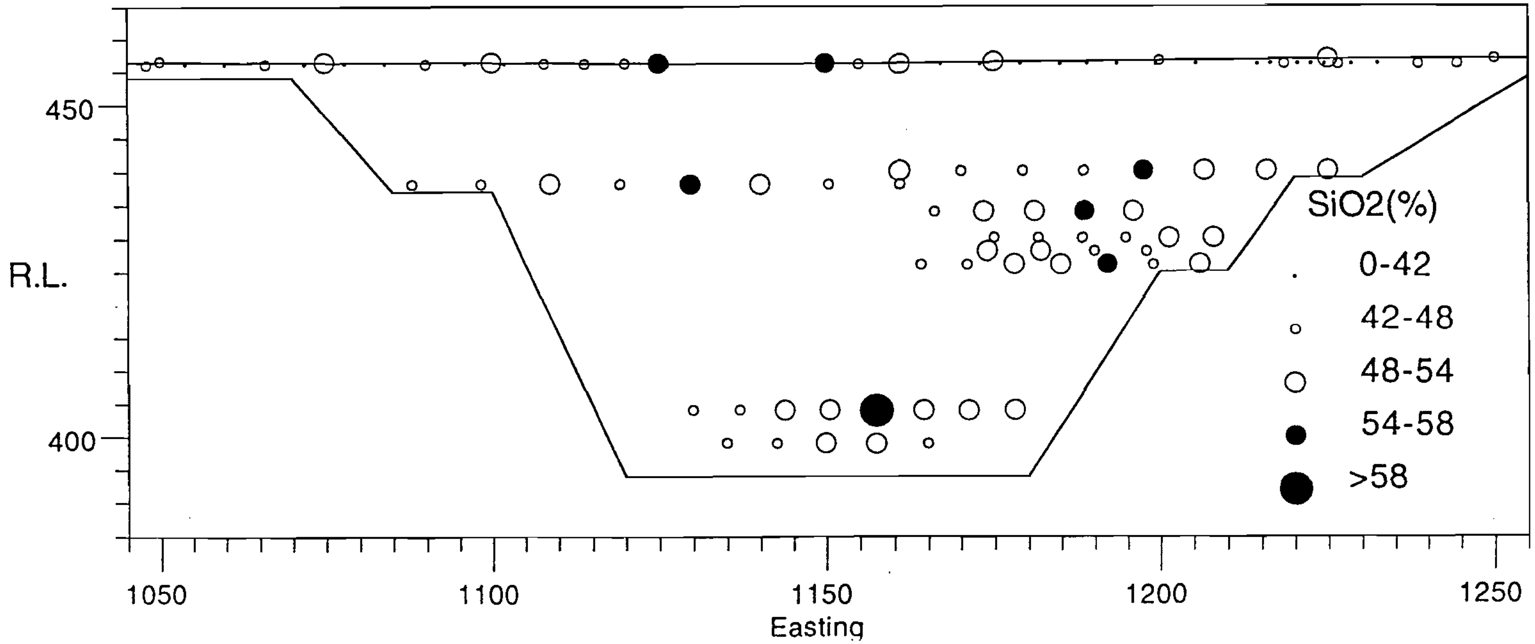
SHID	Easting	Northing	RL	Mo.n	Nb.x	Ni.x	Pb.x	Rb.x	Sb.n	Sr.x	V.x	W.n	Y.x	Zn.x	Zr.i
565	1050	1200	456.5	3	9	106	9	35	1	75	303	2	19	103	136
566	1075	1200	456.3	4	6	98	8	27	1	50	603	2	20	84	132
567	1100	1200	456.3	3	6	112	7	36	1	57	417	2	21	94	138
568	1125	1200	456.1	3	6	91	7	23	1	40	542	4	19	76	120
569	1150	1200	456.1	3	5	104	6	38	1	66	364	2	22	108	133
570	1175	1200	456.3	3	6	103	1	40	1	85	303	2	23	97	133
571	1200	1200	456.6	3	8	83	9	30	1	121	382	2	19	69	122
572	1225	1200	456.8	3	8	91	12	37	0	153	263	2	21	77	124
573	1250	1200	456.8	4	6	110	16	35	1	78	484	2	26	92	129
574	1275	1200	456.9	4	7	114	10	38	1	85	349	2	29	109	131
575	1300	1200	457.1	3	7	111	10	40	0	115	278	2	26	91	126
576	1325	1200	457.2	3	5	121	11	41	1	101	306	2	31	97	122
577	1060	1925	453	4	10	108	7	56	1	55	344	2	22	109	133
578	850	600	463	3	7	102	7	21	1	54	639	2	13	55	153

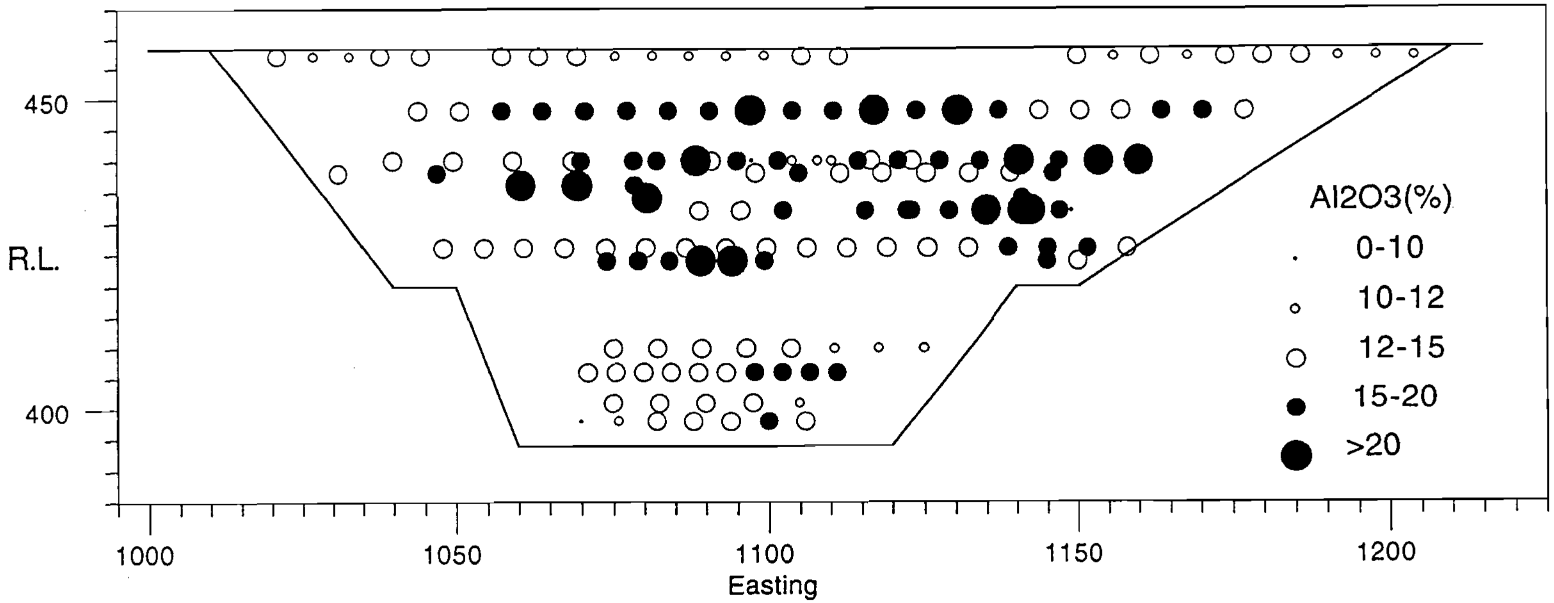
APPENDIX 3

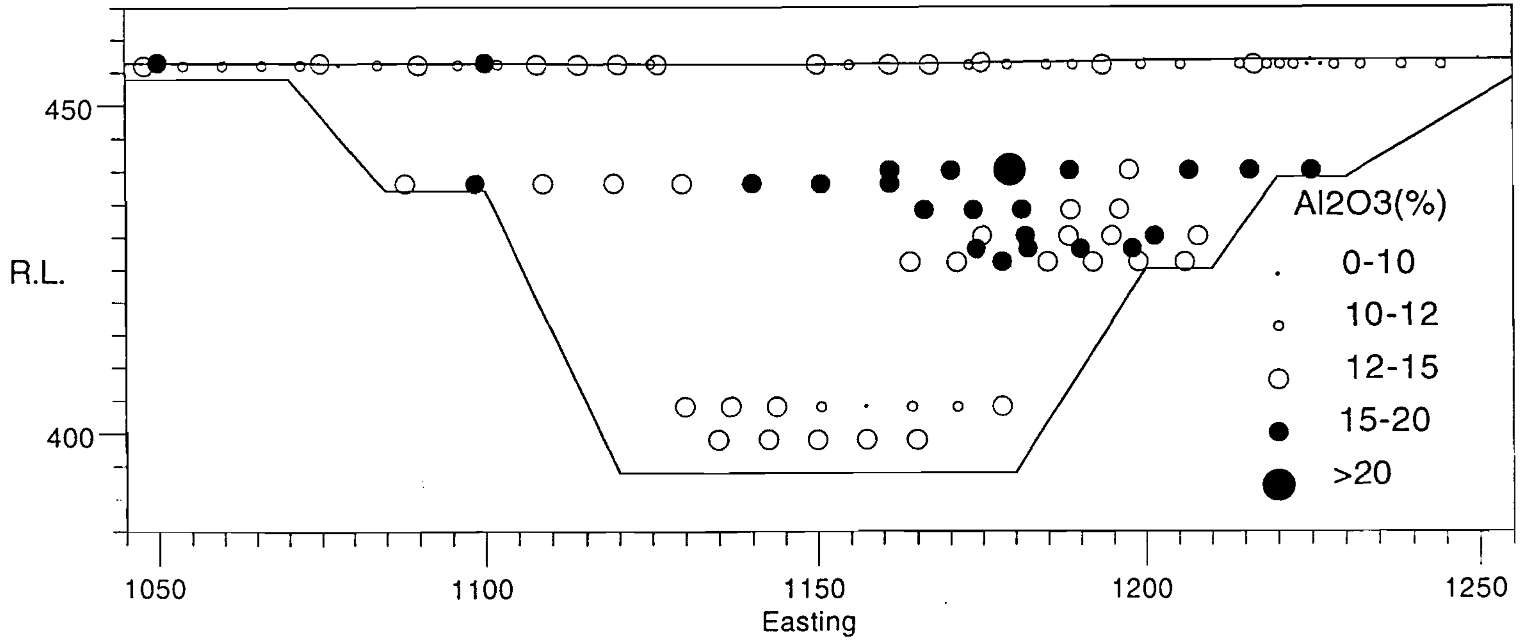
ELEMENT DISTRIBUTIONS,

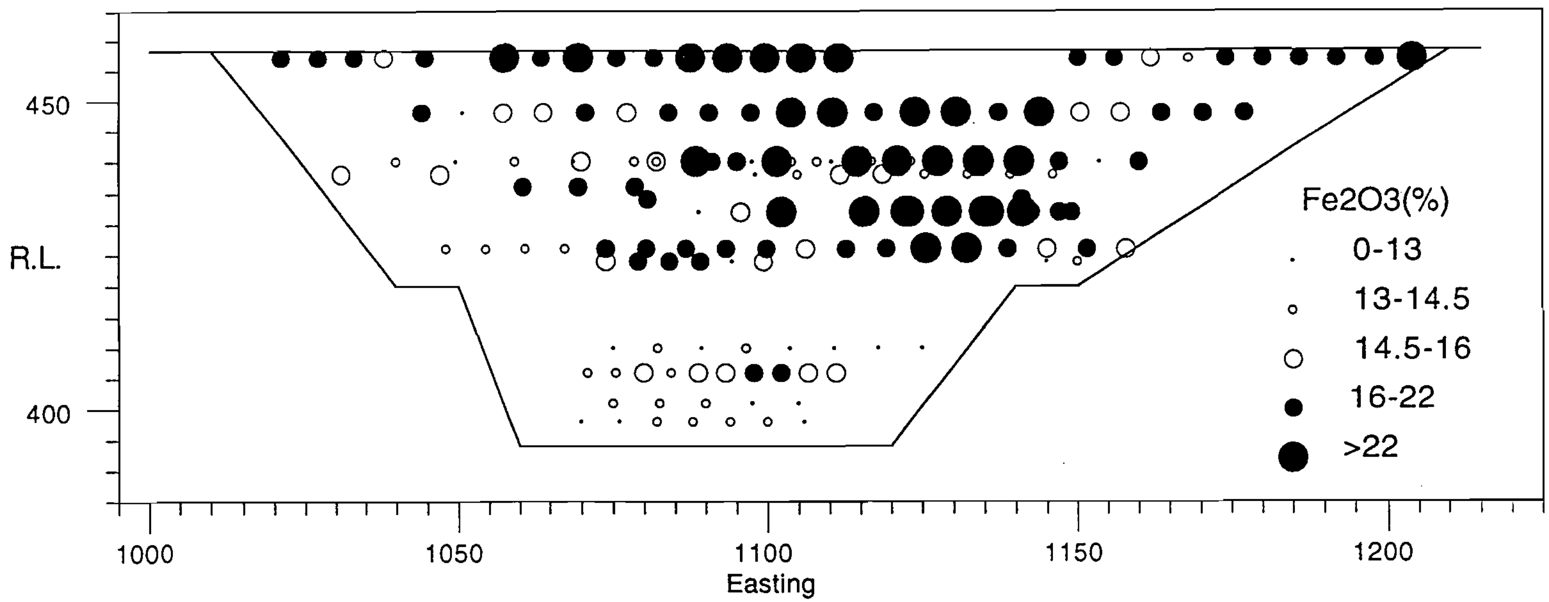
LINES 940N-1050N AND 1200N

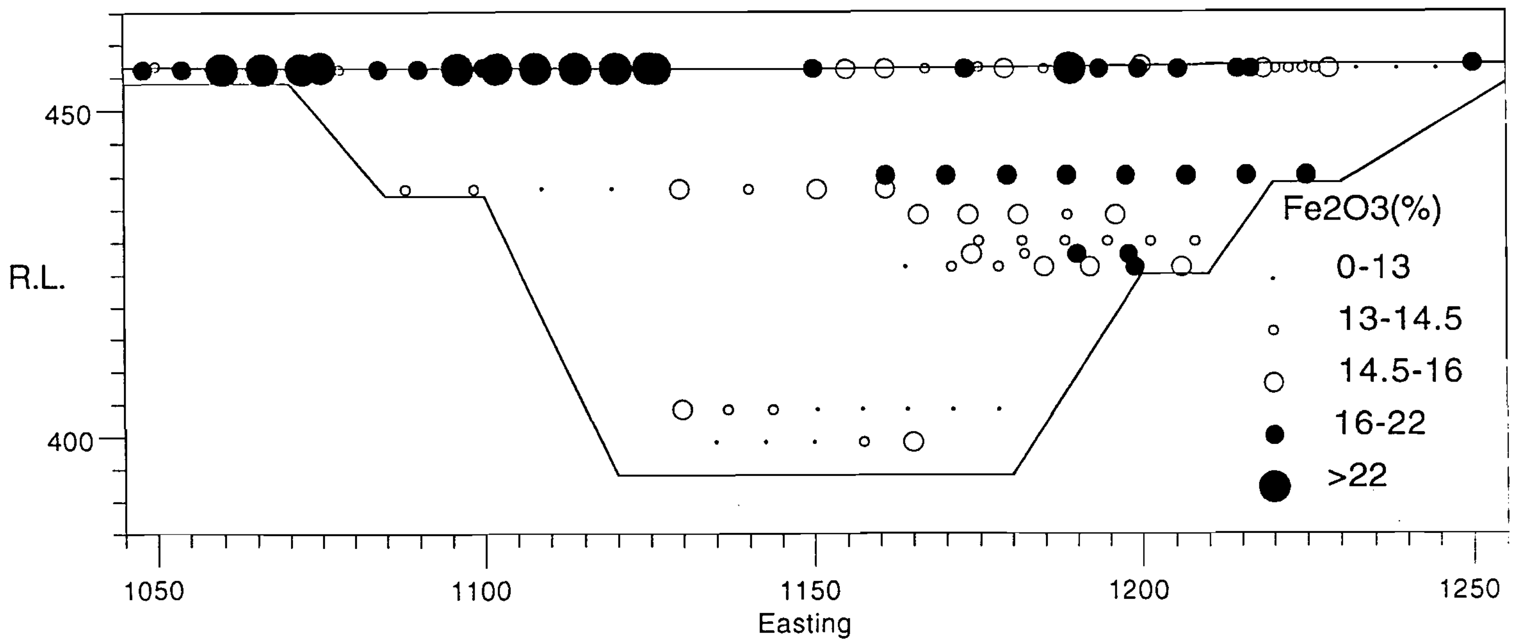

SiO2(%)
0-42
42-48
48-54
54-58
>58
450
400
R.L.
1000
1050
1100
1150
1200
Easting

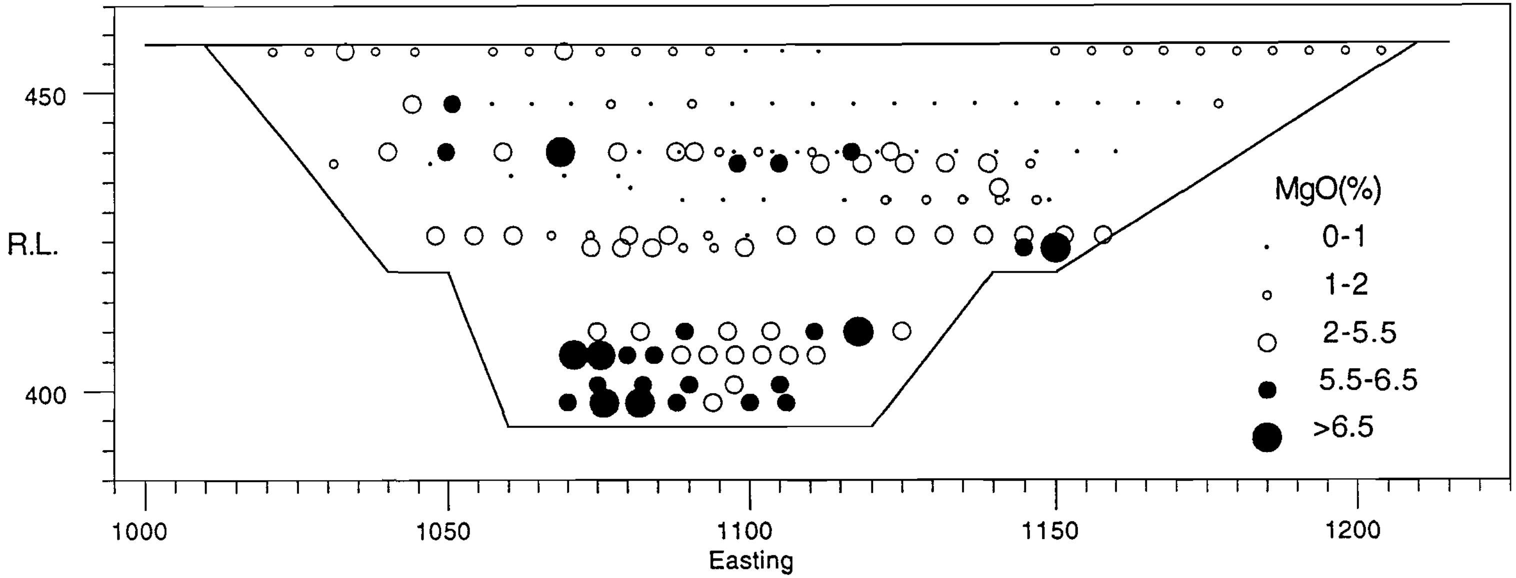

SiO2(%)
0-42
42-48
48-54
54-58
>58
450
400
R.L.
1050
1100
1150
1200
1250
Easting

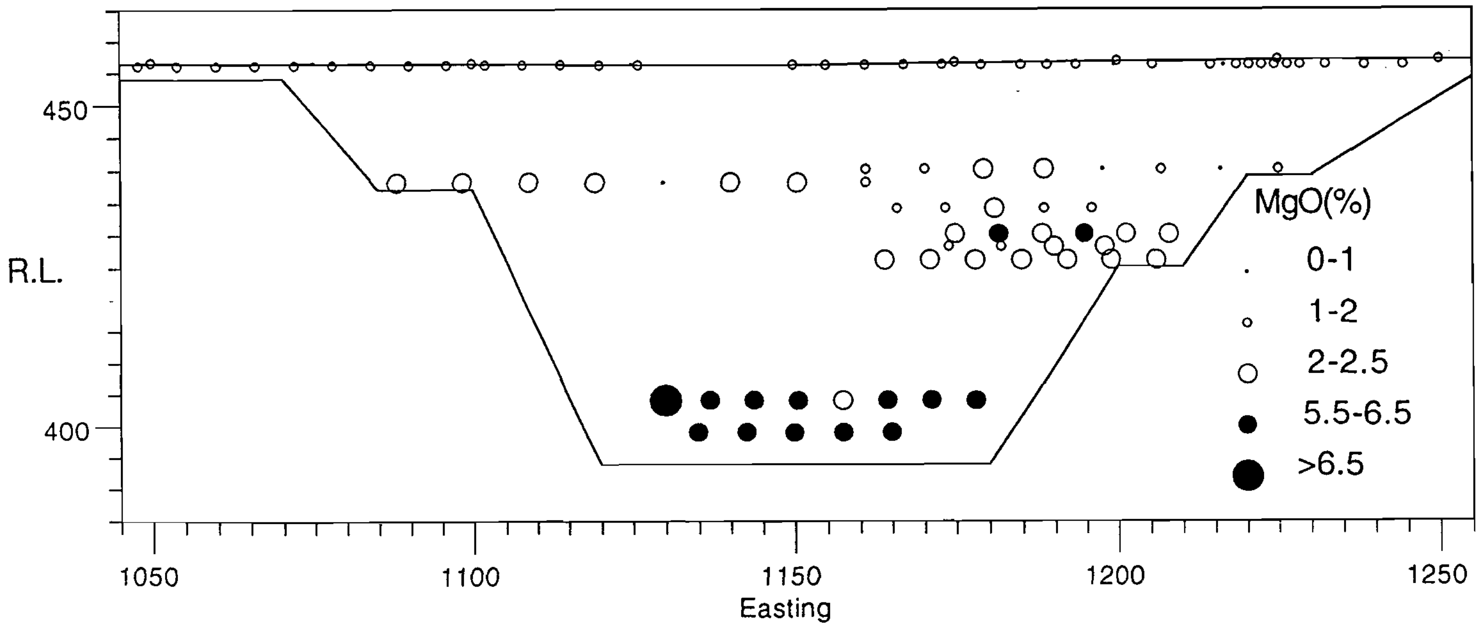

450
400
R.L.
1000
1050
1100
1150
1200
Easting
Al2O3(%)
0-10
10-12
12-15
15-20
>20

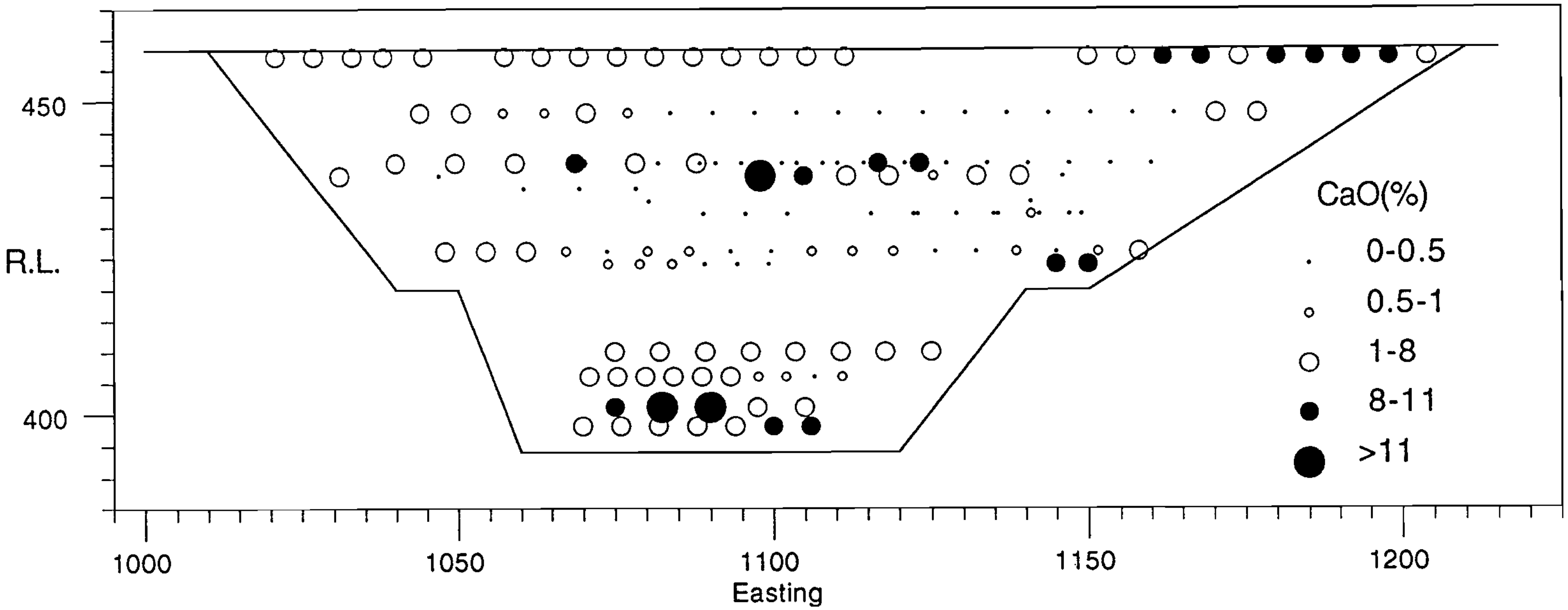

450
400
R.L.
1050
1100
1150
1200
1250
Easting
Al2O3(%)
0-10
10-12
12-15
15-20
>20


450
400
R.L.
1000
1050
1100
1150
1200
Easting
Fe2O3(%)
0-13
13-14.5
14.5-16
16-22
>22

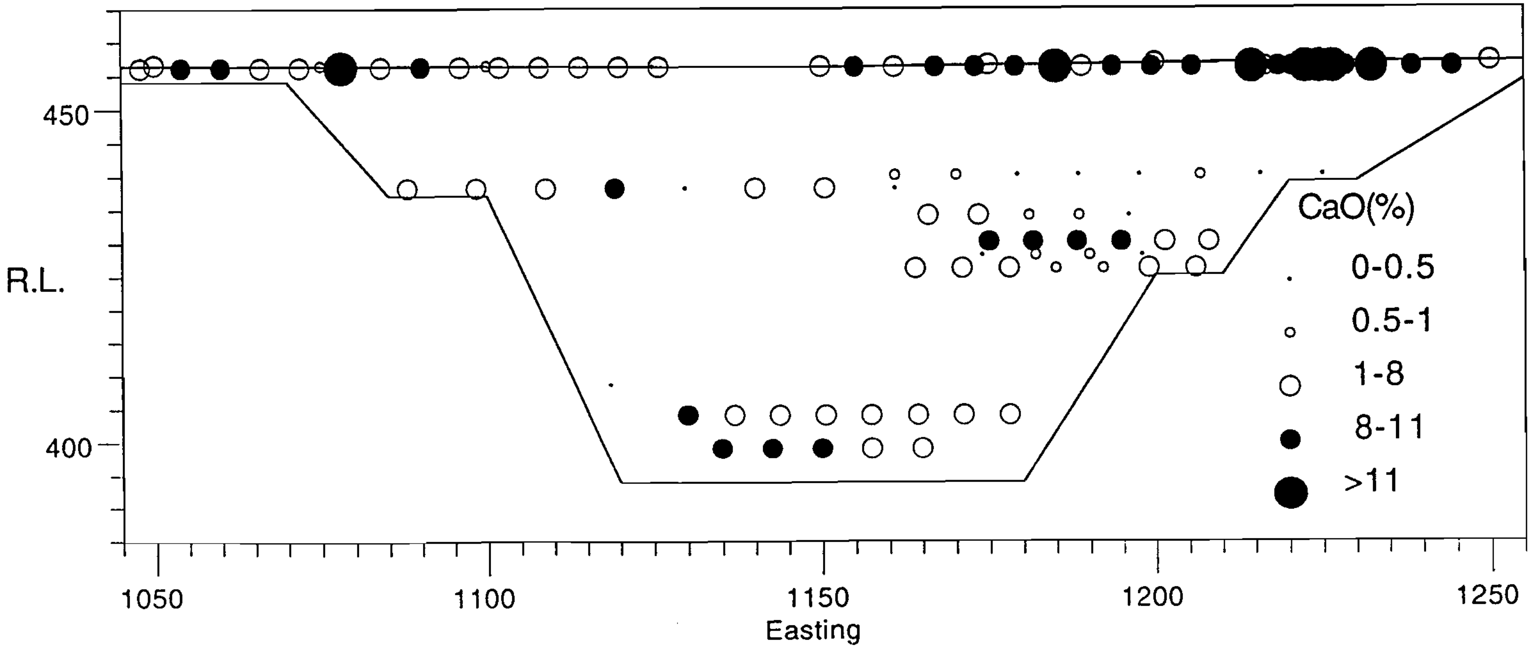

450
400
R.L.
1050
1100
1150
1200
1250
Easting
Fe2O3(%)
0-13
13-14.5
14.5-16
16-22
>22


MgO(%)
0-1
1-2
2-5.5
5.5-6.5
>6.5
R.L.
450
400
1000
1050
1100
1150
1200
Easting

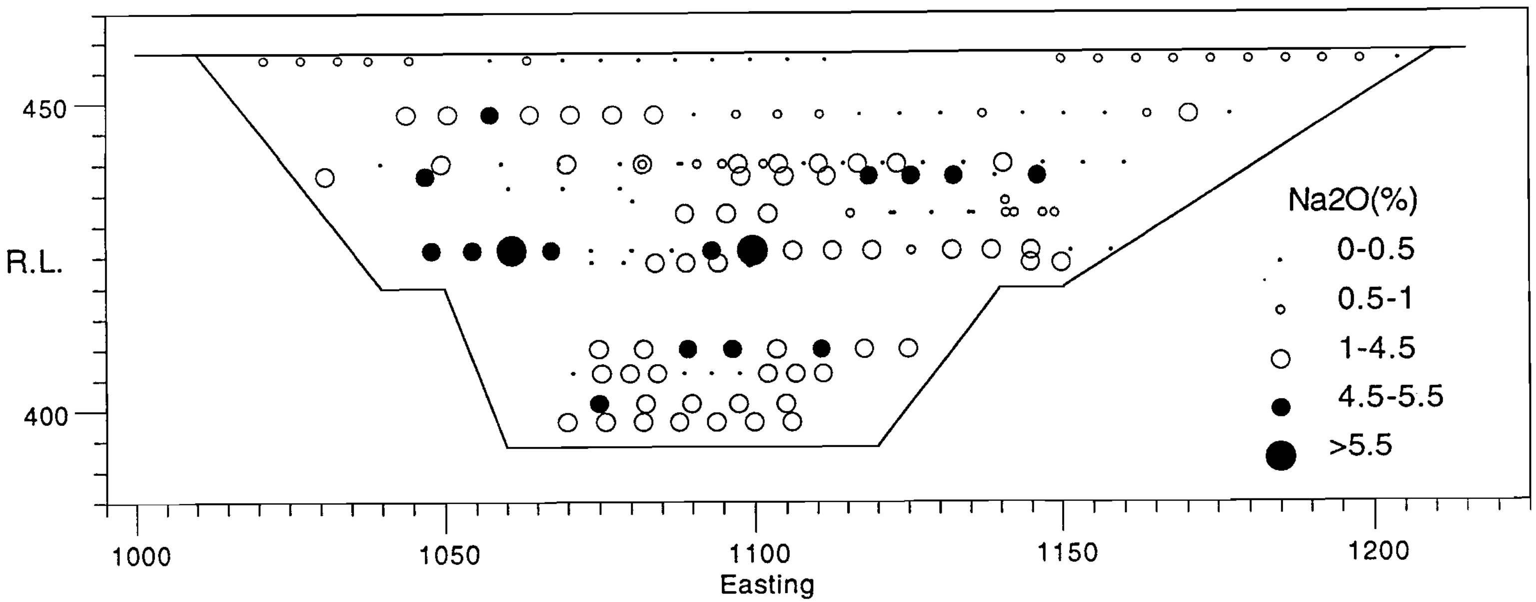

MgO(%)
0-1
1-2
2-2.5
5.5-6.5
>6.5
R.L.
450
400
1050
1100
1150
1200
1250
Easting



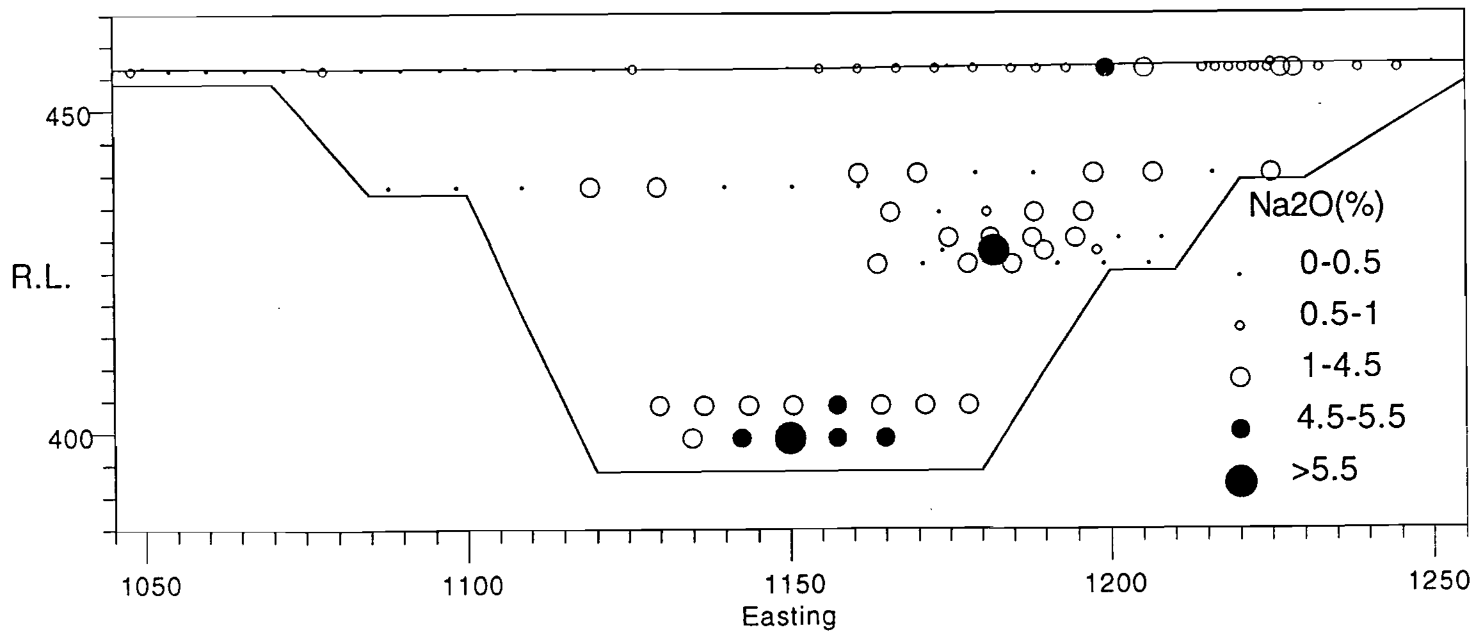
450
400
R.L.
1000
1050
1100
1150
1200
Easting
CaO(%)
0-0.5
0.5-1
1-8
8-11
>11



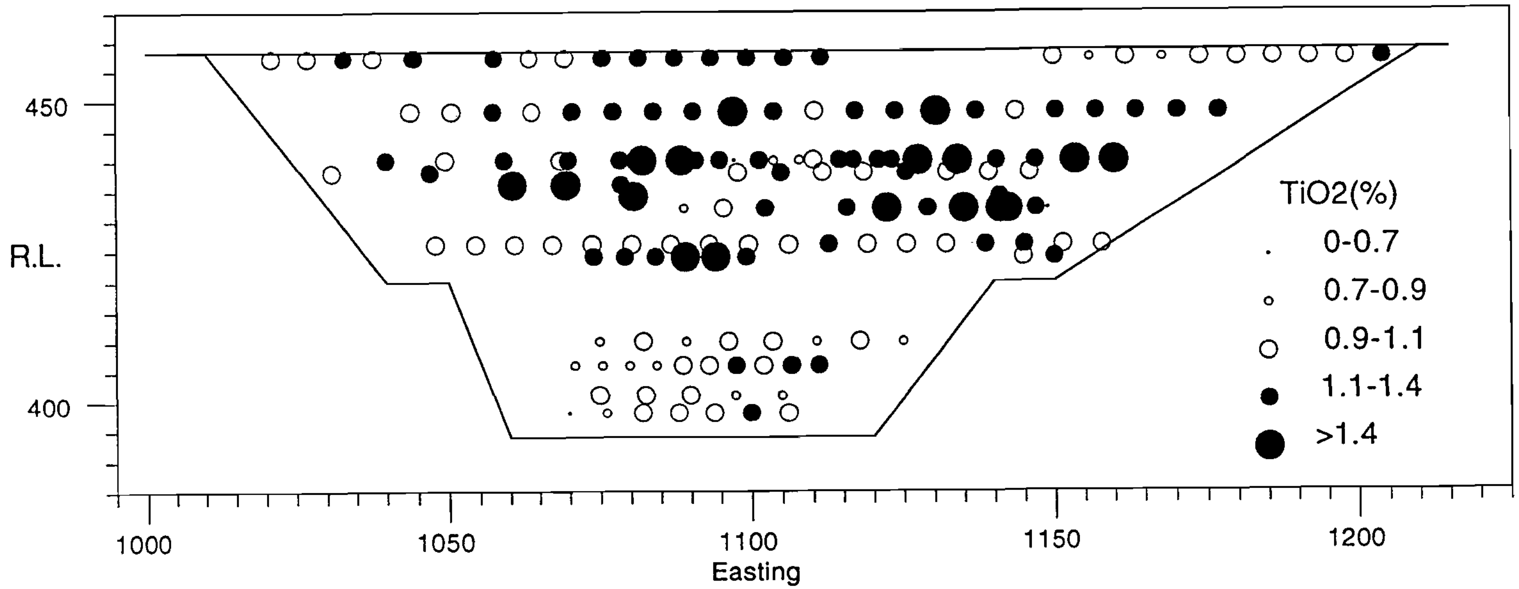
450
400
R.L.
1050
1100
1150
1200
1250
Easting
CaO(%)
0-0.5
0.5-1
1-8
8-11
>11

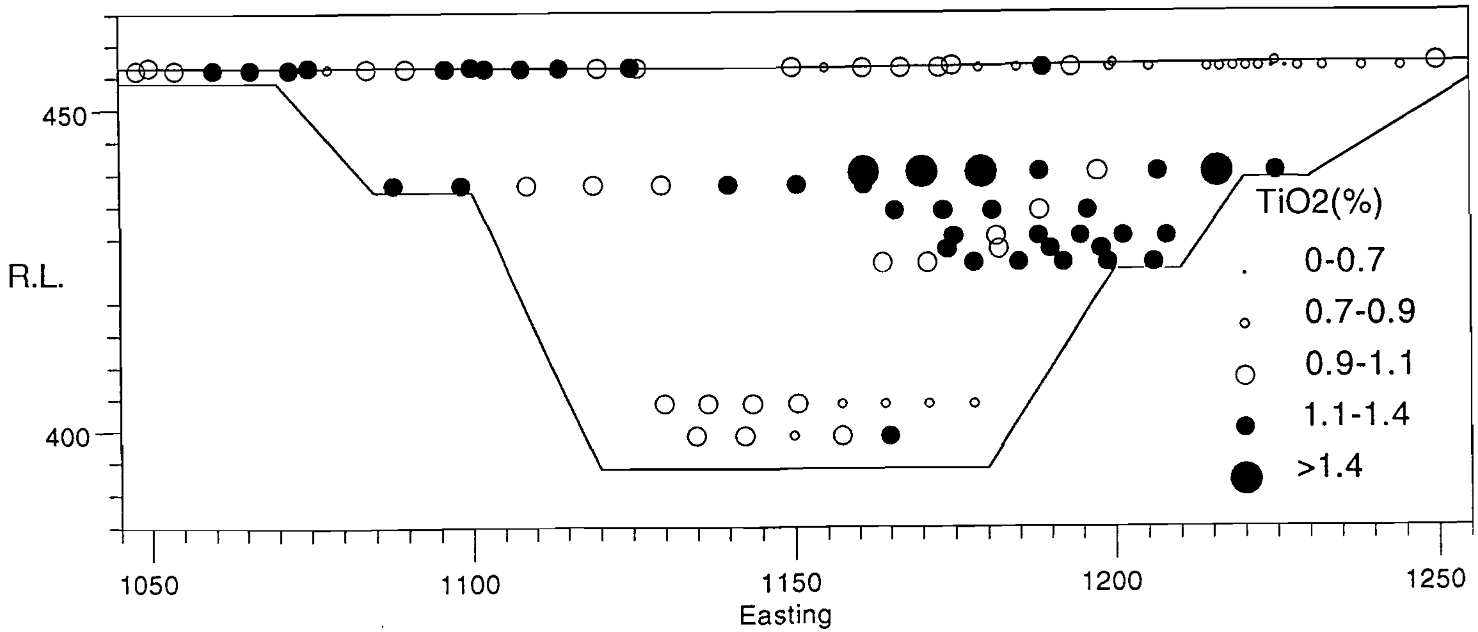


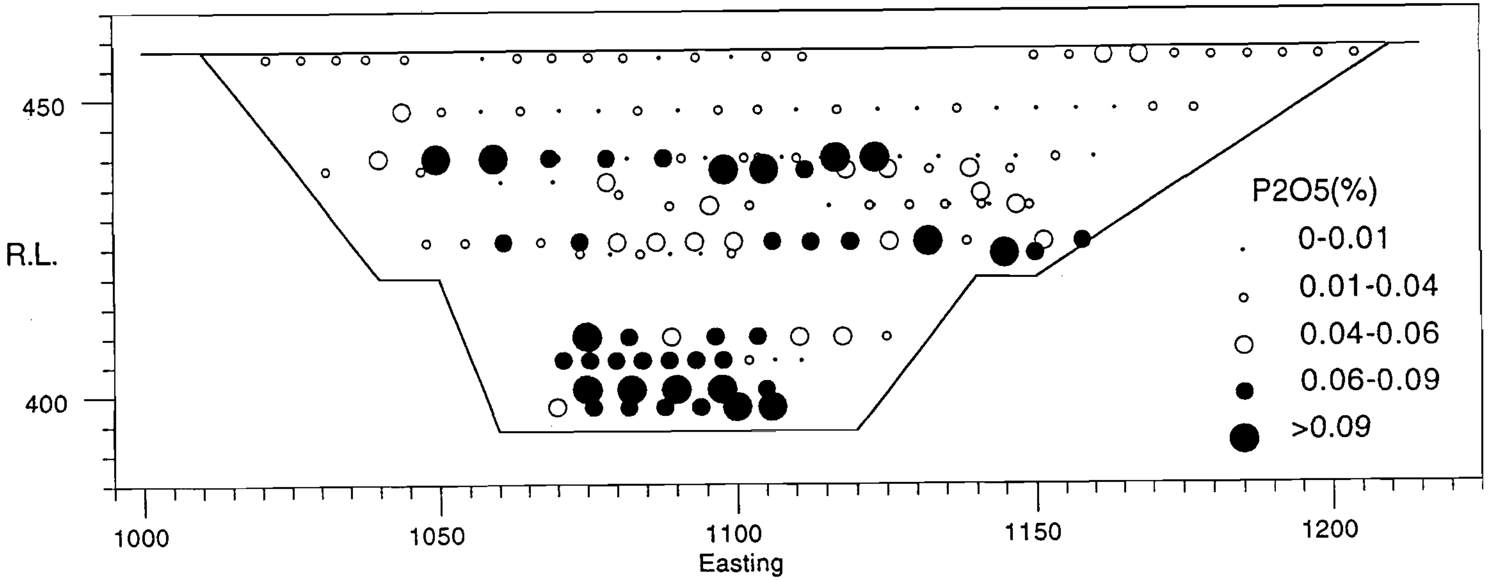
450
400
R.L.
1000
1050
1100
1150
1200
Easting
Na2O(%)
0-0.5
0.5-1
1-4.5
4.5-5.5
>5.5

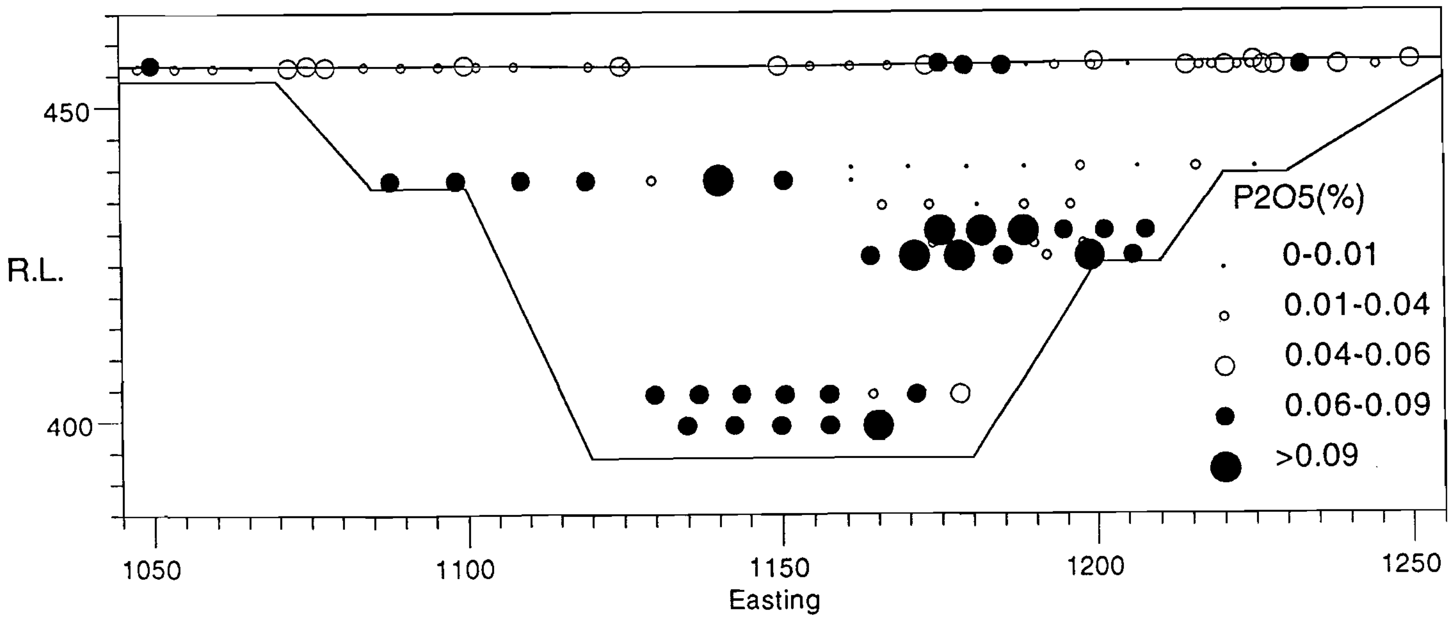


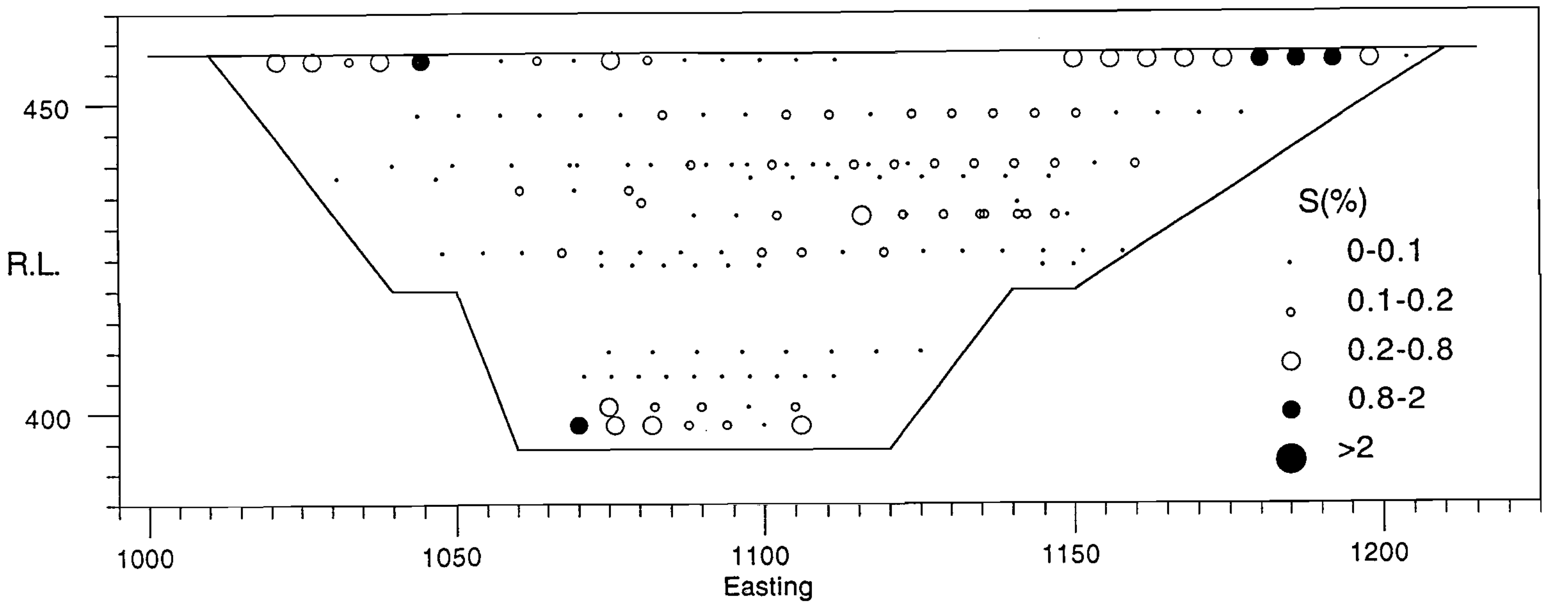
450
400
R.L.
1050
1100
1150
1200
1250
Easting
Na2O(%)
0-0.5
0.5-1
1-4.5
4.5-5.5
>5.5


R.L.
450
400
1000
1050
1100
1150
1200
Easting
TiO2(%)
0-0.7
0.7-0.9
0.9-1.1
1.1-1.4
>1.4

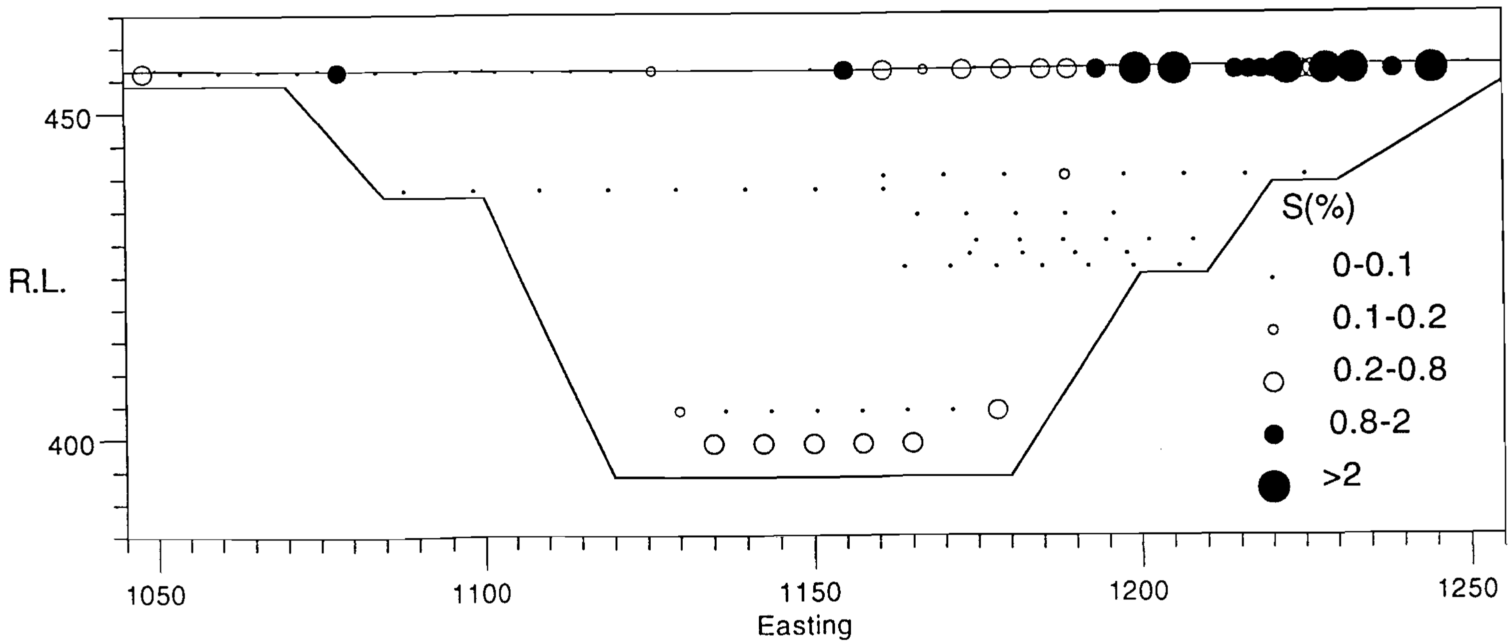

R.L.
450
400
1050
1100
1150
1200
1250
Easting
TiO2(%)
0-0.7
0.7-0.9
0.9-1.1
1.1-1.4
>1.4


P2O5(%)
0-0.01
0.01-0.04
0.04-0.06
0.06-0.09
>0.09
450
400
R.L.
1000
1050
1100
1150
1200
Easting

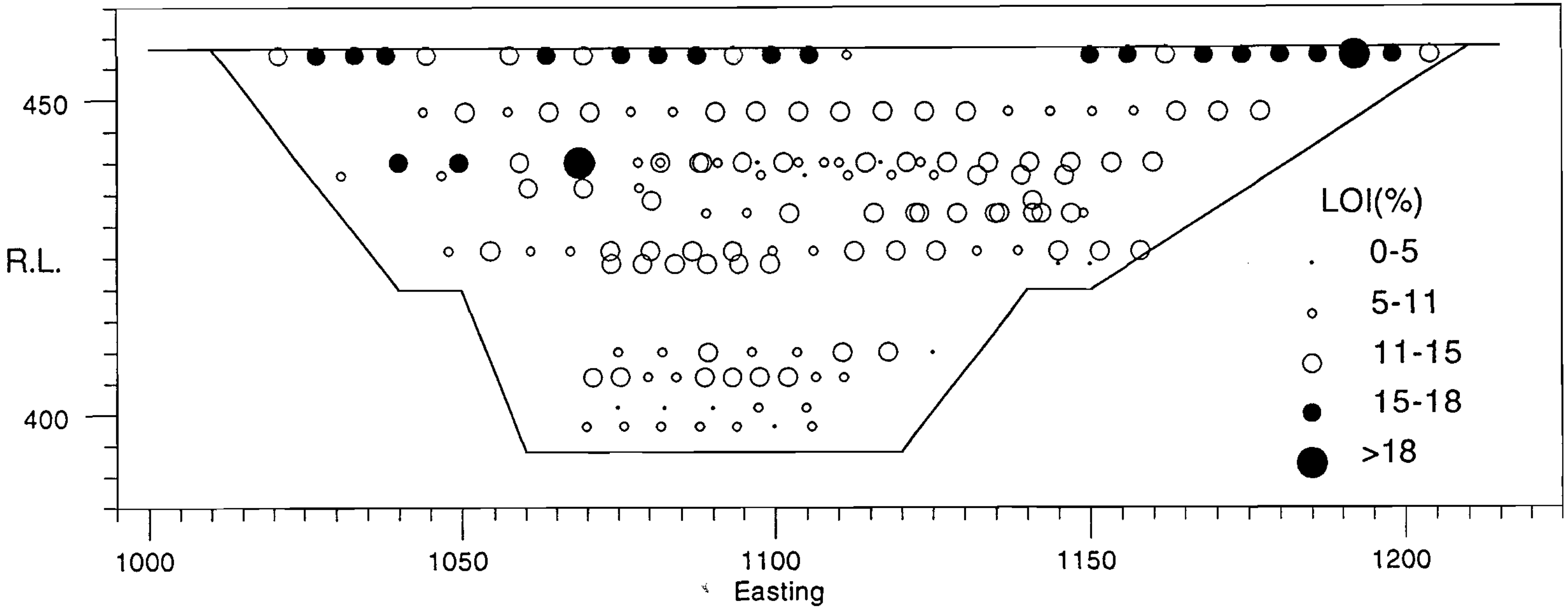

P2O5(%)
0-0.01
0.01-0.04
0.04-0.06
0.06-0.09
>0.09
450
400
R.L.
1050
1100
1150
1200
1250
Easting

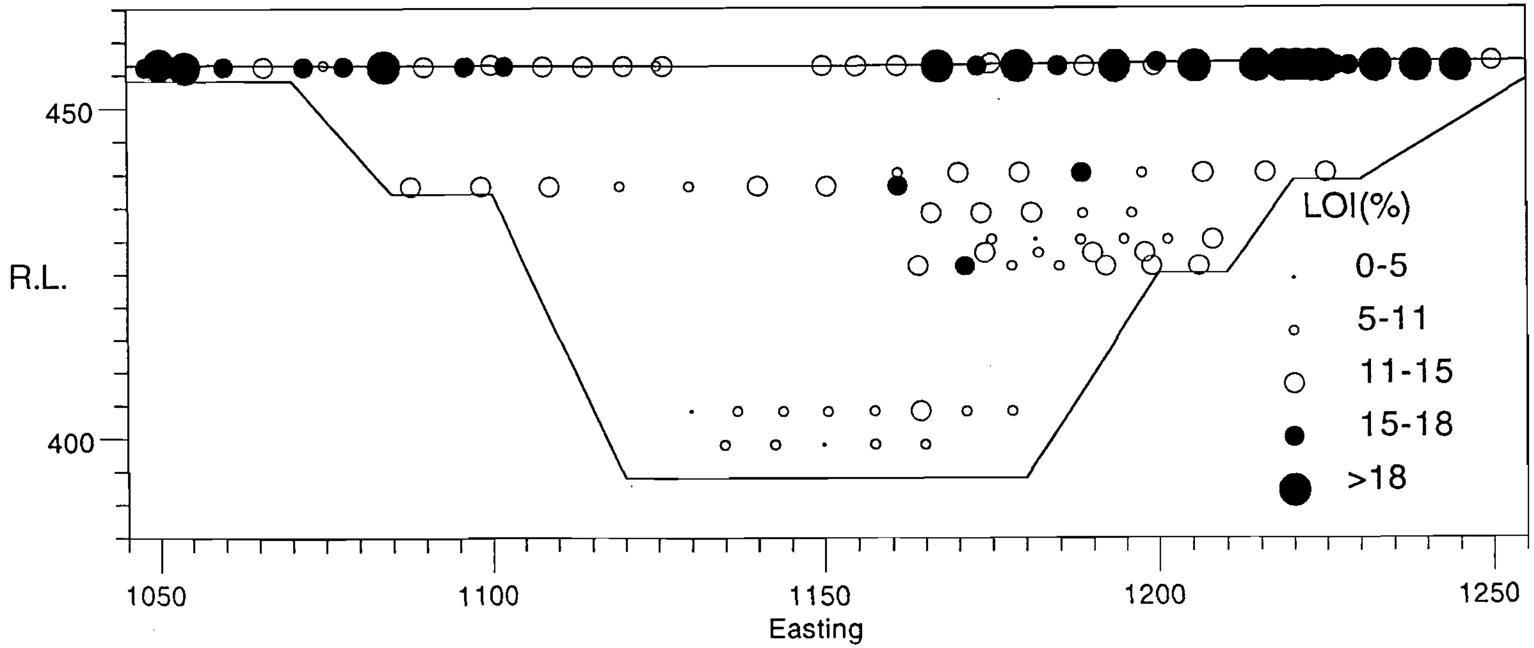


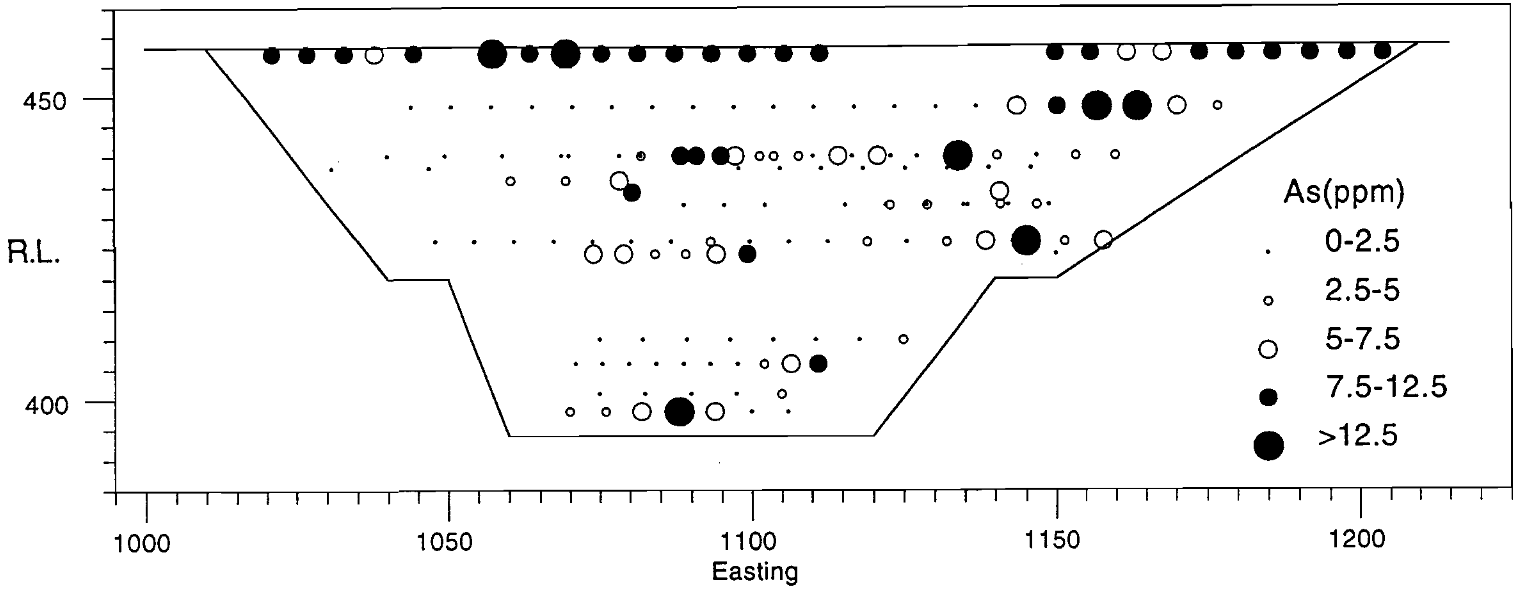
450
400
R.L.
1000
1050
1100
1150
1200
Easting
S(%)
0-0.1
0.1-0.2
0.2-0.8
0.8-2
>2

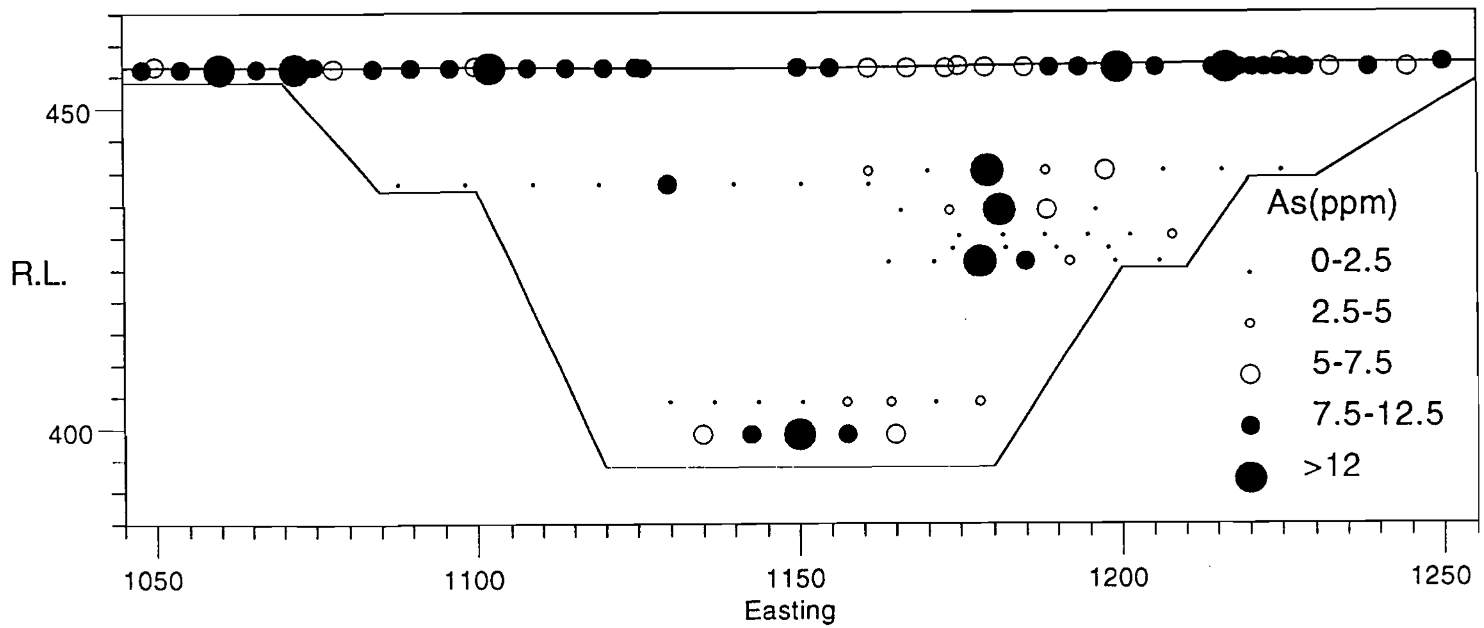


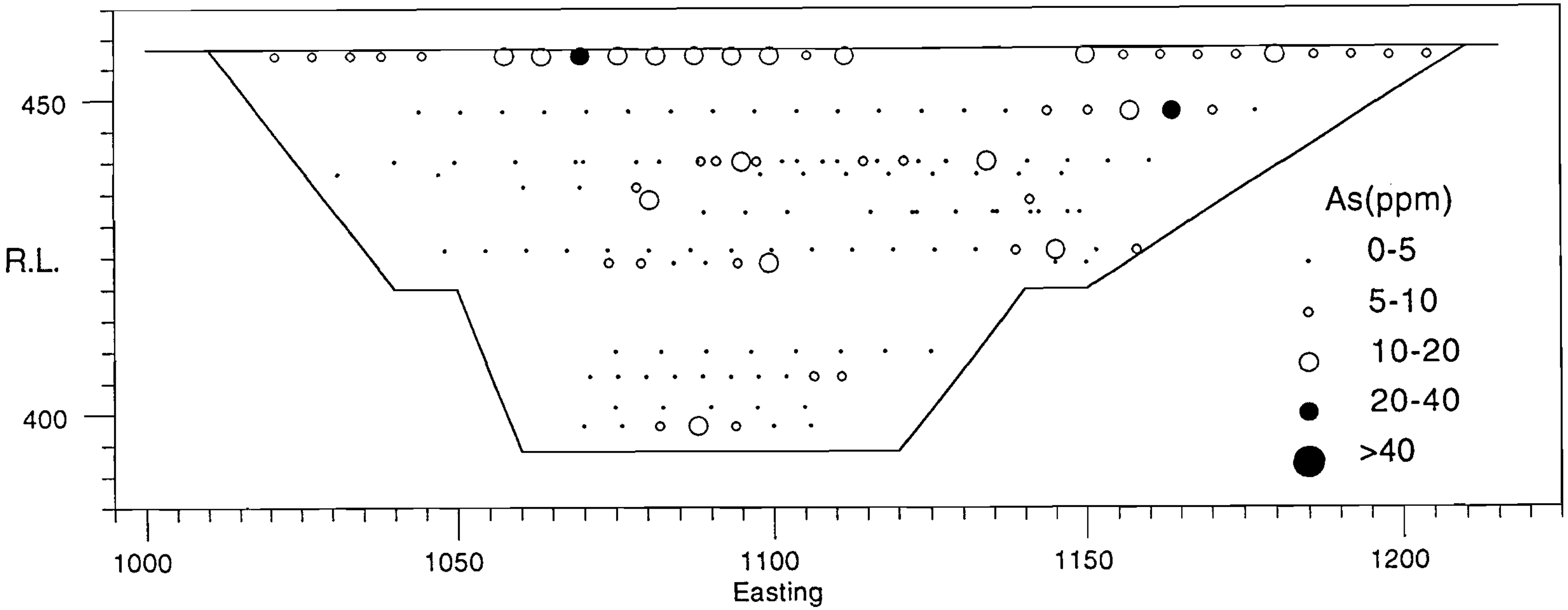
450
400
R.L.
1050
1100
1150
1200
1250
Easting
S(%)
0-0.1
0.1-0.2
0.2-0.8
0.8-2
>2

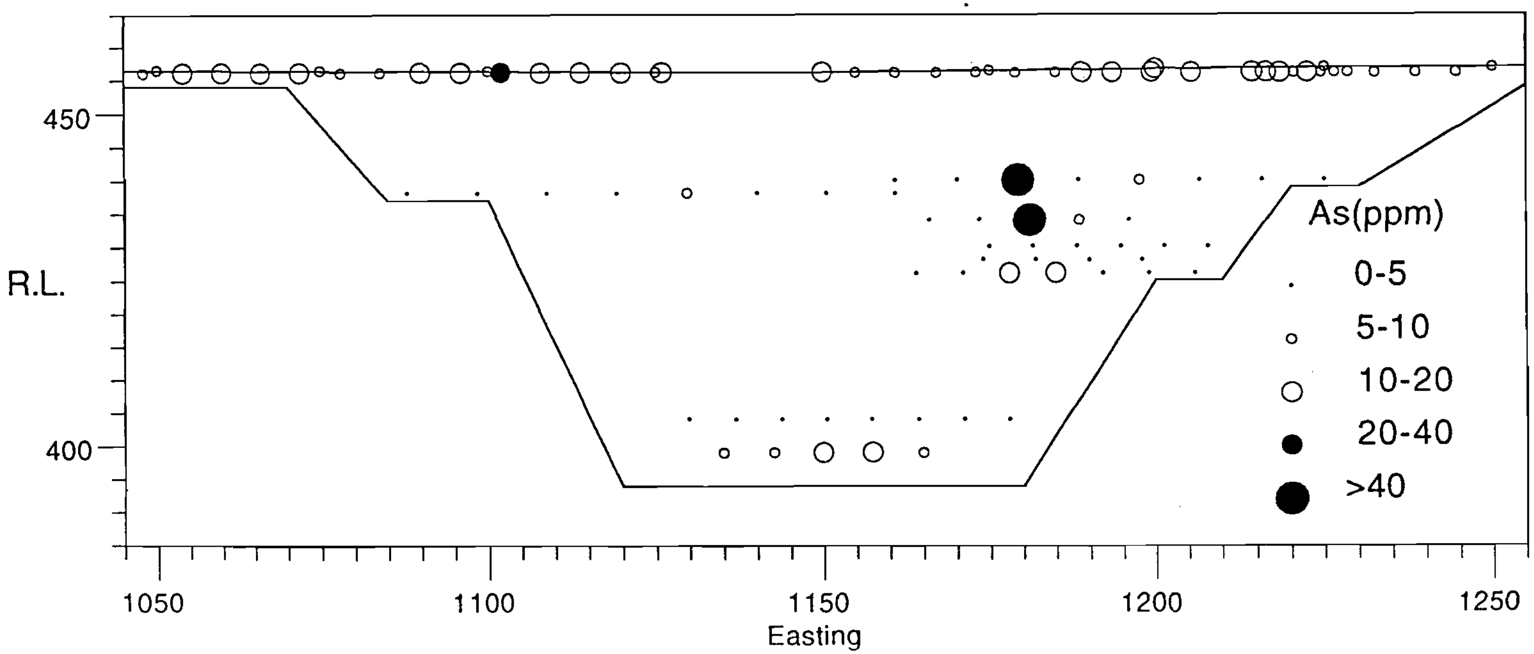

450
400
R.L.
1000
1050
1100
1150
1200
Easting
LOI(%)
0-5
5-11
11-15
15-18
>18

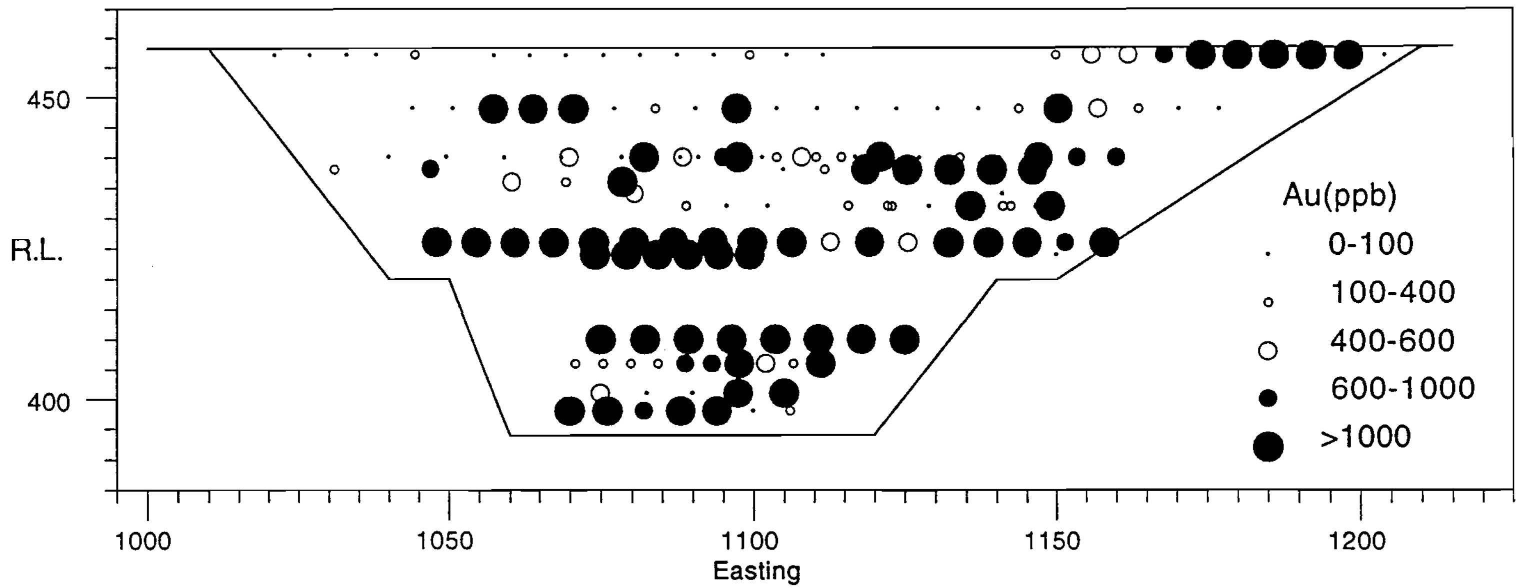

450
400
R.L.
1050
1100
1150
1200
1250
Easting
LOI(%)
0-5
5-11
11-15
15-18
>18

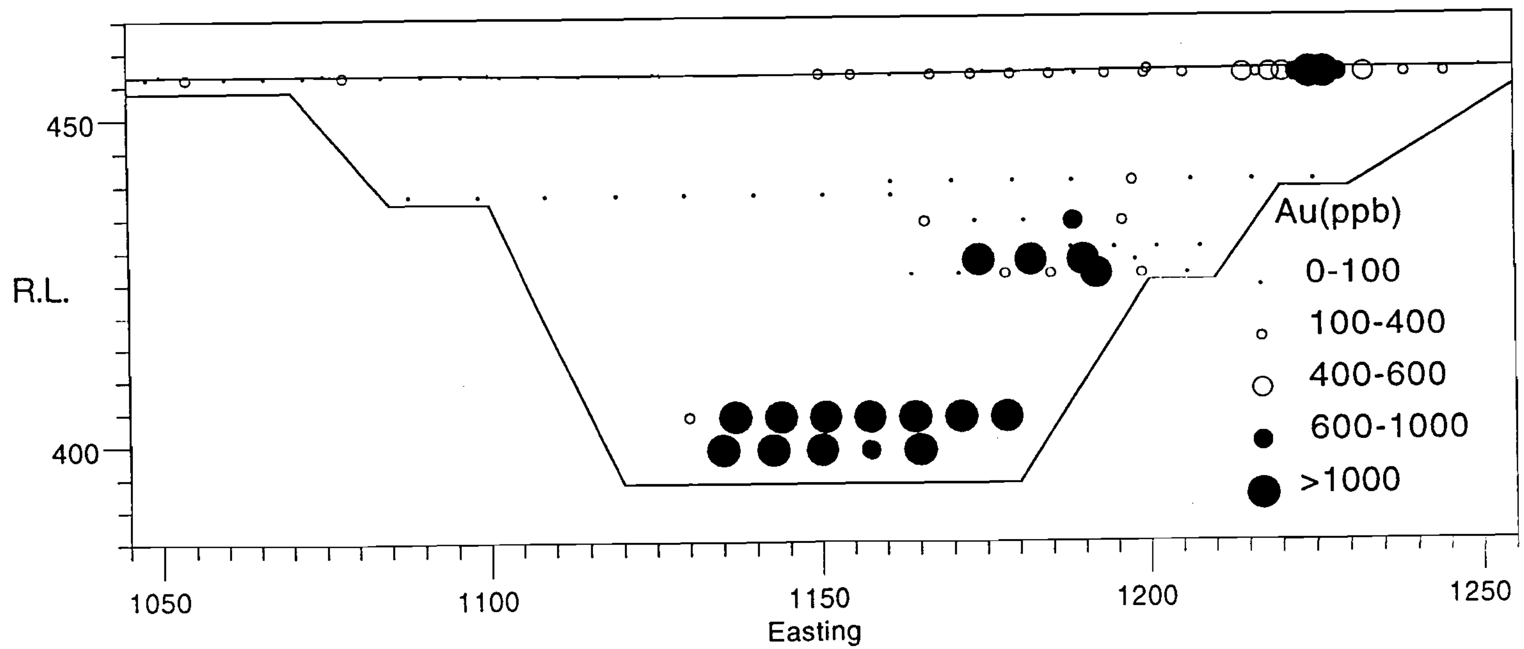

As(ppm)
0-2.5
2.5-5
5-7.5
7.5-12.5
>12.5
R.L.
450
400
1000
1050
1100
1150
1200
Easting

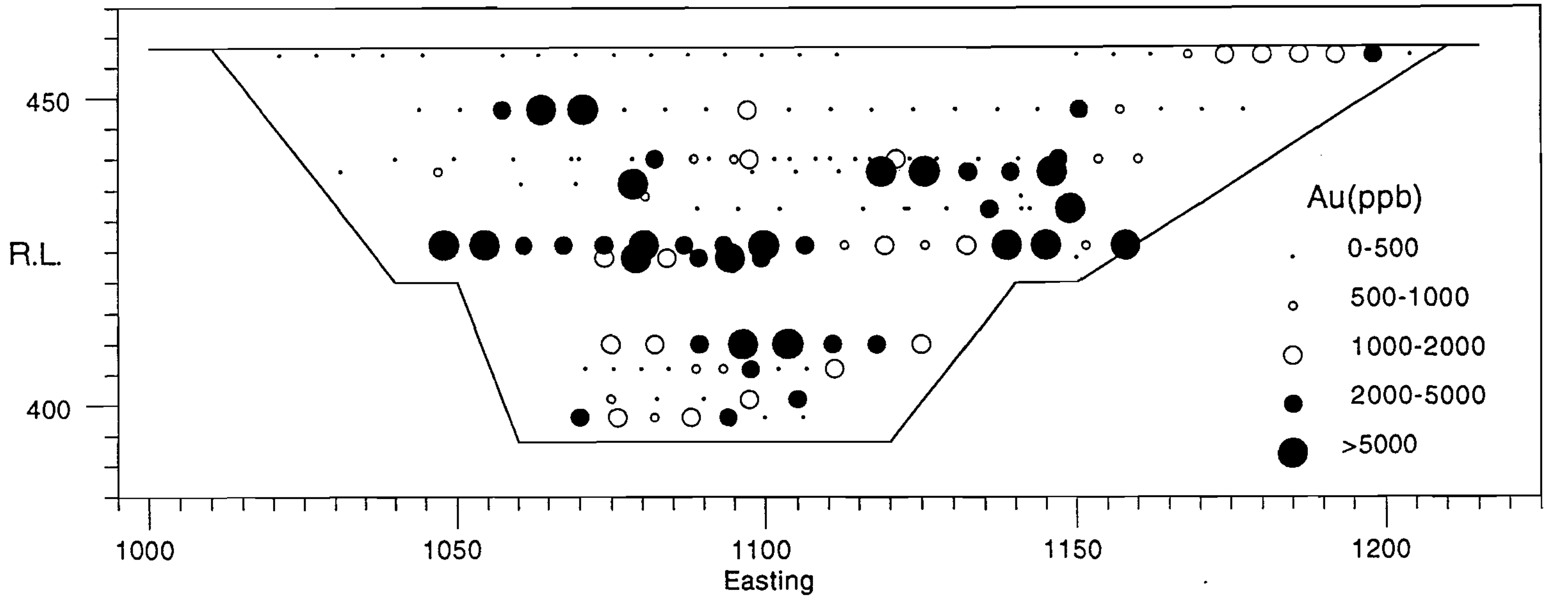

As(ppm)
0-2.5
2.5-5
5-7.5
7.5-12.5
>12
R.L.
450
400
1050
1100
1150
1200
1250
Easting


R.L.
450
400
1000
1050
1100
1150
1200
Easting
As(ppm)
0-5
5-10
10-20
20-40
>40

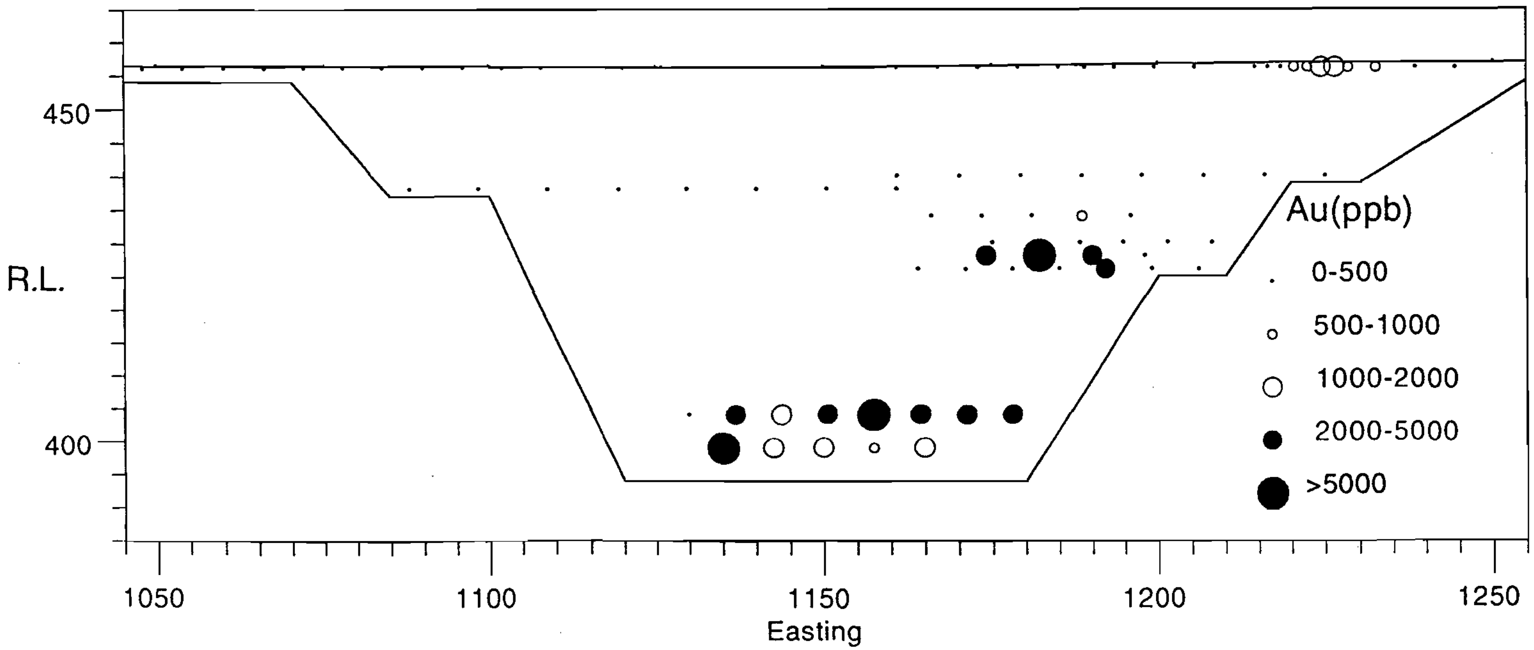

R.L.
450
400
1050
1100
1150
1200
1250
Easting
As(ppm)
0-5
5-10
10-20
20-40
>40


450
400
R.L.
1000
1050
1100
1150
1200
Easting
Au(ppb)
0-100
100-400
400-600
600-1000
>1000

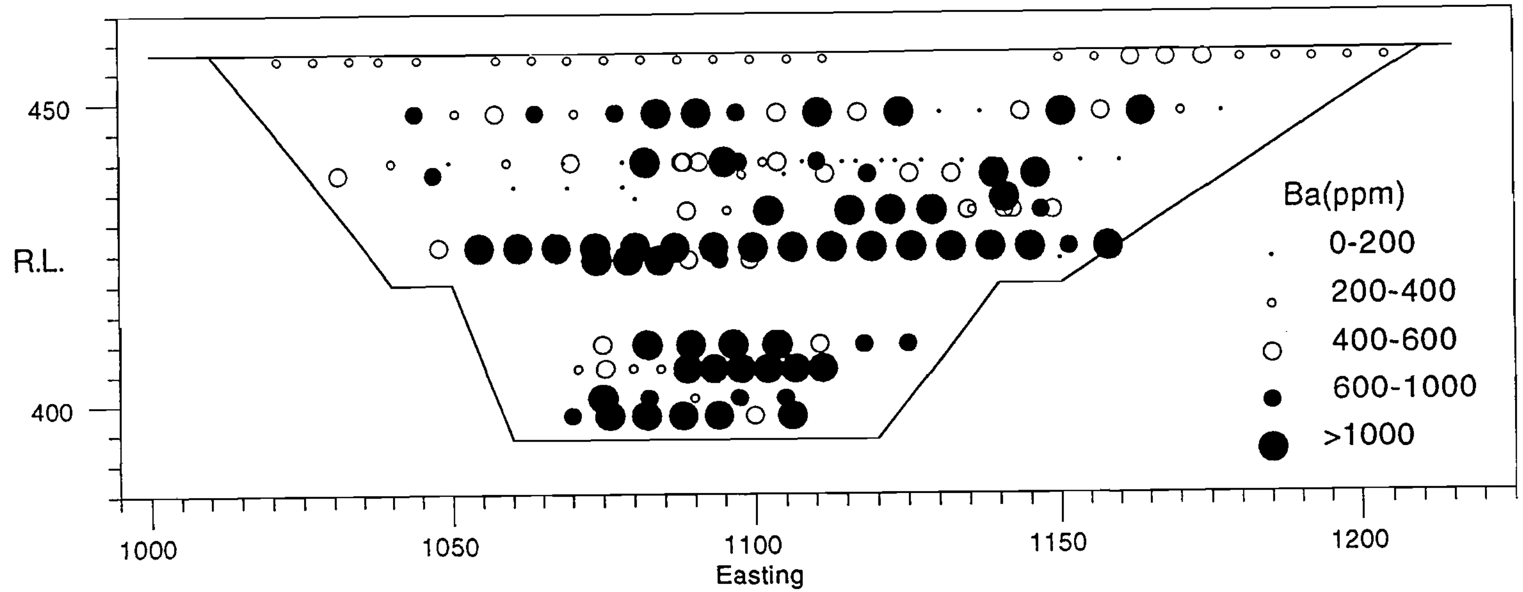

450
400
R.L.
1050
1100
1150
1200
1250
Easting
Au(ppb)
0-100
100-400
400-600
600-1000
>1000

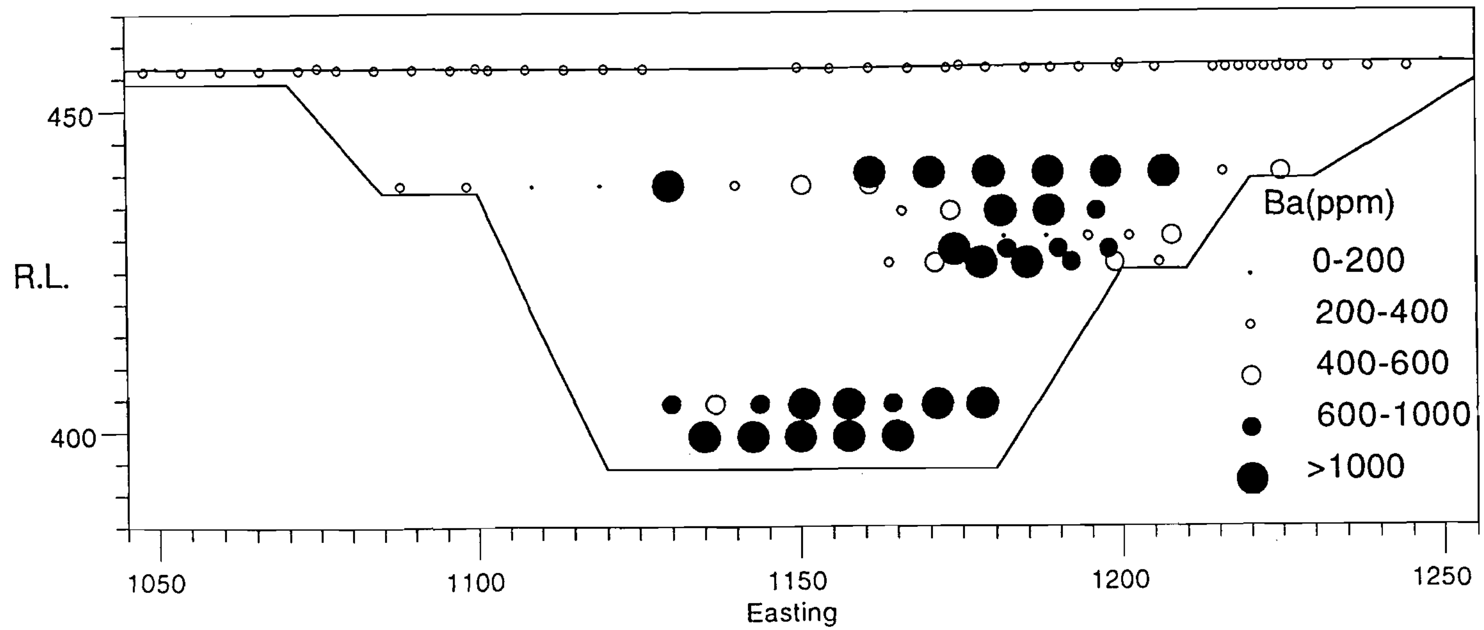


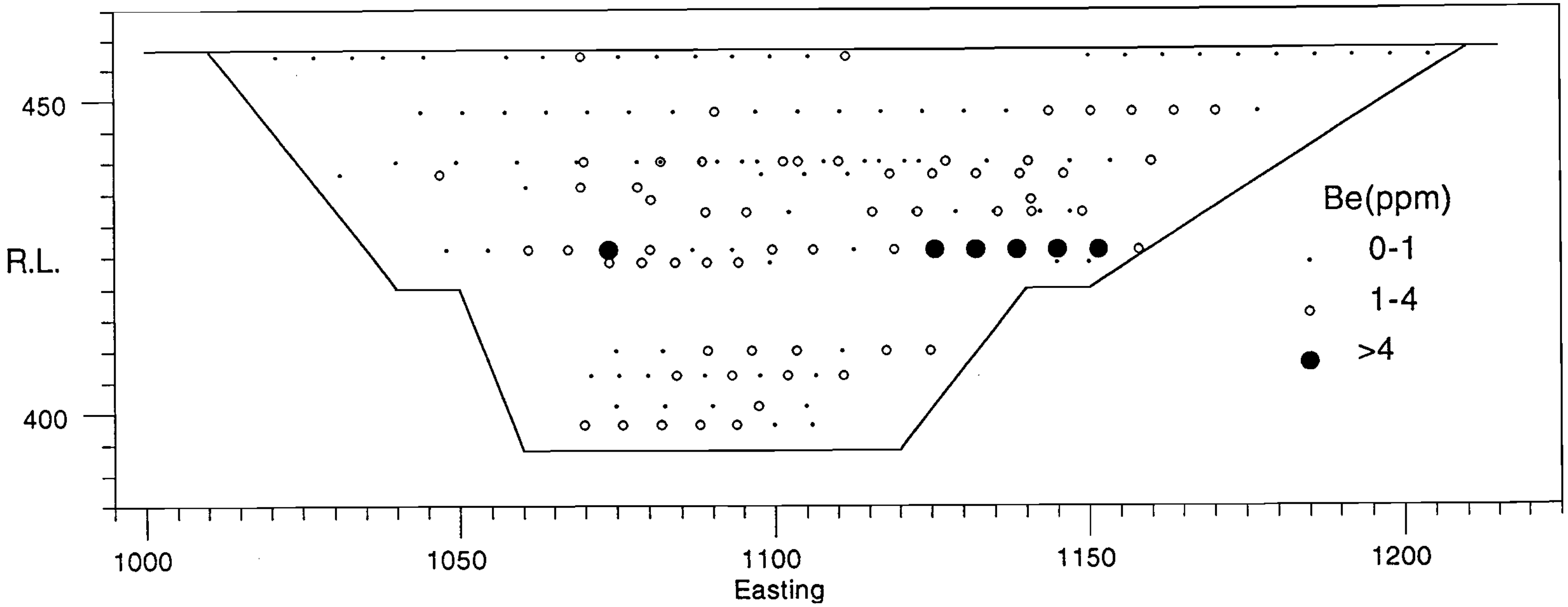
450
400
R.L.
1000
1050
1100
1150
1200
Easting
Au(ppb)
0-500
500-1000
1000-2000
2000-5000
>5000

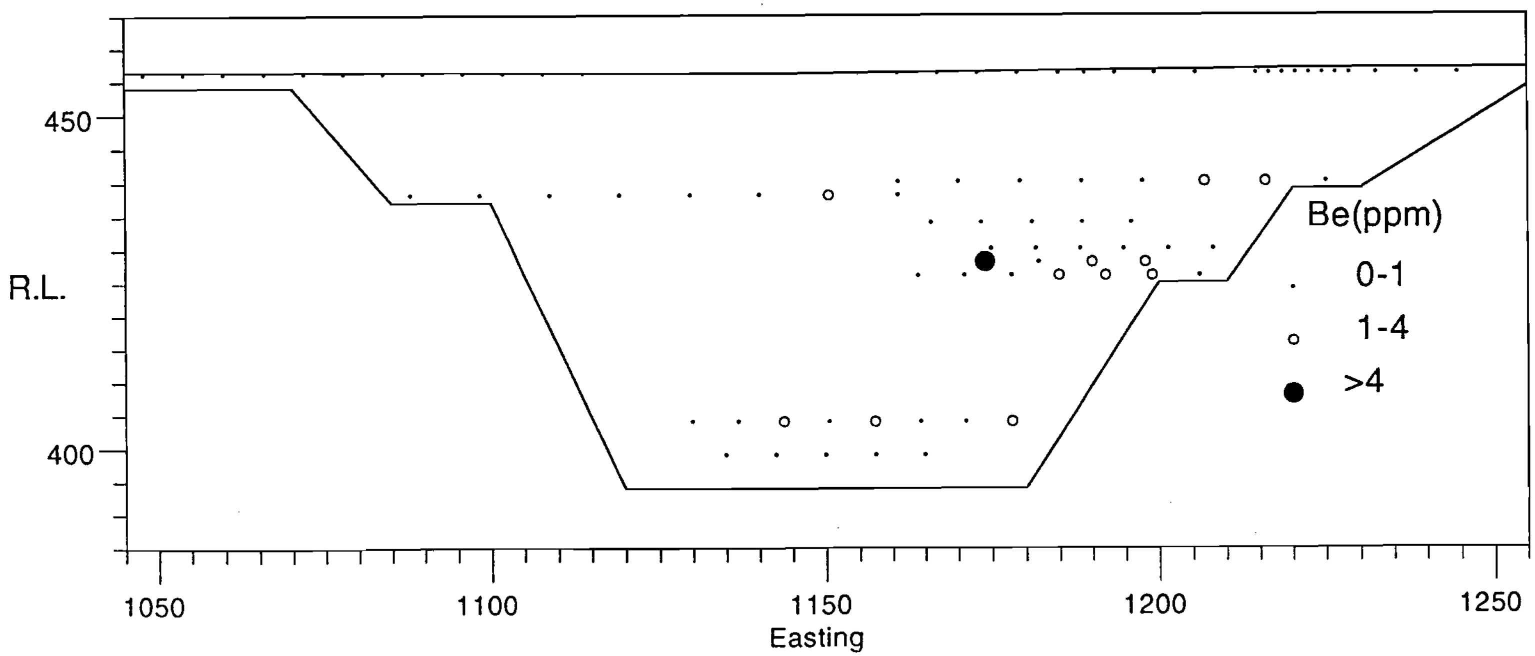


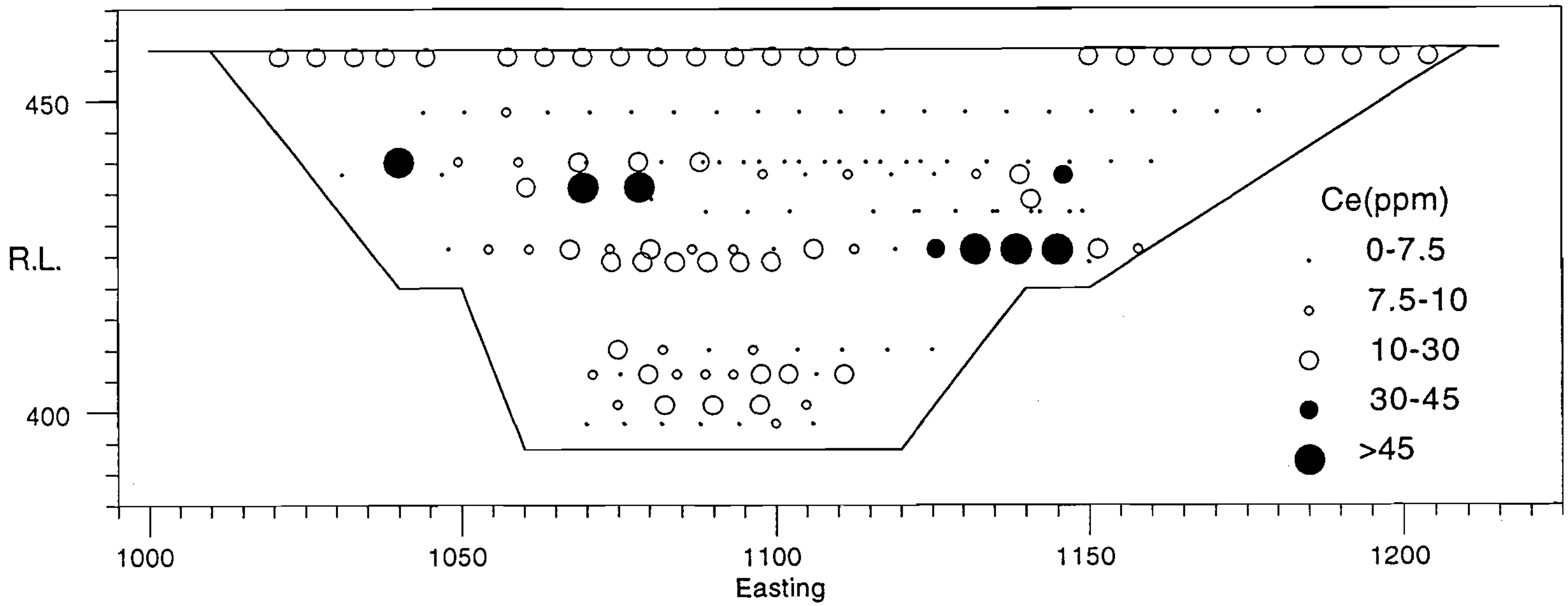
450
400
R.L.
1050
1100
1150
1200
1250
Easting
Au(ppb)
0-500
500-1000
1000-2000
2000-5000
>5000

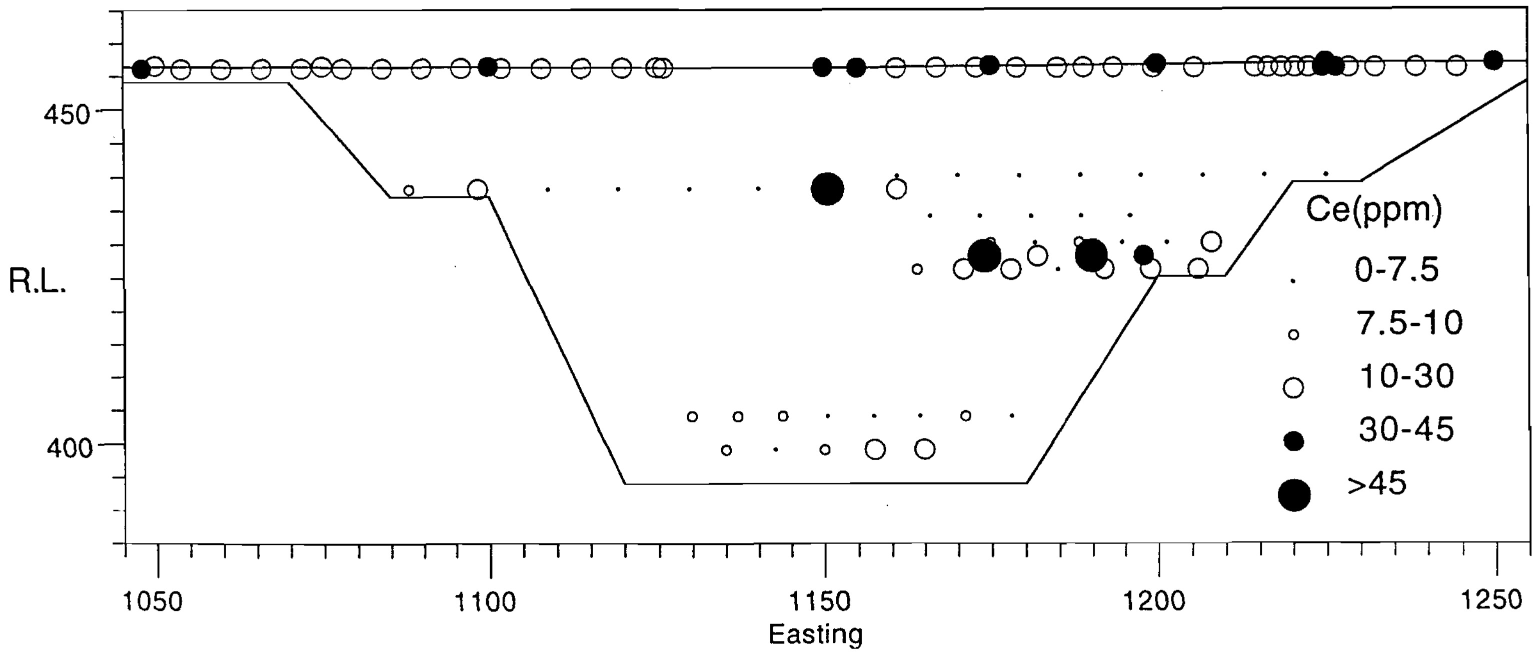

450
R.L.
400
1000
1050
1100
1150
1200
Easting
Ba(ppm)
0-200
200-400
400-600
600-1000
>1000

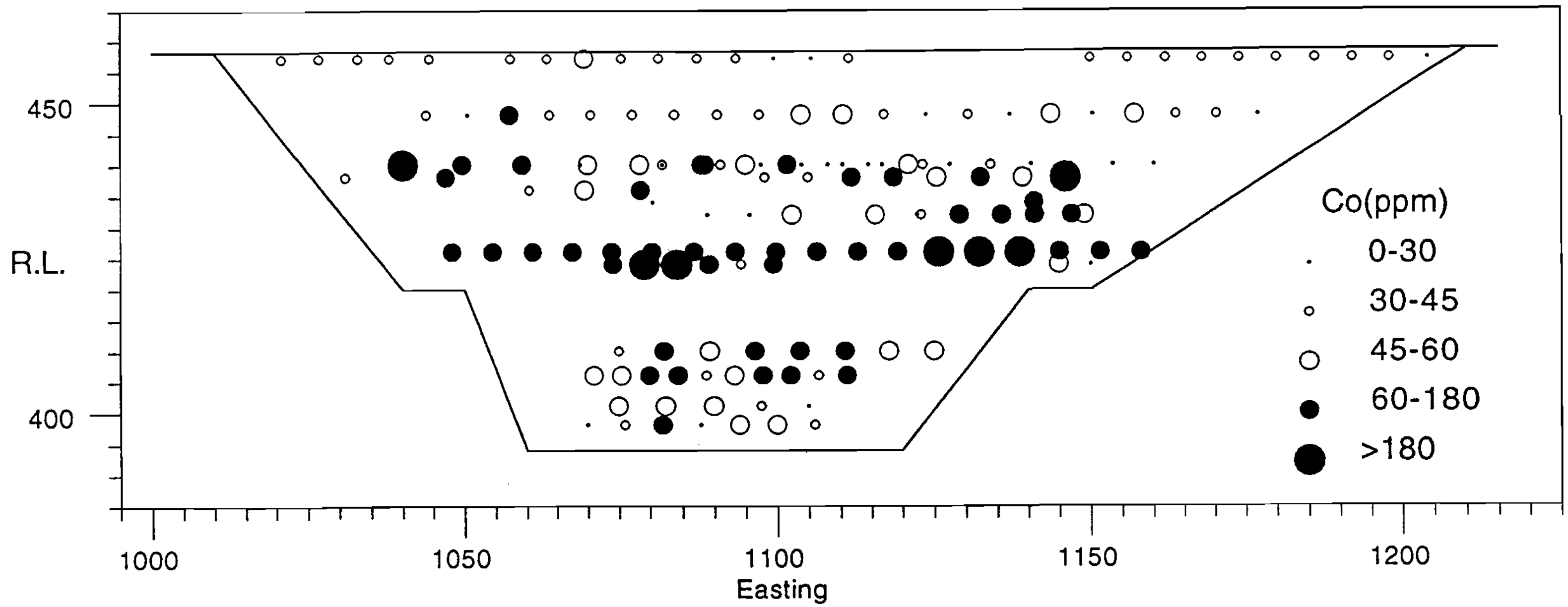

450
R.L.
400
1050
1100
1150
1200
1250
Easting
Ba(ppm)
0-200
200-400
400-600
600-1000
>1000

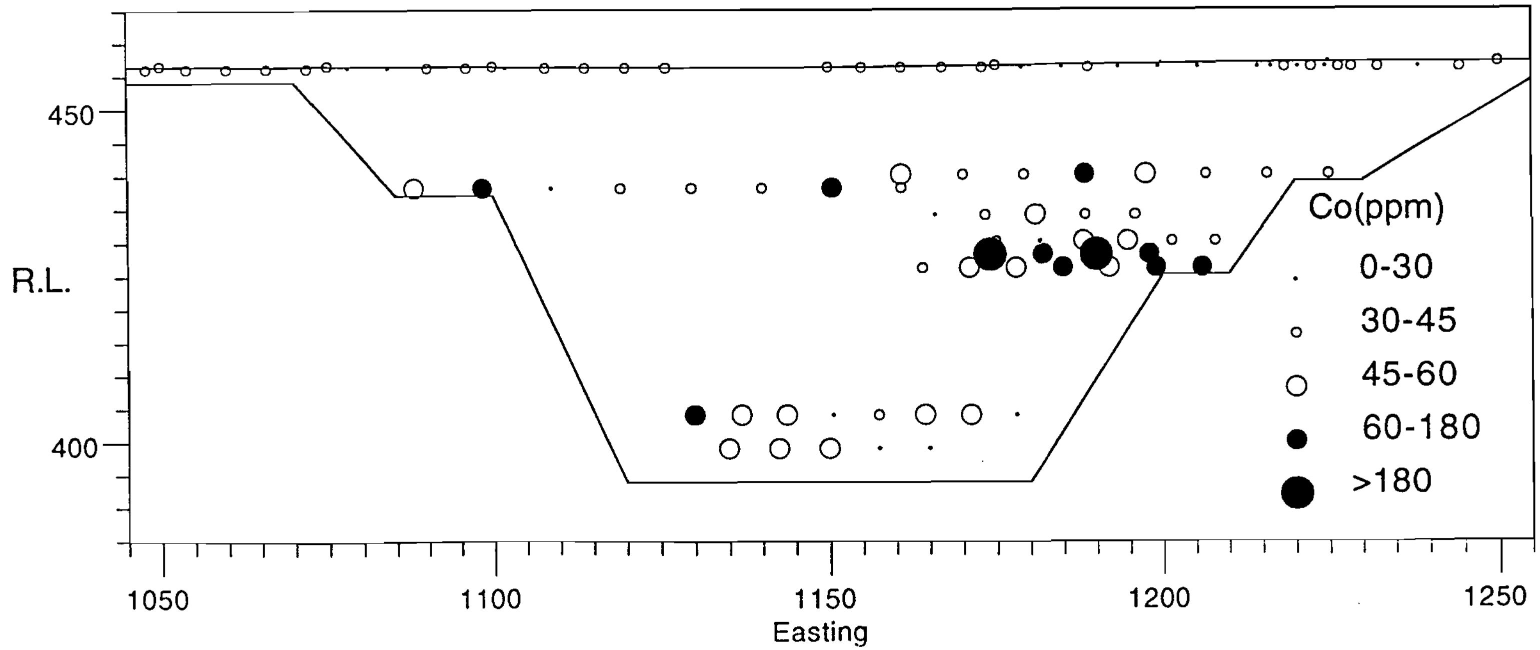

450
400
R.L.
1000
1050
1100
1150
1200
Easting
Be(ppm)
0-1
1-4
>4

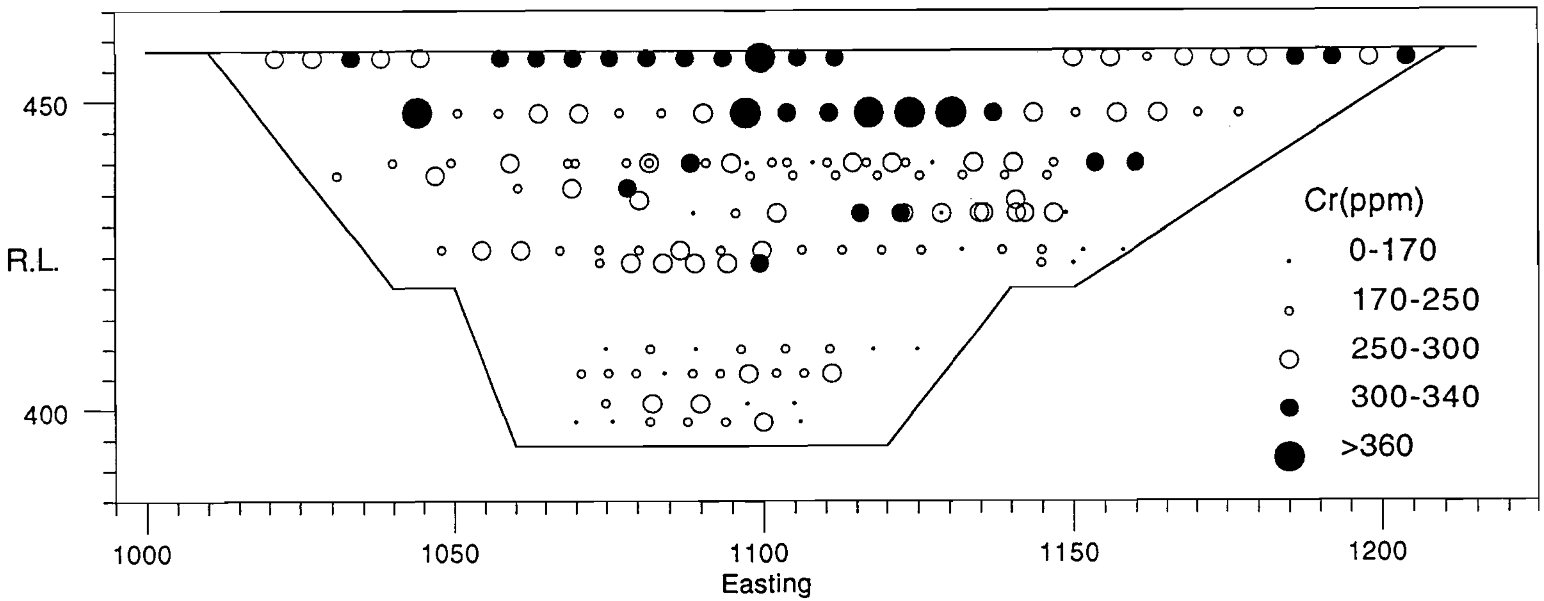

450
400
R.L.
1050
1100
1150
1200
1250
Easting
Be(ppm)
0-1
1-4
>4

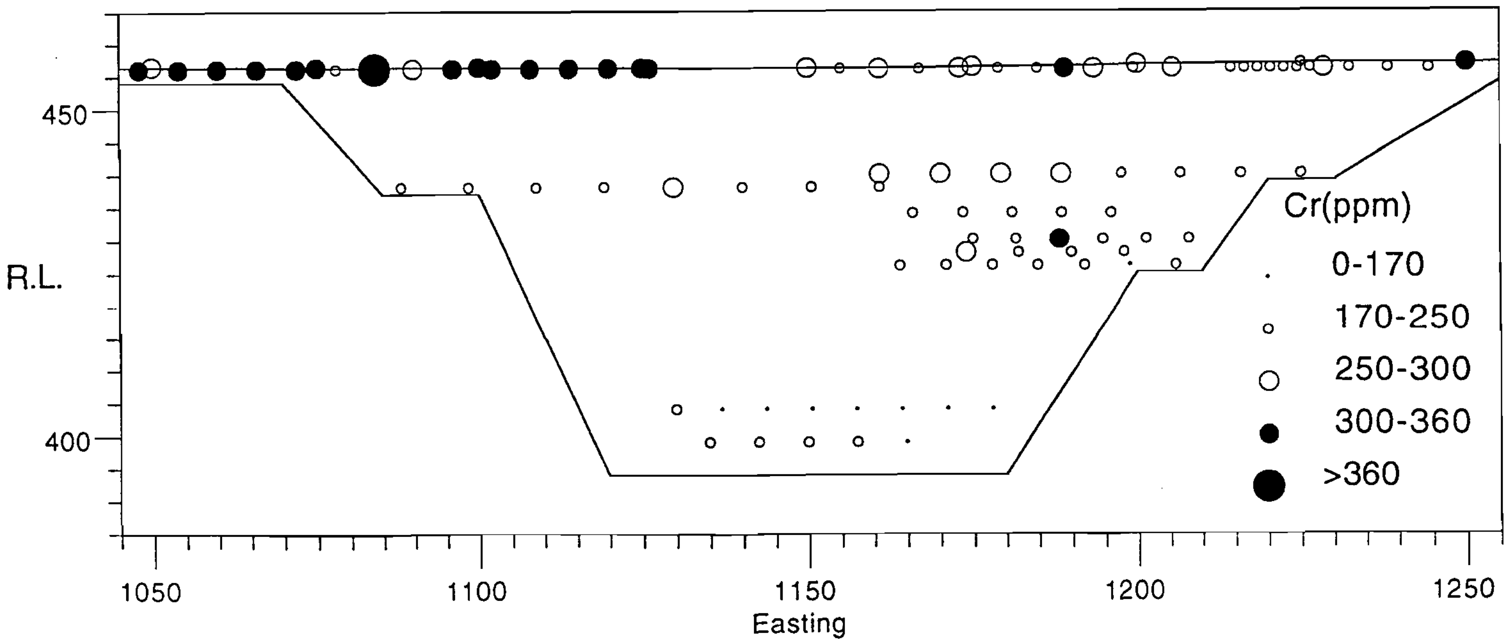

Ce(ppm)
0-7.5
7.5-10
10-30
30-45
>45
R.L.
450
400
1000
1050
1100
1150
1200
Easting

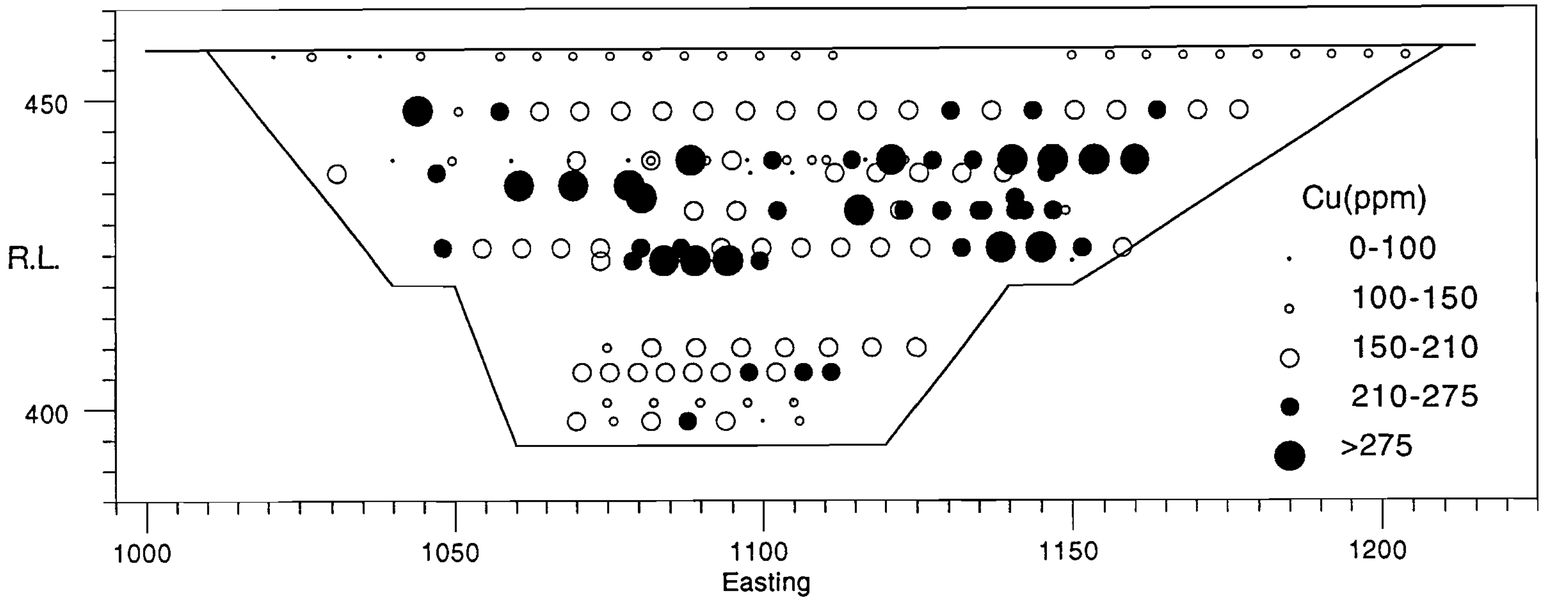

Ce(ppm)
0-7.5
7.5-10
10-30
30-45
>45
R.L.
450
400
1050
1100
1150
1200
1250
Easting

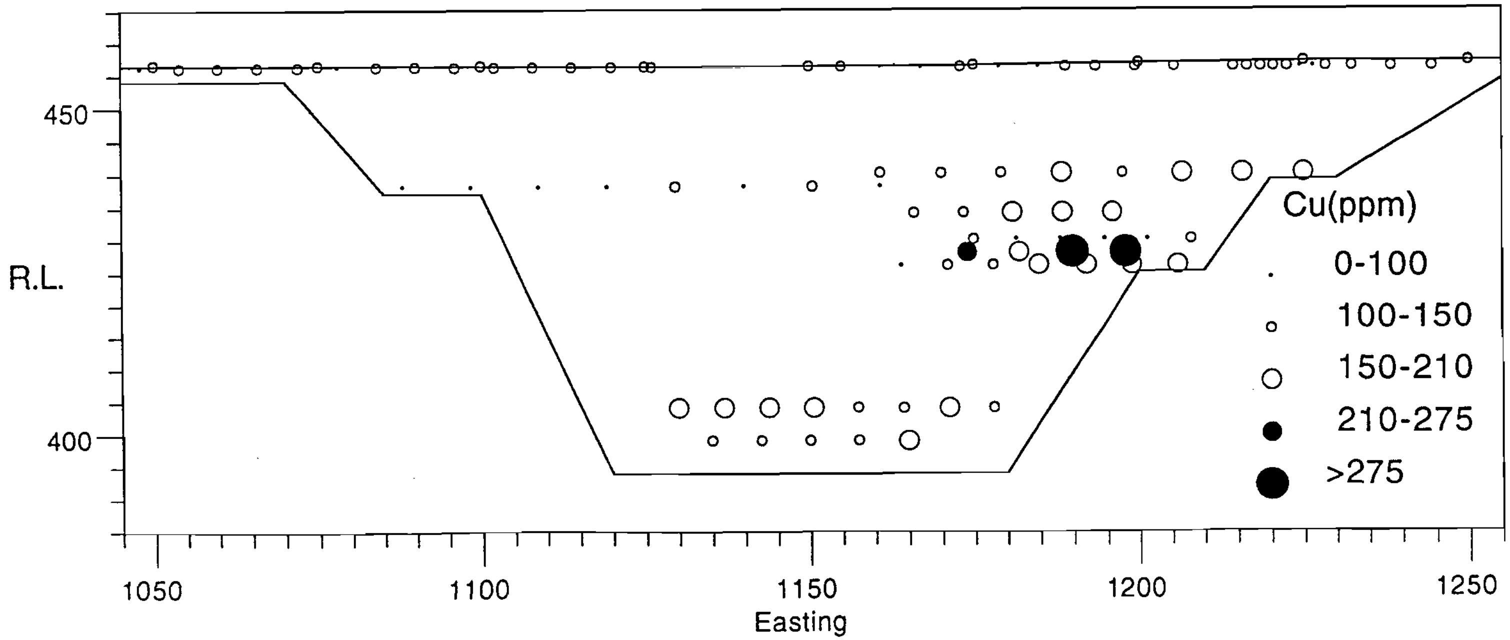

450
R.L.
400
1000
1050
1100
1150
1200
Easting
Co(ppm)
0-30
30-45
45-60
60-180
>180

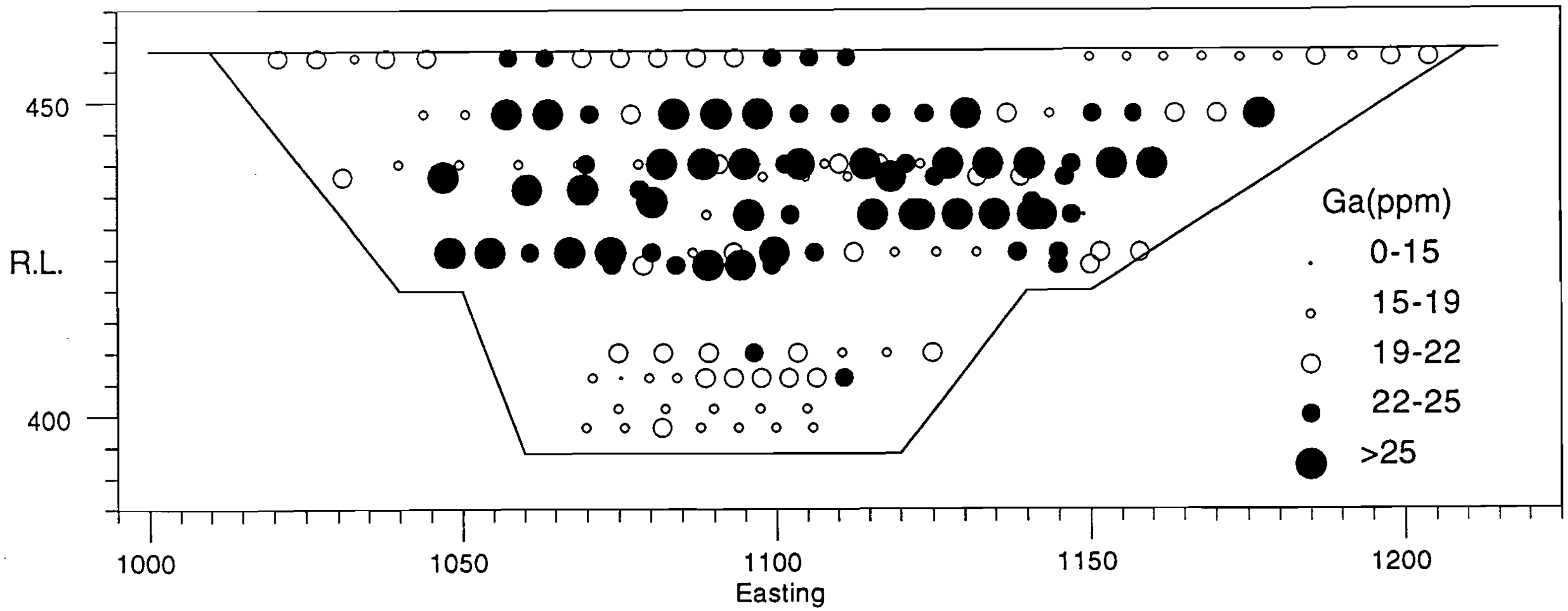

450
R.L.
400
1050
1100
1150
1200
1250
Easting
Co(ppm)
0-30
30-45
45-60
60-180
>180

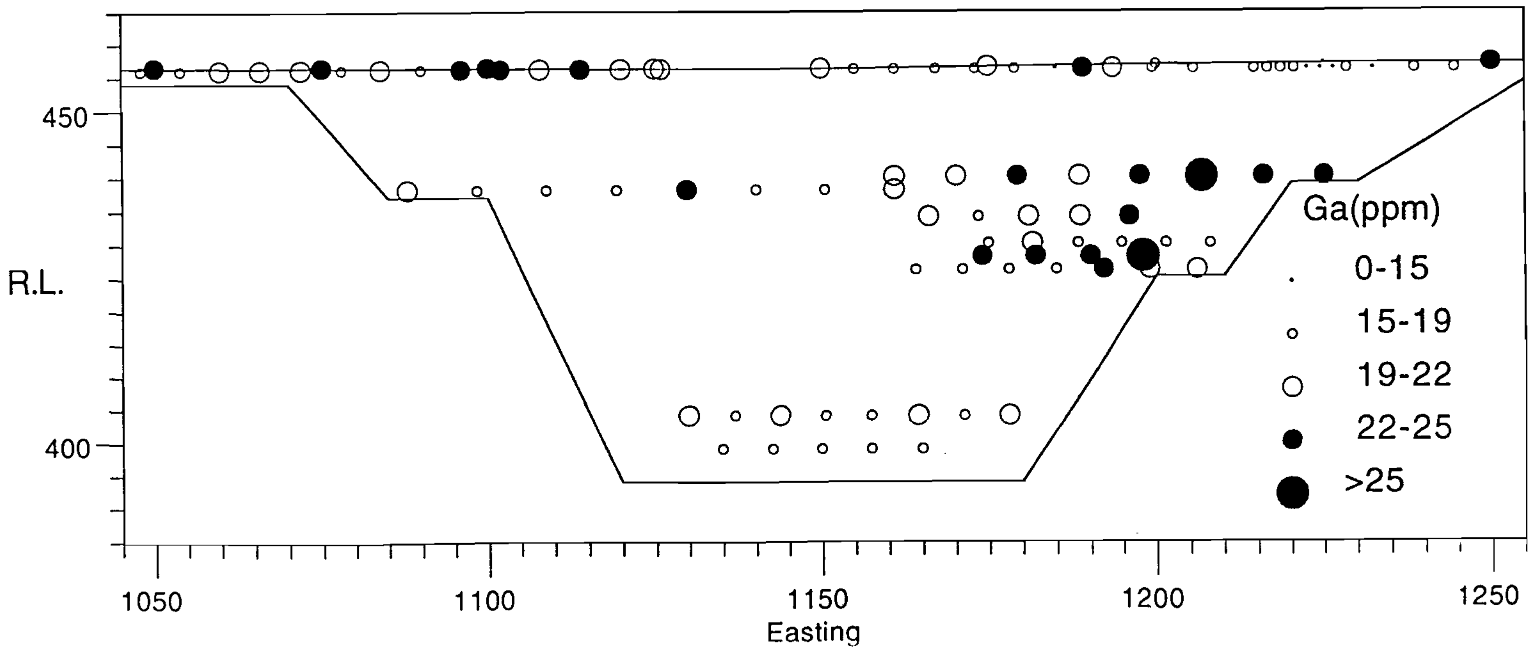

450
R.L.
400
1000
1050
1100
1150
1200
Easting
Cr(ppm)
0-170
170-250
250-300
300-340
>360

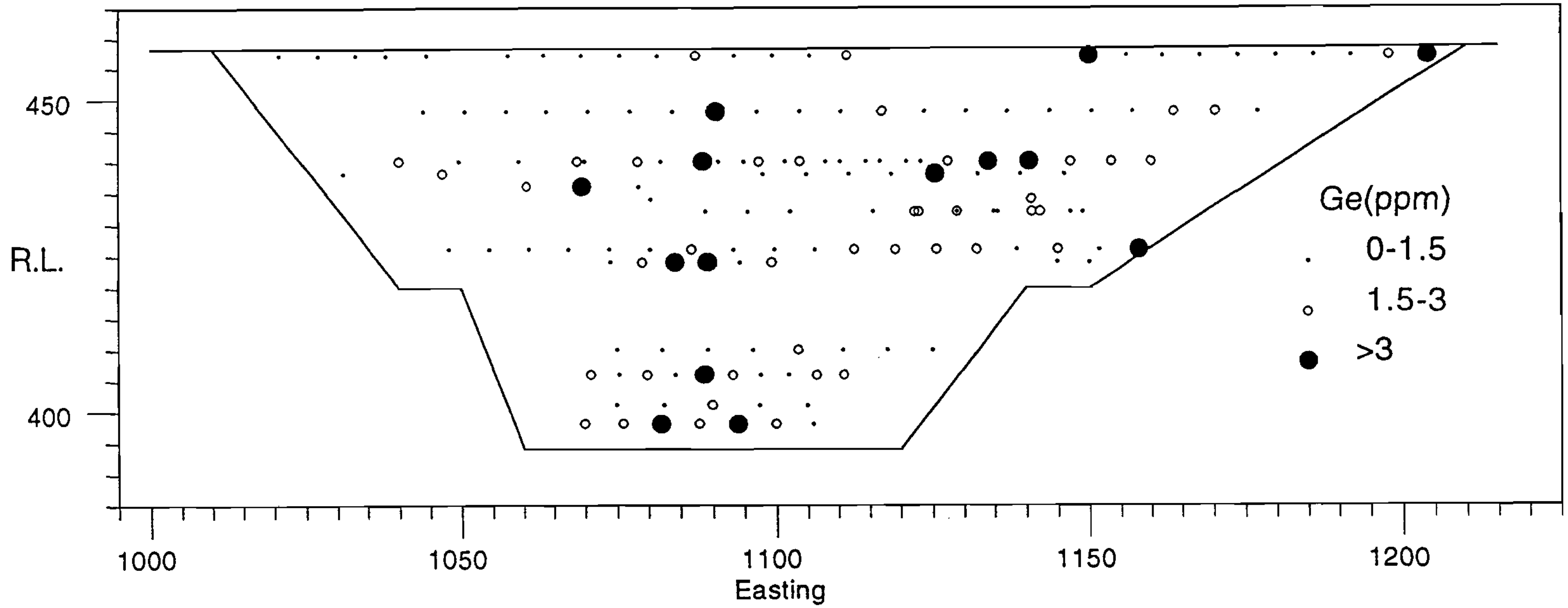

450
R.L.
400
1050
1100
1150
1200
1250
Easting
Cr(ppm)
0-170
170-250
250-300
300-360
>360

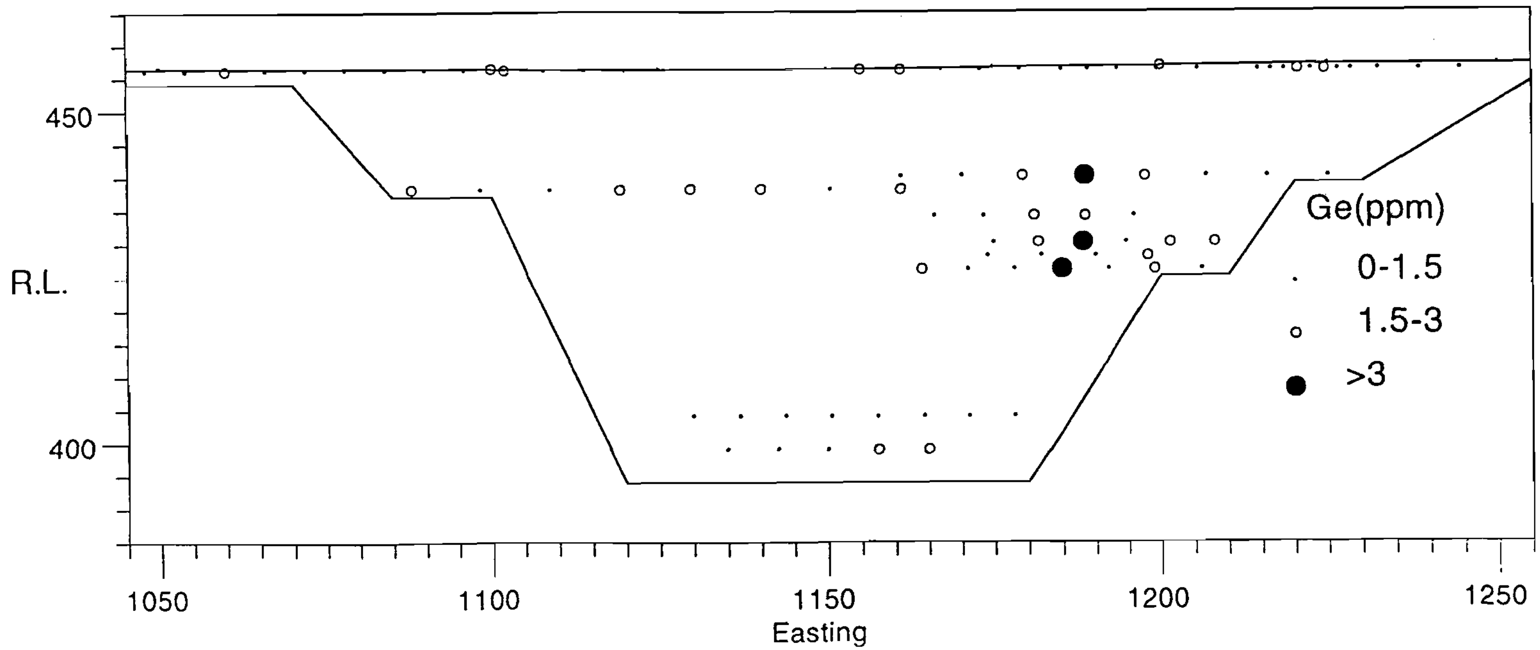

450
R.L.
400
1000
1050
1100
1150
1200
Easting
Cu(ppm)
0-100
100-150
150-210
210-275
>275

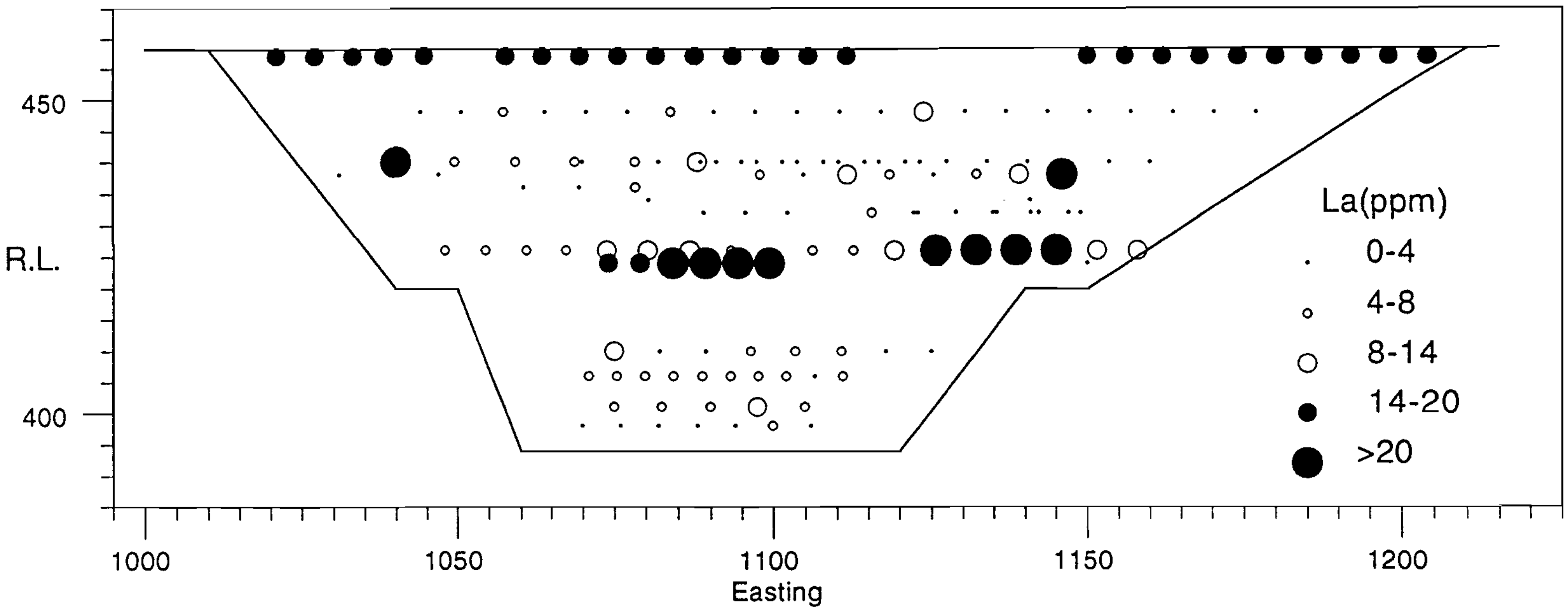

450
R.L.
400
1050
1100
1150
1200
1250
Easting
Cu(ppm)
0-100
100-150
150-210
210-275
>275

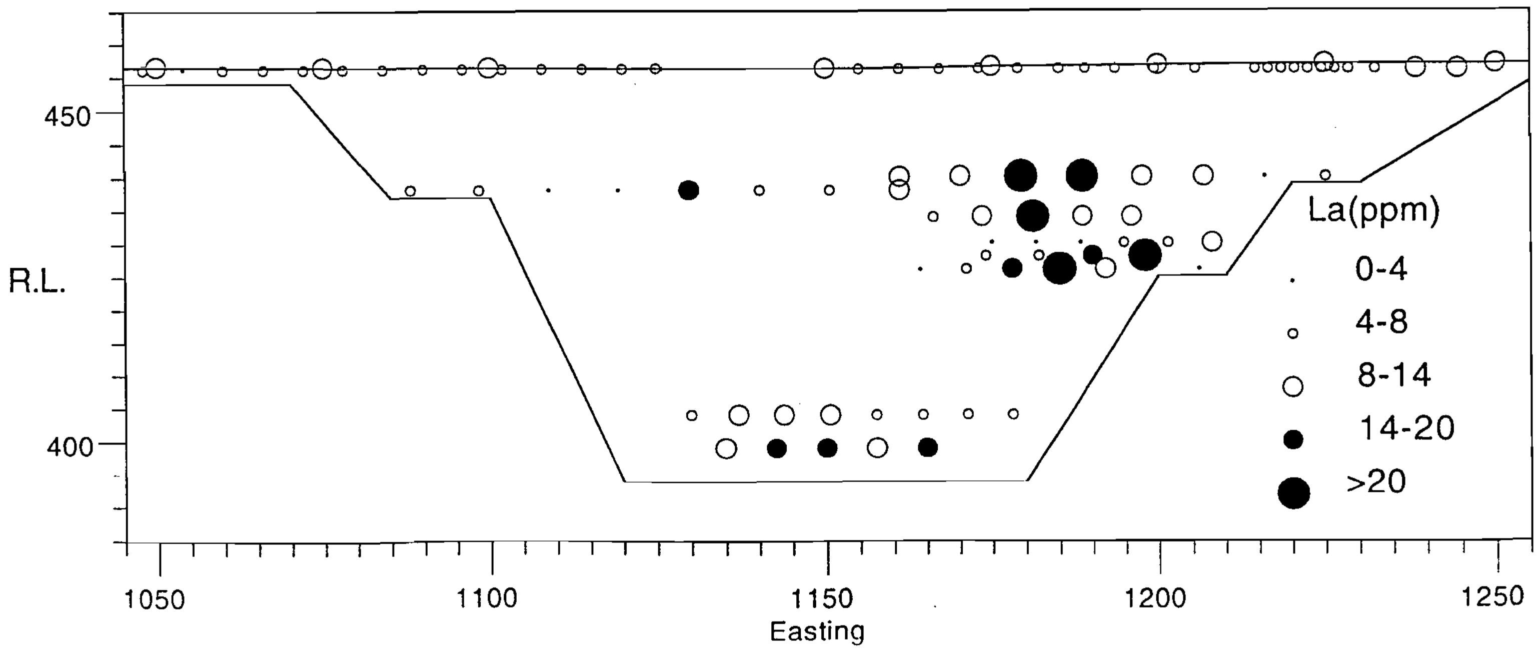

450
400
R.L.
1000
1050
1100
1150
1200
Easting
Ga(ppm)
0-15
15-19
19-22
22-25
>25

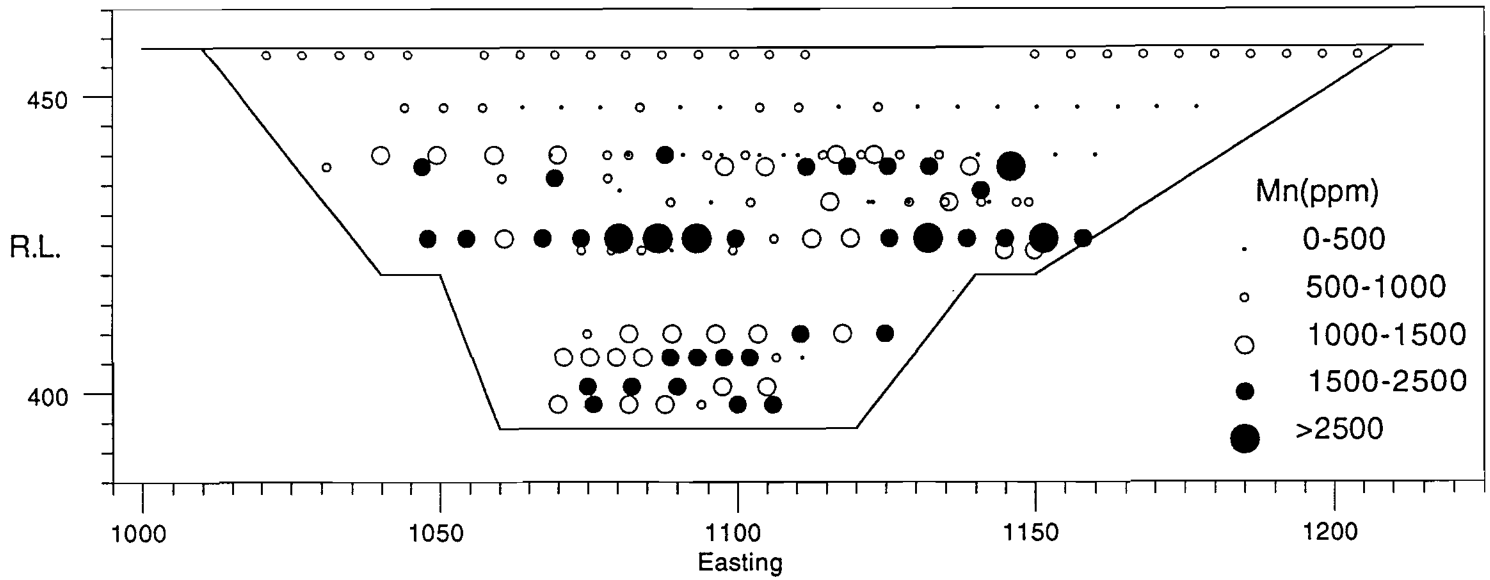

450
400
R.L.
1050
1100
1150
1200
1250
Easting
Ga(ppm)
0-15
15-19
19-22
22-25
>25

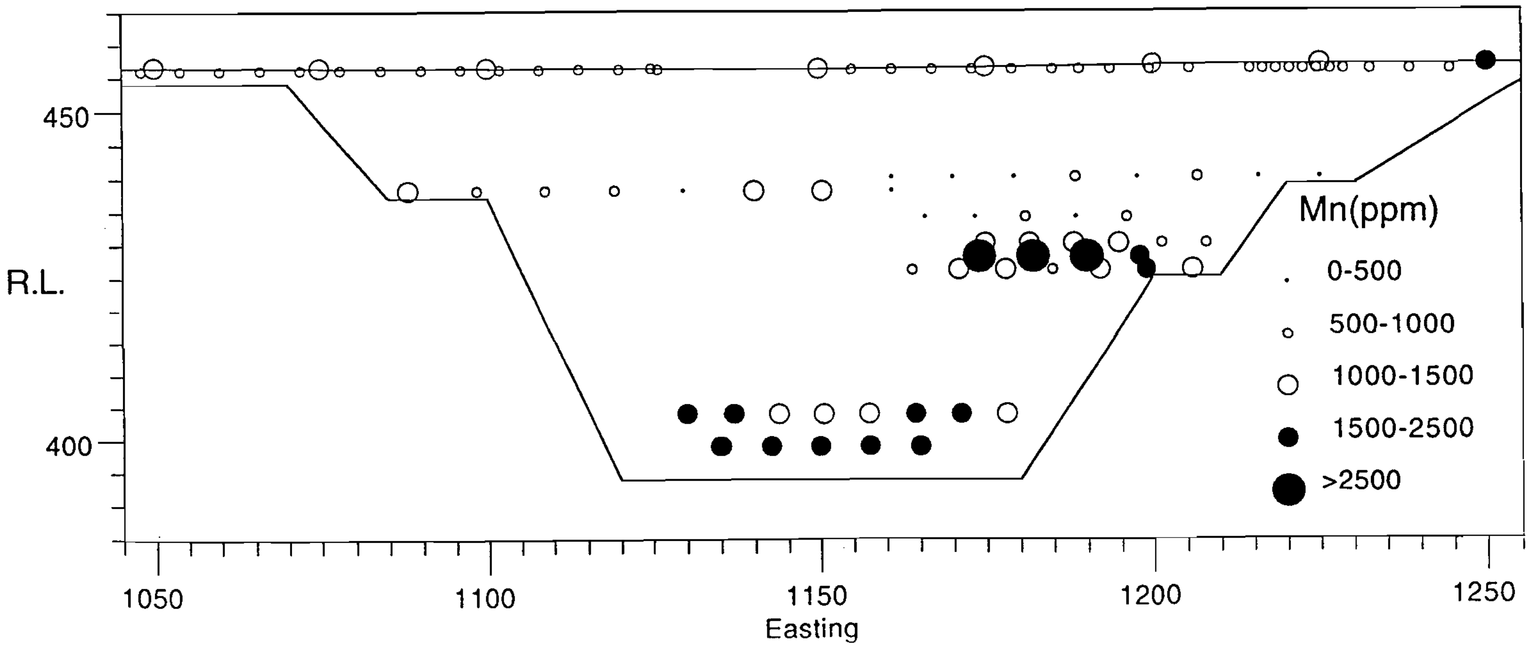

450
400
R.L.
1000
1050
1100
1150
1200
Easting
Ge(ppm)
0-1.5
1.5-3
>3

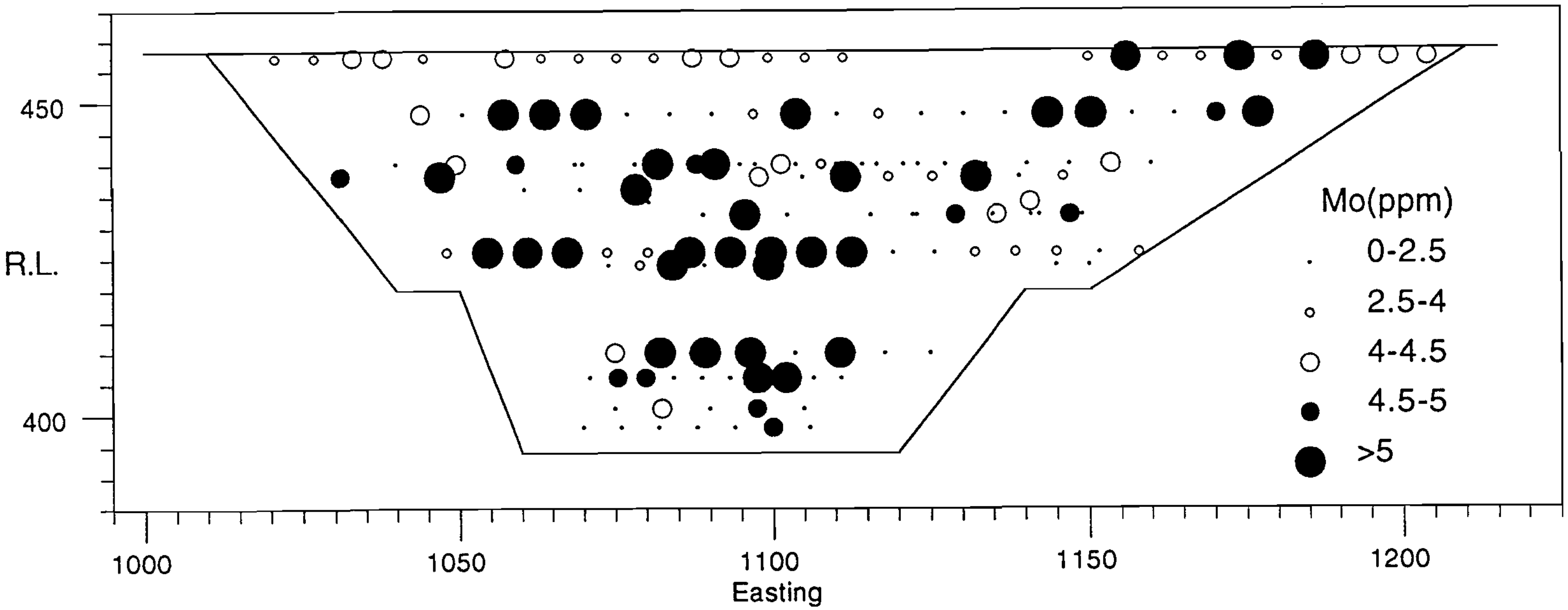

450
400
R.L.
1050
1100
1150
1200
1250
Easting
Ge(ppm)
0-1.5
1.5-3
>3

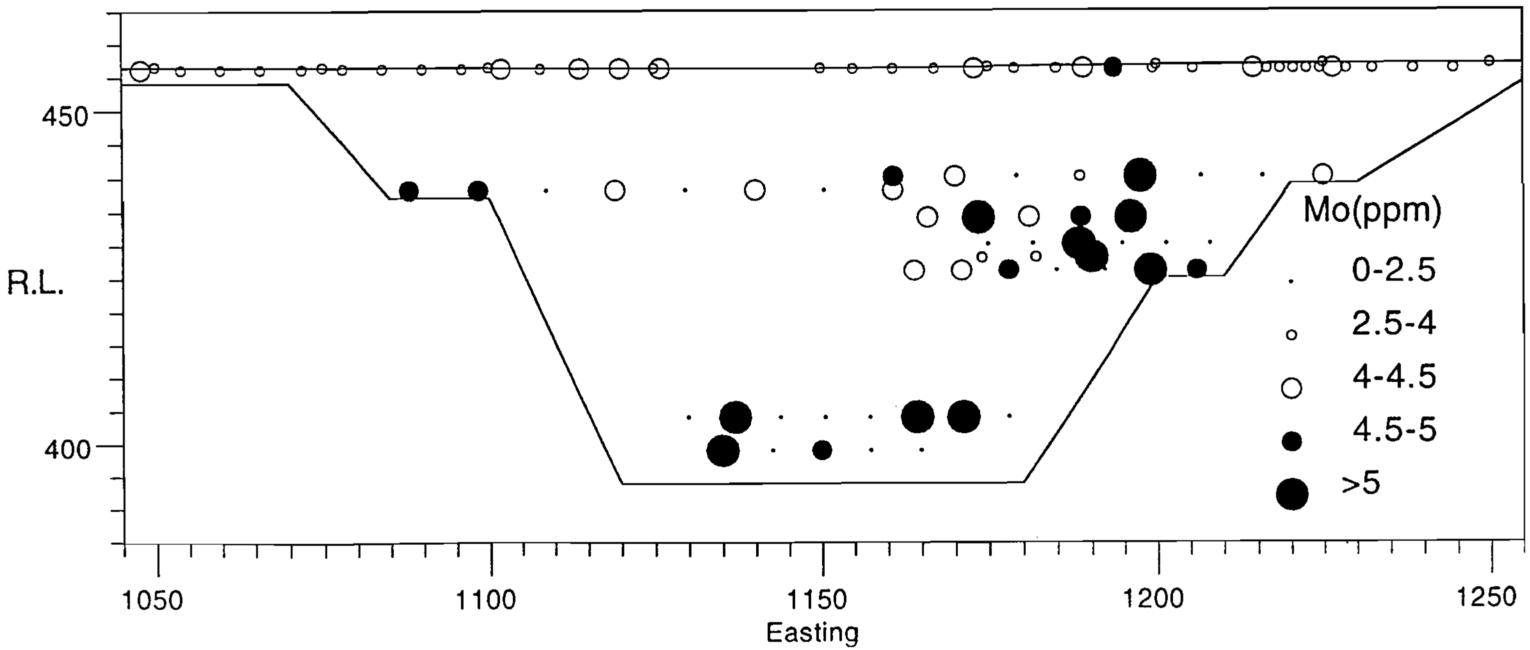

La(ppm)
0-4
4-8
8-14
14-20
>20
R.L.
450
400
1000
1050
1100
1150
1200
Easting

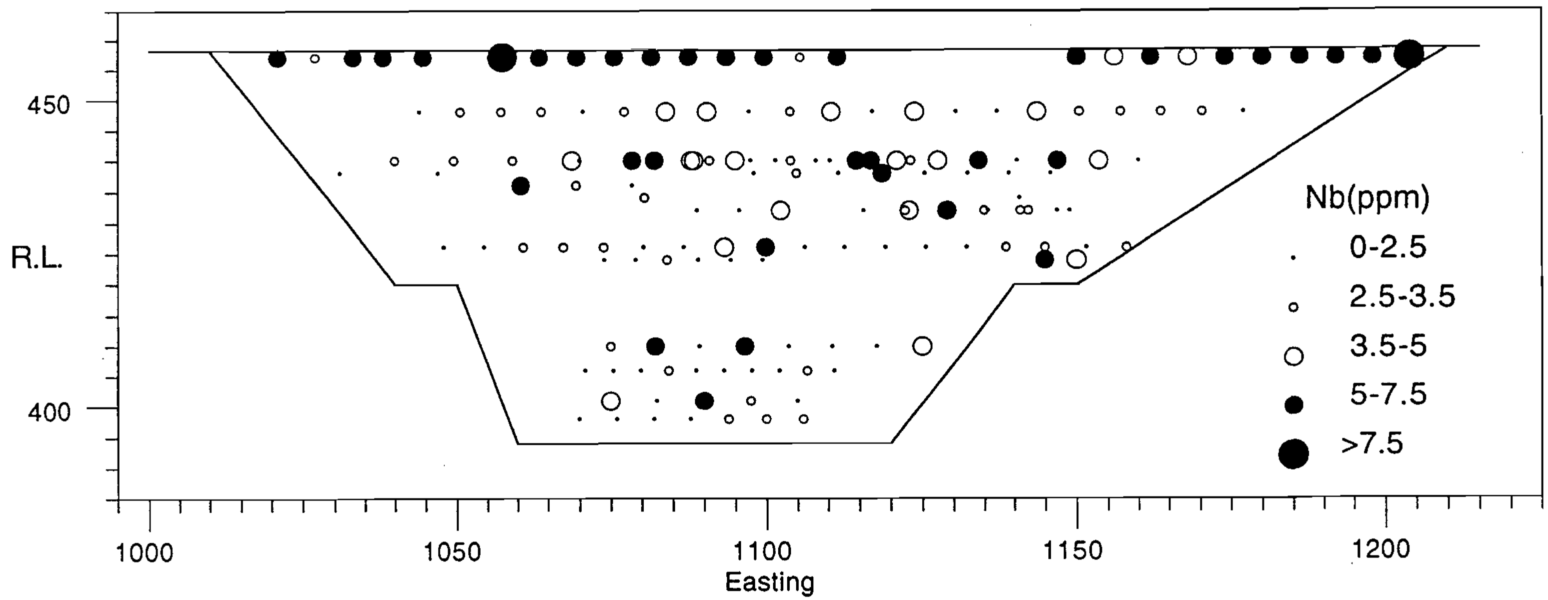

La(ppm)
0-4
4-8
8-14
14-20
>20
R.L.
450
400
1050
1100
1150
1200
1250
Easting

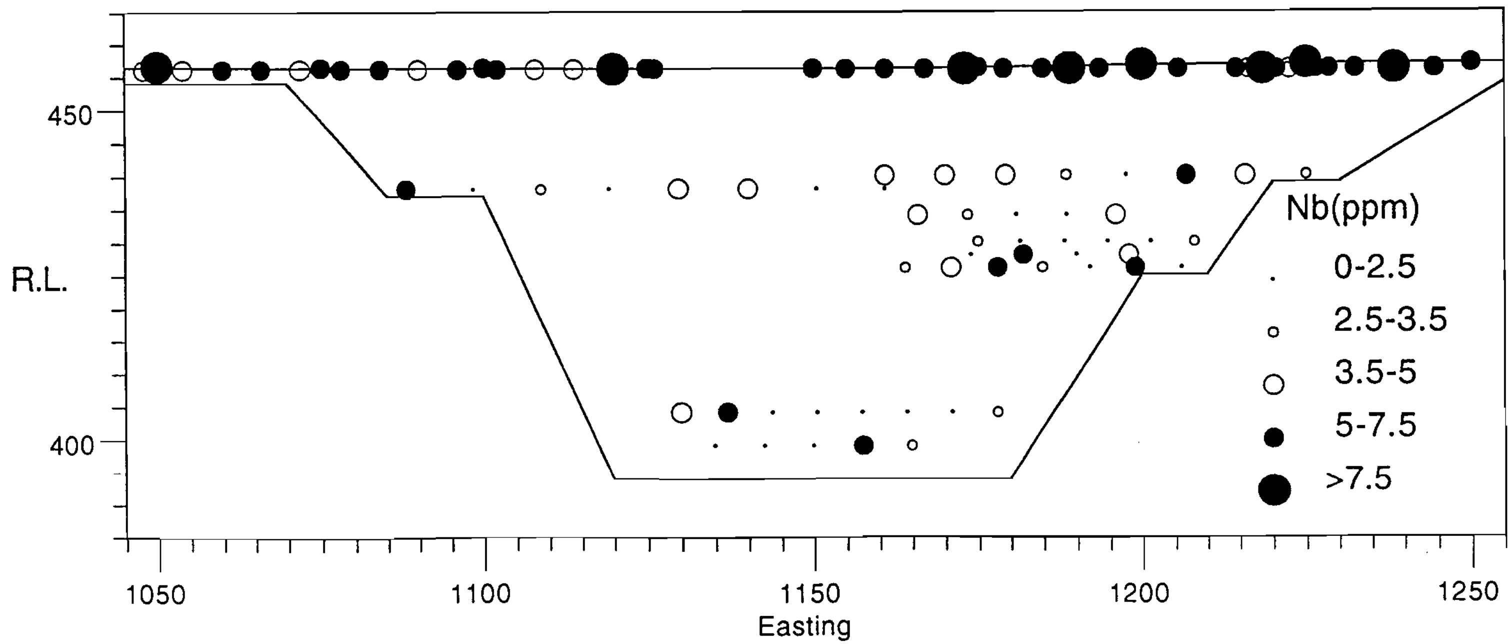

450
400
R.L.
1000
1050
1100
1150
1200
Easting
Mn(ppm)
0-500
500-1000
1000-1500
1500-2500
>2500

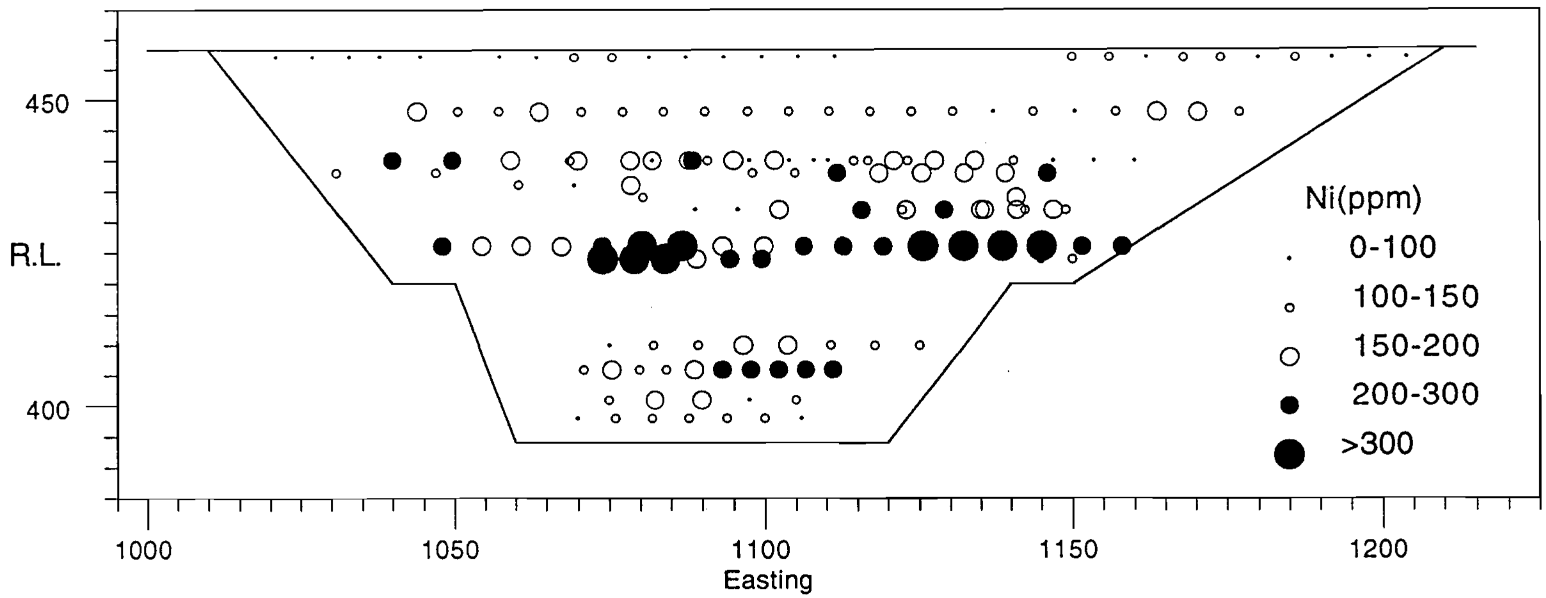

450
400
R.L.
1050
1100
1150
1200
1250
Easting
Mn(ppm)
0-500
500-1000
1000-1500
1500-2500
>2500


450
400
R.L.
1000
1050
1100
1150
1200
Easting
Mo(ppm)
0-2.5
2.5-4
4-4.5
4.5-5
>5

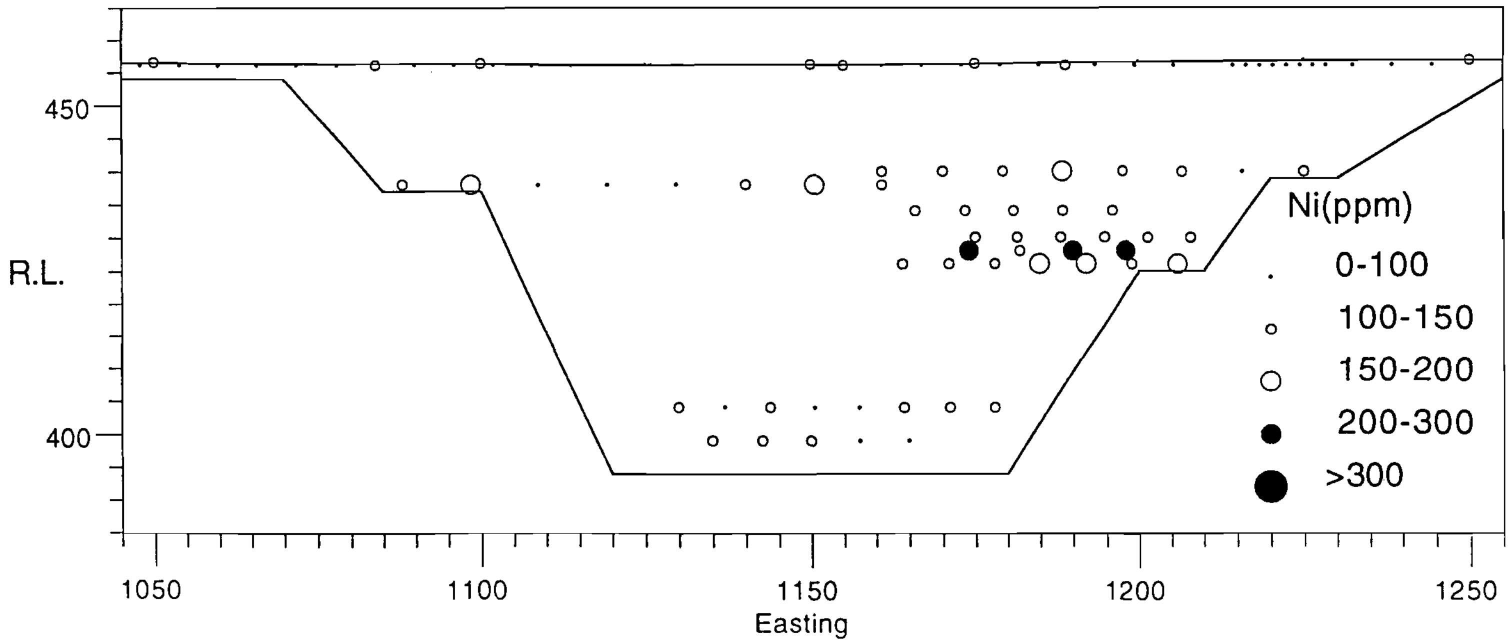

450
400
R.L.
1050
1100
1150
1200
1250
Easting
Mo(ppm)
0-2.5
2.5-4
4-4.5
4.5-5
>5


450
400
R.L.
1000
1050
1100
1150
1200
Easting
Nb(ppm)
0-2.5
2.5-3.5
3.5-5
5-7.5
>7.5

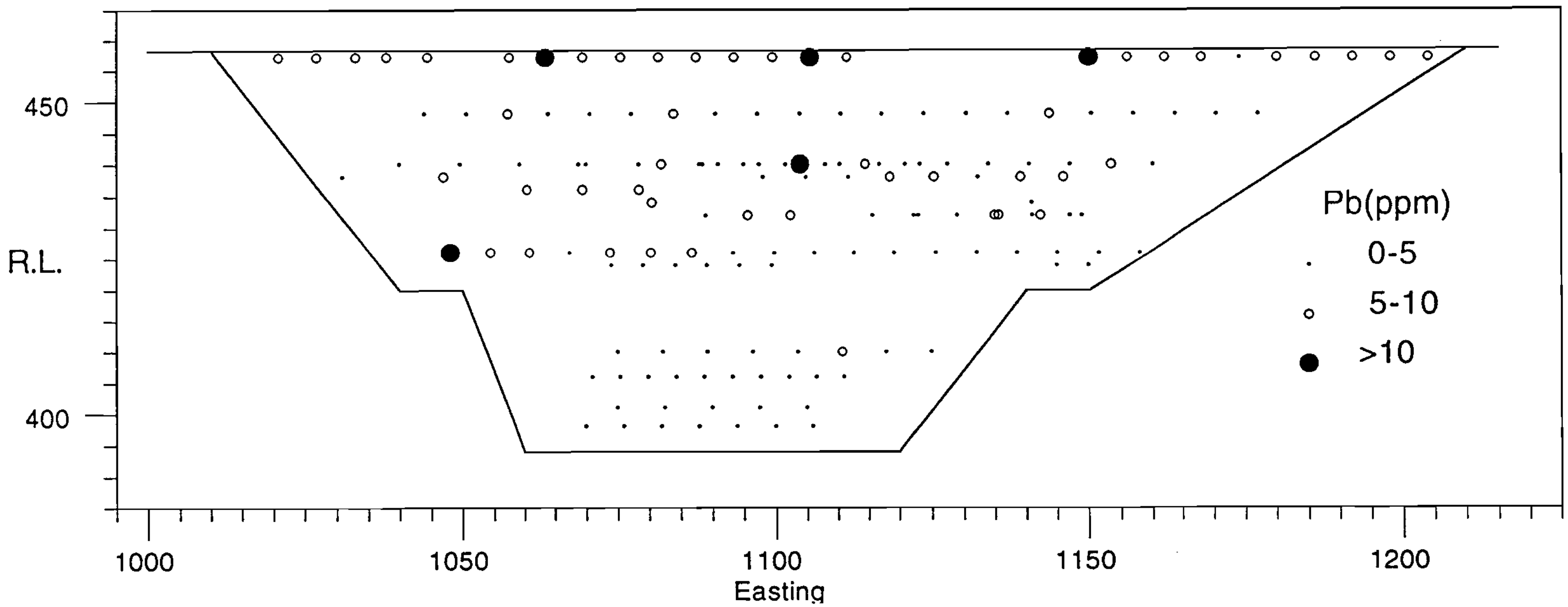

450
400
R.L.
1050
1100
1150
1200
1250
Easting
Nb(ppm)
0-2.5
2.5-3.5
3.5-5
5-7.5
>7.5

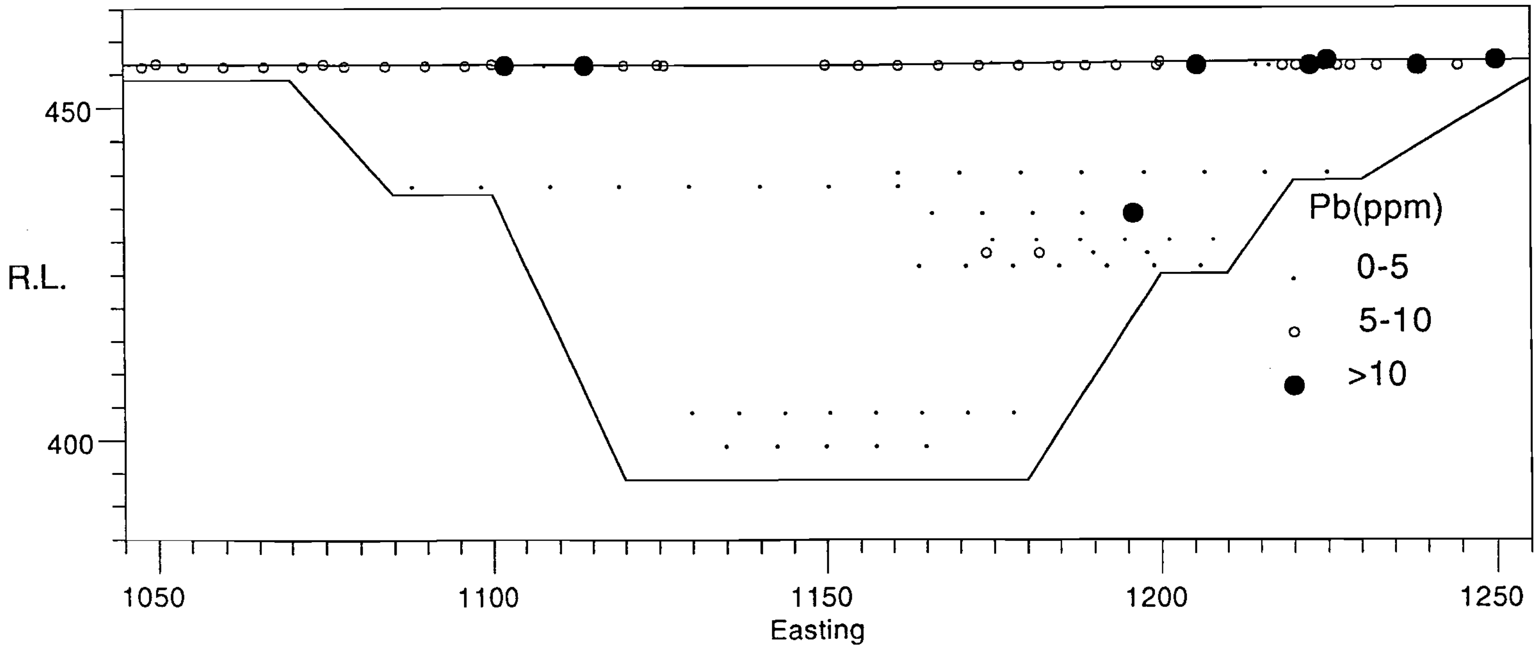


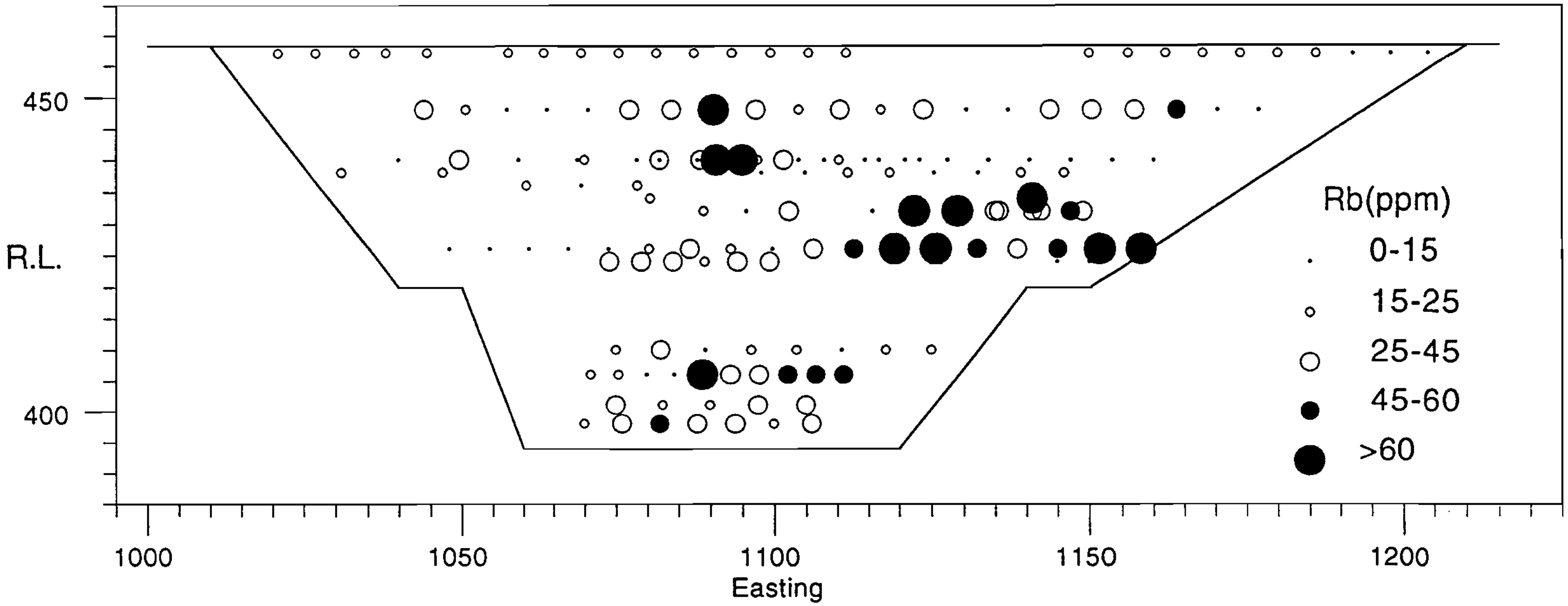
450
400
R.L.
1000
1050
1100
1150
1200
Easting
Ni(ppm)
0-100
100-150
150-200
200-300
>300

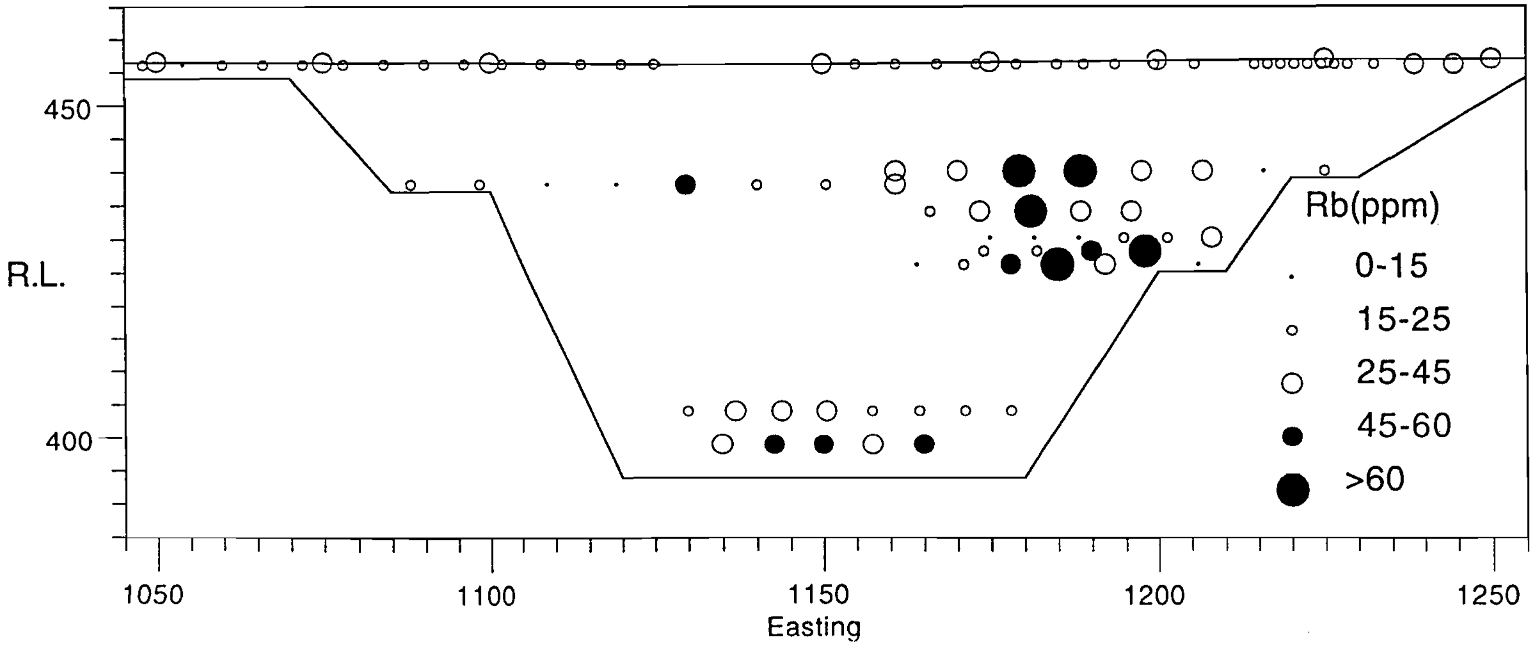


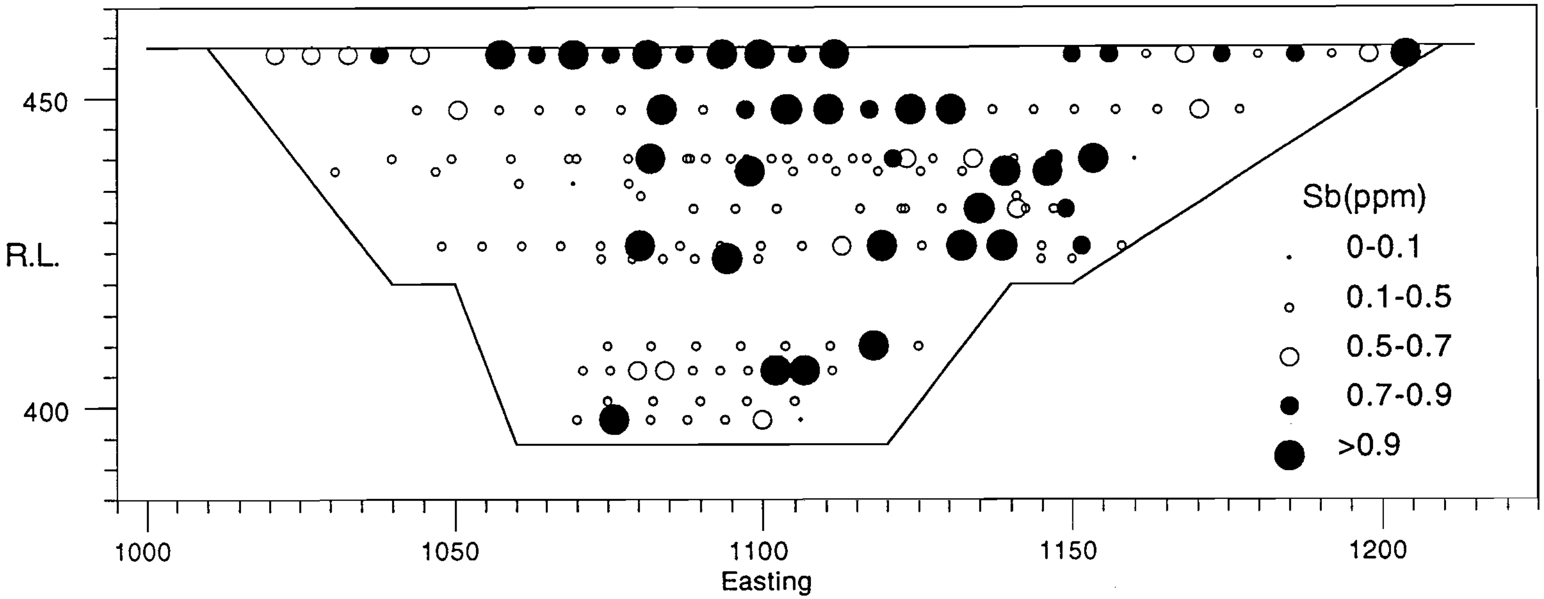
450
400
R.L.
1050
1100
1150
1200
1250
Easting
Ni(ppm)
0-100
100-150
150-200
200-300
>300


Pb(ppm)
0-5
5-10
>10
R.L.
450
400
1000
1050
1100
1150
1200
Easting

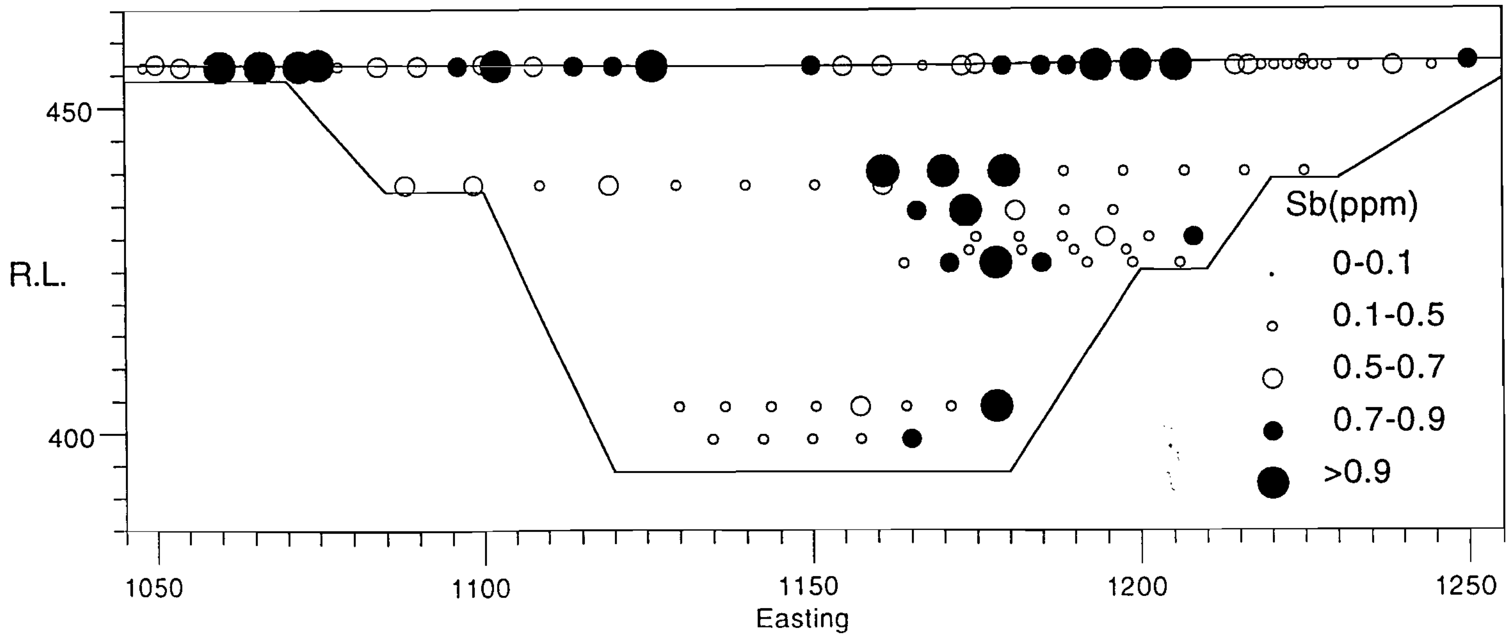

Pb(ppm)
0-5
5-10
>10
R.L.
450
400
1050
1100
1150
1200
1250
Easting


R.L.
450
400
1000
1050
1100
1150
1200
Easting
Rb(ppm)
0-15
15-25
25-45
45-60
>60

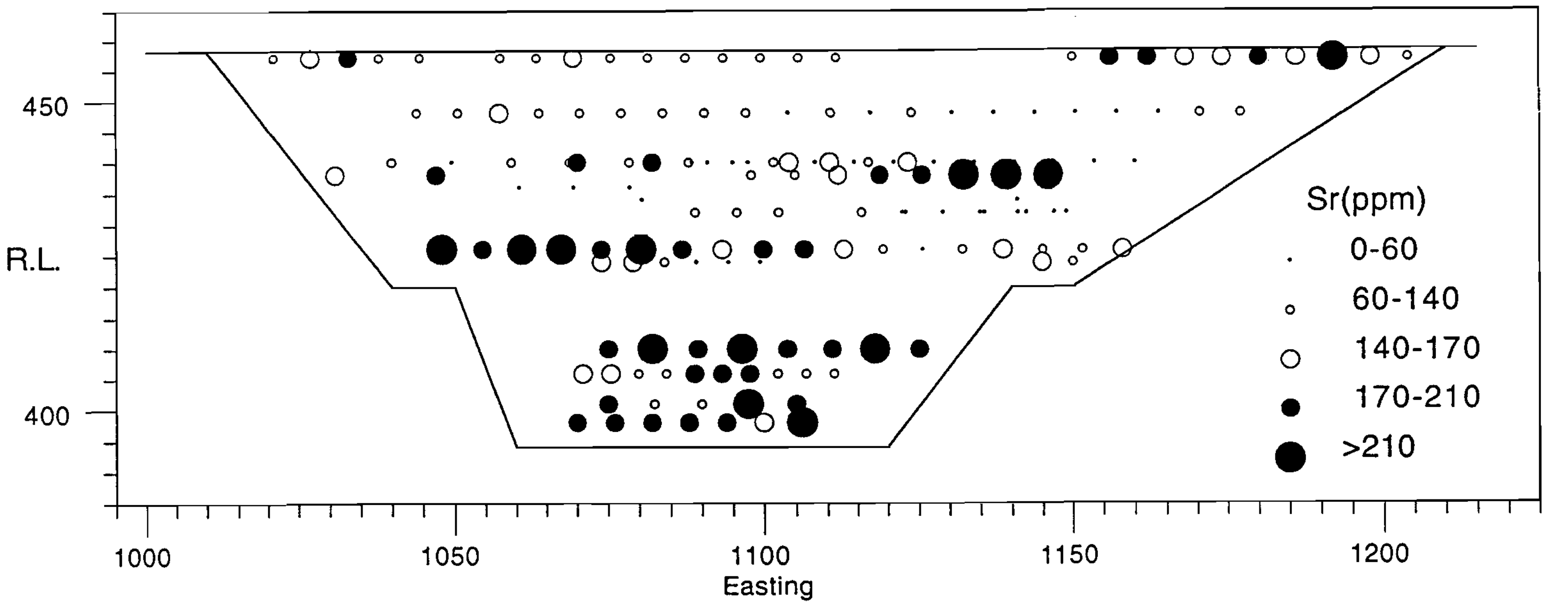

R.L.
450
400
1050
1100
1150
1200
1250
Easting
Rb(ppm)
0-15
15-25
25-45
45-60
>60

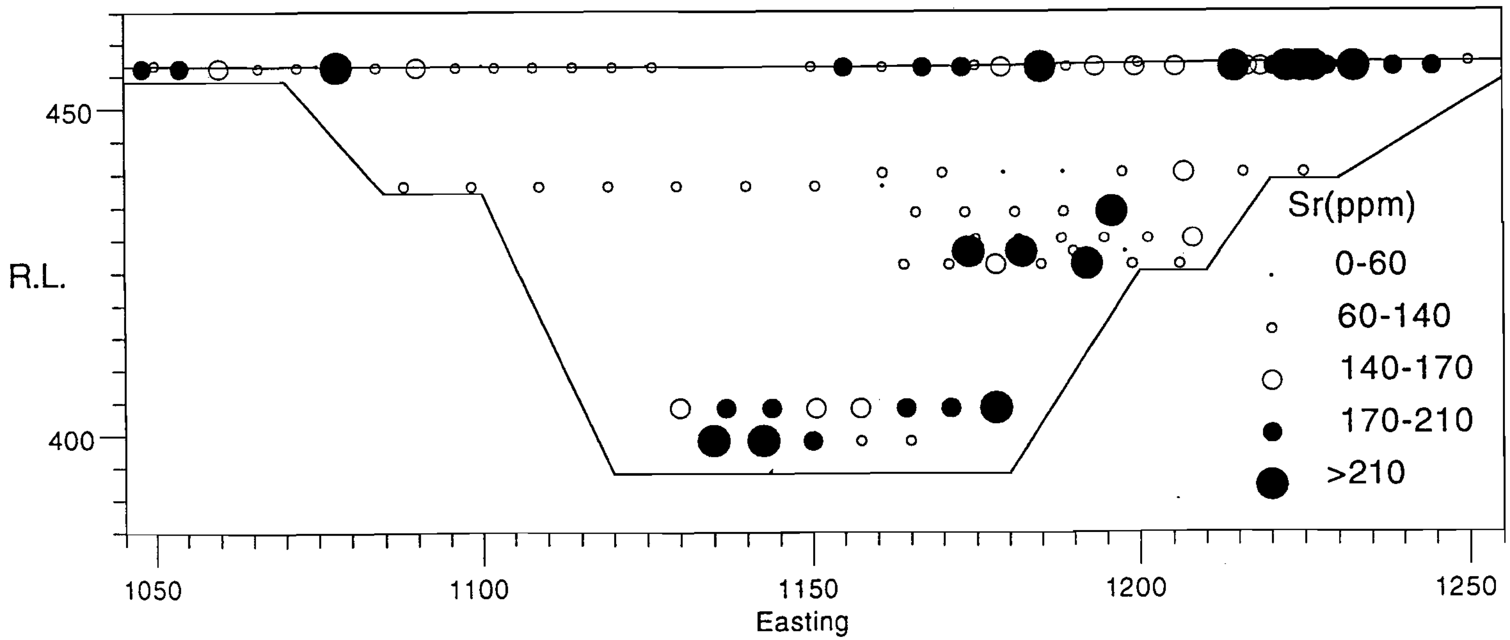


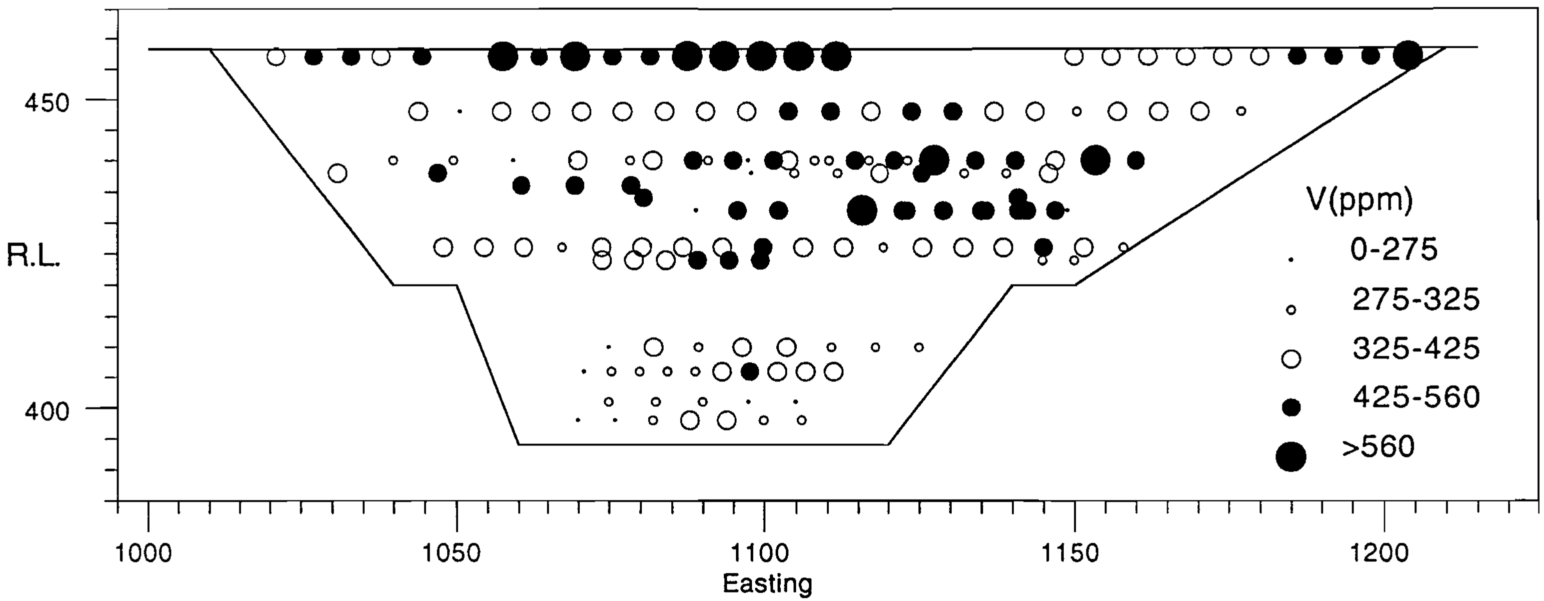
R.L.
450
400
1000
1050
1100
1150
1200
Easting
Sb(ppm)
0-0.1
0.1-0.5
0.5-0.7
0.7-0.9
>0.9

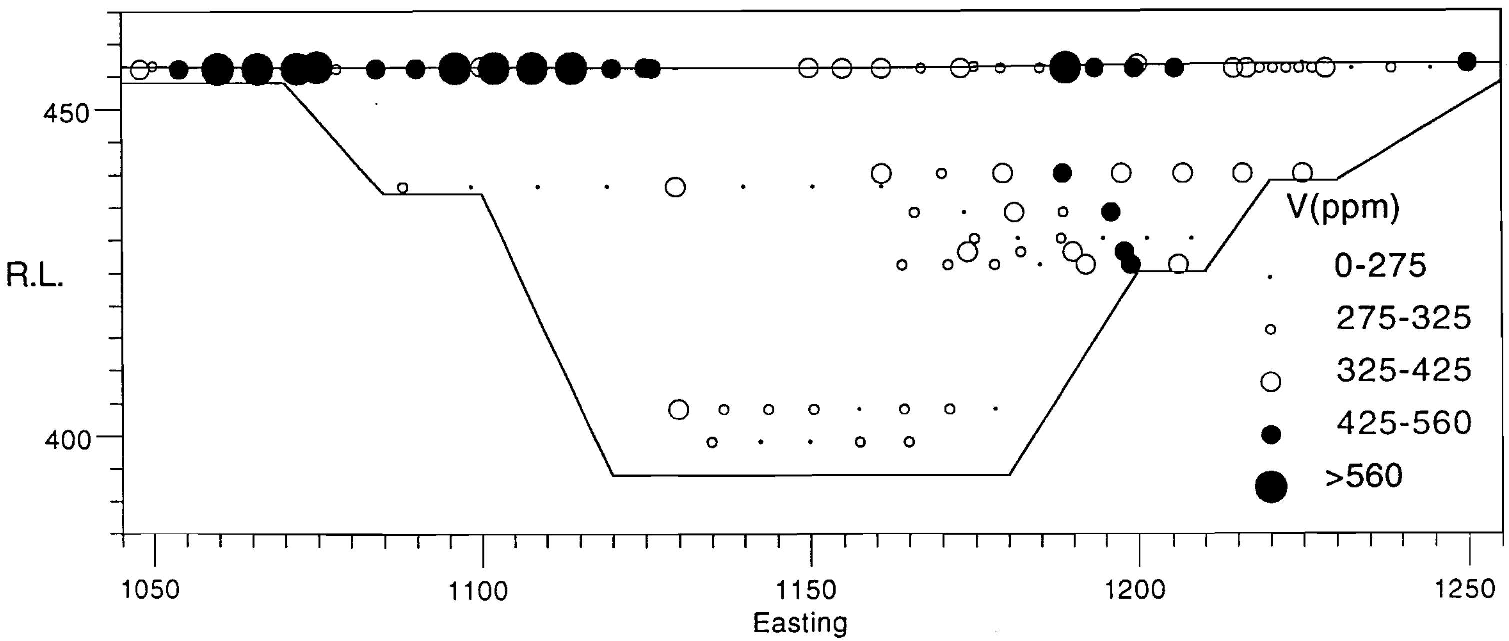


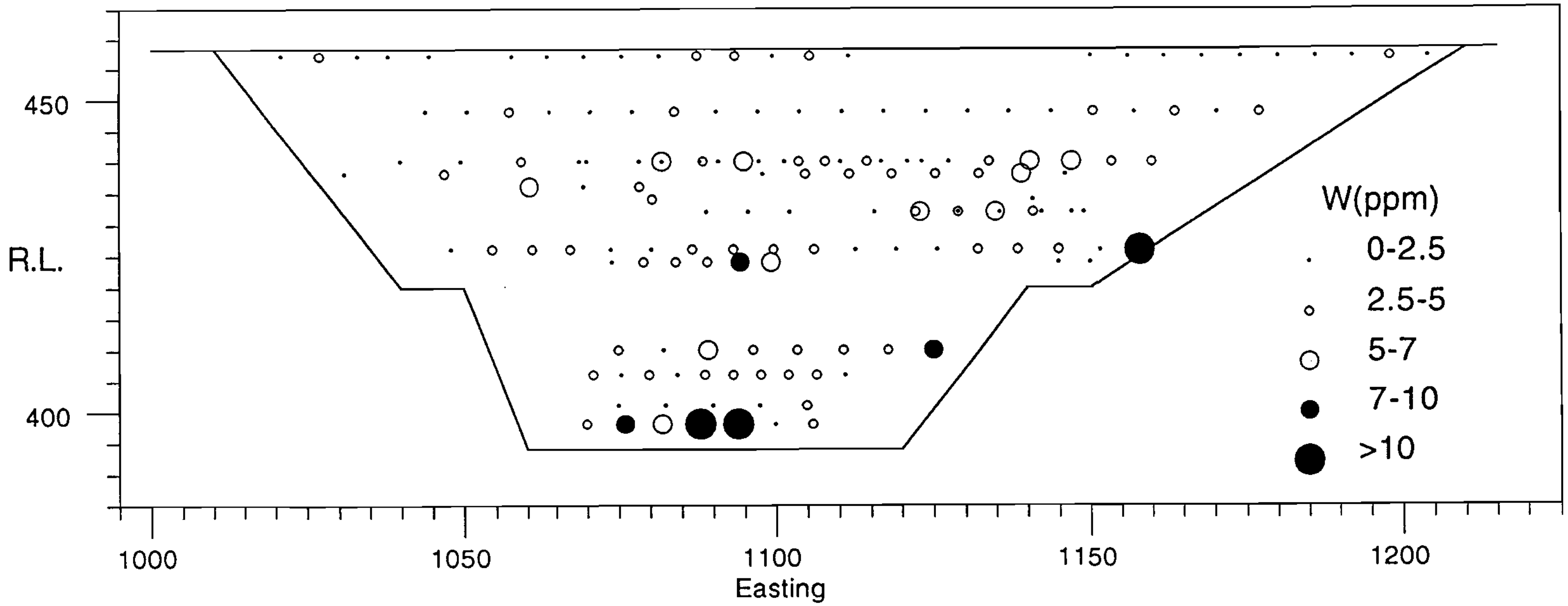
R.L.
450
400
1050
1100
1150
1200
1250
Easting
Sb(ppm)
0-0.1
0.1-0.5
0.5-0.7
0.7-0.9
>0.9


450
400
R.L.
1000
1050
1100
1150
1200
Easting
Sr(ppm)
0-60
60-140
140-170
170-210
>210

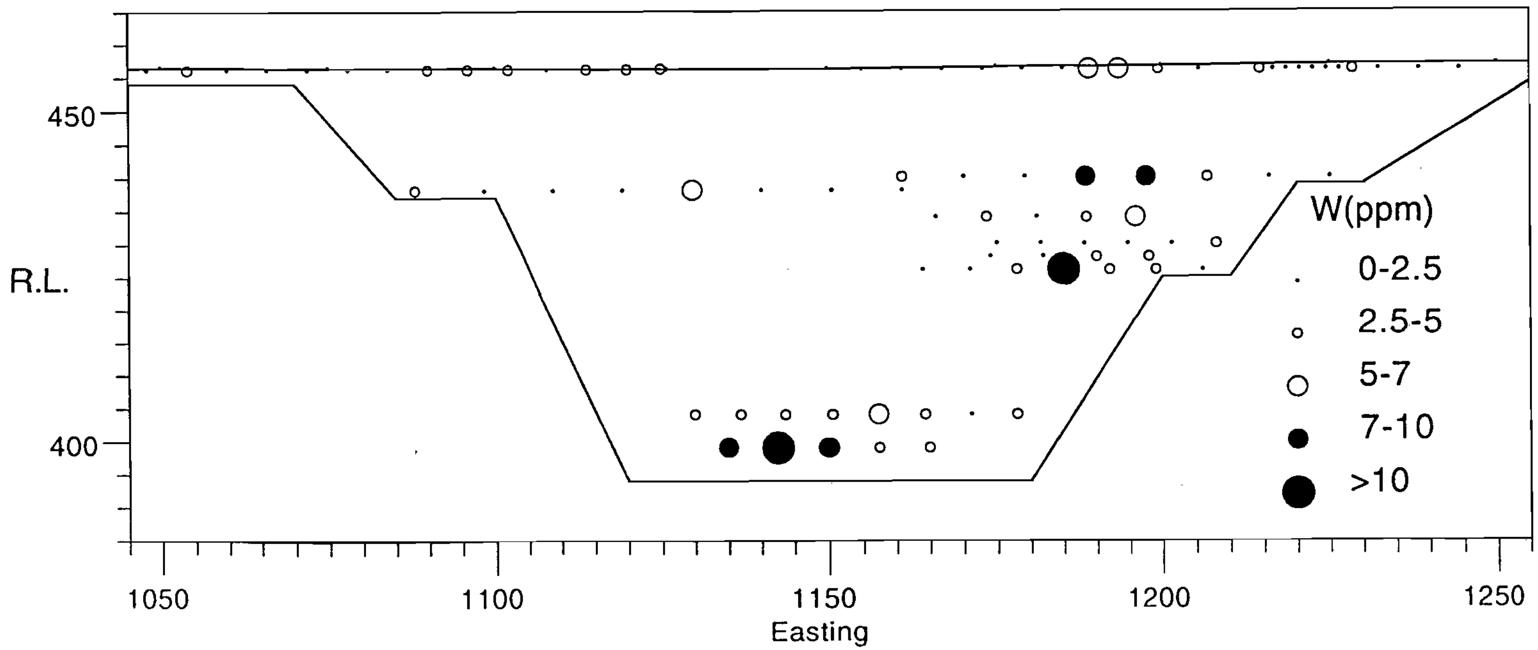

450
400
R.L.
1050
1100
1150
1200
1250
Easting
Sr(ppm)
0-60
60-140
140-170
170-210
>210


R.L.
450
400
1000
1050
1100
1150
1200
Easting
V(ppm)
0-275
275-325
325-425
425-560
>560

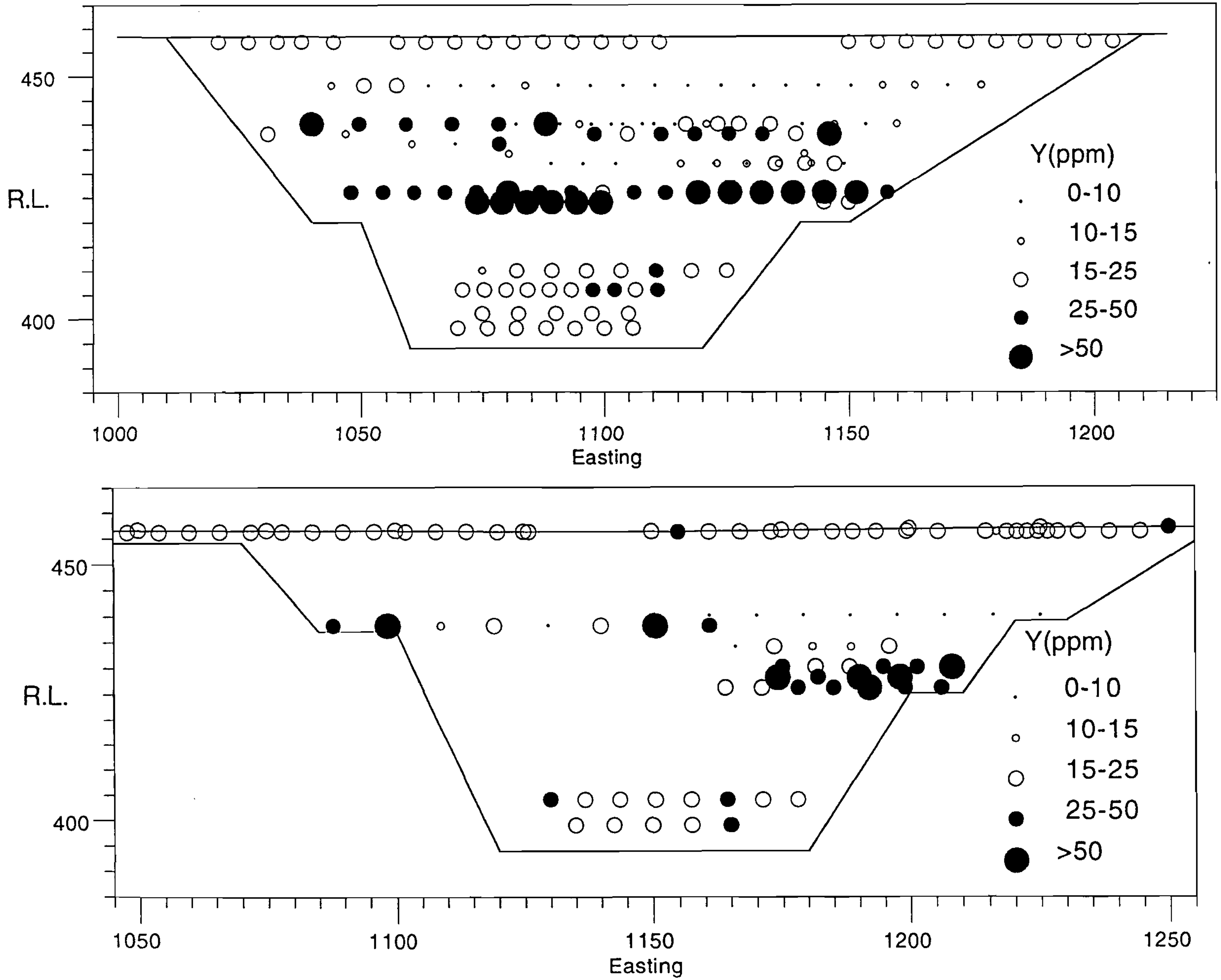

R.L.
450
400
1050
1100
1150
1200
1250
Easting
V(ppm)
0-275
275-325
325-425
425-560
>560

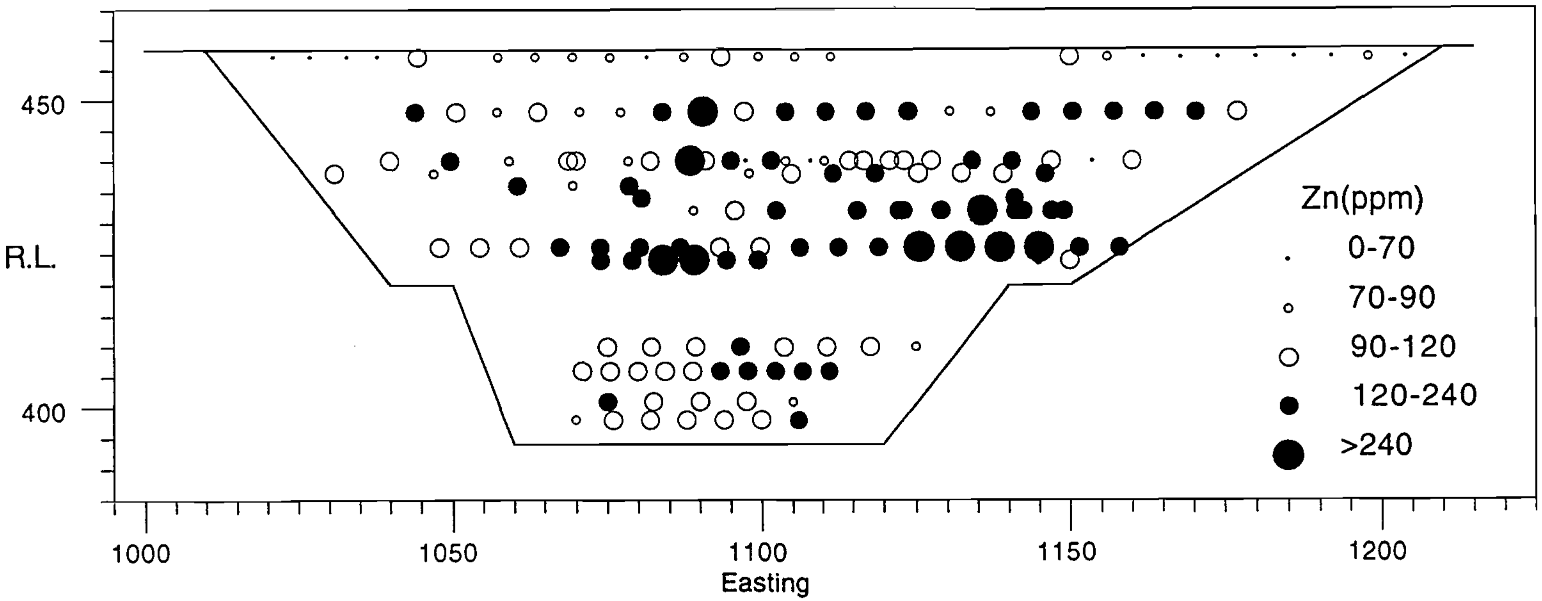


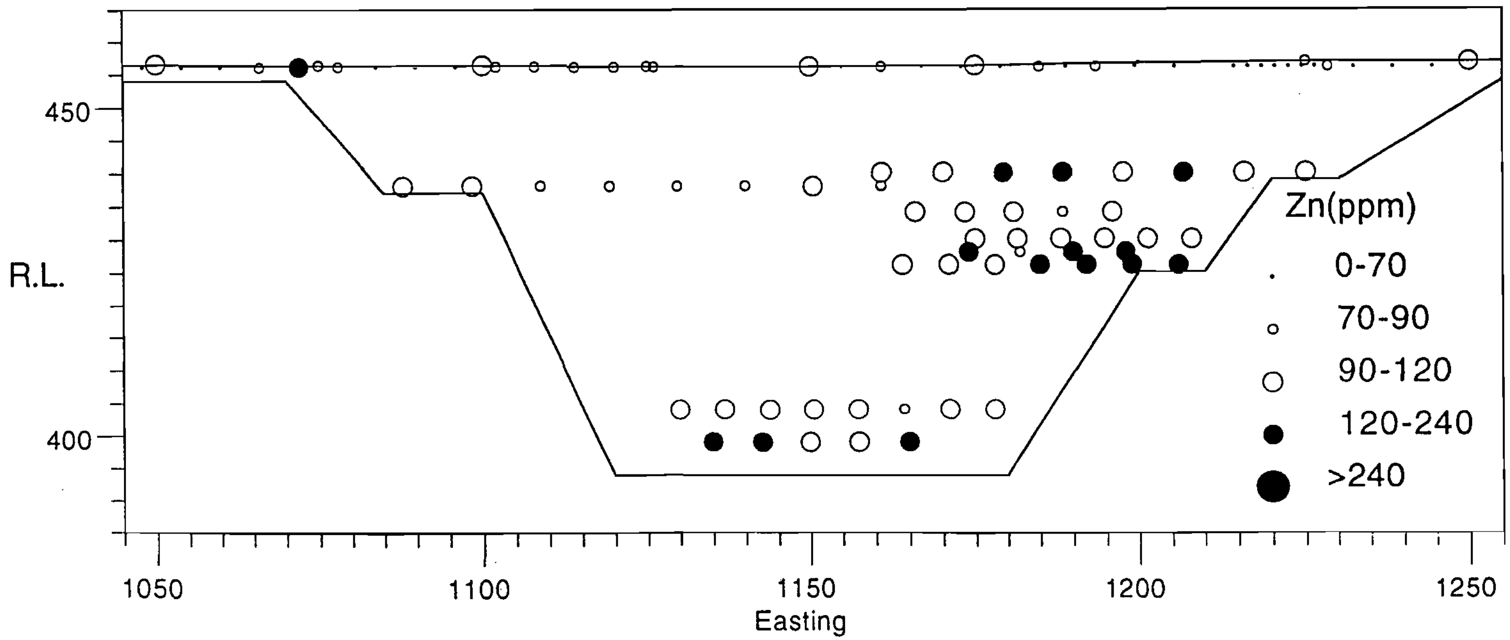
450
400
R.L.
1000
1050
1100
1150
1200
Easting
W(ppm)
0-2.5
2.5-5
5-7
7-10
>10

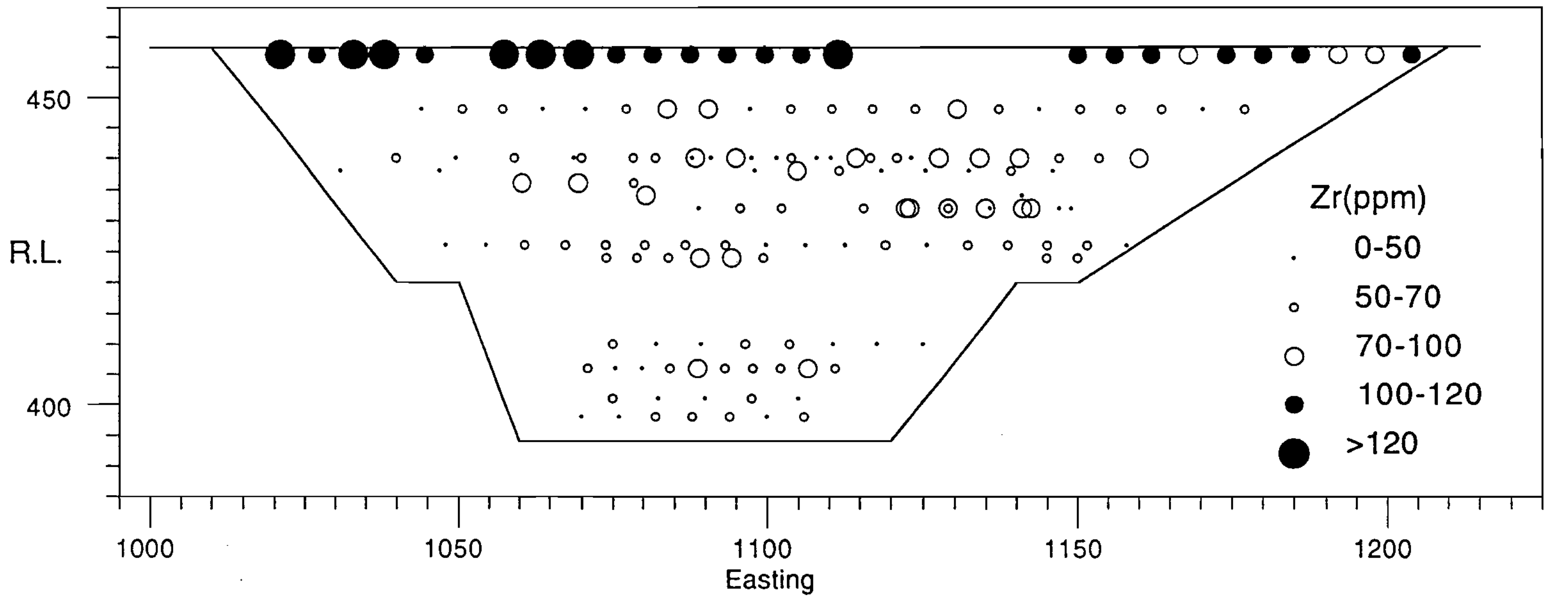


450
400
R.L.
1050
1100
1150
1200
1250
Easting
W(ppm)
0-2.5
2.5-5
5-7
7-10
>10

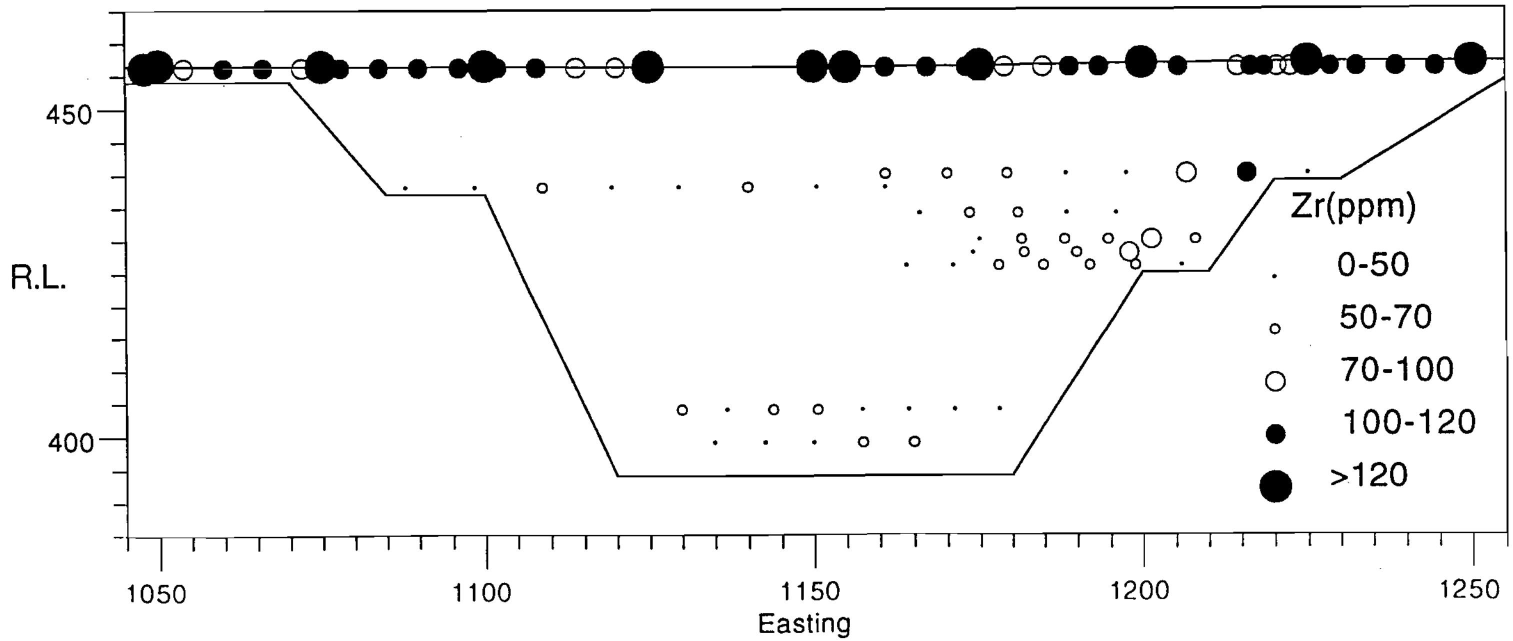

Y(ppm)
0-10
10-15
15-25
25-50
>50
R.L.
450
400
1000
1050
1100
1150
1200
Easting
Y(ppm)
0-10
10-15
15-25
25-50
>50
R.L.
450
400
1050
1100
1150
1200
1250
Easting


450
400
R.L.
1000
1050
1100
1150
1200
Easting
Zn(ppm)
0-70
70-90
90-120
120-240
>240


450
400
R.L.
1050
1100
1150
1200
1250
Easting
Zn(ppm)
0-70
70-90
90-120
120-240
>240



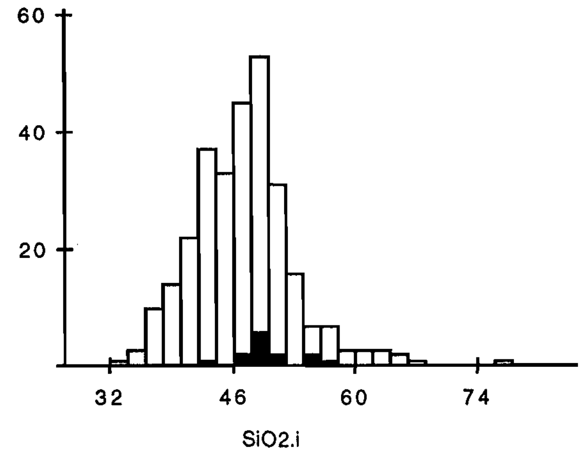
Zr(ppm)
0-50
50-70
70-100
100-120
>120
450
400
R.L.
1000
1050
1100
1150
1200
Easting

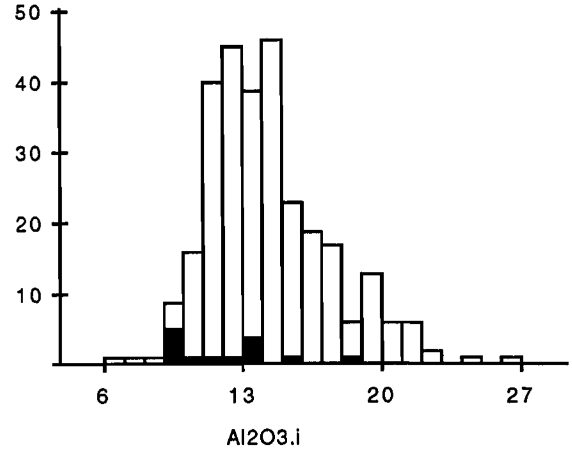


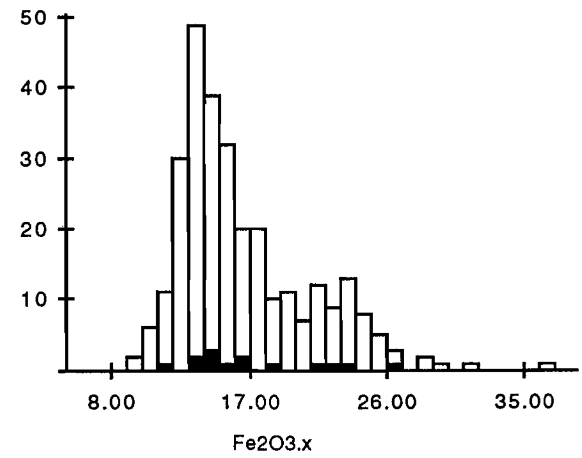
Zr(ppm)
0-50
50-70
70-100
100-120
>120
450
400
R.L.
1050
1100
1150
1200
1250
Easting

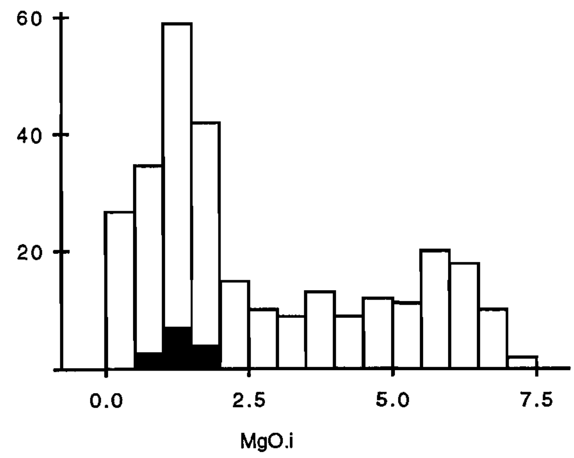
APPENDIX 4

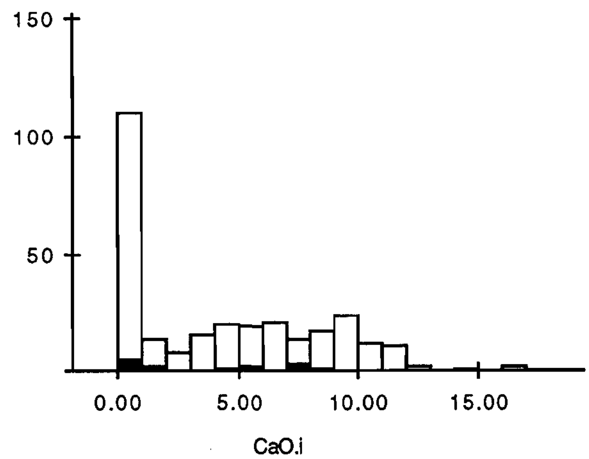
HISTOGRAMS OF SAPROLITE AND SOIL GEOCHEMISTRY

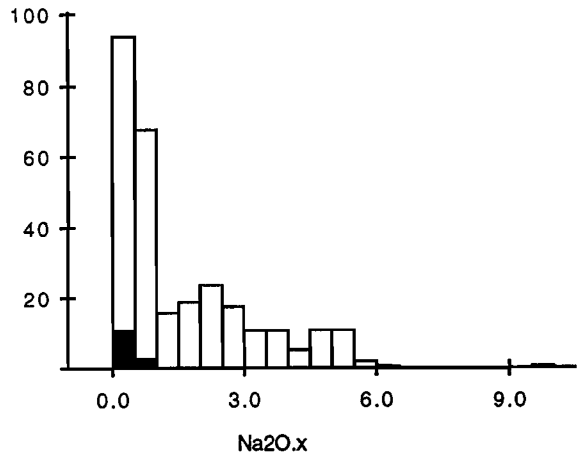

60
40
20
32
46
60
74
SiO2.i


50
40
30
20
10
6
13
20
27
Al2O3.i

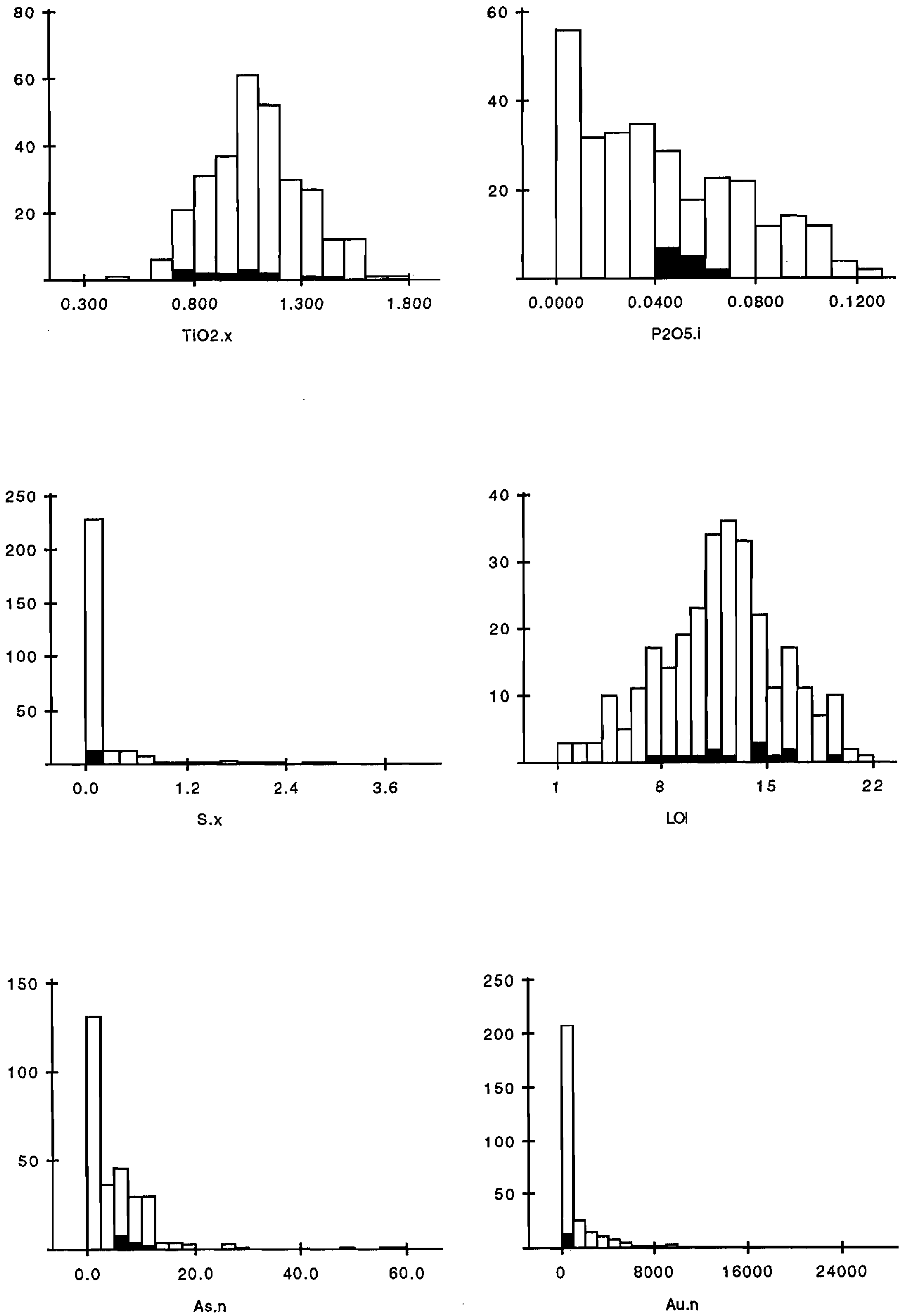

50
40
30
20
10
8.00
17.00
26.00
35.00
Fe2O3.x

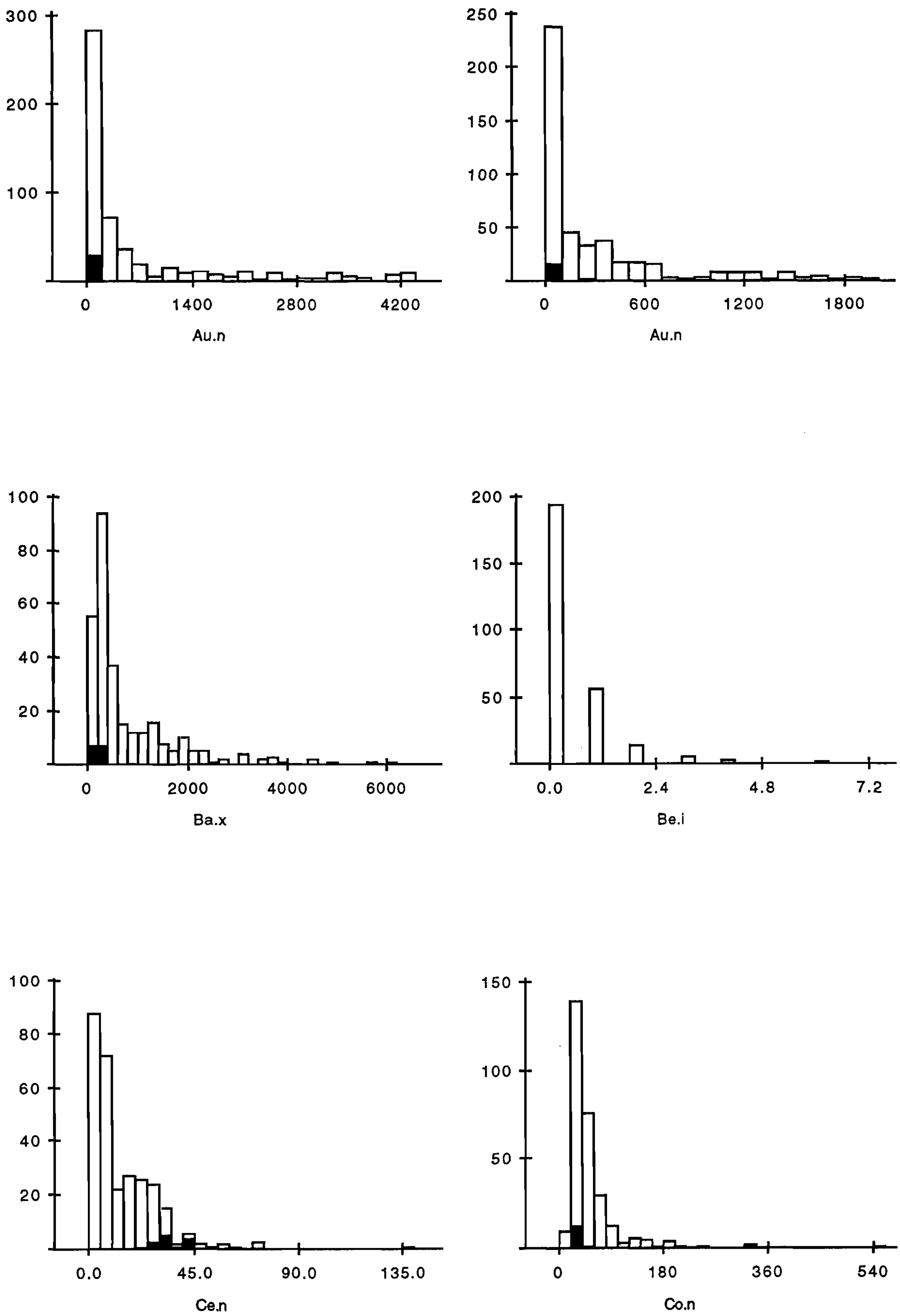

60
40
20
0.0
2.5
5.0
7.5
MgO.i


150
100
50
0.00
5.00
10.00
15.00
CaO.i


100
80
60
40
20
0.0
3.0
6.0
9.0
Na2O.x

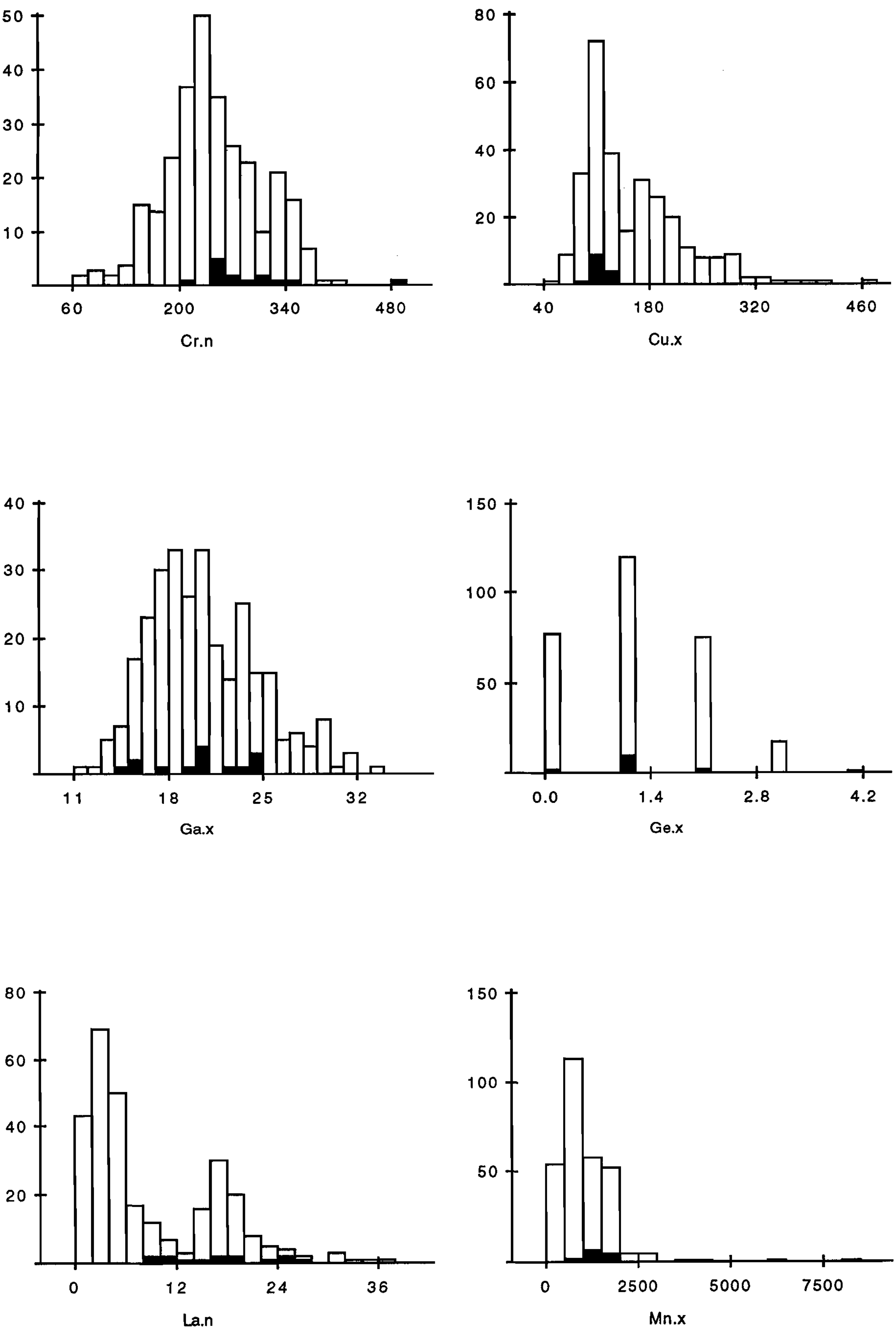
SOLID BARS - SOILS, OPEN BARS - SAPROLITE

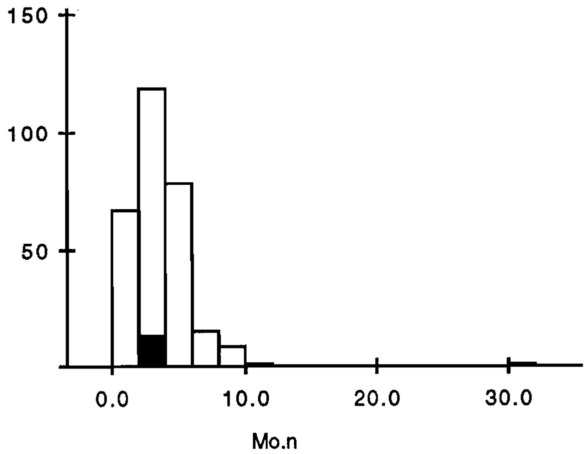


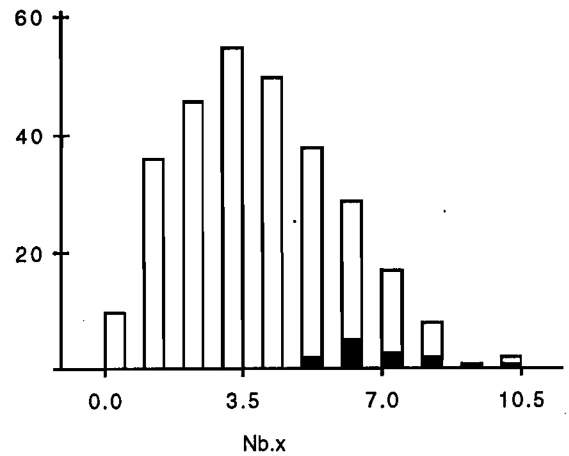


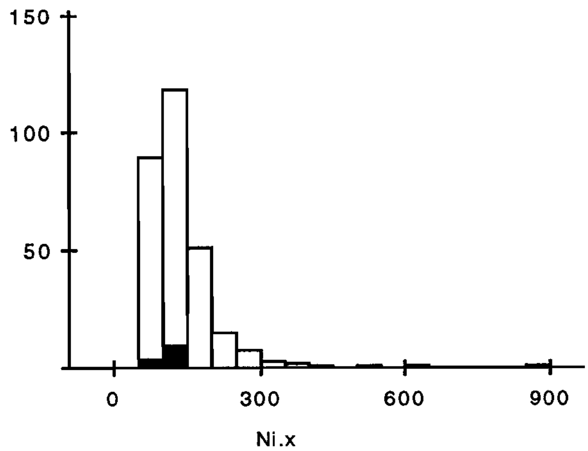
300
200
100
0
1400
2800
4200
Au.n
250
200
150
100
50
0
600
1200
1800
Au.n
100
80
60
40
20
0
2000
4000
6000
Ba.x
200
150
100
50
0.0
2.4
4.8
7.2
Be.i
100
80
60
40
20
0.0
45.0
90.0
135.0
Ce.n
150
100
50
0
180
360
540
Co.n

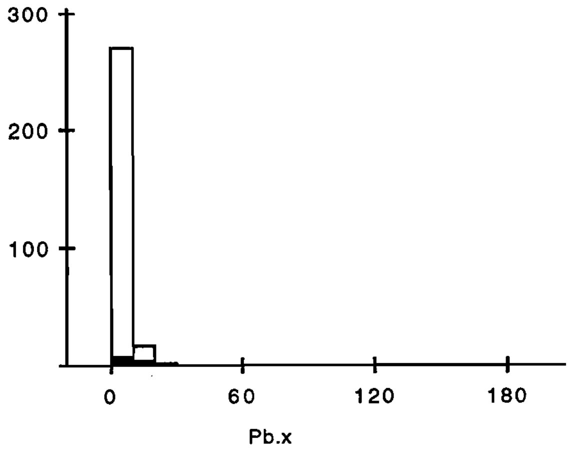
SOLID BARS - SOILS, OPEN BARS - SAPROLITE

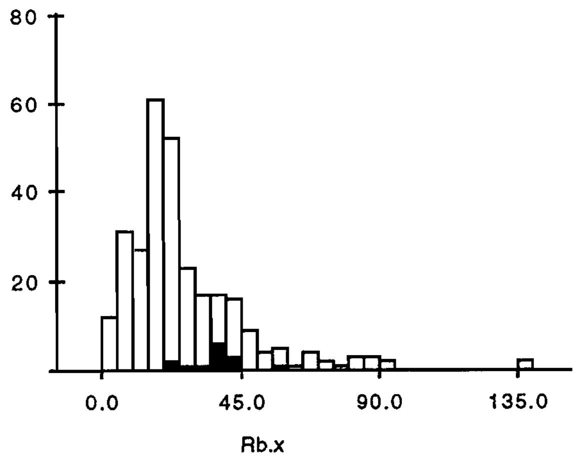


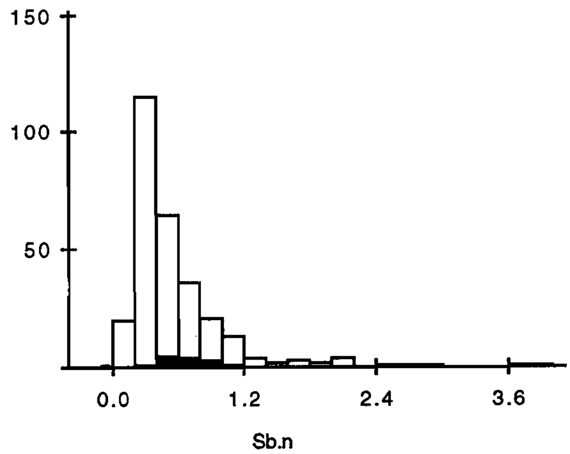

150
100
50
0.0
10.0
20.0
30.0
Mo.n


60
40
20
0.0
3.5
7.0
10.5
Nb.x


150
100
50
0
300
600
900
Ni.x


300
200
100
0
60
120
180
Pb.x


80
60
40
20
0.0
45.0
90.0
135.0
Rb.x


150
100
50
0.0
1.2
2.4
3.6
Sb.n

SOLID BARS - SOILS, OPEN BARS - SAPROLITE