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Till geochemistry, Rideout Island and Elu Inlet map areas, Nunavut (NTS 76O, N/2; 77A, SW/4)

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FIGURES

TABLES

APPENDICES

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INTRODUCTION

Purpose

The Quaternary geology component of the Slave Province National Mapping Program was designed to provide a regional framework for geologic interpretation, environmental management, and drift prospecting. In 1997, Terrain Sciences Division of the Geological Survey of Canada (GSC) mapped the surficial geology of the northern Rideout Island and southwest quadrant of the Elu Inlet map areas (NTS 76O, 77A) (Figure 1). The project involved helicopter-assisted ground work including surficial geology mapping, till sampling, and measuring of ice flow indicators. A total of 95 1-kg samples from the study area were collected for elemental geochemical analysis (Figure 2). At each till sample site, pebbles were collected and classified according to their lithology to assess glacial transport distances. The purposes of this report are (1) to release regional geochemical data; (2) to summarize information on surficial materials and glacial history that is relevant to the interpretation of the geochemical data; and (3) to establish regional background concentrations of selected trace and minor elements for mineral exploration and environmental baseline studies. Interpretive Quaternary geology report and surficial geology map, complementary to this Open File, have been published separately (Kerr et al. 1998a, b). Notes on the glacial geology of the area can also be found in Blake (1963),

The Open File includes the following: 1) regional bedrock and Quaternary geological settings; 2) sample location information (Appendix A); 3) results of geochemical analyses of the < 0.002 mm (clay) fraction analyzed by inductively coupled plasma - atomic emission spectrometry (ICP-AES) (Appendix B), and the < 0.063 mm (silt+clay) fraction analyzed by instrumental neutron activation analysis (INAA) (Appendix C); 4) quality control data relating to standard and duplicate samples (Appendices D and E); 5) summary statistics and histograms; and 6) proportional dot maps showing distributions of concentrations of selected elements (Appendices F and G).

This open file is also available on CD-ROM: the text, figures, Appendices F and G (maps and histograms) and Table 1 are in Adobe Acrobat 3.01, whereas tabular data (Tables 2 to 5) and Appendices A to E are in Excel 4.0.

Location and physiography

The Rideout Island/Elu Inlet map area (Figure 1) lies in the north-central District of Mackenzie. Elevations range from 0 m (present-day sea level) to 319 m in the Buchan and Naujaat Hills in the northwestern regions. The terrain in the western half of the map area rises abruptly inland from the coast southward and eastward, and averages 100-200 m in elevation. Much of the area in the eastern regions, including the Koignuk River valley, is <50-100 m, with the notable exception of the northeastern-most regions where elevations reach 160 m. Local relief is variable, commonly between <5 m and 15 m in areas of outcrop and marine sediments, although relief >100 m occurs in rocky areas of the Buchan and Naujaat Hills.

Regional drainage is northward, into Melville Sound, with a minor westward flow towards Bathurst Inlet. The Koignuk River comprises the largest drainage system, forming a long, north trending basin up to 40 km or more wide that drains into Melville Sound. Its catchment area extends southward beyond the map area. Numerous small lakes occupy glacially scoured bedrock in the west, as well as isolated depressions in marine sediments and wave-washed till in the east. Most drainage ways are shallow; few streams and rivers have cut into bedrock or surficial sediments, with the exception of the Koignuk River which has incised marine and glaciofluvial sediments, and a few smaller unnamed rivers near the coast.

The map area lies north of the treeline, and supports sparse clumps of tundra heath vegetation in rocky areas. In poorly-drained regions underlain by fine-grained marine sediments, low birch, alder, and peat predominate. The Rideout Island/Elu Inlet region lies within the zone of continuous permafrost (Brown, 1967). Climatic data from an Atmospheric Environment Service (AES) weather station operating at Cambridge Bay (120 km to the northeast) indicate an average annual daily air temperature of -15°C (Atmospheric Environment Service, 1982).

REGIONAL GEOLOGY

Bedrock geology

The study area falls within the Bathurst Block of the northeastern Slave Province. Bedrock geology, generalized in Figure 3, consist primarily of Archean volcanic and granitic rocks, Proterozoic sedimentary rocks and gabbro sills and diabase dykes (Fraser, 1964; Roscoe, 1984). Economic interest is focused on the Hope Bay volcanic belt (Gebert, 1990,1993) which is dominated by mafic volcanics with minor felsic volcanics, volcaniclastic rocks, metasedimentary rocks and iron formation. These were metamorphosed from greenschist to amphibolite-facies and intruded by widespread granitic rocks consisting of granite, ganodiorite and gneissic rocks. Proterozoic sedimentary rocks include quartzite, siltstone and minor conglomerate of the Burnside River Formation. Gabbro sills intrude the volcanic, granitic and sedimentary rocks, as do the northwest-trending Mackenzie and Franklin diabase dykes. Many outcrops have been glacially sculptured and striated.

A number of mineral deposits associated with the Hope Bay belt occur in the study area, notably the Boston and Windy gold deposits (Figures 2 and 3), smaller gold showings associated with quartz veins in volcanics, as well as copper prospects in granites. The north end of the belt also hosts an abandoned silver mine where native silver ore was mined in veins. Gossans were observed at sites 5641 and 5650 in the volcanic belt, but no geochemical anomalies were reported in till samples at these locations (see below).

Surficial Geology

Nature of Deposits

Till is a widespread Quaternary sediment in the map area but it is not easily recognized on airphotographs or in the field, i.e., being covered by marine sediments and/or reworked by marine processes because the study area was submerged during and following deglaciation. Till consists of a silty to fine sandy matrix-supported diamicton, and exhibits low to high compaction. It is composed on average of 10 to 30 percent clasts but can reach a maximum of 50 percent clasts, with some being striated. Clasts range in size from small pebbles to large boulders, although medium to large pebbles predominate. Subangular to subrounded clasts are most common.

Till veneers, generally <2 m thick, are common in rocky, more elevated areas containing extensive bedrock outcrops such as the Buchan and Naujaat Hills. Till veneer is generally loosely compact with high concentrations of cobbles and boulders at the surface; where veneer is discontinuous, structural bedrock features are visible on air photographs. In some areas, much of the fine grained sediment in the matrix was removed by meltwater and wave action, resulting in isolated lag deposits consisting of pebble to boulder-sized clasts <2 m in diameter. Till veneers are the main surficial sediment above the limit of marine submergence (approximately 200-220 m a.s.l.). Till blankets are generally >2 m thick, forming low to moderate-relief drumlinoid and crag-and-tail features in the west-central and southeast regions. These tills tend to be relatively compact.

Glaciofluvial deposits consist of eskers, kames and proglacial outwash. Eskers range from small, sinuous ridges a few tens of metres long, to large, more linear features up to 15 km long. They generally trend northwest in the western regions and north northwest to north in the eastern regions. They are rare to absent in the northern half of the map area. Cobble and boulder lags, resulting from wave action during postglacial marine regression, may cover eskers as well as bedrock surfaces between esker segments. Composition ranges from fine sand to cobbles, and may change rapidly over short distances. In the southern half of the map area, small outwash terraces are associated with the esker complexes. As with eskers, their grain size is variable. Esker-outwash complexes generally parallel the dominant glacial flow direction, and those within the Koignuk River valley may be characterised by raised beaches in their flanks. Such glaciofluvial deposits are potential resources for large volumes of granular materials. However, some eskers and outwash sediments are likely cored by massive ice, or are underlain by permafrost which typically results in the formation of ice-wedge polygons. Therefore, geotechnical investigations should be conducted prior to any development.

Marine sediments are the dominant surficial sediment in the map area. They are extensive along the coastal lowlands of Melville Sound, extending up to 75 km inland in the Koignuk River valley, and commonly occupy low areas in the bedrock topography along the coast of Bathurst Inlet. They provide evidence for postglacial marine inundation and subsequent emergence of approximately 220 m. Marine sediments consist primarily of three types: (1) undifferentiated, massive to well stratified clay and silt which may be overlain by a thin sand layer forming a blanket >2 m and up to 20 m or more thick; (2) a veneer ranging in composition from clay to sand and gravel <2 m in thickness covering extensive regions below marine limit; and (3) coarse sand, pebbles and cobbles of littoral origin (raised beaches) found at various elevations from near marine limit to present sea level.

Permafrost has extensively affected marine sediments and evidence for this is widespread. In many areas along the coast, particularly within the Koignuk River valley, the fine-grained marine blanket deposits are gullied and bare of vegetation cover. Retrogressive thaw flowslides are common along streams in this area, with active slides typically >10 m in diameter and headwalls 1-2 m high. Solifluction lobes are particularly active in fine-grained marine sediments. They show considerable sediment translocation, with lobes ten's of metres long. Locally, significant downslope movement has occurred in recent times as evidenced by solifluction lobes encroaching on raised beaches near present sea level. Ice-wedge polygons are common on most raised beach and sandy littoral sediments. Where littoral sediments form laterally extensive veneers over marine silt or clay, tundra ponds and low centre polygons are common.

Alluvial sediments comprise silt to gravel size sediment deposited by postglacial streams and rivers. They range from massive to well stratified and vary in thickness from 1 to 5 m. Alluvial sediments are associated with meandering and braided stream environments, as well as floodplains and alluvial fans.

Organic sediments consist of peat formed by the accumulation of fibrous, woody and mossy vegetative matter up to 1 m or more in thickness, locally overlain by a dense grass cover. They occur predominantly in topographic depressions and valley bottoms with poor drainage, and are most noticeable below marine limit where they overlie fine-grained marine sediments. Ice-wedge polygons are common in organic sediments, and are rooted in the underlying glaciofluvial or marine deposits. Frozen ground was encountered at depths as shallow as 0.10 m below the surface in peat in late summer.

Glacial history

All glacial features in the study area relate to the Late Wisconsin glaciation. This region became ice-free by about 9000 BP (Dyke and Prest, 1987). The oldest reported striae (1 in Fig. 4) may represent a northwestward ice advance prior to the establishment of the dominant regional patterns, possibly during ice build-up. Alternatively, they may be related to early variations in the dominant, final ice flow (2 in Fig. 4). The youngest and most prominent westward to north-northwestward ice flow indicators (2 in Fig. 4) likely relate to the last phases prior to and during deglaciation, as shown by the distribution of eskers which generally parallel this ice flow. The relative age of westward flows in the northeast and their relation to flows 1 and 2, is unclear at present.

During deglaciation, the study area experienced rapid ice retreat which was simultaneous with the marine incursion across isostatically-depressed terrain. Little evidence exists in this region which can be used to precisely define marine limit elevation, but regional data suggests approximately 220 m, and was formed by 9 000 BP (Kerr, 1994). The size and configuration of postglacial precursors of Bathurst Inlet and Meville Sound evolved as a function of isostatic uplift over the last 9000 years. As sea level dropped to successively lower elevations, numerous beaches were formed where suitable sediments for strandlines were present. It is believed the region is still experiencing uplift at present.

Ice flow directions

Figure 4 is a summary diagram of ice flow direction based on airphoto identification of ice-streamlined landforms and 167 striae measurements, as well as on regional observations made by Blake (1963) in the Rideout Island/Elu Inlet map area. At a few locations in the northeast, cross-cutting striae were noted, and their relationships record an early west-northwestward to north-northwestward flow (1 in Fig. 4), although the extent of this event is not presently known.

Throughout the southern and central study area, a strong pattern of ice flow radiating from the southeast (2 in Fig. 4) is apparent. Flow shifts clockwise from west-southwestward in the southwest region to westward, northwestward and eventually north-northwestward in the northeastern map area (2 in Fig. 4). This flow is responsible for the creation of all streamlined glacial landforms (drumlins and crag-and-tails) in the study area. Where Melville Sound meets Bathurst Inlet, the northwestward flow rotates anticlockwise to a westward flow. Westward flows were also recorded in the coastal zones of the northeastern region. Local variations in ice flow directions were encountered along the eastern edge of the Buchan Hills and are attributed to local topography, deflecting ice northward along major escarpments. Ice appears to have preferentially flowed down the NNW trending axis of the broad shallow Koignuk River valley. A late focus of flow was also directed into Bathurst Inlet. The general radiating pattern for ice is reflected in the orientation of fluted landforms.

Glacial transport distances

To illustrate patterns of glacial dispersal and to estimate transport distances as an aid to mineral exploration, volcanic rocks were chosen as an indicator lithology because of a clearly defined source area, economic importance and clasts that are easily distinguished from sedimentary and granitic rocks. Volcanic pebbles in till occur at about 25% of the 95 sites, and the majority of these sites are underlain by volcanic rocks.

The expected distribution pattern of volcanic pebbles is a sharp decline clast concentration down-ice of the source rock and bedrock contact, as illustrated by Shilts (1975) and other workers. This predicted pattern of clast-content attenuation is clearly evident. The pebble distribution illustrates that the dominant north northwestward flow over the Hope Bay volcanic belt transported clasts northwestward onto granitic terrain to the west. The highest concentrations (up to 90%) of volcanic clasts are found in areas underlain by volcanic bedrock. However, their numbers remain generally low (20-40%) even over the volcanic belt itself. Concentrations decrease rapidly to <20% to 0% approximately 10 km down-ice from the nearest source outcrops. Only 5% of the sites record concentrations up to 8% volcanics 45 km down-ice.

Granitic clasts are the dominant pebble lithology throughout most of the study area, with the majority of sites containing almost 90-100% granite. They mask much of the volcanic belt and dilute the volcanic clast count. Only in the area underlain by sedimentary rocks do the granite clasts show any significant decrease, even though they are present as erratic boulders. The highest concentrations (up to 95-100%) of granitic clasts occur east of the volcanic belt and in the south-central regions. A slight decrease in concentration (to 80%) east of Bathurst Inlet is the result of dilution by sedimentary clasts. These clasts may be associated to preexisting outcrops which were completely eroded during the last glaciation, or alternatively to unmapped bedrock covered by surficial sediments.

METHODS

Field

In the Rideout Island/Elu Inlet map area 95 till samples of 1-kg size were collected to determine regional geochemical patterns (Figure 2, and Appendix A). Till samples were taken from hand-dug pits in mud-boils at depths ranging from 30 to 70 cm. The pit walls were examined, and sampled only where there was no evidence of incorporated surface organics or iron/manganese staining. Because of periodic overturning of till in the mud boils by frost action, the samples are representative of the overall composition of the till throughout any given pit. The till is slightly weathered, but less oxidized than if B-horizon soils had been sampled.

Laboratory

The till clay size fraction (<0.002 mm) was separated by centrifuge and decantion at the GSC Sedimentology Laboratory prior to analysis by ICP-AES for selected trace, minor and major elements (Table 1) at Chemex Labs, Mississauga, Ontario. The clay-size fraction was chosen because it is commonly used for trace element geochemistry work by the Geological Survey of Canada, and because the clay-sized particles, which have a large surface area per unit volume, have more exposed lattice irregularities than do coarser size fractions. Therefore, they tend to adsorb cations better than larger sized material, thus accentuating the concentrations of metals, and emphasizing the contrast between background and anomalous concentrations of elements (Dilabio, 1995; Shilts, 1995). All the clay-sized samples were digested in an aqua-regia solution (3HCl:1HNO3) prior to analysis; this digestion may be incomplete for Al, Ba, Be, Ca, Cr, Ga, La, Mg, K, Sc, Na, Sr, Tl, Ti, and W. Analytical results are reported in Appendix B. Element concentrations reported as less than the detection limit were converted to values of half the detection level for the calculation of summary statistics and plotting of proportional symbol maps. In all samples, Be, Bi, Cd, Ga, Sb, Tl and W were at or below detection limits.

The silt+clay size fraction (<0.063 mm) of the till was prepared by dry sieving at the GSC and sent to Activation Laboratories Ltd., Ancaster, Ontario for irradiation and analysis using instrumental neutron activation analysis (INAA) on approximately 30 g aliquots. This method is particularly sensitive for rare earth elements (La, Ce, Nd, Sm, Eu, Tb, Yb, and Lu), as well as for Sc, Co, Cr, Cs, Hf, Ta, Th, U, and Au. The <0.063 mm fraction was used for elements that tend to be less detectable in the clay fraction, or for samples that contain insufficient clay material. Geochemical results for 35 elements are presented in Appendix C. For the Rideout Island/Elu Inlet samples, Ag, Hg, Ir, Se, Sn, Sr and W concentrations were at or below detection limits.

Quality control

Accuracy of geochemical analyses was monitored by inserting 8 lab duplicate samples and an “in house” GSC till standard (TCA 8010) into the sample batch at regular intervals before sending the samples out for analysis by ICP-AES and INAA. Results for the duplicates from the study, and the measured mean and range of concentrations for the TCA 8010 standard from the last several years are shown in Appendices D and E. The term “dup” refers to a laboratory duplicate split of the original sample. Reproducibility is good for many elements, with concentrations varying only ±10% to ±15%. Duplicate ICP-AES results suggest that Al, Co, Cr, Cu, Fe, Mg, Mn, Ni, V and Zn values have variability of up to 20%. The reproducibility is fair to poor for Ba (±30%), La (±30%), Pb (±30%) and Hg (±70%). Determinations for As are unreliable when obtained using ICP-AES methods because of the As lost due to volatilization during the acid digestion. Results of duplicate analyses show that the data of other elements (Ag, Be, Bi, Cd, Ga, Mo, Sb, U and W) are difficult to assess because concentrations are near the lower detection limit. Element levels for the standard sample in the data set were generally between the minimums and maximums determined for the same standard in other studies, although Co and Hg were above the reported maximum for the standard.

Ce, Co, Cr, Fe, La, Sc and Th data for 8 duplicate samples using INAA methods are generally good, being reproducible from ±10% to ±20%. Concentration levels for Ba, Br, Nd and U are more variable, up to ±25-30%. The reproducibility is poor for As (±75%), Rb (60%) and Zn (90%). Results for INAA duplicates also indicate that Ag, Ca, Cs, Hg, Ir, Mo, Ni, Sb, Se, Sn, Sr, Ta, Tb, and W data have very low reproducibility (±100%), as they are at or near detection limit in most cases. Repeated analyses of the standard samples in the Rideout Island/Elu Inlet data set showed concentration levels falling within the minimum to maximum range of values obtained in other studies.

RESULTS

Trace Element Geochemistry

Plots of regional concentrations for trace elements listed in Table 1 and Appendices B and C are shown by histograms and proportional dot maps in Appendices F and G. These figures also show values for the 25th, 50th, 75th, 90th, 95th, 97th, 99th and 100th percentiles of the population, so that both the general distribution of elements, and the location of anomalies can be seen. Descriptive statistics, useful for comparing elements and results from the two analytical methods, are provided in Tables 2 and 3.

Correlation coefficients (r) of > 0.23 or <-0.23 in Tables 4 and 5 indicate statistically significant correlations at the 99% confidence level (96 observations were used in computations). Table 4 indicates that combinations of Al-Cr-Fe, Ba-Cr-Mg-Zn, and Cr-Mg-Ni-Zn have correlations near or above 0.7 for the <0.002 mm fraction, and the <0.063 mm fraction (Table 5) shows relatively high correlations above 0.7 between Ce-Co-Cr-Fe-La-Nd-Sc. It is suggested that statistical correlations be examined in conjunction with elemental plots illustrating the geographic areas where these combinations of elements are present in high concentrations, as they may be of interest to mineral exploration. Several Au, Ag, Cu, Zn, Pb and Cu showings have been reported in the study area (Figure 3).

ICP-AES data on the <0.002 mm fraction

The maps in Appendix F show the distribution of fourteen elements analysed by ICP-AES methods for the <0.002 mm fraction. Although element concentrations appear to be related to rock types to a limited extent, in most cases, well-defined regional relationships are not apparent. Generally, there does appear to be some relationship between the distribution of highest values of specific elements with either volcanic rocks or granitic bedrock. Only a few selected elements have high concentrations over both rock types. Element distributions described below suggest that further investigation for mineral exploration may be warranted.

High concentrations of Co, Cr, Cu, Fe, Mg, Mn and Ni are generally associated with volcanic rocks, either at the north end or south end of the belt. Locally, elevated Cu and Fe values occur down-ice of gabbro sills in the Buchan Hills area, and some high values for Mn are found immediately down-ice (west) of volcanic rocks. Elevated Ba values relate more closely to granitic bedrock in the western regions. Elements with high concentrations associated to both volcanic and granitic bedrock include Al, La, Pb, V and Zn.

Of particular interest are the highest concentrations of Pb-Zn at site 5606 underlain by granite, Cr-Mg-Ni at site 5523 underlain by volcanic rocks, and Cu-V at site 5581 underlain by granite but down-ice from a gabbroic sill.

No combination of kimberlite associated elements such as Ba, Ca, Cr, Fe, La, Mg, Ni, Sr, Ta, Th, Ce, Nd (Mitchell, 1986) is evident in the study area, and no kimberlites have been reported within the region.

Concentrations of Cd and Hg, naturally occurring metals known to be toxic, are either below analytical detection limits in this area or have low reproducibility. The distribution of other elements of environmental concern, such as Cr, Cu, Ni, Pb, and Zn, is variable, as shown in Appendices F and G. Concentration ranges, means, and maximum values are summarized in Table 2.

INAA data on the <0.063 mm fraction

In general, concentrations of elements in the <0.063 mm fraction (analyzed by INAA) are lower than in the clay-sized fraction (analyzed by ICP-AES), although Ba is a notable exception, and Cr values are similar. The contrast between background and anomalous concentrations is also less than in the clay sized fraction; these differences may exist because metal cations were scavenged less efficiently in the silt fraction than in the clay fraction, which has more surface area and more lattice irregularities per unit volume (Cotton and Wilkinson, 1966), or because Ba and Cr are abundant in minerals present in the silt size material. The ten elemental dot maps in Appendix G show that the overall geographic distribution of high and low concentrations also varies considerably in the two size ranges.

As with some of the ICP-AES data, distinct element patterns are difficult to discern regionally. Element concentrations at sample sites may be related to underlying bedrock to a limited extent, but in most cases, well-defined relationships are not apparent. However, high Au values are predominant over the volcanic belt, whereas elevated Rb values are associated with granitic rocks in the western half of the study area. In areas underlain by volcanic rock, the highest values for Au (42 ppb) was at site 5649, Ce (190 ppm) and Co (29 ppm) at site 5654, Cr (160 ppm) at site 5523, La, Nd and Sc at site 5654. Areas of granitic terrain are characterised by the highest values for Ba (site 5617), Fe (site 5617) and Rb (site 5583). High or low concentrations of Ba, Ce, Co, Cr, Fe, La, Nd and Sc do not appear to clearly relate to specific bedrock types. Possible explanations for no well-defined trends include, recurring or concealed rock type, ice flow history, wide sample spacing, and glacial transport distances.

There are a limited number of sites with high concentrations of multiple elements apparent in the INAA data. For instance, site 5654, underlain by volcanic rocks, contains elevated values of Ce-Co-La-Nd-Sc, and site 5617, underlain by granitic rocks, exhibits an anomalous combination of Ba-Fe.

The proportional dot maps in Appendix G indicate that the overall geographic distribution of high and low concentrations of elements in the INAA data are somewhat different than from the ICP-AES data for Fe and La. Ba, Co, and Cr generally have comparable values at most sites with the exception of 5564.

With respect to elements relevant to environmental issues, all samples contain Hg concentrations below detection level, and the reproducibility of As is poor.

SUMMARY

The Rideout Island/Elu Inlet map area is underlain by Archean metavolcanic and metasedimentary rocks of the north trending Hope Bay volcanic belt, granitoid rocks, Proterozoic sedimentary rocks in the northwest, and gabbro sills forming prominent escarpments. During the last glaciation, ice flow shifted clockwise from west-southwestward in the southwest region to westward, northwestward and eventually north-northwestward in the northeastern map area. Pebble sized volcanic clasts were transported generally less than 10 km from their bedrock sources, though transport distances may be as high as 45 km or more. Trace element geochemical analyses of 95 till samples show that there is a relationship between elevated concentrations of Au, Ce, Co, Cr, La, Mg, Nd and Ni and economically significant volcanic rocks of the Hope Bay volcanic belt, where the highest values for Cu-Pb-Zn related to granitic sources. However, no one specific well-defined target based on till geochemistry is evident due to recurring rock type, ice flow history, glacial transport distances and widely spaced samples. Known gold deposits hosted in the Archean volcanic rocks are not readily reflected in the regional till geochemistry data, likely because gold dispersal trains are known to be short, and that no till samples were collected in the immediate vicinity of gold occurrences.

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Appendix F. Maps and histograms of element concentrations determined by ICP-AES (< 0.002 mm fraction)

List of elements depicted on maps and histograms:

Al
Ba
Ca
Co
Cr
Cu
Fe
La
Mg
Mn
Ni
Pb
V
Zn

Abbreviations for Descriptive Statistics:

St. deviation = Standard deviation
Coeff. var = Coefficient of variation
Geom. mean = Geometric mean

NOTE: Range values on thematic dot maps range from (example):

30 to < 40
20 to < 30
10 to < 20
0 to < 10

Appendix G. Maps and histograms of element concentration determined by

INAA (<0.063 mm fraction)

List of elements for maps and histograms:

Au
Ba
Ce
Co
Cr
Fe
La
Nd
Rb
Sc

Abbreviations for Descriptive Statistics:

St. deviation = Standard deviation
Coeff. var = Coefficient of variation
Geom. mean = Geometric mean

NOTE: Range values on thematic dot maps range from (example):

30 to < 40
20 to < 30
10 to < 20
0 to < 10