GEOLOGICAL SURVEY OF CANADA

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Till geochemistry and gold grain results, Contwoyto Lake map area, Northwest Territories (NTS 76 E, north half)

D.E. Kerr, R.D. Knight and L.A. Dredge

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Contribution to the Slave Province NATMAP

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Canada's National Geoscience Mapping Program

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cartographie géoscientifique du Canada

1998

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Till Geochemistry and Gold Grain Results, Contwoyto Lake Map Area (NTS 76 E, north half), Northwest Territories

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 1996, Terrain Sciences Division of the Geological Survey of Canada (GSC) mapped the surficial geology of the northern Contwoyto Lake map area (NTS 76 E). The project involved helicopter-assisted ground work including surficial geology mapping, till sampling, and measuring of ice flow indicators. A total of 112 1-kg samples from the northern half of the Contwoyto Lake map area were collected for elemental geochemical analysis. Twenty-five additional 10-kg samples were collected at some of the sites specifically for regional kimberlite indicator mineral and gold grain analyses. At each till sample site, pebbles were collected and classified according to their lithology to assess glacial transport distances. Till geochemistry for the southwestern region of the study area (15 sites sampled originally in 1994) can be found in Ward et al. (1997). The purposes of this report are (1) to release regional geochemical and gold grain 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 reports and surficial geology maps, complementary to this report, have been published separately (Kerr et al. 1995, 1997a, b; Ward et al. 1996a). Regional kimberlite indicator results for the south half of 76E have been published as Open File 3386 (Ward et al. 1996b), and till geochemistry data as Open File 3387 (Ward et al. 1997). Other preliminary studies of till geochemistry and surficial geology mapping completed in the study area were undertaken by Coker et al. (1992) and Hart et al. (1989).

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) gold grain counts (appendix D); 5) quality control data (Appendices E and F); 6) summary statistics and histograms; and 7) proportional dot maps showing distributions of concentrations of selected elements, including gold (Appendices G, H, and I).

The text and geochemical data of this document are available on computer diskette in Wordperfect 6.0 and Excel 3.0, respectively.

Location and physiography

The Contwoyto Lake map area (Figure 1) lies in the north-central District of Mackenzie, Northwest Territories. Elevations range from 445 m (Contwoyto Lake) to 580 to 640 m in the Peacock and Willingham Hills in the northernmost region of the area. The terrain northwest and east of Contwoyto Lake is generally between 480 to 520 m, whereas much of the area south of the lake is

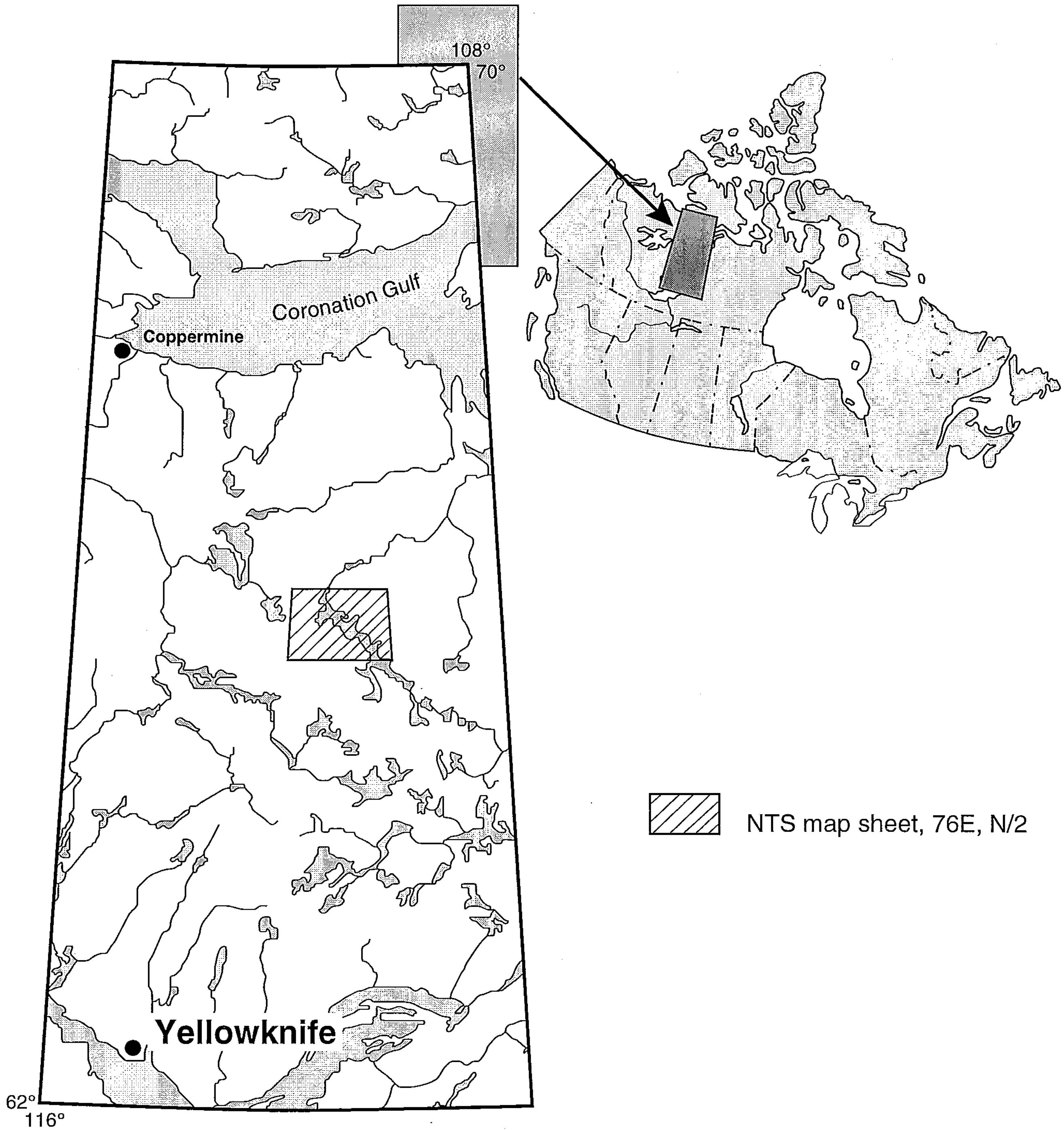

Figure 1. Location map.

< 500 m. Local relief is variable, commonly between < 10 m and 20 m in areas of outcrop and till cover, although relief > 100 m may occur in rocky areas of the Peacock and Willingham Hills. Contwoyto Lake straddles the divide between two drainage systems; its southern outlet is the Contwoyto River which flows into the Back River, and ultimately Chantrey Inlet. The northern outlet drains into Kathawachaga Lake and the Burnside River, and ultimately Bathurst Inlet. Numerous small lakes occupy glacially scoured bedrock basins, as well as isolated depressions in till plains. Most drainage ways are shallow; few streams and rivers have cut into bedrock or surficial sediments, with the exception of a few unnamed streams which have incised glaciofluvial sediments. The map area lies north of treeline, and supports sparse clumps of low birch, alder, and tundra heath vegetation.

REGIONAL GEOLOGY

Bedrock geology

Archean rocks outcrop throughout most of the map area (King et al. 1992 and consist of supracrustal rocks of the Yellowknife Supergroup and younger granitoid rocks (Figure 2). The Yellowknife Supergroup contains metaturbidites (some with iron formation) in the southern, central and eastern map areas, and intermediate to felsic metavolcanic rocks, including rocks of the Central Volcanic Belt (Gebert and Jackson, 1994) in the southwestern quadrant. These rocks have been intruded by granite, granodiorite, diorite, tonalite, and gneissic rocks. Proterozoic sedimentary rocks occur only in the north-central map area (Peacock Hills) and include argillite, siltstone, greywacke, quartzite and minor dolomite. Gabbro sills also are restricted to the north-central map area. The region is cross-cut by a variety of diabase dykes of which the northwest-trending Mackenzie swarm is most prominent.

A number of important mineral deposits occur in the area, notably the iron formation hosted Lupin gold deposit, and the smaller Butterfly gold deposit (Figure 2), both associated with Yellowknife Supergroup metaturbidites. These rocks also host many gold showings southwest of Contwoyto Lake. The Gondor volcanogenic Cu-Zn ± Pb deposit is associated with Yellowknife Supergroup metavolcanics, as are some Cu-Mo gossans.

The central part of the Slave Province is currently the focus of diamond exploration. Numerous diamondiferous pipes, approximately 97 Ma to 52 Ma (Pell, 1995a), occur in the Winter Lake-Lac de Gras-Aylmer lake area to the south, as well as in the southern Contwoyto Lake map area, including the Ranch Lake, Torrie, Sputnik, Eddie, and Suzie pipes (Pell, 1995b). Although kimberlite pipes have been reported in the study area (Jericho pipes, 172 Ma) (Cookenboo, 1997), the exact number and locations of pipes in the northern half of the Contwoyto Lake map sheet have not been published yet (G.N.W.T., 1997). Other unreported or undiscovered pipes likely lie within the map area.

Surficial Geology

Nature of Deposits

Notes on the glacial geology of the area have been published by Craig (1960), Blake (1963), Tremblay (1976) and Kerr et al. (1995). Preliminary maps based on limited field work of the northern 3/4 of the Contwoyto map area were undertaken by Hart et al. (1989). Recently, a map of the surficial geology of the

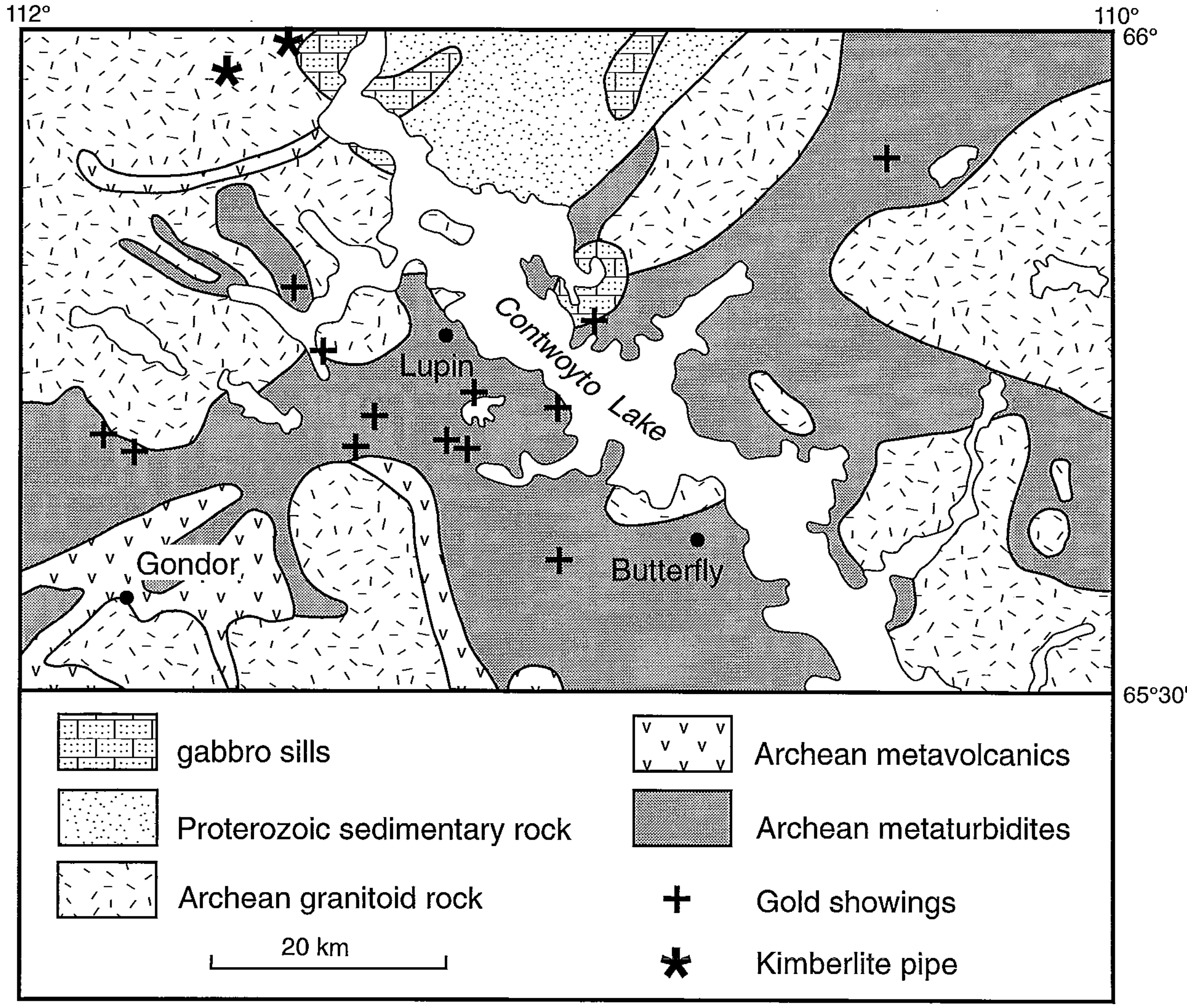

Figure 2. Generalized bedrock geology and selected mineral deposits.

northern Contwoyto Lake map area, compiled at a scale of 1:125 000, has been published (Kerr et al. 1997b), as well as for the southern half of Contwoyto Lake (Ward et al. 1996a).

The area is a glaciated landscape, and till is the most extensive glacial deposit. Only one stratigraphic unit of till is recognized, and it is attributed to Late Wisconsin Laurentide ice. The till sheet has been divided into 3 units based on thickness and surface morphology: veneer (thin: <2 m), blanket (thicker: 2 to 10 m), and hummocky (thickest: 5 to 20+ m). Till veneers and blankets are pervasive throughout the area. Till veneers commonly have a bouldery surface, while blankets have a range of boulder concentrations. Hummocky till forms two broad belts in the southwest and northeast regions, and contains linear, bouldery zones where the till has been extensively winnowed by glacial meltwater. Locally, hummocky till forms irregular mounds a few metres high and ridges ranging in length from tens of metres to over 3 km. Till is a matrix-supported diamicton, with the matrix ranging from silty sand to sand with low percentages of clay. The upper 0.5 to 1 m of the till has been extensively modified by frost churning and solifluction. Surficial organics have been incorporated to depths of 50 to 60 cm, and primary deposition features such as layers or lenses have commonly been cryoturbated.

Glaciofluvial deposits are limited in extent and are predominantly in the form of subglacially formed eskers, outwash terraces and related kames. The largest glaciofluvial complexes primarily lie within the belts of hummocky till and till blanket, and trend west and northwest, in the southwest map area, and north, in the northeast regions. Meltwater corridors of bare washed rock flank many esker ridges and terraces or connect esker segments. Small isolated kames occur throughout the map area.

Isolated beaches and wave-cut terraces indicate that glacial lake levels associated with Contwoyto Lake were higher than present levels during and immediately after deglaciation. These features are best developed along the central and southern shorelines bordering Contwoyto Lake, and are up to 35 to 40 m above present lake level. Glaciolacustrine deposits such as blanket silts and sands are rare, although areas of organic deposits in low-lying areas around Contwoyto Lake and other smaller surrounding lakes could be underlain by fine grained glaciolacustrine material. Within the glacial lake basin, the main surface deposit is till that has been winnowed to various degrees, and consequently may have a sandy matrix. Stream deposits are rare because the relief is low, and no major rivers flow through the area.

Glacial history

The area lies within the central part of the Keewatin Sector of the Laurentide Ice Sheet (Dyke and Prest, 1987; Dyke and Dredge, 1989), west of the M'Clintock Ice Divide, which was prominent during the Late Wisconsin maximum (18 000 - 13 000 BP). At its maximum, the northern margin of Keewatin Sector ice extended north of the Arctic coast and as far west as Mackenzie Valley. From 13 000 BP, the ice divide shifted eastwards into the District of Keewatin, where it remained until about 7 000 years ago. Radiocarbon dates on marine shells beyond the boundaries of this map area suggest that the ice margin lay near the present coast of Coronation Gulf about 9 000 to 10 000 year ago (Kerr, 1994). A radiocarbon date from twigs in an esker on hummocky till terrain southeast of the map area suggests that most of the Contwoyto Lake area was deglaciated by about 8500 BP (TO-4241; Dredge et al. 1996a), although there may have been a late ice remnant in the area of hummocky till. Morainal ridges and non-oriented rim ridges composed of till are present in the northeast regions of hummocky till, and may reflect the position of former crevasses in the ice or the front of ice lobes during recession.

A glacial lake developed in the Contwoyto Lake basin as the ice receded. The lake occupied the glacioisostatically depressed area in front of the southeastward retreating ice sheet. Either the active ice front, or stagnant ice in areas now covered by hummocky till, dammed the lake. The range of lake levels, indicated by the elevation of beaches from 10 to 40 m above the present lake, points to a gradual reduction in lake level. Westward and northward drainage channels are found at the north end of the lake. Evidence of lacustrine outlets also exists in the south half of the Contwoyto Lake map area, southwest of Fry Inlet, as well as the Kathawachaga Lake (76 L) and Mara River (76 K) map areas to the north.

Ice flow directions

Directions and sequences of ice flow and glacial transport of materials can be determined by the relative age of striations, the orientation of glacially moulded till and bedrock forms, and the orientation of eskers. At a few locations in the eastern study area, isolated striae (1 in Figure 3) record an early SW flow. Although the westerly extent of this event is not presently known, a similar SW striae pattern is recorded in the eastern regions of the south half of the Contwoyto Lake map area (Ward et al. 1996a). An early SW flow also was reported in the Lac de Gras and Aylmer Lake areas to the south (Ward et al. 1994). Striae in the northeast quadrant are likely associated with this same event.

In the eastern study area, a subsequent NW ice flow (2 in Figure 3), which gradually shifts to a WNW flow in the western map area (2 in Figure 3), is inferred from cross-cutting relationships of striae. The youngest flow is defined by large-scale ice flow indicators (drumlins and crag-and-tails) and striae (3 in Figure 3). This last, dominant flow varies considerably in direction, and is responsible for the creation of all current landforms in the study area. Ice movement ranges from WNW to NW in the southwest quadrant, and NW along the entire length of Contwoyto Lake. In the central and southeast regions, flow gradually shifts from NW to NNW and NNE, north of Contwoyto Lake. In the easternmost regions, a NW flow predominates.

Glacial transport distances

Studies of lithologies of the pebble-sized clasts in till indicate that pebble dispersal trains are traceable for considerable distances. The expected distribution pattern of Proterozoic pebbles is one of sharply decreasing clast concentration down-ice of the source rock and bedrock contact, as illustrated by Shilts (1975) and other workers. However, because of different ice flow directions over time, the predicted pattern of clast-content attenuation is not as evident. The pebble distribution map (Figure 4) illustrates that the early SW flow transported clasts across the north end of Contwoyto Lake. Concentrations of 20 to 25% occur as much as 18 to 35 km down-ice (SW) of the source, and

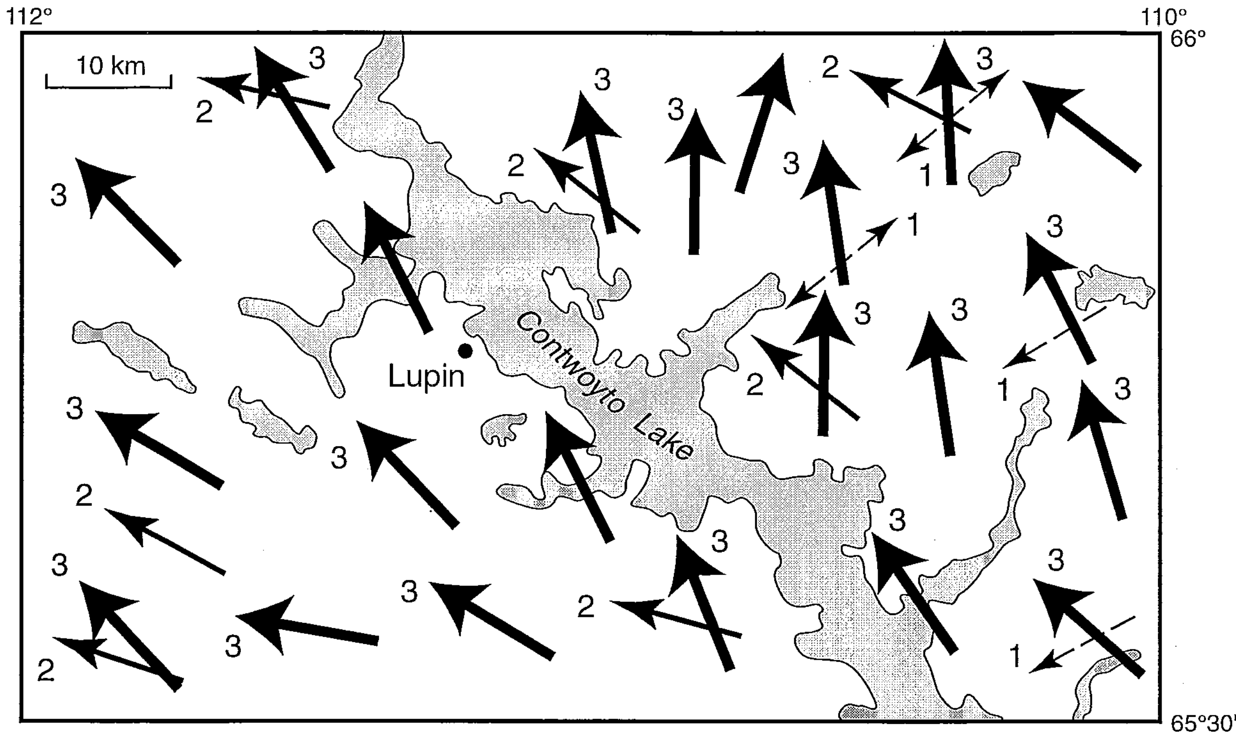

Figure 3. Ice flow summary.

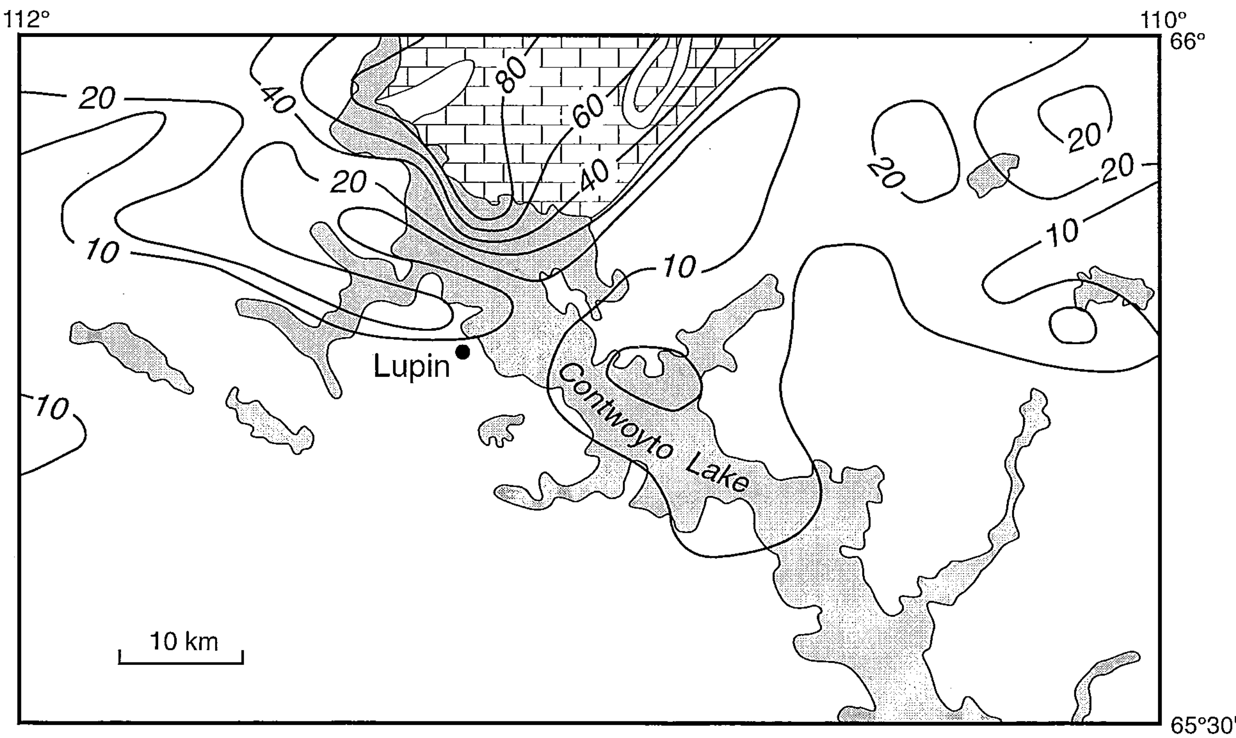

Figure 4. Clast lithology map of percentages of Proterozoic pebbles in till.

generally decrease to <10% approximately 25 to 42 km down-ice from the nearest source outcrops. The highest concentrations (up to 96%) of Proterozoic clasts occur in areas underlain by Proterozoic bedrock. The greatest values are in the western region of Proterozoic terrain. Subsequent NW and the last dominant NNW ice flows are responsible for the dispersal train in the northwest corner of the study area. Northwest of the southeast contact between Proterozoic and granitoid bedrock, Proterozoic pebbles increase in concentration up to 80%, as dilution by granitoid and metaturbidites pebbles decreases.

The distribution of pebbles in the northeast quadrant of the map area may also be evidence of an early SW flow, because the closest mapped Proterozoic bedrock occurs approximately 40 km to the northeast (up-ice). It is unlikely that they relate to bedrock sources at the north end of Contwoyto Lake as this would require a southeasterly ice movement. The possibility exists however that some of the pebbles may be associated to preexisting Proterozoic outcrops which were completely eroded during the last glaciation, or alternatively to unmapped bedrock covered by surficial sediments. For mineral exploration purposes, pebble lithology studies suggest glacial transport distances of up to 40 km or more, with a dominant ice flow towards the west northwest, northwest and north northwest, which has been superimposed on an older southwest dispersal train.

METHODS

Field

In the northern Contwoyto Lake map area 112 till samples of 1-kg size were collected to determine regional geochemical patterns (Figure 5, and Appendix A), and 24 additional 10-kg samples were collected for heavy mineral analysis (including gold grain and kimberlite indicator minerals). Till samples were taken from hand-dug pits in mud-boils at depths ranging from 20 to 80 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 bulk till samples for ICP-AES analysis were centrifuged and decanted at the GSC Sedimentology Laboratory to obtain the clay-sized (<0.002 mm) fraction. The clay material was analyzed 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,

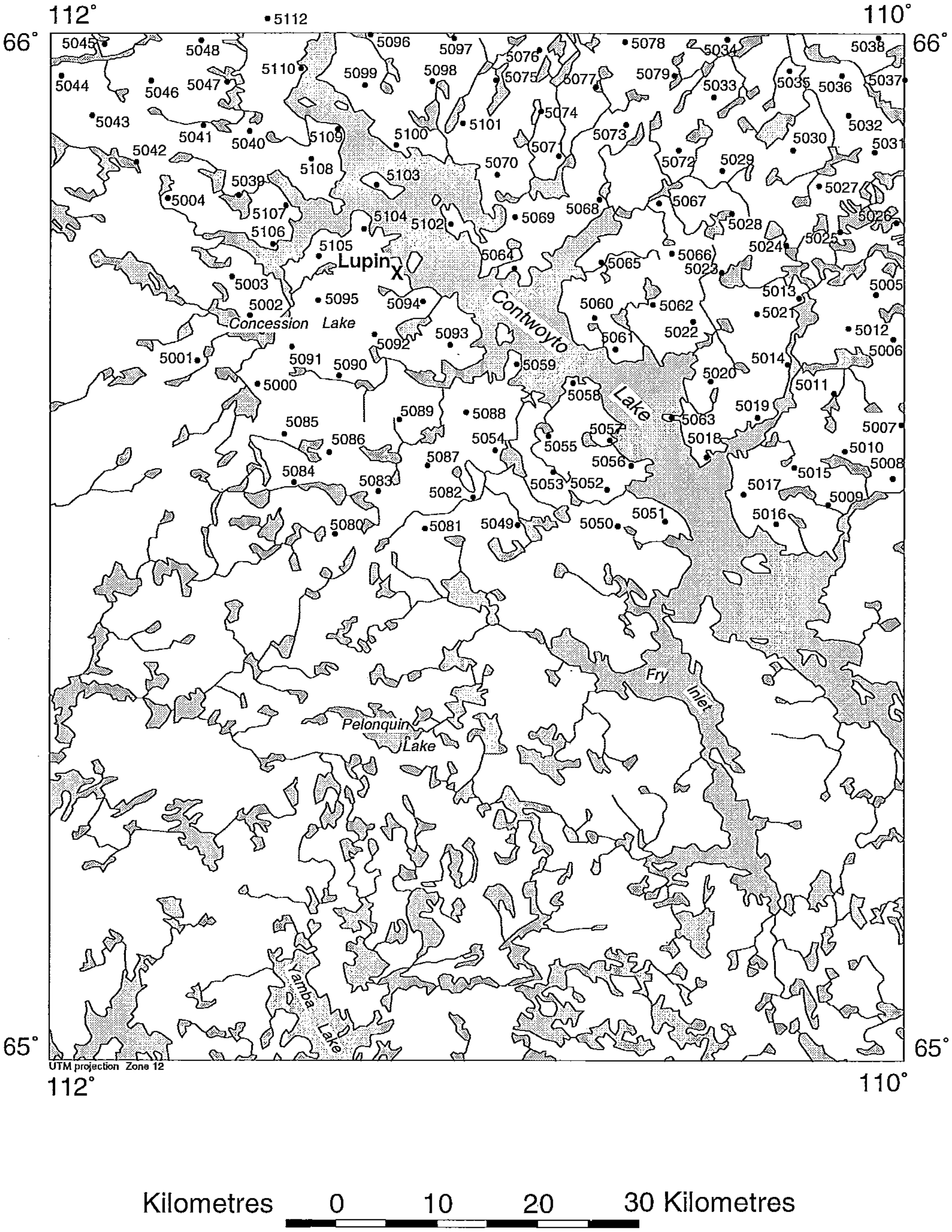

Figure 5. **Sample Locations**
Contwoyto Lake (76E, N/2)

Table 1: Analytical methods and detection limits for the <0.002 mm and <0.063 mm fractions

ELEMENT	DETECTION LIMIT	Method	ELEMENT	DETECTION LIMIT	Method
Ag	5 ppm	INAA[1]	Lu	0.05 ppm	INAA
Ag	0.2 ppm	ICP-AES[2]	Mg	0.01 %	ICP-AES
Al	0.01%	ICP-AES	Mn	5 ppm	ICP-AES
As	0.5 ppm	INAA	Mo	1 ppm	INAA
As	2 ppm	ICP-AES	Mo	1 ppm	ICP-AES
Au	2 ppb	INAA	Na	0.01 %	INAA
Ba	50 ppm	INAA	Na	0.01 %	ICP-AES
Ba	10 ppm	ICP-AES	Nd	5 ppm	INAA
Be	0.5 ppm	ICP-AES	Ni	20 ppm	INAA
Bi	2 ppm	ICP-AES	Ni	1 ppm	ICP-AES
Br	0.5 ppm	INAA	Pb	2 ppm	ICP-AES
Ca	1 %	INAA	Rb	5 ppm	INAA
Ca	0.01 %	ICP-AES	Sb	0.1 ppm	INAA
Cd	0.5 ppm	ICP-AES	Sb	2 ppm	ICP-AES
Ce	3 ppm	INAA	Sc	0.1 ppm	INAA
Co	1 ppm	INAA	Sc	1 ppm	ICP-AES
Co	1 ppm	ICP-AES	Se	5 ppm	INAA
Cr	5 ppm	INAA	Sm	0.1 ppm	INAA
Cr	1 ppm	ICP-AES	Sn	100 ppm	INAA
Cs	1 ppm	INAA	Sr	500 ppm	INAA
Cu	1 ppm	ICP-AES	Sr	1 ppm	ICP-AES
Eu	0.2 ppm	INAA	Ta	0.5 ppm	INAA
Fe	0.01 %	INAA	Tb	0.5 ppm	INAA
Fe	0.01 %	ICP-AES	Th	0.2 ppm	INAA
Ga	10 ppm	ICP-AES	Ti	0.01 %	ICP-AES
Hf	1 ppm	INAA	U	0.5 ppm	INAA
Hg	1 ppm	INAA	V	1 ppm	ICP-AES
Hg	1 ppm	ICP-AES	W	1 ppm	INAA
Ir	5 ppm	INAA	Yb	0.2 ppm	INAA
K	0.01 %	ICP-AES	Zn	50 ppm	INAA
La	0.5 ppm	INAA	Zn	2 ppm	ICP-AES
La	10 ppm	ICP-AES			

1. Instrumental neutron activation analysis
2. Inductively coupled plasma-atomic emission spectroscopy

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, Bi, Cd, Hg and W were 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 Contwoyto Lake samples, Ag, Hg, Ir, Se, and Sn concentrations were below detection limits.

A smaller subset of 24 10-kg till samples were taken and examined for gold grains and for kimberlite indicator minerals. For gold grain analysis, the samples were disaggregated and sieved to <0.25 mm at Overburden Drilling Management Ltd., Nepean, Ontario, and heavy minerals from this fraction were concentrated by shaking table and heavy liquid methods. If gold grains were observed on the shaking table, the concentrate was panned and the number, size and shape of gold grains were noted (Appendix D). A gold concentration (ppb) in the heavy mineral concentrate was estimated from the size of the grains, and the weight of the heavy mineral concentrate.

Quality control

Accuracy of geochemical analyses was monitored by inserting 9 (for ICP-AES) and 10 (for INAA) 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. 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 E and F. 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 Ba, Co, Na and Sc values have variability of up to 20%. The reproducibility is fair to poor for La (±30%), Pb (±30%), Sr (±30%) and Ca (±50%). 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, Hg, 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 a few (As, La, Sr) were above the reported maximum for the standard.

Ba, Ce, Co, Eu, Hf, La, Lu, Na and Sc data for 10 duplicate samples using INAA methods are generally good, being reproducible from ±10% to ±20%. Concentration levels for Br, Cr, Fe, Th, U, Sm and Yb are more variable, up to ±25-30%. The reproducibility is poor for As (±40%) and Nd (±40%). Results for INAA duplicates also indicate that Ag, Au, Ca, Cs, Hg, Ir, Mo, Ni, Rb, Sb, Se, Sn, Sr, Ta, Tb, W and Zn 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 Contwoyto Lake data set showed concentration levels generally falling within the minimum to maximum range of values obtained in other studies; some elements, however, had concentrations that were above the reported maximum for the standard, as well as slightly below the reported minimum. This situation is not uncommon (Levinson, 1974, p. 312); INAA duplicate analyses indicate that Au and Ta values can have a low reproducibility, and fall below and above minimum and maximum values respectively for the standards. However, it is difficult to reliably assess the accuracy of either the ICP-AES and INAA analysis, using the standard, because the database statistics are calculated from only 7 samples from other studies for the size fractions examined here.

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 G and H. These figures also show values for the 10th, 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 (112 observations were used in computations). Table 4 indicates that combinations of Zn-Cr-V, Cu-Zn-Ni, Pb-Zn-Fe and Ni-Ba-Cr have correlations near or above 0.6 for the <0.002 mm fraction , and the <0.063 mm fraction shows particularly high correlations between La-Ce-Nd, La-Ce-Th, La-Ce-U, and Co-Cr-Sc. Although statistical correlations alone must be interpreted with caution, geographic areas where these combinations of elements are present in high concentrations may be of interest to mineral exploration. Occurrences of Cu-Zn in bedrock and several Au prospects have been reported in the sampled area (Figure 2).

ICP-AES data on the <0.002 mm fraction

The maps in Appendix G show the distribution of some elements analysed by ICP-AES methods for the <0.002 mm fraction. Although element concentrations appear be related to rock types to a limited extent, in most cases, well-defined relationships are not apparent. Generally, there does appear to be some relationship between the distribution of highest values and the metasedimentary and metavolcanic rocks, and lower concentrations with granitic rocks. As also noted by Ward et al. (1997) in the south half of the Contwoyto lake map area where similar rock types and surficial sediments occur, concentrations of elements do not clearly relate to rock types. One possible reason for this is that hummocky till covers a substantial part of the sampled area; this till may have been carried englacially for a considerable distance, so that there can be substantial mixing of englacial debris. In addition, the main rock types recur over short distances in this map area, so that the

Table 2. Descriptive Statistics for ICP-AES data (<0.002 mm fraction) Contwoyto Lake

	Mean	Std. Dev.	Count	Minimum	Maximum	Coef. Var.	Geom. Mean	Skewness	Kurtosis	Median	Mode
Ag ppm	0.13	0.06	112	0.1	0.4	0.43	0.12	2.24	6.61	0.1	0.1
Al %	3.97	0.56	112	2.31	5.11	0.14	3.93	-0.63	0.34	4.04	3.87
As ppm	29.29	23.3	112	1	176	0.8	22.44	3.26	16.02	26	18
Ba ppm	106.16	40.03	112	30	280	0.38	99.34	1.33	3.28	100	•
Be ppm	0.94	0.45	112	0.25	3	0.49	0.84	1.4	3.47	1	1
Bi ppm	1	0	112	1	1	0	1	•	•	1	1
Ca %	0.18	0.07	112	0.01	0.41	0.37	0.17	0.23	0.55	0.18	0.21
Cd ppm	0.25	0	112	0.25	0.25	0	0.25	•	•	0.25	0.25
Co ppm	21.93	7.67	112	5	46	0.35	20.36	0.07	0.04	22	23
Cr ppm	95.39	23.25	112	39	181	0.24	92.78	1.03	1.81	90	•
Cu ppm	91.89	35.94	112	21	241	0.39	85.33	1.26	3.34	89	•
Fe %	4.95	0.9	112	2.66	7.78	0.18	4.86	0.14	0.3	5.01	5.39
Ga ppm	8.48	2.31	112	5	10	0.27	8.1	-0.85	-1.27	10	10
Hg ppm	0.5	0.05	112	0.5	1	0.09	0.5	10.44	107.01	0.5	0.5
K %	0.43	0.23	112	0.09	1.22	0.53	0.38	1.36	1.9	0.39	•
La ppm	33.48	10.46	112	10	60	0.31	31.46	-0.16	0.29	30	30
Mg %	1.12	0.42	112	0.21	2.19	0.38	1.03	0.35	0.04	1.07	1.24
Mn ppm	397.05	187.05	112	110	1205	0.47	360.95	1.79	5.04	365	•
Mo ppm	2.05	1.17	112	0.5	6	0.57	1.71	0.6	-0.18	2	1
Na %	0.85	0.27	112	0.28	1.73	0.32	0.81	0.76	0.79	0.83	•
Ni ppm	51.12	17.43	112	13	91	0.34	47.72	0.09	-0.27	49	•
Pb ppm	12.07	4.52	112	2	34	0.37	11.31	1.62	5.49	12	12
Sb ppm	1.37	0.54	112	1	4	0.39	1.28	1.43	3.08	1	1
Sc ppm	7.46	2.63	112	1	18	0.35	7.01	1.17	2.73	7	7
Sr ppm	16.11	3.89	112	6	32	0.24	15.62	0.48	1.86	16	15
Ti %	0.12	0.04	112	0.03	0.23	0.29	0.12	0.15	0.53	0.12	0.1
U ppm	5.71	2.99	112	5	30	0.52	5.4	6.03	41.56	5	5
V ppm	89.94	22.21	112	42	172	0.25	87.31	0.7	0.96	89	•
W ppm	5	0	112	5	5	0	5	•	•	5	5
Zn ppm	80.54	32.14	112	18	198	0.4	74.27	0.82	0.9	74	•

Table 3. Descriptive Statistics for INAA data (<0.063 mm fraction), Contwoyto Lake

	Mean	Std. Dev.	Count	Minimum	Maximum	Coef. Var.	Geom. Mean	Skewness	Kurtosis	Median	Mode
Au ppb	3.66	4.71	112	1.00	34.00	1.29	2.19	3.56	17.27	1.00	1.00
Ag ppm	2.50	0.00	112	2.50	2.50	0.00	2.50	•	•	2.50	2.50
As ppm	5.42	3.90	112	1.60	34.00	0.72	4.67	4.18	25.20	4.65	3.50
Ba ppm	560.45	78.49	112	350.00	800.00	0.14	554.99	0.26	0.22	560.00	540.00
Br ppm	3.91	2.45	112	0.25	13.00	0.63	2.85	0.92	1.60	3.60	0.25
Ca %	1.09	0.66	112	0.50	2.00	0.60	0.91	0.52	-1.50	1.00	0.50
Co ppm	6.84	1.61	112	3.00	12.00	0.24	6.65	0.29	0.03	7.00	•
Cr ppm	49.61	10.12	112	24.00	85.00	0.20	48.64	0.97	2.41	49.00	51.00
Cs ppm	2.02	0.61	112	0.50	4.00	0.30	1.91	0.08	0.84	2.00	2.00
Fe %	2.03	0.30	112	1.37	3.15	0.15	2.01	0.68	1.47	2.01	•
Hf ppm	7.98	1.06	112	6.00	11.00	0.13	7.91	0.50	0.56	8.00	8.00
Hg ppm	0.50	0.00	112	0.50	0.50	0.00	0.50	•	•	0.50	0.50
Ir ppm	2.50	0.00	112	2.50	2.50	0.00	2.50	•	•	2.50	2.50
Mo ppm	1.87	1.70	112	0.50	8.00	0.91	1.22	1.18	0.85	1.00	0.50
Na %	2.12	0.19	112	1.22	2.51	0.09	2.11	-1.19	3.51	2.15	2.14
Ni ppm	20.00	30.62	112	10.00	160.00	1.53	12.79	3.07	8.54	10.00	10.00
Rb ppm	61.17	16.70	112	25.00	120.00	0.27	58.97	0.71	0.80	59.00	•
Sb ppm	0.10	0.09	112	0.05	0.40	0.83	0.08	1.29	0.51	0.05	0.05
Sc ppm	7.24	1.07	112	4.20	11.00	0.15	7.16	0.33	1.18	7.30	7.40
Se ppm	2.51	0.14	112	2.50	4.00	0.06	2.51	10.44	107.01	2.50	2.50
Sn %	0.01	0.00	112	0.01	0.01	0.00	0.01	•	•	0.01	0.01
Ta ppm	0.52	0.55	112	0.25	3.10	1.05	0.37	2.08	4.25	0.25	0.25
Th ppm	8.96	1.40	112	6.00	14.00	0.16	8.86	0.90	1.44	8.90	11.00
U ppm	2.75	0.78	112	1.40	5.10	0.28	2.65	0.87	0.34	2.60	2.20
W ppm	0.54	0.33	112	0.50	3.00	0.61	0.52	7.28	51.02	0.50	0.50
La ppm	33.96	5.20	112	22.00	51.00	0.15	33.57	0.69	1.30	34.00	•
Ce ppm	61.21	9.55	112	39.00	91.00	0.16	60.48	0.58	0.78	60.00	61.00
Nd ppm	26.46	5.08	112	14.00	43.00	0.19	25.97	0.41	0.54	26.00	25.00
Sm ppm	4.78	0.75	112	3.10	7.20	0.16	4.72	0.68	1.17	4.75	4.90
Eu ppm	1.32	0.16	112	1.00	1.70	0.12	1.31	0.15	-0.19	1.30	1.40
Tb ppm	0.38	0.22	112	0.25	1.00	0.58	0.33	1.27	0.00	0.25	0.25
Yb ppm	2.19	0.32	112	1.50	3.30	0.15	2.16	0.78	0.99	2.10	2.00
Lu ppm	0.35	0.05	112	0.21	0.56	0.15	0.34	0.71	1.87	0.34	0.33

Table 4. Correlation matrix for ICP-AES data (<0.002 mm fraction), Contwoyto Lake (N=112)

	Ag ppm	As ppm	Ba ppm	Co ppm	Cr ppm	Cu ppm	Fe %	Mn ppm	Mo ppm	Ni ppm	Pb ppm	V ppm	Zn ppm
Ag ppm	1	0.16	-0.39	-0.37	-0.18	-0.19	-0.09	-0.32	0.25	-0.35	-0.11	-0.15	-0.38
As ppm	0.16	1	-0.21	0.18	-0.05	0.21	0.19	-0.09	0.34	0.17	0.28	-0.07	0.01
Ba ppm	-0.39	-0.21	1	0.61	0.58	0.44	0.53	0.63	-0.17	0.71	0.29	0.51	0.7
Co ppm	-0.37	0.18	0.61	1	0.39	0.41	0.45	0.71	-0.12	0.8	0.39	0.28	0.62
Cr ppm	-0.18	-0.05	0.58	0.39	1	0.37	0.71	0.18	0.16	0.68	0.36	0.78	0.62
Cu ppm	-0.19	0.21	0.44	0.41	0.37	1	0.35	0.25	0.19	0.57	0.36	0.38	0.61
Fe %	-0.09	0.19	0.53	0.45	0.71	0.35	1	0.32	0.16	0.55	0.54	0.82	0.52
Mn ppm	-0.32	-0.09	0.63	0.71	0.18	0.25	0.32	1	-0.31	0.48	0.23	0.25	0.48
Mo ppm	0.25	0.34	-0.17	-0.12	0.16	0.19	0.16	-0.31	1	-0.03	0.17	0.07	-0.14
Ni ppm	-0.35	0.17	0.71	0.8	0.68	0.57	0.55	0.48	-0.03	1	0.41	0.48	0.8
Pb ppm	-0.11	0.28	0.29	0.39	0.36	0.36	0.54	0.23	0.17	0.41	1	0.4	0.53
V ppm	-0.15	-0.07	0.51	0.28	0.78	0.38	0.82	0.25	0.07	0.48	0.4	1	0.58
Zn ppm	-0.38	0.01	0.7	0.62	0.62	0.61	0.52	0.48	-0.14	0.8	0.53	0.58	1

Table 5. Correlation matrix for INAA data (<0.063 mm fraction), Contwoyto Lake (N=112)

	Au ppb	Ba ppm	Co ppm	Cr ppm	Mo ppm	Rb ppm	Sc ppm	Th ppm	U ppm	Zn ppm	La ppm	Ce ppm	Nd ppm
Au ppb	1	0.06	-0.02	-0.02	-0.1	-0.05	0.02	0.13	0.06	0.1	0.13	0.1	0.14
Ba ppm	0.06	1	0.38	0.3	-0.08	0.38	0.39	0.16	0.35	0.21	0.2	0.23	0.22
Co ppm	-0.02	0.38	1	0.64	0.09	0.42	0.69	0.16	0.3	0.15	0.26	0.3	0.19
Cr ppm	-0.02	0.3	0.64	1	-0.09	0.23	0.85	0.27	0.36	0.25	0.38	0.39	0.28
Mo ppm	-0.1	-0.08	0.09	-0.09	1	0.12	-0.05	0.11	0.03	0.09	0.11	0.17	0.09
Rb ppm	-0.05	0.38	0.42	0.23	0.12	1	0.37	0.25	0.4	0.12	0.25	0.29	0.15
Sc ppm	0.02	0.39	0.69	0.85	-0.05	0.37	1	0.41	0.43	0.32	0.51	0.51	0.43
Th ppm	0.13	0.16	0.16	0.27	0.11	0.25	0.41	1	0.59	0.35	0.92	0.91	0.74
U ppm	0.06	0.35	0.3	0.36	0.03	0.4	0.43	0.59	1	0.29	0.62	0.63	0.44
Zn ppm	0.1	0.21	0.15	0.25	0.09	0.12	0.32	0.35	0.29	1	0.32	0.34	0.29
La ppm	0.13	0.2	0.26	0.38	0.11	0.25	0.51	0.92	0.62	0.32	1	0.98	0.81
Ce ppm	0.1	0.23	0.3	0.39	0.17	0.29	0.51	0.91	0.63	0.34	0.98	1	0.79
Nd ppm	0.14	0.22	0.19	0.28	0.09	0.15	0.43	0.74	0.44	0.29	0.81	0.79	1

composition of till that has been transported distances of up to 10 to 20 km, represents a composite from various rock types. Furthermore, the variations in ice flow directions over time may also have influenced till composition by mixing of different source rock components. Nevertheless, element distributions described below suggest that further investigation for mineral exploration may be warranted.

Despite these problems and in the absence of distinctive regional patterns, there are some multi-element relationships apparent for the <0.002 mm fraction. High concentrations of Cr-Fe-K-Mg-Ti-Zn are located at site 5013, and Cr-Fe-Ni-Ti-V concentrations are elevated at site 5011, about 11 km south of 5013. Site 5067 has anomalous K-La-Mg-Sr concentrations, whereas sites 5083 and 5102, about 9 km NE of Lupin, are enriched in Cu-Sc-V-Zn and Pb-Zn respectively.

No combination of kimberlite associated elements such as Ba, Ca, Cr, Fe, La, Mg, Ni, Sr, Ta, Th, Ce, Nd (Mitchell, 1986) is evident, even at sites in close proximity northwest (down-ice) of the Jericho kimberlite pipes (5045, 5048, 5112). This appears to be in contrast with higher concentrations of La and Ca which may relate to kimberlite pipes in the Ranch Lake Pipe - Torrie Pipe areas, as well as other regionally traceable kimberlite indicator dispersal patterns from these pipes (Ward et al. 1997). From a regional perspective, the elements Ba, Co, Fe, K, Mg, Ni and Ti have slightly lower concentrations than for the southern half of the Contwoyto Lake map area, whereas Be and Sc are slightly higher in the north half.

Concentrations of Cd and Hg, naturally occurring metals known to be toxic, are below analytical detection limits in this area, as are most U concentrations. The distribution of other elements of environmental concern, such as Cr, Cu, Ni, Pb, and Zn, are variable, as shown in Appendices. 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. As in the southern Contwoyto Lake map area (Ward et al. 1997), 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). The dot maps in Appendix H show that the overall geographic distribution of high and low concentrations also varies considerably in the two size ranges.

Distinct element patterns are difficult to discern. Element concentrations may be related to rock types to a limited extent, but in most cases, well-defined relationships are not apparent. There does appear to be some relationship between highest values for As, Ba, Ce, Cr, Fe, Nd, Sc and U, with the metasedimentary, metavolcanic, and gabbroic rocks throughout the map area. Concentrations of other elements such as Co, La and Th do not appear to clearly relate to rock types. As described above, possible explanations for no well-defined trends include, recurring rock type, ice flow history and glacial transport distances.

The dot maps in Appendix H 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. Concentrations of rare earth elements such as La, Nd, as well as U, Th, and Ce, are slightly lower in the north half of the Contwoyto map area than in the south, whereas As is slightly higher in the north half, and Ba, Co, Cr, Fe and Sc have comparable values. In the southern half of the Contwoyto map area, the association and distribution of these elements is related to dispersal from known kimberlite pipes (Ranch Lake, Torrie/Sputnik), or from other unreported pipes in the area. However, in the north half of the Contwoyto map area, no such combination of kimberlite elements is apparent, even in close proximity down-ice of known kimberlite pipes (Jericho).

There are a few sites with high concentrations of multiple elements apparent in the INAA data; sites 5013, 5034 and 5081, contain high concentrations of La-Ce with Nd, Th or U, as well as Co-Cr-Sc. Site 5012 exhibits an anomalous combination of Ce-Cr-Fe-La-Sc-Th. Multiple element anomalies are also present at sites 5011 (Ce-Co-Cr-Fe-La-Sc) and 5034 (As-Co-Cr-Fe), both of which are characterized by the presence of some iron-stained boulders.

With respect to elements relevant to environmental issues, all samples contain Hg concentrations below detection level, whereas the distribution of As and Cr is depicted on the geochemical dot-value maps in Appendix H. Their concentration ranges, means, and extreme values are summarized in Table 3.

Gold grains

The total <0.063 mm fraction of the till (silt + clay) was analyzed by INAA methods for gold; in addition, gold grains from the <0.25 mm fraction were separated from heavy mineral concentrates, as described under METHODS. The results from the <0.063 mm fraction (Appendix H), and from the heavy minerals alone (Appendix D) yield different numbers, and show different distributions, as expected from the different sample subsets used. Examination of duplicate samples indicates that the reproducibility of results by the INAA method is poor: this is likely related to the well known "nugget effect or particle sparcity effect" which occurs where elements exist in very low concentrations or in concentrations near the detection limit (Clifton et al. 1969; Harris, 1982).

Gold grain abundances from the northern Contwoyto Lake area are listed in Appendix D. Distributions of gold grains and calculated Au ppb concentrations (see METHODS section) are shown in Appendix I. A few high counts, which might be expected due to the gold-bearing metasediments in the northern part of the Contwoyto Lake map area, are indicated by the data. The total number of grains at individual sites ranges from 0 to 17, and background values, based on other regional surveys in adjacent map sheet areas (Dredge et al. 1996b; Ward et al. 1997) are commonly 0 to 5 grains. Sites with more than 5 grains are distributed across the map area. Gold grains were classified into three morphologic categories which reflect decreasing effects of modification during glacial transport (DiLabio, 1990). Of the 101 gold grains identified, 77 were considered to have been reshaped, 23 were modified, and only 1 was in pristine condition. The high number of reshaped grains suggests that most have undergone considerable glacial transport.

Gold concentrations differ considerably between the <0.063 mm fraction, and those calculated from the size and number of gold grains recovered from heavy mineral concentrates. As expected, gold concentrations are higher in the heavy mineral fraction. The <0.063 mm fraction contains between 0 and 34 ppb Au, with background values between 0 and 15 ppb. Concentrations exceeding 15 ppb were obtained for sites 5049, 5095, 5003, and 5031; the two former overlie metasedimentary rocks of the Yellowknife Supergroup, whereas the two latter are underlain by granite.

Gold concentrations calculated from the heavy mineral concentrates vary from 0 to over 18 000 ppb, at site 5050. They are not geographically clustered, but concentrations appear to relate to metasedimentary bedrock of the Yellowknife Supergroup. Granite is exposed around site 5032 (1906 ppb), although at this location proper, no bedrock was observed, and up to 20% of clasts in till are metasedimentary. The site with the highest gold grain count, 5055 (17 grains), occurs only a few kilometres down ice of site 5050 (>18 000 ppb), both underlain by metasedimentary rock. Two other sites, 5041 (12 grains) and 5045 (10 grains) are underlain by granite but occur down ice of known volcanic bedrock. Of particular interest are the 5 sites with very anomalous till samples, containing >10 grains, which are not close to any known gold deposits, and warrant further investigation.

SUMMARY

The northern Contwoyto Lake area is underlain by metavolcanic and metasedimentary rocks of the Yellowknife Supergroup, granitoid rocks, Proterozoic sedimentary rocks, and a small number of recorded kimberlite pipes. During the last glaciation, ice initially flowed southwestward, followed by northwestward southwest of Contwoyto Lake, to northward northeast of Contwoyto Lake, transporting materials from these source rocks. Pebble sized clasts were transported up to 25 to 35 km from their bedrock sources. Trace element geochemical analyses of 112 till samples show that there is some relationship between elevated concentrations of Cu, Cr, Fe, K, Ti, Sr and Zn and metasedimentary rocks, though no well-defined trends are evident due to recurring rock type, ice flow history, glacial transport distances and widely spaced samples. Known gold deposits hosted in the Yellowknife Supergroup rocks are not reflected in the regional till geochemistry data. However, gold grain studies suggest the potential for unmapped sources of gold-bearing metasedimentary rock in areas currently mapped as granitoid rock northeast of Contwoyto Lake.

This regional till sampling program did not identify any distinct kimberlite dispersal trains on the basis of trace element analysis methods. Two apparent reasons for this are the position of a very small number (2) of known kimberlites in the northwest quadrant at the extreme northern boundary of the study area, and the sampling density. Furthermore, it is possible that the chemistry of the older Jericho pipes differs from that of the better known Ranch Lake and Torrie pipes to the south.

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Appendix A: Sample Locations

Sample	Zone	Easting	Northing	Sample	Zone	Easting	Northing
96 KKA 5000	12	476240	7281870	96 KKA 5047	12	473170	7314549
96 KKA 5001	12	469800	7284500	96 KKA 5048	12	470471	7319035
96 KKA 5002	12	475500	7289300	96 KKA 5049	12	504543	7266550
96 KKA 5003	12	473570	7293519	96 KKA 5050	12	515430	7266430
96 KKA 5004	12	466811	7302005	96 KKA 5051	12	520510	7267020
96 KKA 5005	12	542774	7291815	96 KKA 5052	12	514200	7270425
96 KKA 5006	12	544737	7287006	96 KKA 5053	12	408330	7272275
96 KKA 5007	12	545749	7277760	96 KKA 5054	12	502068	7274585
96 KKA 5008	12	544882	7271968	96 KKA 5055	12	507835	7276200
96 KKA 5009	12	538000	7269023	96 KKA 5056	12	516825	7273005
96 KKA 5010	12	539730	7274810	96 KKA 5057	12	514490	7275735
96 KKA 5011	12	538478	7281085	96 KKA 5058	12	510465	7281900
96 KKA 5012	12	539951	7288102	96 KKA 5059	12	504375	7283936
96 KKA 5013	12	534558	7291292	96 KKA 5060	12	512780	7288976
96 KKA 5014	12	533421	7284148	96 KKA 5061	12	515067	7285618
96 KKA 5015	12	534316	7273000	96 KKA 5062	12	519047	7290460
96 KKA 5016	12	532400	7266853	96 KKA 5063	12	521112	7278294
96 KKA 5017	12	528874	7269968	96 KKA 5064	12	504110	7294278
96 KKA 5018	12	524834	7273978	96 KKA 5065	12	513475	7294995
96 KKA 5019	12	530259	7278334	96 KKA 5066	12	520965	7295960
96 KKA 5020	12	525212	7282238	96 KKA 5067	12	519629	7301375
96 KKA 5021	12	530069	7289538	96 KKA 5068	12	513245	7301766
96 KKA 5022	12	523325	7288622	96 KKA 5069	12	504181	7299846
96 KKA 5023	12	526309	7293949	96 KKA 5070	12	502223	7304354
96 KKA 5024	12	533182	7296939	96 KKA 5071	12	508806	7306410
96 KKA 5025	12	538889	7298547	96 KKA 5072	12	521610	7307158
96 KKA 5026	12	544832	7299563	96 KKA 5073	12	515981	7309846
96 KKA 5027	12	536558	7303420	96 KKA 5074	12	506904	7311219
96 KKA 5028	12	527332	7300340	96 KKA 5075	12	501992	7314636
96 KKA 5029	12	526247	7304970	96 KKA 5076	12	506677	7317900
96 KKA 5030	12	533750	7307225	96 KKA 5077	12	512784	7313920
96 KKA 5031	12	542449	7307145	96 KKA 5078	12	515865	7318800
96 KKA 5032	12	539615	7311095	96 KKA 5079	12	521100	7315215
96 KKA 5033	12	525286	7312874	96 KKA 5080	12	484578	7265594
96 KKA 5034	12	526664	7319157	96 KKA 5081	12	494399	7266145
96 KKA 5035	12	533282	7315858	96 KKA 5082	12	499658	7269514
96 KKA 5036	12	538850	7315367	96 KKA 5083	12	489294	7270222
96 KKA 5037	12	545486	7315042	96 KKA 5084	12	480136	7271236
96 KKA 5038	12	542606	7319550	96 KKA 5085	12	479063	7276475
96 KKA 5039	12	474379	7302268	96 KKA 5086	12	483960	7274472
96 KKA 5040	12	475568	7309201	96 KKA 5087	12	494621	7272975
96 KKA 5041	12	470655	7309840	96 KKA 5088	12	498880	7278710
96 KKA 5042	12	463555	7305995	96 KKA 5089	12	491596	7277942
96 KKA 5043	12	458917	7311056	96 KKA 5090	12	485055	7282710
96 KKA 5044	12	455695	7315377	96 KKA 5091	12	480006	7285865
96 KKA 5045	12	460322	7318807	96 KKA 5092	12	488926	7287158
96 KKA 5046	12	465172	7314767	96 KKA 5093	12	497116	7285982

Appendix A: Sample Locations

Sample	Zone	Easting	Northing		Sample	Zone	Easting	Northing
96 KKA 5094	12	494183	7290688					
96 KKA 5095	12	482882	7290905					
96 KKA 5096	12	488542	7319525					
96 KKA 5097	12	497550	7319090					
96 KKA 5098	12	495165	7314490					
96 KKA 5099	12	487945	7314060					
96 KKA 5100	12	491271	7307559					
96 KKA 5101	12	498526	7309894					
96 KKA 5102	12	497191	7299040					
96 KKA 5103	12	489140	7303275					
96 KKA 5104	12	487810	7298555					
96 KKA 5105	12	482924	7295606					
96 KKA 5106	12	477998	7296957					
96 KKA 5107	12	479394	7301125					
96 KKA 5108	12	482204	7306130					
96 KKA 5109	12	485038	7309325					
96 KKA 5110	12	481070	7315883					
96 KKA 5112	12 W	477555	7321368					

Appendix B: ICP-AES data (<0.002 mm)

Sample	Ag ppm	Al %	As ppm	Ba ppm	Be ppm	Bi ppm	Ca %	Cd ppm	Co ppm	Cr ppm	Cu ppm	Fe %	Ga ppm	Hg ppm	K %
Detection limit	0.2	0.01	2	10	0.5	2	0.01	0.5	1	1	1	0.01	10	1	0.01
96 KKA 5000	<0.2	2.52	10	100	0.5	<2	0.41	<0.5	21	81	78	3.56	<10	<1	0.47
96 KKA 5001	<0.2	4.06	24	110	0.5	<2	0.21	<0.5	23	99	73	5.07	10	<1	0.41
96 KKA 5002	<0.2	3.79	38	60	1	<2	0.11	<0.5	21	66	113	4.02	<10	<1	0.2
96 KKA 5003	<0.2	4.46	32	80	1	<2	0.12	<0.5	16	78	58	4.48	<10	<1	0.25
96 KKA 5004	<0.2	3.87	36	60	0.5	<2	0.12	<0.5	14	80	134	4.43	<10	<1	0.21
96 KKA 5005	0.2	3.74	18	60	0.5	<2	0.1	<0.5	9	86	21	3.93	<10	<1	0.24
96 KKA 5006	<0.2	3.89	6	90	0.5	<2	0.12	<0.5	18	97	54	5.45	10	<1	0.35
96 KKA 5007	<0.2	4.01	16	120	0.5	<2	0.2	<0.5	21	130	146	5.58	10	<1	0.52
96 KKA 5008	0.2	3.43	32	50	0.5	<2	0.09	<0.5	10	89	43	4.12	10	<1	0.23
96 KKA 5009	<0.2	4.02	36	120	1	<2	0.21	<0.5	30	104	108	5.05	10	<1	0.46
96 KKA 5010	<0.2	4.76	28	130	1	<2	0.16	<0.5	29	128	110	6.31	10	<1	0.54
96 KKA 5011	<0.2	4.91	10	200	1.5	<2	0.15	<0.5	32	159	148	7.18	10	<1	0.93
96 KKA 5012	0.2	4.95	<2	170	1	<2	0.1	<0.5	20	140	105	5.39	10	<1	0.7
96 KKA 5013	<0.2	5.11	10	180	1	<2	0.26	<0.5	32	156	107	6.96	10	<1	1.22
96 KKA 5014	<0.2	4.52	4	110	1	<2	0.14	<0.5	21	110	62	6.1	10	<1	0.49
96 KKA 5015	<0.2	4.7	18	120	1	<2	0.12	<0.5	18	109	62	6.64	10	<1	0.42
96 KKA 5016	<0.2	3.41	18	110	0.5	<2	0.25	<0.5	22	106	82	5.07	<10	<1	0.53
96 KKA 5017	0.4	3.89	26	30	1	<2	0.05	<0.5	6	69	56	4.39	<10	<1	0.09
96 KKA 5018	0.2	4.21	18	80	1	<2	0.14	<0.5	15	93	82	4.93	<10	<1	0.24
96 KKA 5019	<0.2	4.39	24	120	1	<2	0.19	<0.5	20	122	98	5.7	10	<1	0.5
96 KKA 5020	<0.2	4.41	14	70	1.5	<2	0.11	<0.5	16	93	69	5.32	10	<1	0.23
96 KKA 5021	<0.2	3.92	6	140	0.5	<2	0.34	<0.5	25	109	81	5.12	10	<1	0.95
96 KKA 5022	<0.2	4.23	18	90	1	<2	0.2	<0.5	33	91	119	4.93	<10	<1	0.35
96 KKA 5023	<0.2	2.9	16	110	0.5	<2	0.28	<0.5	23	80	41	3.93	<10	<1	0.53
96 KKA 5024	0.2	3.72	4	100	0.5	<2	0.24	<0.5	26	87	50	4.17	<10	<1	0.45
96 KKA 5025	<0.2	3.14	6	80	0.5	<2	0.19	<0.5	26	75	73	3.84	<10	<1	0.4
96 KKA 5026	<0.2	4.1	2	100	1	<2	0.2	<0.5	34	109	104	5.5	10	<1	0.47
96 KKA 5027	<0.2	4.06	12	110	0.5	<2	0.2	<0.5	25	98	85	5.18	10	<1	0.61
96 KKA 5028	<0.2	3.67	12	90	0.5	<2	0.21	<0.5	26	90	55	5.41	10	<1	0.36
96 KKA 5029	<0.2	4.03	16	80	0.5	<2	0.15	<0.5	21	79	44	4.57	10	<1	0.32
96 KKA 5030	<0.2	4.17	6	150	0.5	<2	0.25	<0.5	33	118	86	5.51	10	<1	0.91
96 KKA 5031	<0.2	3.87	<2	130	0.5	<2	0.16	<0.5	23	86	63	4.35	10	<1	0.47

Appendix B: ICP-AES data (<0.002 mm)

Sample	La ppm	Mg %	Mn ppm	Mo ppm	Na %	Ni ppm	Pb ppm	Sb ppm	Sc ppm	Sr ppm	Ti %	U ppm	V ppm	W ppm	Zn ppm
Detection limit	10	0.01	5	1	0.01	1	2	2	1	1	0.01	10	1	10	2
96 KKA 5000	50	1.09	380	1	1.73	47	8	<2	7	24	0.03	<10	67	<10	70
96 KKA 5001	30	1.23	370	1	0.87	48	10	<2	7	17	0.14	<10	95	<10	74
96 KKA 5002	20	0.59	225	1	1.5	55	14	<2	5	12	0.1	<10	61	<10	62
96 KKA 5003	30	0.6	245	<1	0.86	30	8	<2	5	13	0.1	<10	73	<10	42
96 KKA 5004	30	0.67	205	2	1.1	44	14	<2	5	12	0.09	<10	75	<10	68
96 KKA 5005	10	0.58	250	2	1.14	19	10	2	3	14	0.08	<10	69	<10	38
96 KKA 5006	30	1.07	280	1	1.18	42	14	<2	6	13	0.1	<10	104	<10	66
96 KKA 5007	40	1.51	385	1	0.72	59	12	<2	8	17	0.15	<10	120	<10	90
96 KKA 5008	20	0.6	215	4	1.19	23	12	<2	4	12	0.12	<10	87	<10	36
96 KKA 5009	30	1.22	415	3	0.88	63	12	<2	7	16	0.12	<10	89	<10	90
96 KKA 5010	40	1.48	400	3	1.08	70	16	2	9	17	0.09	<10	121	<10	90
96 KKA 5011	40	1.8	485	4	0.53	87	22	<2	12	18	0.23	10	153	<10	122
96 KKA 5012	20	1.41	330	3	0.93	56	14	<2	11	12	0.16	<10	118	<10	102
96 KKA 5013	50	2.19	630	2	0.69	82	14	<2	15	22	0.2	10	139	<10	152
96 KKA 5014	30	1.24	350	1	0.75	50	14	2	8	17	0.2	<10	121	<10	82
96 KKA 5015	20	1.05	270	3	0.82	45	12	<2	8	14	0.2	<10	125	<10	78
96 KKA 5016	40	1.24	365	1	0.77	54	8	<2	8	17	0.11	<10	100	<10	94
96 KKA 5017	20	0.21	140	1	1.65	13	8	<2	1	8	0.03	<10	70	<10	18
96 KKA 5018	40	0.77	200	3	1.01	37	10	<2	7	13	0.13	<10	83	<10	48
96 KKA 5019	50	1.36	320	1	0.8	57	14	2	9	18	0.15	10	116	<10	110
96 KKA 5020	40	0.64	240	4	0.99	28	16	<2	6	16	0.14	10	104	<10	48
96 KKA 5021	40	1.82	575	<1	0.48	64	12	<2	11	22	0.19	10	96	<10	124
96 KKA 5022	50	1.02	525	2	0.85	49	12	2	7	21	0.15	<10	87	<10	66
96 KKA 5023	40	1.28	465	1	1.01	42	12	<2	7	22	0.05	<10	67	<10	88
96 KKA 5024	40	1.16	440	1	0.99	43	10	<2	7	17	0.1	<10	71	<10	80
96 KKA 5025	40	0.98	450	1	0.86	43	12	2	6	13	0.09	<10	62	<10	88
96 KKA 5026	40	1.63	530	2	0.6	69	12	<2	8	17	0.15	<10	96	<10	98
96 KKA 5027	40	1.43	430	1	0.78	58	12	2	9	16	0.13	<10	95	<10	112
96 KKA 5028	50	1.18	490	1	0.57	42	14	<2	8	20	0.15	<10	103	<10	78
96 KKA 5029	30	0.94	370	1	1.06	39	12	<2	6	15	0.1	<10	83	<10	66
96 KKA 5030	40	1.81	610	1	0.85	69	14	2	11	19	0.05	<10	102	<10	130
96 KKA 5031	30	1.01	405	2	1.19	37	16	<2	8	16	0.1	<10	78	<10	74

Appendix B: ICP-AES data (<0.002 mm)

Sample	Ag ppm	Al %	As ppm	Ba ppm	Be ppm	Bi ppm	Ca %	Cd ppm	Co ppm	Cr ppm	Cu ppm	Fe %	Ga ppm	Hg ppm	K %
96 KKA 5032	<0.2	4.78	24	240	1	<2	0.28	<0.5	28	129	140	6.33	10	<1	1.1
96 KKA 5033	<0.2	4.17	32	80	1	<2	0.11	<0.5	27	90	118	4.85	<10	<1	0.31
96 KKA 5034	0.2	4.89	176	80	2	<2	0.08	<0.5	40	103	139	7.78	10	<1	0.33
96 KKA 5035	0.2	3.71	16	160	0.5	<2	0.25	<0.5	26	112	93	5.47	10	<1	0.81
96 KKA 5036	<0.2	4.32	14	140	1	<2	0.25	<0.5	28	112	113	5.87	10	<1	0.82
96 KKA 5037	<0.2	3.34	18	130	0.5	<2	0.22	<0.5	28	98	76	4.69	<10	<1	0.53
96 KKA 5038	<0.2	4.46	24	210	1	<2	0.27	<0.5	27	129	116	6.24	10	<1	1.07
96 KKA 5039	0.2	3.72	56	80	1	<2	0.13	<0.5	18	90	64	5.44	10	<1	0.28
96 KKA 5040	<0.2	3.96	54	90	1	<2	0.23	<0.5	23	84	76	5.19	10	<1	0.29
96 KKA 5041	0.2	4.22	40	80	1	<2	0.14	<0.5	14	89	60	5.43	10	<1	0.22
96 KKA 5042	0.2	4.55	24	80	1	<2	0.14	<0.5	14	77	76	4.65	10	<1	0.28
96 KKA 5043	0.2	3.12	42	60	0.5	<2	0.21	<0.5	12	64	233	3.62	<10	<1	0.26
96 KKA 5044	<0.2	2.76	40	80	0.5	<2	0.32	<0.5	23	61	105	3.31	<10	<1	0.35
96 KKA 5045	0.2	3.99	26	50	1	<2	0.11	<0.5	10	72	62	5	10	<1	0.15
96 KKA 5046	0.2	3.86	32	80	1	<2	0.12	<0.5	12	74	66	5.02	10	<1	0.22
96 KKA 5047	0.2	4.11	36	80	1	<2	0.17	<0.5	16	88	57	5.11	10	<1	0.29
96 KKA 5048	<0.2	4.55	38	140	1.5	<2	0.15	<0.5	32	104	104	6.01	10	<1	0.59
96 KKA 5049	<0.2	3.99	28	90	1	<2	0.18	<0.5	16	90	104	5.02	10	<1	0.28
96 KKA 5050	<0.2	2.7	26	80	0.5	<2	0.24	<0.5	18	70	114	3.59	<10	<1	0.3
96 KKA 5051	0.2	4.36	44	60	0.5	<2	0.05	<0.5	6	80	56	4.83	<10	<1	0.15
96 KKA 5052	<0.2	4.42	32	110	1	<2	0.22	<0.5	20	94	105	4.58	10	<1	0.39
96 KKA 5053	<0.2	2.31	18	90	<0.5	<2	0.27	<0.5	15	65	57	2.85	<10	<1	0.39
96 KKA 5054	<0.2	3.83	32	130	1	<2	0.22	<0.5	37	90	91	4.31	<10	<1	0.49
96 KKA 5055	0.2	4	22	60	0.5	<2	0.09	<0.5	7	78	69	3.99	<10	<1	0.18
96 KKA 5056	<0.2	3.8	74	120	1	<2	0.18	<0.5	46	88	82	4.14	<10	<1	0.46
96 KKA 5057	<0.2	3.43	38	100	1	<2	0.18	<0.5	14	120	76	4.17	10	<1	0.37
96 KKA 5058	0.2	4.11	64	80	1.5	<2	0.08	<0.5	14	87	79	5.5	10	<1	0.18
96 KKA 5059	0.2	3.19	40	90	0.5	<2	0.18	<0.5	19	86	105	4.45	<10	<1	0.33
96 KKA 5060	<0.2	3.47	24	110	1	<2	0.23	<0.5	24	82	107	4.09	10	<1	0.44
96 KKA 5061	<0.2	3.92	46	80	1	<2	0.19	<0.5	16	86	92	4.79	10	<1	0.32
96 KKA 5062	<0.2	4.29	18	160	1.5	<2	0.25	<0.5	29	110	145	5.17	10	<1	0.71
96 KKA 5063	<0.2	3.15	28	90	0.5	<2	0.32	<0.5	23	72	73	3.29	<10	<1	0.43

Appendix B: ICP-AES data (<0.002 mm)

Sample	La ppm	Mg %	Mn ppm	Mo ppm	Na %	Ni ppm	Pb ppm	Sb ppm	Sc ppm	Sr ppm	Ti %	U ppm	V ppm	W ppm	Zn ppm
96 KKA 5032	40	2.14	540	<1	0.54	88	16	<2	13	21	0.17	<10	114	<10	148
96 KKA 5033	30	0.94	480	2	1.03	49	10	<2	5	12	0.07	<10	69	<10	72
96 KKA 5034	20	1.13	430	4	0.85	74	14	<2	6	11	0.11	<10	100	<10	76
96 KKA 5035	50	1.72	540	1	0.77	71	12	<2	11	19	0.11	<10	97	<10	118
96 KKA 5036	50	1.9	590	1	0.53	72	16	2	11	17	0.15	10	101	<10	136
96 KKA 5037	40	1.37	435	<1	0.54	61	8	2	8	15	0.13	<10	91	<10	92
96 KKA 5038	50	2.01	535	1	0.68	80	14	<2	14	20	0.09	<10	116	<10	138
96 KKA 5039	30	0.83	255	1	0.93	46	12	<2	6	14	0.13	<10	103	<10	56
96 KKA 5040	30	1.04	385	1	0.65	48	16	<2	7	18	0.14	<10	89	<10	68
96 KKA 5041	30	0.85	250	2	0.86	34	12	<2	7	14	0.14	<10	97	<10	52
96 KKA 5042	30	0.69	240	3	0.74	32	14	<2	6	15	0.14	<10	72	<10	50
96 KKA 5043	30	0.78	245	6	0.69	34	10	2	5	14	0.09	<10	57	<10	74
96 KKA 5044	40	0.99	365	1	0.69	49	14	<2	6	21	0.07	<10	52	<10	72
96 KKA 5045	40	0.62	205	4	0.93	23	12	<2	6	13	0.13	<10	97	<10	40
96 KKA 5046	30	0.76	235	2	1.24	34	14	<2	5	13	0.09	<10	90	<10	54
96 KKA 5047	30	1.03	310	3	0.74	43	10	<2	7	14	0.17	<10	92	<10	66
96 KKA 5048	30	1.43	740	3	0.69	55	16	<2	9	15	0.16	10	114	<10	116
96 KKA 5049	40	0.89	275	2	0.86	41	10	<2	8	15	0.14	<10	86	<10	56
96 KKA 5050	40	0.82	280	2	1.06	45	6	2	7	18	0.07	<10	63	<10	56
96 KKA 5051	10	0.31	110	4	1.1	15	6	2	5	12	0.1	<10	67	<10	24
96 KKA 5052	40	1.08	315	3	0.9	51	6	2	8	17	0.12	<10	82	<10	64
96 KKA 5053	20	0.9	280	1	0.36	39	6	2	6	15	0.08	<10	54	<10	58
96 KKA 5054	20	1.14	545	1	0.86	63	10	2	7	14	0.1	<10	76	<10	76
96 KKA 5055	10	0.51	130	3	1.05	22	2	<2	5	8	0.07	<10	59	<10	30
96 KKA 5056	20	1.07	690	3	0.61	69	8	2	7	12	0.12	<10	71	<10	70
96 KKA 5057	30	1.07	230	3	0.75	44	6	<2	7	13	0.1	<10	115	<10	68
96 KKA 5058	30	0.57	195	4	1.37	40	8	<2	7	10	0.11	<10	99	<10	38
96 KKA 5059	30	0.89	310	3	1.16	45	6	2	5	13	0.08	<10	76	<10	58
96 KKA 5060	30	0.95	395	3	0.9	51	8	<2	7	16	0.1	<10	71	<10	76
96 KKA 5061	40	0.82	250	3	0.99	40	12	<2	7	15	0.12	<10	82	<10	52
96 KKA 5062	40	1.47	490	3	0.86	68	12	2	9	22	0.15	<10	90	<10	100
96 KKA 5063	30	1.03	350	1	0.43	56	8	2	7	19	0.1	<10	57	<10	66

Appendix B: ICP-AES data (<0.002 mm)

Sample	Ag ppm	Al %	As ppm	Ba ppm	Be ppm	Bi ppm	Ca %	Cd ppm	Co ppm	Cr ppm	Cu ppm	Fe %	Ga ppm	Hg ppm	K %
96 KKA 5064	<0.2	4.4	26	70	1.5	<2	0.15	<0.5	20	83	104	5.28	10	<1	0.26
96 KKA 5065	<0.2	4.12	24	140	1.5	<2	0.22	<0.5	23	98	75	4.79	10	<1	0.65
96 KKA 5066	<0.2	4.06	14	160	1.5	<2	0.21	<0.5	28	115	120	5.68	10	<1	0.66
96 KKA 5067	<0.2	4.13	10	200	1	<2	0.35	<0.5	29	130	97	5.84	10	<1	1.18
96 KKA 5068	<0.2	4.53	34	90	1	<2	0.17	<0.5	26	88	106	4.98	10	<1	0.31
96 KKA 5069	<0.2	3.87	40	110	1	<2	0.19	<0.5	20	102	133	5.23	10	<1	0.45
96 KKA 5070	<0.2	3.88	38	110	1	<2	0.26	<0.5	28	88	97	4.93	10	<1	0.45
96 KKA 5071	<0.2	4.36	76	120	2.5	<2	0.18	<0.5	28	114	119	6.11	10	<1	0.46
96 KKA 5072	<0.2	3.88	8	110	1.5	<2	0.23	<0.5	23	85	72	4.66	10	<1	0.46
96 KKA 5073	<0.2	4.19	24	160	1	<2	0.19	<0.5	31	116	127	6.11	10	<1	0.74
96 KKA 5074	0.2	4.33	46	100	1.5	<2	0.18	<0.5	22	98	89	5.96	10	<1	0.41
96 KKA 5075	<0.2	3.54	12	110	0.5	<2	0.17	<0.5	22	78	74	4.24	<10	<1	0.38
96 KKA 5076	<0.2	4.35	14	120	1	<2	0.21	<0.5	28	88	82	4.79	10	<1	0.46
96 KKA 5077	<0.2	3.57	16	100	1	<2	0.17	<0.5	20	82	89	4.67	10	<1	0.4
96 KKA 5078	<0.2	3.35	14	90	0.5	<2	0.14	<0.5	17	74	71	4.13	<10	<1	0.32
96 KKA 5079	<0.2	3.04	22	60	1	<2	0.06	<0.5	10	70	51	4.1	10	<1	0.16
96 KKA 5080	<0.2	4.3	42	130	0.5	<2	0.24	<0.5	26	105	96	5.24	10	<1	0.53
96 KKA 5081	<0.2	4.04	32	110	1	<2	0.18	<0.5	23	129	96	6.13	10	<1	0.38
96 KKA 5082	<0.2	3.34	24	130	0.5	<2	0.31	<0.5	27	101	124	4.44	10	<1	0.76
96 KKA 5083	<0.2	4.64	10	130	1.5	<2	0.23	<0.5	19	126	241	5.39	10	<1	0.51
96 KKA 5084	<0.2	4.15	76	40	0.5	<2	0.05	<0.5	5	53	24	3.87	10	<1	0.1
96 KKA 5085	0.2	4.84	22	60	1	<2	0.09	<0.5	10	73	44	4.16	<10	<1	0.18
96 KKA 5086	0.2	4.38	18	80	1	<2	0.15	<0.5	16	74	75	4.17	10	<1	0.26
96 KKA 5087	<0.2	3.02	18	110	0.5	<2	0.22	<0.5	16	88	75	3.85	10	<1	0.45
96 KKA 5088	<0.2	4.82	30	100	1	<2	0.12	<0.5	13	181	75	5.34	10	<1	0.28
96 KKA 5089	0.2	3.71	28	110	0.5	<2	0.19	<0.5	24	92	79	4.41	10	<1	0.38
96 KKA 5090	<0.2	3.87	32	90	0.5	<2	0.2	<0.5	19	78	98	4.05	<10	<1	0.34
96 KKA 5091	<0.2	3.59	26	90	0.5	<2	0.21	<0.5	22	82	46	4.24	<10	<1	0.35
96 KKA 5092	0.2	4.62	60	90	1	<2	0.14	<0.5	29	117	104	5.39	10	<1	0.29
96 KKA 5093	0.4	3.58	16	40	0.5	<2	<0.01	<0.5	8	74	43	3.38	<10	<1	0.11
96 KKA 5094	0.2	3.48	48	110	0.5	<2	0.25	<0.5	33	87	105	4.24	<10	<1	0.45
96 KKA 5095	<0.2	4.18	34	100	0.5	<2	0.18	<0.5	18	96	73	4.43	<10	<1	0.32

Appendix B: ICP-AES data (<0.002 mm)

Sample	La ppm	Mg %	Mn ppm	Mo ppm	Na %	Ni ppm	Pb ppm	Sb ppm	Sc ppm	Sr ppm	Ti %	U ppm	V ppm	W ppm	Zn ppm
96 KKA 5064	40	0.74	315	2	0.86	40	12	2	6	15	0.16	<10	88	<10	58
96 KKA 5065	40	1.2	380	1	0.61	54	10	2	8	21	0.17	<10	86	<10	78
96 KKA 5066	40	1.4	510	2	0.97	56	18	<2	9	22	0.11	<10	102	<10	96
96 KKA 5067	60	2.1	675	2	0.45	72	16	2	13	32	0.14	10	111	<10	144
96 KKA 5068	40	0.97	380	3	0.81	51	14	2	6	17	0.12	<10	76	<10	64
96 KKA 5069	30	1.13	320	3	0.9	56	10	<2	8	15	0.12	<10	96	<10	92
96 KKA 5070	40	1.21	410	2	0.75	62	12	<2	8	21	0.13	<10	78	<10	84
96 KKA 5071	40	1.33	360	3	0.74	68	28	<2	9	19	0.14	<10	98	<10	138
96 KKA 5072	60	1.16	480	2	0.75	45	16	<2	7	24	0.13	<10	81	<10	94
96 KKA 5073	30	1.61	495	4	0.69	71	14	2	10	18	0.15	<10	109	<10	116
96 KKA 5074	30	1.1	365	4	0.91	50	26	<2	7	18	0.14	<10	93	<10	80
96 KKA 5075	30	1.06	520	1	0.92	42	10	<2	6	16	0.1	<10	69	<10	64
96 KKA 5076	30	1.22	655	1	0.63	55	12	<2	7	19	0.13	<10	77	<10	78
96 KKA 5077	30	0.91	320	2	0.81	46	14	<2	6	15	0.11	<10	78	<10	66
96 KKA 5078	40	0.85	365	3	0.67	33	10	2	6	12	0.1	<10	70	<10	58
96 KKA 5079	10	0.42	160	3	1.1	26	12	<2	4	9	0.13	<10	91	<10	42
96 KKA 5080	30	1.48	450	3	0.4	64	8	2	9	19	0.18	<10	98	<10	100
96 KKA 5081	30	1.23	270	2	0.75	70	8	<2	10	16	0.14	<10	125	<10	88
96 KKA 5082	40	1.4	450	3	0.61	72	10	<2	10	19	0.13	<10	80	<10	94
96 KKA 5083	50	1.62	275	1	0.69	59	14	2	18	19	0.13	<10	172	<10	198
96 KKA 5084	10	0.26	145	2	1.2	15	10	2	3	9	0.11	<10	68	<10	42
96 KKA 5085	30	0.52	195	3	1.3	25	10	<2	5	12	0.1	<10	64	<10	42
96 KKA 5086	30	0.66	245	1	1.46	36	8	2	5	13	0.12	<10	77	<10	46
96 KKA 5087	30	1.1	295	3	0.52	48	8	2	7	16	0.12	<10	79	<10	74
96 KKA 5088	30	0.79	240	3	0.96	49	12	<2	6	18	0.15	<10	103	<10	50
96 KKA 5089	30	1.08	340	1	0.9	60	8	2	7	15	0.12	<10	80	<10	68
96 KKA 5090	30	0.91	320	2	0.75	55	8	<2	6	16	0.11	<10	66	<10	98
96 KKA 5091	30	1.06	445	2	0.55	44	8	2	6	18	0.11	<10	78	<10	68
96 KKA 5092	40	1	345	3	0.72	91	14	<2	6	14	0.15	<10	89	<10	86
96 KKA 5093	10	0.35	145	3	1.44	22	6	2	3	6	0.05	<10	63	<10	32
96 KKA 5094	30	1.24	455	1	0.63	77	12	2	7	17	0.11	<10	66	<10	90
96 KKA 5095	30	1.02	310	1	0.9	50	8	4	6	14	0.11	<10	73	<10	62

Appendix B: ICP-AES data (<0.002 mm)

Sample	Ag ppm	Al %	As ppm	Ba ppm	Be ppm	Bi ppm	Ca %	Cd ppm	Co ppm	Cr ppm	Cu ppm	Fe %	Ga ppm	Hg ppm	K %
96 KKA 5096	<0.2	3.03	8	40	0.5	<2	0.1	<0.5	10	39	44	2.66	<10	<1	0.1
96 KKA 5097	0.2	4.34	46	80	1.5	<2	0.12	<0.5	18	78	95	5.75	10	<1	0.19
96 KKA 5098	<0.2	3.53	14	280	1	<2	0.21	<0.5	31	83	179	5.72	10	<1	0.41
96 KKA 5099	<0.2	4.21	26	120	1.5	<2	0.15	<0.5	30	83	75	5.79	10	<1	0.32
96 KKA 5100	<0.2	3.83	32	110	1.5	<2	0.23	<0.5	28	100	93	5.41	10	<1	0.36
96 KKA 5101	0.2	3.88	46	110	1.5	<2	0.24	<0.5	28	78	102	4.83	10	<1	0.36
96 KKA 5102	<0.2	4.23	136	100	2	<2	0.22	<0.5	33	92	169	4.91	10	<1	0.39
96 KKA 5103	<0.2	4.49	30	160	1.5	<2	0.21	<0.5	25	117	109	5.67	10	<1	0.8
96 KKA 5104	<0.2	4.23	36	160	1	<2	0.22	<0.5	29	111	135	5.64	10	<1	0.84
96 KKA 5105	<0.2	2.5	28	80	0.5	<2	0.24	<0.5	15	81	71	3.41	<10	<1	0.4
96 KKA 5106	0.2	4.25	52	90	3	<2	0.13	<0.5	31	171	120	6.2	10	1	0.31
96 KKA 5107	0.2	4.66	42	110	1	<2	0.17	<0.5	22	108	92	5.77	10	<1	0.44
96 KKA 5108	<0.2	4.34	28	130	0.5	<2	0.17	<0.5	20	114	111	5.46	10	<1	0.65
96 KKA 5109	<0.2	4.12	30	100	1	<2	0.16	<0.5	17	127	155	5.39	10	<1	0.34
96 KKA 5110	<0.2	4.85	20	100	1.5	<2	0.16	<0.5	22	73	63	5.22	10	<1	0.23
96 KKA 5112	0.2	3.84	28	90	1	<2	0.19	<0.5	23	73	112	5.02	10	<1	0.27

Appendix B: ICP-AES data (<0.002 mm)

Sample	La ppm	Mg %	Mn ppm	Mo ppm	Na %	Ni ppm	Pb ppm	Sb ppm	Sc ppm	Sr ppm	Ti %	U ppm	V ppm	W ppm	Zn ppm
96 KKA 5096	10	0.33	310	<1	1.04	17	6	<2	3	8	0.07	<10	42	<10	34
96 KKA 5097	40	0.78	295	2	1.57	35	20	<2	6	15	0.13	<10	114	<10	62
96 KKA 5098	40	2.03	1205	1	0.81	60	14	<2	16	15	0.12	<10	105	<10	82
96 KKA 5099	30	1.31	1100	<1	0.53	46	12	2	8	16	0.14	<10	100	<10	74
96 KKA 5100	40	1.76	1140	<1	0.91	59	12	<2	9	16	0.1	<10	121	<10	116
96 KKA 5101	40	1.02	700	1	0.81	47	16	<2	7	25	0.1	<10	76	<10	102
96 KKA 5102	50	1.24	420	3	1.09	81	34	<2	7	20	0.1	<10	71	<10	168
96 KKA 5103	30	1.79	470	<1	0.49	76	10	<2	10	17	0.16	<10	105	<10	128
96 KKA 5104	30	1.74	550	3	0.54	89	16	<2	10	20	0.17	<10	98	<10	130
96 KKA 5105	30	1.06	295	1	0.28	49	6	2	6	16	0.1	<10	61	<10	64
96 KKA 5106	30	1.26	430	5	1.14	86	22	<2	6	16	0.09	30	143	<10	114
96 KKA 5107	30	1.33	360	3	0.51	61	12	<2	8	18	0.19	<10	100	<10	84
96 KKA 5108	20	1.55	360	3	0.57	67	14	<2	9	15	0.17	<10	107	<10	126
96 KKA 5109	50	1.17	260	<1	0.59	56	14	<2	11	15	0.12	20	122	<10	110
96 KKA 5110	30	0.96	655	1	0.75	43	12	<2	7	17	0.13	<10	91	<10	58
96 KKA 5112	30	1.03	670	1	0.79	43	12	2	6	16	0.11	<10	104	<10	74

Appendix C: INAA data (<0.063 mm)

Sample	Au ppb	Ag ppm	As ppm	Ba ppm	Br ppm	Ca %	Co ppm	Cr ppm	Cs ppm	Fe %	Hf ppm	Hg ppm	Ir ppm	Mo ppm
Detection limit	2	5	0.5	50	0.5	1	1	5	1	0.01	1	1	5	1
96 KKA 5000	<2	<5	3.8	550	<0.5	<1	5	39	2	1.61	9	<1	<5	5
96 KKA 5001	2	<5	4.1	540	3.3	1	6	51	2	2.03	7	<1	<5	<1
96 KKA 5002	15	<5	14	590	9.7	<1	8	51	2	2.12	6	<1	<5	<1
96 KKA 5003	<2	<5	6	490	3.9	2	4	34	2	1.56	7	<1	<5	<1
96 KKA 5004	<2	<5	3.6	430	5.4	<1	6	45	2	1.65	6	<1	<5	7
96 KKA 5005	<2	<5	4.5	540	3.6	2	5	45	2	1.87	9	<1	<5	3
96 KKA 5006	<2	<5	2.4	430	3.7	2	6	42	2	1.83	7	<1	<5	<1
96 KKA 5007	9	<5	3.2	540	2.5	2	7	64	2	2.17	8	<1	<5	<1
96 KKA 5008	<2	<5	4.7	460	7.6	2	4	54	2	1.85	8	<1	<5	<1
96 KKA 5009	<2	<5	3.5	550	3.4	<1	8	53	2	2	8	<1	<5	<1
96 KKA 5010	<2	<5	3.7	520	3.3	<1	7	67	2	2.17	9	<1	<5	3
96 KKA 5011	4	<5	2.3	630	2.1	2	10	83	3	2.7	8	<1	<5	<1
96 KKA 5012	<2	<5	3.5	640	7.5	<1	9	85	3	2.93	9	<1	<5	<1
96 KKA 5013	<2	<5	2	580	<0.5	2	8	58	2	2.27	10	<1	<5	8
96 KKA 5014	4	<5	2.9	470	3.5	<1	7	47	3	2.06	7	<1	<5	2
96 KKA 5015	<2	<5	5.4	590	6.7	<1	7	62	2	2.39	8	<1	<5	3
96 KKA 5016	<2	<5	3.8	520	<0.5	2	5	55	2	2	9	<1	<5	<1
96 KKA 5017	<2	<5	5.9	470	12	1	3	40	1	1.92	8	<1	<5	<1
96 KKA 5018	<2	<5	6.1	460	4.8	<1	6	50	2	1.87	8	<1	<5	<1
96 KKA 5019	<2	<5	3.8	460	4.3	<1	8	67	3	2.55	9	<1	<5	<1
96 KKA 5020	10	<5	3.8	630	5.9	<1	8	51	2	2.36	8	<1	<5	6
96 KKA 5021	5	<5	2.1	650	<0.5	2	9	46	2	2.05	9	<1	<5	3
96 KKA 5022	<2	<5	3.3	460	5.9	1	9	56	2	2.25	8	<1	<5	5
96 KKA 5023	<2	<5	2.5	580	1.5	2	7	47	2	2.08	8	<1	<5	2
96 KKA 5024	<2	<5	1.6	570	2.9	2	8	53	2	2.12	8	<1	<5	<1
96 KKA 5025	<2	<5	3.6	500	3.2	1	7	34	2	1.89	9	<1	<5	4
96 KKA 5026	<2	<5	2.8	560	1.7	<1	10	59	2	2.5	8	<1	<5	3
96 KKA 5027	4	<5	3.2	550	1.9	2	6	45	1	1.97	10	<1	<5	2
96 KKA 5028	6	<5	2.3	470	2.5	<1	8	51	2	2.12	9	<1	<5	5
96 KKA 5029	<2	<5	2.5	470	4.8	2	7	45	2	2.02	8	<1	<5	<1
96 KKA 5030	6	<5	1.6	560	1.6	<1	8	54	2	2.2	10	<1	<5	2

Appendix C: INAA data (<0.063 mm)

Sample	Na %	Ni ppm	Rb ppm	Sb ppm	Sc ppm	Se ppm	Sn %	Sr %	Ta ppm	Th ppm	U ppm	W ppm	Zn ppm	La ppm
Detection limit	0.01	20	5	0.1	0.1	3	0.01	0.05	0.5	0.2	0.5	1	50	0.5
96 KKA 5000	2.21	<20	25	<0.1	6.3	<3	<0.01	<0.05	<0.5	10	2	<1	<50	37
96 KKA 5001	1.98	<20	54	0.2	7.4	<3	<0.01	<0.05	<0.5	7.5	1.6	<1	<50	29
96 KKA 5002	1.78	<20	32	<0.1	6.6	<3	<0.01	<0.05	<0.5	7.4	1.8	<1	64	29
96 KKA 5003	1.89	<20	47	<0.1	5.2	<3	<0.01	<0.05	<0.5	7.1	2.1	<1	<50	27
96 KKA 5004	2.02	<20	35	<0.1	6	<3	<0.01	<0.05	3.1	7.4	1.4	<1	<50	28
96 KKA 5005	1.92	<20	28	0.2	6.4	<3	<0.01	<0.05	<0.5	9.8	2.9	<1	<50	32
96 KKA 5006	1.74	<20	50	<0.1	6.5	<3	<0.01	<0.05	<0.5	6.7	1.8	<1	<50	26
96 KKA 5007	1.86	<20	50	<0.1	8	<3	<0.01	<0.05	<0.5	8.6	3	<1	88	35
96 KKA 5008	1.78	<20	48	<0.1	6.6	<3	<0.01	<0.05	<0.5	7.1	1.6	<1	<50	25
96 KKA 5009	2.06	<20	50	<0.1	7.4	<3	<0.01	<0.05	1.8	8.5	1.9	<1	116	31
96 KKA 5010	1.88	<20	45	<0.1	8.3	<3	<0.01	<0.05	<0.5	9.4	2.2	<1	<50	37
96 KKA 5011	2.24	<20	68	<0.1	10	<3	<0.01	<0.05	<0.5	11	3.8	<1	64	45
96 KKA 5012	2.2	<20	120	<0.1	11	<3	<0.01	<0.05	<0.5	13	3.7	<1	126	44
96 KKA 5013	2.35	<20	75	<0.1	9.1	<3	<0.01	<0.05	<0.5	12	4	3	121	45
96 KKA 5014	2.01	<20	58	<0.1	6.9	<3	<0.01	<0.05	<0.5	7.6	2.5	<1	89	29
96 KKA 5015	2.17	<20	81	<0.1	8.1	<3	<0.01	<0.05	<0.5	6.9	2.3	<1	<50	28
96 KKA 5016	2.51	<20	66	<0.1	7.5	<3	<0.01	<0.05	<0.5	9.6	2.7	<1	<50	37
96 KKA 5017	2.02	<20	40	<0.1	5.8	<3	<0.01	<0.05	<0.5	9	2.6	<1	<50	30
96 KKA 5018	2.25	<20	47	<0.1	7.4	<3	<0.01	<0.05	<0.5	9.2	2.4	<1	<50	36
96 KKA 5019	2.36	<20	55	<0.1	9.4	<3	<0.01	<0.05	<0.5	11	4.3	<1	<50	43
96 KKA 5020	2.42	<20	95	<0.1	7.7	<3	<0.01	<0.05	<0.5	9.4	3.1	<1	56	36
96 KKA 5021	2.22	<20	98	<0.1	7.4	<3	<0.01	<0.05	<0.5	9.1	2.2	<1	<50	32
96 KKA 5022	2.39	<20	80	0.2	7.8	<3	<0.01	<0.05	1.5	8.9	3.2	<1	<50	38
96 KKA 5023	2.15	<20	82	0.3	7.8	<3	<0.01	<0.05	2.2	9.4	2.8	<1	<50	36
96 KKA 5024	2.27	<20	57	<0.1	7.6	<3	<0.01	<0.05	<0.5	8.7	3	<1	<50	34
96 KKA 5025	1.99	<20	77	<0.1	6.6	<3	<0.01	<0.05	<0.5	8.8	2	<1	<50	29
96 KKA 5026	2.19	<20	100	<0.1	9	<3	<0.01	<0.05	<0.5	7.5	2.6	<1	<50	29
96 KKA 5027	2.01	<20	62	0.2	7.4	<3	<0.01	<0.05	<0.5	9.4	2.5	<1	<50	35
96 KKA 5028	2.07	<20	72	<0.1	7.9	<3	<0.01	<0.05	<0.5	9.2	3.7	<1	65	37
96 KKA 5029	1.98	80	58	<0.1	7.2	<3	<0.01	<0.05	0.9	7.7	2.5	<1	<50	28
96 KKA 5030	2.22	<20	71	<0.1	8.3	<3	<0.01	<0.05	<0.5	9.7	3	<1	86	38

Appendix C: INAA data (<0.063 mm)

Sample	Ce ppm	Nd ppm	Sm ppm	Eu ppm	Tb ppm	Yb ppm	Lu ppm	Mass gm
Detection limit	3	5	0.1	0.2	0.5	0.2	0.05	
96 KKA 5000	71	25	5.2	1.5	<0.5	2.3	0.4	28.32
96 KKA 5001	55	24	4.1	1.2	<0.5	1.9	0.28	30.72
96 KKA 5002	56	29	4	1.2	<0.5	1.8	0.26	24.85
96 KKA 5003	48	22	3.7	1	<0.5	1.7	0.29	30.95
96 KKA 5004	52	23	3.9	1.3	<0.5	1.8	0.21	29.34
96 KKA 5005	57	22	4.5	1.4	<0.5	2.1	0.34	36.7
96 KKA 5006	48	25	3.7	1.1	<0.5	1.9	0.25	29.63
96 KKA 5007	65	29	4.8	1.4	<0.5	2.4	0.4	27.06
96 KKA 5008	42	20	3.4	1	0.9	1.7	0.24	28.76
96 KKA 5009	56	24	4.4	1.4	<0.5	2	0.36	29.27
96 KKA 5010	66	29	5	1.2	<0.5	2.2	0.32	29.87
96 KKA 5011	78	33	5.9	1.6	0.8	2.6	0.4	28.94
96 KKA 5012	83	32	6.3	1.5	<0.5	2.8	0.43	22.54
96 KKA 5013	82	40	6.3	1.6	<0.5	2.7	0.47	28.6
96 KKA 5014	57	16	4	1.1	<0.5	2	0.32	29.18
96 KKA 5015	50	17	3.8	1	<0.5	1.9	0.33	29.71
96 KKA 5016	66	29	5.1	1.4	<0.5	2.3	0.34	30.43
96 KKA 5017	55	23	4	1.2	0.6	2	0.33	29.19
96 KKA 5018	65	24	4.9	1.4	<0.5	2.2	0.37	28.88
96 KKA 5019	76	33	5.7	1.7	<0.5	2.3	0.34	25.84
96 KKA 5020	66	32	5.1	1.5	<0.5	2.1	0.37	26.48
96 KKA 5021	58	26	4.4	1.2	<0.5	2.2	0.37	30.01
96 KKA 5022	67	26	5.4	1.5	0.9	2	0.33	26.85
96 KKA 5023	66	27	5.2	1.4	0.5	2.5	0.37	33.32
96 KKA 5024	62	23	4.8	1.2	<0.5	2.4	0.38	30.09
96 KKA 5025	54	27	4	1.2	<0.5	2.4	0.33	31.07
96 KKA 5026	51	17	4.1	1.3	<0.5	2.2	0.34	25.57
96 KKA 5027	61	32	4.6	1.2	<0.5	2.7	0.44	31.68
96 KKA 5028	67	26	5.2	1.4	<0.5	2.5	0.45	26.86
96 KKA 5029	52	23	3.9	1.1	<0.5	2.1	0.34	30.2
96 KKA 5030	66	32	5	1.4	0.8	2.5	0.4	26.23

Appendix C: INAA data (<0.063 mm)

Sample	Au ppb	Ag ppm	As ppm	Ba ppm	Br ppm	Ca %	Co ppm	Cr ppm	Cs ppm	Fe %	Hf ppm	Hg ppm	Ir ppm	Mo ppm
96 KKA 5031	15	<5	2.9	590	4.9	<1	8	48	2	2.22	9	<1	<5	<1
96 KKA 5032	6	<5	3.6	440	<0.5	1	9	57	2	2.41	8	<1	<5	1
96 KKA 5033	<2	<5	6.9	480	5.2	<1	8	62	2	2.52	8	<1	<5	<1
96 KKA 5034	<2	<5	34	680	9	<1	12	84	3	3.15	6	<1	<5	2
96 KKA 5035	4	<5	1.6	500	<0.5	<1	6	50	2	1.9	8	<1	<5	<1
96 KKA 5036	<2	<5	3.1	470	<0.5	1	7	42	1	1.97	8	<1	<5	<1
96 KKA 5037	<2	<5	2.8	540	1.9	2	8	49	1	2.08	8	<1	<5	<1
96 KKA 5038	<2	<5	3.5	560	<0.5	2	8	53	2	2.21	8	<1	<5	3
96 KKA 5039	<2	<5	6.2	520	5.8	2	5	43	2	1.77	6	<1	<5	<1
96 KKA 5040	3	<5	7.5	530	6.2	1	6	46	2	2.03	7	<1	<5	4
96 KKA 5041	<2	<5	3.2	530	4.2	1	5	42	2	1.76	7	<1	<5	<1
96 KKA 5042	8	<5	5.5	350	5.6	1	6	50	2	2.05	10	<1	<5	<1
96 KKA 5043	8	<5	6.2	410	2.7	1	4	34	1	1.45	8	<1	<5	2
96 KKA 5044	8	<5	7.8	500	2.6	<1	5	38	2	1.58	8	<1	<5	3
96 KKA 5045	<2	<5	4.6	530	7.8	<1	6	43	2	1.88	7	<1	<5	<1
96 KKA 5046	5	<5	4.4	570	7.9	<1	5	32	2	1.79	9	<1	<5	4
96 KKA 5047	<2	<5	6.2	460	9.7	<1	7	49	2	2.1	7	<1	<5	<1
96 KKA 5048	5	<5	8.9	570	7.2	1	10	59	4	2.56	8	<1	<5	4
96 KKA 5049	34	<5	3.7	530	4.1	2	6	45	1	1.91	8	<1	<5	<1
96 KKA 5050	<2	<5	4.3	590	2.2	<1	6	49	1	1.98	8	<1	<5	3
96 KKA 5051	8	<5	12	540	6.9	1	5	46	2	1.88	7	<1	<5	2
96 KKA 5052	9	<5	4.9	630	3.7	<1	6	50	1	1.91	9	<1	<5	2
96 KKA 5053	<2	<5	4.7	650	1.9	1	7	52	1	1.82	8	<1	<5	<1
96 KKA 5054	<2	<5	5.7	620	2.7	<1	8	51	1	2.03	9	<1	<5	<1
96 KKA 5055	10	<5	3.5	530	5.4	1	5	49	2	1.94	8	<1	<5	<1
96 KKA 5056	6	<5	13	500	2.8	2	9	44	2	1.83	7	<1	<5	1
96 KKA 5057	6	<5	5	540	2	<1	5	46	2	1.6	7	<1	<5	2
96 KKA 5058	<2	<5	7.6	480	4.4	<1	5	32	<1	1.5	7	<1	<5	2
96 KKA 5059	5	<5	6.7	540	4	2	5	40	2	1.7	7	<1	<5	2
96 KKA 5060	3	<5	5.5	560	3.4	1	6	43	1	1.79	8	<1	<5	4
96 KKA 5061	4	<5	6.2	420	3.9	<1	4	37	2	1.64	8	<1	<5	<1
96 KKA 5062	2	<5	2.8	500	2.3	2	6	43	2	1.74	6	<1	<5	3

Appendix C: INAA data (<0.063 mm)

Sample	Na %	Ni ppm	Rb ppm	Sb ppm	Sc ppm	Se ppm	Sn %	Sr %	Ta ppm	Th ppm	U ppm	W ppm	Zn ppm	La ppm
96 KKA 5031	2.24	<20	71	<0.1	8.2	<3	<0.01	<0.05	<0.5	11	3.5	<1	88	34
96 KKA 5032	1.9	<20	49	0.1	8.8	4	<0.01	<0.05	<0.5	8.9	2.2	<1	<50	36
96 KKA 5033	2.01	<20	56	<0.1	8.9	<3	<0.01	<0.05	1.4	11	2.3	<1	<50	40
96 KKA 5034	1.62	92	72	0.1	9.8	<3	<0.01	<0.05	<0.5	6.4	2.1	<1	<50	28
96 KKA 5035	1.89	89	41	<0.1	7.3	<3	<0.01	<0.05	<0.5	7.8	2.8	<1	79	34
96 KKA 5036	1.89	<20	71	0.2	7.2	<3	<0.01	<0.05	<0.5	9.1	3	3	<50	32
96 KKA 5037	1.74	<20	56	0.2	7.8	<3	<0.01	<0.05	<0.5	7.5	2	<1	<50	33
96 KKA 5038	1.83	<20	52	0.2	8.3	<3	<0.01	<0.05	1.2	8.4	2.4	<1	81	34
96 KKA 5039	2.01	<20	98	0.1	6	<3	<0.01	<0.05	<0.5	7	2	<1	<50	26
96 KKA 5040	2.08	<20	51	<0.1	6.9	<3	<0.01	<0.05	2	8.4	2.4	<1	78	32
96 KKA 5041	2.19	<20	71	<0.1	6.1	<3	<0.01	<0.05	<0.5	7.5	2	<1	<50	29
96 KKA 5042	2.06	<20	43	<0.1	7.3	<3	<0.01	<0.05	1.4	9.9	2.8	<1	<50	39
96 KKA 5043	2.27	<20	70	<0.1	4.9	<3	<0.01	<0.05	<0.5	8.8	1.9	<1	66	33
96 KKA 5044	2.48	<20	55	<0.1	5.5	<3	<0.01	<0.05	<0.5	11	2.7	<1	<50	39
96 KKA 5045	2.28	<20	55	<0.1	6.4	<3	<0.01	<0.05	<0.5	8.5	2.4	<1	<50	35
96 KKA 5046	2.3	<20	89	<0.1	5.9	<3	<0.01	<0.05	1.4	11	3	<1	<50	41
96 KKA 5047	2.14	<20	59	0.1	6.5	<3	<0.01	<0.05	1.2	8.4	2.3	<1	<50	30
96 KKA 5048	2.11	<20	71	<0.1	8	<3	<0.01	<0.05	<0.5	9.9	4.7	<1	66	37
96 KKA 5049	2.37	<20	62	<0.1	7.1	<3	<0.01	<0.05	0.8	8.5	2.6	<1	65	34
96 KKA 5050	2.25	100	58	<0.1	7.3	<3	<0.01	<0.05	0.9	8.4	2.3	<1	64	34
96 KKA 5051	2	<20	49	<0.1	6.8	<3	<0.01	<0.05	<0.5	7.8	2.5	<1	53	29
96 KKA 5052	2.29	<20	55	0.2	7.8	<3	<0.01	<0.05	<0.5	9.6	2.5	<1	78	36
96 KKA 5053	2.37	<20	44	<0.1	7.1	<3	<0.01	<0.05	<0.5	8.4	2.5	<1	<50	33
96 KKA 5054	2.27	<20	50	<0.1	7.6	<3	<0.01	<0.05	<0.5	10	2.6	<1	67	38
96 KKA 5055	2.01	<20	38	<0.1	7.4	<3	<0.01	<0.05	1.5	9.2	2.2	<1	<50	35
96 KKA 5056	2.07	<20	47	<0.1	6.9	<3	<0.01	<0.05	<0.5	8	2	<1	63	31
96 KKA 5057	2.07	<20	49	0.2	6.5	<3	<0.01	<0.05	<0.5	8.1	1.9	<1	<50	29
96 KKA 5058	1.99	<20	31	<0.1	5.1	<3	<0.01	<0.05	<0.5	7.6	1.9	<1	<50	28
96 KKA 5059	2.1	<20	62	<0.1	6.1	<3	<0.01	<0.05	1.6	7.5	1.5	<1	<50	29
96 KKA 5060	2.15	<20	58	0.2	6.5	<3	<0.01	<0.05	1.4	8.3	2.1	<1	61	32
96 KKA 5061	2.06	<20	43	0.2	6	<3	<0.01	<0.05	<0.5	9	2.2	<1	<50	34
96 KKA 5062	2.18	<20	51	<0.1	6.1	<3	<0.01	<0.05	<0.5	7.7	2.3	<1	<50	32

Appendix C: INAA data (<0.063 mm)

Sample	Ce ppm	Nd ppm	Sm ppm	Eu ppm	Tb ppm	Yb ppm	Lu ppm	Mass gm
96 KKA 5031	63	20	4.9	1.3	<0.5	2.4	0.38	28.53
96 KKA 5032	63	32	4.9	1.4	0.7	2.8	0.4	30.06
96 KKA 5033	70	37	5.5	1.4	<0.5	2.4	0.37	27.13
96 KKA 5034	51	22	3.7	1.2	<0.5	1.7	0.29	26.99
96 KKA 5035	58	28	4.4	1.2	<0.5	2.1	0.36	28.12
96 KKA 5036	57	22	4.4	1.1	<0.5	2.4	0.38	28.48
96 KKA 5037	57	21	4.3	1.3	<0.5	2.5	0.39	30
96 KKA 5038	61	27	4.7	1.4	0.6	2.5	0.39	31.5
96 KKA 5039	46	21	3.5	1	<0.5	1.6	0.26	29.89
96 KKA 5040	60	24	4.4	1.2	<0.5	2	0.32	27.01
96 KKA 5041	52	20	4	1.2	<0.5	1.8	0.26	32.79
96 KKA 5042	67	30	5.2	1.5	<0.5	2.5	0.37	29.68
96 KKA 5043	59	28	4.6	1.1	<0.5	2.1	0.34	30.97
96 KKA 5044	71	31	5.5	1.4	1	2.4	0.37	31.91
96 KKA 5045	65	24	4.6	1.2	<0.5	2	0.31	27.24
96 KKA 5046	73	29	5.2	1.3	<0.5	2.2	0.33	28.8
96 KKA 5047	53	21	4.1	1.2	<0.5	1.9	0.3	29.17
96 KKA 5048	67	25	4.9	1.3	0.7	2	0.33	24.73
96 KKA 5049	60	27	4.7	1.3	0.6	2	0.34	31.51
96 KKA 5050	59	25	4.9	1.4	<0.5	2.2	0.37	28.54
96 KKA 5051	51	23	3.9	1.2	<0.5	1.8	0.29	28.72
96 KKA 5052	64	30	5	1.3	<0.5	2.3	0.38	31.44
96 KKA 5053	60	23	4.6	1.3	<0.5	2.2	0.32	30.18
96 KKA 5054	69	31	5.2	1.5	0.8	2.6	0.38	30.32
96 KKA 5055	61	27	4.9	1.3	<0.5	2.2	0.32	28.66
96 KKA 5056	55	23	4.3	1.1	<0.5	1.9	0.31	34.08
96 KKA 5057	53	22	4.1	1.3	0.7	2.1	0.32	30.84
96 KKA 5058	49	25	3.8	1.1	<0.5	1.8	0.29	32.56
96 KKA 5059	52	25	4.1	1.2	<0.5	1.8	0.3	29.47
96 KKA 5060	56	25	4.5	1.3	<0.5	2.1	0.33	29.62
96 KKA 5061	59	27	4.7	1.2	0.7	2.1	0.36	30.7
96 KKA 5062	58	25	4.7	1.3	<0.5	1.9	0.36	28.33

Appendix C: INAA data (<0.063 mm)

Sample	Au ppb	Ag ppm	As ppm	Ba ppm	Br ppm	Ca %	Co ppm	Cr ppm	Cs ppm	Fe %	Hf ppm	Hg ppm	Ir ppm	Mo ppm
96 KKA 5063	3	<5	6.8	490	3.1	2	5	37	1	1.6	8	<1	<5	4
96 KKA 5064	<2	<5	5.3	510	4.2	2	6	39	2	1.66	7	<1	<5	5
96 KKA 5065	<2	<5	3.2	540	2.4	<1	5	40	2	1.61	7	<1	<5	1
96 KKA 5066	<2	<5	4.5	680	4	<1	10	55	3	2.43	8	<1	<5	5
96 KKA 5067	5	<5	3	760	1.5	<1	7	51	2	2.23	7	<1	<5	<1
96 KKA 5068	<2	<5	5.7	590	4.7	1	8	48	3	1.99	7	<1	<5	3
96 KKA 5069	<2	<5	4.2	520	2.7	2	5	37	2	1.7	7	<1	<5	<1
96 KKA 5070	4	<5	5.4	570	3.6	<1	7	43	2	1.79	8	<1	<5	3
96 KKA 5071	<2	<5	12	490	4.1	2	9	58	3	2.31	8	<1	<5	5
96 KKA 5072	<2	<5	2.7	630	2.7	<1	7	56	3	2.18	8	<1	<5	<1
96 KKA 5073	2	<5	7.6	570	6	<1	7	47	2	2.09	7	<1	<5	5
96 KKA 5074	6	<5	2.8	600	3.2	<1	8	55	3	2.1	7	<1	<5	3
96 KKA 5075	6	<5	3.9	630	3.6	<1	8	47	3	2.15	8	<1	<5	<1
96 KKA 5076	5	<5	3.5	580	3.7	<1	7	53	3	2.08	9	<1	<5	<1
96 KKA 5077	<2	<5	4.9	600	5.5	2	7	55	3	2.19	7	<1	<5	<1
96 KKA 5078	<2	<5	4	700	4.6	<1	8	52	3	2.14	9	<1	<5	<1
96 KKA 5079	<2	<5	5.9	500	5.7	<1	6	49	2	1.99	8	<1	<5	4
96 KKA 5080	<2	<5	6.7	730	2.1	1	7	51	2	2.18	8	<1	<5	<1
96 KKA 5081	8	<5	3.5	640	2.4	<1	7	56	2	2	11	<1	<5	2
96 KKA 5082	7	<5	3.3	690	<0.5	2	6	39	<1	1.85	8	<1	<5	3
96 KKA 5083	<2	<5	2.9	710	<0.5	2	7	53	2	2.32	8	<1	<5	<1
96 KKA 5084	<2	<5	12	580	5.5	<1	4	34	2	1.71	8	<1	<5	1
96 KKA 5085	6	<5	5.8	660	7.2	<1	5	47	2	2.09	9	<1	<5	<1
96 KKA 5086	<2	<5	5.9	590	5.1	2	7	46	2	1.99	9	<1	<5	2
96 KKA 5087	6	<5	3.8	670	<0.5	<1	5	53	2	1.86	9	<1	<5	3
96 KKA 5088	<2	<5	5.2	610	5.7	1	7	76	2	2.09	8	<1	<5	3
96 KKA 5089	8	<5	8.4	650	4.4	2	9	62	2	1.98	7	<1	<5	<1
96 KKA 5090	<2	<5	5.7	550	4.1	<1	6	45	2	1.78	7	<1	<5	1
96 KKA 5091	<2	<5	4.3	570	2.5	1	6	42	1	1.8	8	<1	<5	<1
96 KKA 5092	<2	<5	11	560	7.3	2	10	65	2	2.28	7	<1	<5	<1
96 KKA 5093	2	<5	3.7	550	4.9	2	6	39	1	1.59	6	<1	<5	<1
96 KKA 5094	5	<5	10	650	2.7	<1	9	48	2	1.83	8	<1	<5	<1

Appendix C: INAA data (<0.063 mm)

Sample	Na %	Ni ppm	Rb ppm	Sb ppm	Sc ppm	Se ppm	Sn %	Sr %	Ta ppm	Th ppm	U ppm	W ppm	Zn ppm	La ppm
96 KKA 5063	2.21	<20	51	<0.1	5.8	<3	<0.01	<0.05	<0.5	9.2	1.9	<1	<50	34
96 KKA 5064	2.11	<20	48	<0.1	5.8	<3	<0.01	<0.05	<0.5	7.9	2.1	<1	<50	31
96 KKA 5065	2.14	<20	72	<0.1	5.8	<3	<0.01	<0.05	<0.5	9.1	2.6	<1	<50	33
96 KKA 5066	2.33	150	80	<0.1	8.1	<3	<0.01	<0.05	<0.5	10	4.3	<1	<50	39
96 KKA 5067	2.28	<20	92	0.2	7.6	<3	<0.01	<0.05	<0.5	7.9	5.1	<1	<50	33
96 KKA 5068	2.25	<20	64	<0.1	6.7	<3	<0.01	<0.05	<0.5	8.3	2.4	<1	<50	32
96 KKA 5069	2.17	140	68	<0.1	6.1	<3	<0.01	<0.05	<0.5	8.2	3.5	<1	83	31
96 KKA 5070	2.32	<20	61	<0.1	6.2	<3	<0.01	<0.05	1.5	9.7	3.3	<1	<50	37
96 KKA 5071	2.29	<20	72	0.2	8.1	<3	<0.01	<0.05	<0.5	11	3.7	<1	<50	41
96 KKA 5072	2.09	<20	75	<0.1	7.8	<3	<0.01	<0.05	<0.5	9.6	4.6	<1	72	40
96 KKA 5073	2.22	<20	89	0.2	6.6	<3	<0.01	<0.05	<0.5	8.3	3.9	<1	<50	30
96 KKA 5074	2.16	<20	76	<0.1	7.7	<3	<0.01	<0.05	<0.5	8.6	3.8	<1	51	33
96 KKA 5075	2.22	<20	84	<0.1	7.7	<3	<0.01	<0.05	<0.5	9.5	2.9	<1	68	36
96 KKA 5076	2.13	<20	72	0.4	7.1	<3	<0.01	<0.05	<0.5	12	3.7	<1	<50	44
96 KKA 5077	2.38	<20	78	<0.1	7.3	<3	<0.01	<0.05	1.3	10	3.7	<1	<50	36
96 KKA 5078	2.16	<20	100	<0.1	7.9	<3	<0.01	<0.05	<0.5	9.3	3.1	<1	<50	37
96 KKA 5079	1.9	<20	61	<0.1	6.9	<3	<0.01	<0.05	<0.5	8.4	2.3	<1	<50	29
96 KKA 5080	2.21	<20	53	<0.1	8	<3	<0.01	<0.05	<0.5	8.4	2.3	<1	<50	33
96 KKA 5081	2.25	<20	62	<0.1	8.4	<3	<0.01	<0.05	<0.5	12	3.4	<1	<50	47
96 KKA 5082	2.42	<20	60	<0.1	6.7	<3	<0.01	<0.05	<0.5	8.2	2	<1	80	32
96 KKA 5083	2.04	<20	52	0.2	9.5	<3	<0.01	<0.05	<0.5	8.9	2.8	<1	<50	35
96 KKA 5084	1.96	<20	41	0.3	5.9	<3	<0.01	<0.05	<0.5	7.2	2.1	<1	<50	25
96 KKA 5085	2.15	60	59	0.3	7.3	<3	<0.01	<0.05	<0.5	10	3.1	<1	77	36
96 KKA 5086	2.22	<20	65	0.2	6.9	<3	<0.01	<0.05	<0.5	9.3	2.5	<1	110	35
96 KKA 5087	2.27	160	46	0.2	7.4	<3	<0.01	<0.05	<0.5	9	3.5	<1	101	34
96 KKA 5088	2.14	<20	46	<0.1	7.5	<3	<0.01	<0.05	<0.5	8.9	2.8	<1	86	33
96 KKA 5089	2.2	<20	51	<0.1	7.6	<3	<0.01	<0.05	1.7	7.9	2.2	<1	<50	31
96 KKA 5090	2.18	110	60	<0.1	6.7	<3	<0.01	<0.05	<0.5	8.3	2.6	<1	<50	31
96 KKA 5091	2.11	<20	55	0.2	6.4	<3	<0.01	<0.05	<0.5	8.5	2.2	<1	<50	29
96 KKA 5092	2.15	<20	64	0.3	7.6	<3	<0.01	<0.05	<0.5	8.5	2.2	<1	<50	33
96 KKA 5093	2.14	<20	53	<0.1	5.9	<3	<0.01	<0.05	<0.5	6	2.1	<1	<50	22
96 KKA 5094	2.18	<20	60	0.2	6.7	<3	<0.01	<0.05	<0.5	9.7	2	<1	<50	35

Appendix C: INAA data (<0.063 mm)

Sample	Ce ppm	Nd ppm	Sm ppm	Eu ppm	Tb ppm	Yb ppm	Lu ppm	Mass gm
96 KKA 5063	60	28	4.7	1.2	<0.5	2.1	0.32	33.13
96 KKA 5064	55	22	4.2	1.2	<0.5	2	0.28	30.56
96 KKA 5065	58	24	4.7	1.4	<0.5	2	0.32	32.41
96 KKA 5066	77	34	6.2	1.7	0.6	2.2	0.37	28.75
96 KKA 5067	62	22	4.9	1.5	0.6	1.9	0.32	24.72
96 KKA 5068	62	29	4.9	1.4	0.8	2	0.33	30.02
96 KKA 5069	52	25	4.6	1.1	<0.5	2.1	0.33	29.47
96 KKA 5070	68	25	5.5	1.5	<0.5	2.2	0.39	29.42
96 KKA 5071	79	28	6.1	1.6	<0.5	2.8	0.39	26.94
96 KKA 5072	73	34	5.7	1.4	0.9	2.1	0.39	30.62
96 KKA 5073	55	21	4.4	1.4	<0.5	1.8	0.3	28.39
96 KKA 5074	59	29	4.8	1.4	0.7	2	0.34	27.18
96 KKA 5075	68	26	5.3	1.5	<0.5	2.2	0.33	27.62
96 KKA 5076	78	33	6.3	1.4	0.8	2.8	0.41	29.73
96 KKA 5077	68	32	5.4	1.5	<0.5	2.1	0.32	28.06
96 KKA 5078	70	31	5.3	1.5	0.7	2.5	0.37	29.54
96 KKA 5079	53	19	4.1	1.1	<0.5	2	0.33	30.18
96 KKA 5080	57	33	4.8	1.3	0.7	2.1	0.3	27.96
96 KKA 5081	83	39	6.7	1.7	0.7	3	0.47	28.93
96 KKA 5082	58	27	4.7	1.4	<0.5	2.2	0.33	31.51
96 KKA 5083	61	32	5.2	1.3	<0.5	2.5	0.4	25.18
96 KKA 5084	44	19	3.5	1	<0.5	1.6	0.3	31.52
96 KKA 5085	66	27	5.2	1.4	<0.5	2.5	0.35	32.43
96 KKA 5086	62	27	5	1.4	<0.5	2.3	0.35	32.44
96 KKA 5087	61	27	4.9	1.4	<0.5	2.3	0.33	30.78
96 KKA 5088	60	21	4.6	1.3	<0.5	2.1	0.32	31.33
96 KKA 5089	54	20	4.5	1.3	<0.5	2	0.33	31.45
96 KKA 5090	56	28	4.6	1.2	<0.5	2.1	0.29	32.7
96 KKA 5091	51	24	4.3	1.2	0.6	2.1	0.35	34.32
96 KKA 5092	58	25	4.7	1.2	<0.5	2.1	0.32	28.46
96 KKA 5093	39	18	3.4	1.1	<0.5	1.5	0.27	35.39
96 KKA 5094	59	25	4.9	1.4	<0.5	2	0.35	30.82

Appendix C: INAA data (<0.063 mm)

Sample	Au ppb	Ag ppm	As ppm	Ba ppm	Br ppm	Ca %	Co ppm	Cr ppm	Cs ppm	Fe %	Hf ppm	Hg ppm	Ir ppm	Mo ppm
96 KKA 5095	25	<5	7	580	5.4	1	7	57	2	2.12	9	<1	<5	<1
96 KKA 5096	<2	<5	1.9	460	5.4	1	5	24	1	1.37	10	<1	<5	2
96 KKA 5097	10	<5	7	610	4.9	<1	7	45	2	2.16	8	<1	<5	<1
96 KKA 5098	5	<5	3.1	800	<0.5	<1	9	50	2	2.56	8	<1	<5	2
96 KKA 5099	<2	<5	5.8	680	5.3	<1	9	51	3	2.49	7	<1	<5	<1
96 KKA 5100	<2	<5	3.6	450	2.9	2	7	48	2	2.11	7	<1	<5	2
96 KKA 5101	<2	<5	9.7	610	4.9	<1	8	41	2	1.97	9	<1	<5	2
96 KKA 5102	7	<5	19	520	3.5	<1	6	48	2	2.01	11	<1	<5	3
96 KKA 5103	5	<5	5.3	670	<0.5	1	8	52	3	2.22	8	<1	<5	<1
96 KKA 5104	<2	<5	7.3	590	2.8	2	8	48	3	2.01	7	<1	<5	<1
96 KKA 5105	<2	<5	5.1	610	1.8	2	6	45	2	1.84	9	<1	<5	2
96 KKA 5106	<2	<5	5.1	560	3.6	2	8	67	2	1.98	8	<1	<5	<1
96 KKA 5107	<2	<5	5.4	570	3.2	<1	6	54	2	2.08	7	<1	<5	<1
96 KKA 5108	<2	<5	5.2	650	3	1	6	53	2	2.03	6	<1	<5	<1
96 KKA 5109	4	<5	5.2	610	2.9	<1	6	56	2	2.19	11	<1	<5	<1
96 KKA 5110	<2	<5	5.7	560	13	1	8	51	3	2.41	8	<1	<5	5
96 KKA 5112	5	<5	5.5	550	2.8	2	7	47	2	2.27	8	<1	<5	4

Appendix C: INAA data (<0.063 mm)

Sample	Na %	Ni ppm	Rb ppm	Sb ppm	Sc ppm	Se ppm	Sn %	Sr %	Ta ppm	Th ppm	U ppm	W ppm	Zn ppm	La ppm
96 KKA 5095	2.14	<20	51	<0.1	7.6	<3	<0.01	<0.05	0.8	9.9	3.3	<1	51	36
96 KKA 5096	1.22	71	45	0.2	4.2	<3	<0.01	<0.05	<0.5	6.7	2.3	<1	<50	22
96 KKA 5097	2.22	<20	53	<0.1	7.2	<3	<0.01	<0.05	1.2	8.2	2.6	<1	65	32
96 KKA 5098	1.74	<20	90	0.3	7.7	<3	<0.01	<0.05	<0.5	9.3	3.1	<1	72	39
96 KKA 5099	1.89	<20	78	0.3	8	<3	<0.01	0.06	<0.5	9.1	2.9	<1	57	31
96 KKA 5100	2.16	<20	55	0.3	7.4	<3	<0.01	<0.05	<0.5	7.8	2.2	<1	<50	33
96 KKA 5101	2.11	<20	62	0.2	6.7	<3	<0.01	<0.05	<0.5	10	3.6	<1	75	37
96 KKA 5102	2.15	93	61	0.2	7.1	<3	<0.01	<0.05	1.6	14	4.1	<1	89	51
96 KKA 5103	2.25	<20	64	<0.1	8	<3	<0.01	<0.05	<0.5	9.4	3.6	<1	97	35
96 KKA 5104	2.4	95	62	<0.1	7	<3	<0.01	0.05	1	9.2	3.7	<1	64	34
96 KKA 5105	2.14	<20	59	<0.1	7.2	<3	<0.01	<0.05	<0.5	11	3	<1	<50	40
96 KKA 5106	2.02	<20	42	0.2	7.6	<3	<0.01	<0.05	<0.5	8.8	4.2	<1	81	33
96 KKA 5107	2.18	<20	50	0.2	7.5	<3	<0.01	<0.05	<0.5	8.3	2.8	<1	<50	33
96 KKA 5108	2.33	<20	67	<0.1	7.3	<3	<0.01	<0.05	1.1	7.9	3.6	<1	<50	29
96 KKA 5109	2.17	<20	69	<0.1	8.5	<3	<0.01	0.06	1.1	13	5.1	<1	100	51
96 KKA 5110	2.06	<20	68	0.3	7.8	<3	<0.01	<0.05	<0.5	9.3	1.9	<1	104	35
96 KKA 5112	2.14	<20	52	<0.1	7.7	<3	<0.01	<0.05	1.3	9	2.9	<1	71	34

Appendix C: INAA data (<0.063 mm)

Sample	Ce ppm	Nd ppm	Sm ppm	Eu ppm	Tb ppm	Yb ppm	Lu ppm	Mass gm
96 KKA 5095	63	29	5.2	1.3	<0.5	2.4	0.4	26.48
96 KKA 5096	40	14	3.1	1	<0.5	1.8	0.31	32.77
96 KKA 5097	57	23	4.6	1.3	<0.5	2.2	0.33	27.83
96 KKA 5098	72	31	5.5	1.5	<0.5	2.5	0.37	27.91
96 KKA 5099	59	26	4.5	1.3	<0.5	2	0.37	26
96 KKA 5100	61	25	4.8	1.3	<0.5	2	0.33	28.56
96 KKA 5101	67	28	5.2	1.3	0.6	2.5	0.41	30.75
96 KKA 5102	89	43	7.2	1.5	<0.5	3.3	0.56	30.21
96 KKA 5103	61	31	5	1.4	0.8	2.2	0.4	27.06
96 KKA 5104	60	25	4.9	1.3	<0.5	2.3	0.34	27.56
96 KKA 5105	74	32	5.7	1.5	<0.5	2.7	0.46	31.06
96 KKA 5106	61	31	4.8	1.2	0.5	2	0.35	27.86
96 KKA 5107	57	22	4.5	1.3	<0.5	2	0.36	30.41
96 KKA 5108	52	24	4.3	1.2	0.7	1.8	0.29	25.07
96 KKA 5109	91	36	7.2	1.7	0.8	3.2	0.48	27.55
96 KKA 5110	68	30	5	1.4	0.7	2.3	0.3	25.52
96 KKA 5112	60	29	4.9	1.4	0.9	2.1	0.33	30.52

Appendix D: Gold grain data

			Gold grain counts				Non-mag	*Estimated ppb value*			
Easting	Northing	Sample	Total	Res	Mod	Prist	wt (g)*	Total	Res	Mod	Prist
476240	7281870	96 KKA 5000	4	4	0	0	24.3	28	28	0	0
473570	7293519	96 KKA 5003	4	4	0	0	19.7	19	19	0	0
544737	7287006	96 KKA 5006	1	1	0	0	19.4	10	10	0	0
539730	7274810	96 KKA 5010	1	1	0	0	19.0	34	34	0	0
528874	7269968	96 KKA 5017	0	0	0	0	15.7	0	0	0	0
530069	7289538	96 KKA 5021	1	1	0	0	16.4	39	39	0	0
538889	7298547	96 KKA 5025	7	6	1	0	18.1	998	987	11	0
526247	7304970	96 KKA 5029	1	1	0	0	19.7	4	4	0	0
539615	7311095	96 KKA 5032	14	8	6	0	25.1	1906	1860	46	0
526664	7319157	96 KKA 5034	0	0	0	0	9.4	0	0	0	0
470655	7309840	96 KKA 5041	12	9	2	1	20.0	309	303	2	4
460322	7318807	96 KKA 5045	10	2	8	0	18.9	37	9	29	0
515430	7266430	96 KKA 5050	8	7	1	0	23.0	18440	90	18350	0
507835	7276200	96 KKA 5055	17	16	1	0	23.0	80	78	2	0
515067	7285618	96 KKA 5061	2	2	0	0	18.7	3	3	0	0
504110	7294278	96 KKA 5064	1	1	0	0	20.6	9	9	0	0
520965	7295960	96 KKA 5066	1	0	0	0	16.6	12	0	12	0
506904	7311219	96 KKA 5074	1	1	0	0	15.9	24	24	0	0
489294	7270222	96 KKA 5083	1	1	0	0	21.7	4	4	0	0
498880	7278710	96 KKA 5088	2	2	0	0	19.9	8	8	0	0
488926	7287158	96 KKA 5092	10	7	3	0	17.3	41	28	13	0
497550	7319090	96 KKA 5097	2	1	1	0	18.9	11	1	10	0
491271	7307559	96 KKA 5100	1	1	0	0	18.9	1	1	0	0
487810	7298555	96 KKA 5104	0	0	0	0	21.3	0	0	0	0
Total			101	77	23	1					
* Weight of non-magnetic heavy mineral fraction											
Gold grain shape (DiLabio, 1990):											
Res=reshaped		Mod=modified			Prist=pristine						

Appendix E: Standards and duplicates for ICP-AES analyses (<0.002 mm)

Sample	Ag ppm	Al %	As ppm	Ba ppm	Be ppm	Bi ppm	Ca %	Cd ppm	Co ppm	Cr ppm	Cu ppm	Fe %	Ga ppm	Hg ppm	K %
Detection limit	0.2	0.01	2	10	0.5	2	0.01	0.5	1	1	1	0.01	10	1	0.01
96 KKA 5003	<0.2	4.46	32	80	1	<2	0.1	<0.5	16	78	58	4.48	<10	<1	0.25
96 KKA 5003 dup	<0.2	5.13	36	90	1.5	<2	0.2	<0.5	16	90	65	5.04	10	<1	0.28
96 KKA 5012	0.2	4.95	<2	170	1	<2	0.1	<0.5	20	140	105	5.39	10	<1	0.7
96 KKA 5012 dup	0.2	4.73	6	160	1	<2	0.1	<0.5	17	140	99	5.77	10	<1	0.74
96 KKA 5028	<0.2	3.67	12	90	0.5	<2	0.2	<0.5	26	90	55	5.41	10	<1	0.36
96 KKA 5028 dup	<0.2	3.79	14	90	1	<2	0.2	<0.5	22	94	58	5.54	10	<1	0.39
96 KKA 5041	0.2	4.22	40	80	1	<2	0.1	<0.5	14	89	60	5.43	10	<1	0.22
96 KKA 5041 dup	<0.2	4.29	34	80	1	<2	0.1	<0.5	14	93	61	5.41	10	<1	0.23
96 KKA 5051	0.2	4.36	44	60	0.5	<2	0.1	<0.5	6	80	56	4.83	<10	<1	0.15
96 KKA 5051 dup	0.2	4.33	42	50	0.5	<2	0.1	<0.5	6	83	57	4.76	<10	<1	0.14
96 KKA 5070	<0.2	3.88	38	110	1	<2	0.3	<0.5	28	88	97	4.93	10	<1	0.45
96 KKA 5070 dup	<0.2	4.02	40	120	1	<2	0.3	<0.5	27	90	99	4.78	10	<1	0.48
96 KKA 5081	<0.2	4.04	32	110	1	<2	0.2	<0.5	23	129	96	6.13	10	<1	0.38
96 KKA 5081 dup	<0.2	3.97	32	110	1	<2	0.2	<0.5	21	129	97	6.03	10	<1	0.37
96 KKA 5094	0.2	3.48	48	110	0.5	<2	0.3	<0.5	33	87	105	4.24	<10	<1	0.45
96 KKA 5094 dup	<0.2	3.25	52	100	0.5	<2	0.2	<0.5	31	82	99	3.98	<10	<1	0.41
96 KKA 5110	<0.2	4.85	20	100	1.5	<2	0.2	<0.5	22	73	63	5.22	10	<1	0.23
96 KKA 5110 dup	<0.2	4.8	26	100	1.5	<2	0.2	<0.5	22	71	62	5.2	10	<1	0.22

Standard ICP-AES (TCA 8010)

Sample	Ag ppm	Al %	As ppm	Ba ppm	Be ppm	Bi ppm	Ca %	Cd ppm	Co ppm	Cr ppm	Cu ppm	Fe %	Ga ppm	Hg ppm	K %
Detection limit	0.2	0.01	2	10	0.5	2	0.01	0.5	1	1	1	0.01	10	1	0.01
min	<0.2	0	<2	0	0	0	0	0	0	0	0	0	0	0	0
mean	<0.2	0.68	1.7	21	0	0	0.32	0	4.6	19	23	1.18	0	0	0.03
max	<0.2	1.02	4	30	0	0	0.49	0	7	28	34	1.78	0	0	0.05
Lab standard	<0.2	0.97	6	30	<0.5	<2	0.4	<0.5	7	26	32	1.68	<10	<1	0.05
Lab standard	<0.2	0.97	6	30	<0.5	<2	0.4	<0.5	7	26	33	1.68	<10	<1	0.05

Appendix E: Standards and duplicates for ICP-AES analyses (<0.002 mm)

Sample	La ppm	Mg %	Mn ppm	Mo ppm	Na %	Ni ppm	Pb ppm	Sb ppm	Sc ppm	Sr ppm	Ti %	U ppm	V ppm	W ppm	Zn ppm
Detection limit	10	0.01	5	1	0.01	1	2	2	1	1	0.01	10	1	10	2
96 KKA 5003	30	0.6	245	<1	0.9	30	8	<2	5	13	0.1	<10	73	<10	42
96 KKA 5003 dup	30	0.7	280	3	0.8	34	10	<2	6	17	0.13	<10	83	<10	48
96 KKA 5012	20	1.4	330	3	0.9	56	14	<2	11	12	0.16	<10	118	<10	102
96 KKA 5012 dup	20	1.5	325	4	0.8	59	14	<2	11	14	0.2	<10	121	<10	104
96 KKA 5028	50	1.2	490	1	0.6	42	14	<2	8	20	0.15	<10	103	<10	78
96 KKA 5028 dup	50	1.3	505	3	0.5	45	16	2	9	27	0.16	<10	111	<10	82
96 KKA 5041	30	0.9	250	2	0.9	34	12	<2	7	14	0.14	<10	97	<10	52
96 KKA 5041 dup	40	0.9	255	3	0.8	36	12	<2	7	17	0.16	<10	101	<10	54
96 KKA 5051	10	0.3	110	4	1.1	15	6	2	5	12	0.1	<10	67	<10	24
96 KKA 5051 dup	10	0.3	115	4	0.9	17	8	<2	5	13	0.11	<10	67	<10	26
96 KKA 5070	40	1.2	410	2	0.8	62	12	<2	8	21	0.13	<10	78	<10	84
96 KKA 5070 dup	40	1.3	425	3	0.7	64	16	<2	8	28	0.15	<10	82	<10	90
96 KKA 5081	30	1.2	270	2	0.8	70	8	<2	10	16	0.14	<10	125	<10	88
96 KKA 5081 dup	40	1.2	265	2	0.8	73	8	4	9	18	0.14	<10	126	<10	92
96 KKA 5094	30	1.2	455	1	0.6	77	12	2	7	17	0.11	<10	66	<10	90
96 KKA 5094 dup	30	1.2	430	1	0.6	74	14	<2	6	16	0.1	<10	63	<10	90
96 KKA 5110	30	1	655	1	0.8	43	12	<2	7	17	0.13	<10	91	<10	58
96 KKA 5110 dup	30	1	635	1	0.7	42	12	2	6	17	0.13	<10	91	<10	58

Sample	La ppm	Mg %	Mn ppm	Mo ppm	Na %	Ni ppm	Pb ppm	Sb ppm	Sc ppm	Sr ppm	Ti %	U ppm	V ppm	W ppm	Zn ppm
Detection limit	10	0.01	5	1	0.01	1	2	2	1	1	0.01	10	1	10	2
min	0	0	0	0	0.00	0	0	0	0	0	0	0	0	0	0
mean	7.1	0.30	156	0	0.01	10.7	1.4	0.3	3.5	14.6	0.06	0	21	0	20
max	10	0.44	235	0	0.01	16	4	2	6	22	0.09	0	31	0	30
Lab standard	20	0.4	225	<1	<0.01	16	4	<2	5	28	0.08	<10	30	<10	30
Lab standard	20	0.4	220	<1	<0.01	17	4	2	5	29	0.08	<10	30	<10	32

Appendix F: Standards and duplicates for INAA analyses (<0.063 mm)

Sample	Au ppb	Ag ppm	As ppm	Ba ppm	Br ppm	Ca %	Co ppm	Cr ppm	Cs ppm	Fe %	Hf ppm	Hg ppm	Ir ppm	Mo ppm
Detection limit	2	5	0.5	50	0.5	1	1	5	1	0.01	1	1	5	1
96 KKA 5005	<2	<5	4.5	540	3.6	2	5	45	2	1.87	9	<1	<5	3
96 KKA 5005 dup	10	<5	4.3	560	4.5	2	6	47	2	1.99	9	<1	<5	<1
96 KKA 5015	<2	<5	5.4	590	6.7	<1	7	62	2	2.39	8	<1	<5	3
96 KKA 5015 dup	<2	<5	4.6	570	7.6	1	7	58	3	2.37	7	<1	<5	4
96 KKA 5025	<2	<5	3.6	500	3.2	1	7	34	2	1.89	9	<1	<5	4
96 KKA 5025 dup	8	<5	4.1	510	3	<1	7	43	2	1.96	8	<1	<5	4
96 KKA 5035	4	<5	1.6	500	<0.5	<1	6	50	2	1.9	8	<1	<5	<1
96 KKA 5035 dup	8	<5	2.8	530	2	2	7	51	2	2.24	9	<1	<5	<1
96 KKA 5045	<2	<5	4.6	530	7.8	<1	6	43	2	1.88	7	<1	<5	<1
96 KKA 5045 dup	<2	<5	4.8	630	8.6	<1	6	41	3	2.11	7	<1	<5	<1
96 KKA 5055	10	<5	3.5	530	5.4	1	5	49	2	1.94	8	<1	<5	<1
96 KKA 5055 dup	<2	<5	4.2	600	6	<1	6	57	2	2.15	9	<1	<5	4
96 KKA 5065	<2	<5	3.2	540	2.4	<1	5	40	2	1.61	7	<1	<5	1
96 KKA 5065 dup	<2	<5	3.9	600	3.1	2	6	46	2	2.01	8	<1	<5	3
96 KKA 5075	6	<5	3.9	630	3.6	<1	8	47	3	2.15	8	<1	<5	<1
96 KKA 5075 dup	<2	<5	3.4	690	3.2	2	7	44	3	2.05	8	<1	<5	<1
96 KKA 5085	6	<5	5.8	660	7.2	<1	5	47	2	2.09	9	<1	<5	<1
96 KKA 5085 dup	31	<5	5.8	470	7.5	2	6	46	2	2.15	9	<1	<5	5
96 KKA 5095	25	<5	7	580	5.4	1	7	57	2	2.12	9	<1	<5	<1
96 KKA 5095 dup	<2	<5	5.3	630	5.6	2	7	64	2	2.22	8	<1	<5	<1
Standard INAA (TCA 8010)														
min	159	<5	5	480	<0.5	<1	8	56	<1	2.15	8	<1	<5	<1
mean	236	23	6	583	2.2	2	9	61	1	2.41	8	<1	3	<1
max	411	25	8.7	650	3.2	3	10	64	1	2.74	9	<1	<5	6
Lab standard	162	<5	6.2	640	2.4	2	8	50	1	2.27	7	<1	<5	<1
Lab standard	155	<5	5.8	710	<0.5	2	8	49	1	2.26	8	<1	<5	<1
min, mean, max based on 7 samples														

Appendix F: Standards and duplicates for INAA analyses (<0.063 mm)

Sample	Na %	Ni ppm	Rb ppm	Sb ppm	Sc ppm	Se ppm	Sn %	Sr %	Ta ppm	Th ppm	U ppm	W ppm	Zn ppm	La ppm
Detection limit	0.01	20	5	0.1	0.1	3	0.01	0.05	0.5	0.2	0.5	1	50	0.5
96 KKA 5005	1.92	<20	28	0.2	6.4	<3	<0.01	<0.05	<0.5	9.8	2.9	<1	<50	32
96 KKA 5005 dup	2.1	<20	69	0.2	7	<3	<0.01	<0.05	<0.5	9.6	3.1	<1	<50	33
96 KKA 5015	2.17	<20	81	<0.1	8.1	<3	<0.01	<0.05	<0.5	6.9	2.3	<1	<50	28
96 KKA 5015 dup	2.01	<20	65	0.1	8	<3	<0.01	<0.05	<0.5	7.3	2.3	<1	69	26
96 KKA 5025	1.99	<20	77	<0.1	6.6	<3	<0.01	<0.05	<0.5	8.8	2	<1	<50	29
96 KKA 5025 dup	1.97	<20	59	0.2	6.8	<3	<0.01	<0.05	<0.5	9	2.5	<1	67	27
96 KKA 5035	1.89	89	41	<0.1	7.3	<3	<0.01	<0.05	<0.5	7.8	2.8	<1	79	34
96 KKA 5035 dup	2.01	<20	47	0.2	8.3	<3	<0.01	<0.05	1.6	10	2.6	<1	<50	39
96 KKA 5045	2.28	<20	55	<0.1	6.4	<3	<0.01	<0.05	<0.5	8.5	2.4	<1	<50	35
96 KKA 5045 dup	2.31	<20	80	<0.1	6.7	<3	<0.01	<0.05	<0.5	9.4	3	<1	114	35
96 KKA 5055	2.01	<20	38	<0.1	7.4	<3	<0.01	<0.05	1.5	9.2	2.2	<1	<50	35
96 KKA 5055 dup	2.2	<20	37	<0.1	8.1	<3	<0.01	<0.05	1.3	11	2.8	<1	<50	37
96 KKA 5065	2.14	<20	72	<0.1	5.8	<3	<0.01	<0.05	<0.5	9.1	2.6	<1	<50	33
96 KKA 5065 dup	2.43	<20	55	0.3	6.9	<3	<0.01	<0.05	<0.5	9.6	2.6	<1	<50	37
96 KKA 5075	2.22	<20	84	<0.1	7.7	<3	<0.01	<0.05	<0.5	9.5	2.9	<1	68	36
96 KKA 5075 dup	2.08	<20	66	0.3	7.4	<3	<0.01	<0.05	<0.5	8.9	2.5	<1	<50	35
96 KKA 5085	2.15	60	59	0.3	7.3	<3	<0.01	<0.05	<0.5	10	3.1	<1	77	36
96 KKA 5085 dup	2.07	<20	58	0.2	7.4	<3	<0.01	0.08	<0.5	10	2.4	<1	62	36
96 KKA 5095	2.14	<20	51	<0.1	7.6	<3	<0.01	<0.05	0.8	9.9	3.3	<1	51	36
96 KKA 5095 dup	2.12	<20	47	<0.1	8	<3	<0.01	<0.05	<0.5	10	2.5	<1	<50	35
min	2.17	<20	33	2.4	9.0	<3	<0.01	<0.05	0.3	5.0	<0.5	<1	25	26
mean	2.32	<20	49	3.0	10.5	<3	<0.01	<0.05	0.6	5.8	1.3	<1	61	28
max	2.41	<20	62	3.3	11.0	<3	<0.01	<0.05	1.4	6.0	1.9	<1	173	30
Lab standard	2.13	<20	57	2.5	9.2	<3	<0.01	<0.05	<0.5	5.8	1.2	<1	<50	25
Lab standard	2.11	<20	48	2.5	9	<3	<0.01	<0.05	1.7	5.8	<0.5	<1	65	24

Appendix F: Standards and duplicates for INAA analyses (<0.063 mm)

Sample	Ce ppm	Nd ppm	Sm ppm	Eu ppm	Tb ppm	Yb ppm	Lu ppm	Mass gm
Detection limit	3	5	0.1	0.2	0.5	0.2	0.05	
96 KKA 5005	57	22	4.5	1.4	<0.5	2.1	0.34	36.7
96 KKA 5005 dup	60	26	4.7	1.2	0.6	2.2	0.36	35.43
96 KKA 5015	50	17	3.8	1	<0.5	1.9	0.33	29.71
96 KKA 5015 dup	50	21	3.7	1.1	0.8	2	0.3	30.06
96 KKA 5025	54	27	4	1.2	<0.5	2.4	0.33	31.07
96 KKA 5025 dup	51	23	4	1.1	0.7	2.3	0.36	30.8
96 KKA 5035	58	28	4.4	1.2	<0.5	2.1	0.36	28.12
96 KKA 5035 dup	71	30	5.5	1.4	0.7	2.8	0.41	31.58
96 KKA 5045	65	24	4.6	1.2	<0.5	2	0.31	27.24
96 KKA 5045 dup	60	25	4.9	1.4	0.9	2	0.35	18.67
96 KKA 5055	61	27	4.9	1.3	<0.5	2.2	0.32	28.66
96 KKA 5055 dup	67	26	5.4	1.3	0.8	2.3	0.35	30.38
96 KKA 5065	58	24	4.7	1.4	<0.5	2	0.32	32.41
96 KKA 5065 dup	69	34	5.6	1.5	<0.5	2.3	0.32	29.49
96 KKA 5075	68	26	5.3	1.5	<0.5	2.2	0.33	27.62
96 KKA 5075 dup	63	28	4.8	1.4	<0.5	2.1	0.34	30.15
96 KKA 5085	66	27	5.2	1.4	<0.5	2.5	0.35	32.43
96 KKA 5085 dup	68	27	5.2	1.4	0.7	2.2	0.38	30.27
96 KKA 5095	63	29	5.2	1.3	<0.5	2.4	0.4	26.48
96 KKA 5095 dup	62	30	5.2	1.3	<0.5	2.1	0.38	27.5
min	45	20	3.7	1.0	<0.5	1.9	0.26	---
mean	51	23	4.0	1.2	<0.5	2.0	0.29	---
max	53	25	4.3	1.3	0.6	2.0	0.31	---
Lab standard	45	17	3.7	1.1	0.6	1.9	0.27	34.28
Lab standard	43	22	3.7	1.2	0.6	1.8	0.32	34.79

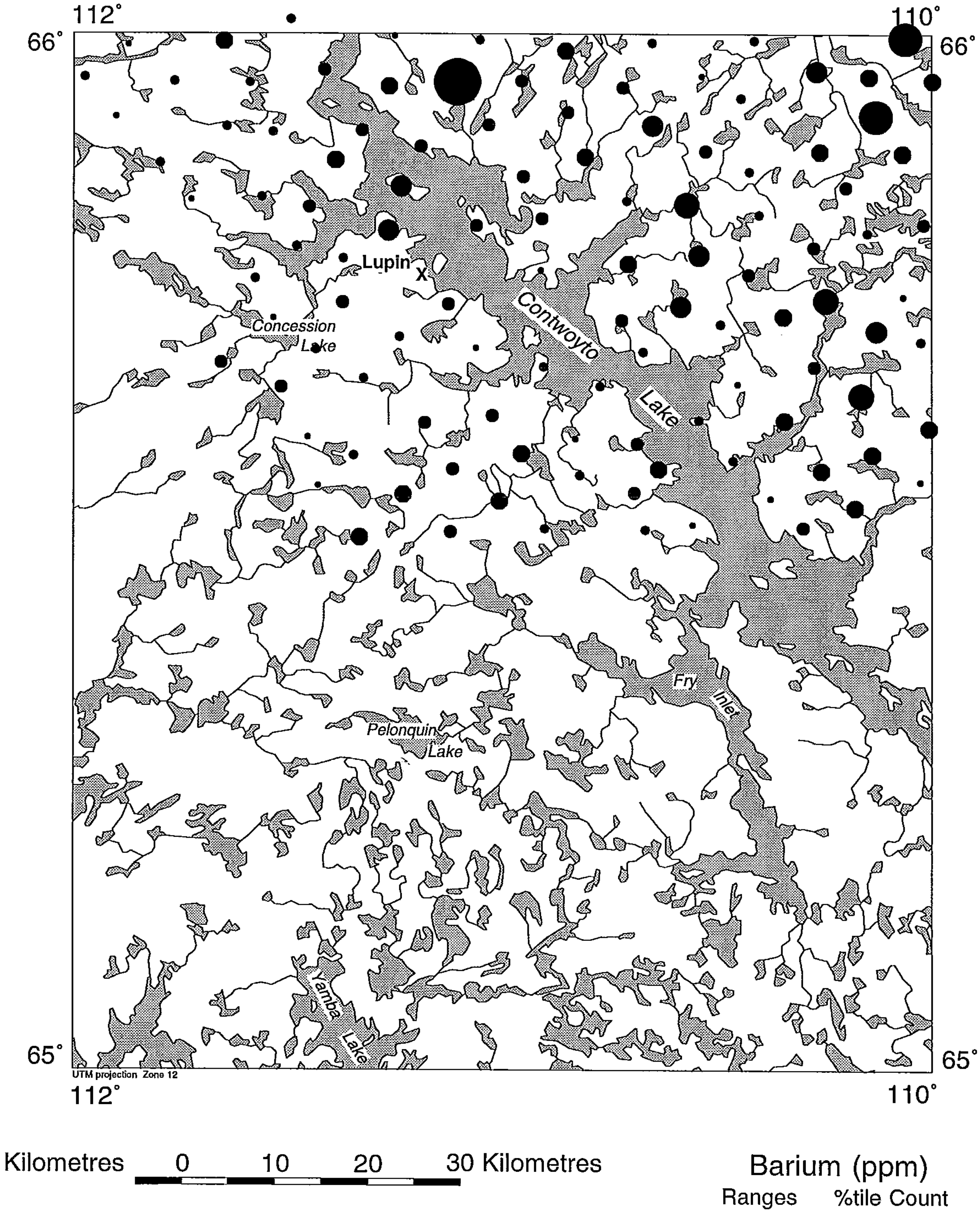
Appendix G. Maps and histograms of element concentrations determined by ICP-AES (< 0.002 mm fraction)

List of elements depicted on maps and histograms:

Ba
Be
Co
Cr
Cu
Fe
K
La
Mg
Mn
Ni
Pb
Sc
Sr
Ti
V
Zn

Abbreviations for Descriptive Statistics:

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



Ba

Contwoyto Lake (76E, N/2)

Barium (ppm)

Ranges	%tile	Count
255 - 280	100	(1)
201 - 255	99	(2)
179 - 201	97	(3)
160 - 179	95	(7)
120 - 160	90	(21)
100 - 120	75	(29)
80 - 100	50	(33)
< 80	25	(16)

Till geochemistry, Contwoyto Lake NTS 76 E (N/2)

BARIUM

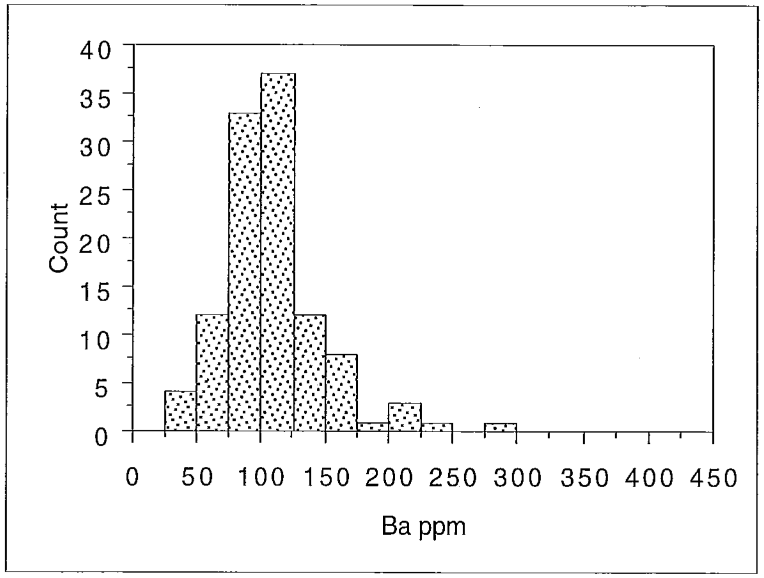
Ba (ppm)

Fraction:	<0.002 mm	Detection limit:	10 ppm
Method:	ICP-AES	Preparation:	Nitric acid-aqua regia partial leach

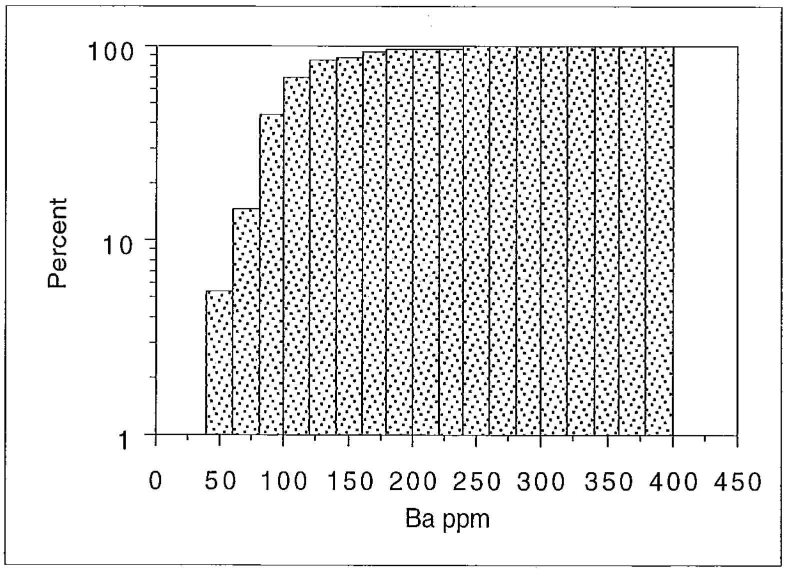
Descriptive Statistics

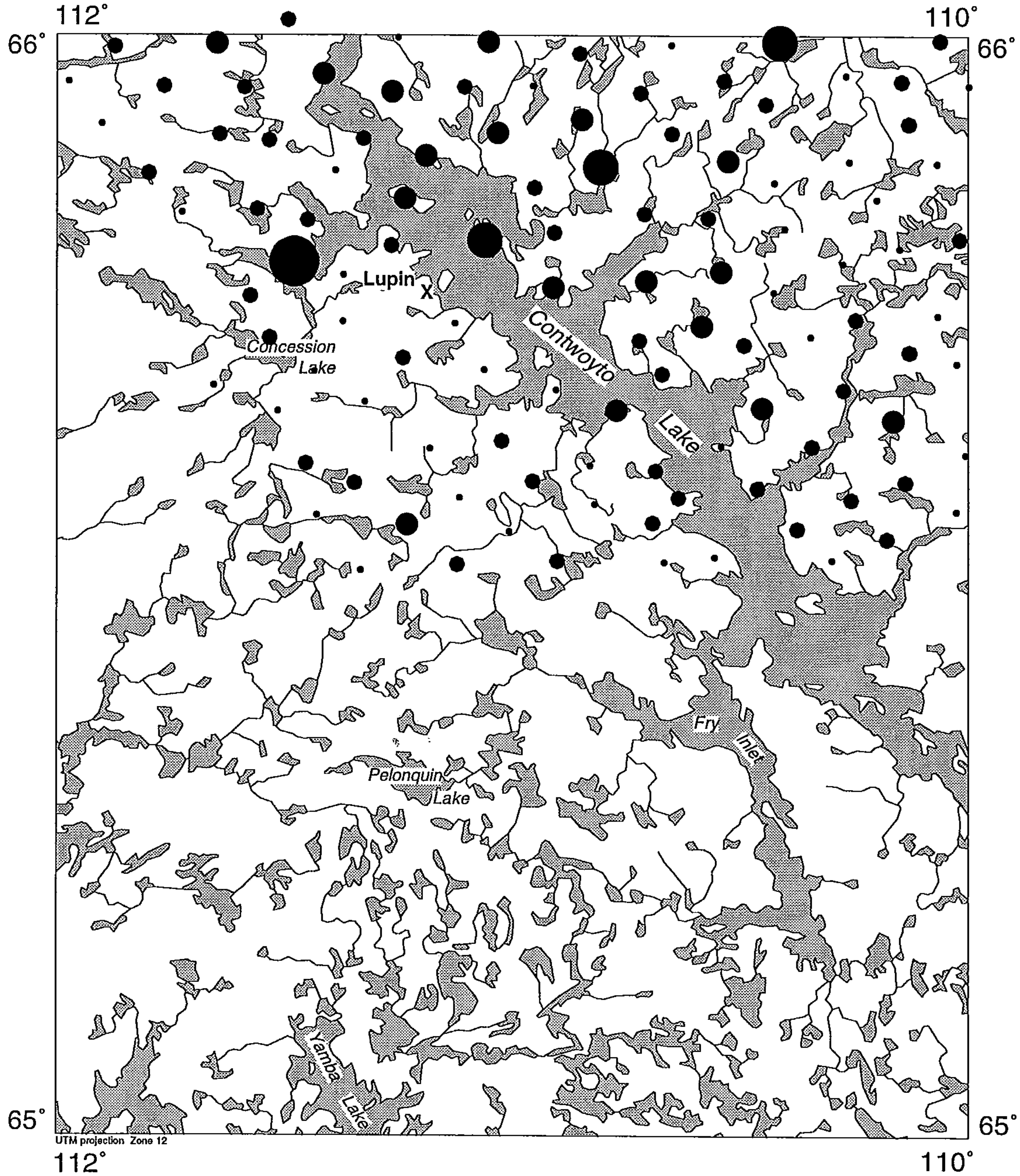
Count:	112
Minimum:	30
Maximum:	280
Mean:	106.16
Median:	100
Mode:	
St. deviation:	40.03
Coeff. var:	0.38
Geom. mean	99.34
Skewness:	1.33
Kurtosis:	3.28

Frequency Histogram



Cumulative Plot





Kilometres 0 10 20 30 Kilometres

Berylium (ppm)

Ranges	%tile	Count
2.7 - 3	100	(1)
2 - 2.7	99	(3)
1.5 - 2	97	(17)
1 - 1.5	95	(49)
< 1	75	(42)

Be

Contwoyto Lake (76E, N/2)

Till geochemistry, Contwoyto Lake NTS 76 E (N/2)

BERYLLIUM

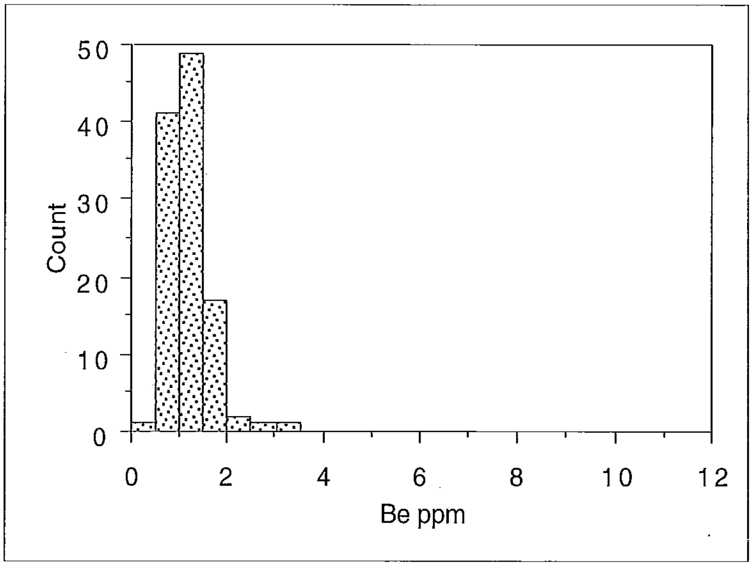
Be (ppm)

Fraction:	<0.002 mm	Detection limit:	0.5 ppm
Method:	ICP-AES	Preparation:	Nitric acid-aqua regia partial leach

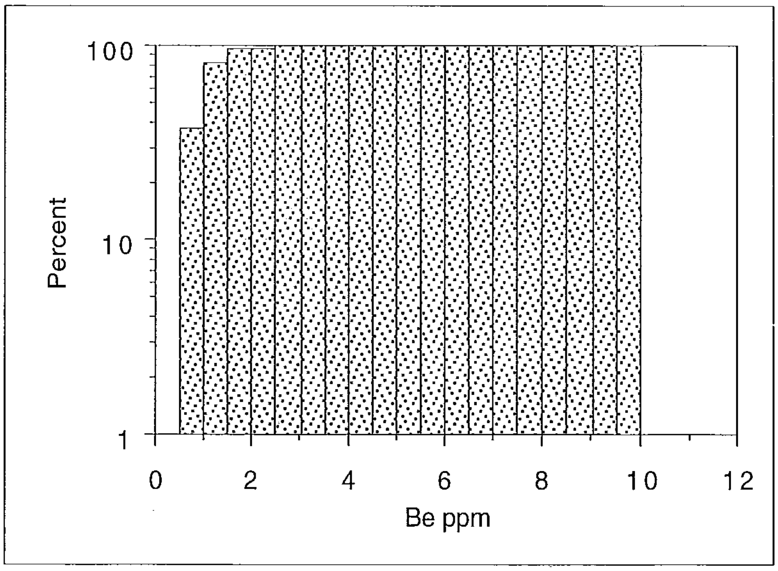
Descriptive Statistics

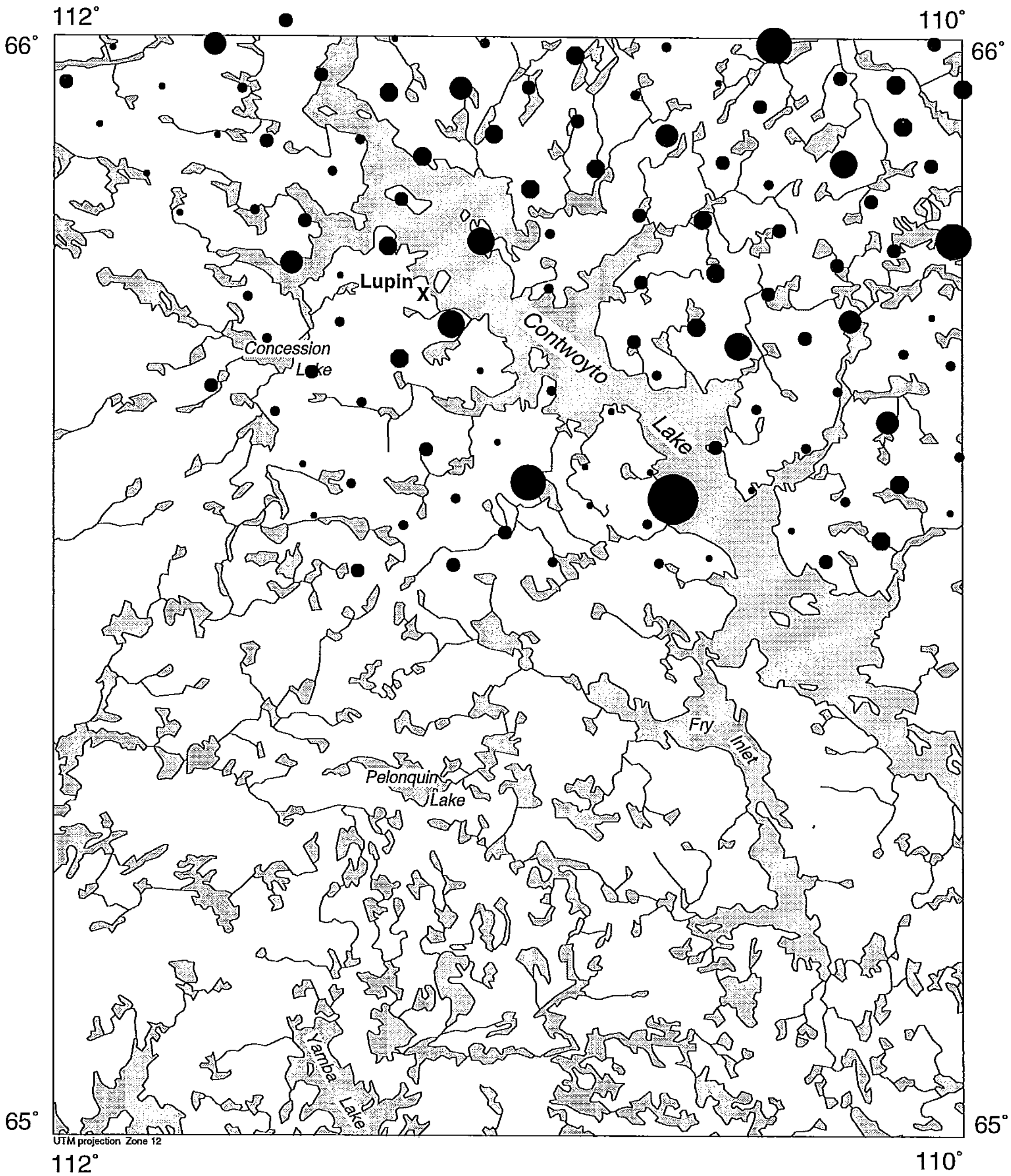
Count:	112
Minimum:	0.25
Maximum:	3
Mean:	0.94
Median:	1
Mode:	1
St. deviation:	0.45
Coeff. var:	0.49
Geom. mean	0.84
Skewness:	1.4
Kurtosis:	3.47

Frequency Histogram



Cumulative Plot





Kilometres 0 10 20 30 Kilometres

Co

Contwoyto Lake (76E, N/2)

Cobalt (ppm)

Ranges	%tile	Count
42 - 46	100	(1)
34 - 42	99	(3)
33 - 34	97	(4)
31 - 33	95	(6)
28 - 31	90	(16)
22 - 28	75	(30)
16 - 22	50	(30)
< 16	25	(22)

Till geochemistry, Contwoyto Lake NTS 76 E (N/2)

COBALT

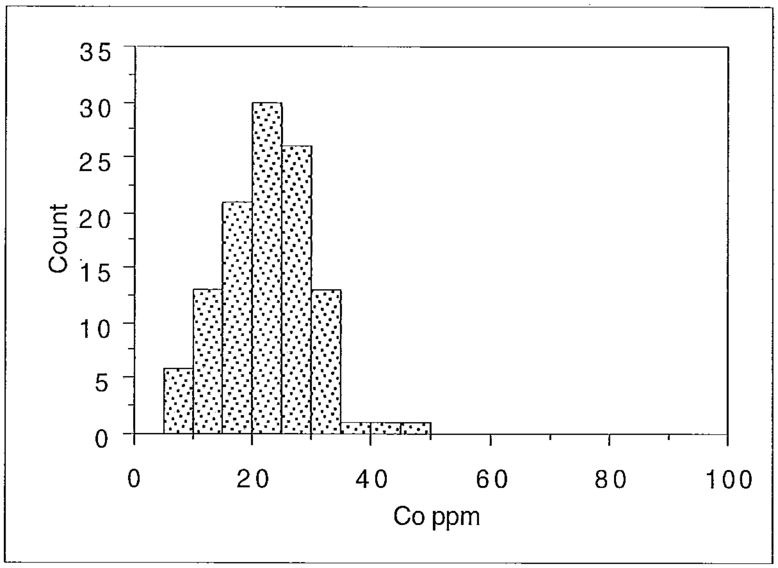
Co (ppm)

Fraction:	<0.002 mm	Detection limit:	1 ppm
Method:	ICP-AES	Preparation:	Nitric acid-aqua regia partial leach

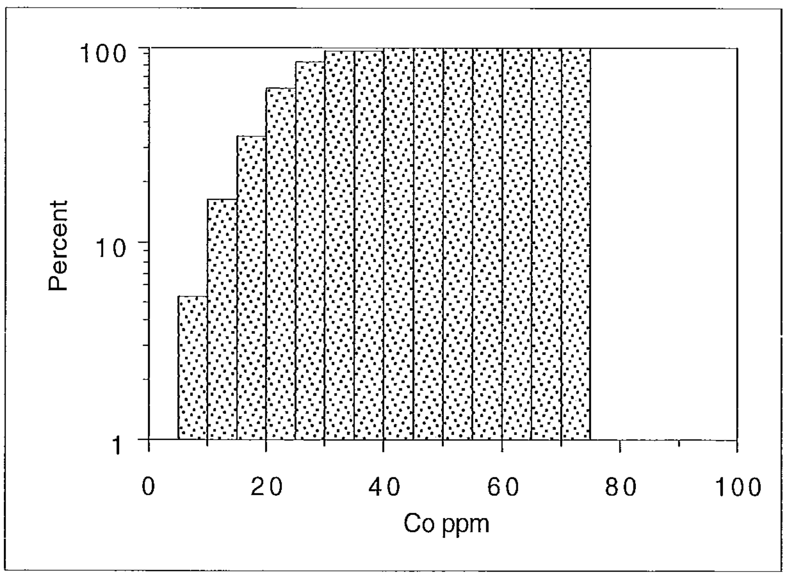
Descriptive Statistics

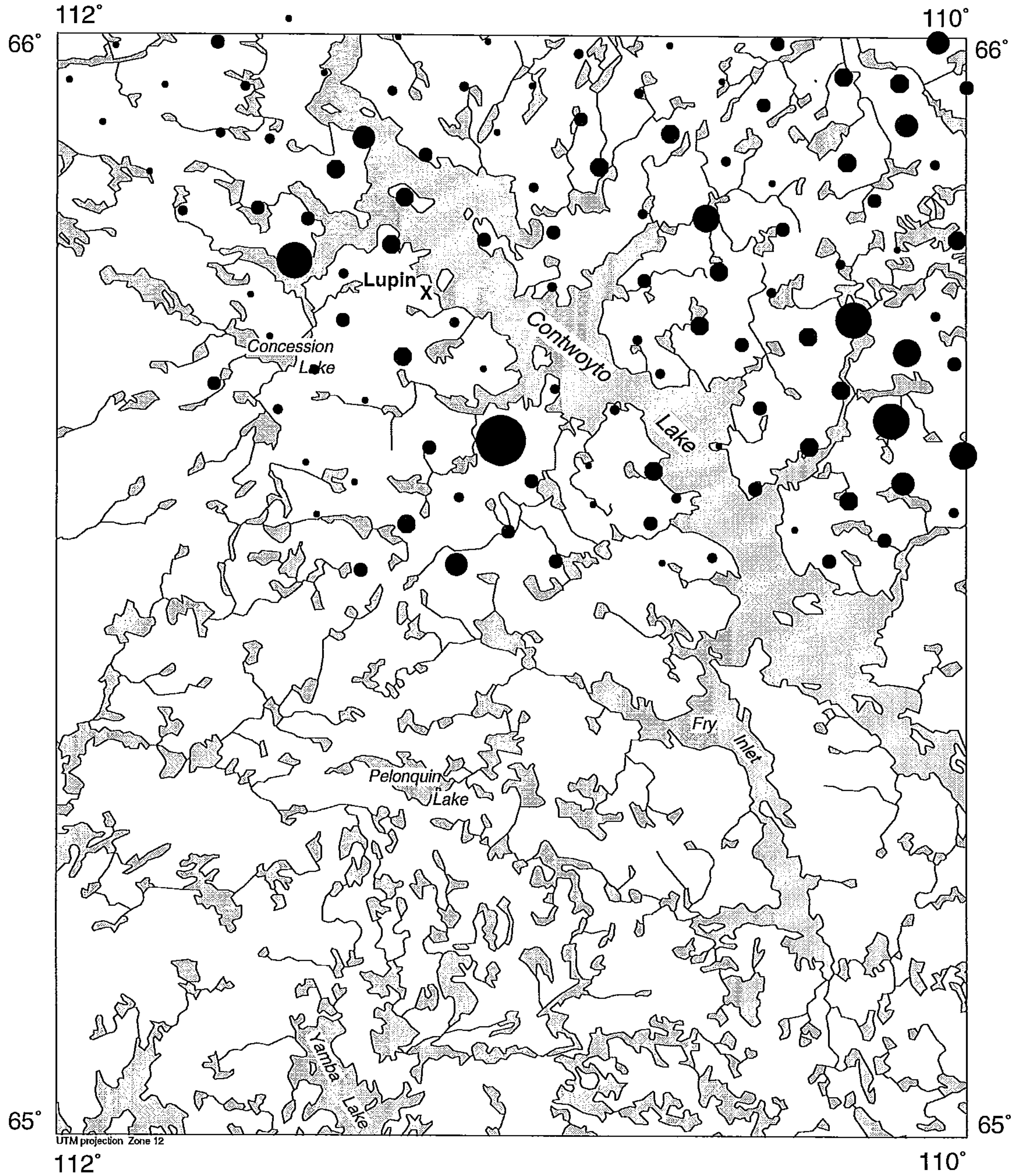
Count:	112
Minimum:	5
Maximum:	46
Mean:	21.93
Median:	22
Mode:	23
St. deviation:	7.67
Coeff. var:	0.35
Geom. mean	20.36
Skewness:	0.07
Kurtosis:	0.04

Frequency Histogram



Cumulative Plot





Kilometres 0 10 20 30 Kilometres

Chromium (ppm)

Ranges	%tile	Count
175 - 181	100	(1)
156 - 175	99	(3)
130 - 156	97	(3)
127 - 130	95	(5)
109 - 127	90	(18)
90 - 109	75	(27)
80 - 90	50	(28)
< 80	25	(27)

Cr

Contwoyto Lake (76E, N/2)

Till geochemistry, Contwoyto Lake NTS 76 E (N/2)

CHROMIUM

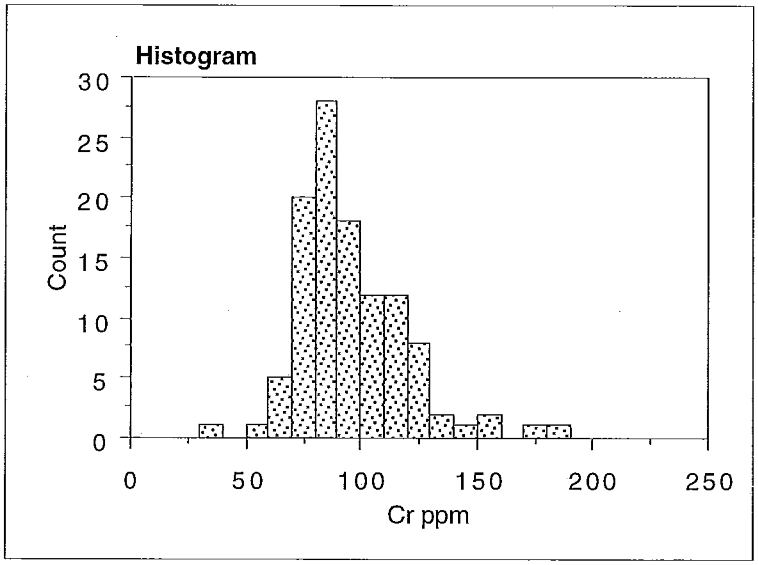
Cr (ppm)

Fraction:	<0.002 mm	Detection limit:	1 ppm
Method:	ICP-AES	Preparation:	Nitric acid-aqua regia partial leach

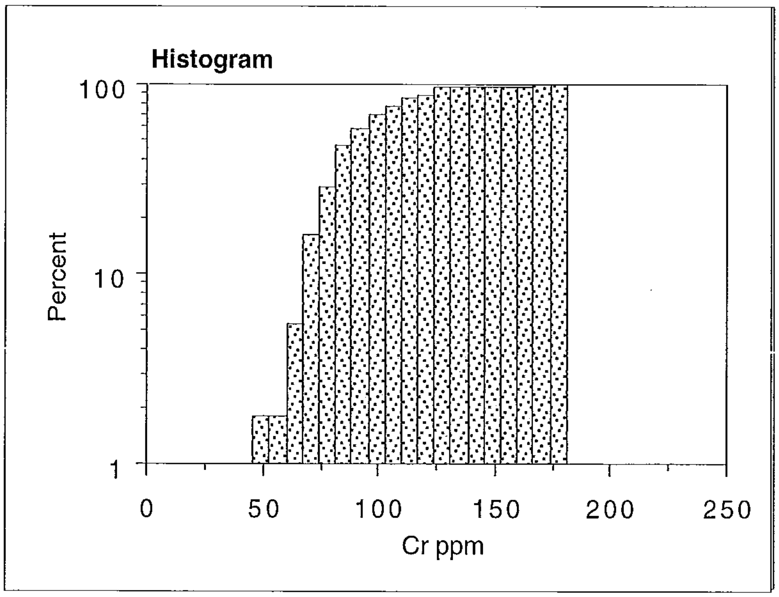
Descriptive Statistics

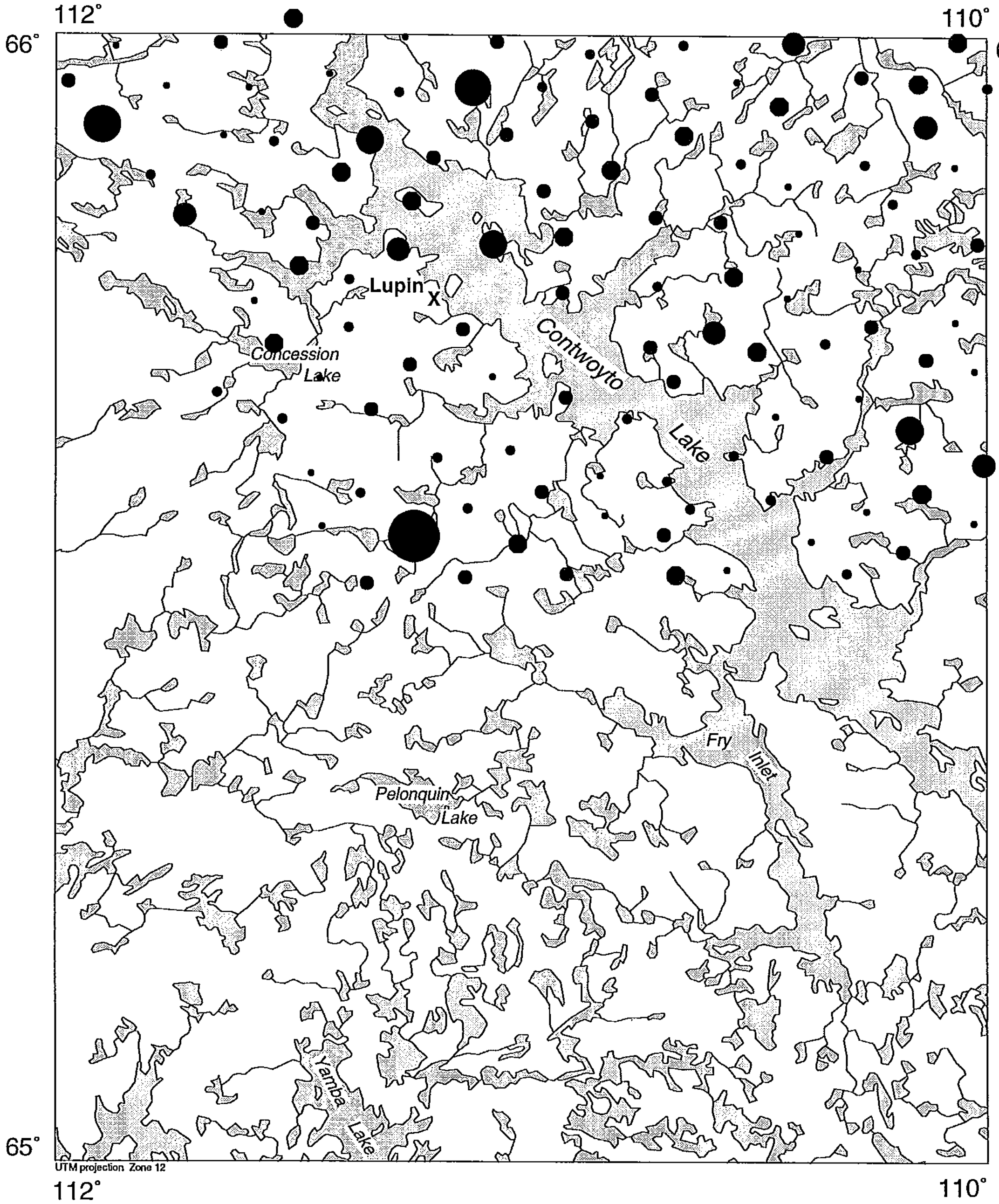
Count:	112
Minimum:	39
Maximum:	18
Mean:	95.39
Median:	90
Mode:	
St. deviation:	23.25
Coeff. var:	0.24
Geom. mean	92.78
Skewness:	1.03
Kurtosis:	1.81

Frequency Histogram



Cumulative Plot





Kilometres 0 10 20 30 Kilometres

Cu

Contwoyto Lake (76E, N/2)

Copper (ppm)

Ranges	%tile	Count
236 - 241	100	(1)
170 - 236	99	(2)
148 - 170	97	(3)
134 - 148	95	(6)
109 - 134	90	(16)
89 - 109	75	(29)
70 - 89	50	(27)
< 70	25	(28)

Till geochemistry, Contwoyto Lake NTS 76 E (N/2)

COPPER

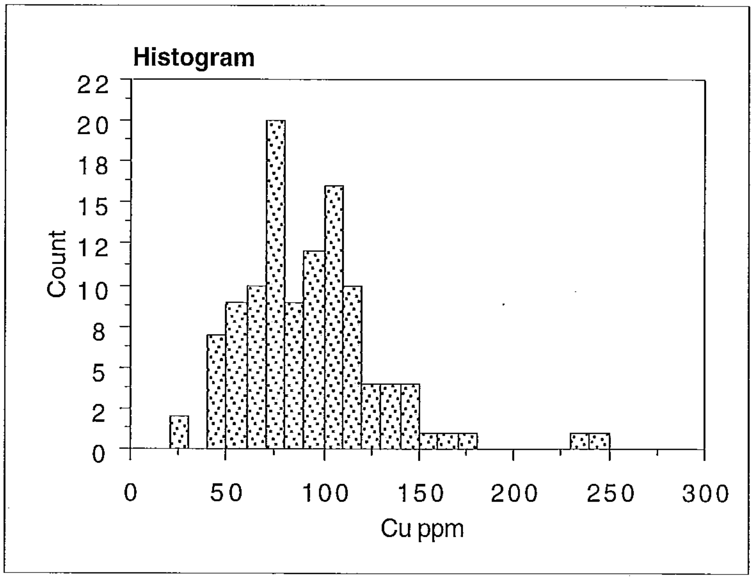
Cu (ppm)

Fraction:	<0.002 mm	Detection limit:	1 ppm
Method:	ICP-AES	Preparation:	Nitric acid-aqua regia partial leach

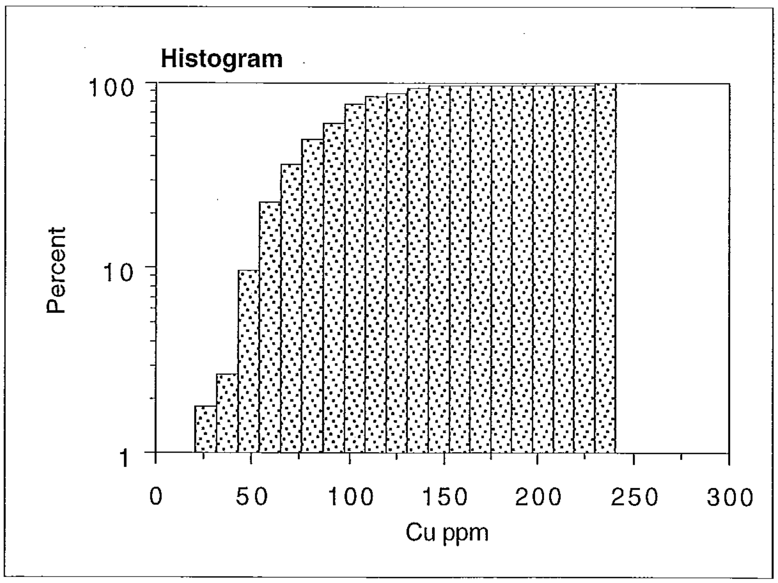
Descriptive Statistics

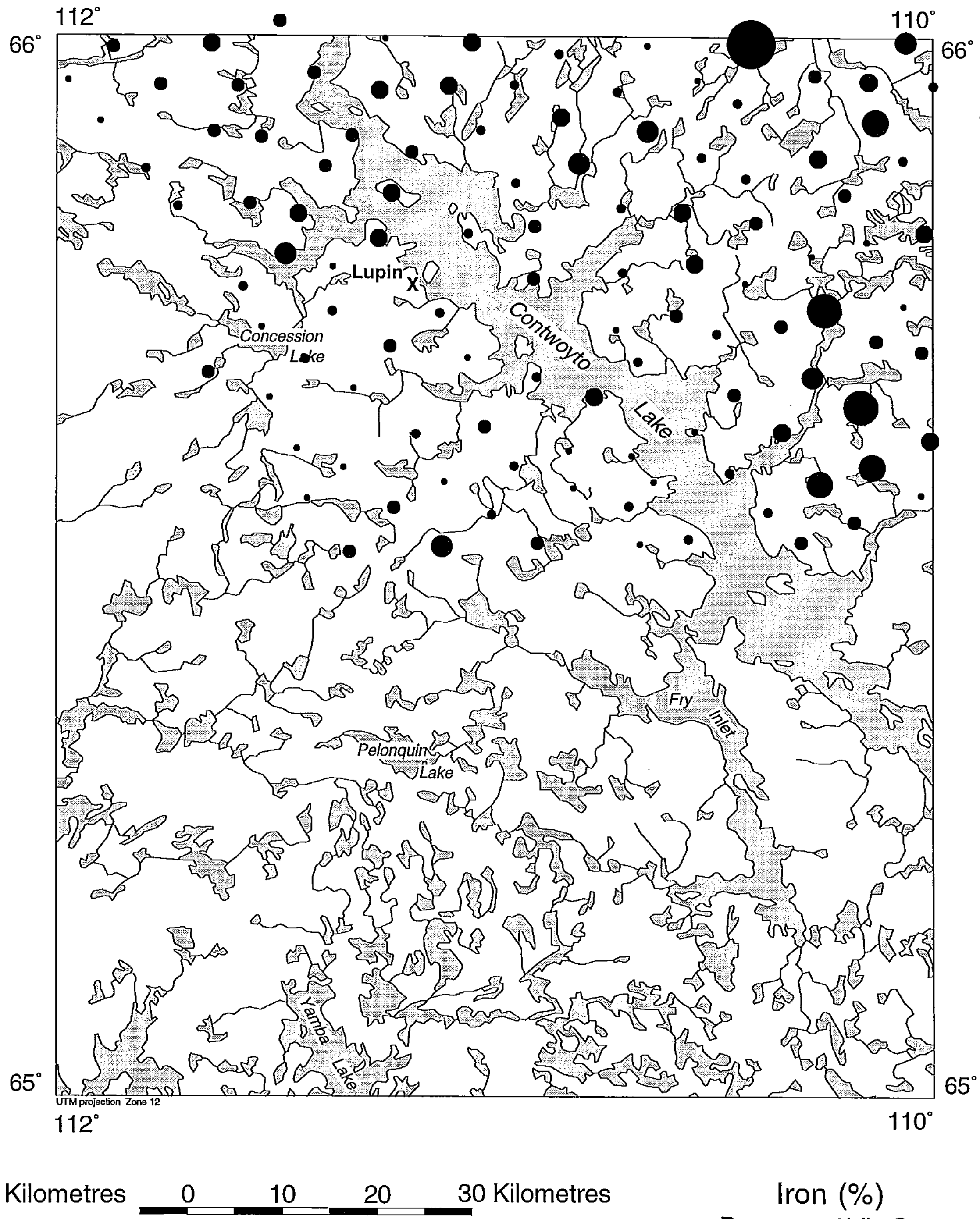
Count:	112
Minimum:	21
Maximum:	241
Mean:	91.89
Median:	89
Mode:	
St. deviation:	35.94
Coeff. var:	0.39
Geom. mean	85.33
Skewness:	1.26
Kurtosis:	3.34

Frequency Histogram



Cumulative Plot





Iron (%)

Ranges	%tile	Count
7.4 - 7.8	100	(1)
6.7 - 7.4	99	(2)
6.3 - 6.7	97	(3)
6.1 - 6.3	95	(6)
5.5 - 6.1	90	(16)
5.0 - 5.5	75	(29)
4.2 - 5.0	50	(29)
< 4.2	25	(26)

Fe

Contwoyto Lake (76E, N/2)

Till geochemistry, Contwoyto Lake NTS 76 E (N/2)

IRON

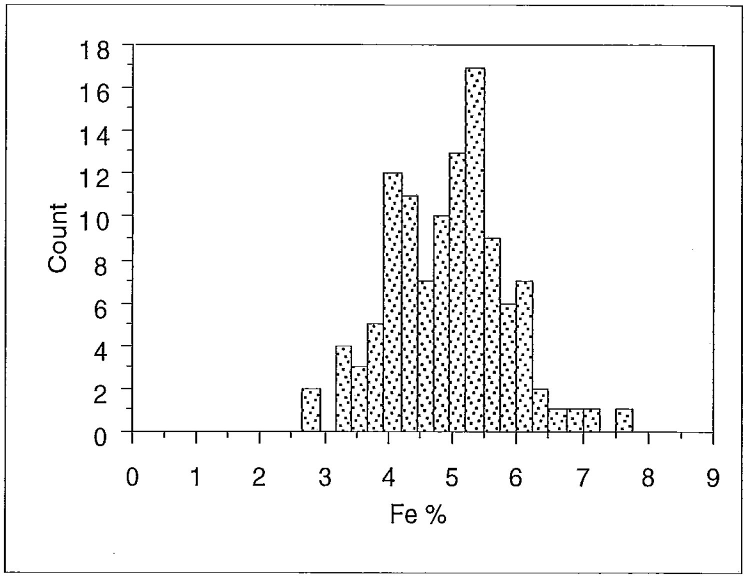
Fe (%)

Fraction:	<0.002 mm	Detection limit:	0.10%
Method:	ICP-AES	Preparation:	Nitric acid-aqua regia partial leach

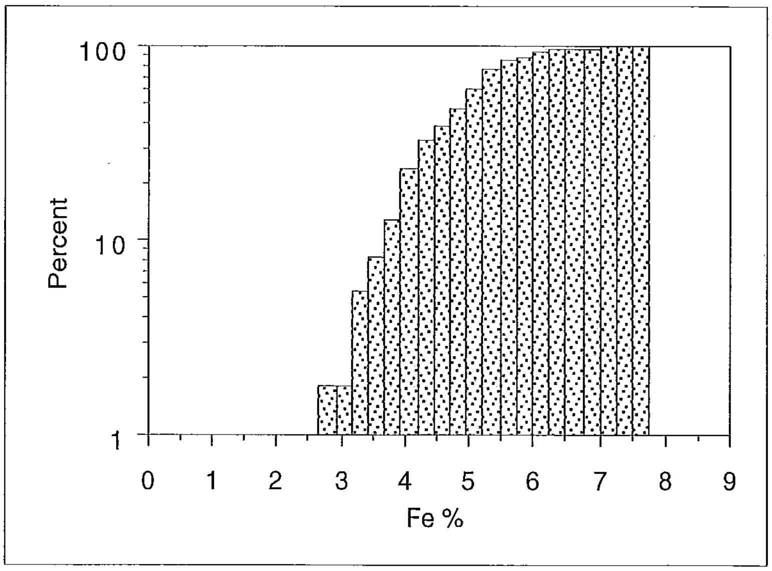
Descriptive Statistics

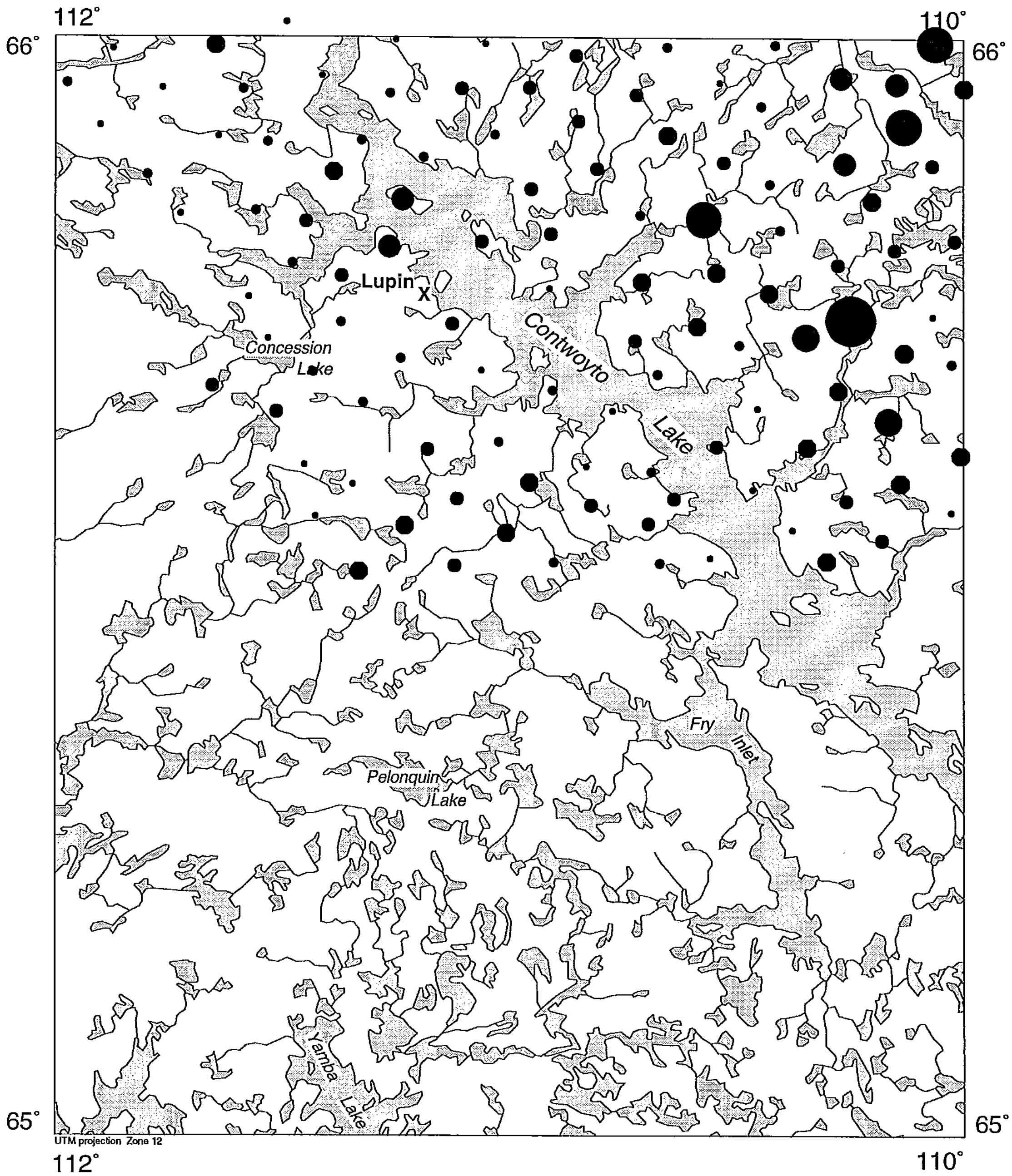
Count:	112
Minimum:	2.66
Maximum:	7.78
Mean:	4.95
Median:	5.01
Mode:	5.39
St. deviation:	0.09
Coeff. var:	0.18
Geom. mean	4.86
Skewness:	0.14
Kurtosis:	0.3

Frequency Histogram



Cumulative Plot





Kilometres 0 10 20 30 Kilometres

K

Contwoyto Lake (76E, N/2)

Potassium (%)

Ranges	%tile	Count
1.19 - 1.22	100	(1)
1.07 - 1.19	99	(3)
0.93 - 1.07	97	(2)
0.77 - 0.93	95	(5)
0.49 - 0.77	90	(19)
0.38 - 0.49	75	(29)
0.28 - 0.38	50	(28)
< 0.28	25	(25)

Till geochemistry, Contwoyto Lake NTS 76 E (N/2)

POTASSIUM

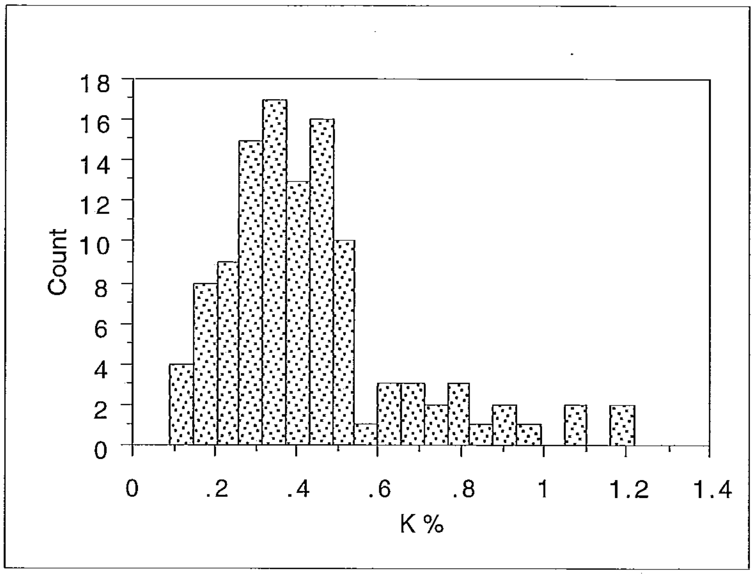
K (%)

Fraction:	<0.002 mm	Detection limit:	0.01%
Method:	ICP-AES	Preparation:	Nitric acid-aqua regia partial leach

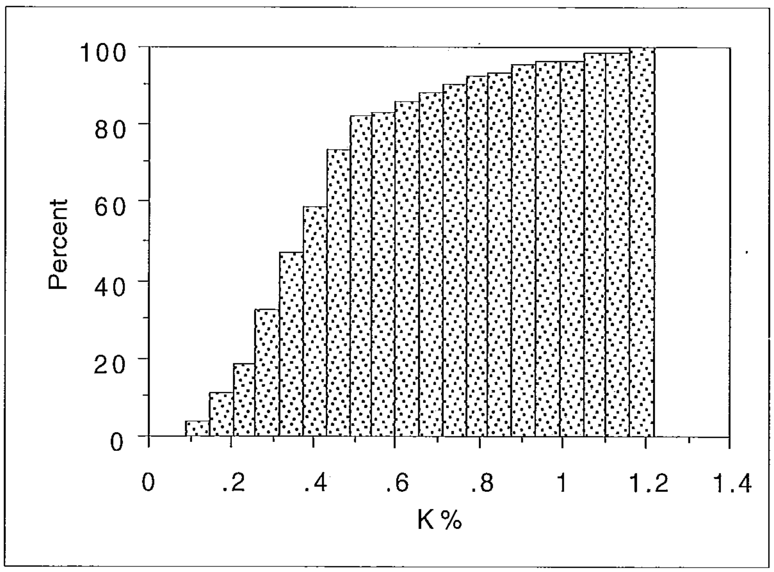
Descriptive Statistics

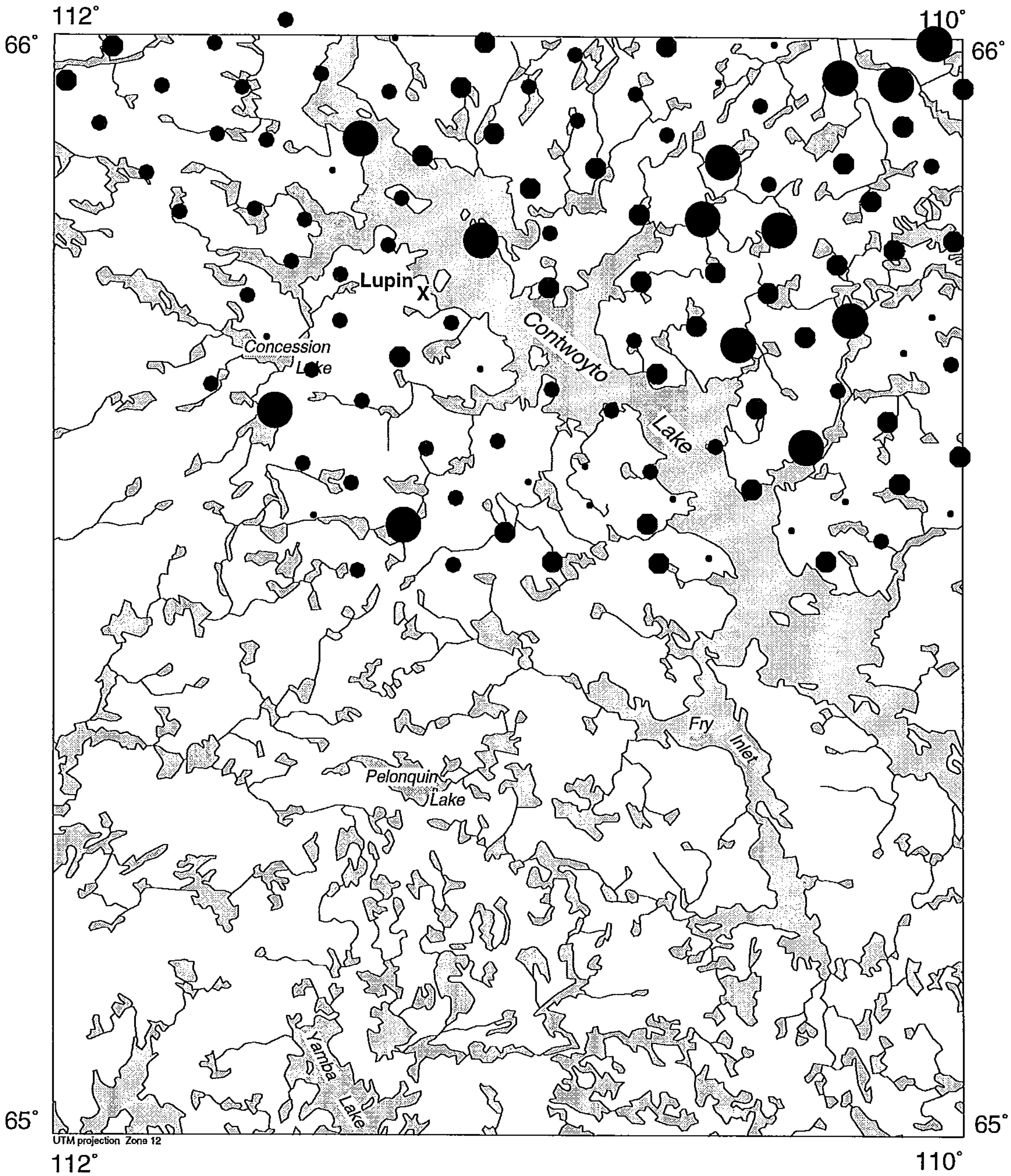
Count:	112
Minimum:	0.9
Maximum:	1.22
Mean:	0.43
Median:	0.39
Mode:	
St. deviation:	0.23
Coeff. var:	0.53
Geom. mean	0.38
Skewness:	1.36
Kurtosis:	1.9

Frequency Histogram



Cumulative Plot





Kilometres 0 10 20 30 Kilometres

Lanthanum (ppm)

Ranges	%tile	Count
50 - 60	100	(13)
40 - 50	97	(35)
30 - 40	75	(47)
< 30	50	(17)

La

Contwoyto Lake (76E, N/2)

Till geochemistry, Contwoyto Lake NTS 76 E (N/2)

LANTHANUM

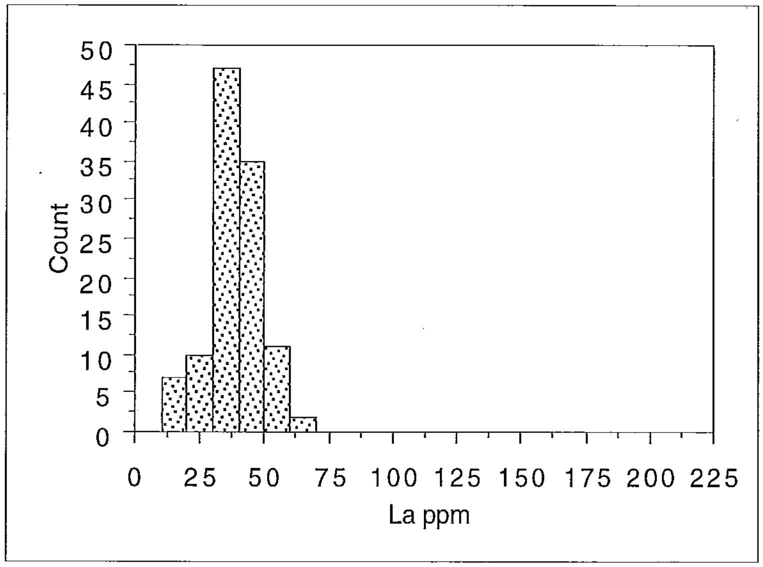
La (ppm)

Fraction:	<0.002 mm	Detection limit:	10 ppm
Method:	ICP-AES	Preparation:	Nitric acid-aqua regia partial leach

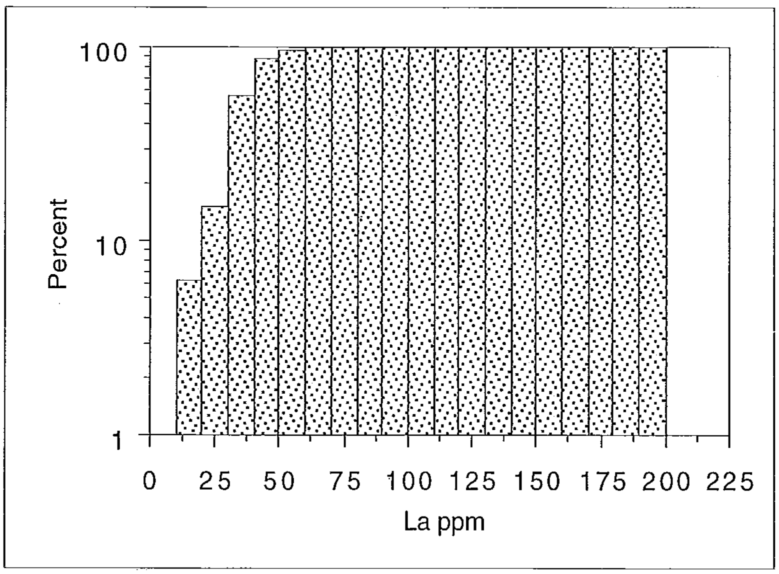
Descriptive Statistics

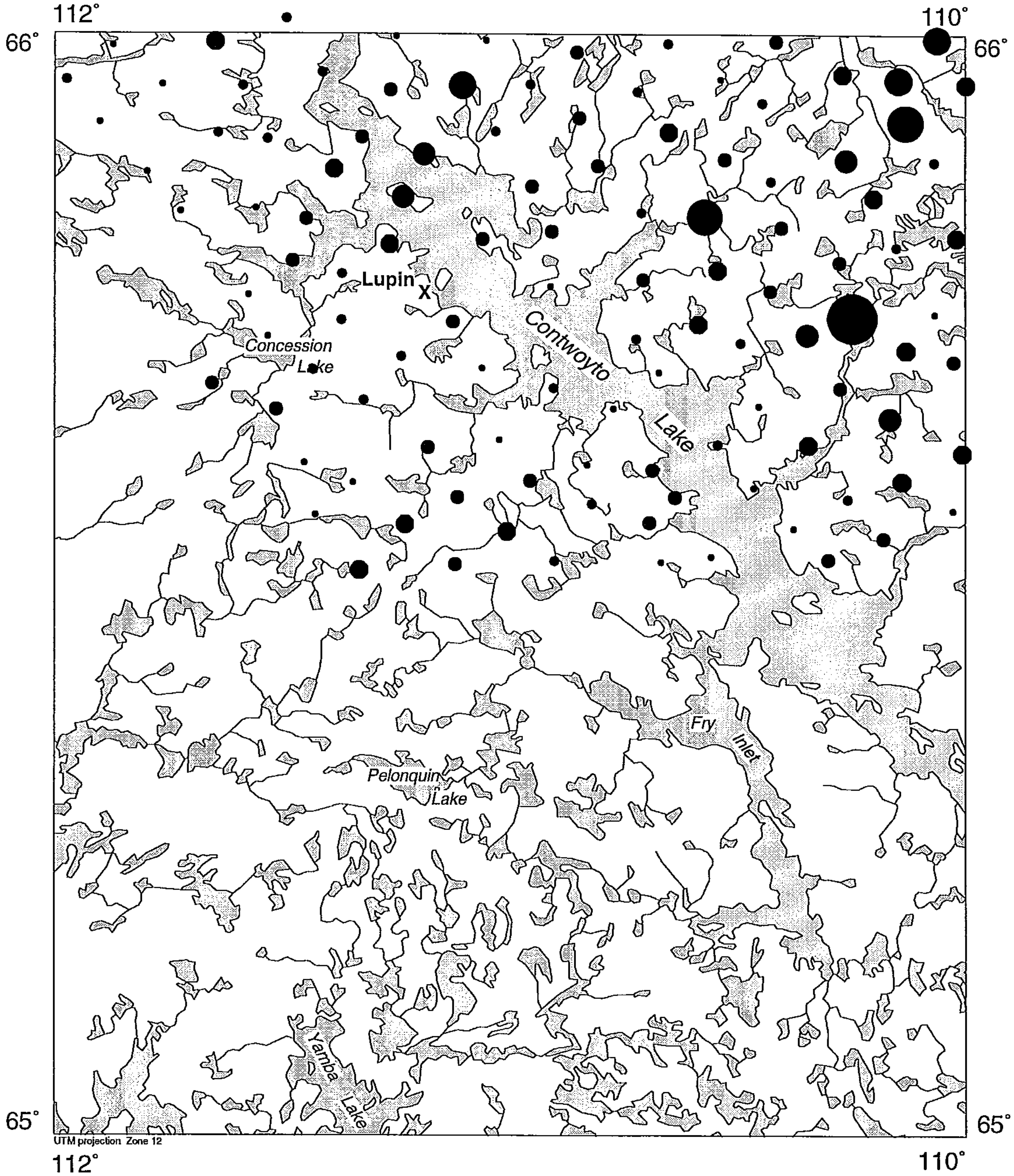
Count:	112
Minimum:	10
Maximum:	60
Mean:	33.48
Median:	30
Mode:	30
St. deviation:	10.46
Coeff. var:	0.31
Geom. mean	31.46
Skewness:	-0.16
Kurtosis:	0.29

Frequency Histogram



Cumulative Plot





Kilometres 0 10 20 30 Kilometres

Magnesium (%)

Ranges	%tile	Count
2.16 - 2.19	100	(1)
2.04 - 2.16	99	(2)
1.89 - 2.04	97	(3)
1.75 - 1.89	95	(5)
1.35 - 1.75	90	(17)
1.07 - 1.35	75	(30)
0.85 - 1.07	50	(27)
< 0.85	25	(27)

Mg

Contwoyto Lake (76E, N/2)

Till geochemistry, Contwoyto Lake NTS 76 E (N/2)

MAGNESIUM

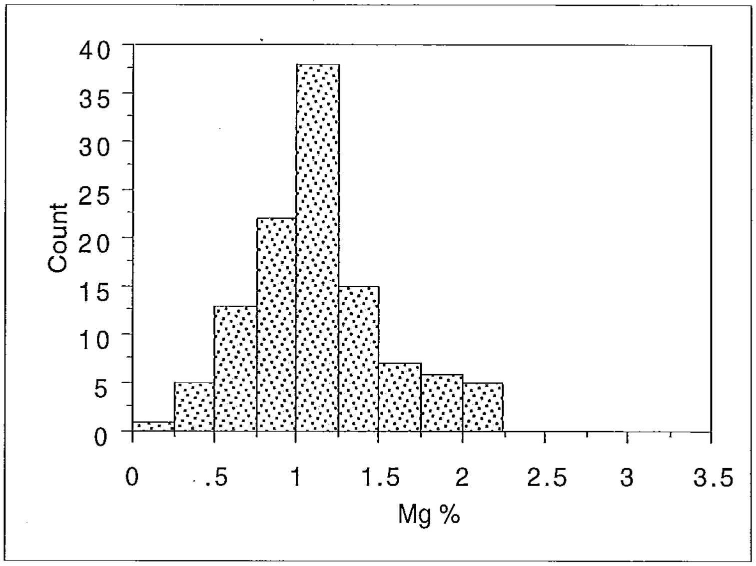
Mg (%)

Fraction:	<0.002 mm	Detection limit:	0.01%
Method:	ICP-AES	Preparation:	Nitric acid-aqua regia partial leach

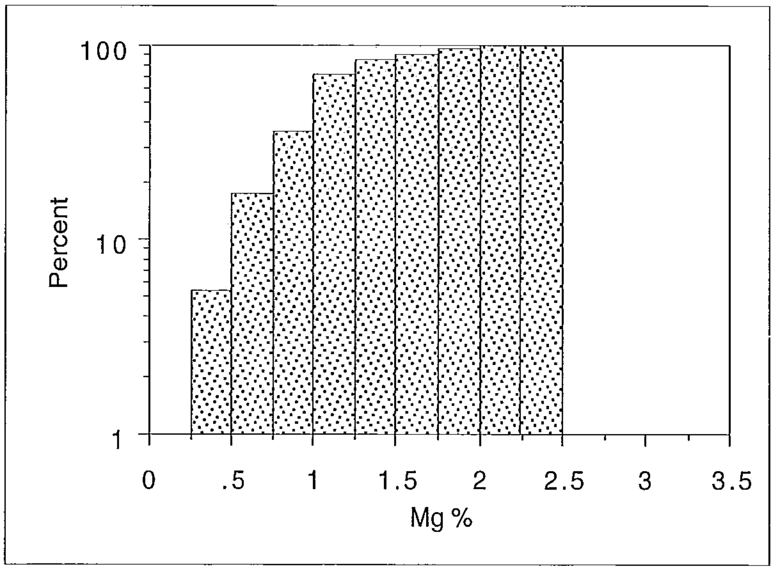
Descriptive Statistics

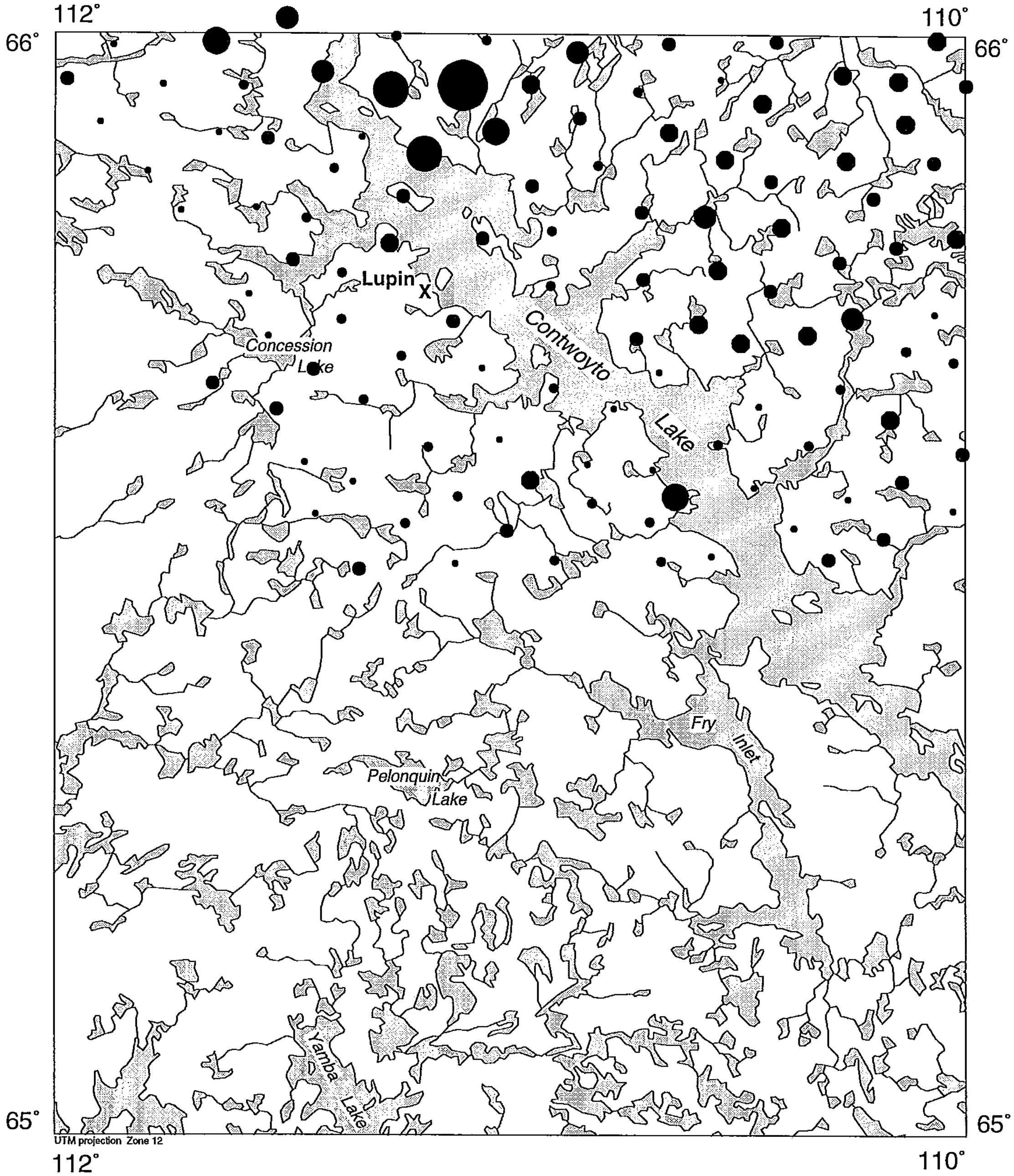
Count:	112
Minimum:	0.21
Maximum:	2.19
Mean:	1.12
Median:	1.07
Mode:	1.24
St. deviation:	0.42
Coeff. var:	0.38
Geom. mean	1.03
Skewness:	0.35
Kurtosis:	0.04

Frequency Histogram



Cumulative Plot





Kilometres 0 10 20 30 Kilometres

Mn

Contwoyto Lake (76E, N/2)

Manganese (ppm)

Ranges	%tile	Count
1164 - 1205	100	(1)
790 - 1164	99	(2)
688 - 790	97	(3)
616 - 688	95	(5)
480 - 616	90	(18)
365 - 480	75	(29)
273 - 365	50	(26)
< 273	25	(28)

Till geochemistry, Contwoyto Lake NTS 76 E (N/2)

MANGANEESE

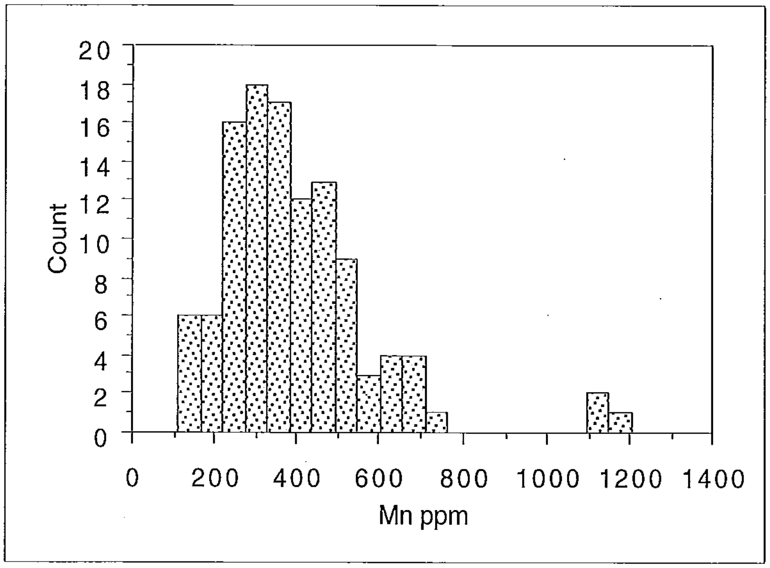
Mn (ppm)

Fraction:	<0.002 mm	Detection limit:	5 ppm
Method:	ICP-AES	Preparation:	Nitric acid-aqua regia partial leach

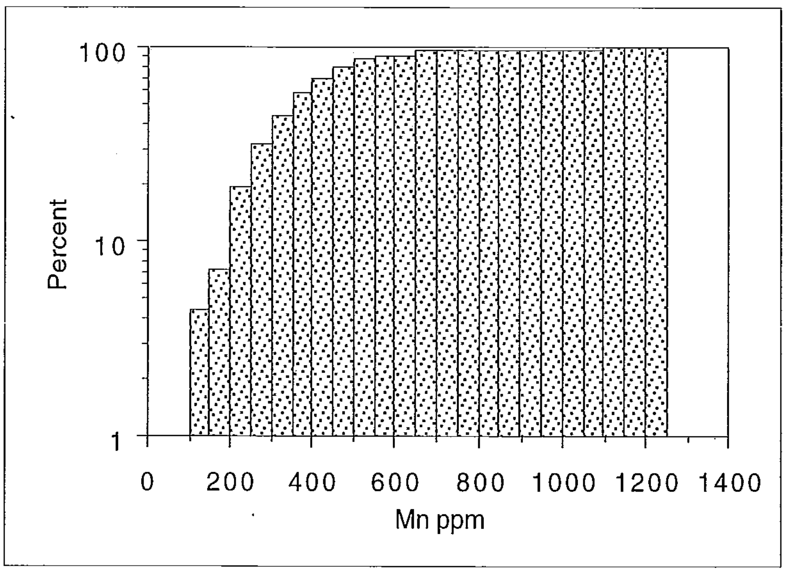
Descriptive Statistics

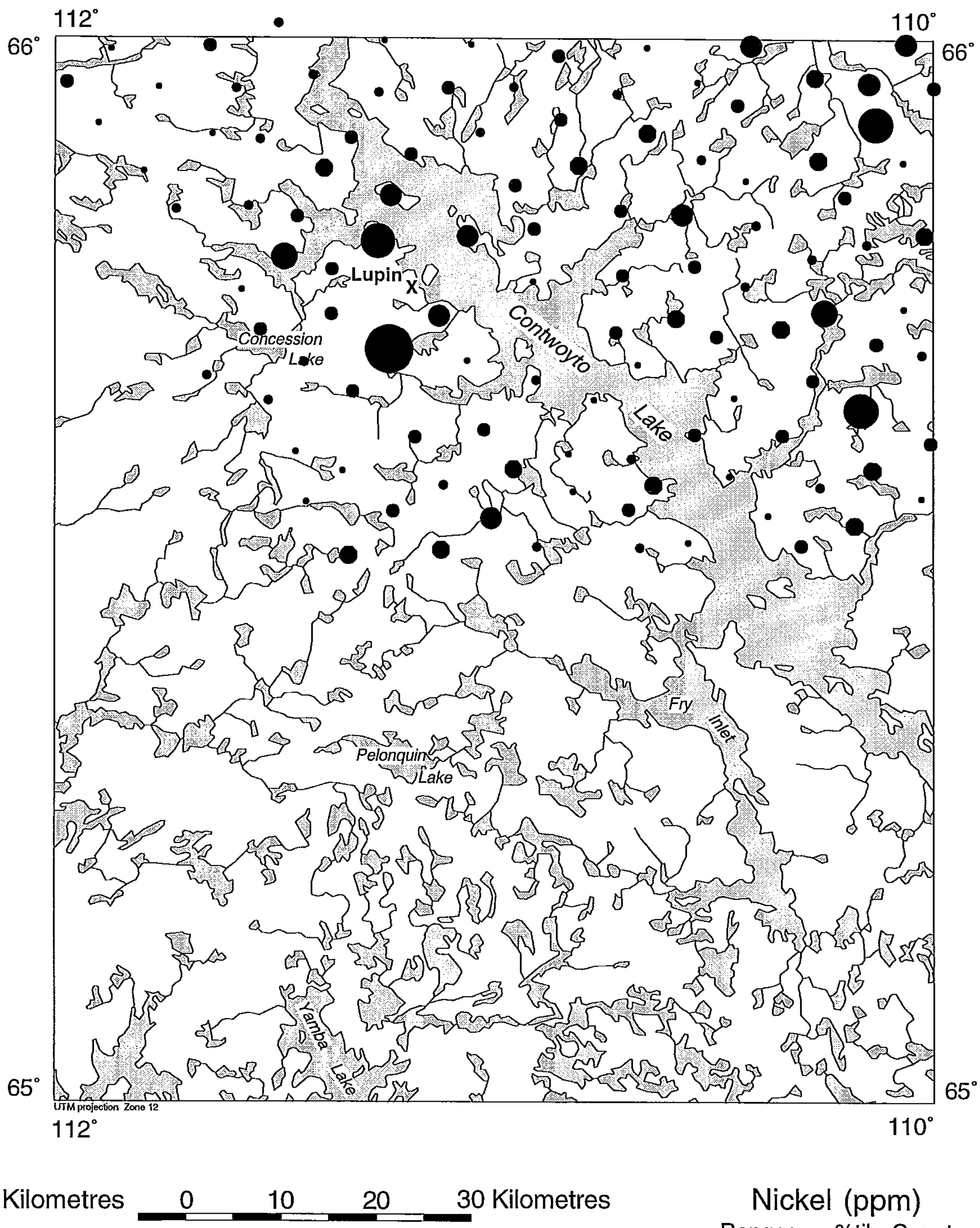
Count:	112
Minimum:	110
Maximum:	1205
Mean:	397.05
Median:	365
Mode:	
St. deviation:	187.05
Coeff. var:	0.47
Geom. mean	360.95
Skewness:	1.79
Kurtosis:	5.04

Frequency Histogram



Cumulative Plot





Nickel (ppm)

Ranges	%tile	Count
90 - 91	100	(1)
87 - 90	99	(3)
82 - 87	97	(2)
72 - 82	95	(8)
63 - 72	90	(14)
49 - 63	75	(32)
41 - 49	50	(25)
< 41	25	(27)

Ni

Contwoyto Lake (76E, N/2)

Till geochemistry, Contwoyto Lake NTS 76 E (N/2)

NICKEL

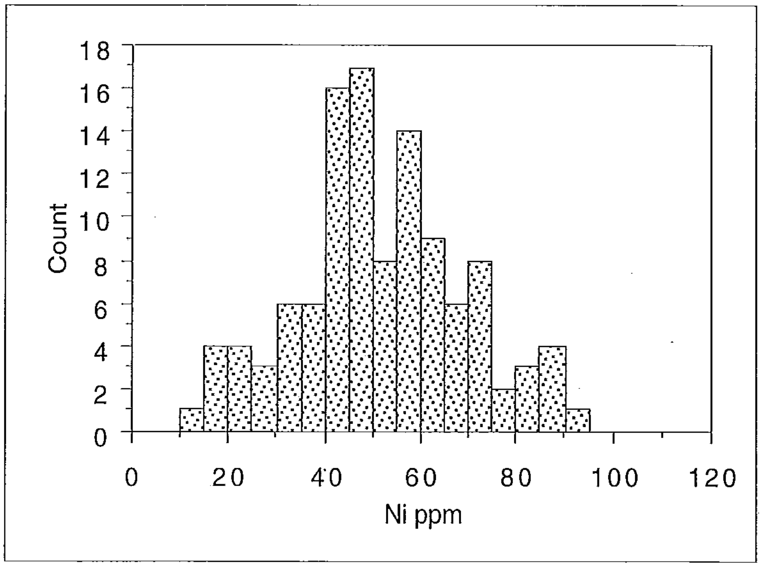
Ni (ppm)

Fraction:	<0.002 mm	Detection limit:	1 ppm
Method:	ICP-AES	Preparation:	Nitric acid-aqua regia partial leach

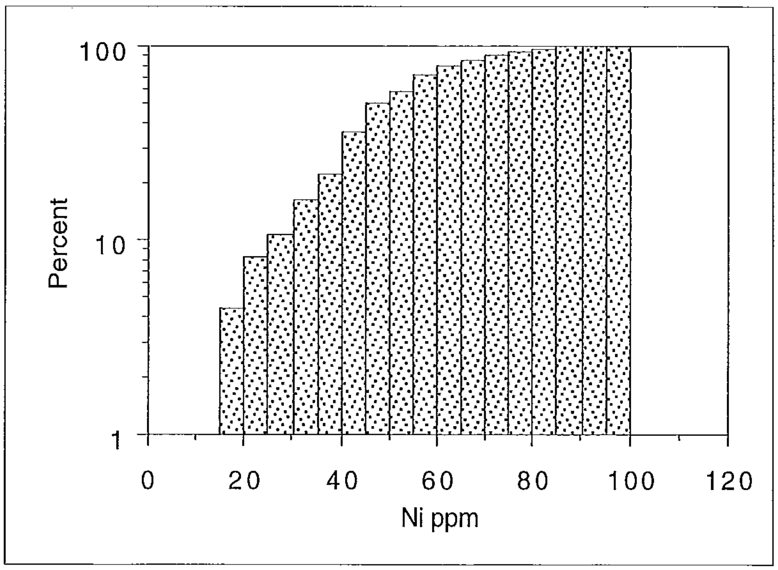
Descriptive Statistics

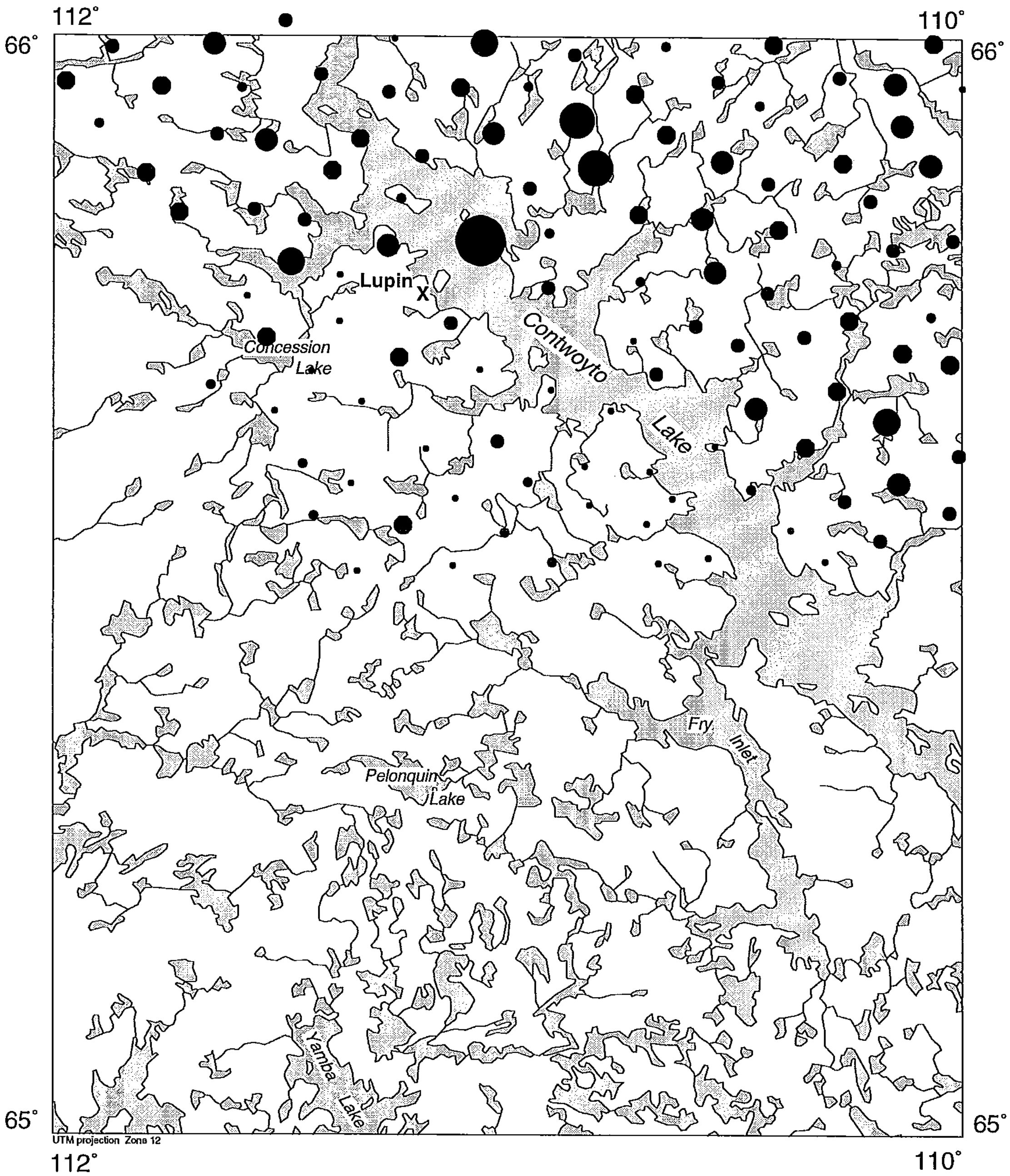
Count:	112
Minimum:	13
Maximum:	91
Mean:	51.12
Median:	49
Mode:	
St. deviation:	17.43
Coeff. var:	0.34
Geom. mean	47.72
Skewness:	0.09
Kurtosis:	-0.27

Frequency Histogram



Cumulative Plot





Kilometres 0 10 20 30 Kilometres

Lead (ppm)

Ranges	%tile	Count
30 - 34	100	(1)
23 - 30	99	(2)
20 - 23	97	(3)
16 - 20	95	(12)
14 - 16	90	(22)
12 - 14	75	(28)
10 - 12	50	(17)
< 10	25	(27)

Pb

Contwoyto Lake (76E, N/2)

Till geochemistry, Contwoyto Lake NTS 76 E (N/2)

LEAD

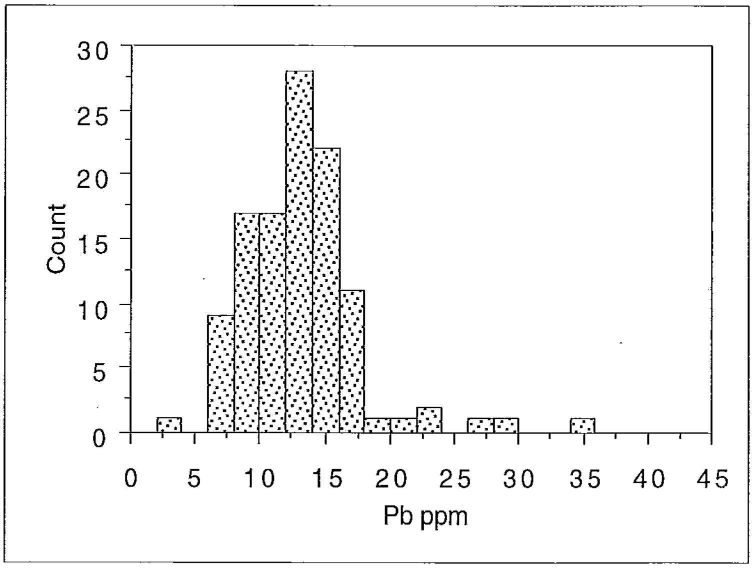
Pb (ppm)

Fraction:	<0.002 mm	Detection limit:	2 ppm
Method:	ICP-AES	Preparation:	Nitric acid-aqua regia partial leach

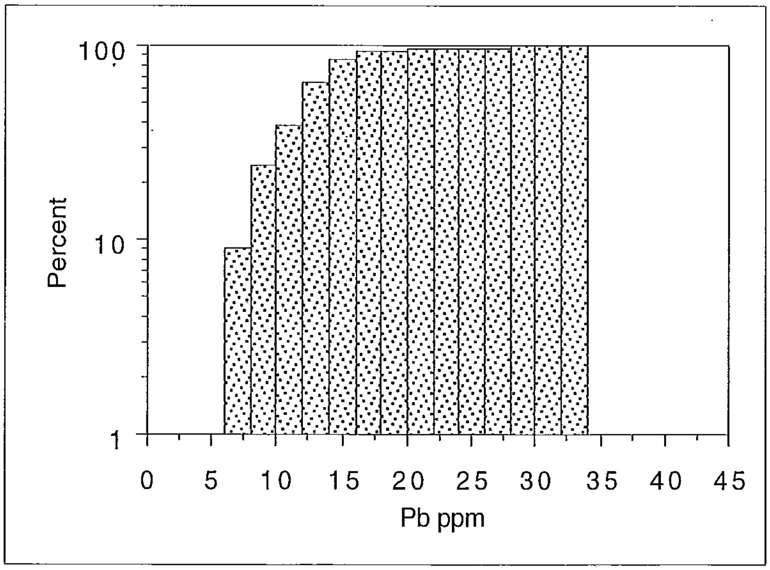
Descriptive Statistics

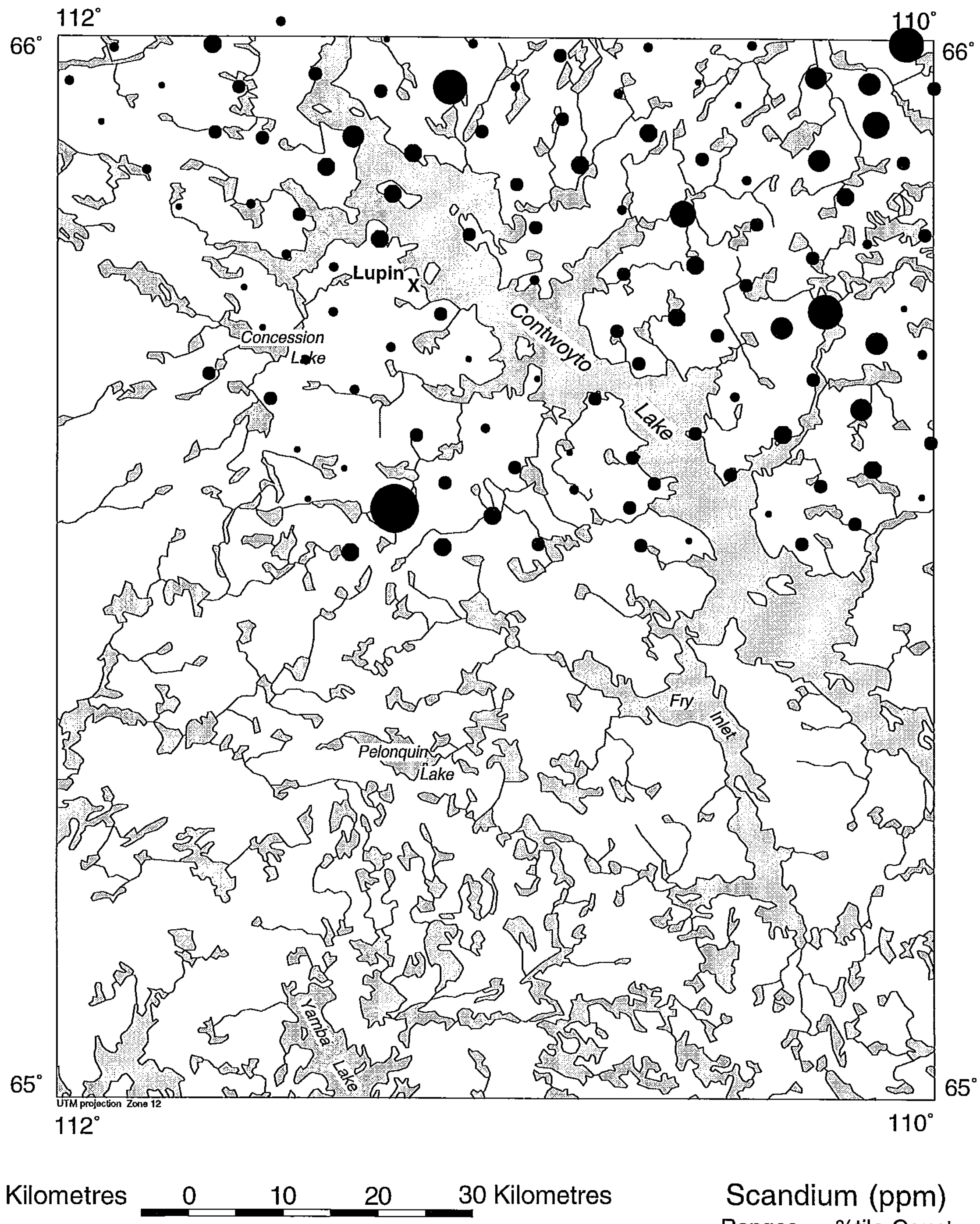
Count:	112
Minimum:	2
Maximum:	34
Mean:	12.07
Median:	12
Mode:	12
St. deviation:	4.52
Coeff. var:	0.37
Geom. mean	11.31
Skewness:	1.62
Kurtosis:	5.49

Frequency Histogram



Cumulative Plot





Scandium (ppm)

Ranges	%tile	Count
17 - 18	100	(1)
14 - 17	99	(3)
13 - 14	97	(2)
11 - 13	95	(7)
9 - 11	90	(15)
7 - 9	75	(42)
6 - 7	50	(24)
< 6	25	(18)

Sc

Contwoyto Lake (76E, N/2)

Till geochemistry, Contwoyto Lake NTS 76 E (N/2)

SCANDIUM

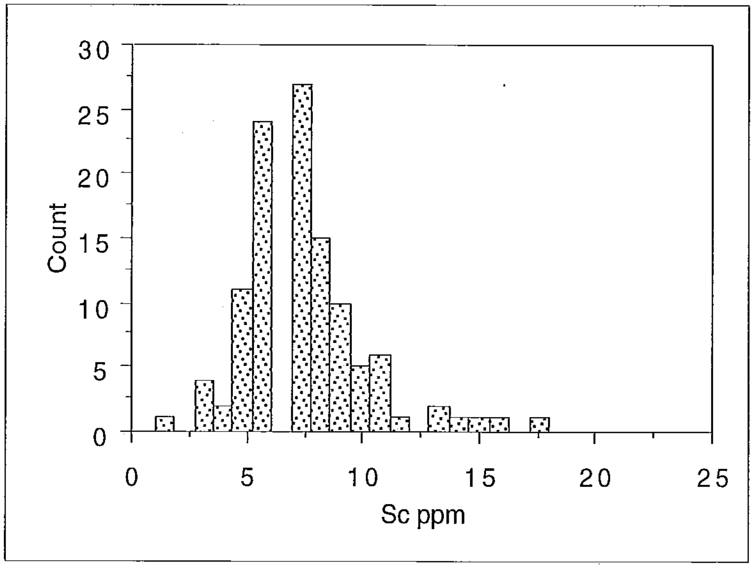
Sc (ppm)

Fraction:	<0.002 mm	Detection limit:	1 ppm
Method:	ICP-AES	Preparation:	Nitric acid-aqua regia partial leach

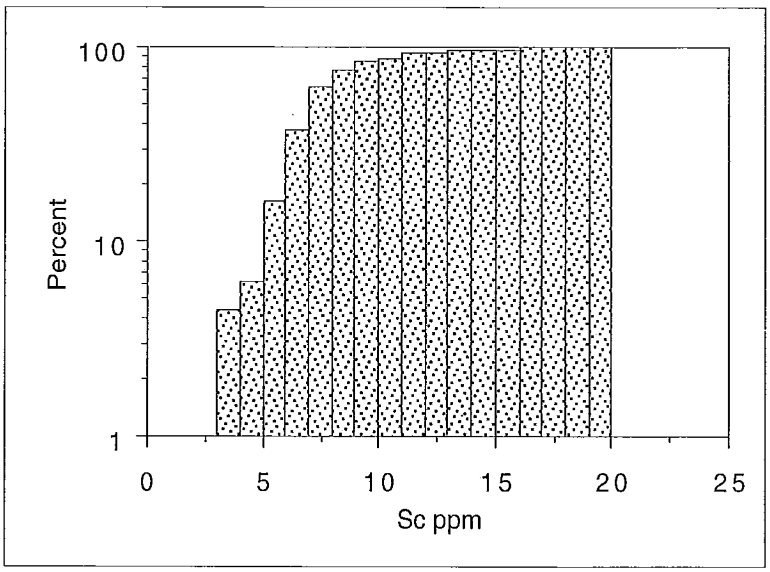
Descriptive Statistics

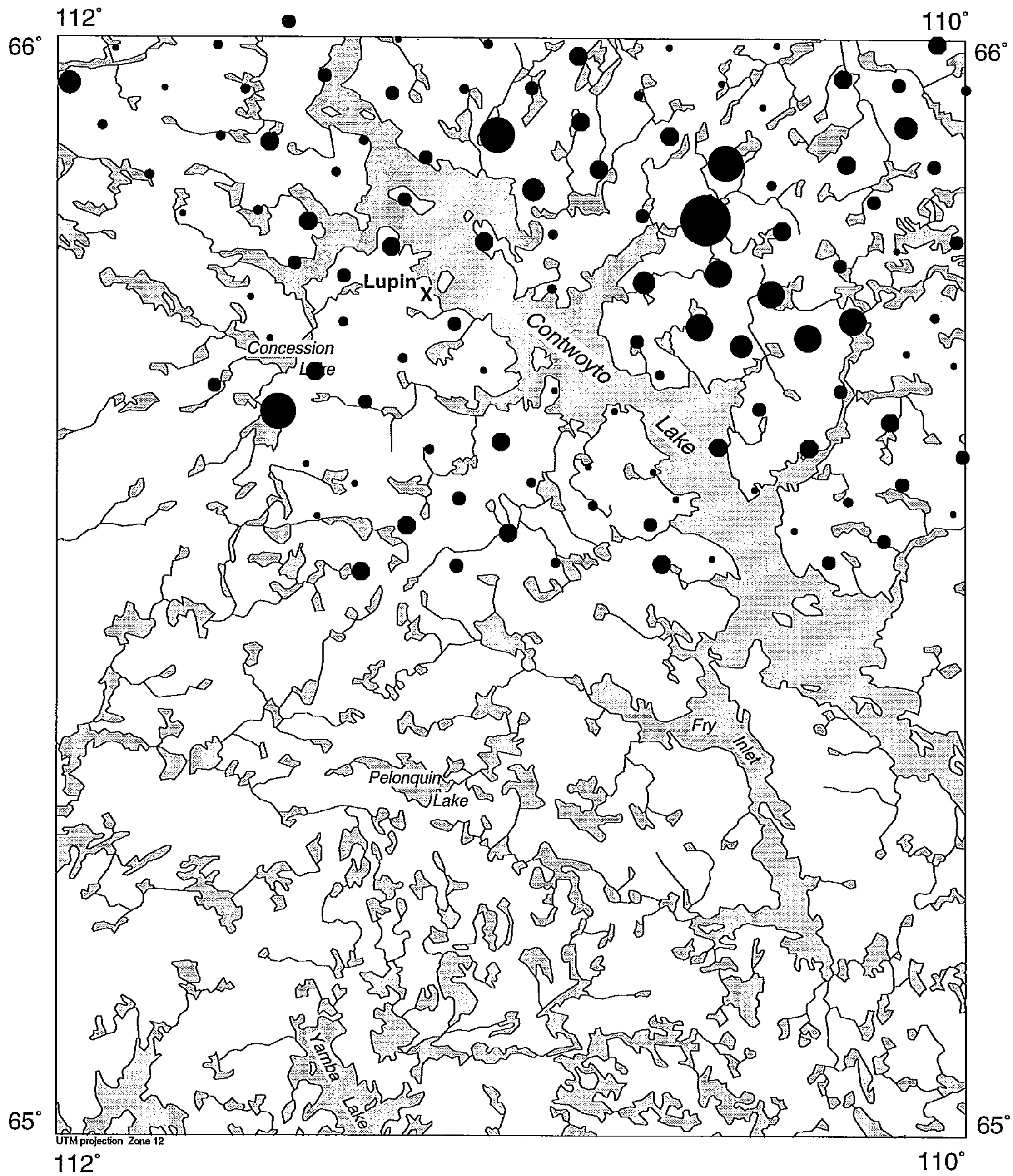
Count:	112
Minimum:	1
Maximum:	18
Mean:	7.46
Median:	7
Mode:	7
St. deviation:	2.63
Coeff. var:	0.35
Geom. mean	7.01
Skewness:	1.17
Kurtosis:	2.73

Frequency Histogram



Cumulative Plot





Kilometres 0 10 20 30 Kilometres

Sr

Contwoyto Lake (76E, N/2)

Strontium (ppm)

Ranges	%tile	Count
28 - 32	100	(1)
24 - 28	99	(3)
22 - 24	97	(5)
21 - 22	95	(5)
18 - 21	90	(21)
16 - 18	75	(27)
14 - 16	50	(24)
< 14	25	(26)

Till geochemistry, Contwoyto Lake NTS 76 E (N/2)

STRONTIUM

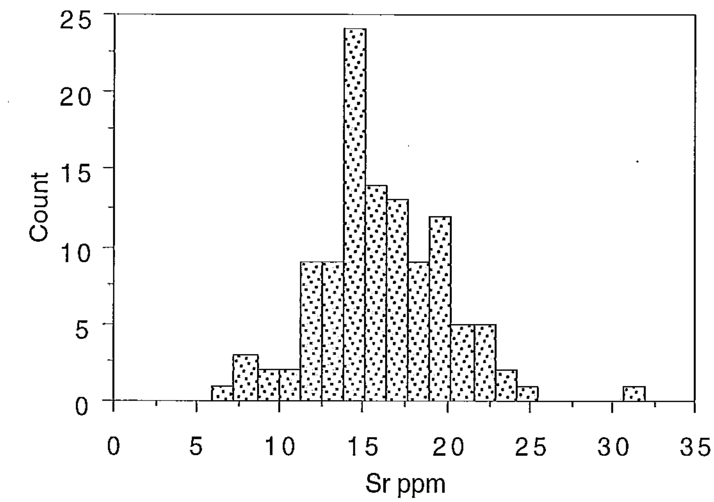
Sr (ppm)

Fraction:	<0.002 mm	Detection limit:	1 ppm
Method:	ICP-AES	Preparation:	Nitric acid-aqua regia partial leach

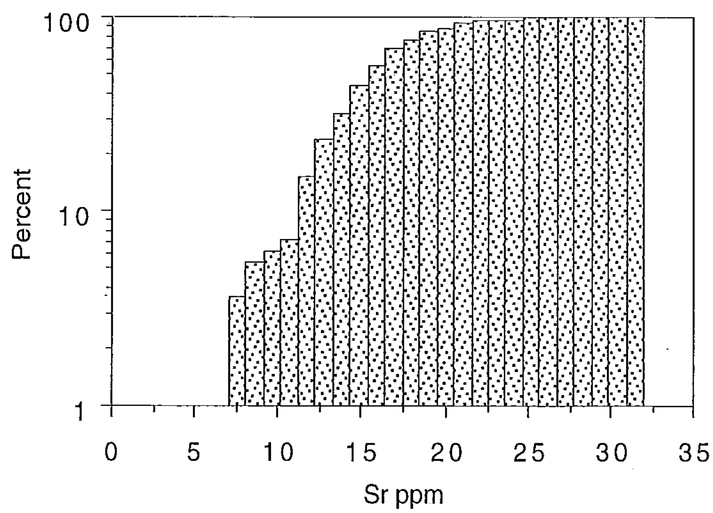
Descriptive Statistics

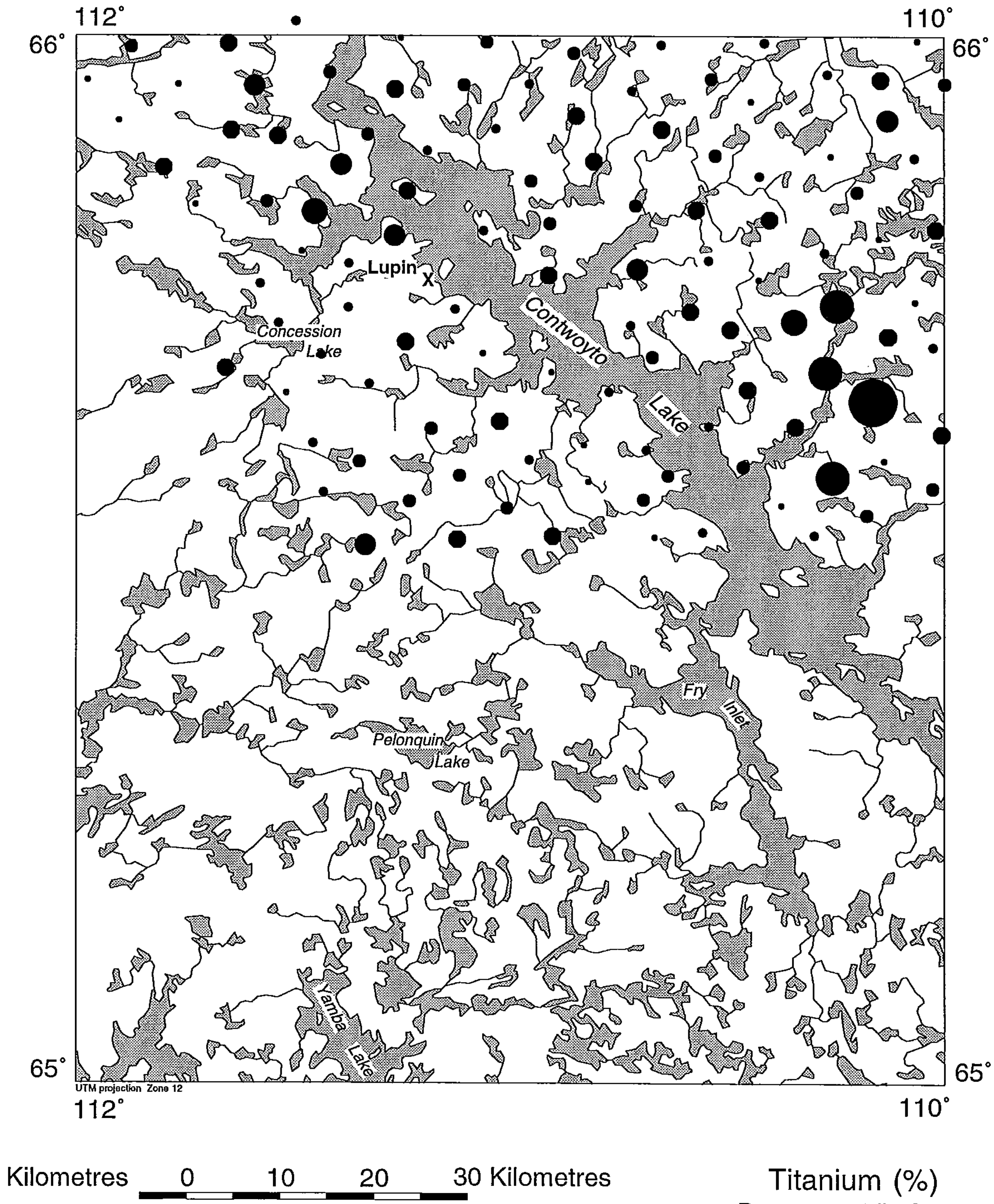
Count:	112
Minimum:	6
Maximum:	32
Mean:	16.11
Median:	16
Mode:	15
St. deviation:	3.89
Coeff. var:	0.24
Geom. mean	15.62
Skewness:	0.48
Kurtosis:	1.86

Frequency Histogram



Cumulative Plot





Titanium (%)

Ranges	%tile	Count
0.21 - 0.23	100	(1)
0.2 - 0.21	99	(3)
0.19 - 0.2	97	(2)
0.17 - 0.19	95	(6)
0.14 - 0.17	90	(25)
0.12 - 0.14	75	(25)
0.10 - 0.12	50	(30)
< 0.10	25	(20)

Ti

Contwoyto Lake (76E, N/2)

Till geochemistry, Contwoyto Lake NTS 76 E (N/2)

TITANIUM

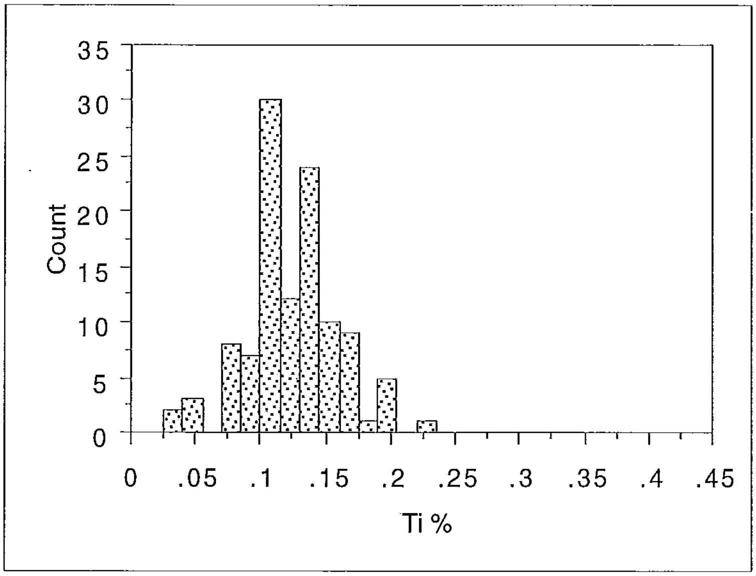
Ti (%)

Fraction:	<0.002 mm	Detection limit:	0.01%
Method:	ICP-AES	Preparation:	Nitric acid-aqua regia partial leach

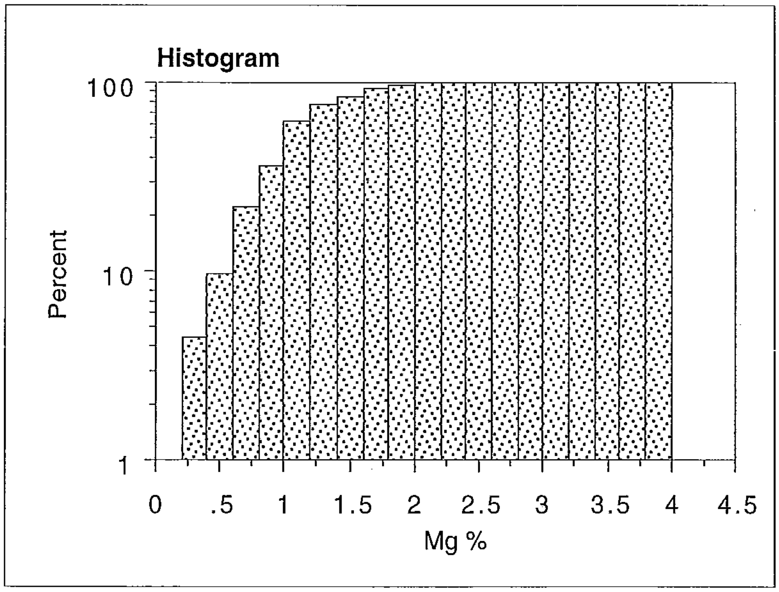
Descriptive Statistics

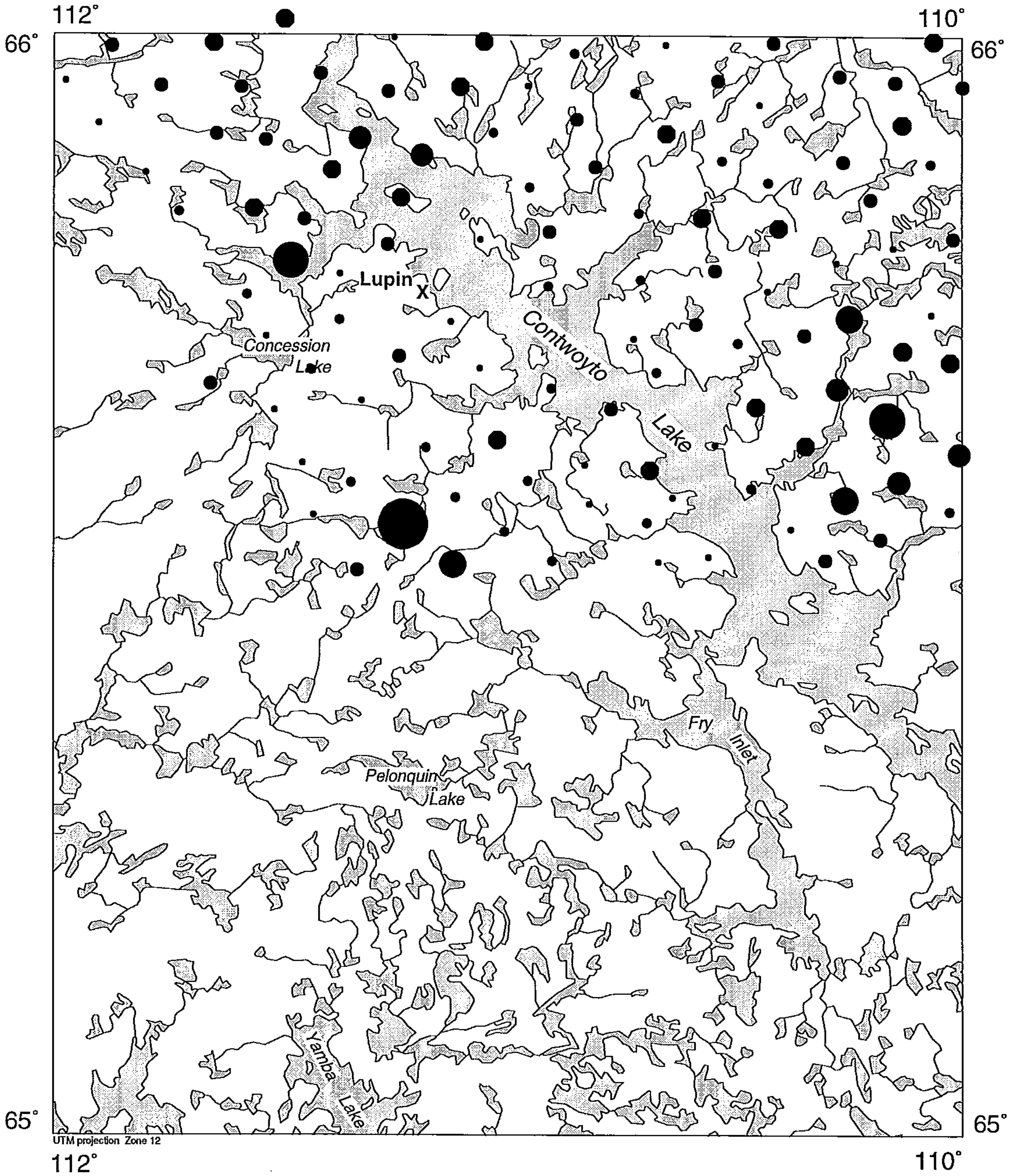
Count:	112
Minimum:	0.03
Maximum:	0.23
Mean:	0.12
Median:	0.12
Mode:	0.01
St. deviation:	0.04
Coeff. var:	0.29
Geom. mean	0.12
Skewness:	0.15
Kurtosis:	0.53

Frequency Histogram



Cumulative Plot





Kilometres 0 10 20 30 Kilometres

V

Contwoyto Lake (76E, N/2)

Vanadium (ppm)

Ranges	%tile	Count
160 - 172	100	(1)
140 - 160	99	(2)
125 - 140	97	(3)
119 - 125	95	(5)
103 - 119	90	(18)
89 - 103	75	(29)
73 - 89	50	(26)
< 73	25	(28)

Till geochemistry, Contwoyto Lake NTS 76 E (N/2)

VANADIUM

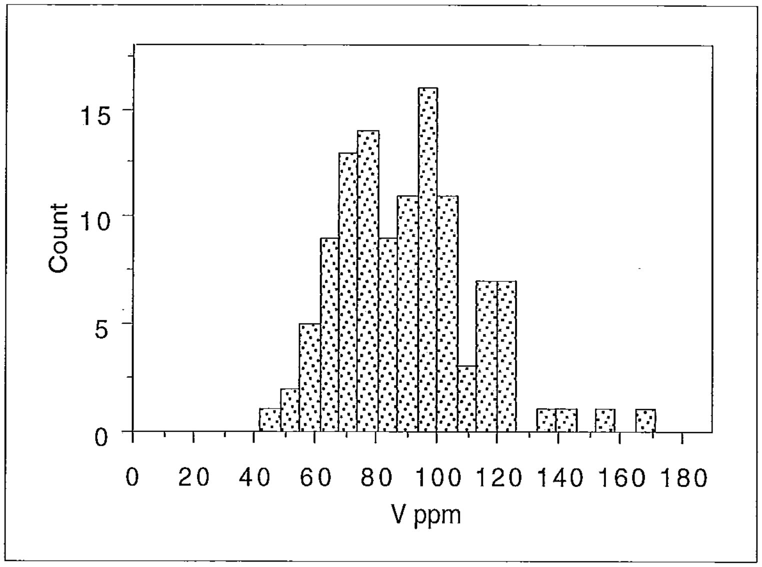
V (ppm)

Fraction:	<0.002 mm	Detection limit:	1 ppm
Method:	ICP-AES	Preparation:	Nitric acid-aqua regia partial leach

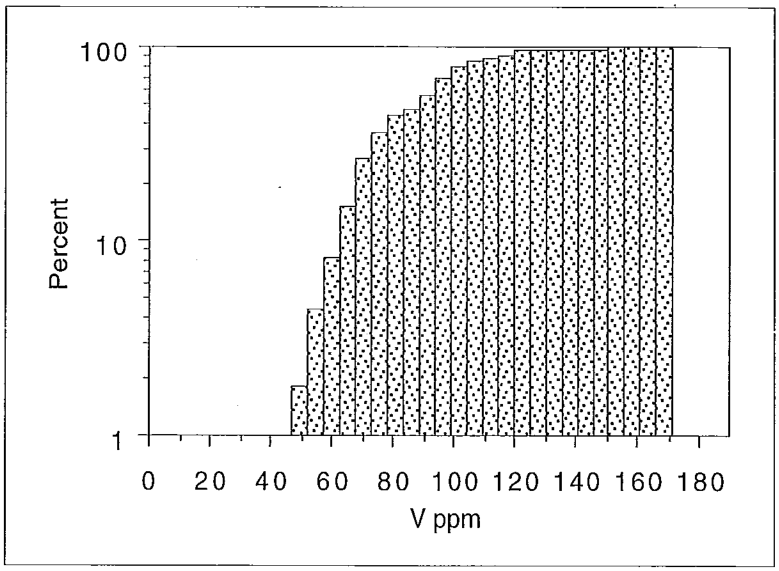
Descriptive Statistics

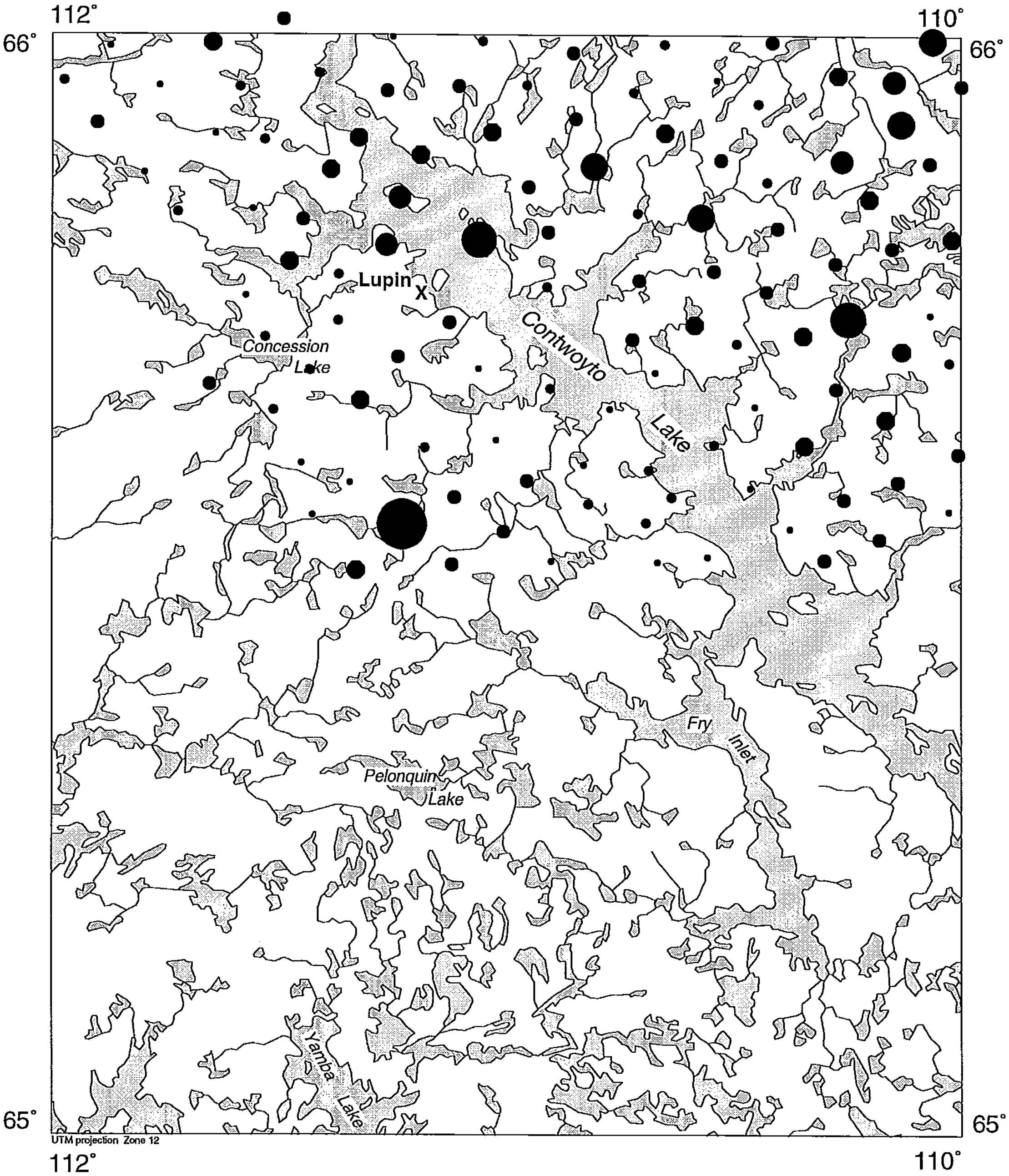
Count:	112
Minimum:	42
Maximum:	172
Mean:	89.94
Median:	89
Mode:	
St. deviation:	22.21
Coeff. var:	0.25
Geom. mean	87.31
Skewness:	0.7
Kurtosis:	0.96

Frequency Histogram



Cumulative Plot





Kilometres 0 10 20 30 Kilometres

Zn

Contwoyto Lake (76E, N/2)

Zinc (ppm)

Ranges	%tile	Count
179 - 198	100	(1)
149 - 179	99	(2)
138 - 149	97	(4)
127 - 138	95	(4)
97 - 127	90	(17)
74 - 97	75	(33)
58 - 74	50	(27)
< 58	25	(24)

Till geochemistry, Contwoyto Lake NTS 76 E (N/2)

ZINC

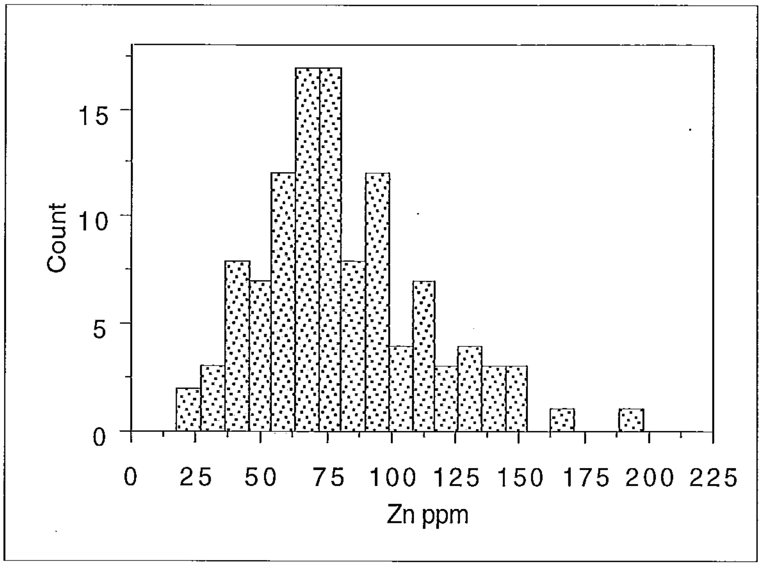
Zn (ppm)

Fraction:	<0.002 mm	Detection limit:	2 ppm
Method:	ICP-AES	Preparation:	Nitric acid-aqua regia partial leach

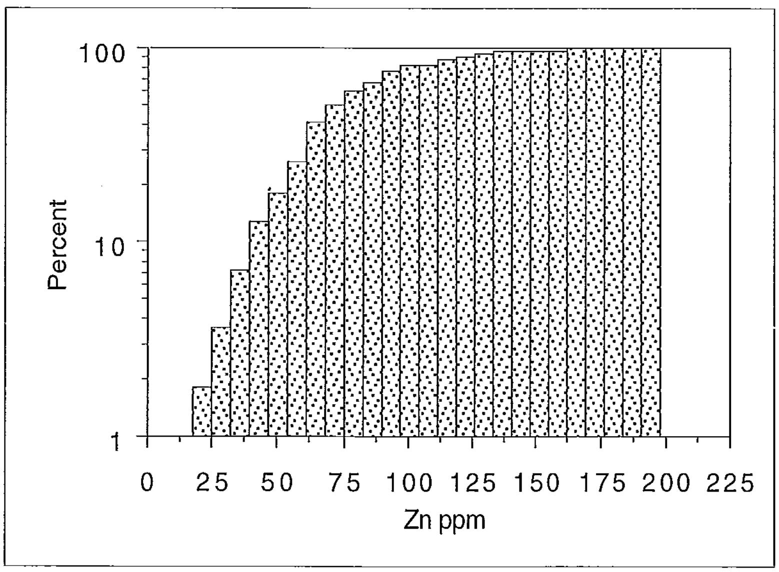
Descriptive Statistics

Count:	112
Minimum:	18
Maximum:	198
Mean:	80.54
Median:	74
Mode:	
St. deviation:	32.14
Coeff. var:	0.4
Geom. mean	74.27
Skewness:	0.82
Kurtosis:	0.9

Frequency Histogram



Cumulative Plot



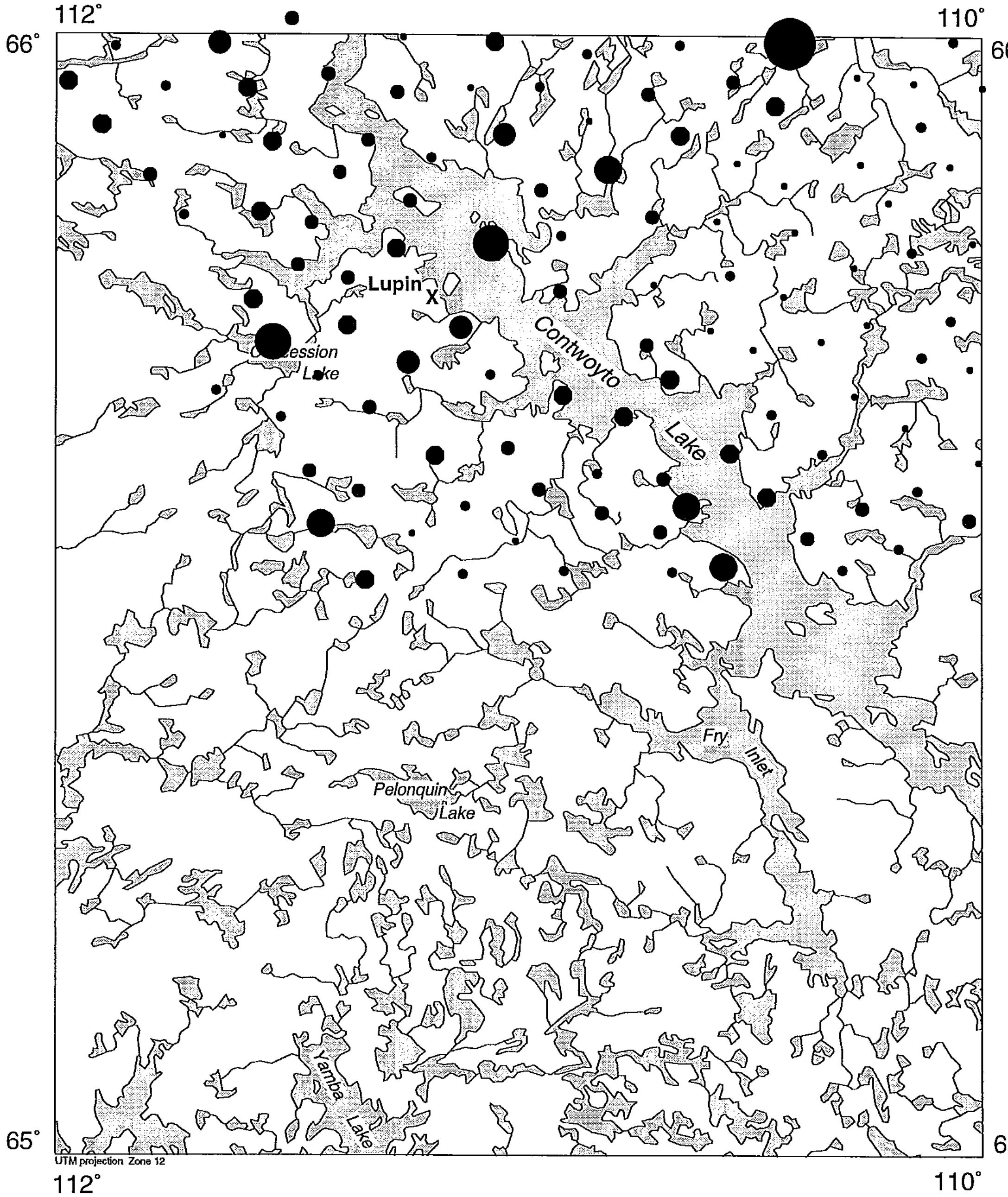
Appendix H. Maps and histograms of element concentration determined by INAA (<0.063 mm fraction)

List of elements for maps and histograms:

As
Au
Ba
Ce
Co
Cr
Fe
La
Nd
Sc
Ta
Th
U

Abbreviations for Descriptive Statistics:

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



Kilometres 0 10 20 30 Kilometres

As

Contwoyto Lake (76E, N/2)

Arsenic (ppm)

Ranges	%tile	Count
24.7 - 34.0	100	(1)
13.1 - 24.7	99	(2)
12.0 - 13.1	97	(4)
8.6 - 12.0	95	(4)
6.0 - 8.6	90	(18)
4.7 - 6.0	75	(27)
3.4 - 4.7	50	(28)
< 3.4	25	(28)

Till geochemistry, Contwoyto Lake NTS 76 E (N/2)

ARSENIC

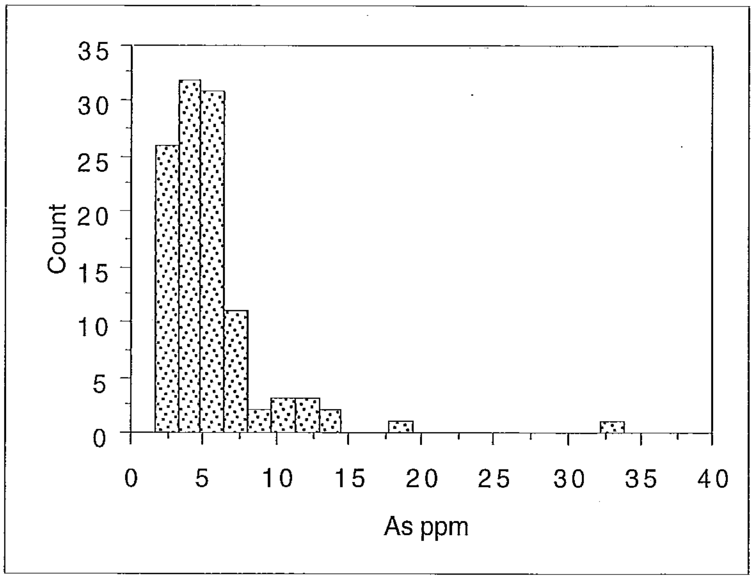
As (ppm)

Fraction:	<0.063 mm	Detection limit:	0.5 ppm
Method:	INAA		

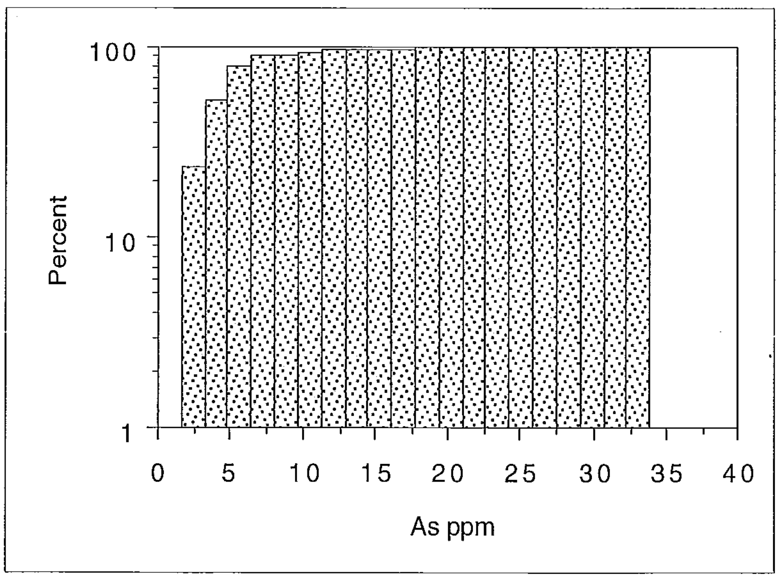
Descriptive Statistics

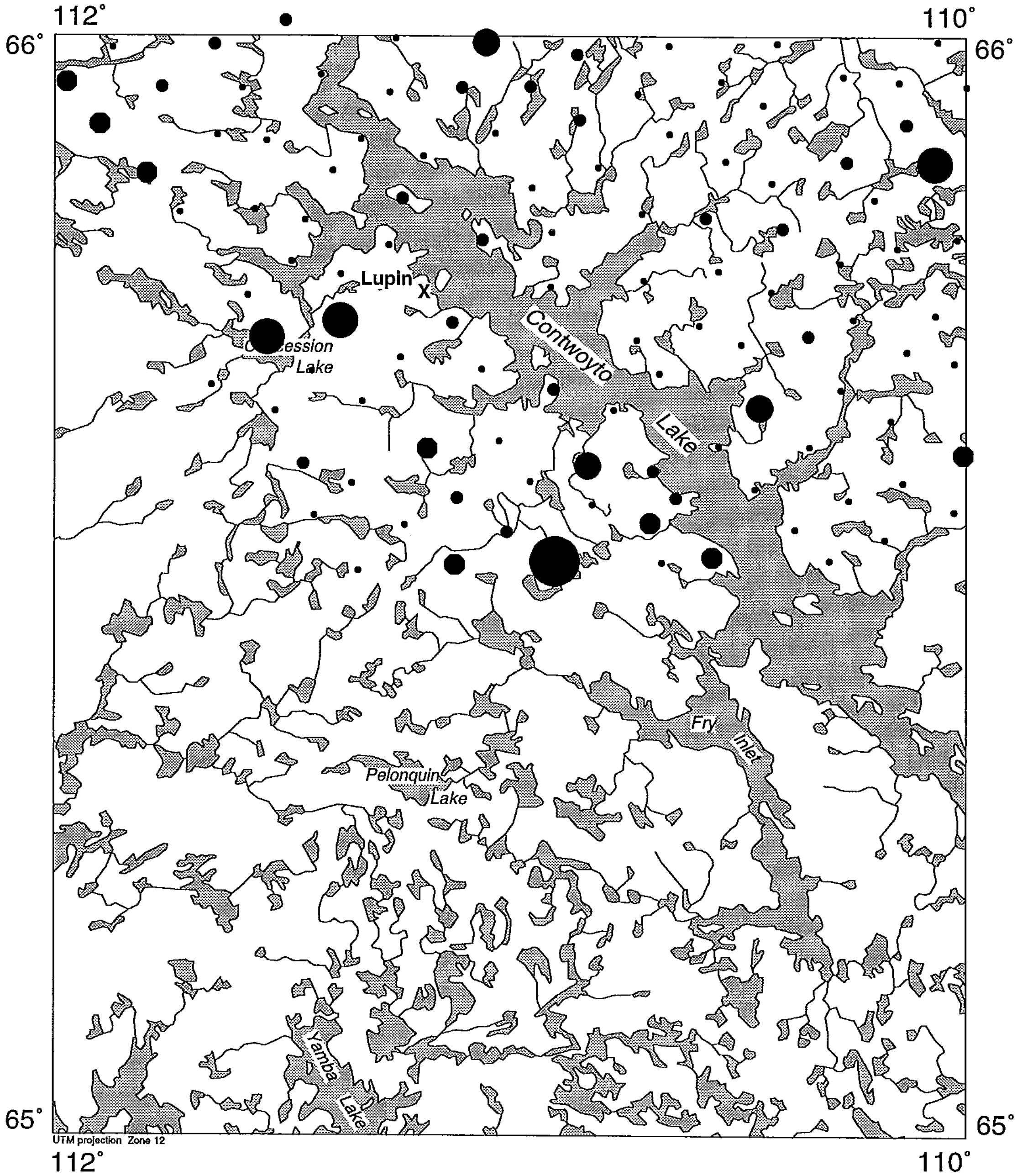
Count:	112
Minimum:	1.6
Maximum:	34
Mean:	5.42
Median:	4.65
Mode:	3.5
St. deviation:	3.9
Coeff. var:	0.72
Geom. mean	4.67
Skewness:	4.18
Kurtosis:	25.2

Frequency Histogram



Cumulative Plot





Kilometres 0 10 20 30 Kilometres

Gold (ppb)

Ranges	%tile	Count
28 - 34	100	(1)
15 - 28	99	(3)
10 - 15	97	(3)
8 - 10	95	(8)
5 - 8	90	(21)
. < 5	75	(76)

Au

Contwoyto Lake (76E, N/2)

Till geochemistry, Contwoyto Lake NTS 76 E (N/2)

GOLD

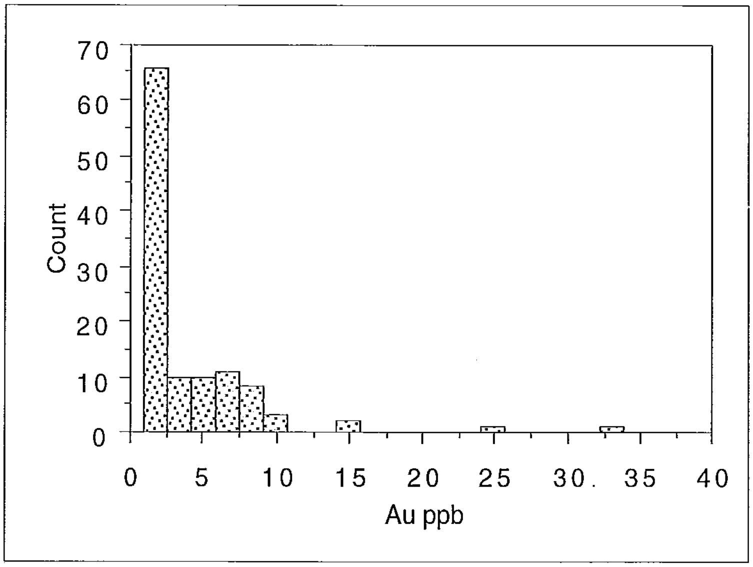
Au (ppm)

Fraction:	<0.063 mm	Detection limit:	2 ppb
Method:	INAA		

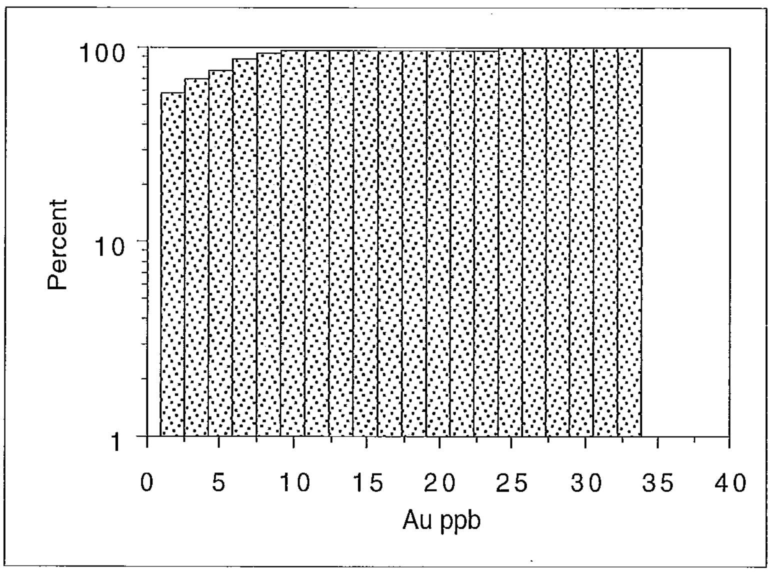
Descriptive Statistics

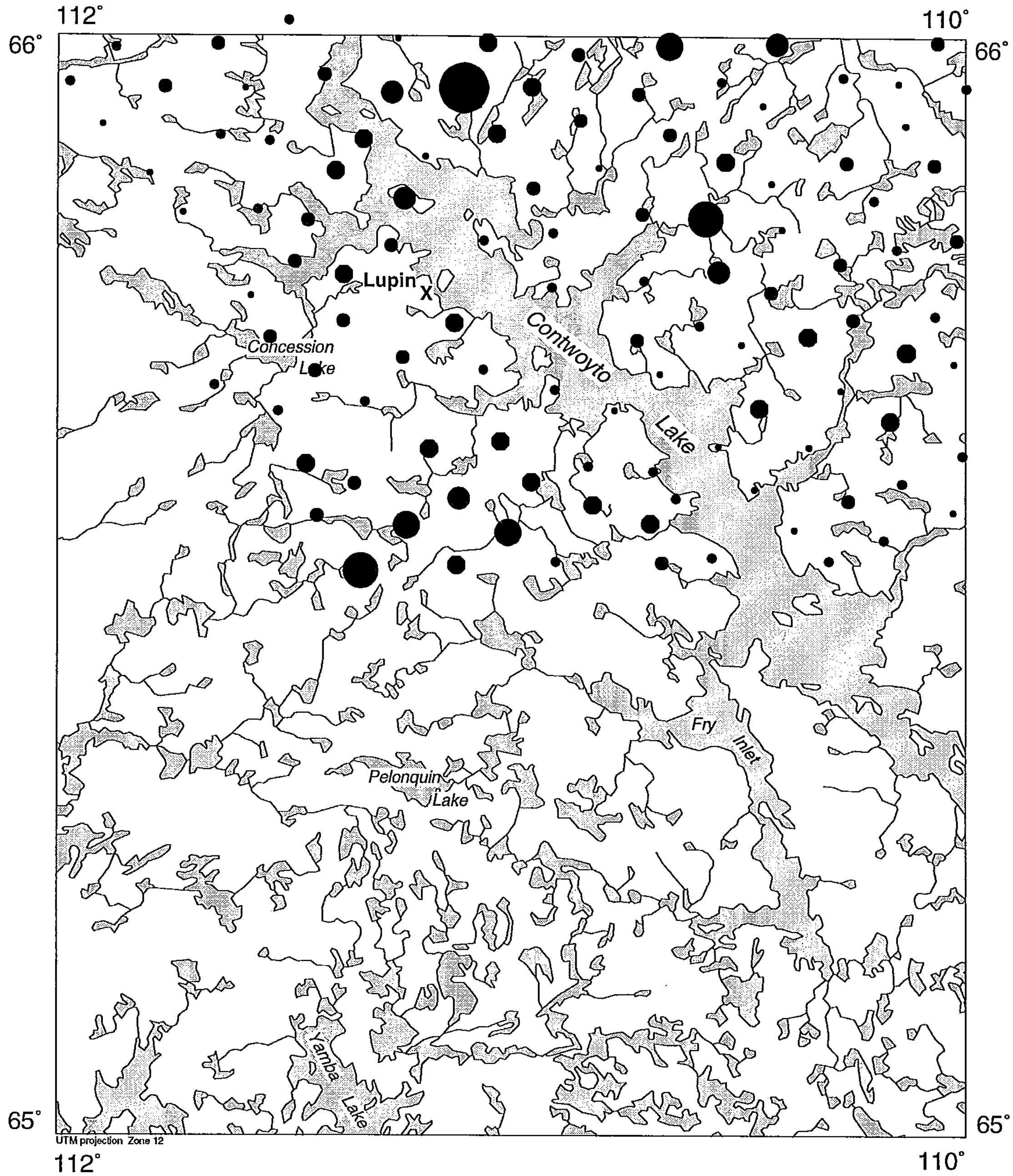
Count:	112
Minimum:	1
Maximum:	34
Mean:	3.66
Median:	1
Mode:	1
St. deviation:	4.71
Coeff. var:	1.29
Geom. mean	2.19
Skewness:	3.56
Kurtosis:	17.27

Frequency Histogram



Cumulative Plot





Kilometres 0 10 20 30 Kilometres

Ba

Contwoyto Lake (76E, N/2)

Barium (ppm)

Ranges	%tile	Count
775 - 800	100	(1)
712 - 775	99	(2)
689 - 712	97	(3)
663 - 689	95	(5)
610 - 663	90	(19)
560 - 610	75	(28)
500 - 560	50	(31)
< 500	25	(23)

Till geochemistry, Contwoyto Lake NTS 76 E (N/2)

BARIUM

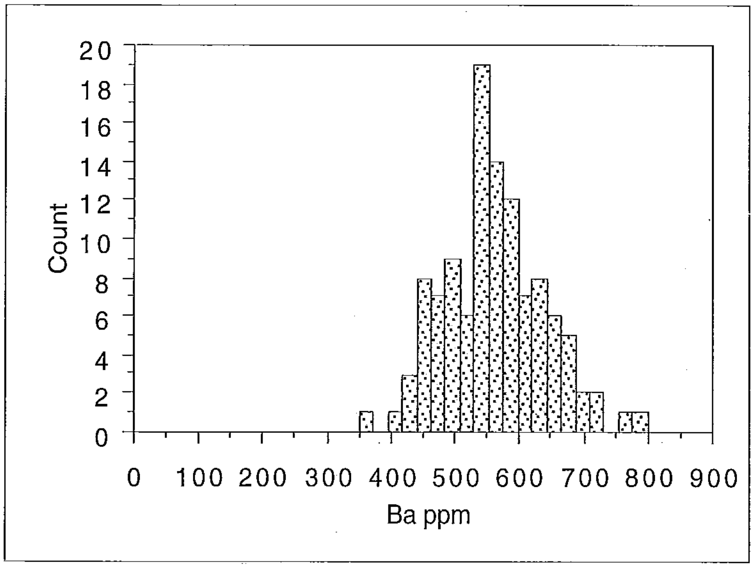
Ba (ppm)

Fraction:	<0.063 mm	Detection limit:	50 ppm
Method:	INAA		

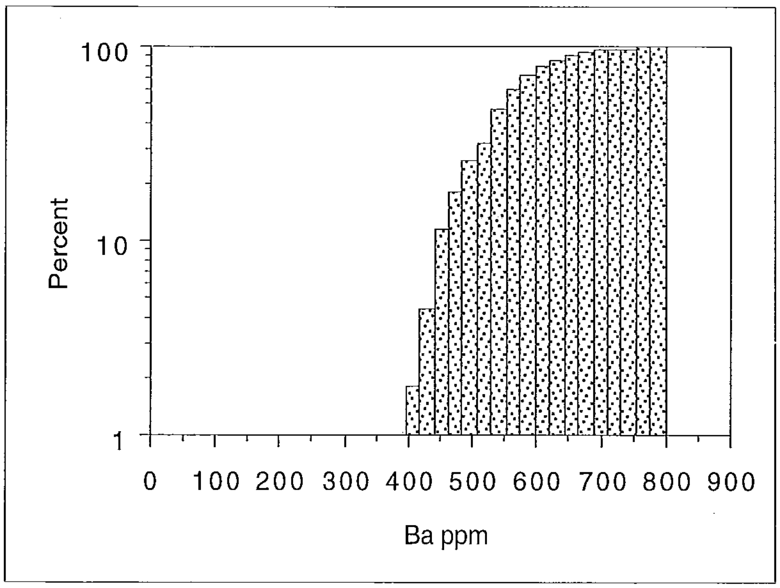
Descriptive Statistics

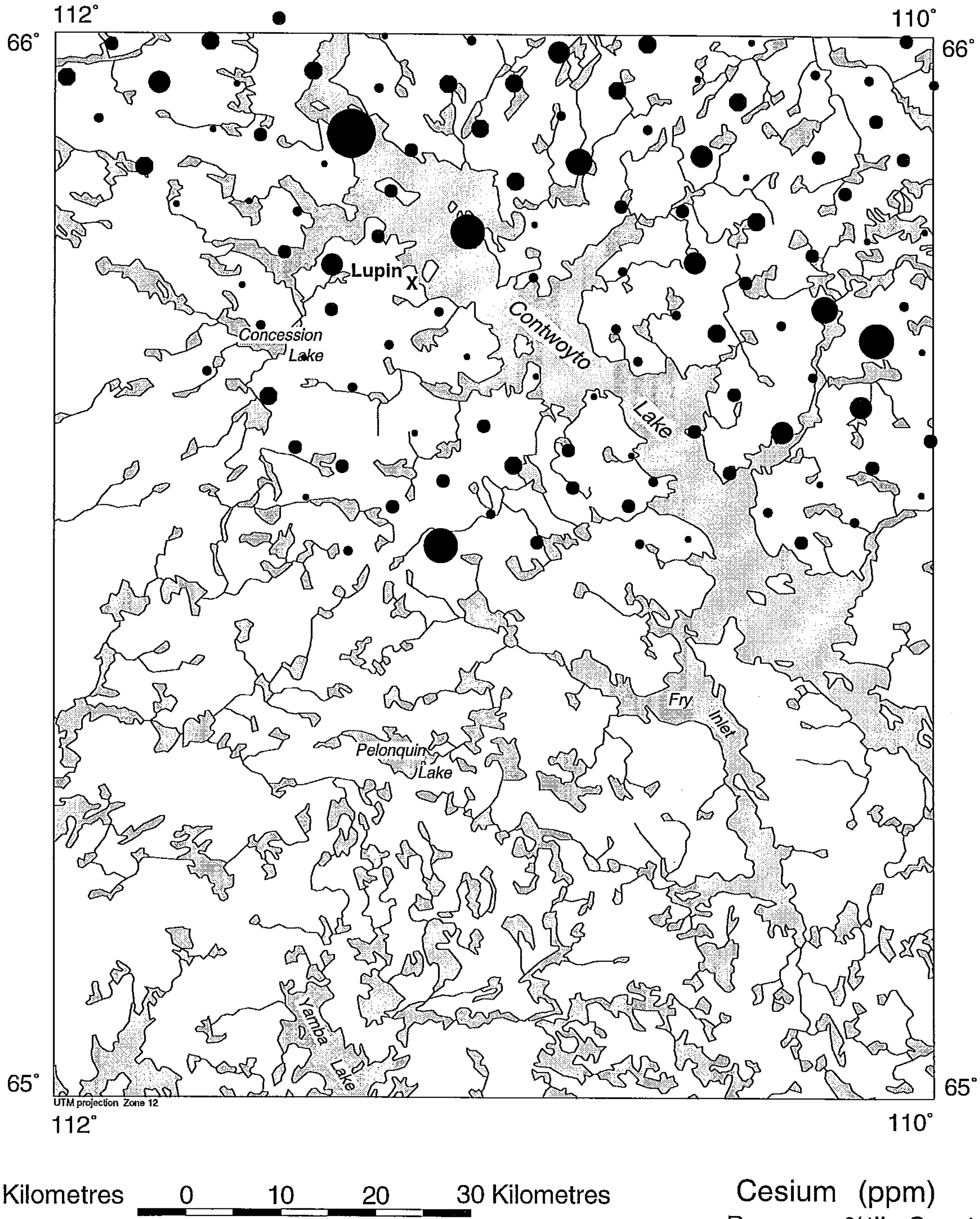
Count:	112
Minimum:	350
Maximum:	800
Mean:	560.45
Median:	560
Mode:	540
St. deviation:	78.49
Coeff. var:	0.14
Geom. mean	554.99
Skewness:	0.26
Kurtosis:	0.22

Frequency Histogram



Cumulative Plot





Cesium (ppm) Ranges	%tile	Count
90 - 91	100	(1)
83 - 90	99	(3)
79 - 83	97	(2)
73 - 79	95	(7)
67 - 73	90	(15)
60 - 67	75	(32)
55 - 60	50	(28)
< 55	25	(24)

Ce

Contwoyto Lake (76E, N/2)

Till geochemistry, Contwoyto Lake NTS 76 E (N/2)

CESIUM

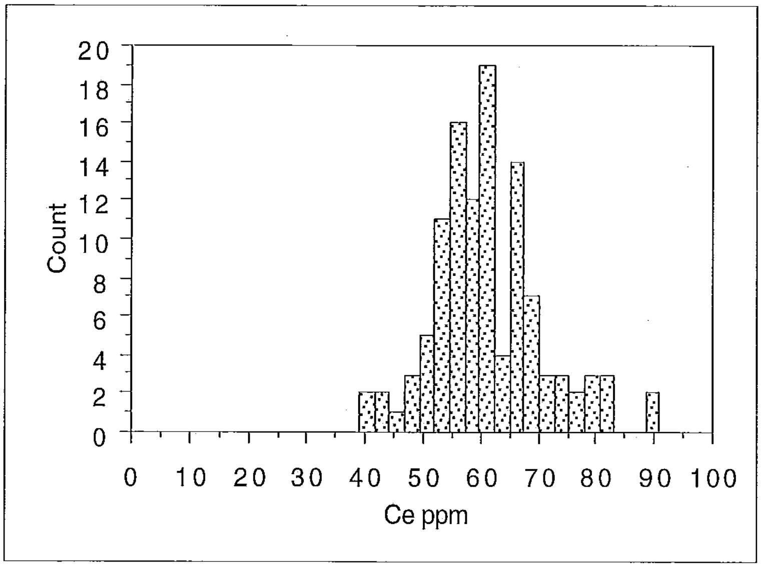
Ce (ppm)

Fraction:	<0.063 mm	Detection limit:	3 ppm
Method:	INAA		

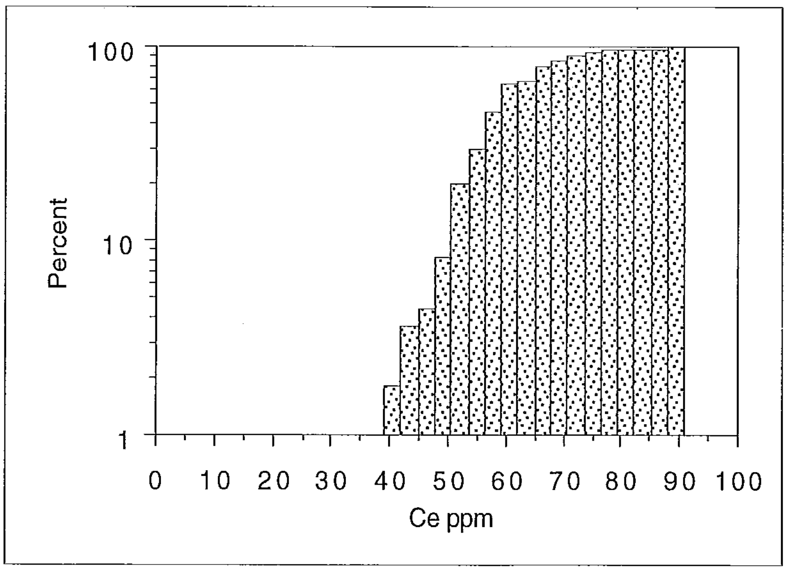
Descriptive Statistics

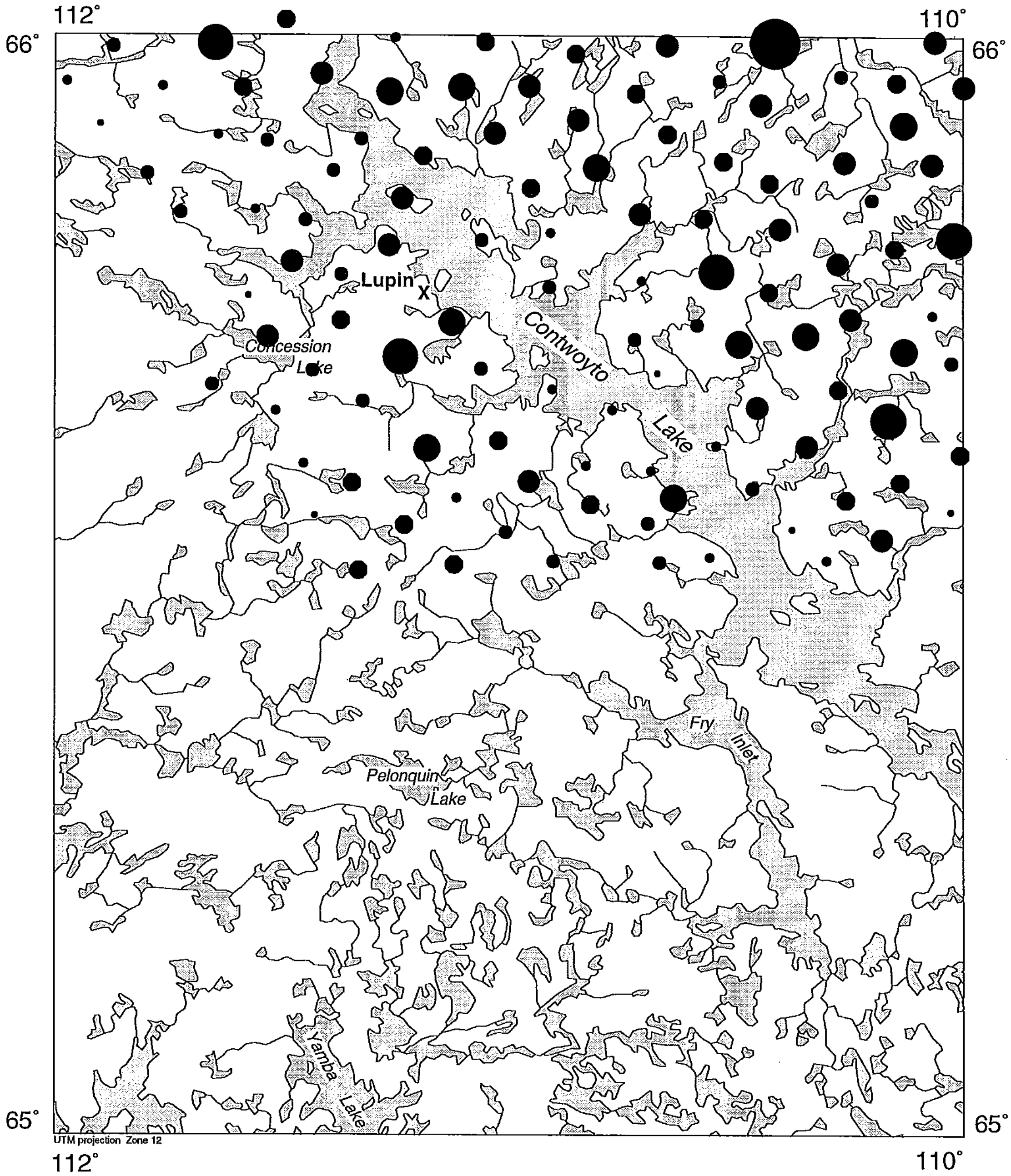
Count:	112
Minimum:	39
Maximum:	91
Mean:	61.21
Median:	60
Mode:	61
St. deviation:	9.55
Coeff. var:	0.16
Geom. mean	60.48
Skewness:	0.58
Kurtosis:	0.78

Frequency Histogram



Cumulative Plot





Kilometres 0 10 20 30 Kilometres

Cobalt (ppm)

Ranges	%tile	Count
11 - 12	100	(1)
10 - 11	99	(5)
9 - 10	95	(10)
8 - 9	90	(22)
7 - 8	75	(25)
6 - 7	50	(25)
5 - 6	25	(18)
< 5	10	(6)

Co

Contwoyto Lake (76E, N/2)

Till geochemistry, Contwoyto Lake NTS 76 E (N/2)

COBALT

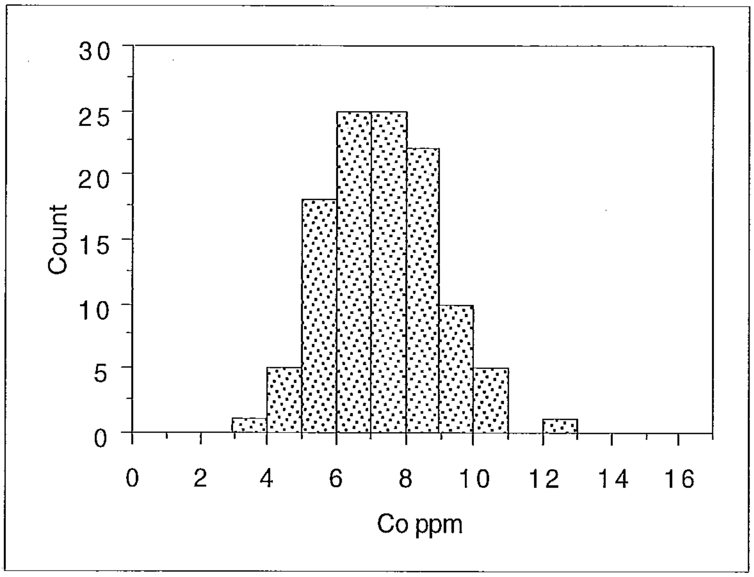
Co (ppm)

Fraction:	<0.063 mm	Detection limit:	1 ppm
Method:	INAA		

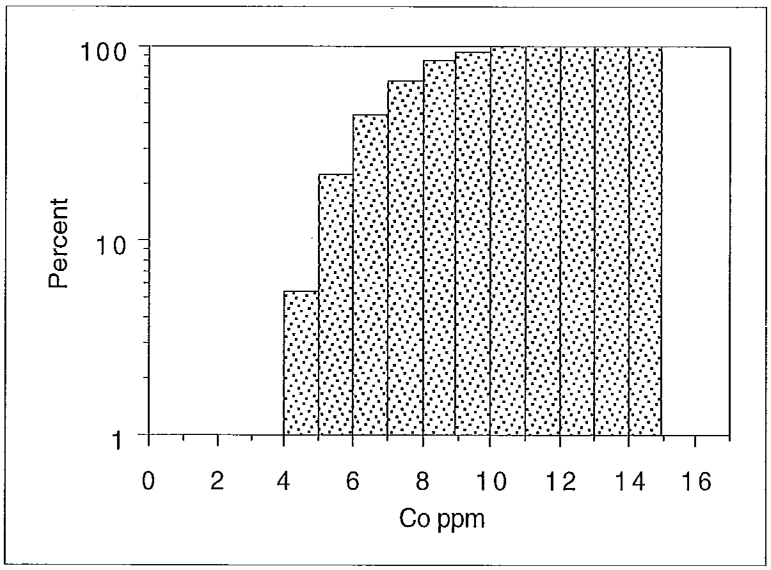
Descriptive Statistics

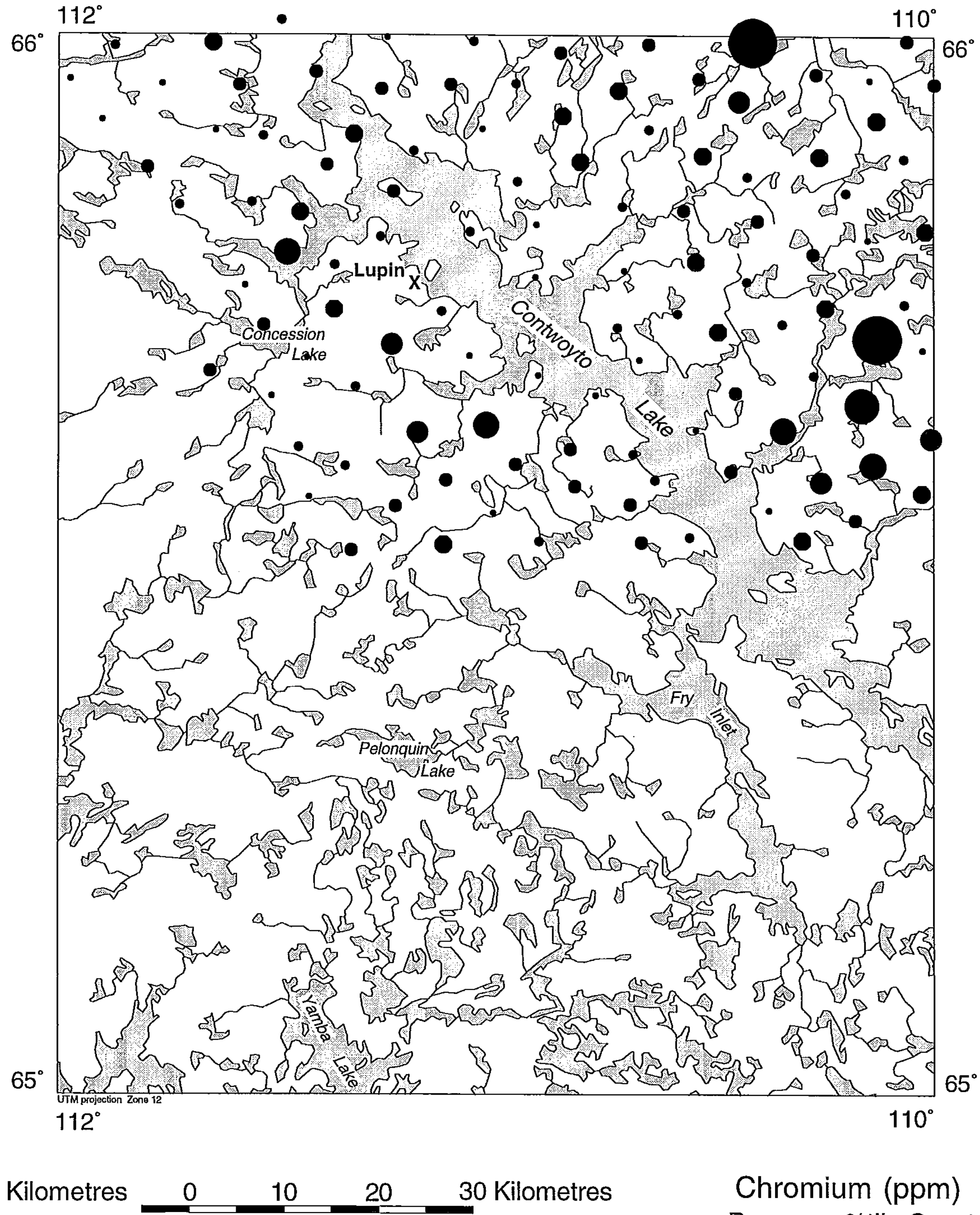
Count:	112
Minimum:	3
Maximum:	12
Mean:	6.84
Median:	7
Mode:	
St. deviation:	1.61
Coeff. var:	0.24
Geom. mean	6.65
Skewness:	0.29
Kurtosis:	0.03

Frequency Histogram



Cumulative Plot





Chromium (ppm)

Ranges	%tile	Count
84 - 85	100	(2)
77 - 84	99	(1)
67 - 77	97	(4)
62 - 67	95	(5)
54 - 62	90	(17)
49 - 54	75	(29)
43 - 49	50	(31)
< 43	25	(23)

Cr

Contwoyto Lake (76E, N/2)

Till geochemistry, Contwoyto Lake NTS 76 E (N/2)

CHROMIUM

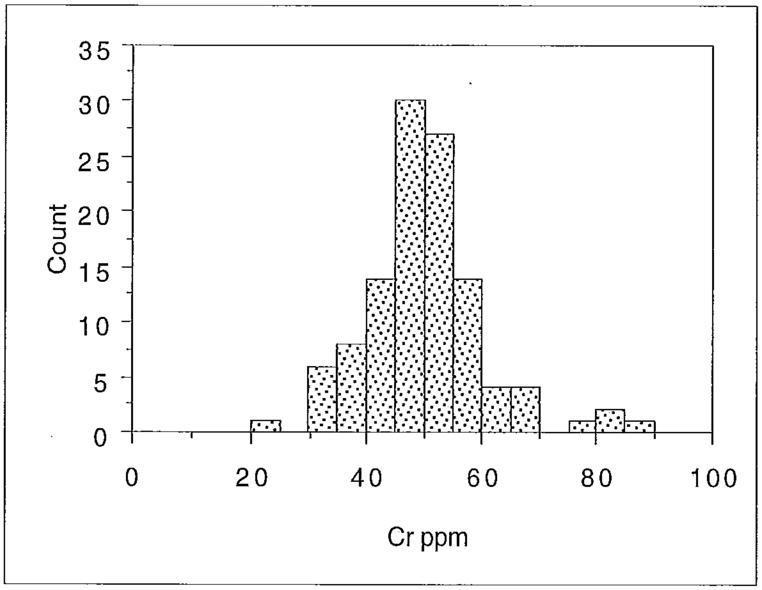
Cr (ppm)

Fraction:	<0.063 mm	Detection limit:	1 ppm
Method:	INAA		

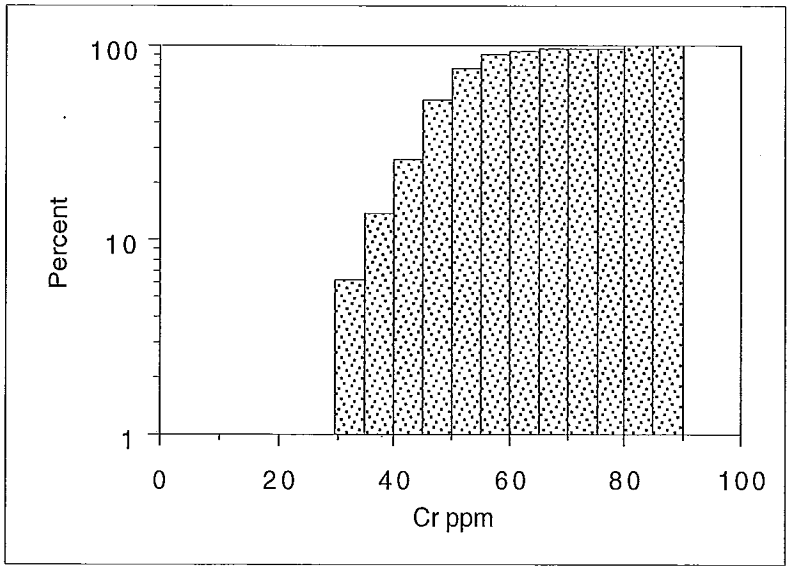
Descriptive Statistics

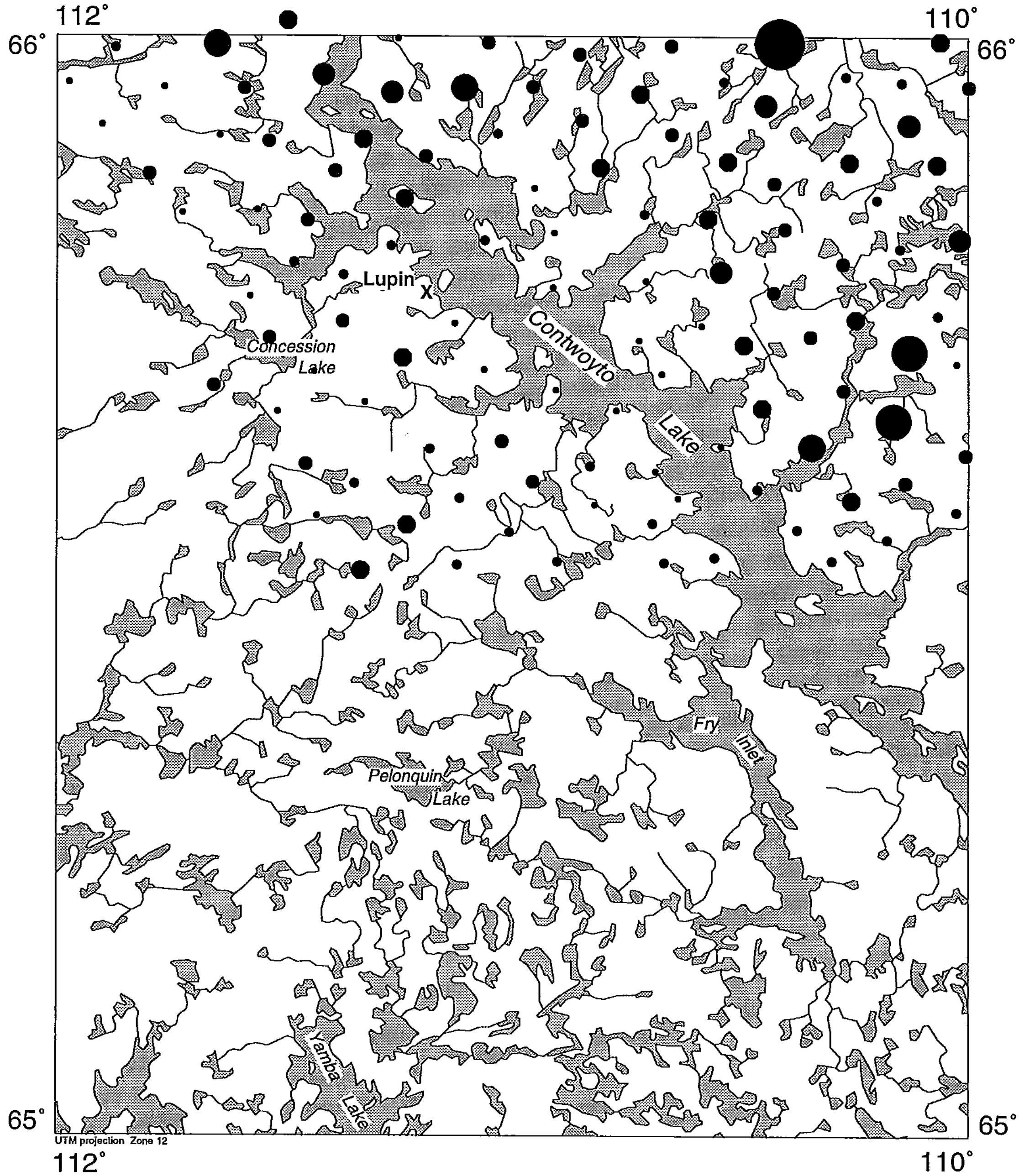
Count:	112
Minimum:	24
Maximum:	85
Mean:	49.61
Median:	49
Mode:	51
St. deviation:	10.12
Coeff. var:	0.2
Geom. mean	48.64
Skewness:	0.97
Kurtosis:	2.41

Frequency Histogram



Cumulative Plot





Kilometres 0 10 20 30 Kilometres

Fe

Contwoyto Lake (76E, N/2)

Iron (%)

Ranges	%tile	Count
3.01 - 3.15	100	(1)
2.58 - 3.01	99	(2)
2.55 - 2.58	97	(3)
2.41 - 2.55	95	(6)
2.18 - 2.41	90	(17)
2.02 - 2.18	75	(27)
1.84 - 2.02	50	(28)
< 1.84	25	(28)

Till geochemistry, Contwoyto Lake NTS 76 E (N/2)

IRON

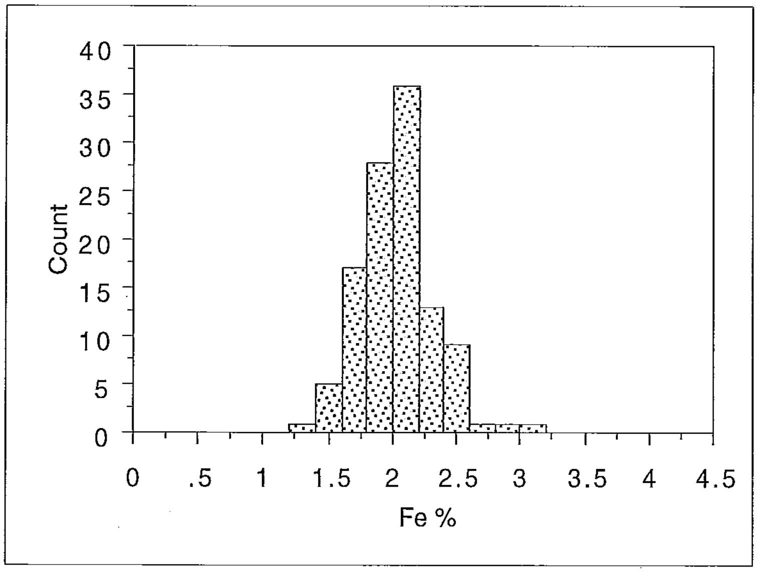
Fe (%)

Fraction:	<0.063 mm	Detection limit:	0.01%
Method:	INAA		

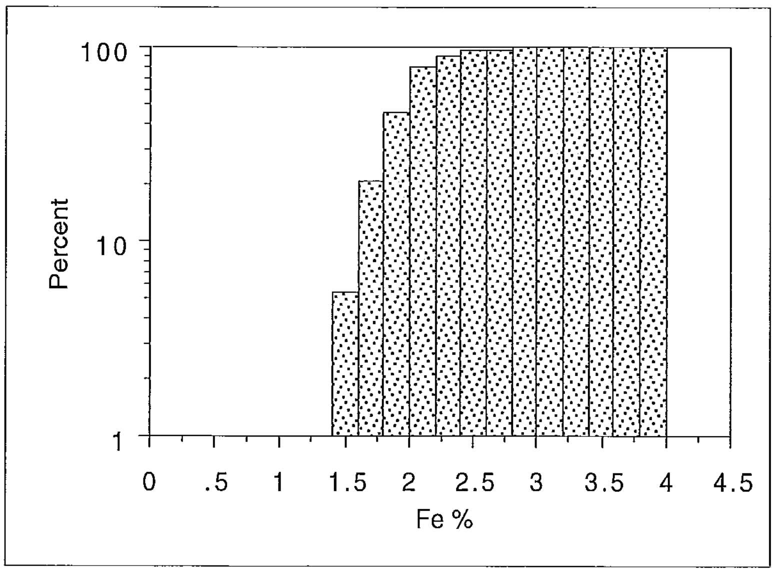
Descriptive Statistics

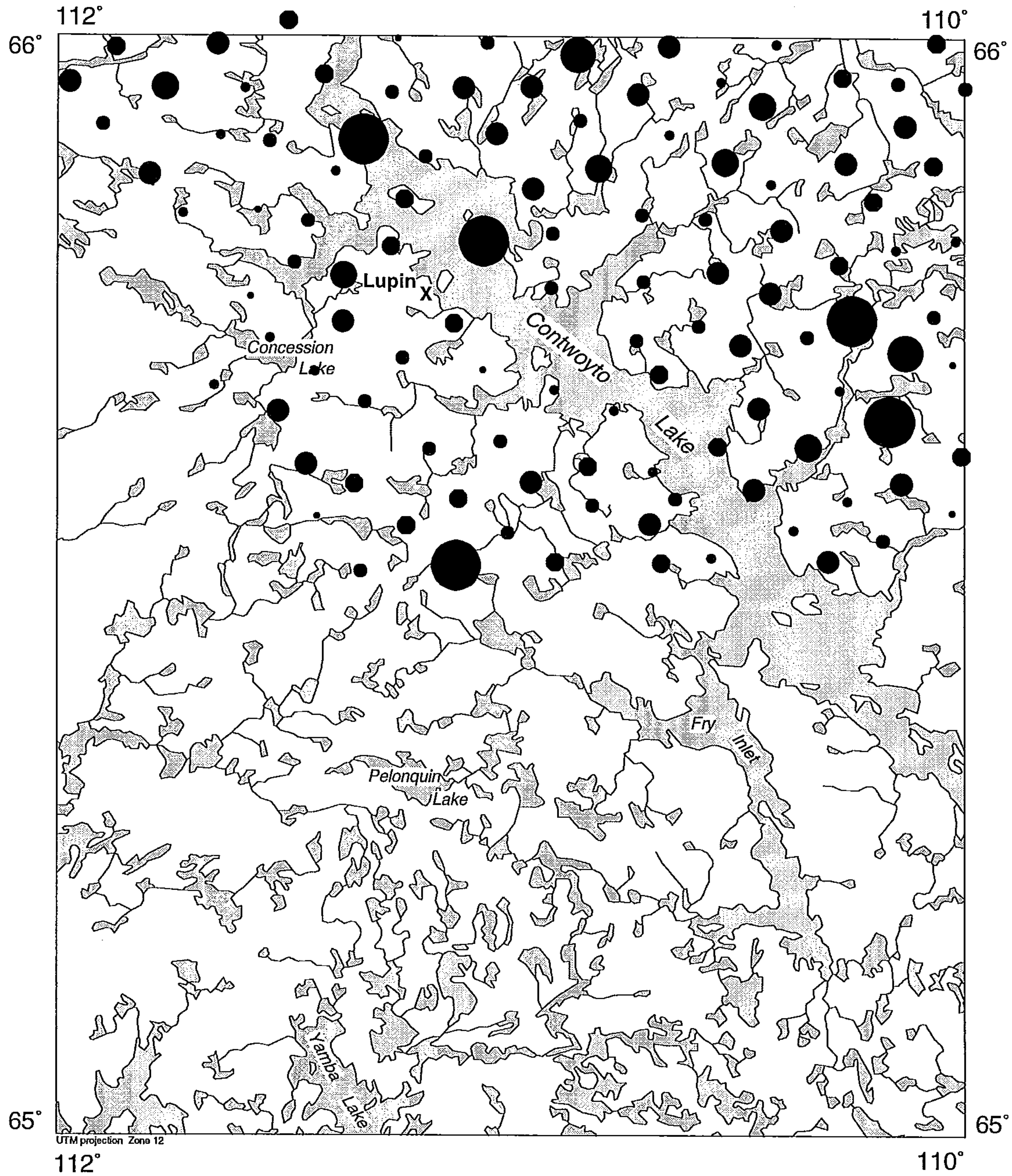
Count:	112
Minimum:	1.37
Maximum:	3.15
Mean:	2.03
Median:	2.01
Mode:	
St. deviation:	0.3
Coeff. var:	0.15
Geom. mean	2.01
Skewness:	0.68
Kurtosis:	1.47

Frequency Histogram



Cumulative Plot





Kilometres 0 10 20 30 Kilometres

Lanthanum (ppm)

Ranges	%tile	Count
45 - 51	100	(5)
44 - 45	97	(2)
40 - 44	95	(6)
36 - 40	90	(24)
34 - 36	75	(20)
31 - 34	50	(28)
28 - 31	25	(20)
< 28	10	(7)

La

Contwoyto Lake (76E, N/2)

Till geochemistry, Contwoyto Lake NTS 76 E (N/2)

LANTHANUM

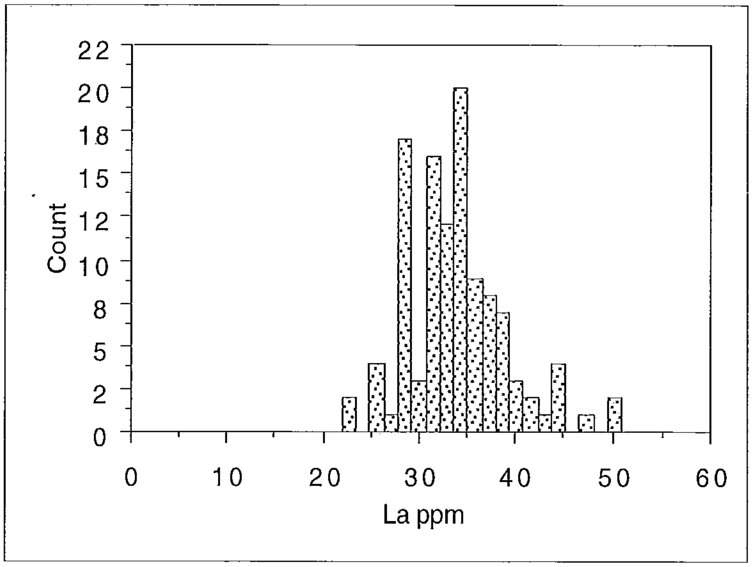
La (ppm)

Fraction:	<0.063 mm	Detection limit:	0.5 ppm
Method:	INAA		

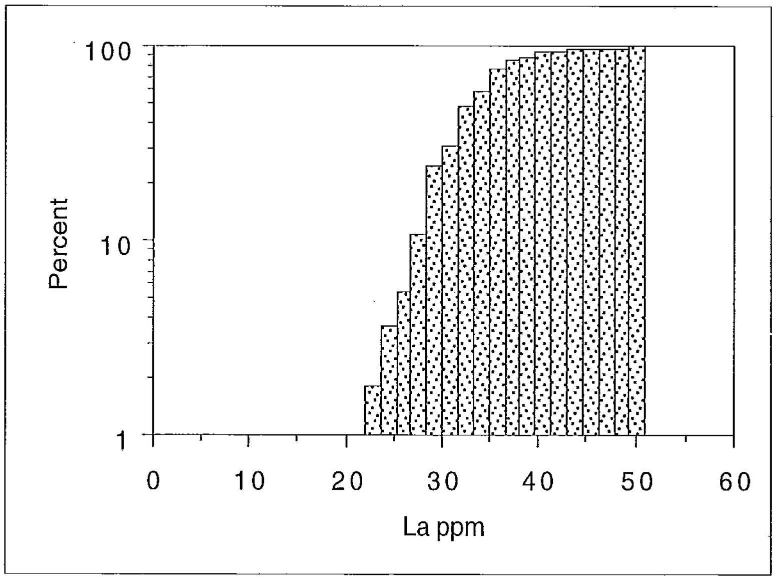
Descriptive Statistics

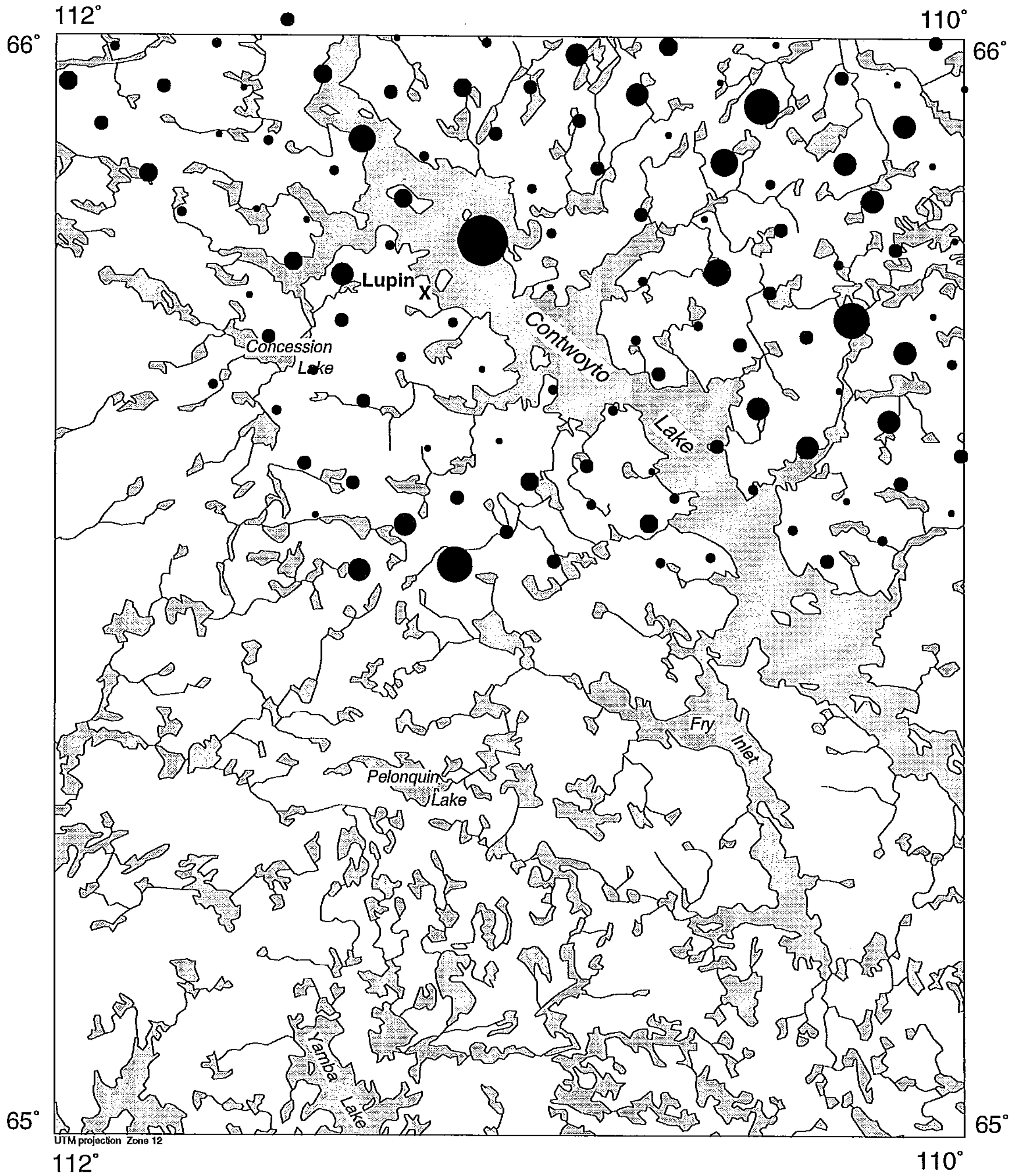
Count:	112
Minimum:	22
Maximum:	51
Mean:	33.96
Median:	34
Mode:	
St. deviation:	5.2
Coeff. var:	0.15
Geom. mean	33.57
Skewness:	0.69
Kurtosis:	1.3

Frequency Histogram



Cumulative Plot





Kilometres 0 10 20 30 Kilometres

Neodymium (ppm) Ranges	%tile	Count
41 - 43	100	(1)
37 - 41	99	(3)
34 - 37	97	(3)
32 - 34	95	(12)
30 - 32	90	(9)
26 - 30	75	(30)
23 - 26	50	(30)
< 23	25	(24)

Nd

Contwoyto Lake (76E, N/2)

Till geochemistry, Contwoyto Lake NTS 76 E (N/2)

NEODYMIUM

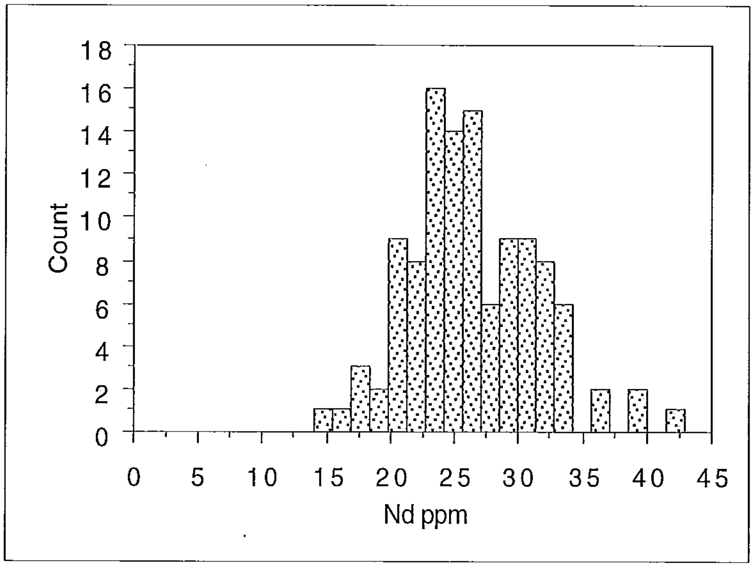
Nd (ppm)

Fraction:	<0.063 mm	Detection limit:	5 ppm
Method:	INAA		

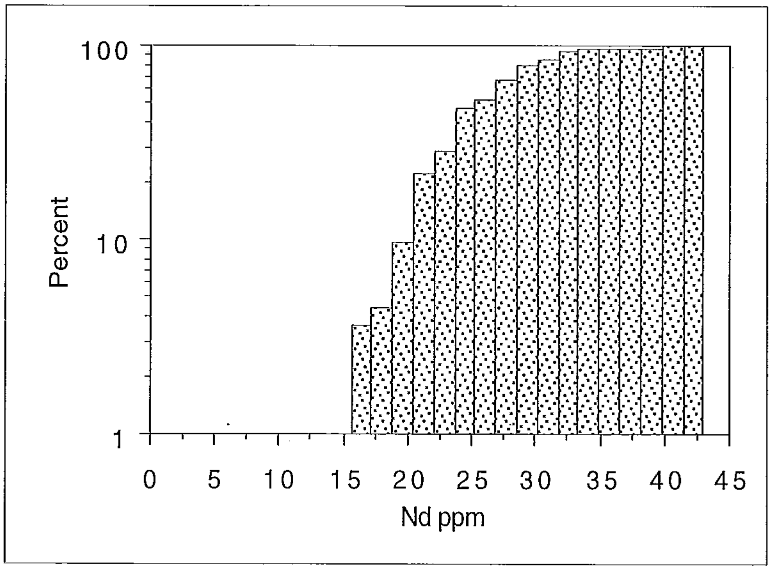
Descriptive Statistics

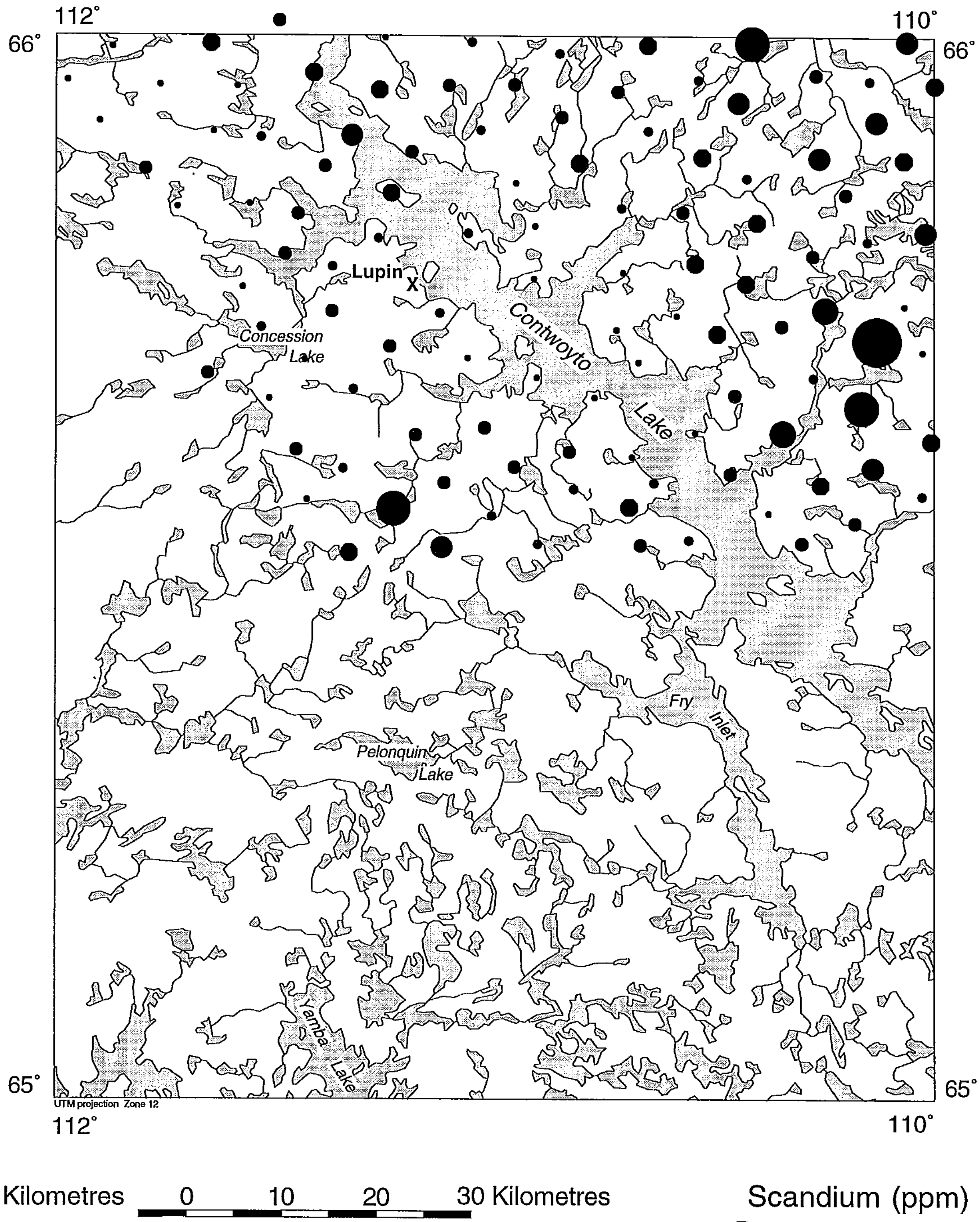
Count:	112
Minimum:	14
Maximum:	43
Mean:	26.46
Median:	26
Mode:	25
St. deviation:	5.08
Coeff. var:	0.19
Geom. mean	25.97
Skewness:	0.41
Kurtosis:	0.54

Frequency Histogram



Cumulative Plot





Scandium (ppm)

Ranges	%tile	Count
10.4 - 11	100	(1)
9.5 - 10.4	99	(3)
9.1 - 9.5	97	(2)
8.3 - 9.1	95	(8)
7.8 - 8.3	90	(17)
7.3 - 7.8	75	(29)
6.6 - 7.3	50	(24)
< 6.6	25	(28)

Sc

Contwoyto Lake (76E, N/2)

Till geochemistry, Contwoyto Lake NTS 76 E (N/2)

SCANDIUM

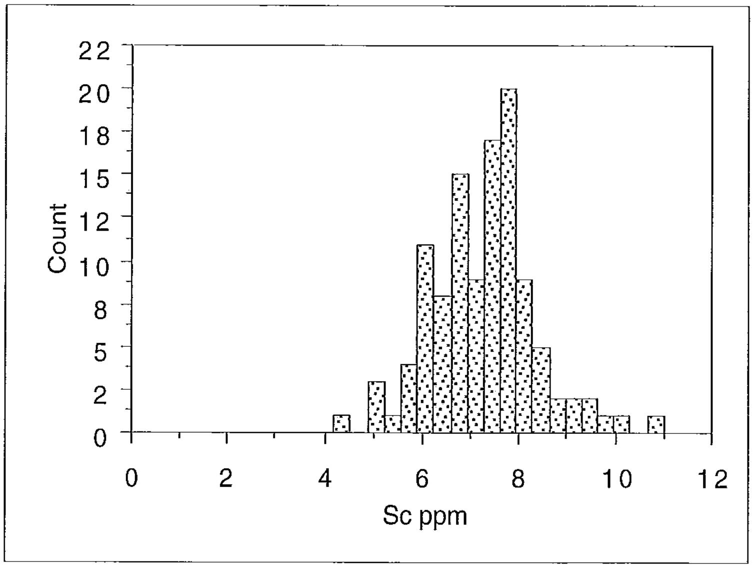
Sc (ppm)

Fraction:	<0.063 mm	Detection limit:	1 ppm
Method:	INAA		

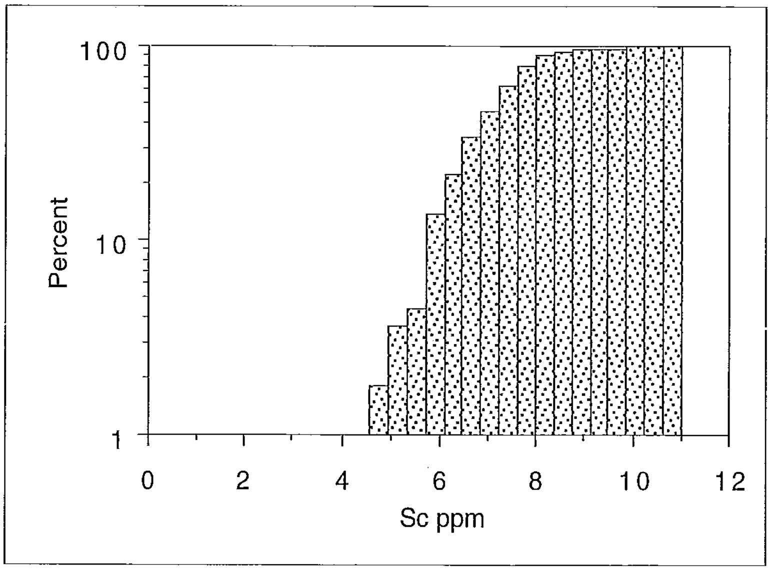
Descriptive Statistics

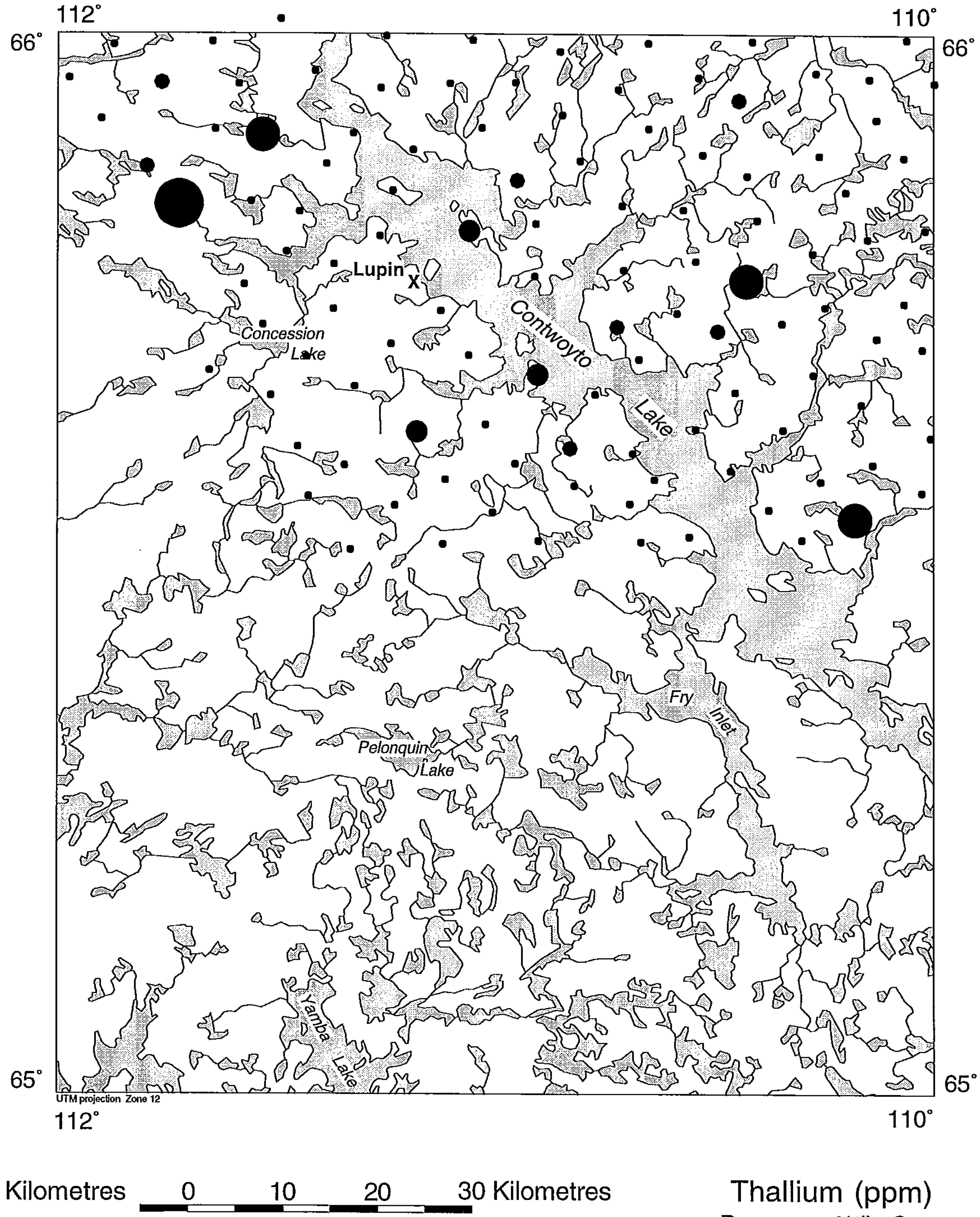
Count:	112
Minimum:	4.2
Maximum:	11
Mean:	7.24
Median:	7.3
Mode:	7.4
St. deviation:	1.07
Coeff. var:	0.15
Geom. mean	7.16
Skewness:	0.33
Kurtosis:	1.18

Frequency Histogram



Cumulative Plot





Thallium (ppm)

Ranges	%tile	Count
2.5 - 3.2	100	(1)
1.8 - 2.5	99	(3)
1.6 - 1.8	97	(3)
1.4 - 1.6	95	(7)
< 1.4	90	(98)

Ta

Contwoyto Lake (76E, N/2)

Till geochemistry, Contwoyto Lake NTS 76 E (N/2)

TANTALUM

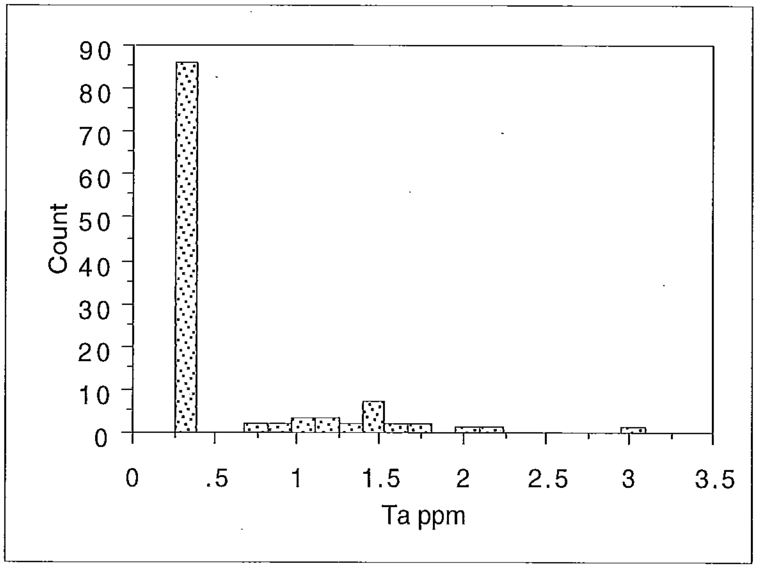
Ta (ppm)

Fraction:	<0.063 mm	Detection limit:	0.5 ppm
Method:	INAA		

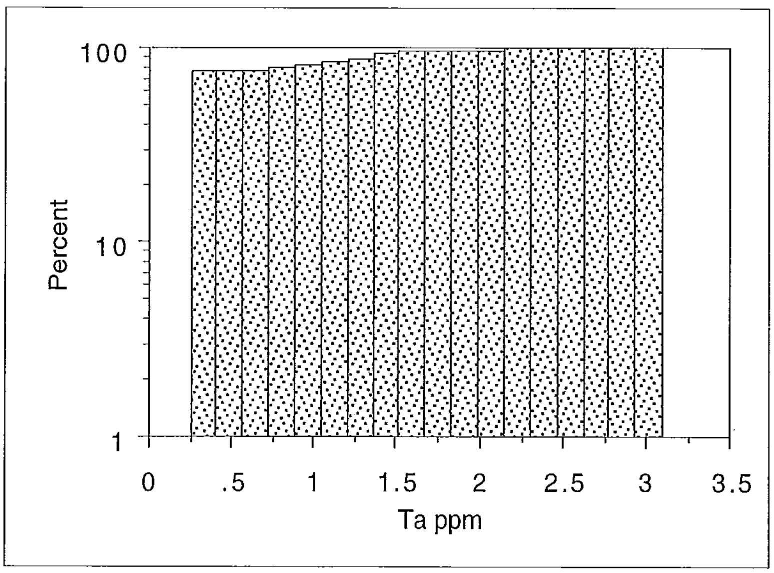
Descriptive Statistics

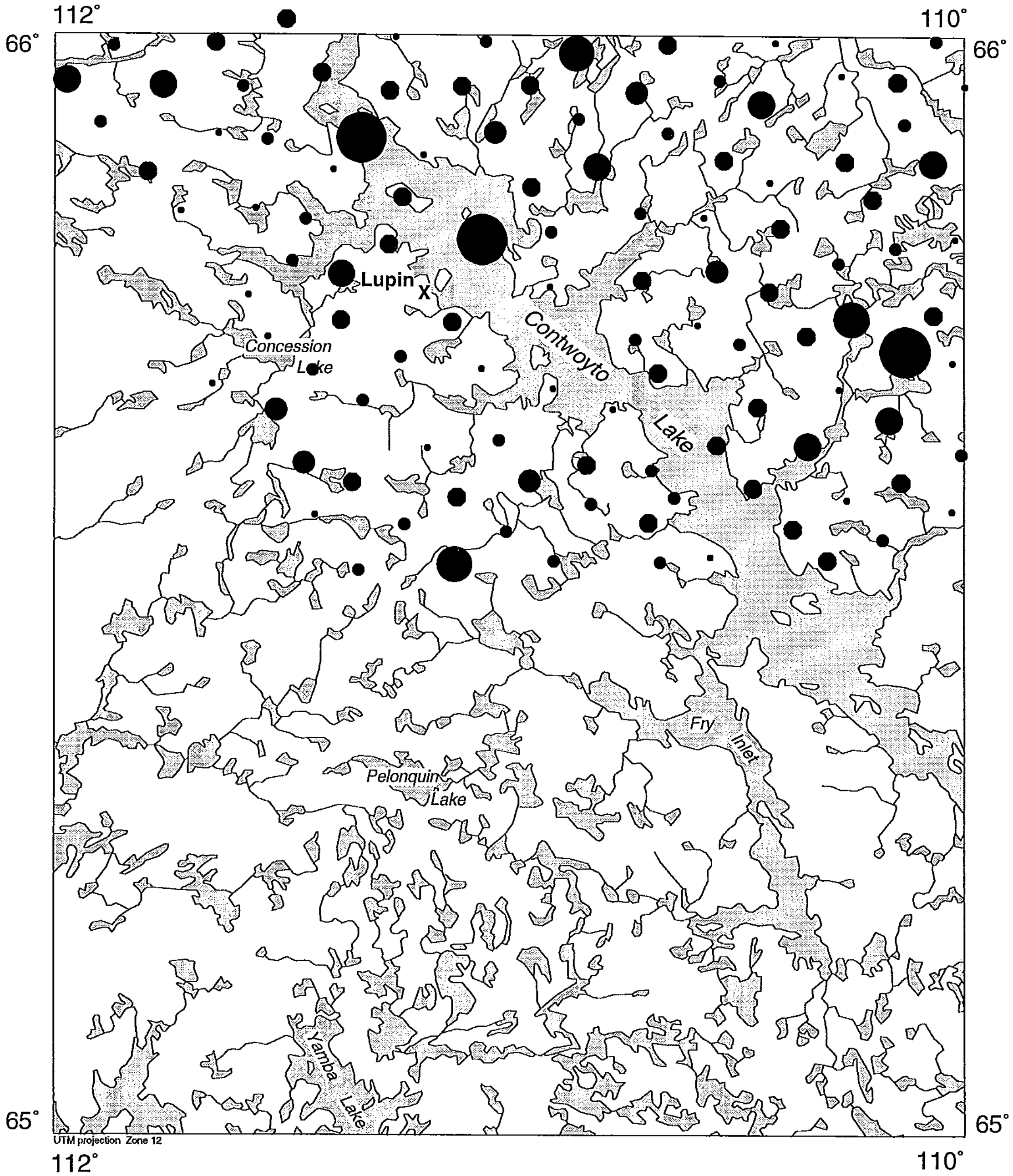
Count:	112
Minimum:	0.25
Maximum:	3.1
Mean:	0.52
Median:	0.25
Mode:	0.25
St. deviation:	0.55
Coeff. var:	1.05
Geom. mean	0.37
Skewness:	2.08
Kurtosis:	4.25

Frequency Histogram



Cumulative Plot





Kilometres 0 10 20 30 Kilometres

Thorium (ppm)

Ranges	%tile	Count
13 - 14	100	(3)
12 - 13	99	(3)
11 - 12	95	(8)
10 - 11	90	(6)
9 - 10	75	(33)
8 - 9	50	(32)
< 8	25	(27)

Th

Contwoyto Lake (76E, N/2)

Till geochemistry, Contwoyto Lake NTS 76 E (N/2)

THORIUM

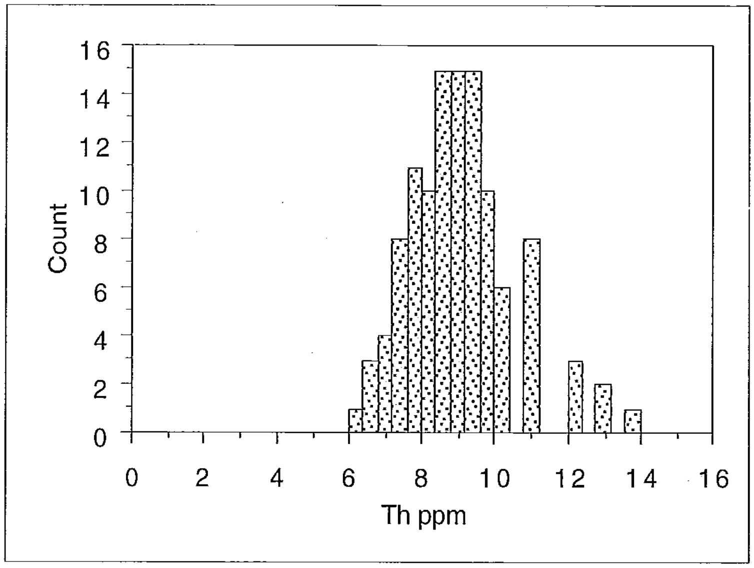
Th (ppm)

Fraction:	<0.063 mm	Detection limit:	0.2 ppm
Method:	INAA		

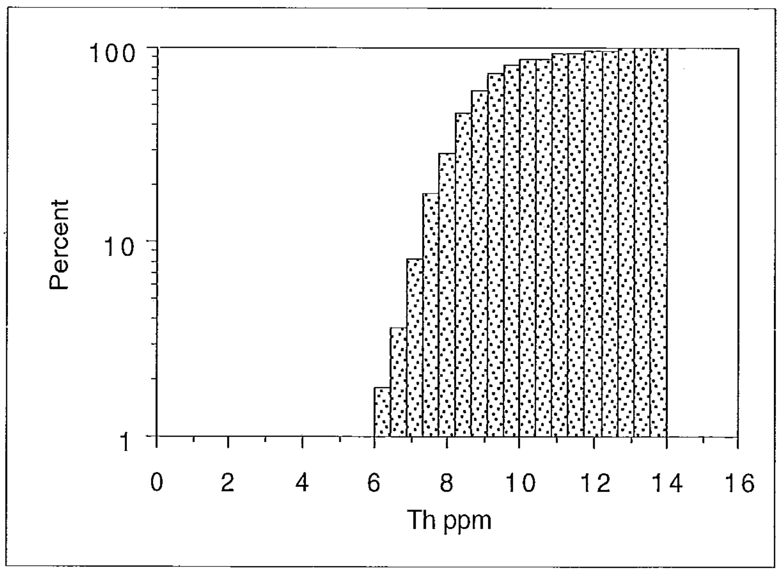
Descriptive Statistics

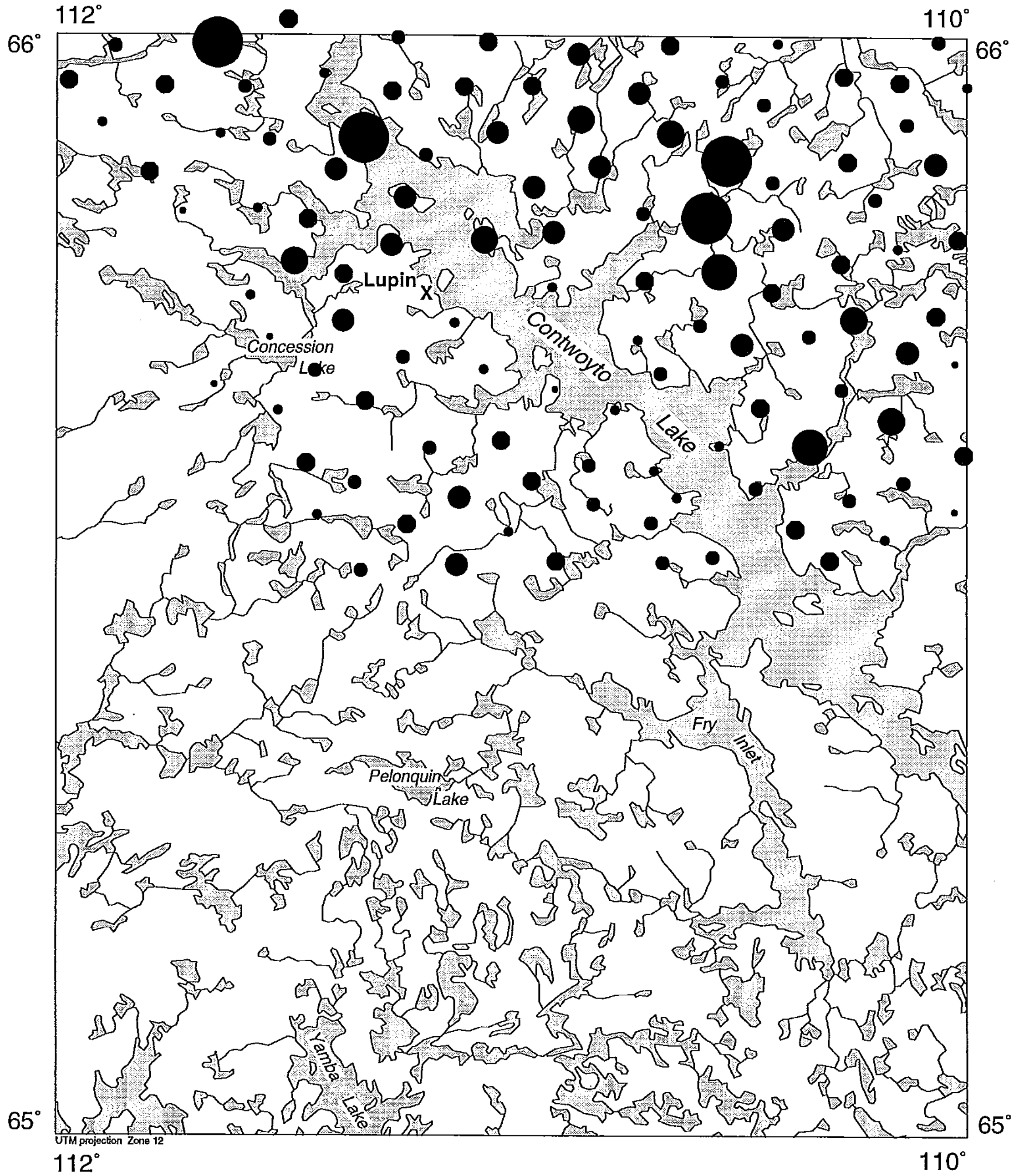
Count:	112
Minimum:	6
Maximum:	14
Mean:	8.96
Median:	8.9
Mode:	11
St. deviation:	1.4
Coeff. var:	0.16
Geom. mean	8.86
Skewness:	0.9
Kurtosis:	1.44

Frequency Histogram



Cumulative Plot





Kilometres 0 10 20 30 Kilometres

Uranium (ppm)

Ranges	%tile	Count
4.6 - 5.1	100	(4)
4.3 - 4.6	97	(2)
3.8 - 4.3	95	(6)
3.2 - 3.8	90	(16)
2.6 - 3.2	75	(29)
2.2 - 2.6	50	(29)
1.9 - 2.2	25	(20)
< 1.9	10	(6)

U

Contwoyto Lake (76E, N/2)

Till geochemistry, Contwoyto Lake NTS 76 E (N/2)

URANIUM

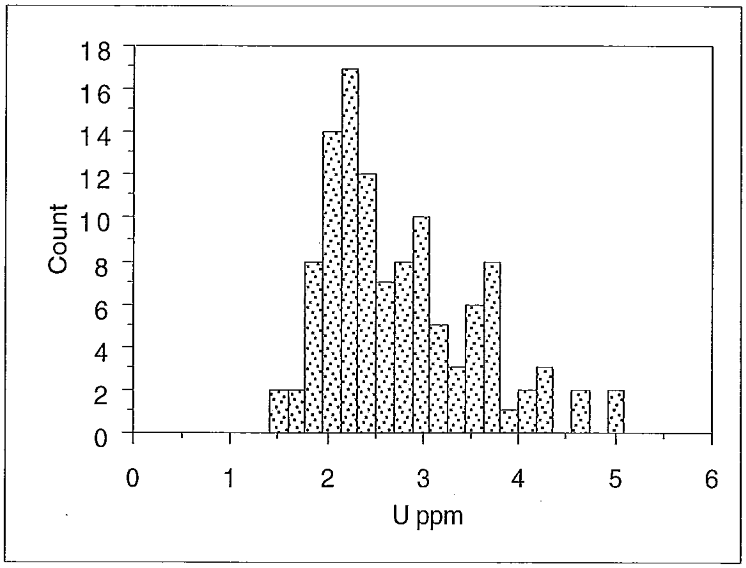
U (ppm)

Fraction:	<0.063 mm	Detection limit:	0.5 ppm
Method:	INAA		

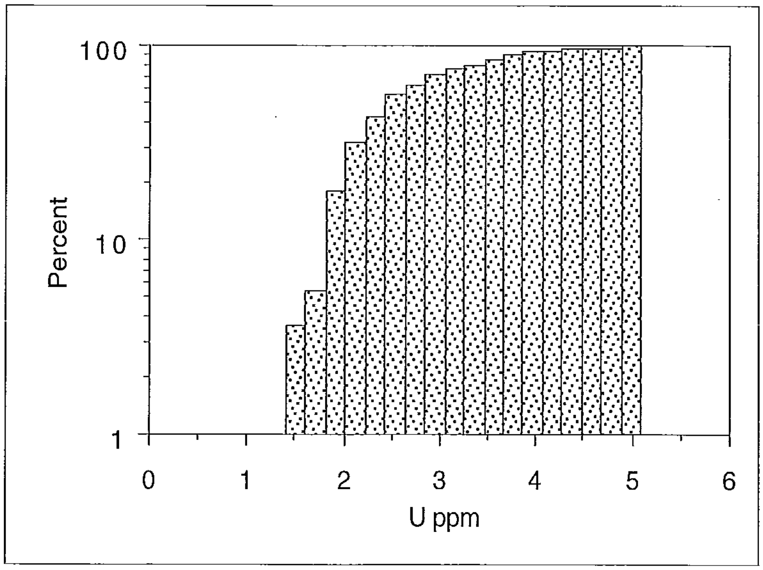
Descriptive Statistics

Count:	112
Minimum:	1.4
Maximum:	5.1
Mean:	2.75
Median:	2.6
Mode:	2.2
St. deviation:	0.78
Coeff. var:	0.28
Geom. mean	2.65
Skewness:	0.87
Kurtosis:	0.34

Frequency Histogram



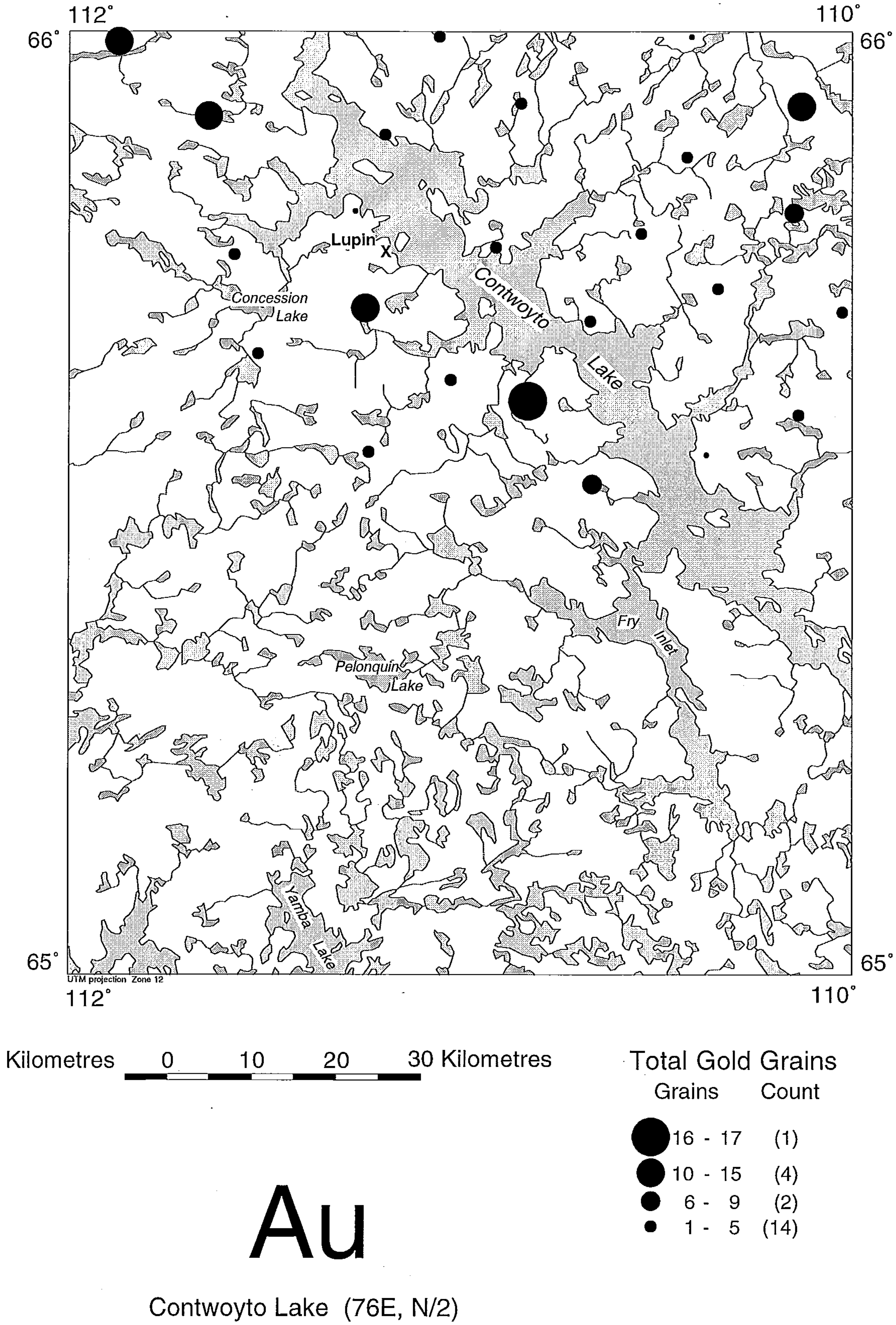
Cumulative Plot



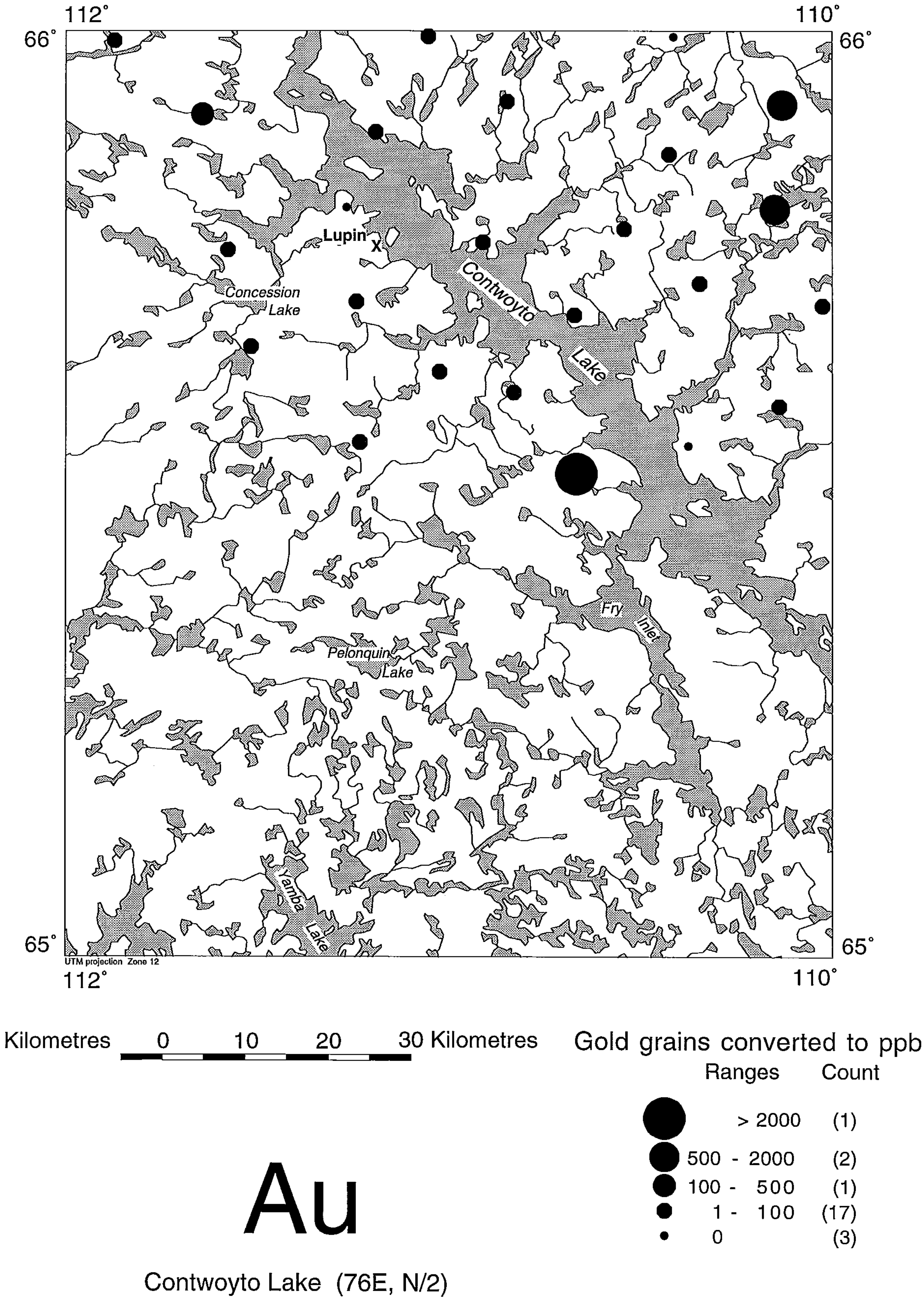
Appendix I. Gold analysis from heavy mineral concentrate

I.1. Gold grain counts in heavy mineral concentrates

I.2. Gold grain concentrations converted to ppb



Appendix I.1. Gold grain counts in heavy mineral concentrates.



Appendix I.2. Gold grain concentrations converted to ppb.