



## GEOLOGICAL SURVEY OF CANADA

**OPEN FILE 2909**

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# Regional till geochemistry, Mount Tatlow and Elkin Creek area, British Columbia (92O/5 and O/12)

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**1994**



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## Introduction

Chilcotin Plateau (Fig. 1), located east of the Coast Mountains in west central British Columbia is characterized by a thick cover of Tertiary flow basalt which is in turn overlain by a blanket of unconsolidated surficial sediments. The western sector of the Chilcotin Plateau is the focus of recent mineral exploration since the delineation of the Fish Lake Cu-Au porphyry deposit hosted by Cretaceous to Tertiary intrusive rocks exposed in a window through Tertiary volcanic rocks. The Fish Lake deposit contains a mineable reserve of 9.4 million ounces of gold and 3.5 billion pounds of copper (Taseko Mines Limited 1993 Annual Report).

A regional till sampling program was initiated through the Canada-British Columbia Agreement on Mineral Development (1991-1995) and cover two 1 : 50 000 scale NTS map sheets (92-O/5 and O/12) on the Chilcotin Plateau. It was designed to: (1) test the potential of drift prospecting to detect mineralization and (2) determine background metal concentrations in surficial sediments. Other regional till geochemical surveys and surficial geology mapping projects are in progress (Plouffe and West, 1994; Plouffe and Ballantyne 1993) as well as multi-disciplinary studies related to surficial expressions of porphyry system mineralization (Ballantyne and Harris, 1994; Harris and Ballantyne, 1994; Shives, 1994).

Field work was conducted in the fall of 1992 and the summer of 1993 during which time a total of 118 till and 26 glaciofluvial sediment samples were collected (Appendix 1). The main purpose of this report is to present results of geochemical analysis completed on all samples.

Brief notes on pertinent methodology are presented, followed by a summary of the glacial history of the area. Included in the latter is a map showing patterns of ice flow which prevailed during the last glaciation (Fig. 2) to aid in the interpretation of the geochemical data. Geochemical results for two grain size fractions ( $<2\text{ }\mu\text{m}$  and  $<63\text{ }\mu\text{m}$ ) are presented in a spreadsheet format in three ASCII files (tab delimited) along with a sample location file on the attached computer diskette (Table 1). Paper copies of the above files have not been included in this Open File release as most users are interested only in data in a digital form. Computer generated proportional symbol maps for selected elements of potential economic interest are presented in Appendix 1.

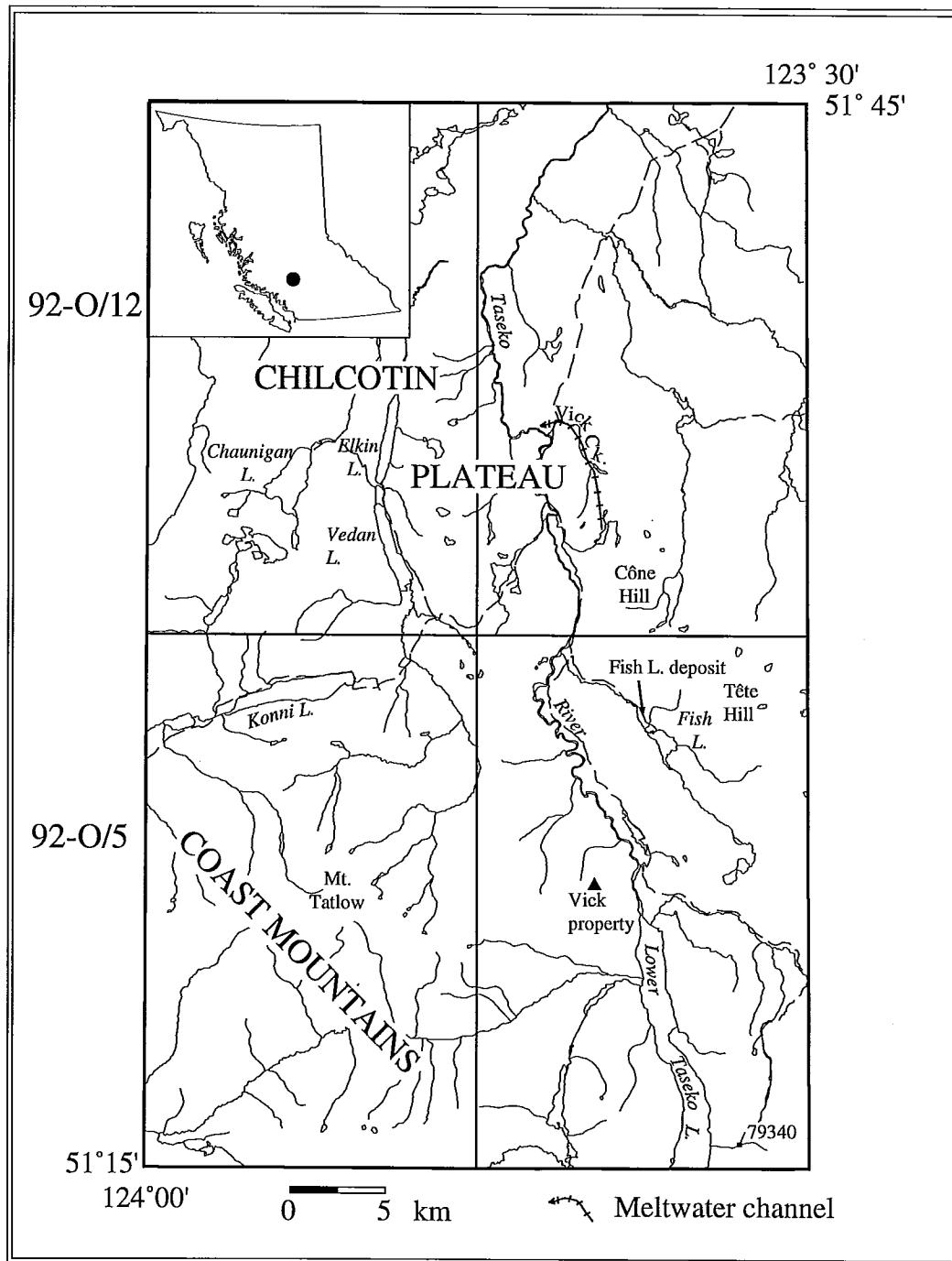


Figure 1. Study area, west-central British Columbia,  
with major physiographic divisions. See text  
for details.

Name of file	Content
2ICP.TXT	Geochemical results - clay size fraction (<2 µm) - ICP-AES (till and glaciofluvial sediment samples)
63ICP.TXT	Geochemical results - silt plus clay size fraction (<63 µm) - ICP-AES (till and glaciofluvial sediment samples)
63NA.TXT	Geochemical results - silt plus clay size fraction (<63 µm) - INAA (till and glaciofluvial sediment samples)
LOC.TXT	Sample description: number, type, location (latitude, longitude and UTM coordinates).

Table 1. List of ASCII files on computer diskette. See text for details of analysis.

### Location and physiography

The area selected for this regional surficial sediment sampling program lies within latitude 51°15' N and 51°45' N and longitude 124° E and 124° 30' E (Fig. 1). It covers two 1 : 50 000 scale NTS map sheets: 92-O/5 and O/12 (Mount Tatlow and Elkin Creek, respectively).

The southern section of the study area, located in the Coast Mountains, is characterized by peaks and arêtes with summits slightly higher than 2400 m asl (8000 ft) (Fig. 1). The remainder, which forms part of the Chilcotin Plateau, is rolling to relatively flat with an average elevation of 1400 m asl (4500 ft), except for higher hills, such as Tête and Cône hills, which reach elevations of 1818 m asl (6000 ft) and 1758 m asl (5800 ft), respectively. The Chilcotin Plateau has been incised approximately 180 m (600 ft) by the Taseko River.

## **Methodology**

### **Field work**

Till, which represents debris deposited directly from or in close association with ice, is the predominant surficial sediment. It was selected as the primary sample medium because (1) it is the first derivative of the bedrock (Shilts, 1993) and (2) since ice has been flowing more or less northerly without any major deflection, tracing of anomalies in till becomes uncomplicated. Several valleys in the area are filled with thick accumulations of glaciofluvial sand and gravel. Glaciofluvial sediments were collected only in those areas where till was not exposed at the surface and, hence available for sampling.

Samples were collected from road side exposures and bluffs along rivers and creeks. At every site, samples were hand dug and care was taken to collect material as unweathered as possible. At most sites, samples were collected below one meter from the unoxidized to slightly oxidized materials which form the transition zone between lower B and C soil horizons. Sample sites along roads are at 2 kilometer intervals. Detailed sampling was undertaken in areas of known mineralization, such as Fish Lake.

### **Laboratory procedures**

Geochemical analyses were performed on the silt plus clay size fraction (<63 µm) of all samples and the clay size fraction (<2µm) for the 1993 samples only. The clay size fraction was selected for analysis based on previous studies on metal partitioning in till which indicate the tendency of metals to concentrate in that grain size fraction (e.g. DiLabio, in press; Nikkarinen et al., 1984; Shilts, 1984; in press). Gold partitioning studies on till from the Fish Lake and other mineralized sites show that gold generally resides in the silt size fraction (Delaney and Fletcher, 1993; in press; DiLabio, 1982a; 1982b; 1985; 1988). Consequently, gold and multi-element analyses were conducted on the silt plus clay (<63 µm) size fraction.

The silt plus clay size fraction was separated by dry sieving at the Sedimentology Laboratories of the Geological Survey of Canada and British Columbia Geological Survey Branch. Clay separations were done by centrifuging and decanting using procedures developed at the Geological Survey of Canada. Both size fractions were analyzed by

inductively coupled plasma-atomic emission spectrometry (ICP-AES) following an aqua regia digestion at Chemex Labs Ltd. in North Vancouver, British Columbia, for the following elements : Ag, Al, As, Ba, Be, Bi, Ca, Cd, Co, Cr, Cu, Fe, Ga, K, La, Mg, Mn, Mo, Na, Ni, P, Pb, Sb, Sc, Sr, Ti, Tl, U, V, W, and Zn. The clay size fraction of samples collected in 1993 (93-PMA's) was also analyzed for Hg by cold vapor-atomic absorption. The silt plus clay size fraction was analyzed for Au, Ag, As, Ba, Br, Ca, Co, Cr, Cs, Fe, Hf, Hg, Ir, Mo, Na, Ni, Rb, Sb, Sc, Se, Sn, Sr, Ta, Th, U, W, Zn, La, Ce, Nd, Sm, Eu, Tb, Yb, and Lu by instrumental neutron activation analyses (INAA) at Activation Laboratories Ltd. in Ancaster, Ontario.

### **Bedrock geology**

A regional bedrock geology map of the area was first presented by Tipper (1978). More detailed mapping of the area was completed in 1992 by the British Columbia Geological Survey Branch and the Geological Survey of Canada. Several maps and reports based on this work have been released ( Hickson, 1993; Hickson and Higman, 1993; Riddell et al. 1993a; 1993b). The reader is referred to those maps and reports for more details about the bedrock geology.

### **Glacial history**

As climate deteriorated in late Wisconsinan time, Coast Mountains valley glaciers advanced and coalesced to form piedmont glaciers which flowed over the interior portion of west central British Columbia. At the onset of the glaciation, ice tongues flowed parallel to valleys but as the ice sheet build-up, glaciers advanced more independent of topography. Cirques on Mount Tatlow and Olson (lies south of the area) were ice sources of the first valley glaciers. Ice then flowed to the north and northeast over the area as illustrated on Figure 2.

At the end of the glaciation, as the ice front retreated towards the mountains, regional ice flow patterns were maintained (Heginbottom, 1972). However, since deglaciation was rapid, large blocks of ice melted in-situ in valleys which temporarily influenced the drainage (Fulton, 1967; 1991). For example, meltwater which drained down the Taseko River valley was temporarily diverted into Vick Creek valley as ice stagnated in the main valley (this is shown by a meltwater channel symbol on Figure 1). When the obstructing ice melted, drainage in the main valley was reestablished. Sections of till overlain by glacio-

## Fish Lake Area - Ice flow indicators

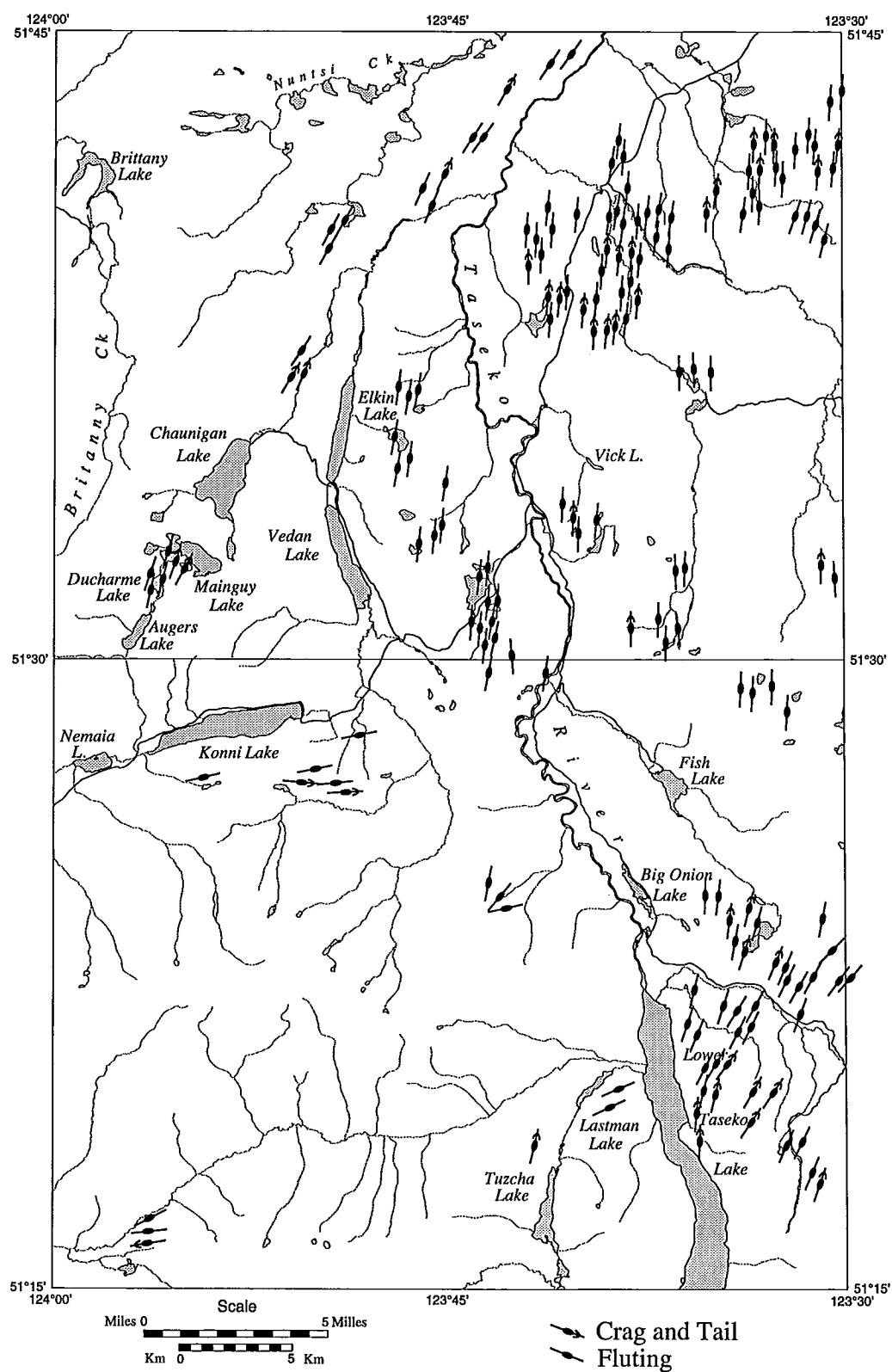


Figure 2. Ice flow patterns, based on drumlin orientations. (after Heginbottom (1972))

fluvial sand and gravel are exposed at a few sites along the Taseko River. This reveals that during ice retreat, important accumulations of glacio-fluvial sand and gravel were deposited as outwash fans overlying till, in the main valleys.

Early Holocene was a period of valley deposit degradation marked by the incision of glaciofluvial terraces. No evidence of neoglaciation, which might have affected cirques in the Coast Mountains, has been found in Taseko valley.

### **Drift geochemistry**

As mentioned previously, two types of sediments, till and glaciofluvial sand and gravel, were collected during this survey. The two types are treated separately in this report since they were transported by different media (ice and ice and water). Consequently, they have been transported over differing distances. Moreover, glaciofluvial sediments are generally more porous and permeable than till and as a result, they contain more weathering products such as iron and manganese oxides. Co-precipitation of certain metals with these oxides will result in higher metal levels in the glaciofluvial sand and gravel, as observed by Shilts (1972). This seems to be the case for copper within the study area. Away from known mineralization, mean copper concentrations in the till is 44 ppm and in glaciofluvial sediments 61 ppm.

### **Analytical quality control**

#### *Clay separation*

In till samples, the Al content of the silt plus clay and clay size fractions of a sample can be compared to verify the quality of the clay separation (Thorleifson and Kristjansson, 1990; Shilts, in press). The aluminum concentration should be higher in the clay size fraction than in the silt plus clay since clay size material is mostly composed of aluminosilicates. A low Al content in the first compared to the second is most likely the result of a poor quality clay separation. Since most metals are concentrated in the clay (e.g. Shilts, 1984), abundant silt size material in the clay size fraction would dilute metal concentrations of a sample and could obscure regional patterns of trace element distribution in drift.

Al content of both size fractions are compared on a scattergram (Fig. 3). Since data points fall below the 1:1 correlation line, clay separations are thought to be of a respectable quality which is the first step in attaining reliable geochemical results.

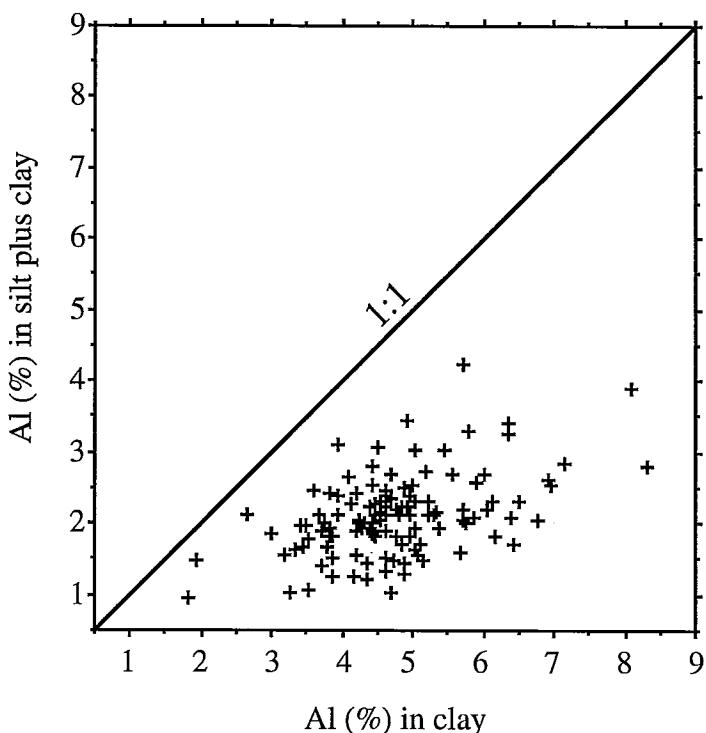


Figure 3. Comparison of the Al content in the  $<2\mu\text{m}$  and  $<63\mu\text{m}$  size fractions. Note the high Al content of the clay size fraction and see text for details.

#### *Accuracy and precision of analytical methods*

Non-certified standards were analyzed with each batch of samples to monitor the accuracy and precision of geochemical analyses. All results fell within the range of concentrations previously measured on those standards when analyzed for other GSC projects (Appendix 2). Field duplicates (two samples from the same field station) and laboratory duplicates (two laboratory splits from the same sample) were introduced to verify analytical precision, i.e. reproducibility of analyses. Results are depicted as correlation plots in Appendix 3.

Reproducibility of ICP-AES analyses of the silt plus clay and clay size fractions is very good for all elements, except arsenic, which yields better results in the clay size compared to the silt plus clay size material. The poorer reproducibility of As analyses for the silt plus

clay size fraction suggests that arsenic is heterogeneously distributed, perhaps as discrete arsenic bearing minerals in the silt size material. Precision of INAA analyses is relatively good even for Au, which may, in some cases, show poorer results due to "nugget" effect. The use of a large sample size for INAA analysis (30 g) might partly account for this consistency. However, reproducibility is lower for certain elements including Ba, Cs, Ni, Rb, U, Zn and Tb. Again, these elements are probably present in mineral phases which are heterogeneously distributed within these size fractions. Mo also shows poor reproducibility, as would be expected, since concentration levels are all close to detection limit where precision is known to be lower (Howarth and Thompson, 1976; Thompson and Howarth, 1976).

## **Results and interpretation**

Detailed interpretations of geochemical anomalies in drift encountered within the area will not be presented in this report. However, a few areas with high metal concentrations in surficial sediments discovered through this survey are briefly discussed below.

A series of samples were collected from drift overlying the Fish Lake mineralization site. For each given element, if concentrations above the 80th percentile are arbitrarily considered anomalous, the silt plus clay size fraction of samples in proximity of the Fish Lake mineralized zone have anomalous levels of Au, As, Cu, Hg, Ni and Sb (Appendix 1). Moderately high Cr and Co concentrations were detected overlying and north of the mineralized zone. The Cr and Co anomalies in the till to the north of Fish Lake correspond closely to biogeochemical anomalies for the same elements (C. Dunn, pers. comm. 1994). In addition, clay size fractions of samples contain anomalous concentrations of Cu, As, Co and Cr (Appendix 1). In summary, Fish Lake porphyry mineralization is reflected locally in the till by Au, As, Cu, Co, Cr, and Hg anomalies.

Elsewhere, samples collected approximately 2-3 km to the northwest of Fish Lake mineralization site, also have high metal levels (Au, As, Cu, Co and Hg - Appendix 1). A RGS (Regional Geochemical Survey) stream sediment sample collected from a creek that is draining this high ground yielded 269 ppb Au (Jackaman, et al., 1992). During our study, panned heavy mineral concentrates from this stream yielded visible gold grains. The stream sediment and till geochemical anomalies can probably be linked to an area under active exploration by Pioneer Metals Corp. who have identified drill target coincident with geochemical and IP anomalies (D. Dunn, pers. comm. 1994).

The Vick prospect, northwest of Lower Taseko Lake, is underlain by a series of northeast-striking gold, silver and copper-bearing quartz-sulphide veins which can be traced from the top of the hill to the east face (Riddell, et al., 1993b) (Fig. 1). Till samples collected in the Taseko valley, directly to the northeast of Vick prospect have anomalous concentrations of Au, Co, Cu, Pb, Zn, and Hg (Appendix 1). Drift with high metal levels was likely derived from bedrock composing the mineralized veins of the Vick prospect itself or their continuation. Debris from the veins was likely transported to the northeast by ice flowing from the high ground of the Coast Mountains down into the Taseko valley.

Stream sediments collected as part of the Regional Geochemical Survey were reanalyzed for a larger suite of elements by the British Columbia Geological Survey Branch (Jackaman, et al., 1992). Stream sediment sample 793140, collected on the east side of Lower Taseko Lake (Fig. 1), in an unnamed creek, reveals a coincident precious and base metal anomaly. Till sample 93-PMA-322, collected down-ice from the watershed of the creek, contains anomalous concentrations of As, Cu, Hg, W, and Zn (Appendix 1). As for the area northwest of Fish Lake mineralization, the stream sediment and till geochemical anomalies are likely to be derived from the same unknown source area.

### Acknowledgments

This regional survey was financed under the Canada-British Columbia Agreement on Mineral Development (1991-1995). Better Resources Ltd, Pioneer Metals Corporation, Taseko Mines Ltd., Valerie Gold Resources, and Verdstone Resources are all acknowledged for allowing access to their properties and, in some instances, for sharing valuable information such as drill core stratigraphy. Capable field assistance was provided by E. McDonald, C. McPhee, A. Mouton, and C. West. Grain size separations and sample processing was handled by the sedimentology laboratory of the Geological Survey of Canada and British Columbia Geological Survey Branch, under the supervision of R. Lett (BCGSB), P. Lindsay (GSC) and M. Wyergangs (GSC). Proportional symbol geochemical maps were produced by W. D. Finley (Northwood Geoscience Ltd.).

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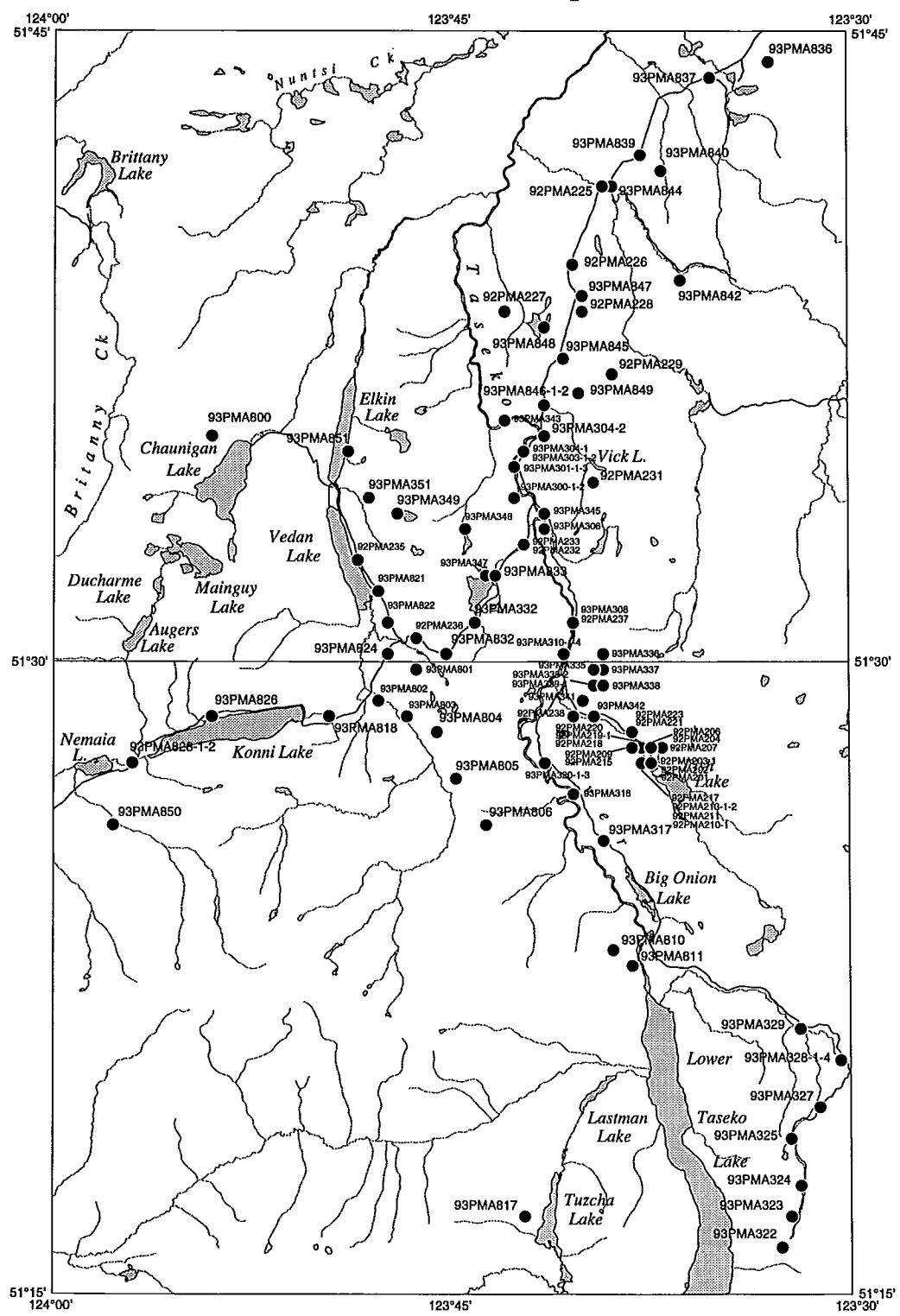
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## Appendix 1

Maps showing sample locations and  
proportional symbols for selected  
elements

## Fish Lake Area - Till Sample Location

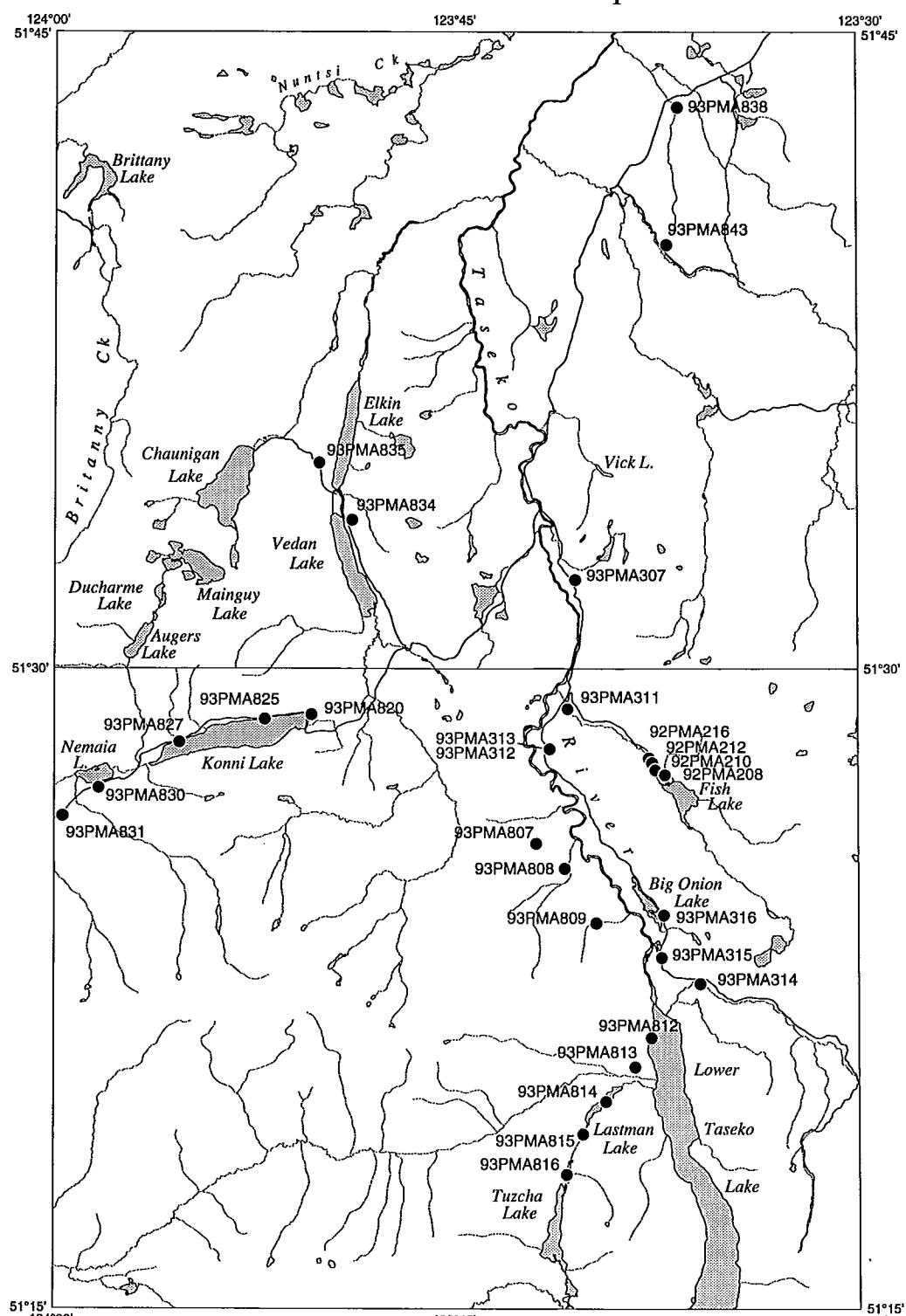


**1992, 1993 Till Sample Sites**

### Scales

Km 0 5 Km

## Fish Lake Area - Glaciofluvial Sample Location

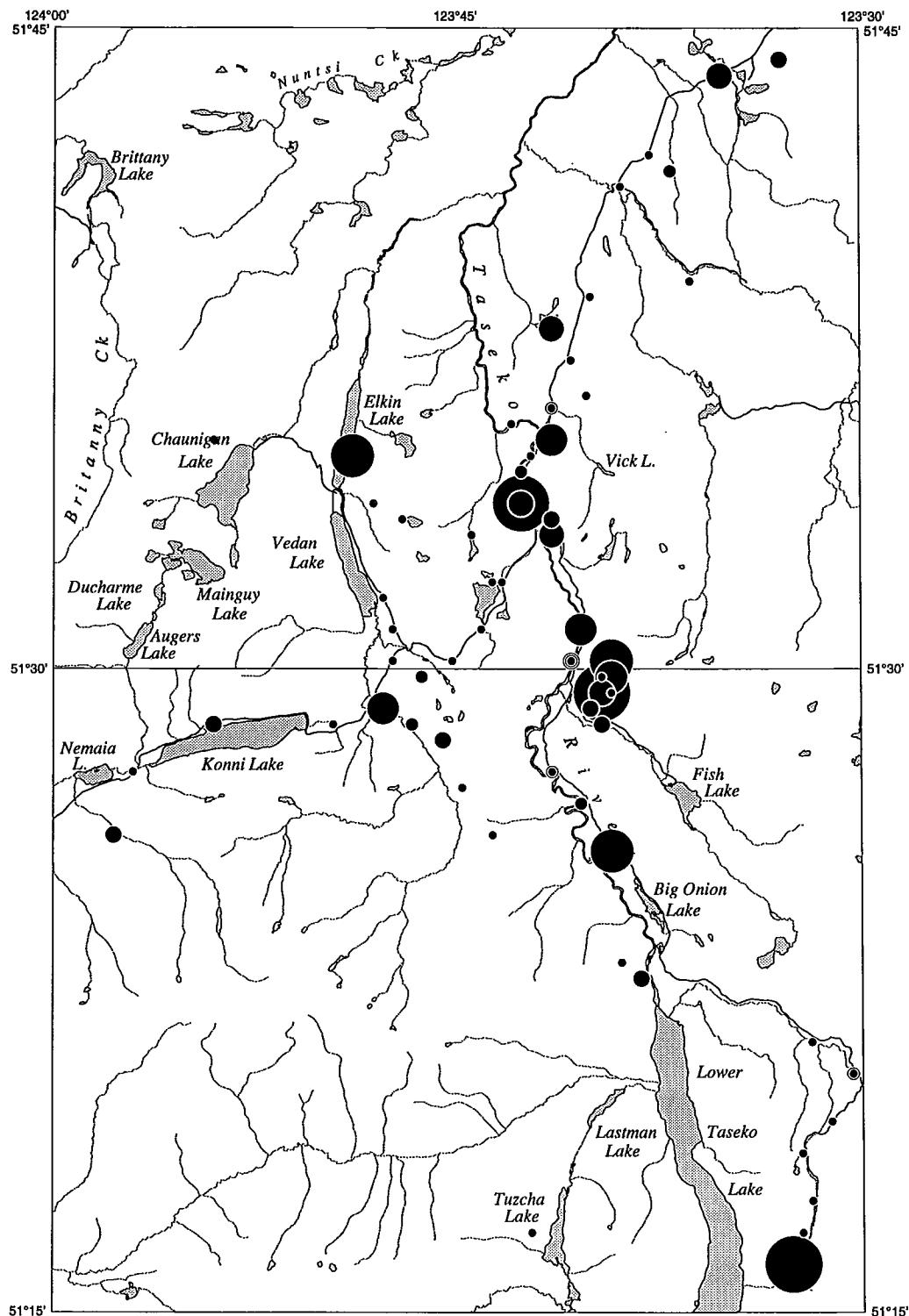


Scale



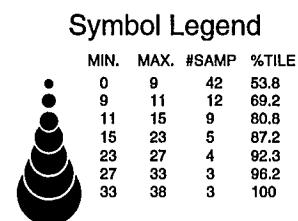
● 1992, 1993 Fluvial Sample Sites

## Fish Lake Area - Till Geochemical Sampling Program

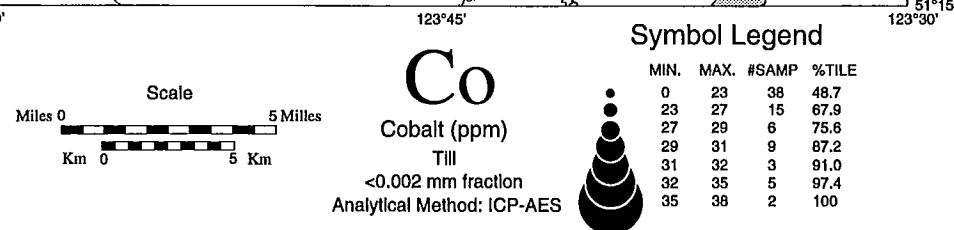
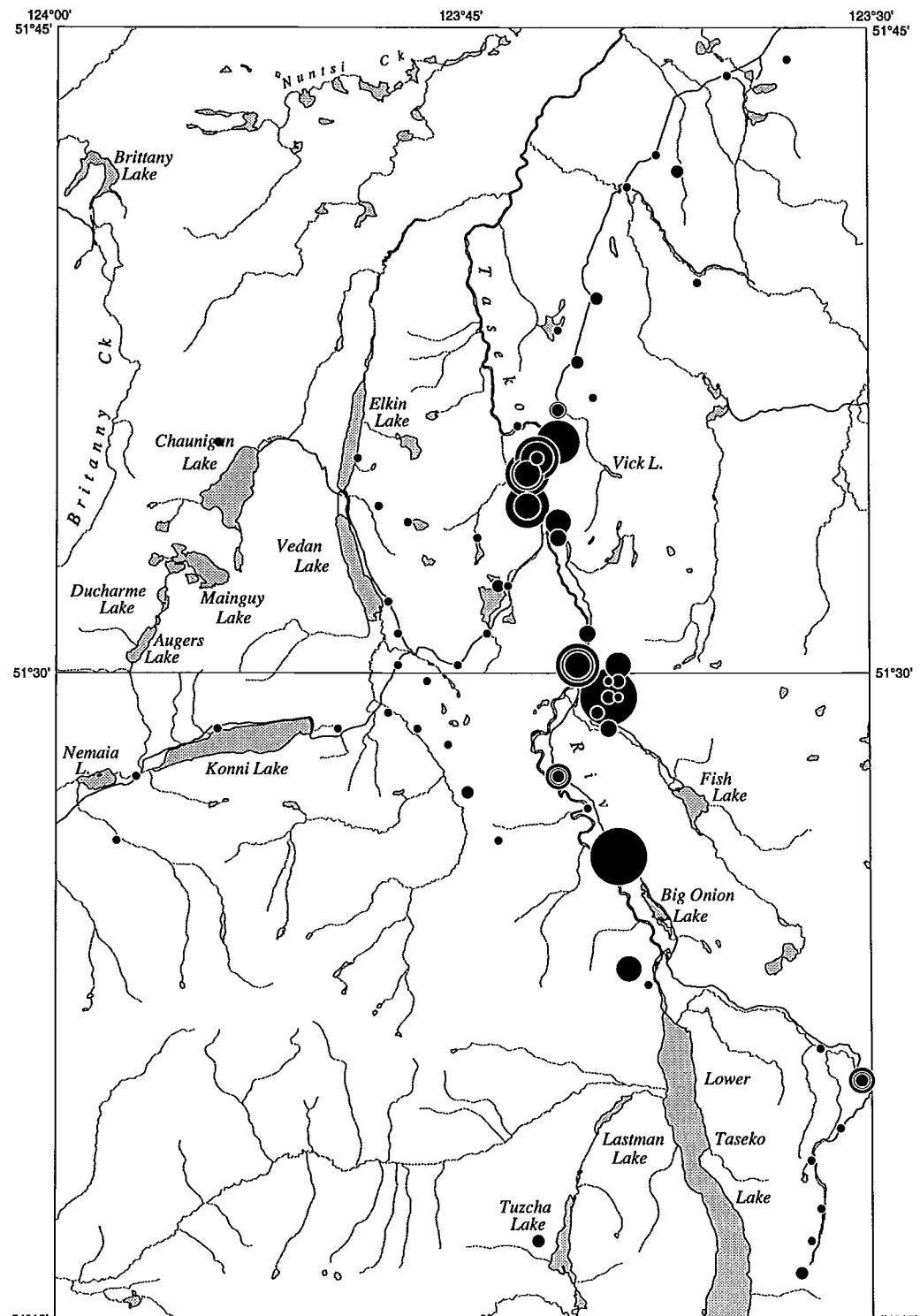


Scale  
Miles 0 5 Miles  
Km 0 5 Km

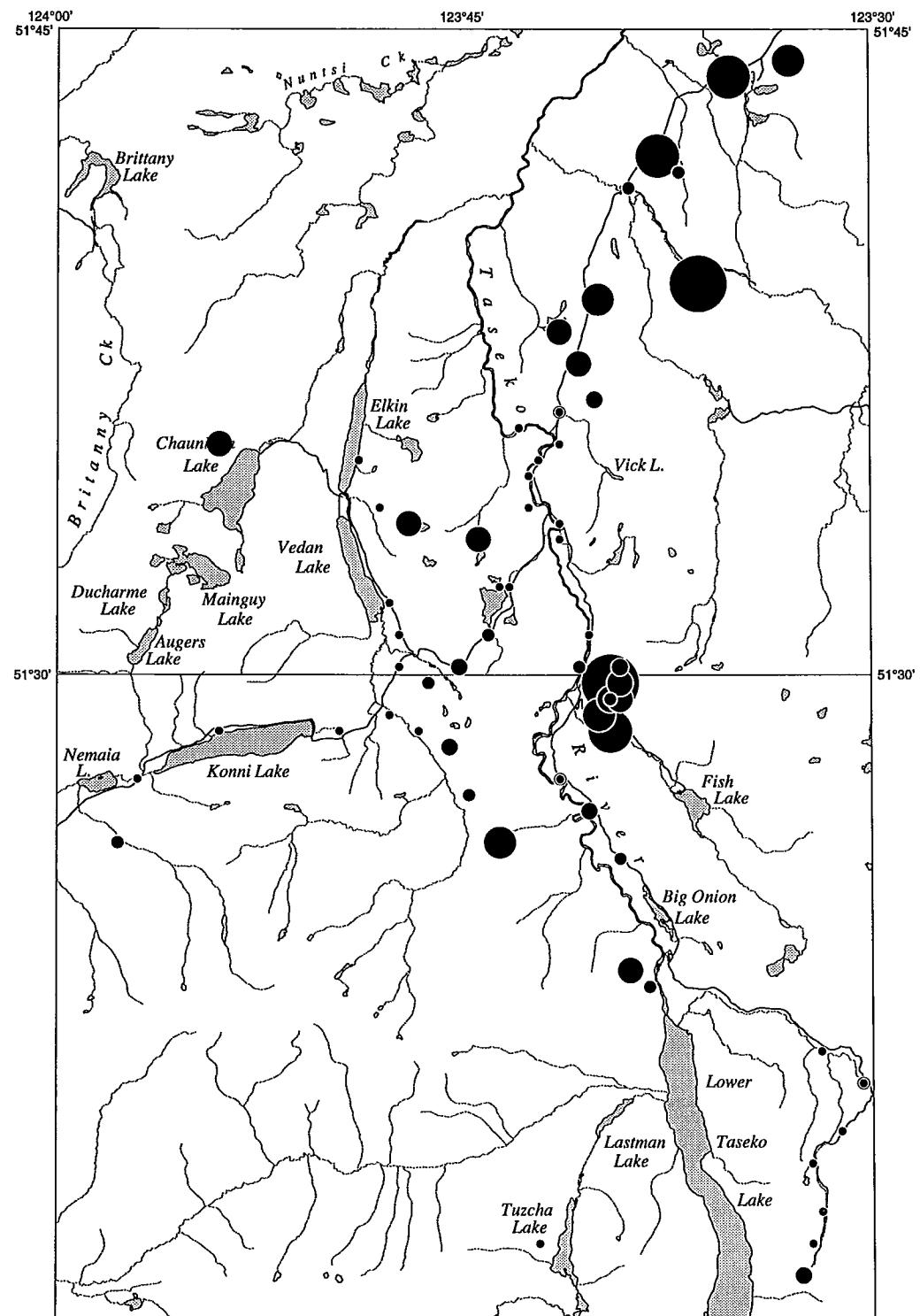
**AS**  
Arsenic (ppm)  
Till  
<0.002 mm fraction  
Analytical Method: ICP-AES



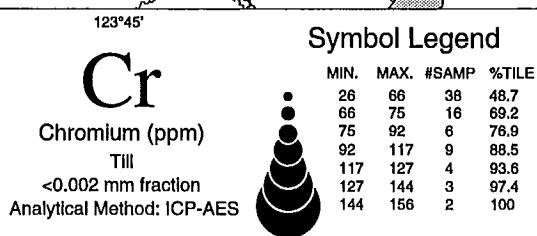
## Fish Lake Area - Till Geochemical Sampling Program



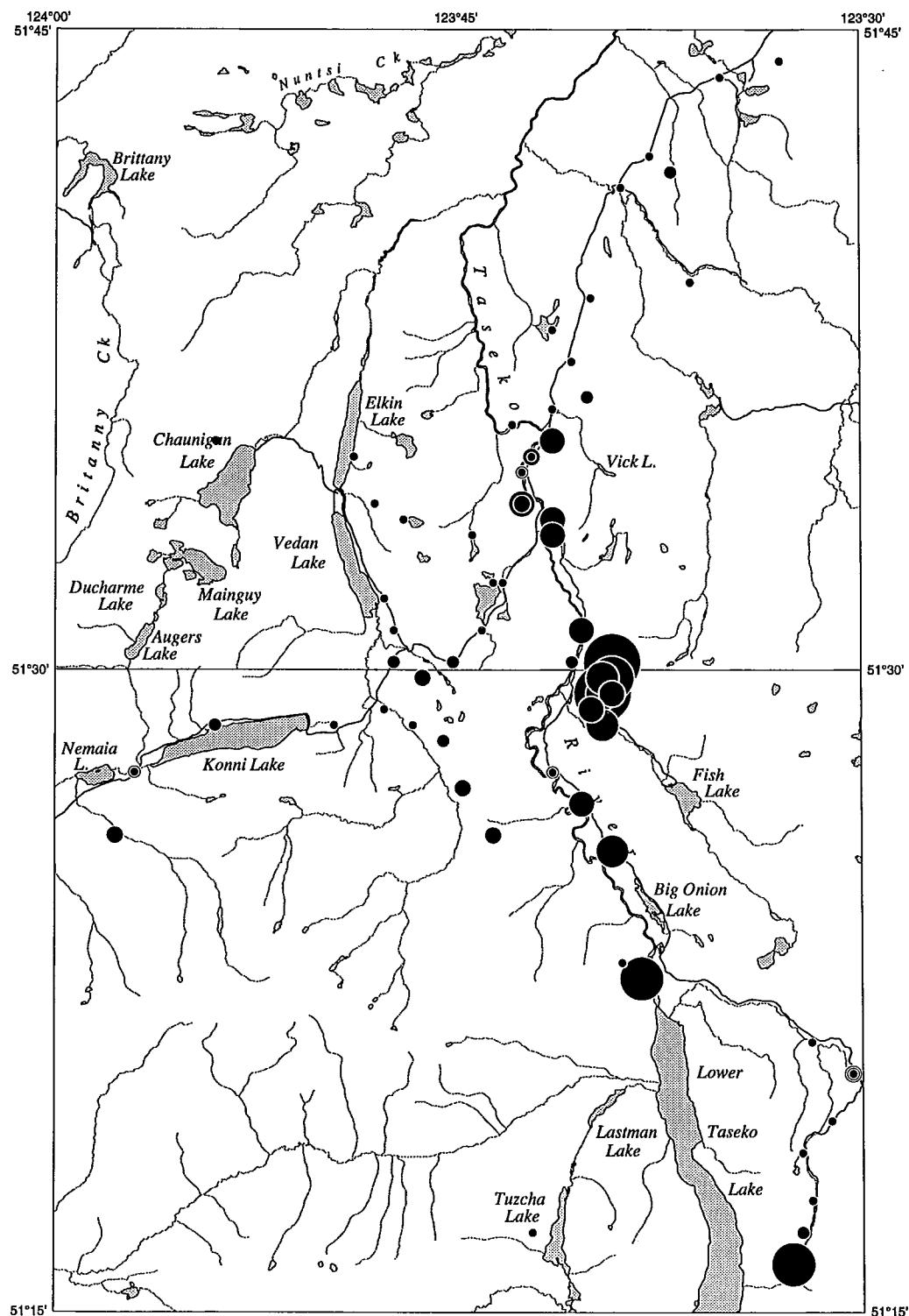
## Fish Lake Area - Till Geochemical Sampling Program



Scale  
Miles 0 5 Miles  
Km 0 5 Km



## Fish Lake Area - Till Geochemical Sampling Program



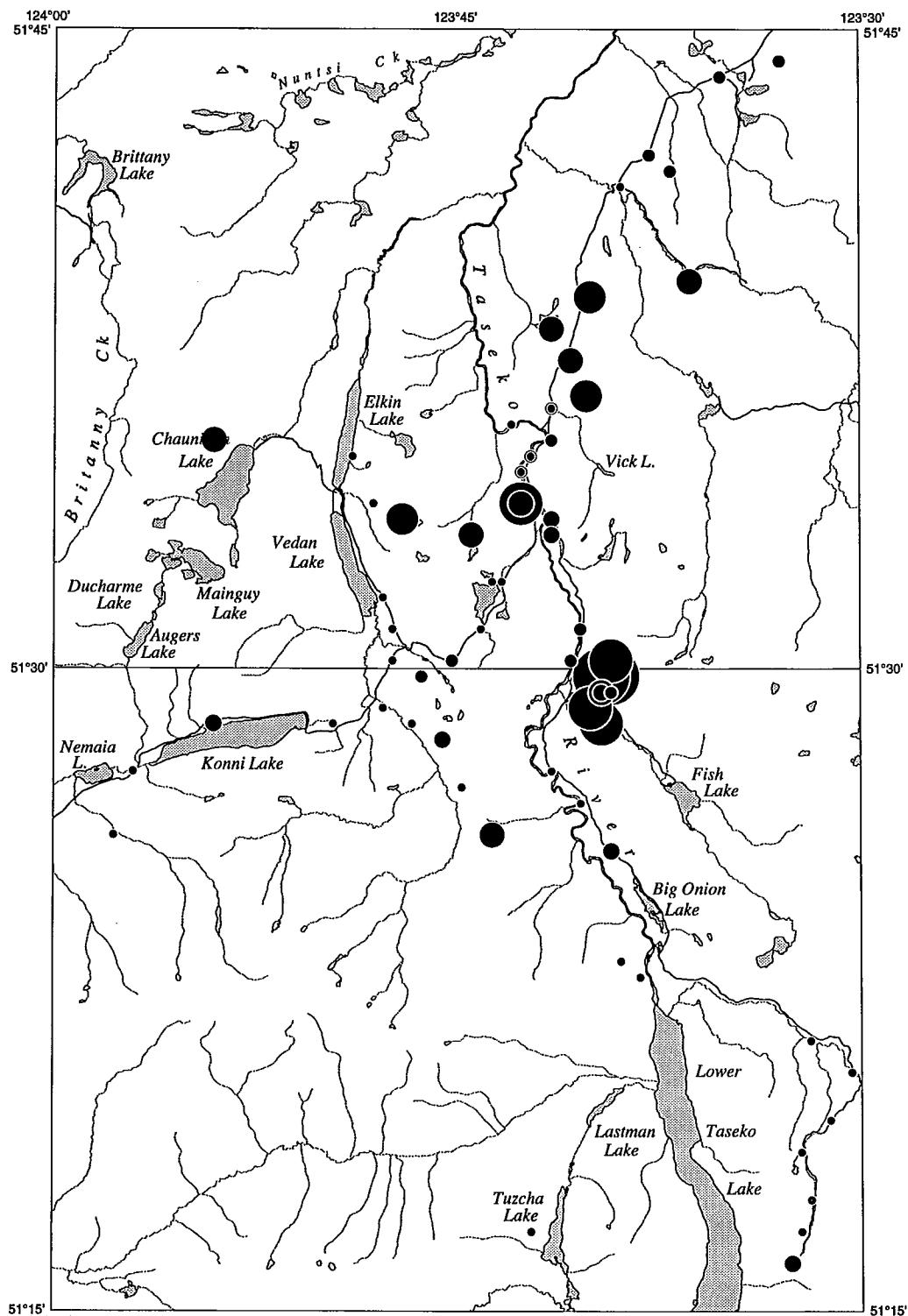
Scale  
Miles 0 5 Miles  
Km 0 5 Km

**Cu**  
Copper (ppm)  
Till  
<0.002 mm fraction  
Analytical Method: ICP-AES



MIN.	MAX.	#SAMP	%TILE
41	89	37	47.4
89	100	17	69.2
100	112	7	78.2
112	151	8	88.5
151	227	4	93.6
227	374	3	97.4
374	380	2	100

## Fish Lake Area - Till Geochemical Sampling Program

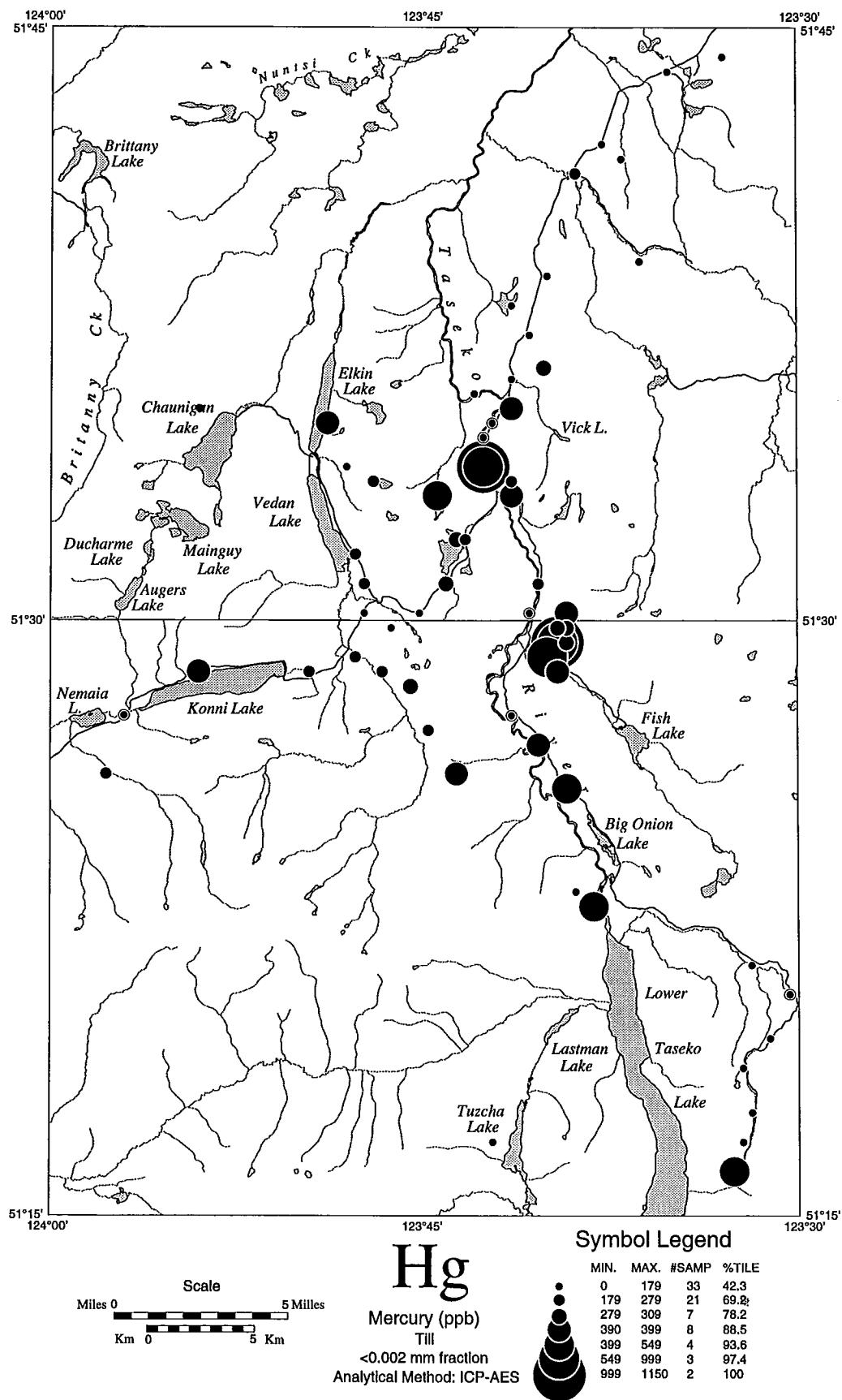


Scale  
Miles 0 5 Miles  
Km 0 5 Km

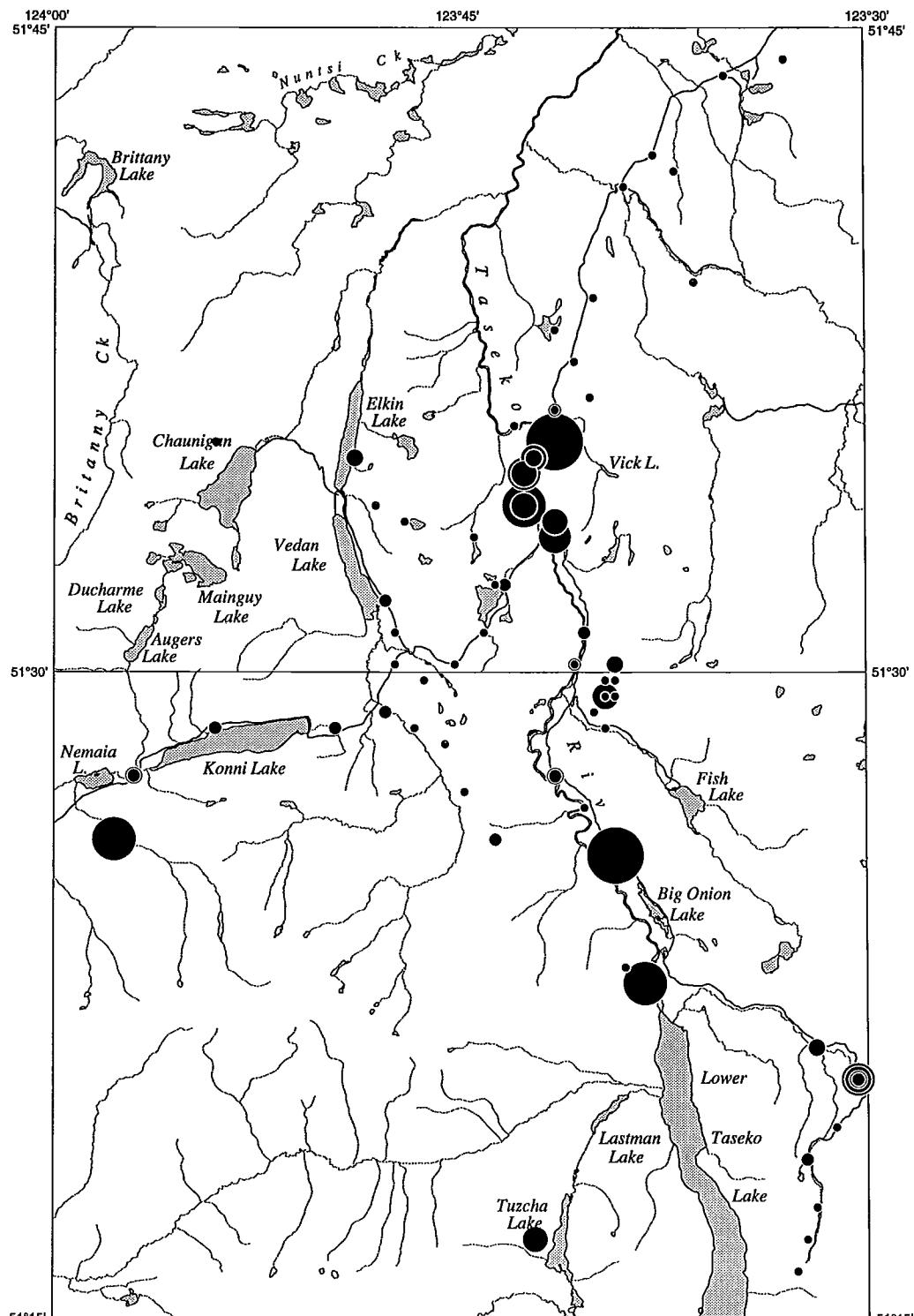
**Fe**  
Iron (%)  
Till  
<0.002 mm fraction  
Analytical Method: ICP-AES

MIN.	MAX.	#SAMP	%TILE
0	6.48	38	48.72
6.48	6.92	18	69.23
6.92	7.19	7	78.21
7.19	7.42	8	88.46
7.42	7.71	3	92.31
7.71	8.14	4	97.44
8.14	8.63	2	100

## Fish Lake Area - Till Geochemical Sampling Program

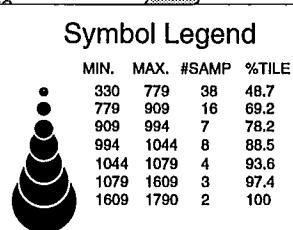


## Fish Lake Area - Till Geochemical Sampling Program

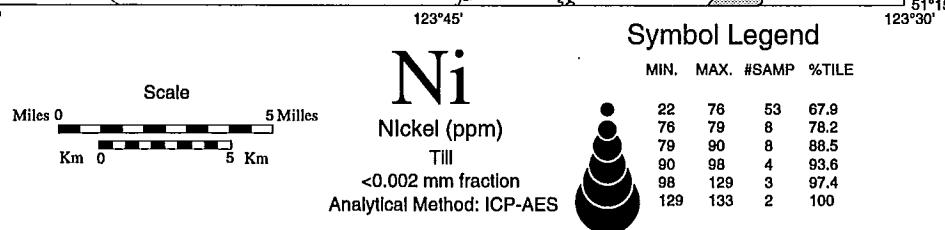
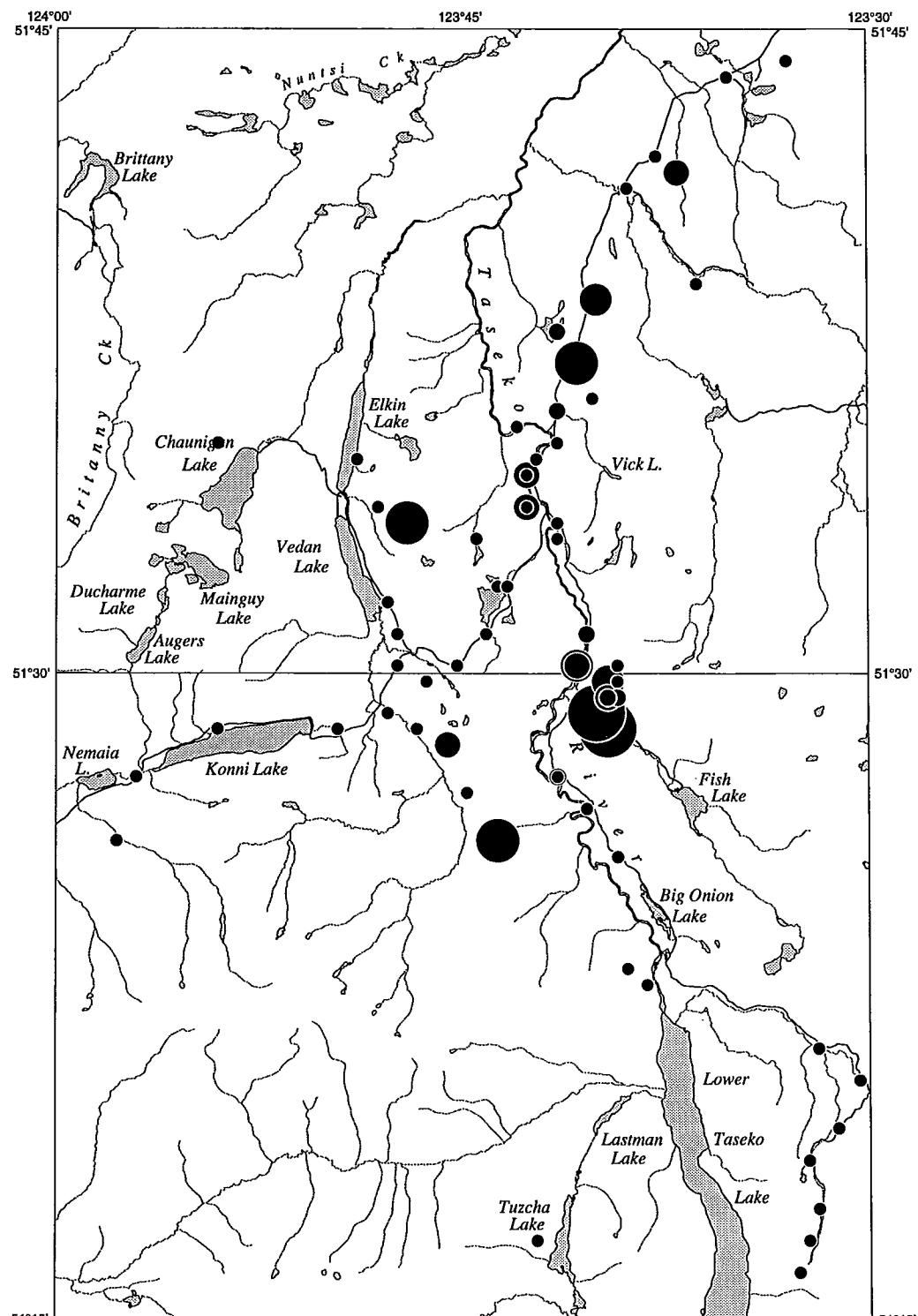


Scale  
Miles 0 5 Miles  
Km 0 5 Km

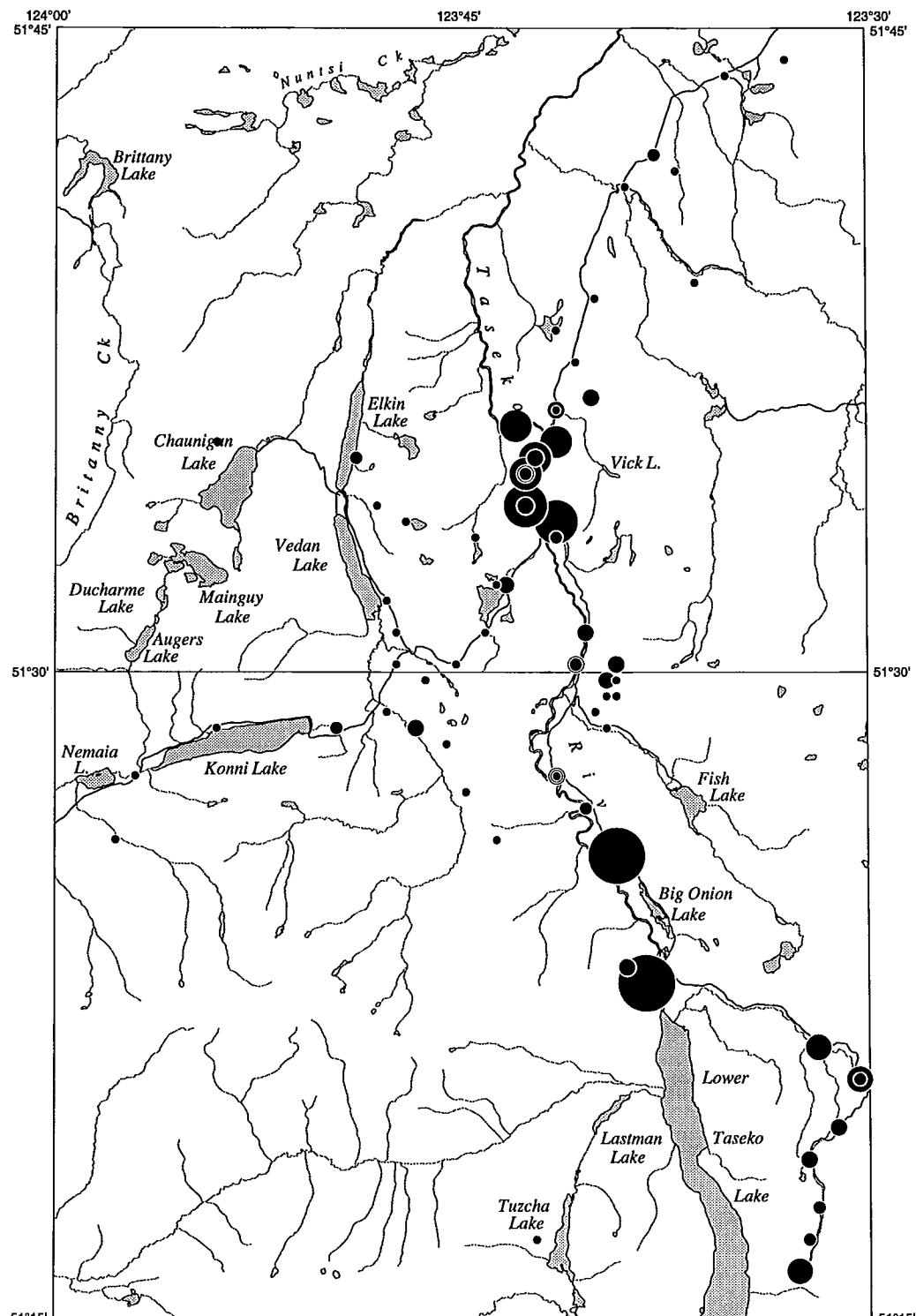
**Mn**  
Manganese (ppm)  
Till  
<0.002 mm fraction  
Analytical Method: ICP-AES



## Fish Lake Area - Till Geochemical Sampling Program



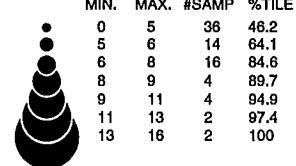
## Fish Lake Area - Till Geochemical Sampling Program



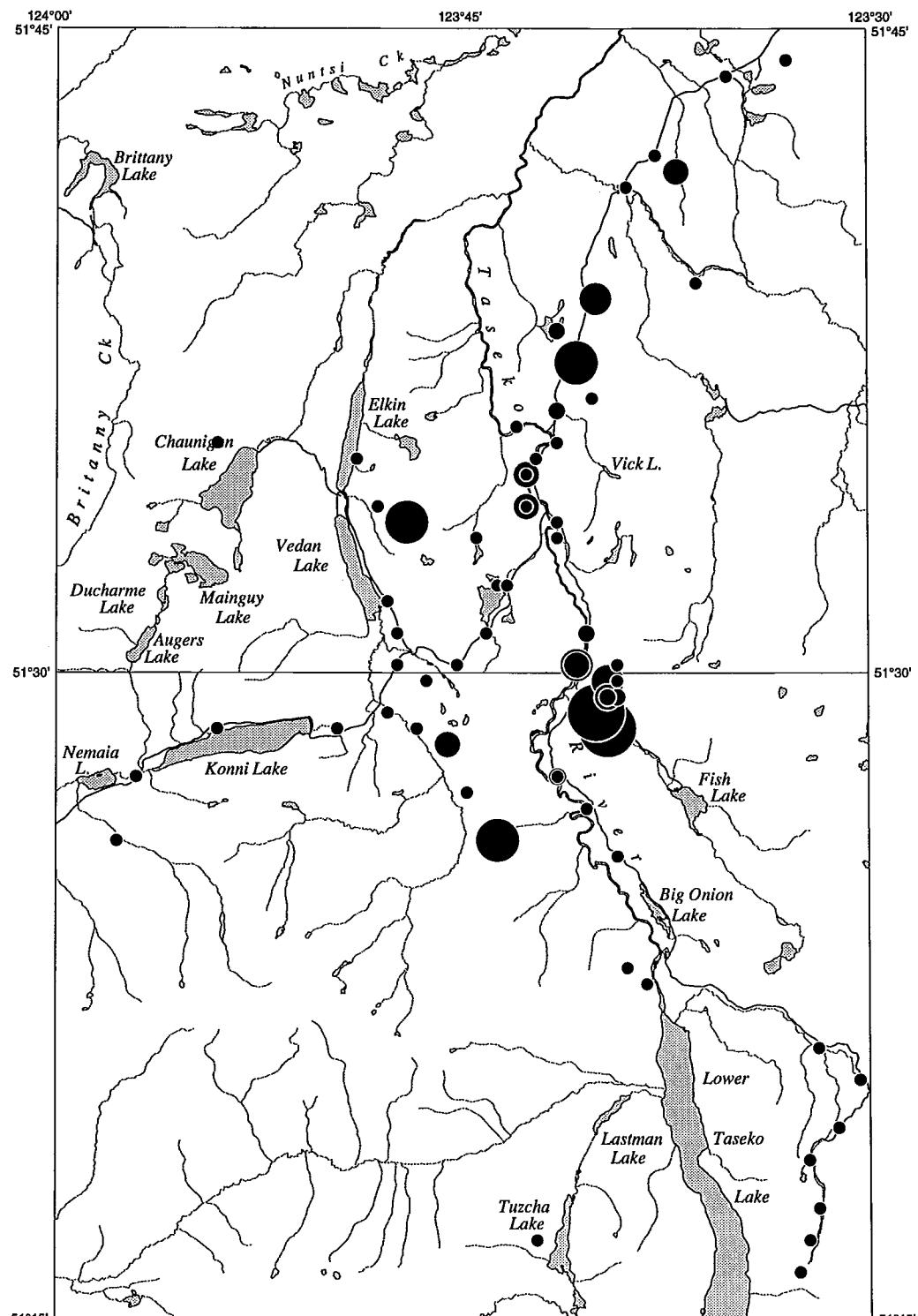
Scale  
Miles 0 5 Miles  
Km 0 5 Km

**Pb**  
Lead (ppm)  
Till  
<0.002 mm fraction  
Analytical Method: ICP-AES

### Symbol Legend



## Fish Lake Area - Till Geochemical Sampling Program



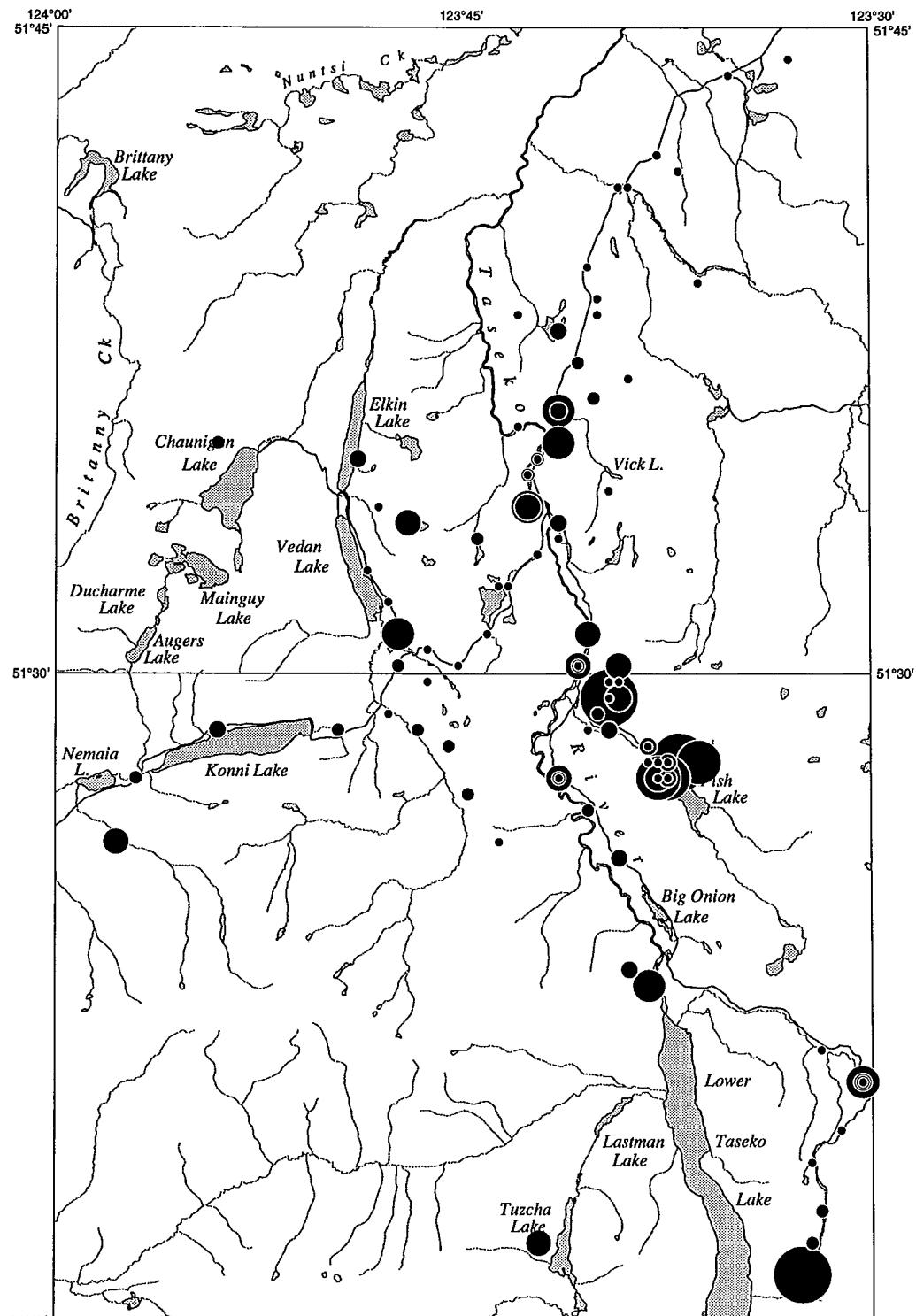
Scale  
Miles 0 5 Miles  
Km 0 5 Km

**Zn**  
Zinc (ppm)  
Till  
<0.002 mm fraction  
Analytical Method: ICP-AES

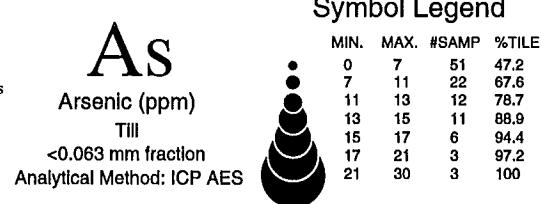


	MIN.	MAX.	#SAMP	%TILE
	46	76	53	67.9
	76	79	8	78.2
	79	90	8	88.5
	90	98	4	93.6
	98	129	3	97.4
	129	133	2	100

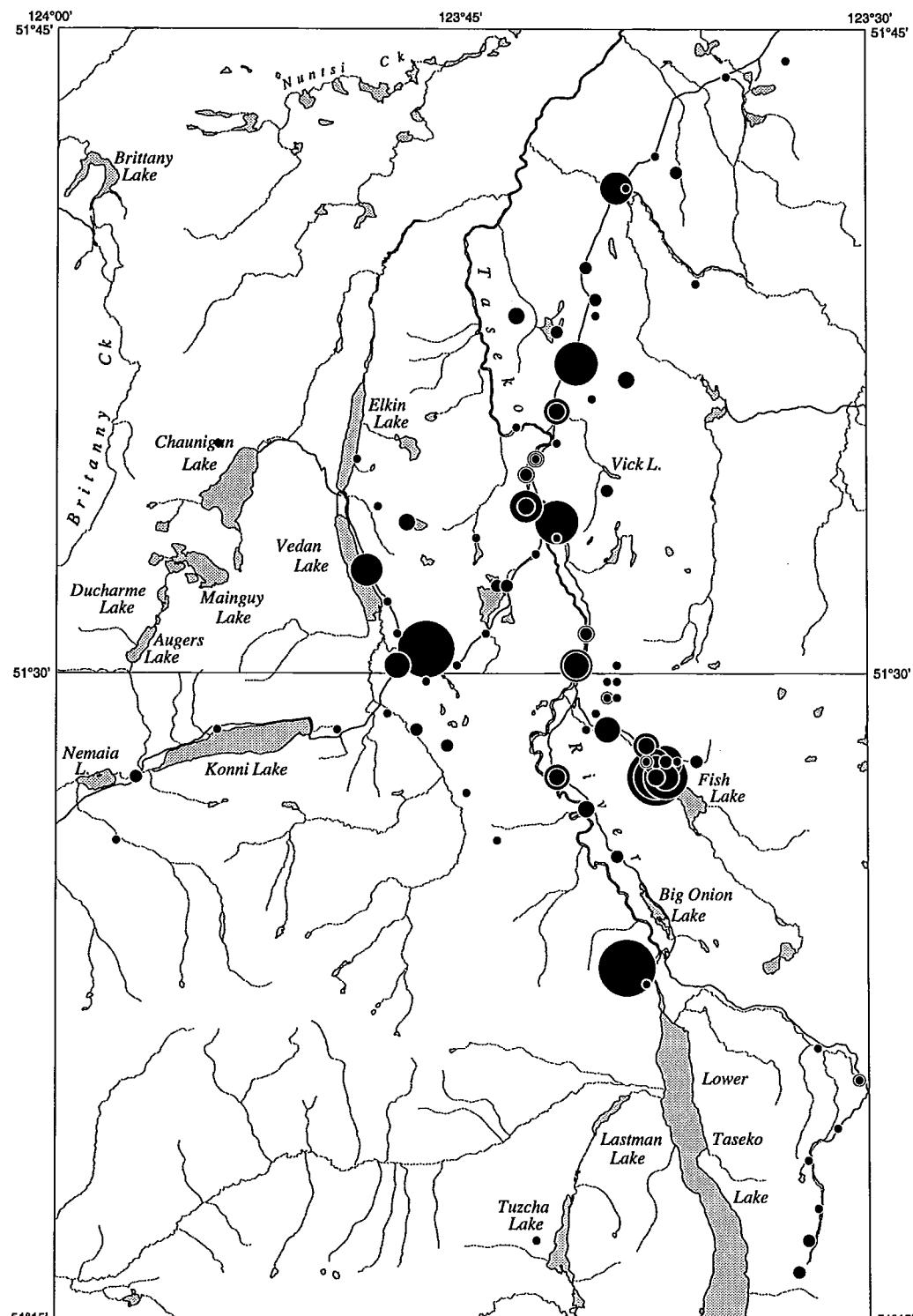
## Fish Lake Area - Till Geochemical Sampling Program



Scale  
Miles 0 5 Miles  
Km 0 5 Km

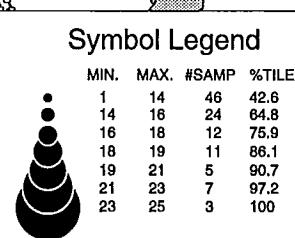


## Fish Lake Area - Till Geochemical Sampling Program

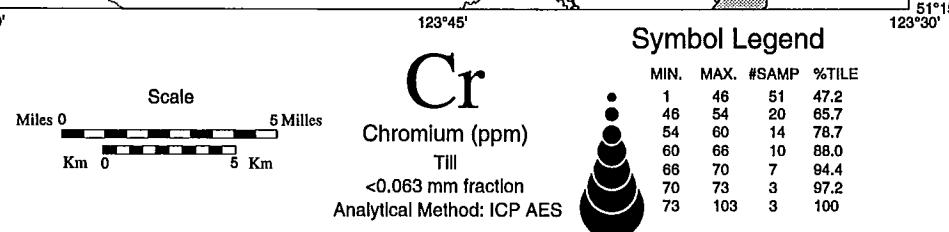
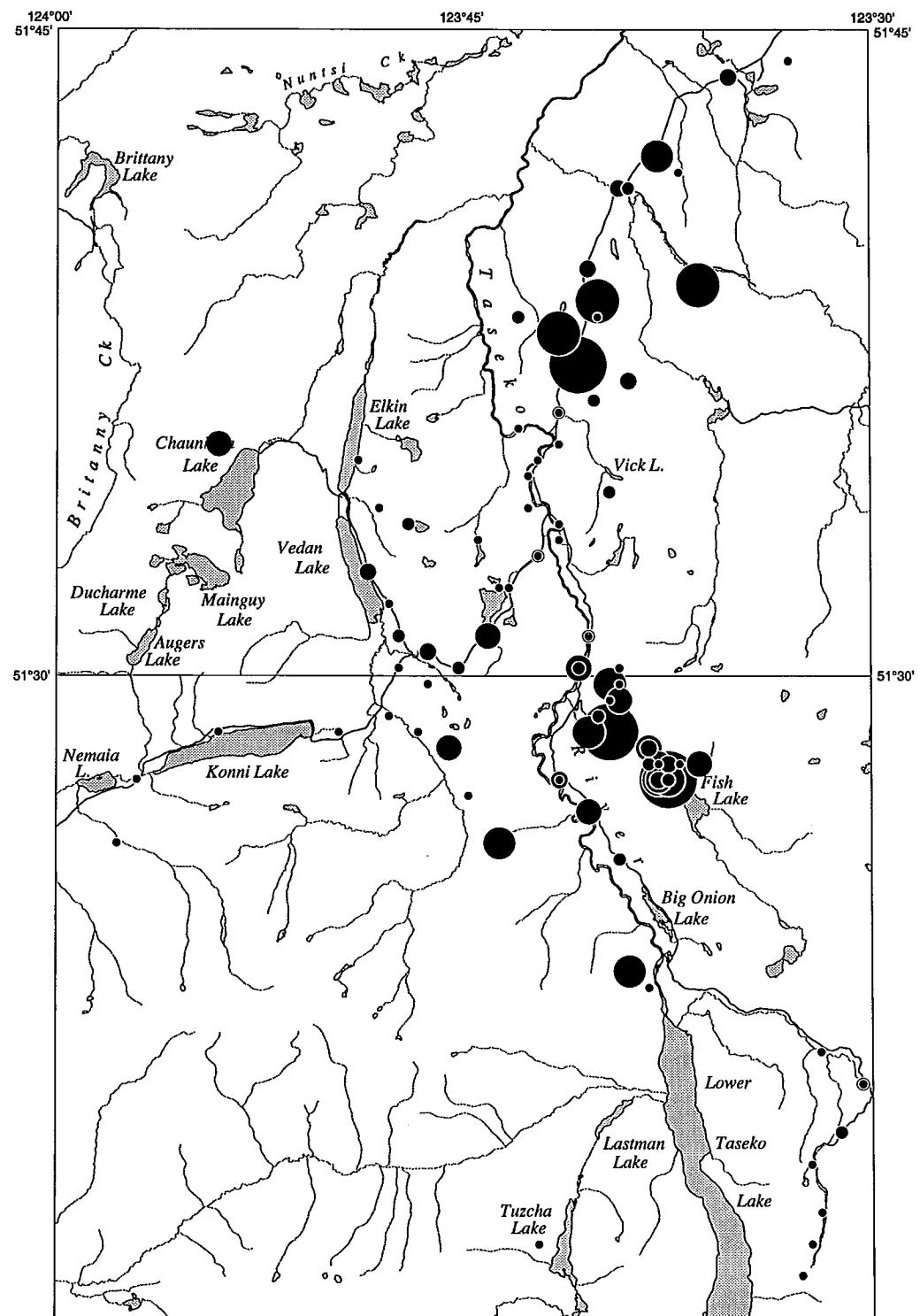


Scale  
Miles 0 5 Miles  
Km 0 5 Km

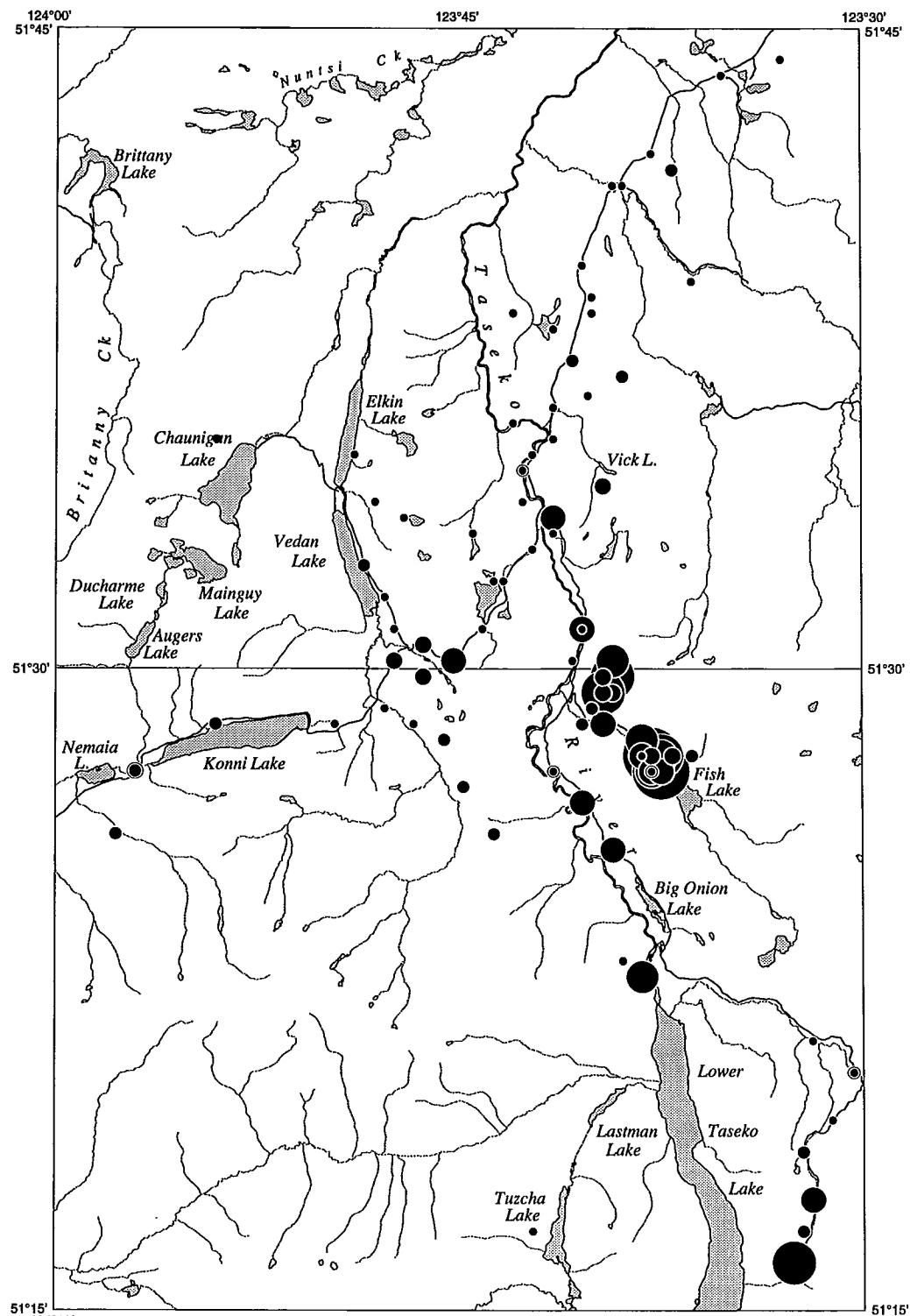
**CO**  
Cobalt (ppm)  
Till  
<0.063 mm fraction  
Analytical Method: ICP AES



## Fish Lake Area - Till Geochemical Sampling Program

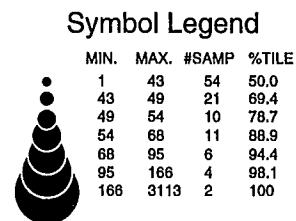


## Fish Lake Area - Till Geochemical Sampling Program

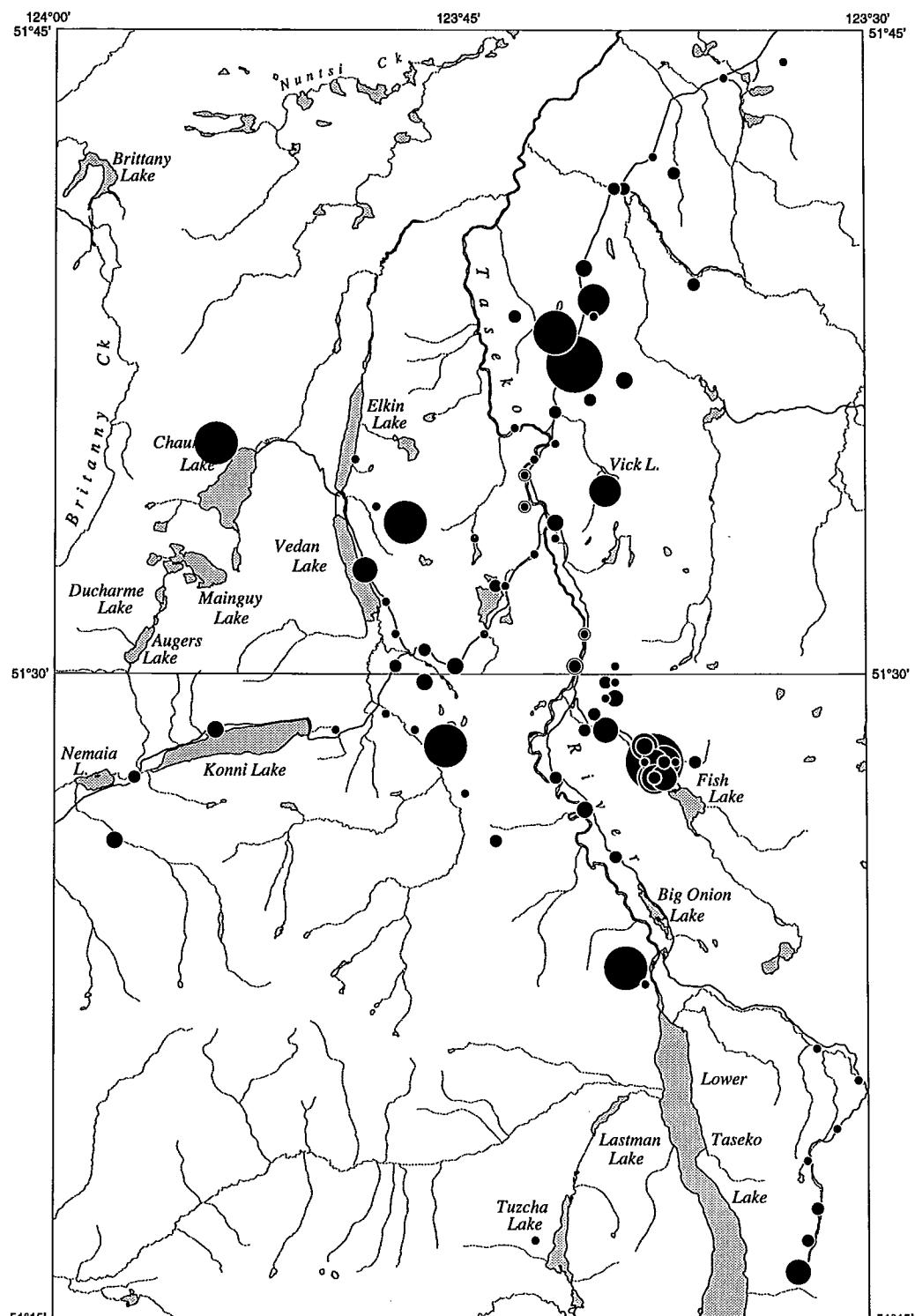


Scale  
Miles 0 5 Miles  
Km 0 5 Km

**Cu**  
Copper (ppm)  
Till  
<0.063 mm fraction  
Analytical Method: ICP AES



## Fish Lake Area - Till Geochemical Sampling Program



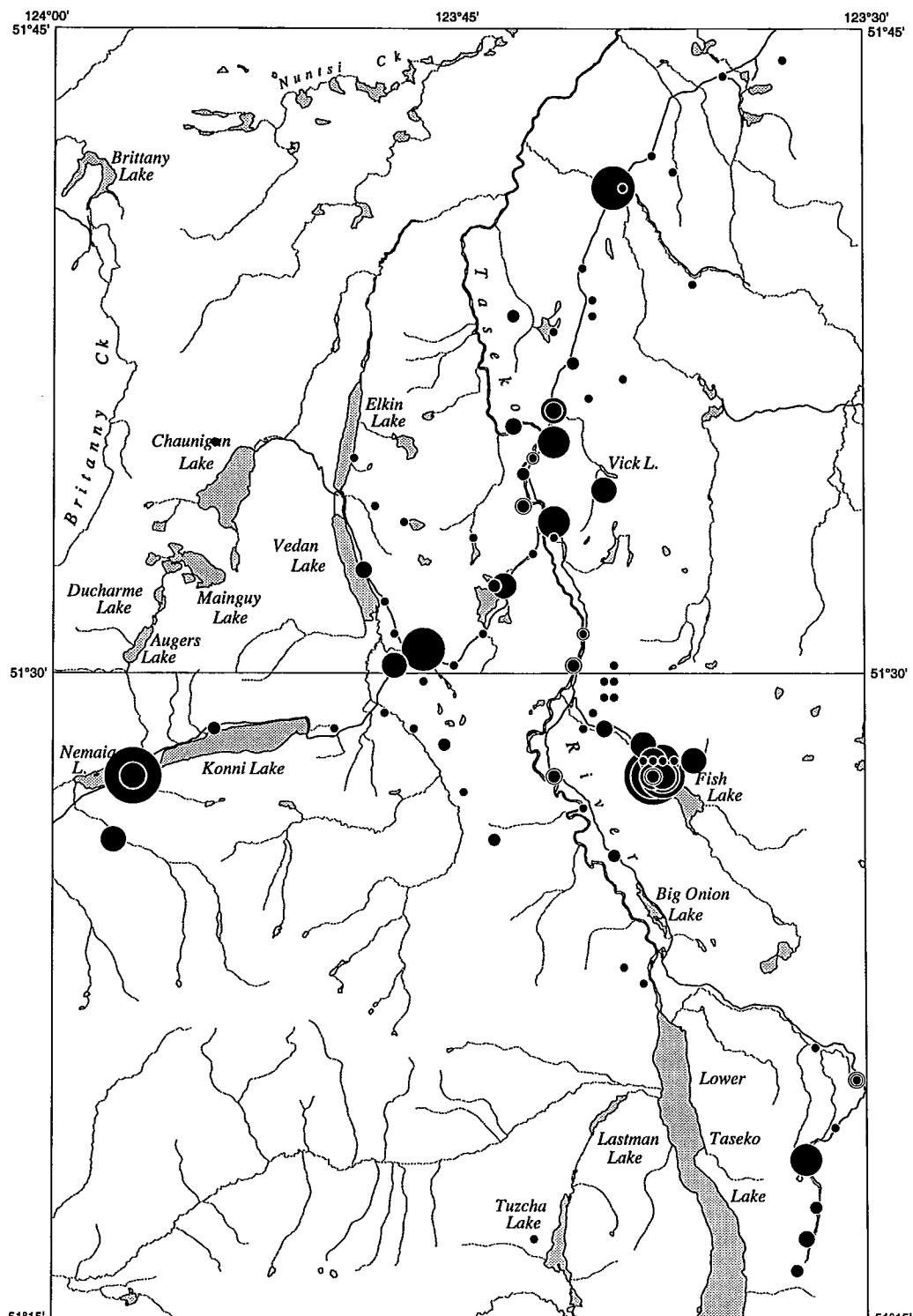
Scale  
Miles 0 5 Miles  
Km 0 5 Km

**Fe**  
Iron (%)  
Till  
<0.063 mm fraction  
Analytical Method: ICP AES

### Symbol Legend

	MIN.	MAX.	#SAMP	%TILE
●	0.01	3.70	42	38.9
●	3.70	4.05	33	69.4
●	4.05	4.23	11	79.6
●	4.23	4.53	11	89.8
●	4.53	4.64	4	93.5
●	4.64	5.72	5	98.1
●	5.72	11.03	2	100

## Fish Lake Area - Till Geochemical Sampling Program

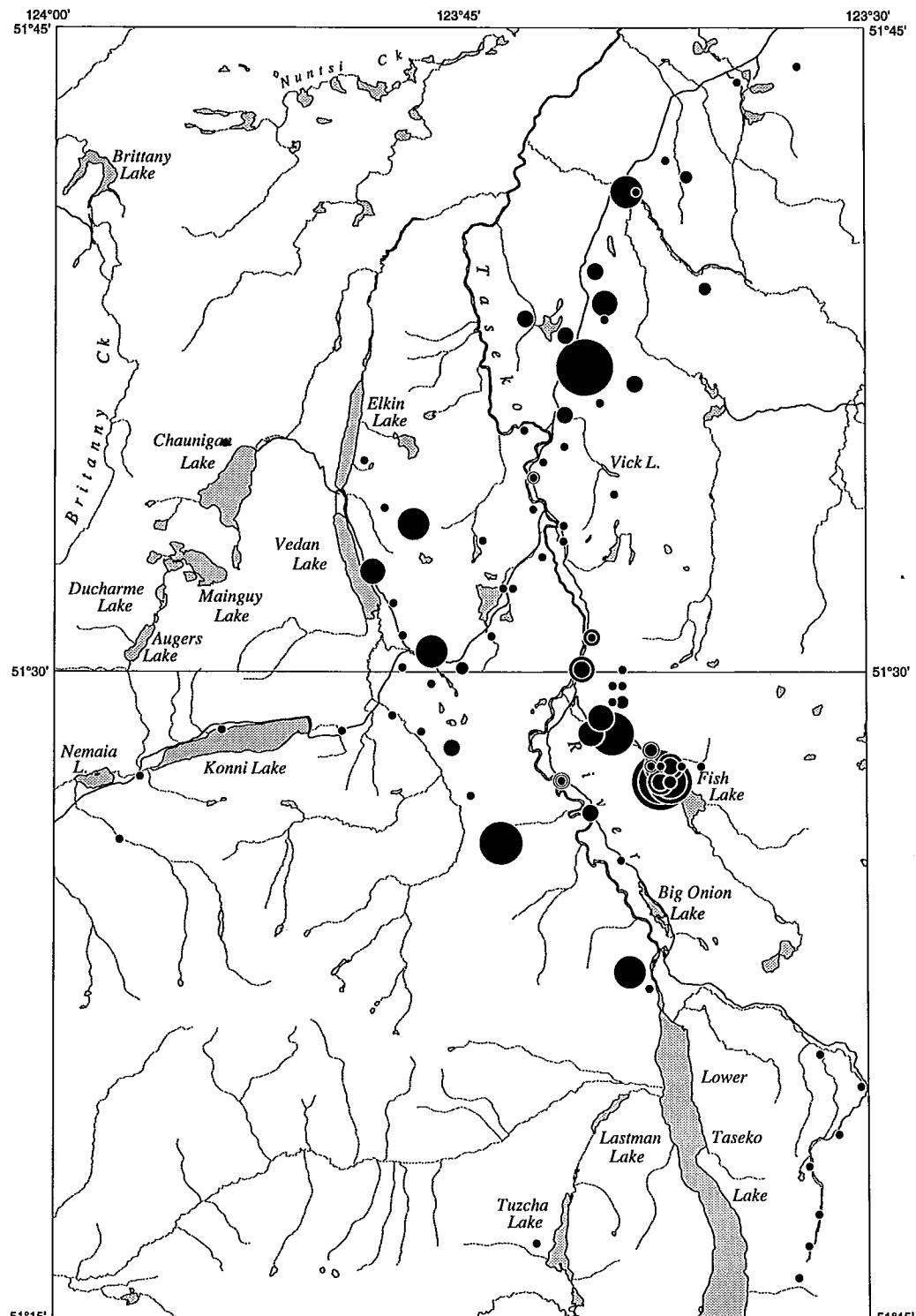


Scale  
Miles 0 5 Miles  
Km 0 5 Km

**Mn**  
Manganese (ppm)  
TIII  
<0.063 mm fraction  
Analytical Method: ICP AES

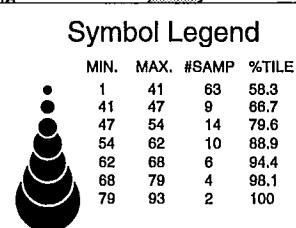
MIN.	MAX.	#SAMP	%TILE
5	579	52	48.1
579	651	23	69.4
651	709	10	78.7
709	814	12	89.8
814	894	5	94.4
894	1074	4	98.1
1074	1220	2	100

## Fish Lake Area - Till Geochemical Sampling Program

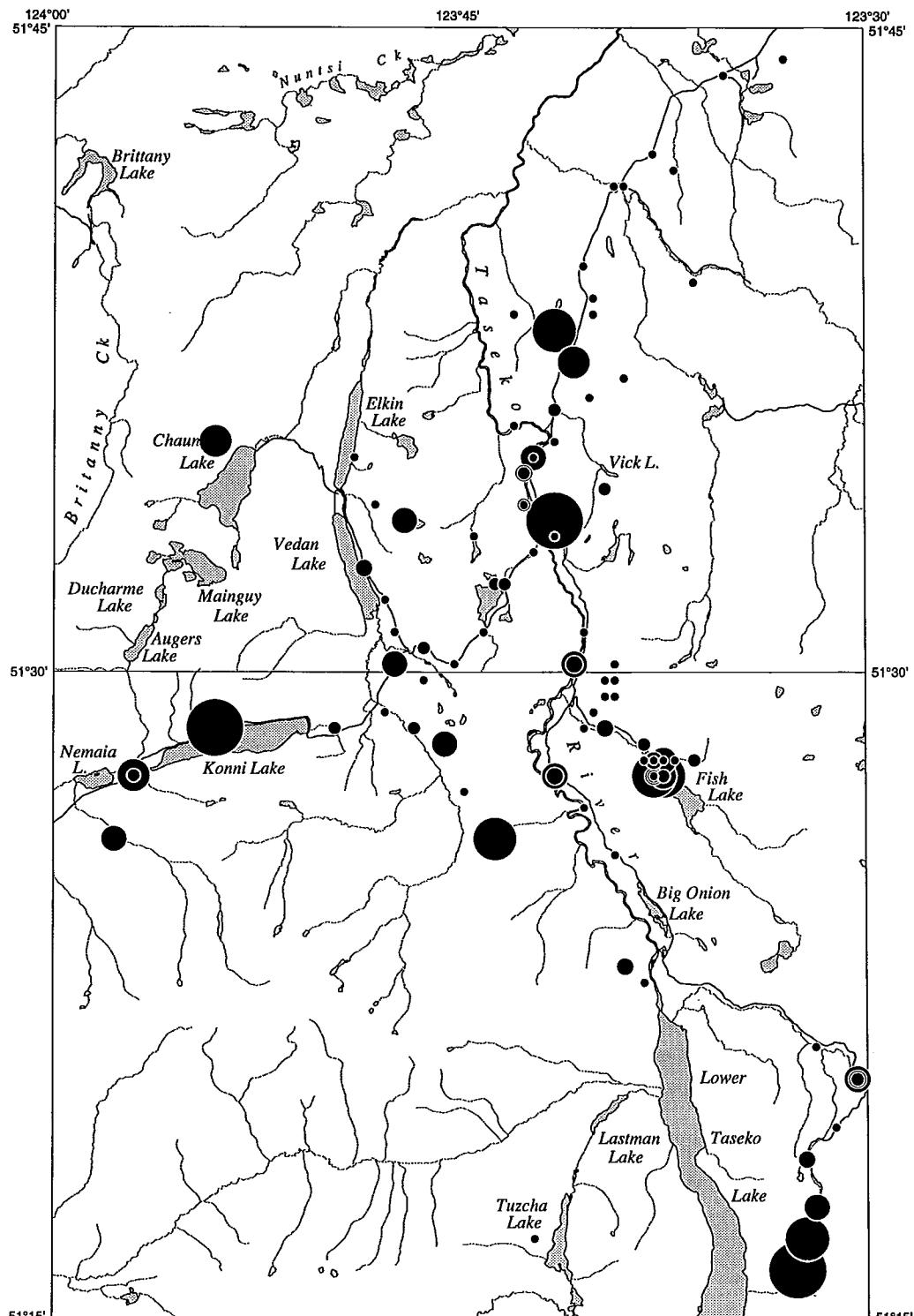


Scale  
Miles 0 5 Miles  
Km 0 5 Km

Ni  
Nickel (ppm)  
Till  
<0.063 mm fraction  
Analytical Method: ICP AES

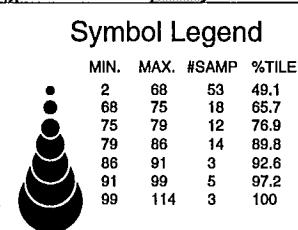


## Fish Lake Area - Till Geochemical Sampling Program

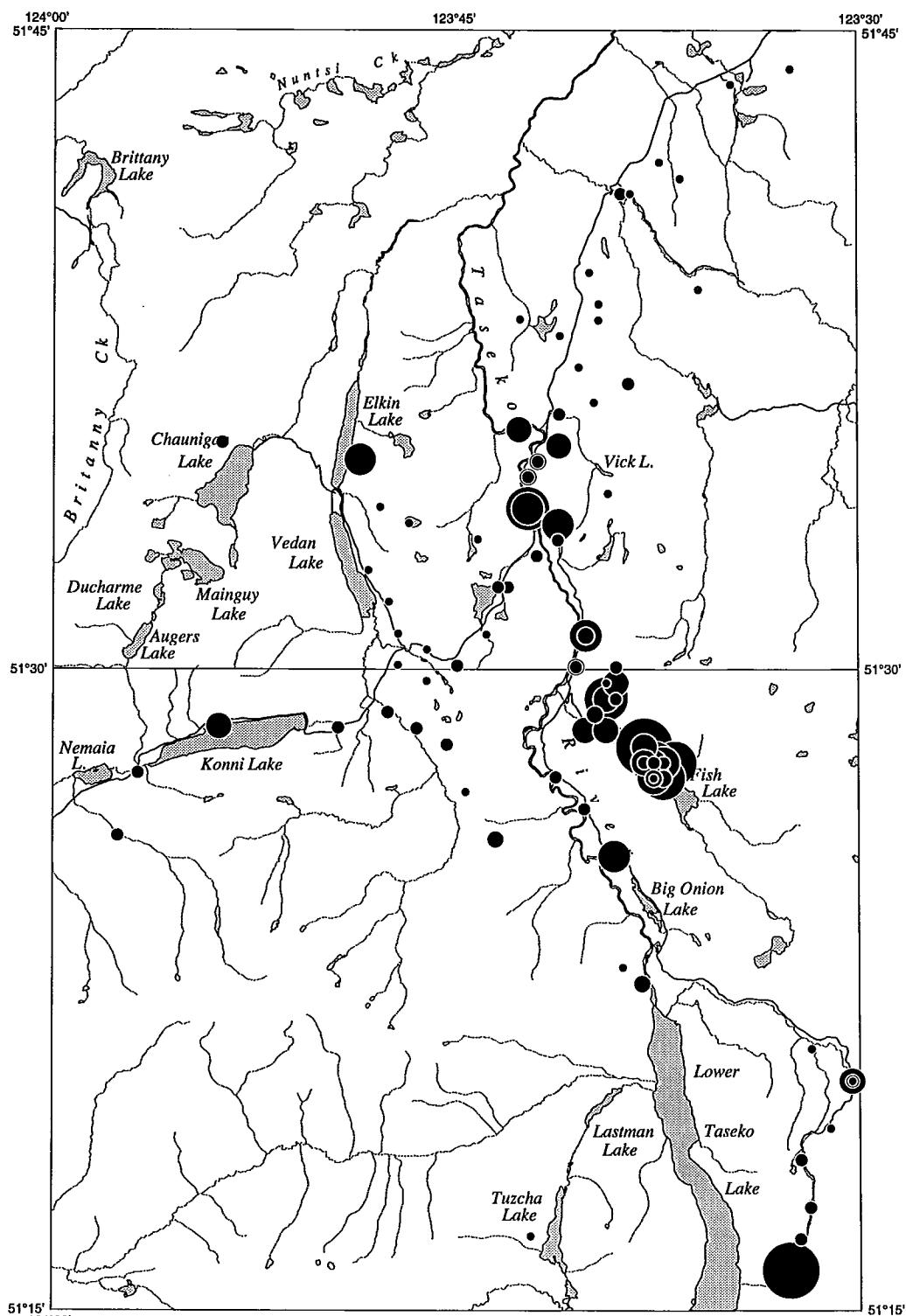


Scale  
Miles 0 5 Miles  
Km 0 5 Km

**Zn**  
Zinc (ppm)  
Till  
<0.063 mm fraction  
Analytical Method: ICP AES



## Fish Lake Area - Till Geochemical Sampling Program



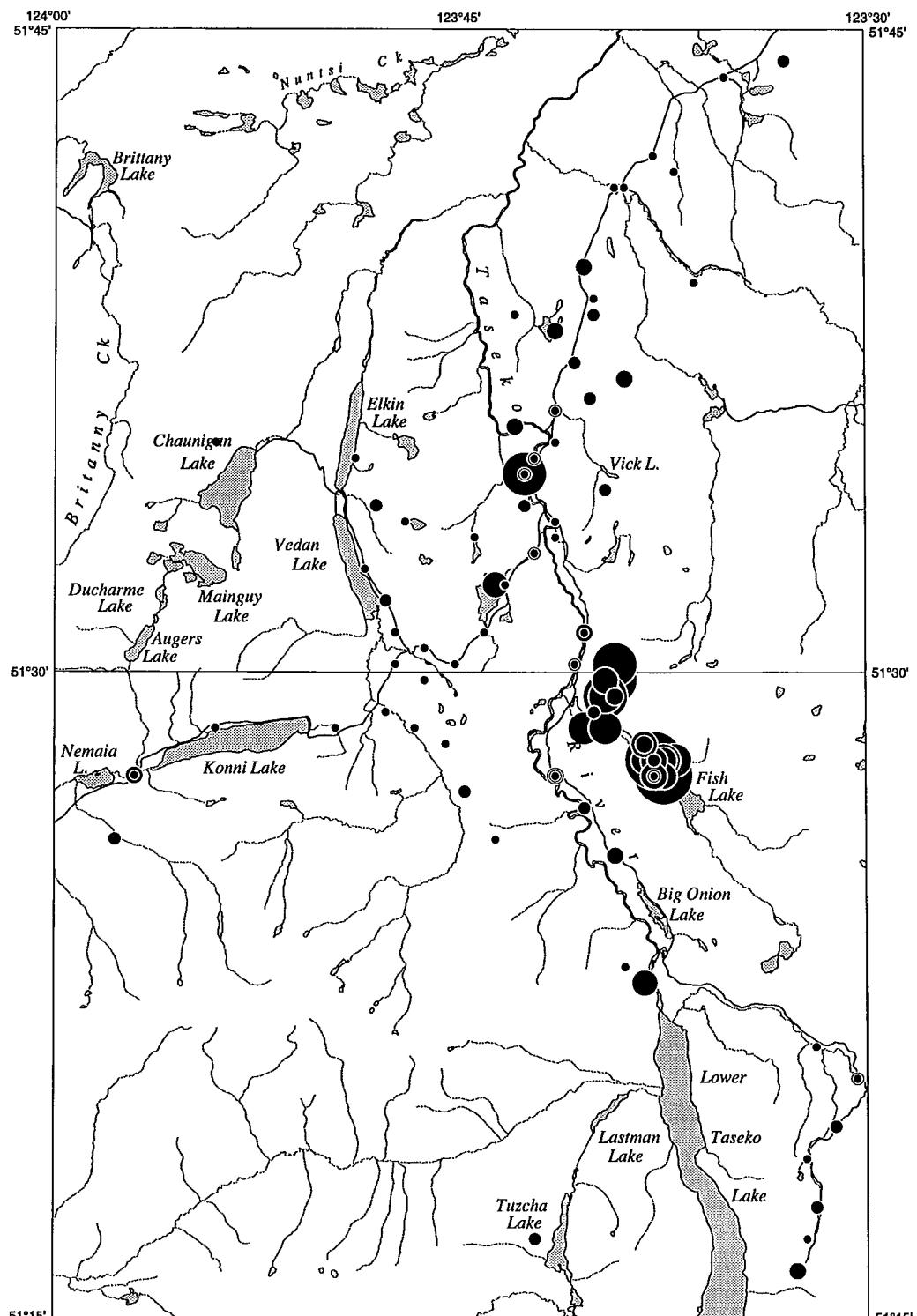
Scale  
Miles 0 5 Miles  
Km 0 5 Km

**AS**  
Arsenic (ppm)  
Till  
<0.063 mm fraction  
Analytical Method: INAA

Symbol Legend

MIN.	MAX.	#SAMP	%TILE
0.5	8	34	31.5
8	10	38	66.7
10	11	11	76.9
11	13	11	87.0
13	15	7	93.5
15	27	5	98.1
27	31	2	100

## Fish Lake Area - Till Geochemical Sampling Program



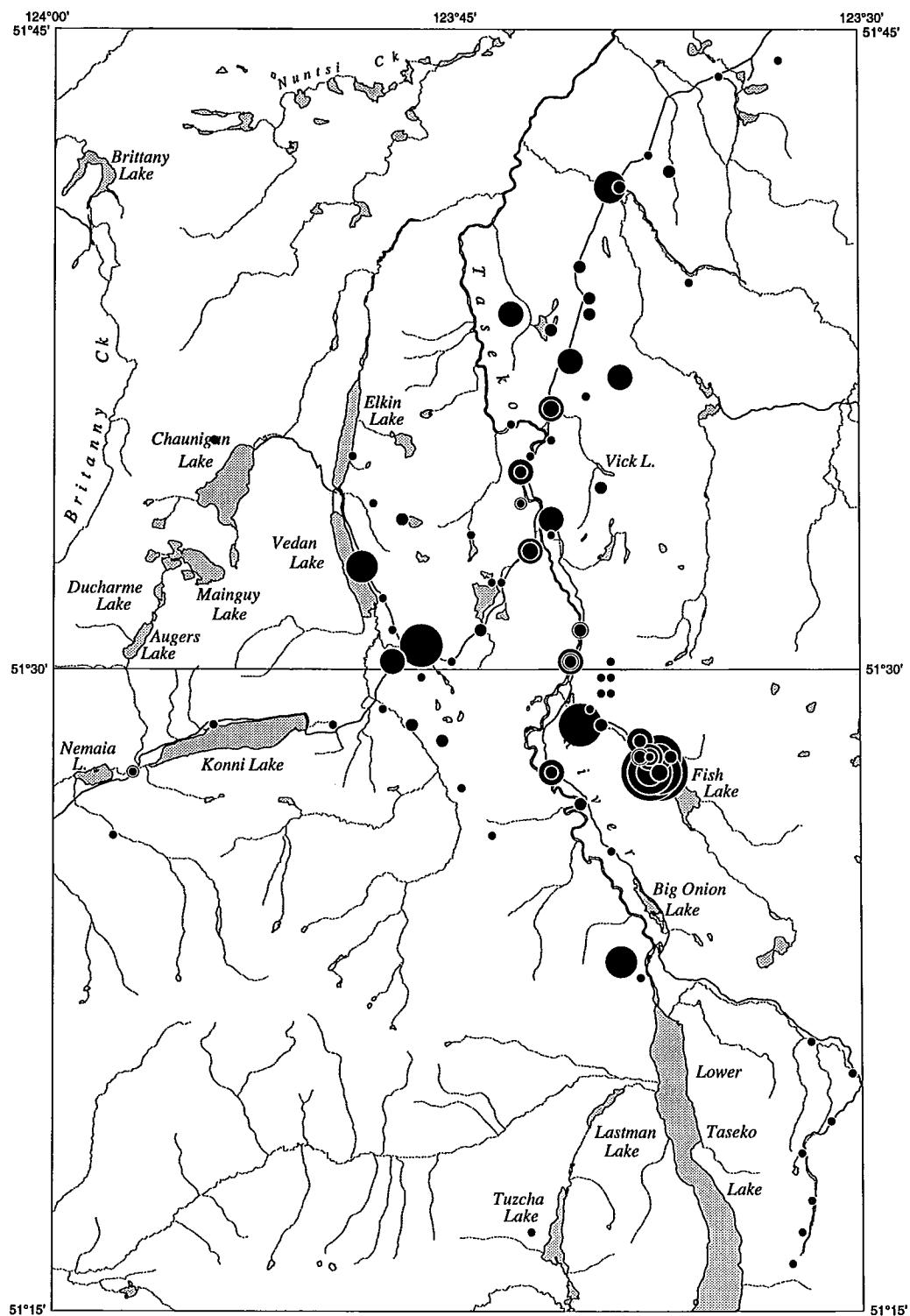
Scale  
Miles 0 5 Miles  
Km 0 5 Km

**Au**  
Gold (ppb)  
Till  
<0.063 mm fraction  
Analytical Method: INAA



MIN.	MAX.	#SAMP	%TILE
1	2	47	43.5
2	5	27	68.5
5	8	11	78.7
8	16	12	89.8
16	39	5	94.4
39	54	4	98.1
54	873	2	100

## Fish Lake Area - Till Geochemical Sampling Program



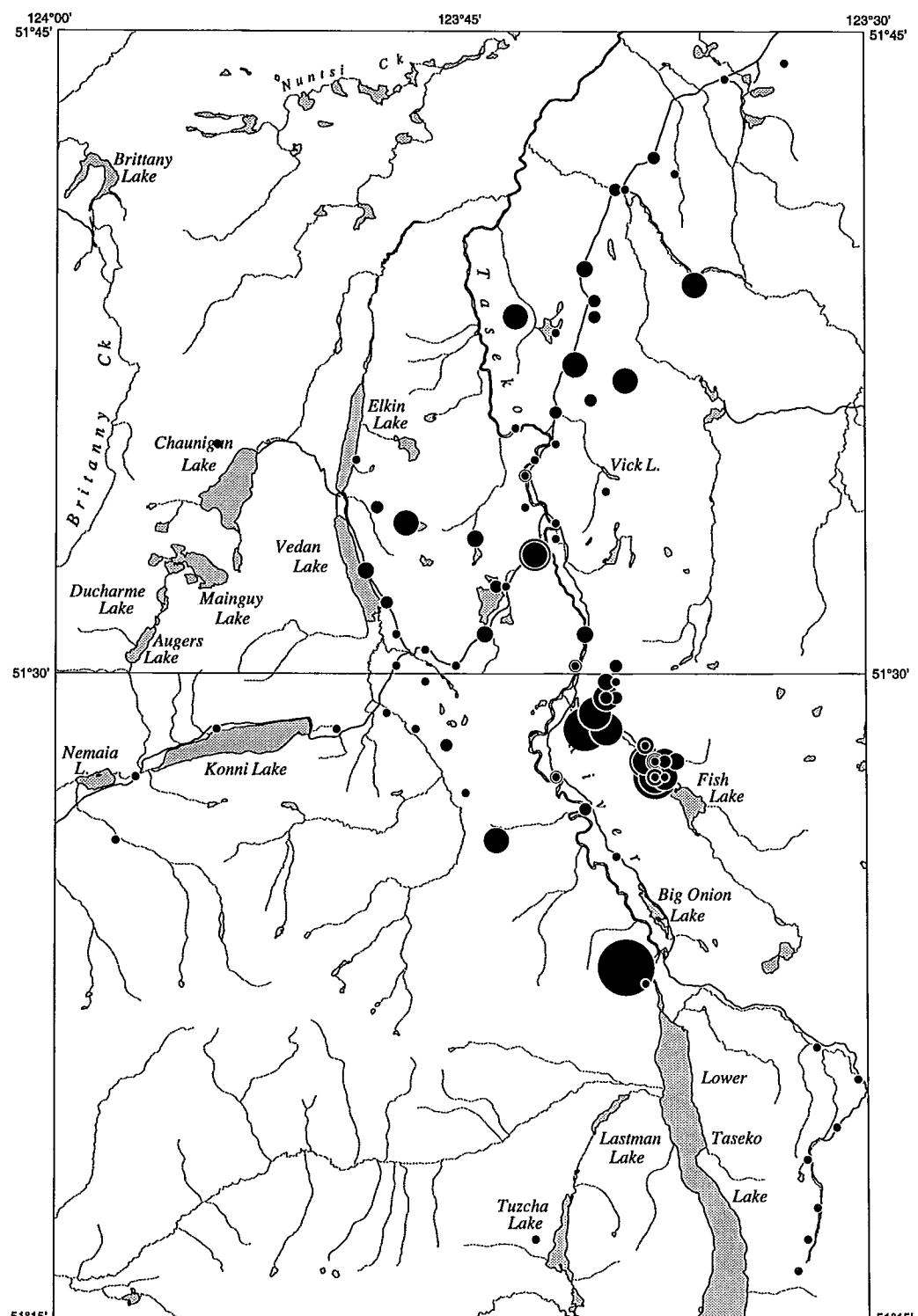
Scale  
Miles 0 5 Miles  
Km 0 5 Km

**Co**  
Cobalt (ppm)  
Till  
<0.063 mm fraction  
Analytical Method: INAA



MIN.	MAX.	#SAMP	%TILE
1	18	50	46.3
18	22	25	69.4
22	23	7	75.9
23	27	15	89.8
27	28	3	92.6
28	30	5	97.2
30	33	3	100

## Fish Lake Area - Till Geochemical Sampling Program

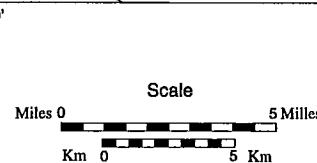
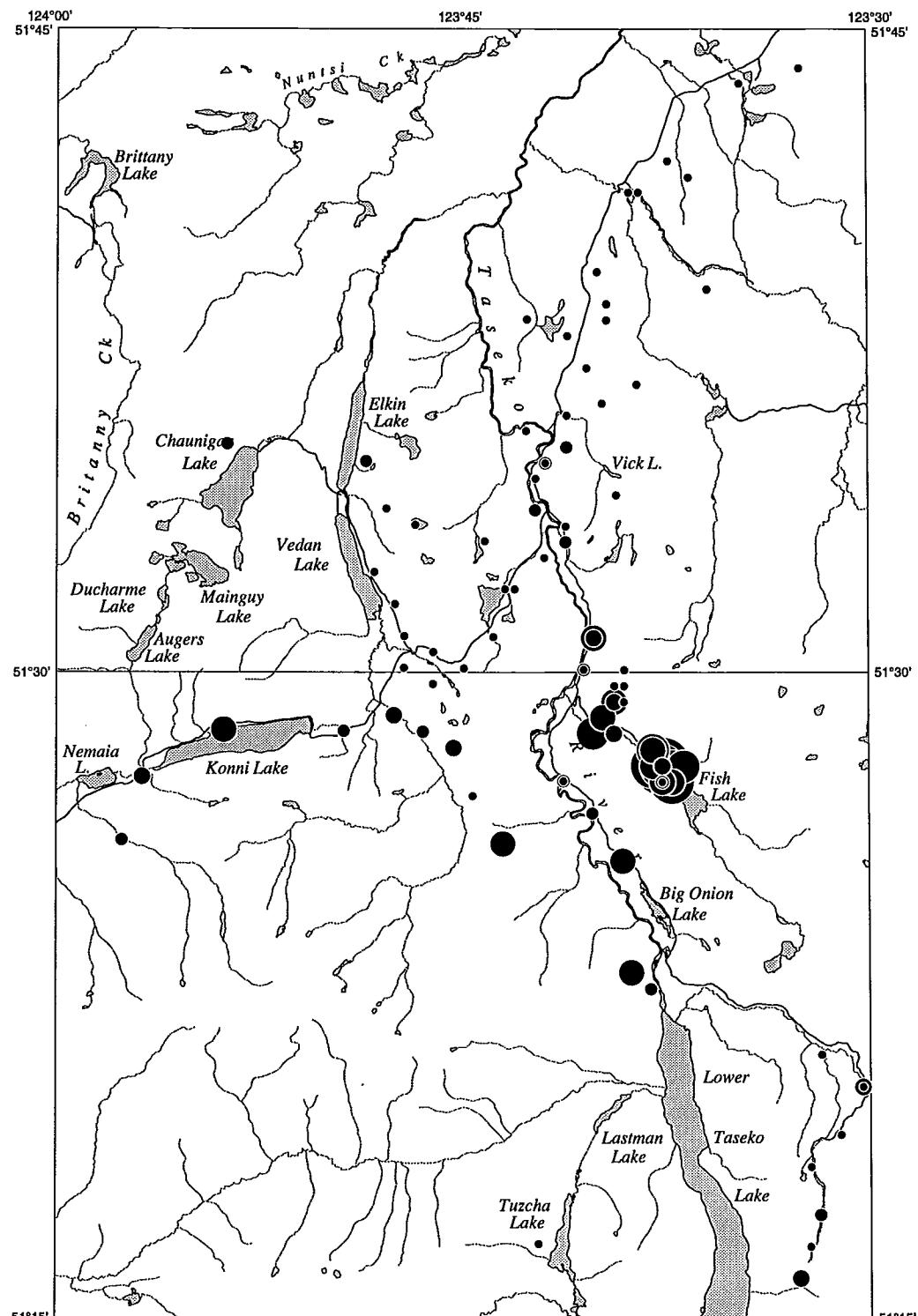


Scale  
Miles 0 5 Miles  
Km 0 5 Km

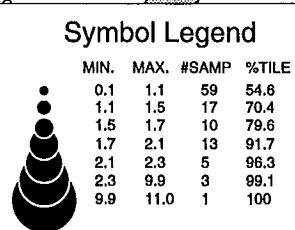
**Cr**  
Chromium (ppm)  
Till  
<0.063 mm fraction  
Analytical Method: INAA

MIN.	MAX.	#SAMP	%TILE
5	129	56	51.9
129	149	20	70.4
149	159	11	80.6
159	179	12	91.7
179	199	6	97.2
199	399	2	99.1
399	500	1	100

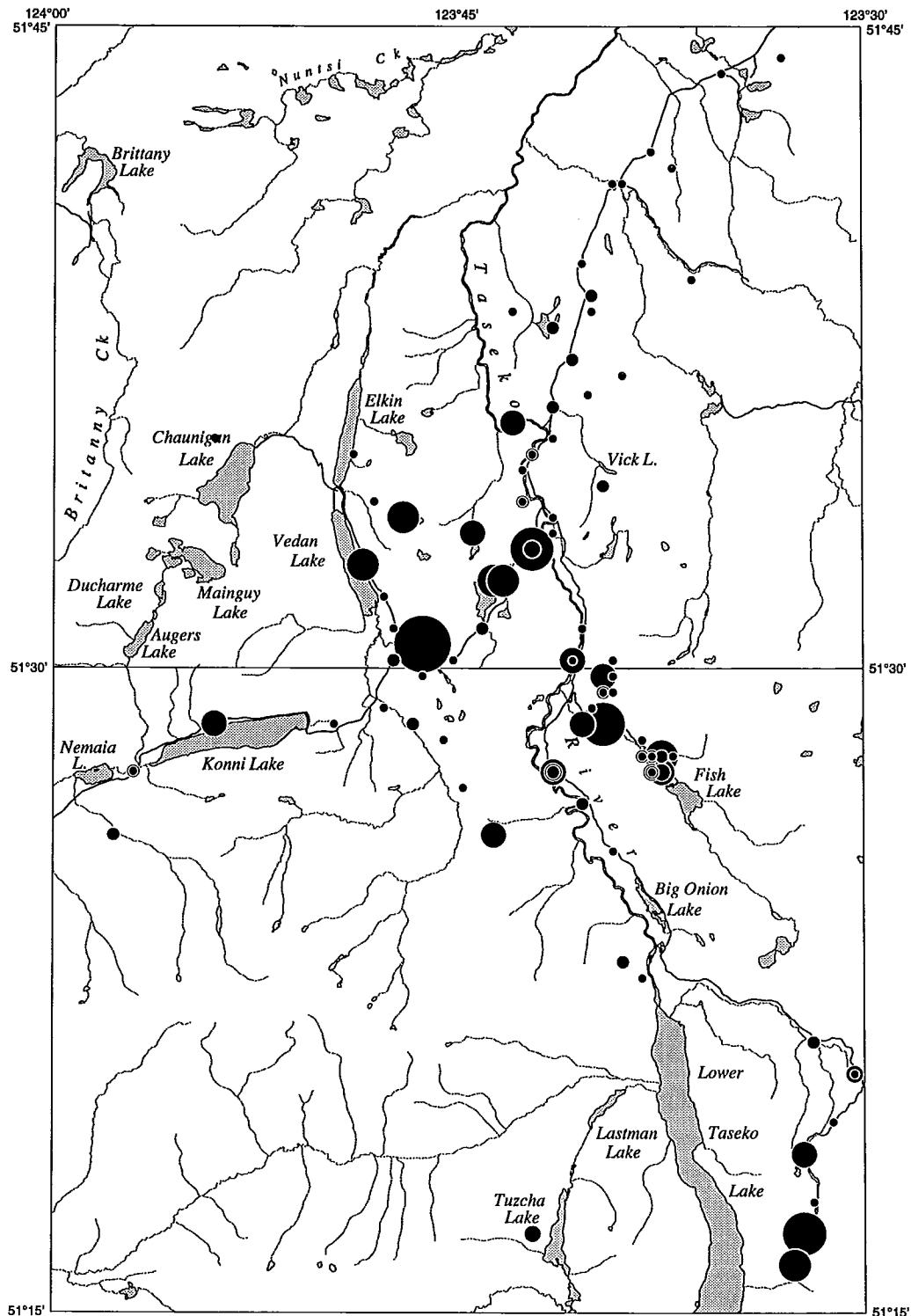
## Fish Lake Area - Till Geochemical Sampling Program



**Sb**  
Antimony (ppm)  
Till  
<0.063 mm fraction  
Analytical Method: INAA



## Fish Lake Area - Till Geochemical Sampling Program



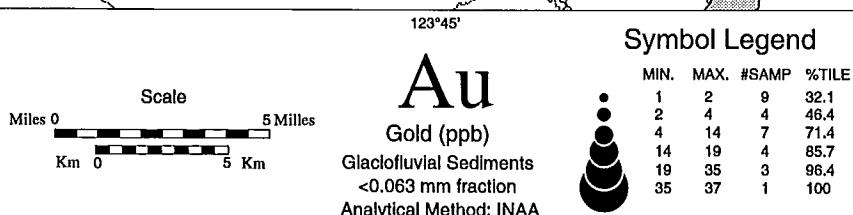
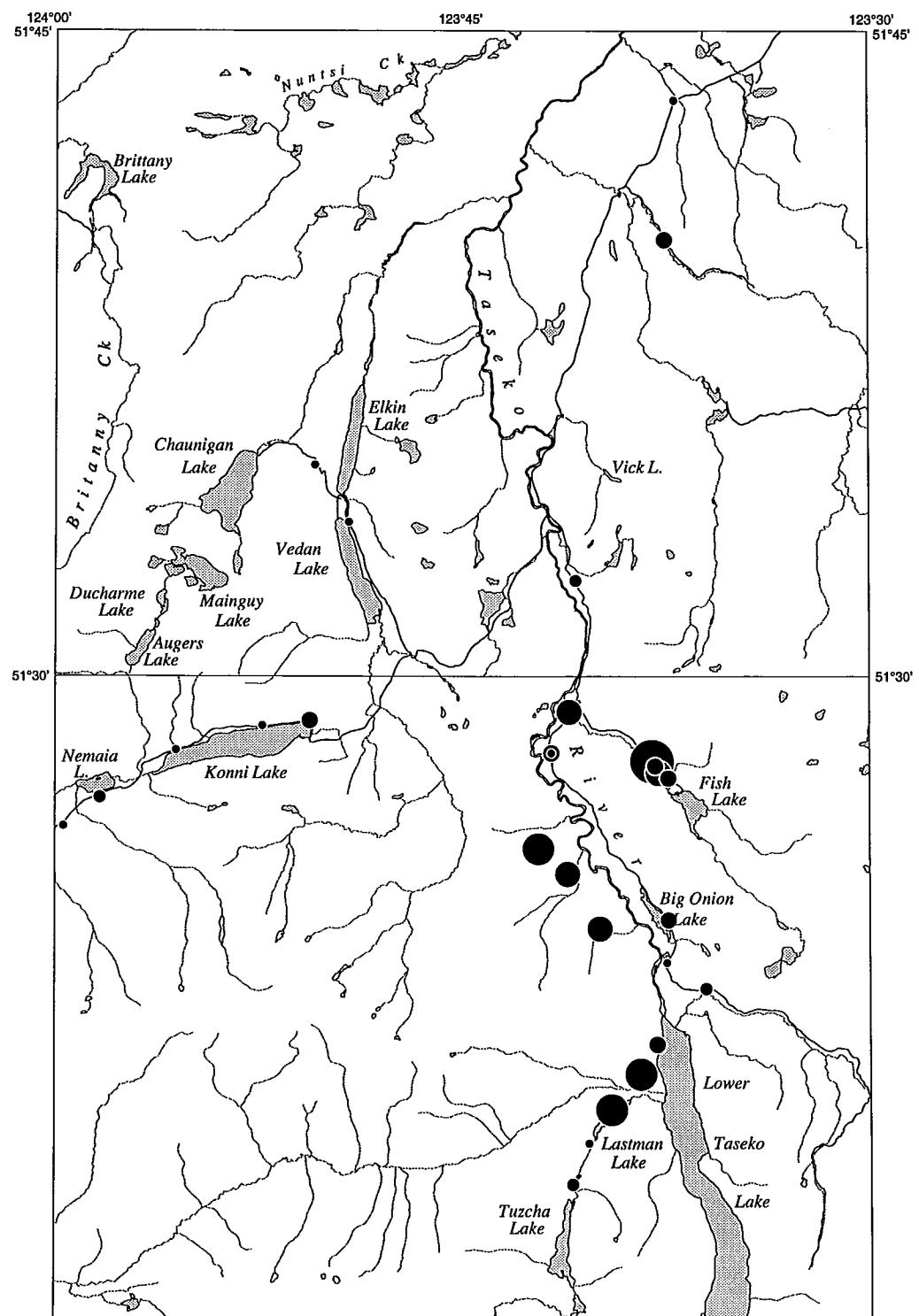
Scale  
Miles 0 5 Miles  
Km 0 5 Km

**Zn**  
Zinc (ppm)  
Till  
<0.063 mm fraction  
Analytical Method: INAA

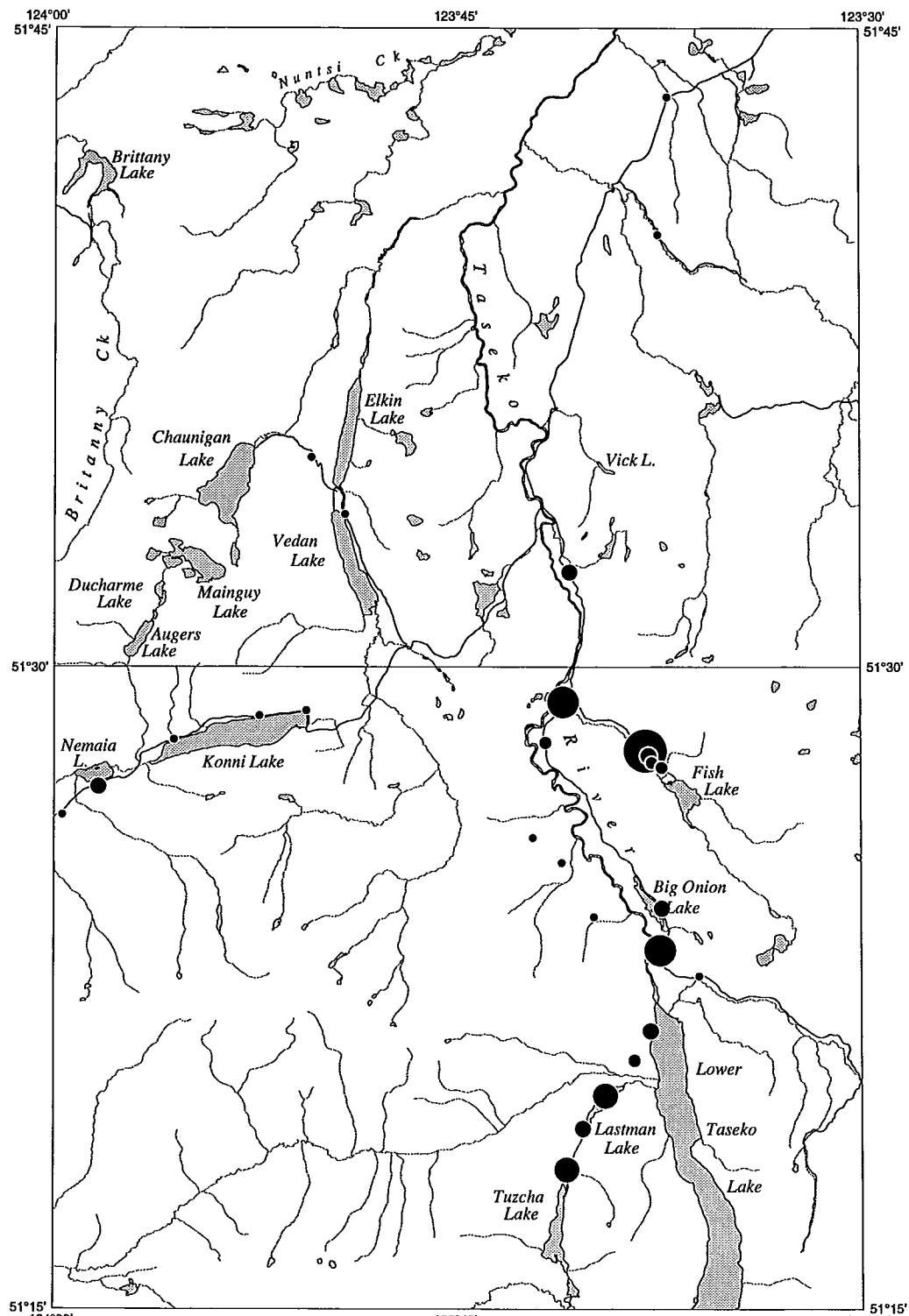


MIN.	MAX.	#SAMP	%TILE
50	102	54	50.0
102	122	23	71.3
122	131	10	80.6
131	139	11	90.7
139	150	6	96.3
150	159	3	99.1
159	190	1	100

## Fish Lake Area - Glaciofluvial Sediments



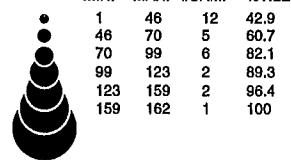
## Fish Lake Area - Glaciofluvial Sediments



### Symbol Legend

Scale  
Miles 0 5 Miles  
Km 0 5 Km

**Cu**  
Copper (ppm)  
Glaciofluvial Sediments  
<0.063 mm fraction  
Analytical Method: ICP-AES



## Appendix 2

### Standard sample analyses

### Analytical method : ICP-AES

8010 standard  
Analytical method : INAA

Analyses of 8010 (this project)																		
Sample ID	Au	Ag	As	Ba	Br	Ca	Co	Cr	Cs	Fe	Hf	Hg	Ir	Mo	Na	Ni	Rb	Sb
	ppb	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	%	ppm	ppm	ppb	ppm	ppm	ppm	ppm	ppm
8010	162.	<5.	7.4	620.	2.5	2.	9.	57.	<1.	2.34	7.	<1.	<5.	<1.	2.03	<32.	40.	2.6
8010	189.	<5.	7.6	630.	2.4	1.	10.	60.	<1.	2.44	7.	<1.	<5.	<1.	2.15	<34.	70.	3.1
8010	162.	<5.	7.6	590.	2.2	2.	9.	53.	1.	2.28	6.	<1.	<5.	2.	2.02	<25.	60.	3.0
8010	175.	<5.	7.8	480.	2.3	2.	9.	53.	<1.	2.29	7.	<1.	<5.	<1.	2.07	<21.	51.	3.0
8010	175.	<5.	6.9	480.	2.4	2.	9.	55.	1.	2.39	7.	<1.	<5.	<1.	2.15	81.	52.	3.0
Analyses of 8010 (other GSC projects)																		
Sample ID	Au	Ag	As	Ba	Br	Ca	Co	Cr	Cs	Fe	Hf	Hg	Ir	Mo	Na	Ni	Rb	Sb
	ppb	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	%	ppm	ppm	ppb	ppm	ppm	ppm	ppm	ppm
Min	143	3	8.6	730	2.7	2	10	60	1	2.33	7	0.5	3	0.50	1.90	10	64	3.50
Mean	171	3	7.6	546	2.4	1.5	9	56	0.8	2.24	7	0.5	3	0.5	1.85	10	51	3.20
Max	194	3	6.8	430	2.2	1	8	52	0.5	2.14	7	0.5	3	0.5	1.76	10	43	2.90
Analyses of 8010 (this project)																		
Sample ID	Sc	Se	Sn	Sr	Ta	Th	U	Zr	La	Ce	Nd	Sm	Eu	Tb	Yb	Lu		
	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	
8010	10.0	<3.	<100.	<500.	<0.5	6.0	2.0	80.	28.0	51.	17.	4.0	1.2	1.2	1.8	0.31		
8010	11.0	<3.	<100.	<500.	<0.5	6.4	1.4	136.	30.0	55.	24.	4.3	1.2	<0.5	2.1	0.31		
8010	10.0	<3.	<100.	<500.	<0.5	5.9	0.9	85.	28.0	50.	19.	3.9	1.1	<0.5	2.0	0.28		
8010	11.0	<3.	<100.	<500.	<0.5	6.3	1.6	75.	28.0	53.	23.	3.9	1.2	0.6	1.9	0.28		
8010	11.0	<3.	<100.	<500.	<0.5	6.1	0.9	75.	28.0	49.	21.	4.0	1.1	0.5	2.0	0.28		
Analyses of 8010 (other GSC projects)																		
Sample ID	Sc	Se	Sn	Sr	Ta	Th	U	Zr	La	Ce	Nd	Sm	Eu	Tb	Yb	Lu		
	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	
Min	10.00	3.00	50.00	250.00	1.1	6.7	1.60	67.00	28.00	50.00	22.00	4.40	1.20	0.70	1.90	0.33		
Mean	9.90	3.00	50.00	250.00	0.5	6.2	1.20	35.00	27.00	48.00	20.00	4.00	1.10	0.50	1.80	0.30		
Max	9.50	3.00	50.00	250.00	0.3	5.8	0.80	25.00	25.00	45.00	19.00	3.70	1.00	0.30	1.70	0.26		

SBA standard

Analytical method : ICP-AES

		Analyses of SBA (this project)																			
Sample ID	Ag	Al	As	Ba	Bi	Ca	Co	Cr	Cu	Fe	K	La	Mg	Mn	Mo	Na	Ni	P	Pb	Sb	Sc
	ppm	%	ppm	ppm	ppm	%	ppm	ppm	ppm	%	%	ppm	%	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm
SBA	0	3.07	20	90	0	0.1	16	39	72	3.61	0.3	30	0.8	845	0	0	36	590	18	0	8
SBA	0	3.03	4	90	0	0.1	15	38	72	3.58	0.3	30	0.8	840	1	0	38	550	14	2	8
SBA	0.2	3.13	24	90	0	0.1	14	41	70	3.64	0.3	30	0.8	810	0	0	34	530	20	0	8
SBA	0.2	2.86	32	90	0	0.1	14	37	67	3.5	0.3	30	0.8	795	0	0	33	510	22	0	7
SBA	0	3.18	30	90	0	0.1	13	42	73	3.69	0.3	30	0.8	855	1	0	32	570	26	2	8

## Appendix 3

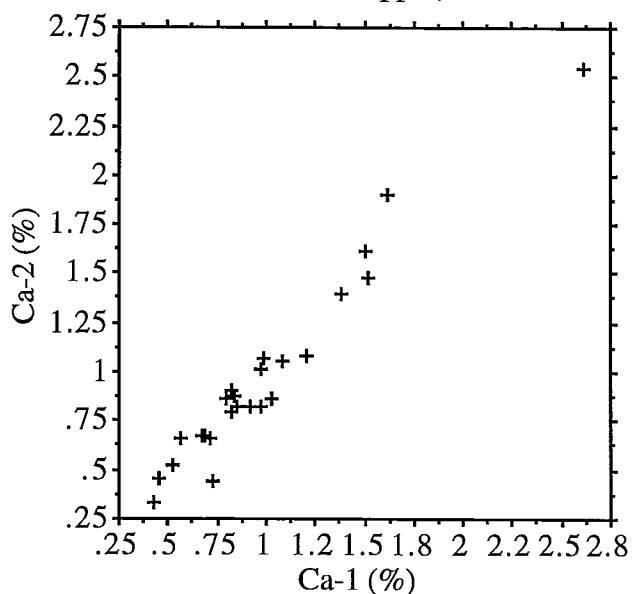
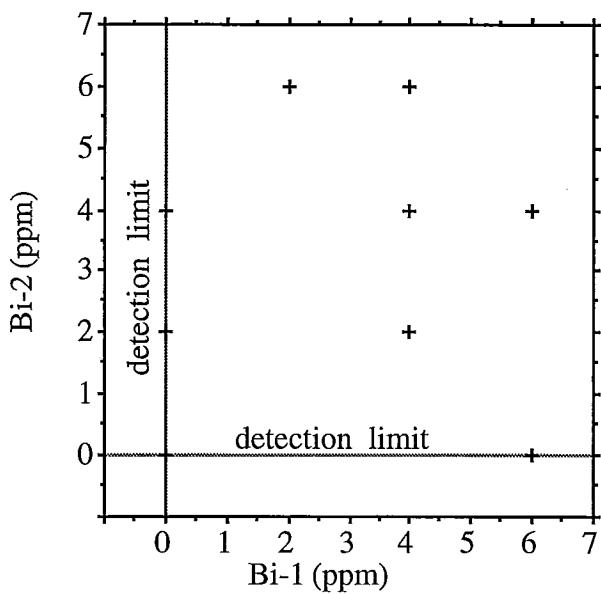
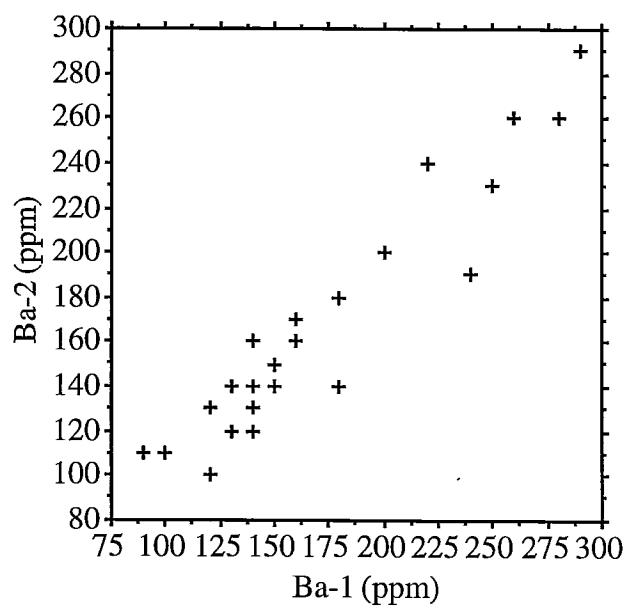
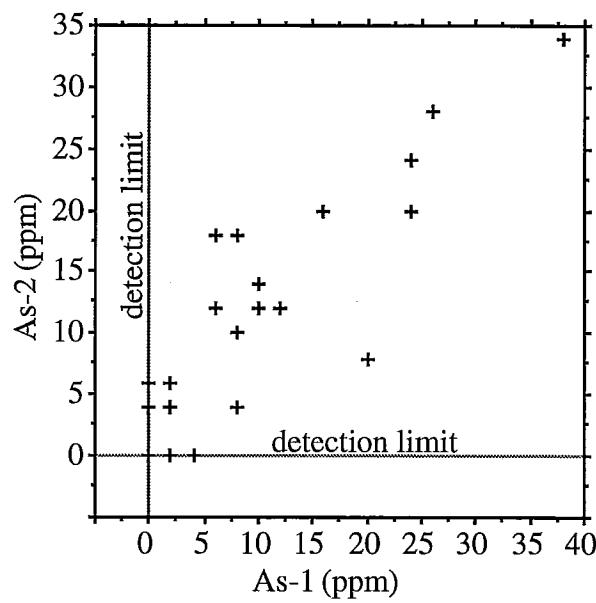
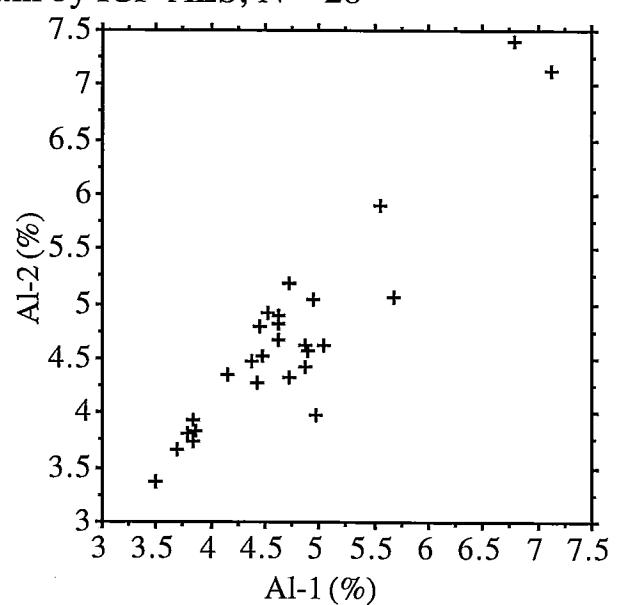
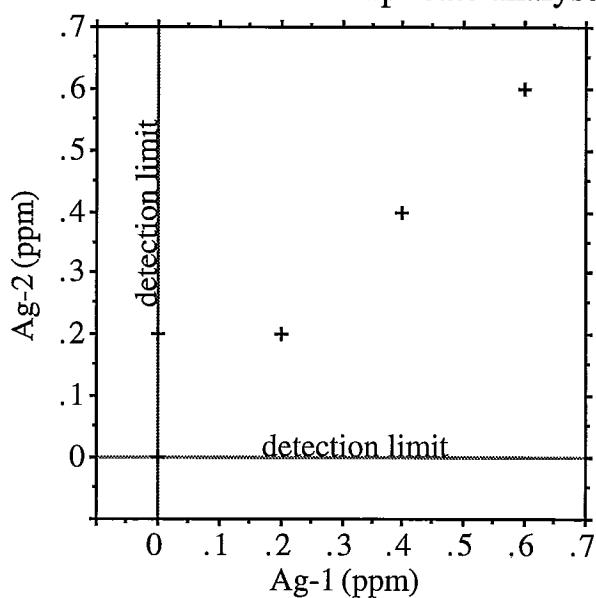
### Scattergrams Duplicate sample analyses

#### Legend

Ag-1	first analysis
Ag-2	second analysis

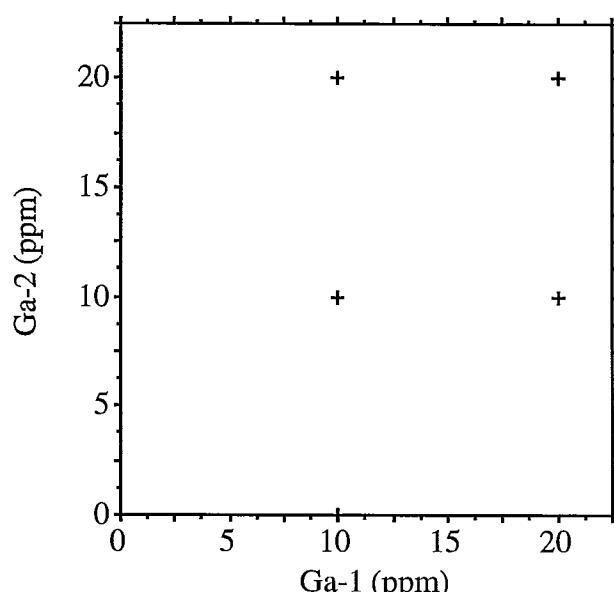
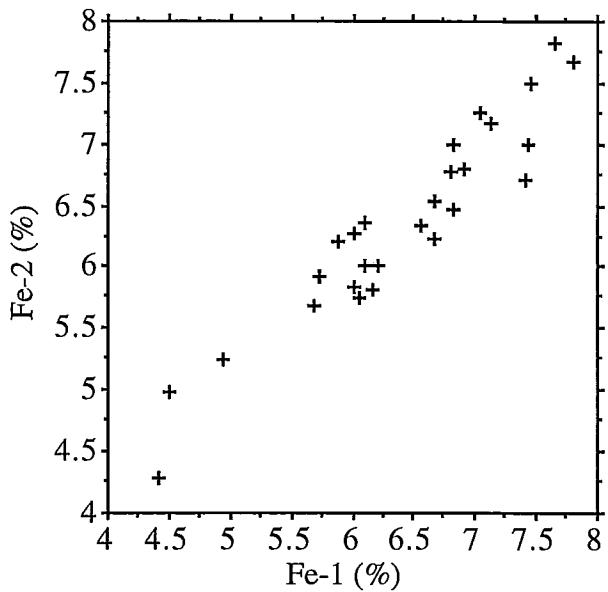
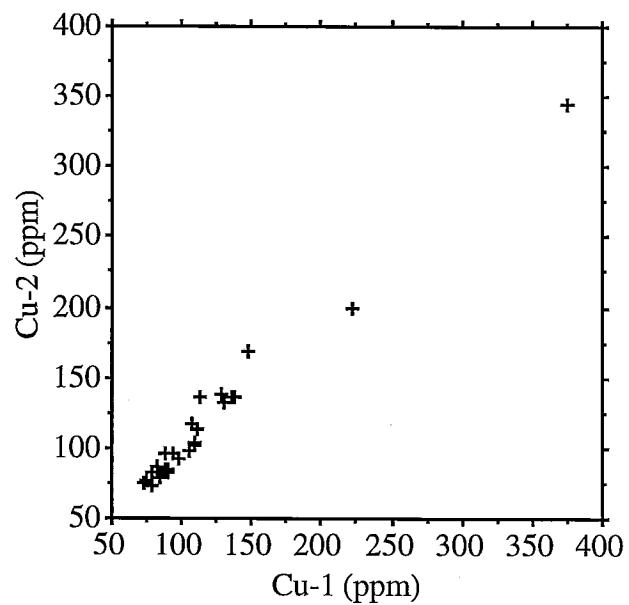
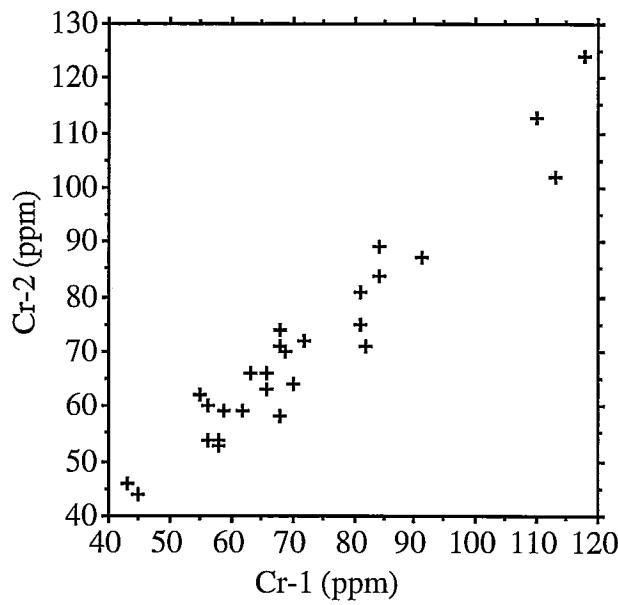
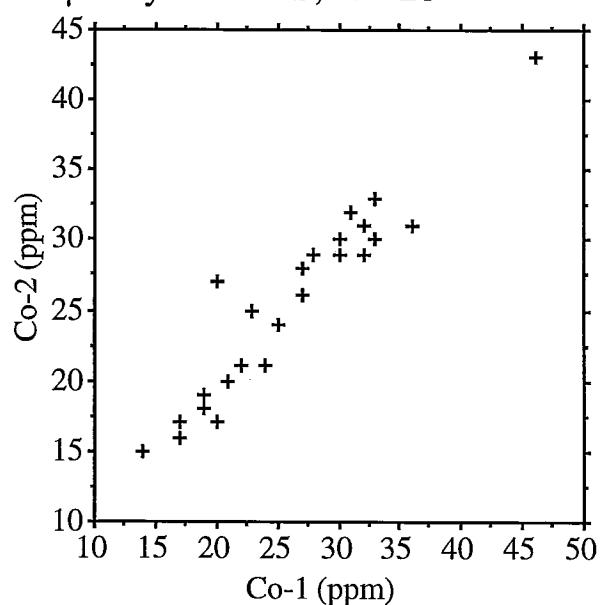
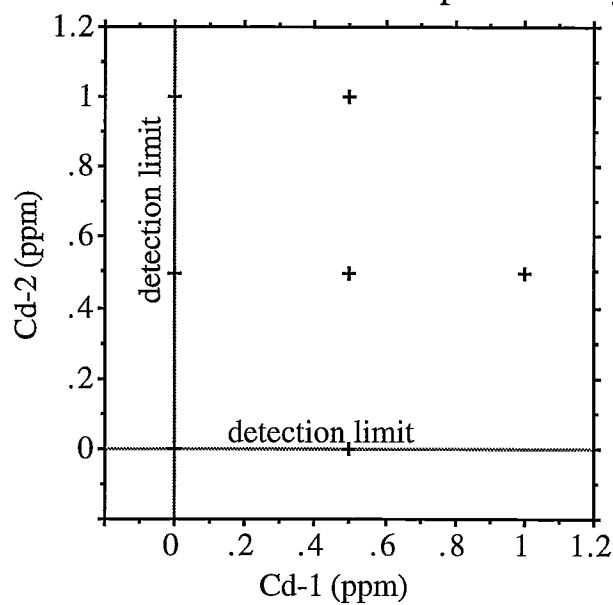
Duplicate analyses: < 2 $\mu$ m by ICP-AES; N = 28

50



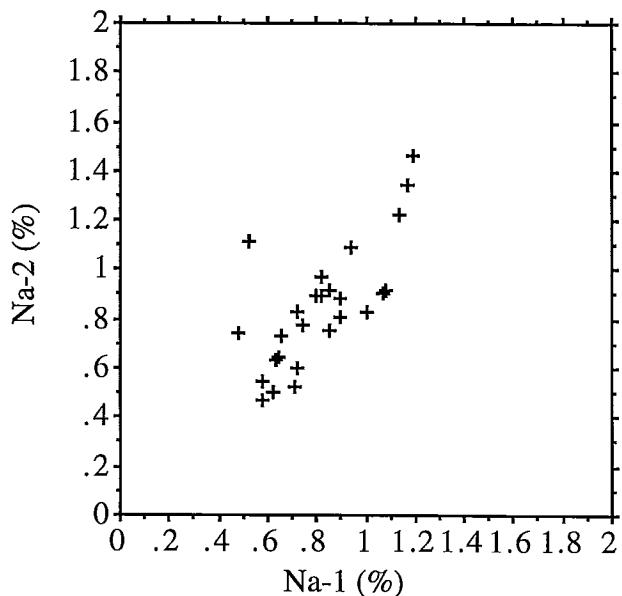
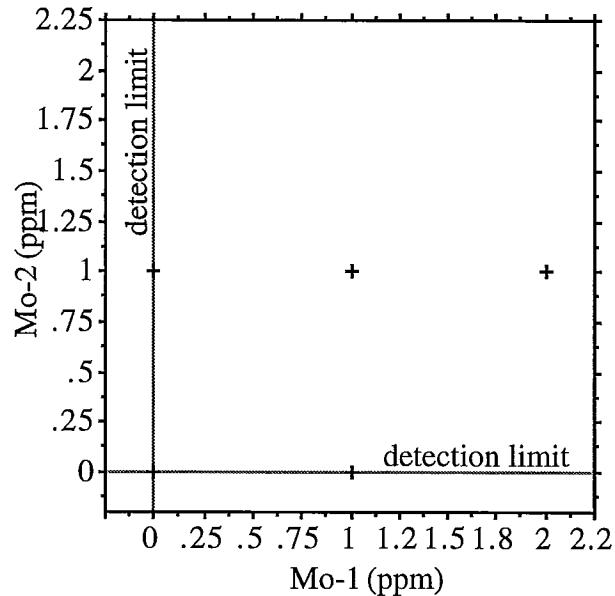
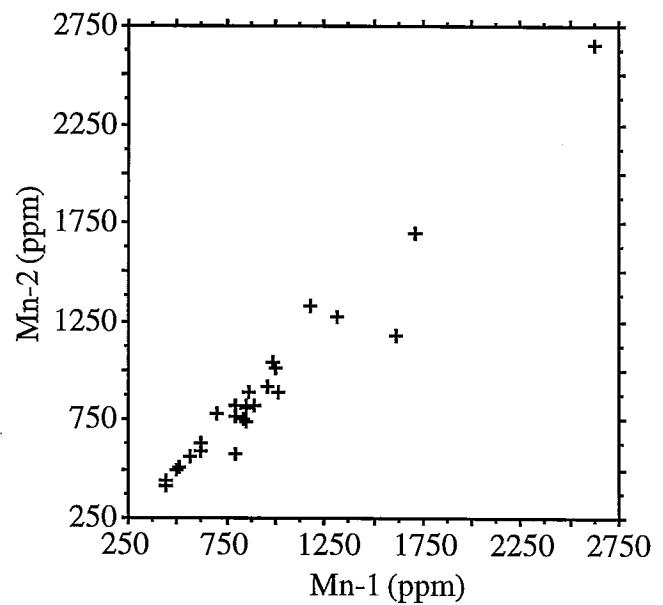
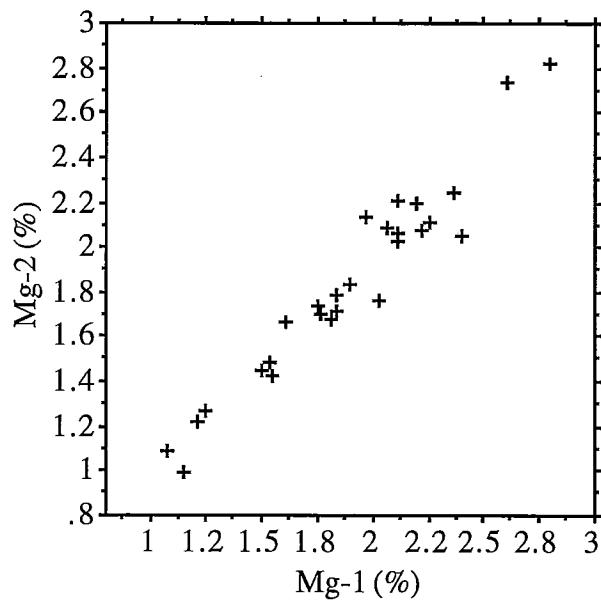
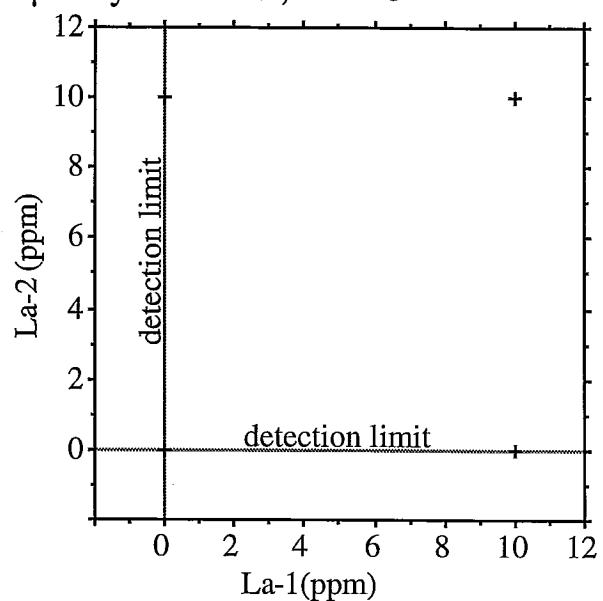
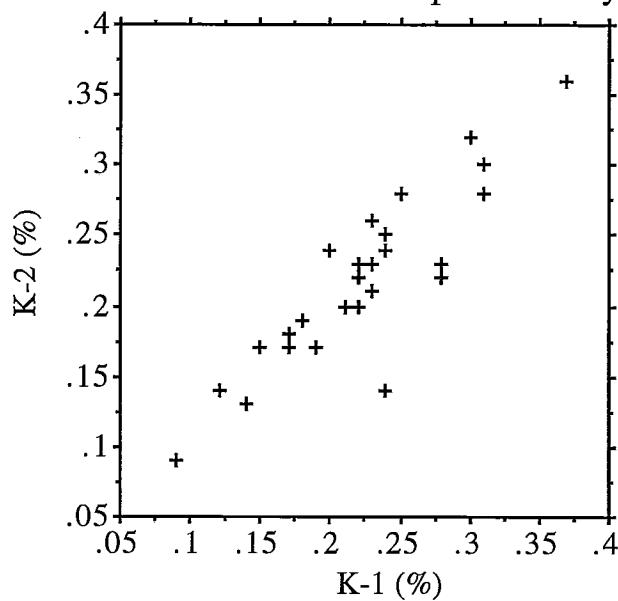
Duplicate analyses: < 2 $\mu$ m by ICP-AES; N = 28

51



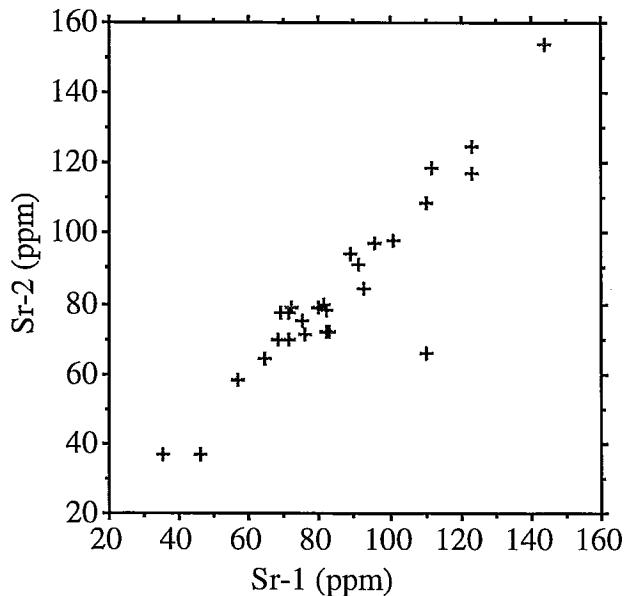
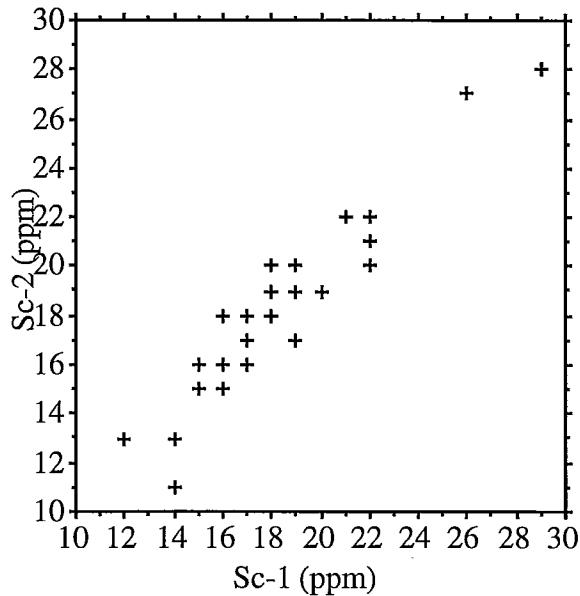
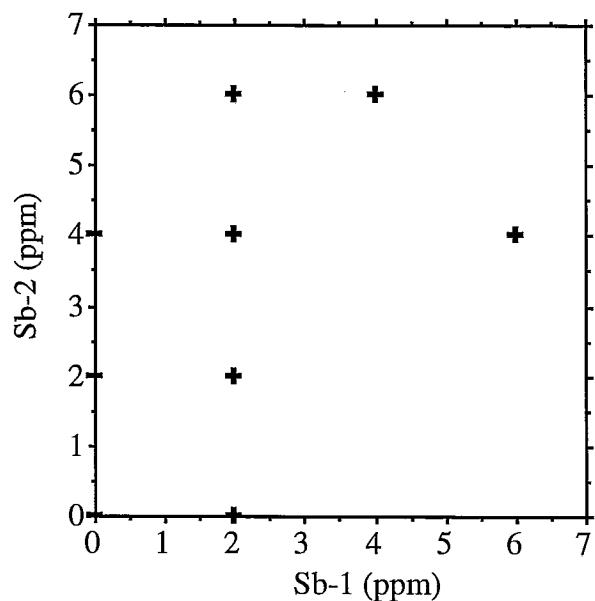
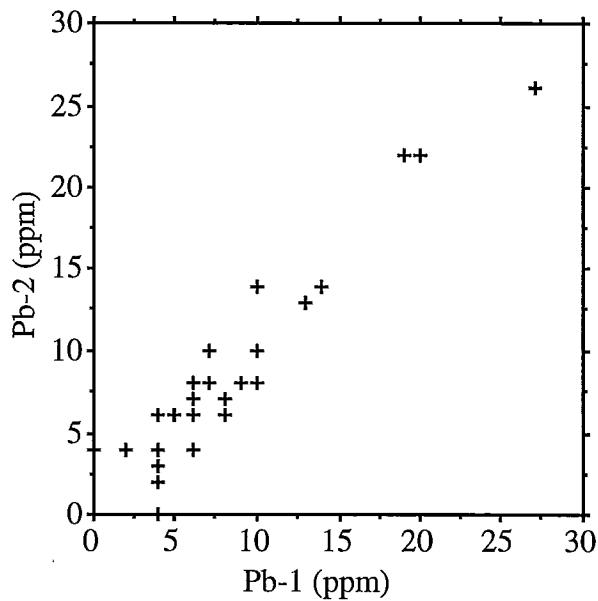
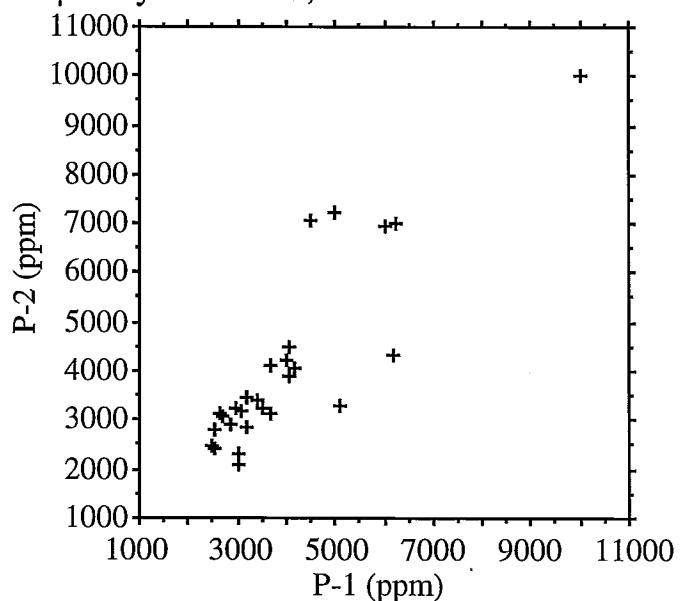
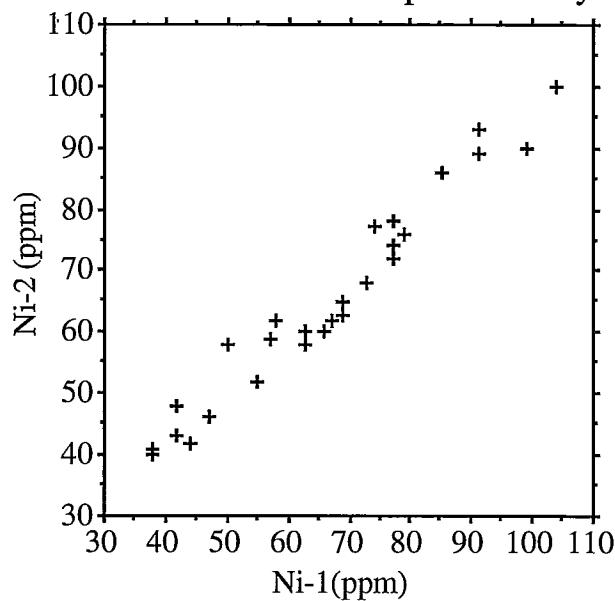
Duplicate analyses:  $< 2\mu\text{m}$  by ICP-AES; N = 28

52



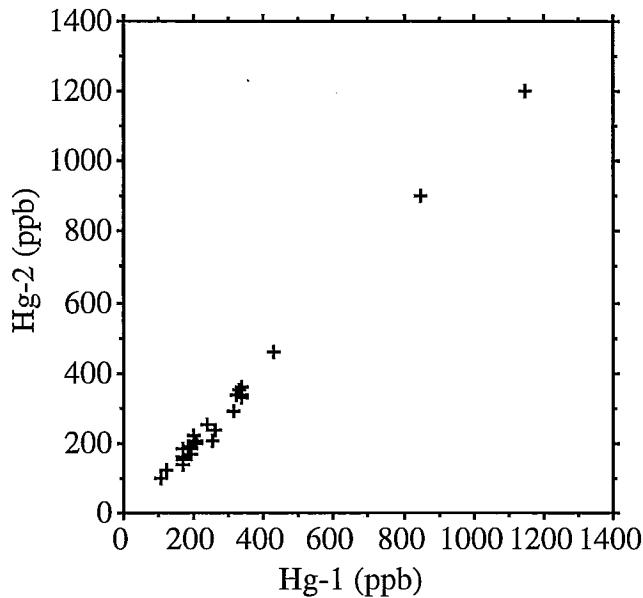
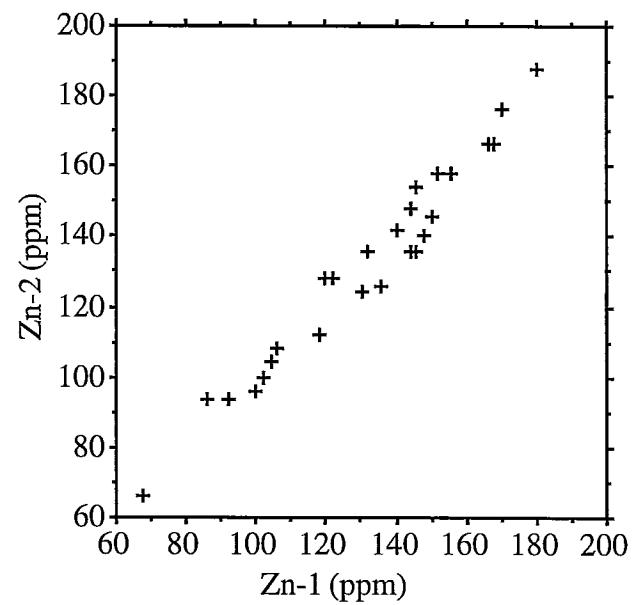
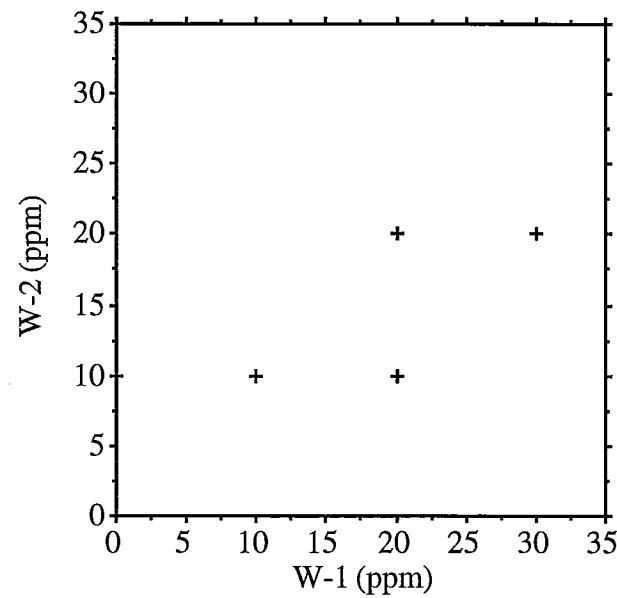
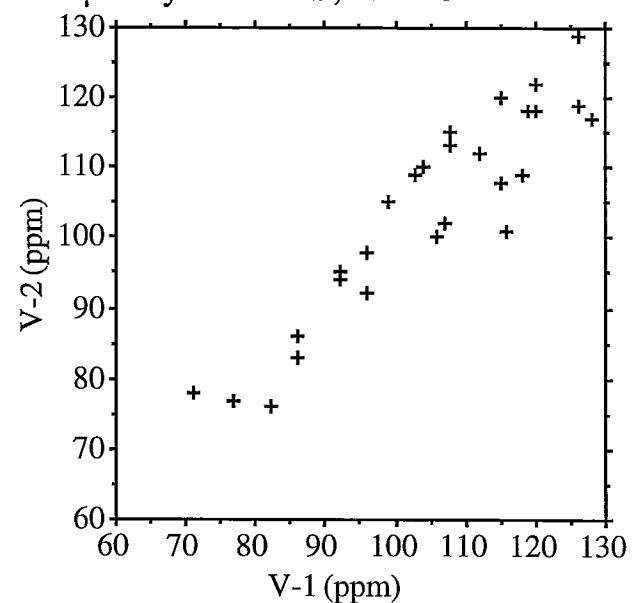
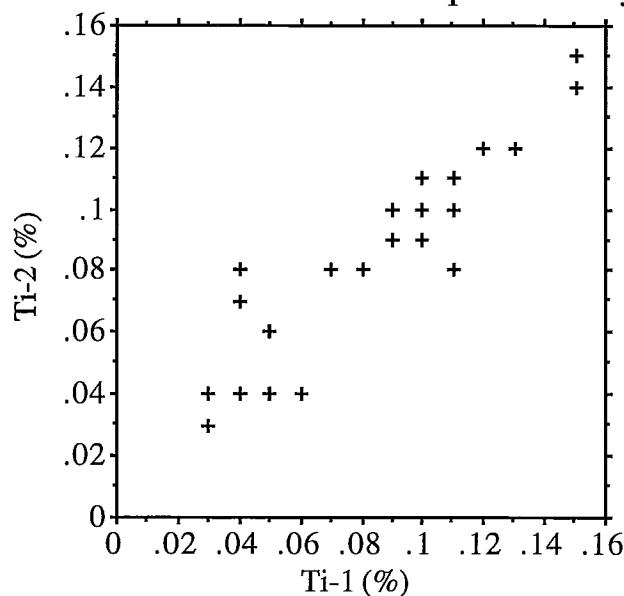
Duplicate analyses: < 2 $\mu$ m by ICP-AES; N = 28

53



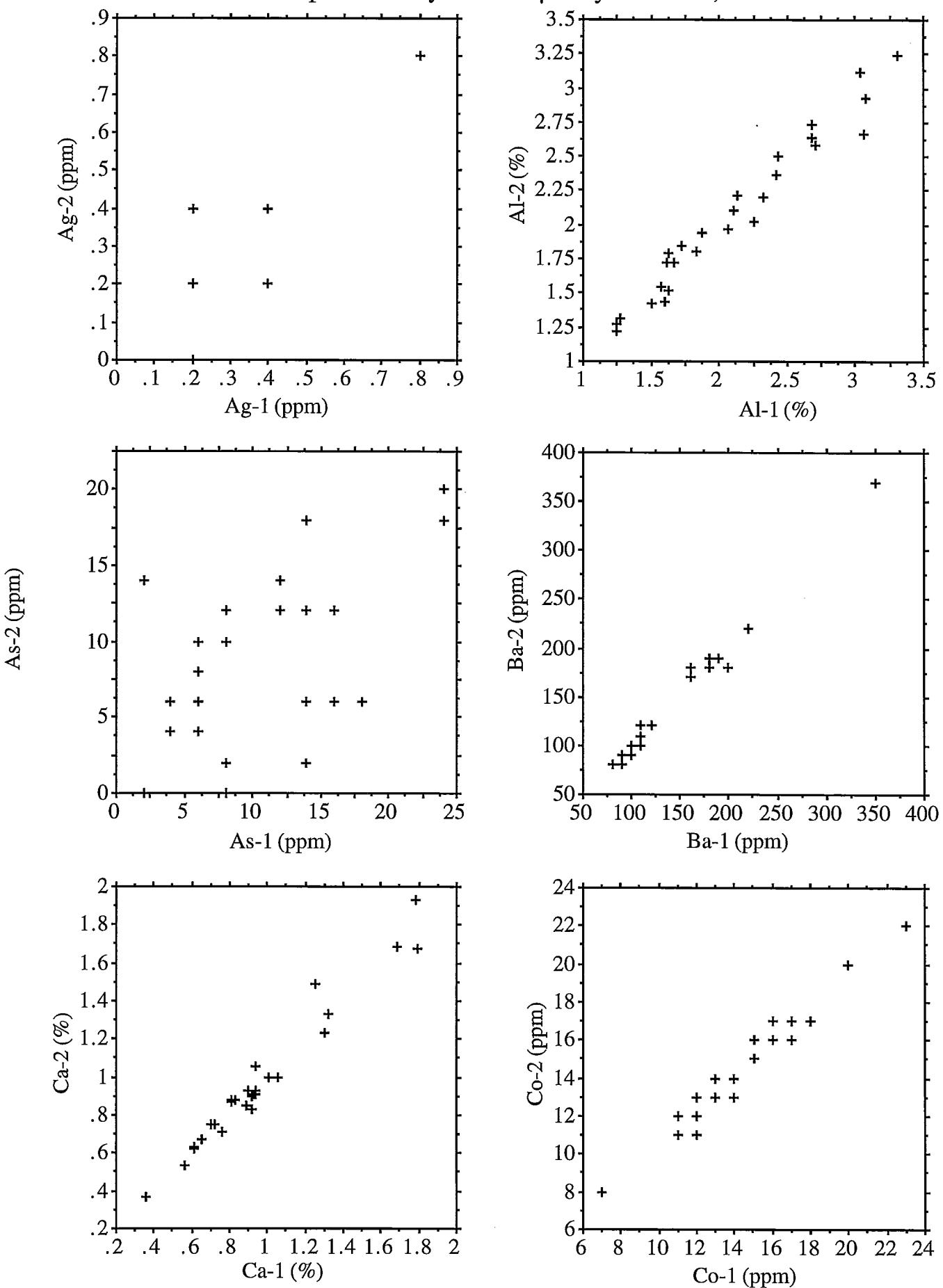
Duplicate analyses:  $< 2\mu\text{m}$  by ICP-AES; N = 28

54



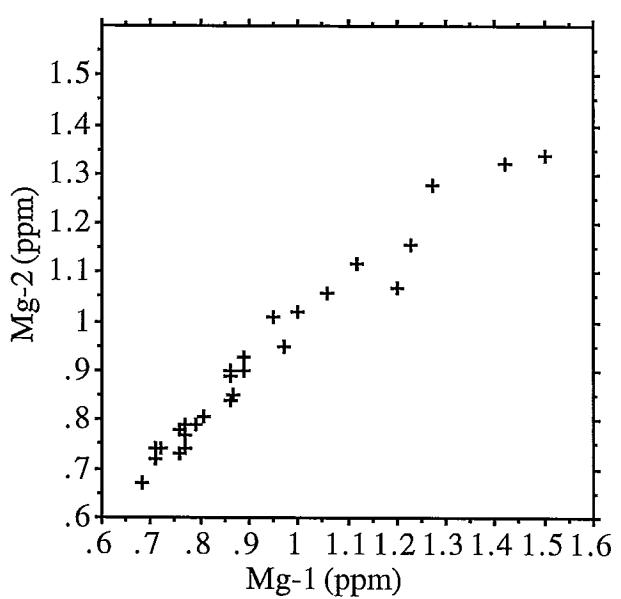
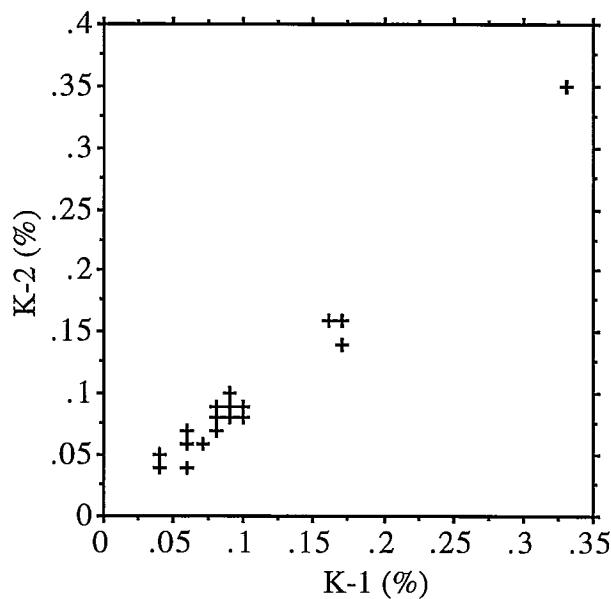
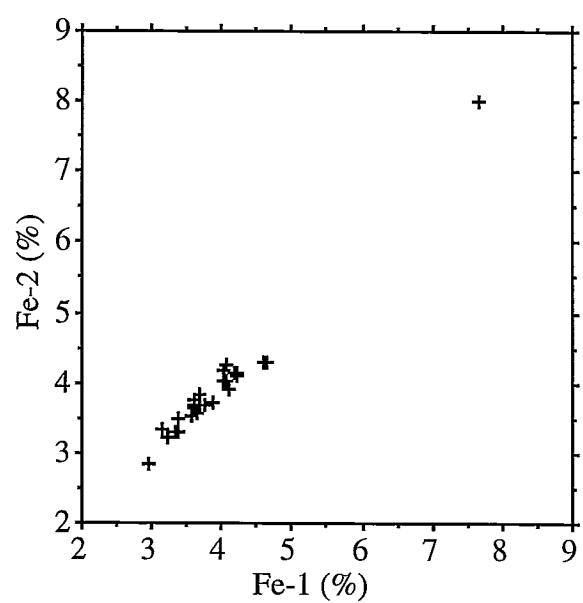
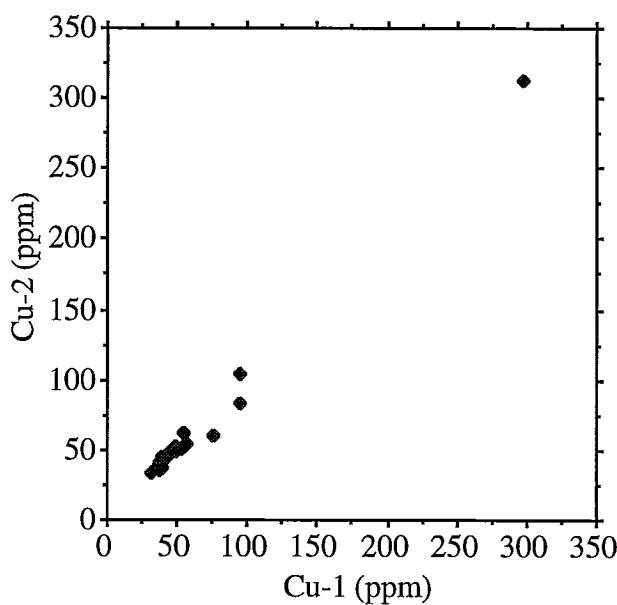
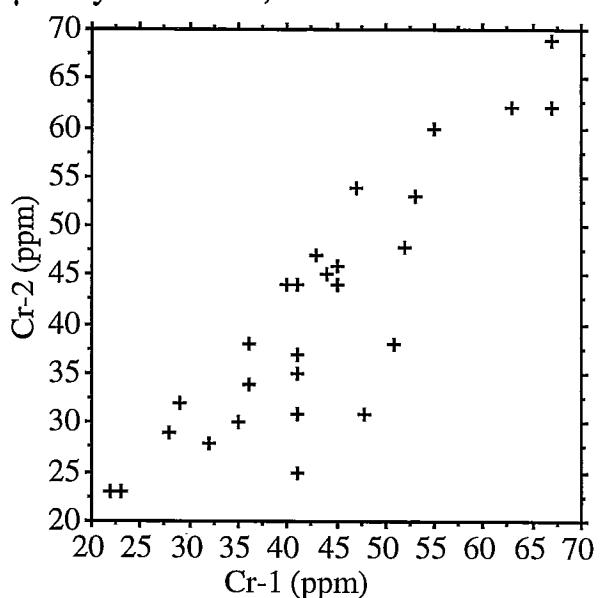
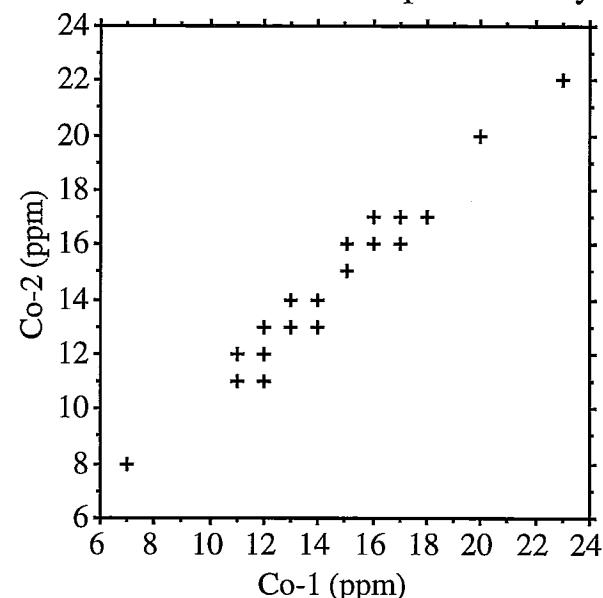
Duplicate analyses: < 63  $\mu$ m by ICP-AES; N = 27

55



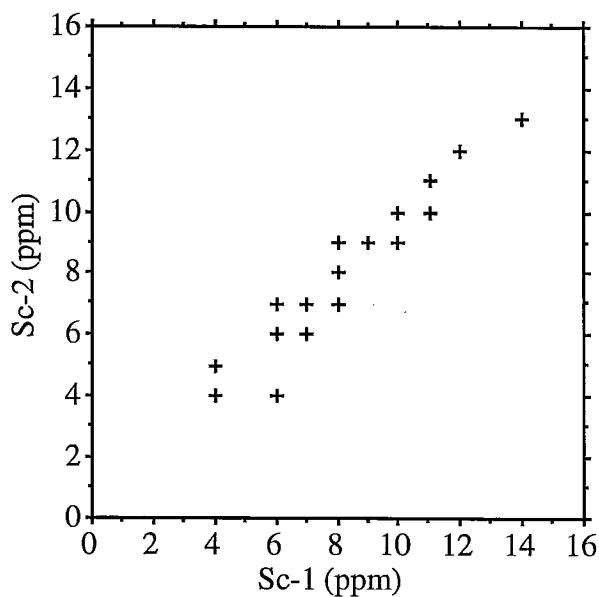
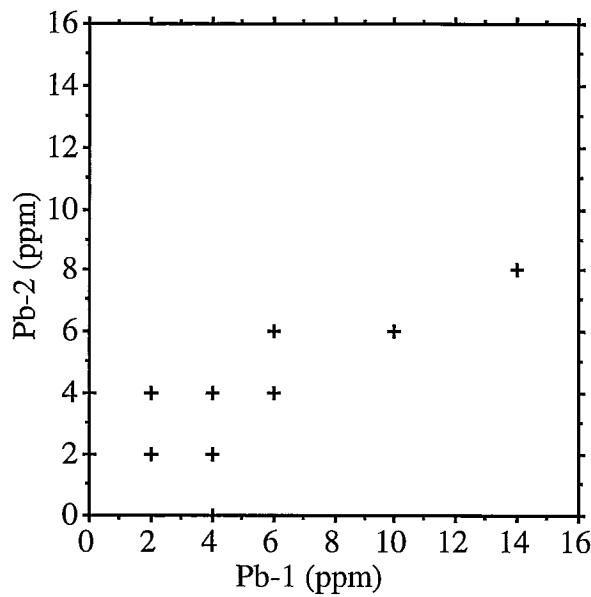
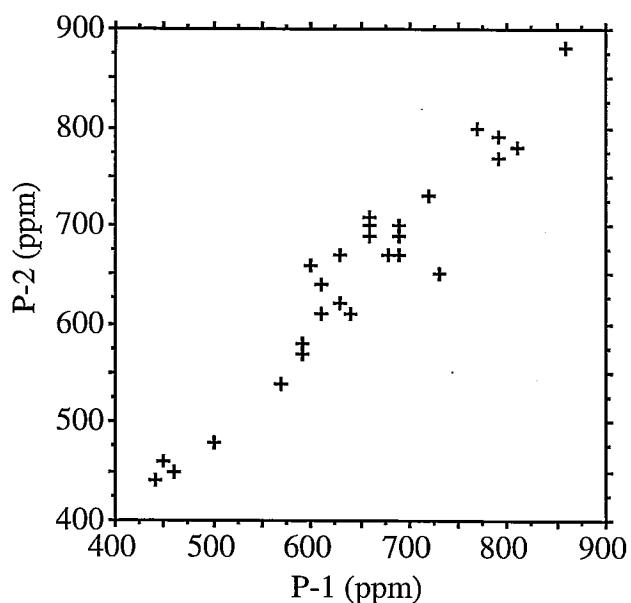
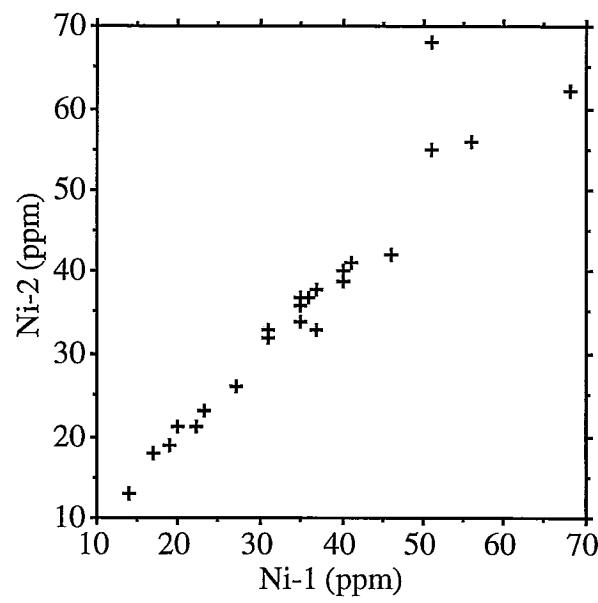
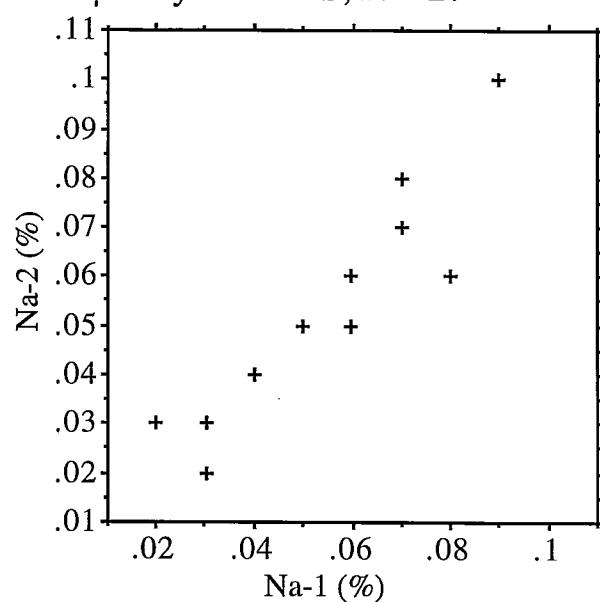
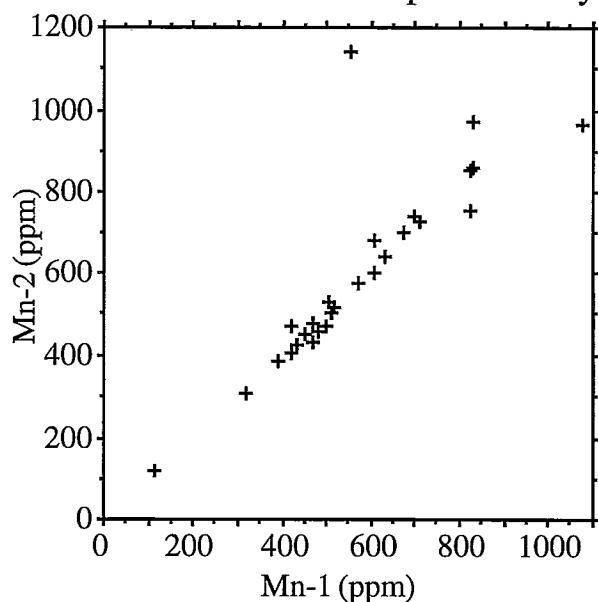
Duplicate analyses: < 63  $\mu\text{m}$  by ICP-AES; N = 27

56



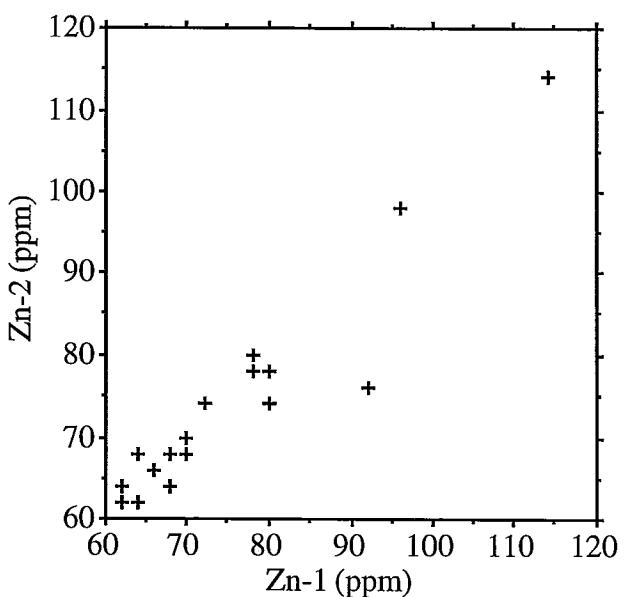
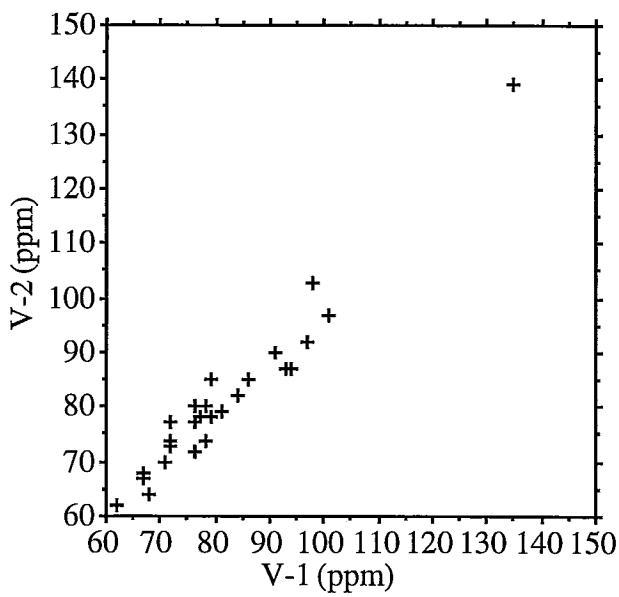
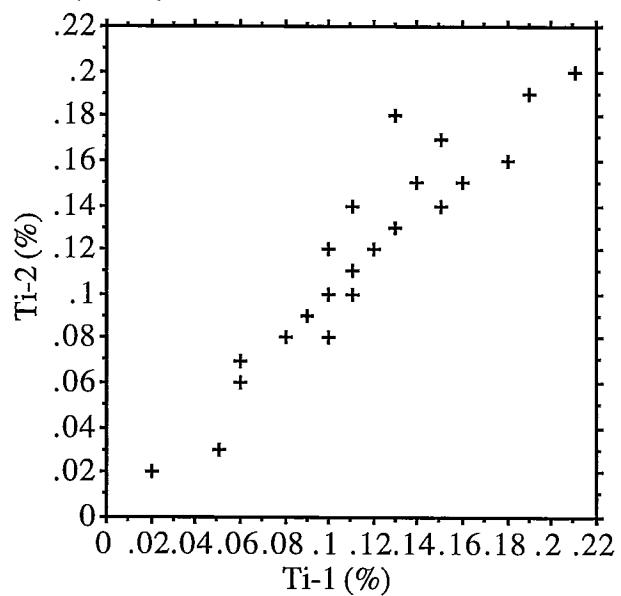
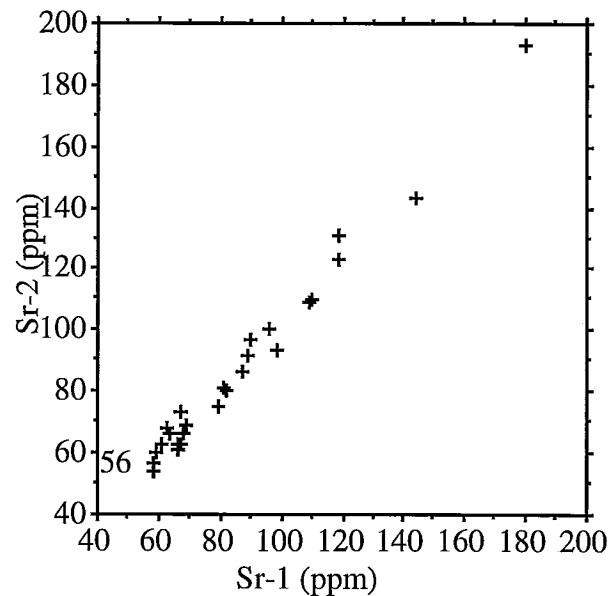
Duplicate analyses: < 63  $\mu\text{m}$  by ICP-AES; N = 27

57

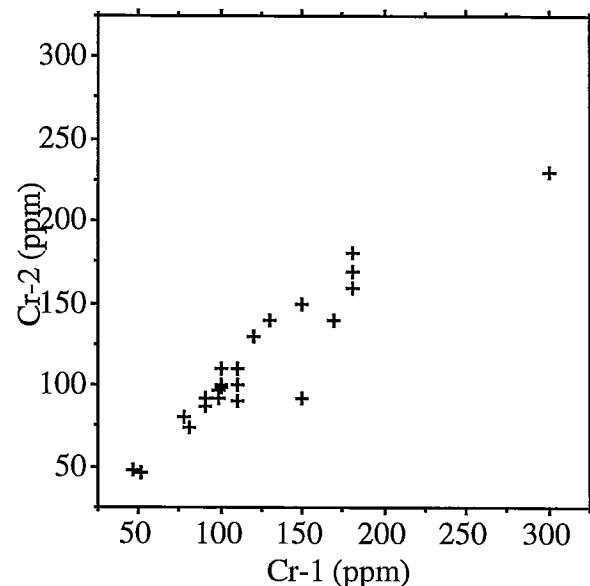
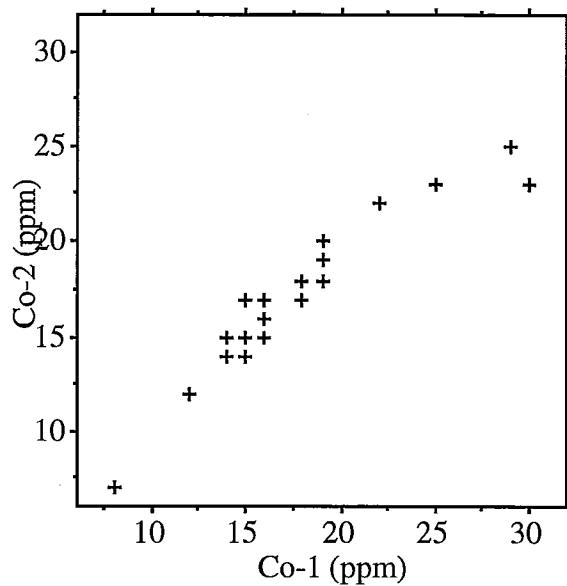
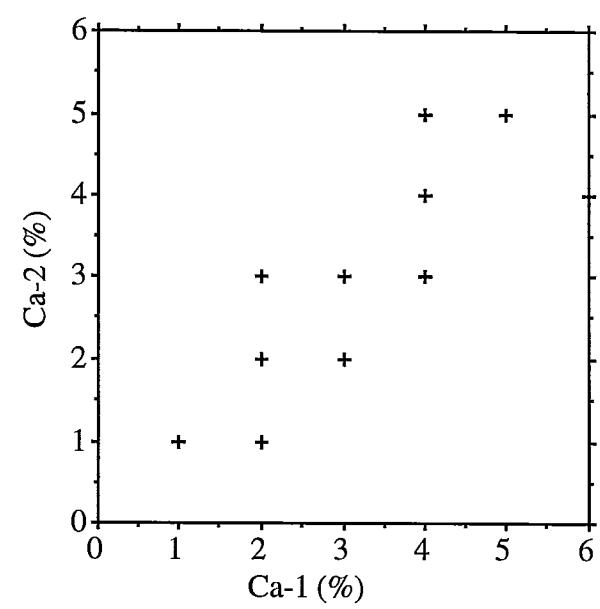
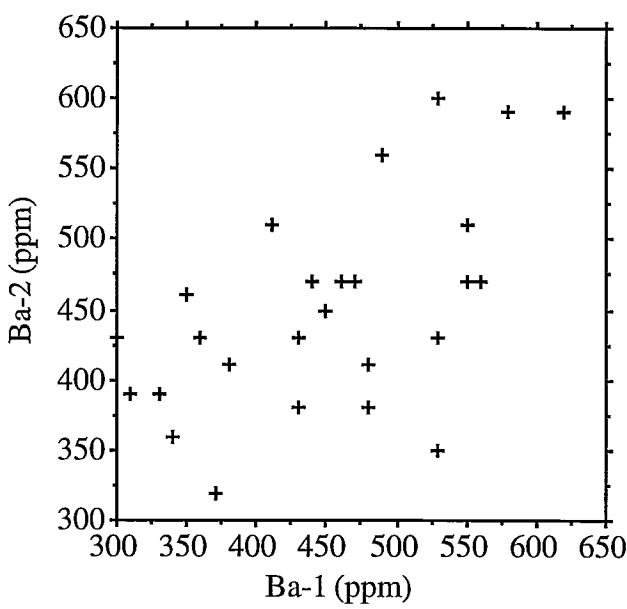
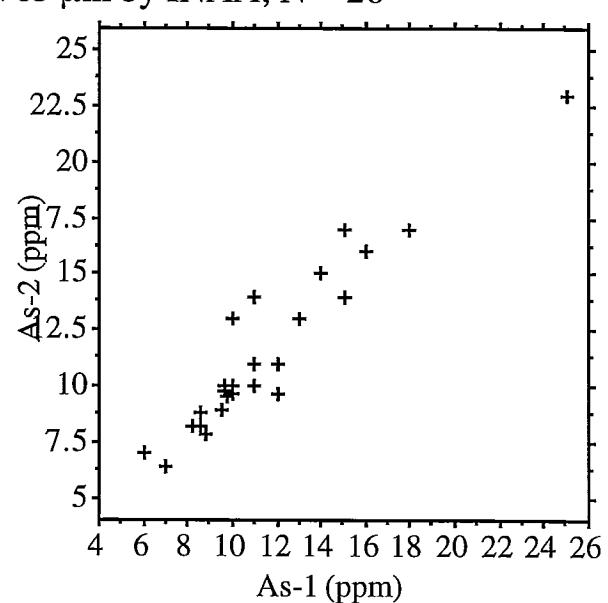
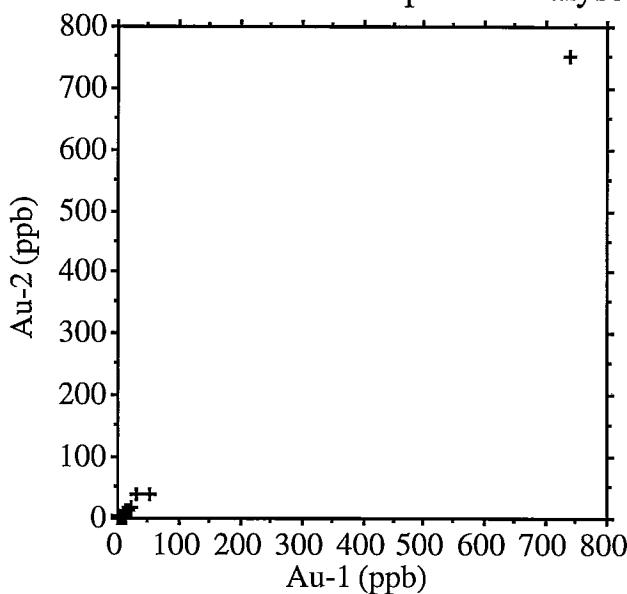


Duplicate analyses: < 63  $\mu$ m by ICP-AES; N = 27

58

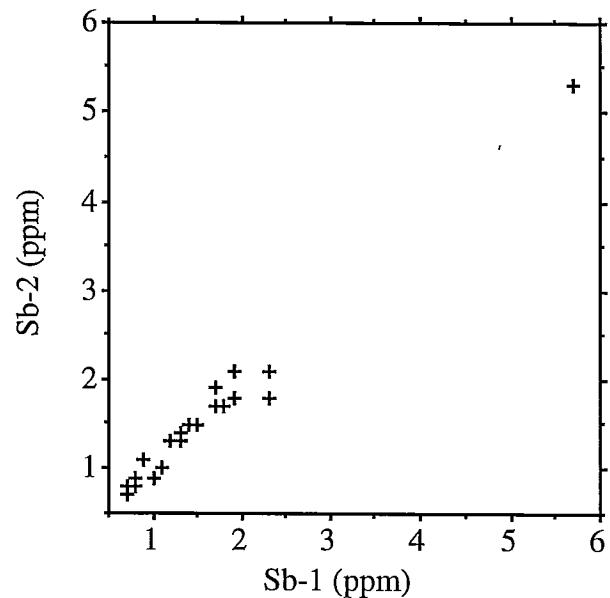
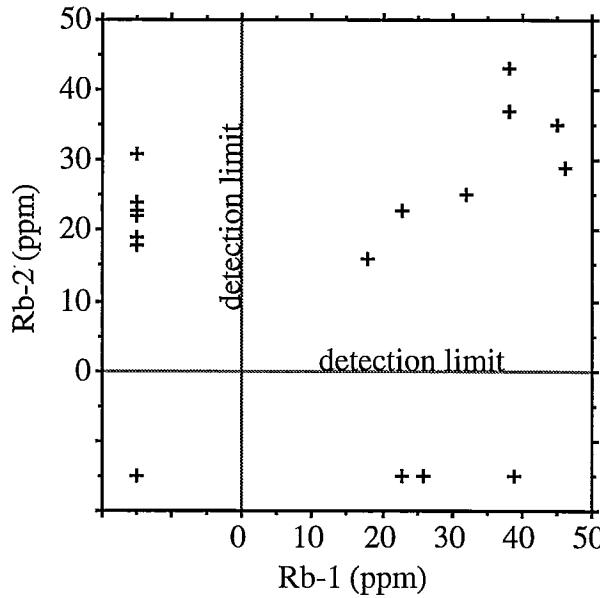
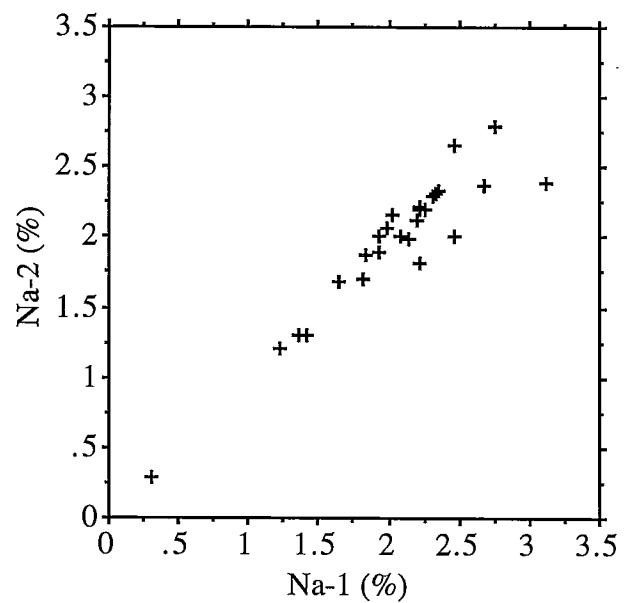
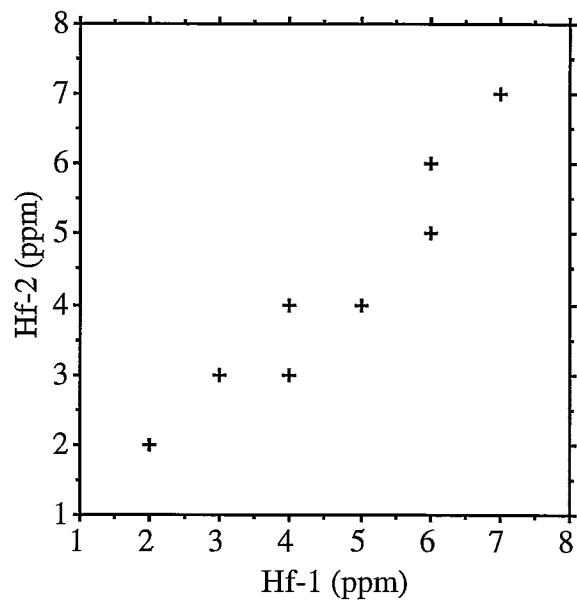
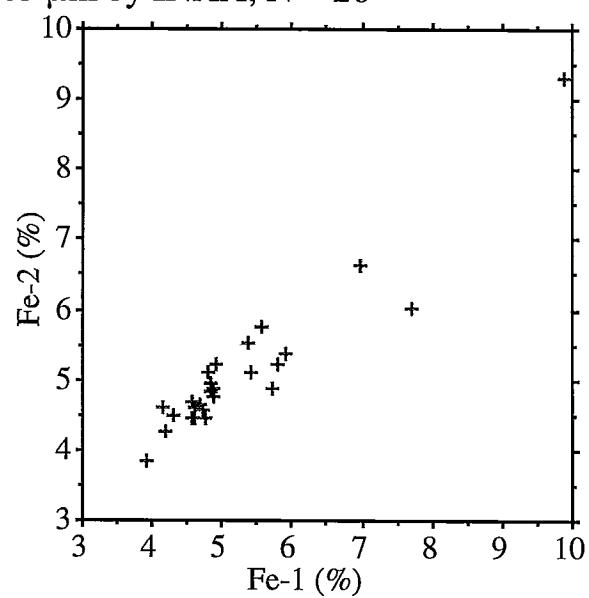
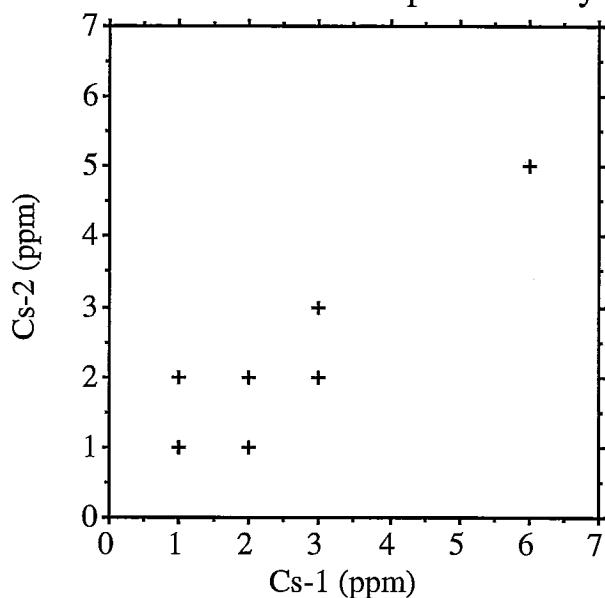


Duplicate analyses: < 63  $\mu\text{m}$  by INAA; N = 26



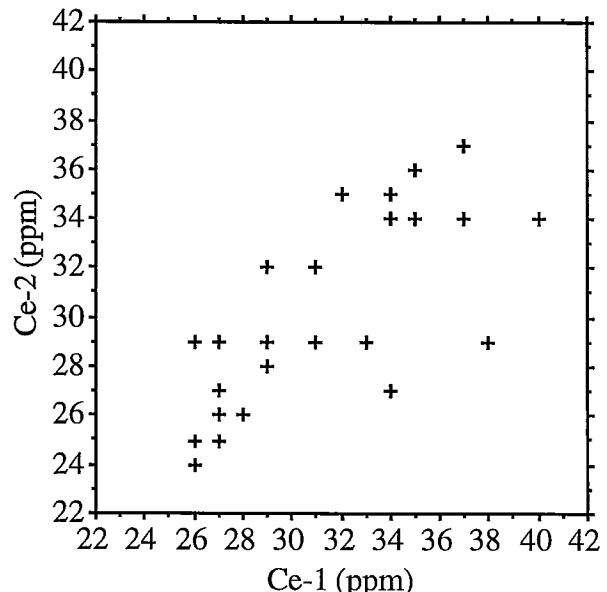
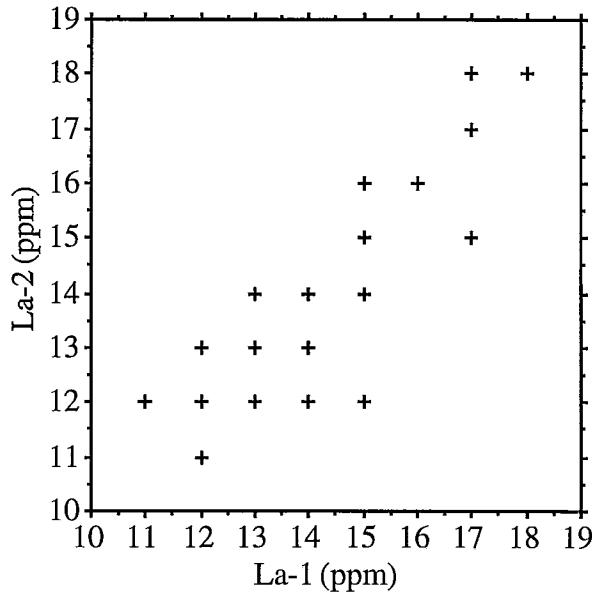
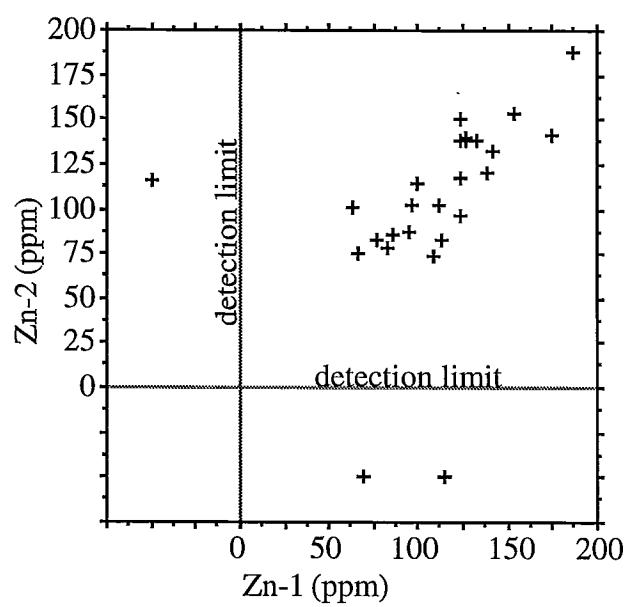
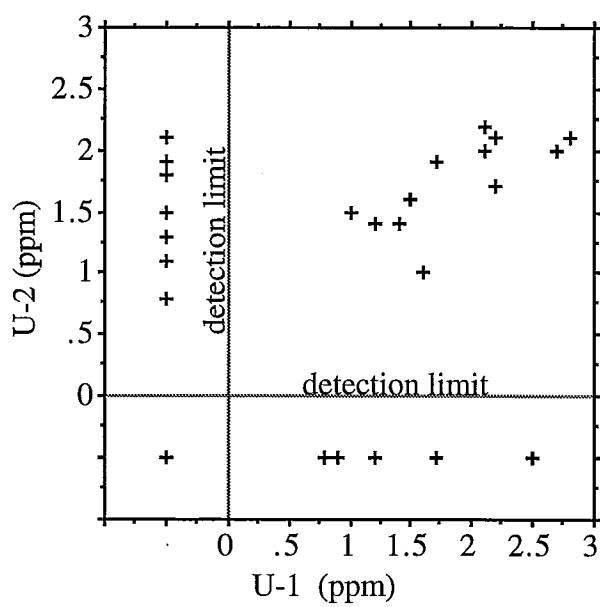
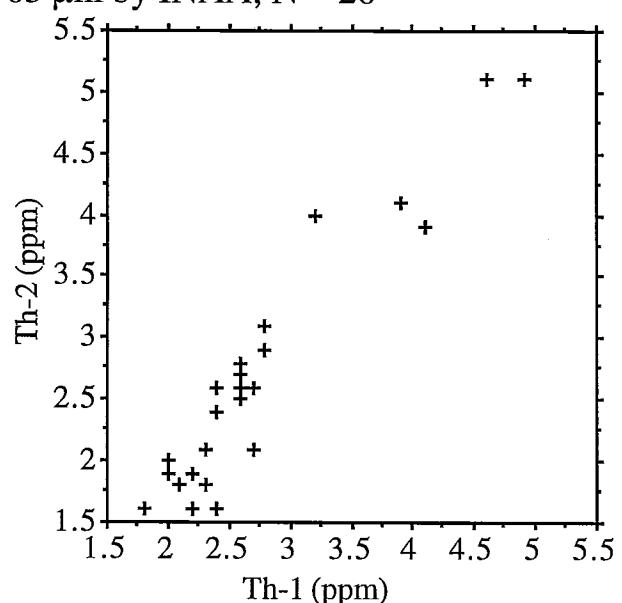
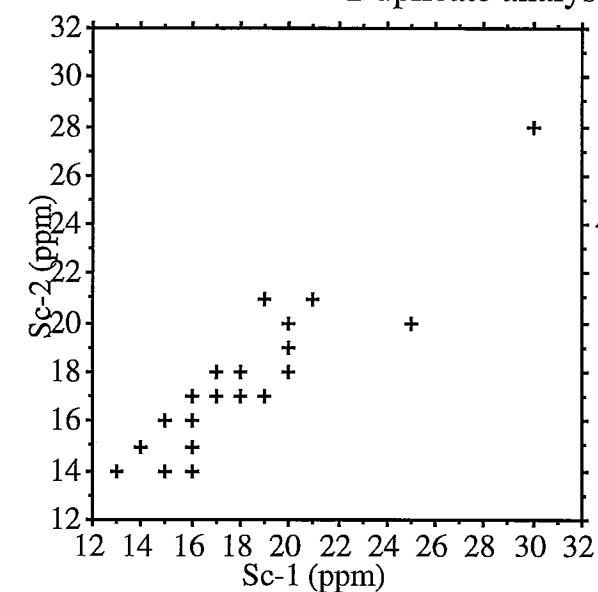
Duplicate analyses: < 63  $\mu$ m by INAA; N = 26

60



Duplicate analyses: < 63  $\mu\text{m}$  by INAA; N = 26

61



Duplicate analyses: < 63  $\mu\text{m}$  by INAA; N = 26

62

