LAKE SEDIMENT EXPLORATION GEOCHEMICAL SURVEY OF PORTIONS OF LAKE AND ST. LOUIS COUNTIES, MINNESOTA

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ABSTRACT

An organic-rich lake sediment exploration geochemical survey was conducted over a major portion of Lake County and a small portion of southeastern St. Louis County, Minnesota, as part of a program to evaluate mineral potential for land management purposes.

In the course of the survey, 1096 samples from a 2770 mi^2 (7175 km^2) area were collected from lakes underlain by bedrock of the Duluth Complex, North Shore Volcanic Group, and Virginia Formation rocks. Unashed samples were analyzed by atomic absorption for Ag, Co, Cu, Ni, Pb, Zn, Fe, and Mn by using a 4M HNO_3/1M HCl leach, and for As by using a concentrated HNO_3/30% hydrogen peroxide leach. Organic content was estimated by loss-on-ignition (LOI). Results of the survey indicate that the chemistry of the bedrock geology is reflected in the element concentrations of the lake sediment, which suggests that the lake sediment should reflect economic mineralization under favorable chemical, geologic, and hydrologic conditions.

Statistical analysis of the data indicates that Fe and Mn demonstrate a positive relation to all trace elements and that As, Co, Cu, Ni, Pb, Fe, and Mn show a negative relation to LOI. Element ratios were not justified because of non-proportional parameter relations, and neither univariate regression residuals nor inorganic concentration conversions based on LOI significantly normalized the data for the effects or relations of Fe, Mn, or LOI.

No positive relations were observed between the trace elements and LOI, suggesting that organic complexing does not play a major role in the concentration of the trace elements in the lake sediment. Furthermore, the negative relation of some elements to LOI indicates that these elements are predominantly concentrated in the inorganic fraction of the sediment.

A non-proportional, approximately exponential relation was found between the trace elements and Fe, Mn, and LOI, while a proportional, approximately exponential relation was demonstrated between Fe and Mn. It is suggested that these relations are not related to chemical processes, which tend to enhance the trace element concentrations. Results from other lake sediment surveys from Minnesota performed by the Division of Minerals are similar to those reported above. The observations and suggestions described are based only on the analytical methods used and may differ with other chemical techniques.

Several anomalous regional trends and significant multi-element anomalies were revealed by this survey; the most striking of which may be the reflection of known Cu-Ni mineralization along the northwestern basal contact of the Duluth Complex.

Factors such as glacial dispersion and variation of trace element background with bedrock lithology should be considered in the interpretation of this survey.

INTRODUCTION

The area covered by this survey lies in portions of Lake and St. Louis counties in northeastern Minnesota (Fig. 1). Portions of these counties within the survey area have been explored for several decades, revealing numerous occurrences that include Cu, Ni, Co, Ti, V, and other minerals. None, however, have been developed to date. Intensive mineral exploration, both currently and in the past, has been concentrated in the Duluth Complex near its northwestern basal contact. Taconite from the Mesabi Range is mined several miles northwest of the survey area.

The Division of Minerals of the Minnesota Department of Natural Resources manages and administers approximately 25 percent of the mineral lands in Lake and St. Louis counties, which are scattered throughout most of the survey area. A regional lake sediment exploration geochemical reconnaissance survey was undertaken by the Division of Minerals in a portion of Lake and St. Louis counties as part of a program to evaluate the mineral potential of state lands for land management purposes. Lake sediment geochemistry has been researched and applied to a number of areas in northern and central Minnesota by the Division of Minerals since 1974 (Meineke, Vadis, and Klaysmat, 1976, 1977a, 1977b, 1977c, 1977d, and 1979; Meineke, Butz, and Vadis, 1977; Vadis and Meineke, 1982), and the Geological Survey of Canada has recently completed lake sediment surveys in Ontario adjacent to Minnesota (Hornbrook and Coker, 1977; Coker and Shilts, 1979).

The lake sediment sampling was conducted in 1978-1979 over an area of approximately 2770 mi^2 (7175 km^2) (Fig. 1). All lakes within this area containing acceptable sample material were sampled. This area is bounded by the Boundary Waters Canoe Area Wilderness to the north, Cook County to the east, Lake Superior to the south, and a line approximately two miles west of the Duluth Complex contact to the west. A large portion of the survey area lies within the Superior National Forest. The Boundary Waters Canoe Area (BWCA) is a U.S. government wilderness area that was expanded, effective January, 1979. Samples collected from the expanded area prior to inclusion in the BWCA are included in this report. The various additions to the BWCA are illustrated on the plates which accompany this report.

The samples were chemically analyzed at the Division of Minerals under the direction and supervision of A. W. Klaysmat, Research Scientist. Subsequent to chemical analysis, a computer-assisted statistical analysis of the data was performed to identify relationships and characteristics of the element data and other survey parameters that would assist in the interpretation of the survey for mineral potential purposes.

GEOLOGY AND PHYSIOGRAPHY

The geology and physiography of the survey area have been shaped by events occurring from the Archean to the Pleistocene. The bedrock geology includes Archean, Middle and Late Precambrian (Keweenawan) rocks, while the Pleistocene is represented by glacial deposits covering approximately 95 percent of the bedrock. The lithologic and structural character of the Precambrian bedrock and the Pleistocene glaciation have, to a large degree, determined the physiography of the survey area.

Precambrian Geology

The bedrock geology, as adapted from several authors, is dominated by Late Precambrian (Keweenawan) rocks, the only Archean units present being the granitic and metasedimentary rocks in the extreme northwestern part of the area (Plate 1). These are unconformably overlain by the Middle Precambrian Pokegama Quartzite (not shown because of scale), the Biwabik Iron-formation (bif), and the Virginia Formation (vag) of the Animikie Group.

The remainder of the survey area is divided between the Keweenawan North Shore Volcanic Group, the Duluth and Beaver Bay complexes, and other Keweenawan intrusives. The North Shore Volcanic Group and Middle Precambrian Animikie Group in the survey area have been extensively intruded by Keweenawan rocks ranging from troctolite to granophyre in composition. The North Shore Volcanic Group consists of mostly mafic flows with lesser intermediate and felsic flows and minor interflow sediments. Numerous mineral showings, occurrences, and deposits in the survey area have been described in the literature, and a compilation of this data and data from additional field surveys is in preparation by Gladen, Meineke, and McKenna. The most significant mineralization occurs along the northwestern basal contact of the Duluth Complex and is illustrated by the stippled areas on Plate 1 (in pocket). These stippled areas, according to Listerud and Meineke (1977), contain 4.4 billion tons of $\geq$.50% Cu averaging .66% Cu and .20% Ni.

Glacial Geology

Minnesota was subject to multiple events of continental glaciation during Pleistocene time. The survey area (Fig. 1) was in the path of glaciers which moved out of the Hudson Bay lowland and the Winnipeg area. The survey area has probably undergone numerous ice invasions, but evidence of only the latest Wisconsin glaciers, the Superior lobe, the Rainy lobe, and the St. Louis sublobe of the Des Moines lobe, is indicated in the present-day glacial deposits. The Rainy lobe moved into the area from the north-northeast, the Superior lobe from the east-northeast along the Lake Superior basin, and the St. Louis sublobe from the west-northwest. Figure 2 is a composite map illustrating the major phases of these glaciers (after Wright 1972). Figure 3 illustrates the distribution of the Rainy lobe, Superior lobe, and St. Louis sublobe drifts in the survey area (adapted from Goebel, 1979). The following simplified discussion of the phases of Wisconsin glaciation in the survey area and northeastern Minnesota is based on Wright (1972) and Wright et al., (1969).

St. Croix Phase— During the St. Croix Phase, the Rainy lobe advanced from the north-northeast and followed a southwest course roughly parallel to the present-day Lake Superior shoreline while the Superior lobe

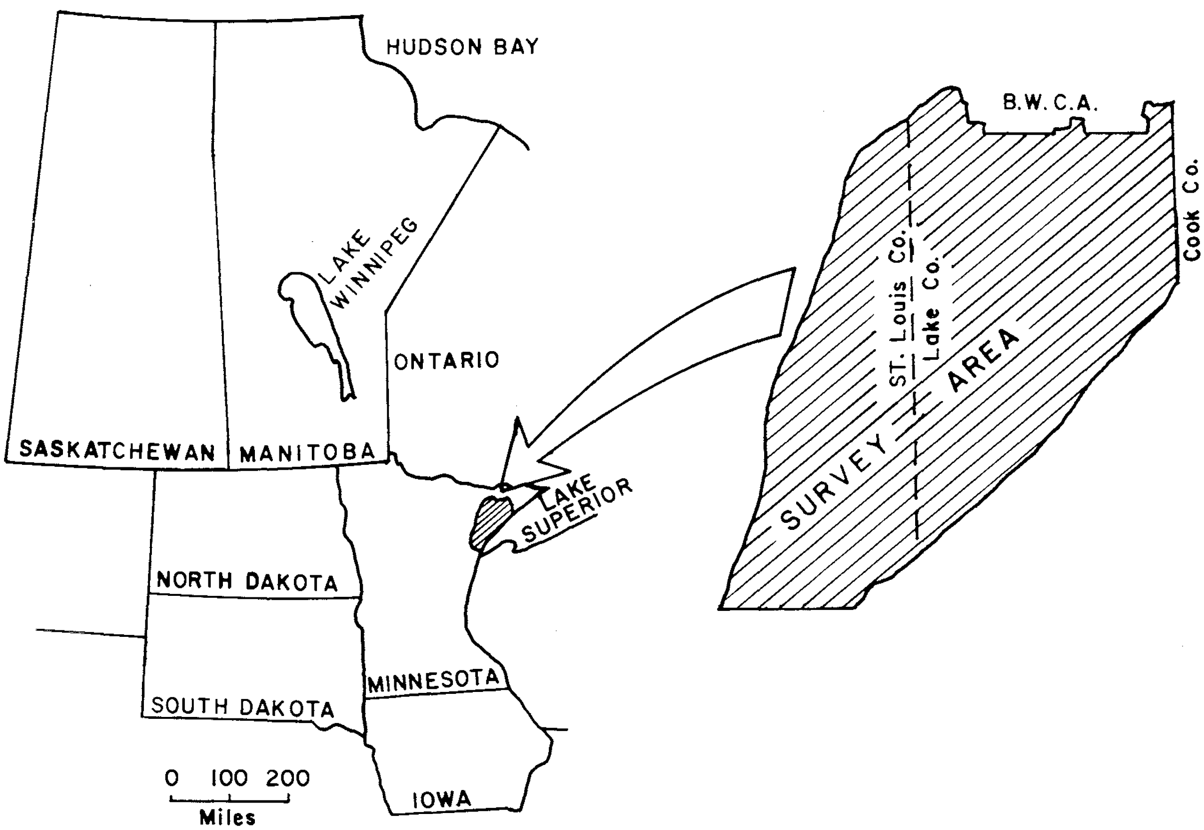


FIGURE I: Location map of Minnesota, Lake County, and lake sediment survey area.

moved from the northeast and followed the Lake Superior trough. Both of these glaciers terminated southwest of the survey area. The Toimi drumlin field, produced by the Rainy lobe, contains about 1400 drumlins trending 345° west and averaging about one mile in length and 50 feet in height. The drumlin field is truncated on the north by the Vermilion moraine, which is from a later advance of the Rainy lobe, to the east and south by the Highland moraine of the Superior lobe, and to the west by the Culver moraine of the St. Louis sublobe. The Toimi drumlins consist of grey, sandy, stoney till containing little clay or silt, with the predominant rock type being gabbro. The end of this phase was marked by a general deglaciation and the retreat of the Rainy and Superior lobes, the Superior lobe just into the Lake Superior basin and the Rainy lobe to near the Canadian border.

Automba Phase— This phase began with the readvance of the Superior and Rainy lobes, the Rainy lobe advancing as far as the Vermilion moraine while the Superior lobe advanced out of the head of the Lake Superior basin producing the Highland moraine. The Vermilion moraine is joined on the east by the Highland moraine (Fig. 2), which follows the North Shore Highland for 100 miles as a belt of hummocky topography 5 to 10 miles wide. The area between the Highland moraine and the north shore of Lake Superior is marked by a pattern of linear ridges and scarps in bedrock, referred to as the Highland flutes (Wright and Watts, 1969). They are perpendicular to the direction of ice movement of the Superior lobe and suggest that the Highland moraine resembles a lateral moraine. The Superior lobe retreated far enough into the Lake Superior basin to produce sizeable proglacial lakes at its margins, which deposited clayey and silty sediments.

Split Rock Phase— The Split Rock phase, distinguished by an accumulation of red clayey drift, was produced by the readvance of the Superior lobe out of the Lake Superior basin. The till is generally only a few feet thick, and in the survey area the till extends only a short distance northward from the present Lake Superior shoreline. The till derives its clayey nature from incorporation of proglacial lake sediments formed during wastage of previous phases of the Superior lobe. The retreat of the Superior lobe into the Lake Superior basin marked the conclusion of the Split Rock phase.

Nickerson-Alborn Phase— The Nickerson and Alborn phases correspond to advances of the Superior lobe and St. Louis sublobe of the Des Moines lobe respectively, which were contemporaneous lobes of the late stage Wisconsin glaciation. The readvance of the Superior lobe during the Nickerson phase produced a glacial lobe narrower than the Split Rock phase advance. In the survey area, this till extends only a short distance north of the present shoreline of Lake Superior. The St. Louis sublobe advanced from the west terminating in this area at the Culver moraine, which buried the western edge of the Toimi drumlin field and parts of the Highland moraine. This material appears at the western edge of the survey area and consists of pebbly clay (Fig. 3).

The tills from the Rainy lobe and the non-clayey phases of the Superior lobe are sandy to bouldery, the character of stone content being commonly dominated by the local bedrock type. The glacial drift of the survey area shows compositional variations reflecting the underlying or nearby bedrock, forms a relatively thin cover, and has apparent high permeability due to its sandy nature. Nearly all of the lakes sampled in this survey occur over these till types. This suggests that the area should be a good environment to reflect bedrock trace element chemistry and economic mineralization through geochemical exploration techniques.

Physiography

The physiographic divisions of northeastern Minnesota are illustrated in Figure 4, adapted from Wright (1972b). Portions of four of these physiographic areas, described by Wright (1972b), fall within the survey area: The Border Lakes area, the North Shore Highland, the Toimi drumlin field, and the Aurora-Alborn clay till.

The northern portion of the survey area lies within the southern part of the Border Lakes area. Here, the lake distribution and form are determined by structures and weak zones parallel to the layering in the Duluth Complex as well as depositional features of the glacial till.

The North Shore Highland area (Fig. 4), mostly underlain by southeastward dipping Keweenawan volcanics (Plate 1), is characterized by short streams (10-15 miles long) which lead directly to Lake Superior. The North Shore Highland overlooks Lake Superior from a height of 900 to 1500 feet. Few lakes are located adjacent to the Lake Superior shoreline. The toe of the Highland moraine forms the boundary between the North Shore Highland and the Border Lakes area (Figs. 2 and 4).

The Toimi drumlin field is located in approximately the center of the survey area and is distinguished by southwestward trending drumlins and linear stream patterns. The drumlins are about one to two miles long, one-quarter mile wide, and 30 to 50 feet high (Wright and Watts, 1969). Outwash from the Highland and Vermilion moraines produced long, gravelly plains winding among the drumlins. A few of the interdrumlin areas were not affected by this outwash; these areas often contain bogs but have some lakes.

A narrow strip of the western portion of the survey area falls within the Aurora-Alborn clay till area (Fig. 2). In this area, clayey drift from the St. Louis sublobe of the Des Moines lobe truncated and buried the western edge of the Toimi drumlin field. Few lakes from the survey area fall in this clayey till.

SEDIMENT SAMPLING TECHNIQUE

Sampling was accomplished with a specially designed core sampler, designed in such a way that samples could be obtained at a desired depth within the sediment, that mixing or disturbance of the sediment would be minimized, and that the nature of the sample could be easily deter-

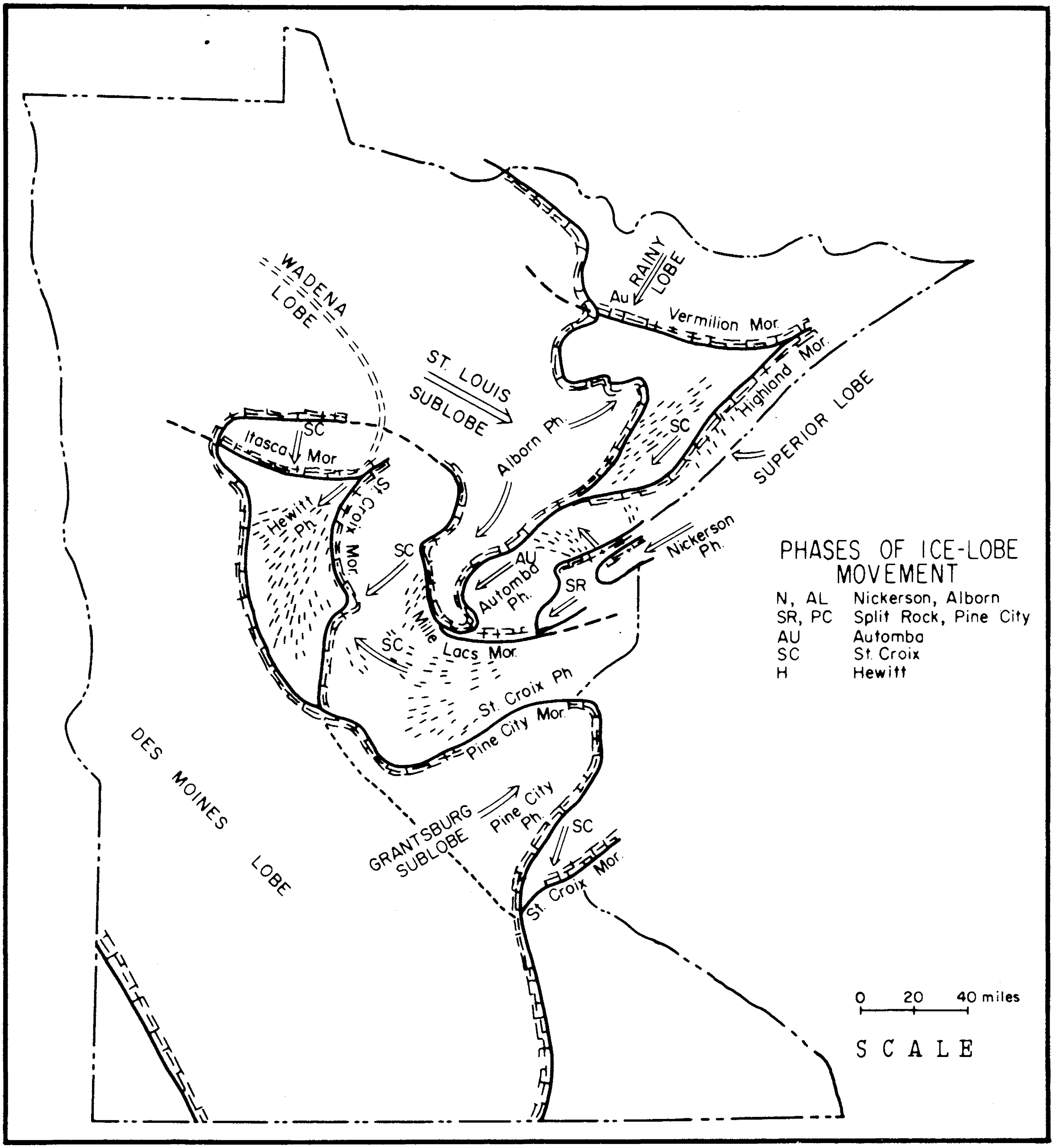
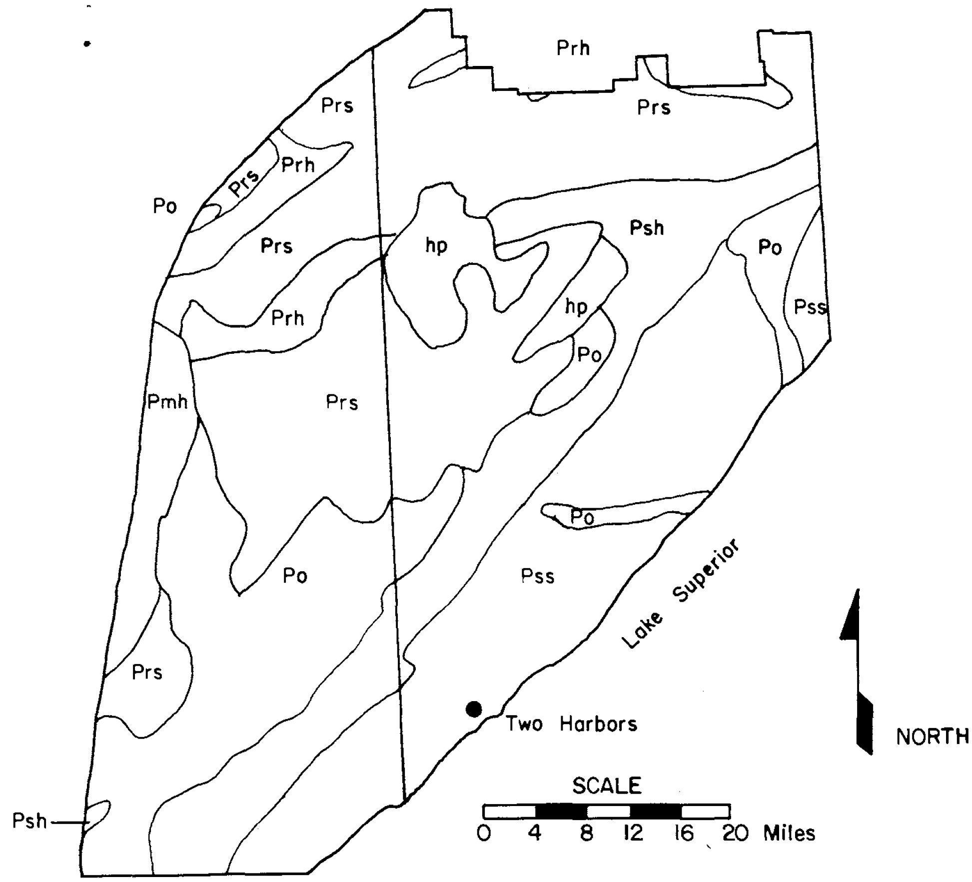


Figure 2: Composite map showing main phases of Wisconsin glaciation in Minnesota. (From Wright, 1972b)



EXPLANATION

HOLOCENE DEPOSIT

hp	Peat

PLEISTOCENE DEPOSITS

Redistributed Drift

Po	Outwash

Late Wisconsin Till

DES MOINES LOBE

Pmh	Pitted to hilly moraine

SUPERIOR LOBE

Pss	Smooth to undulating moraine
Psh	Pitted to hilly moraine

RAINY LOBE

Prs	Smooth to undulating moraine
Prh	Pitted to hilly moraine

FIGURE 3: Quaternary geology of Lake County (adapted from Goebel, 1979).

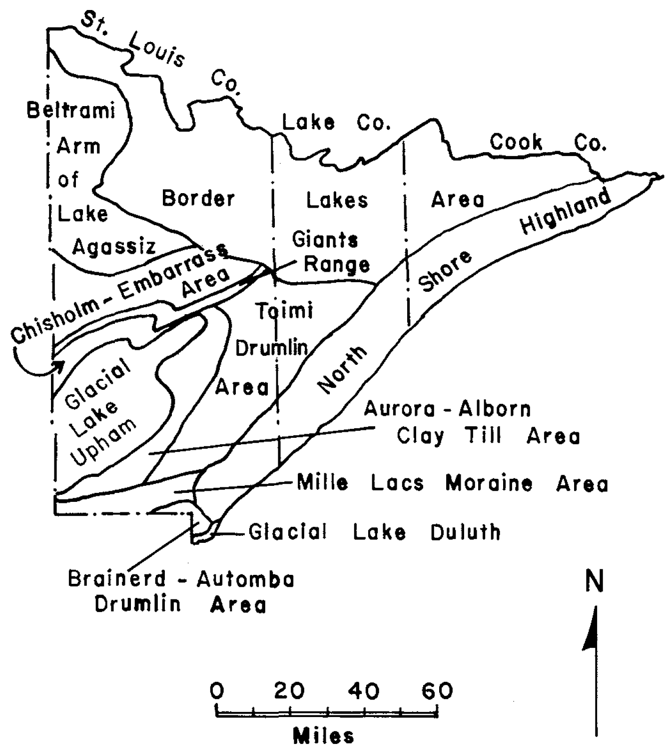


FIGURE 4: Physiographic areas of northeastern Minnesota (adapted from Wright, 1972a).

mined by visual examination. The sampler consists of a two-inch (5 cm) diameter, thin walled, transparent plastic tube 18 inches (47 cm) long, which is retained in an outer steel pipe by a threaded plastic cutting tip. A water well foot-valve is located at the top of the outer steel pipe to retard sample loss during retrieval of the sampler. Approximately 15 pounds (6.8 kg) of weight is located near the bottom of the sampler to increase penetration into the lake sediment. Three fins near the top of the sampler assist in maintaining a vertical attitude while the sampler is lowered. The sampler is lowered and retrieved by hand rope. The sampler yields, except for compaction, a relatively undisturbed vertical section of the lake sediment. Metallic contamination is completely avoided as the sample is in contact with only the plastic portions of the sampler.

When the sampler is retrieved after a sample run, the plastic cutting tip is removed and the plastic liner tube containing the sample is removed. The nature and color of the sample is readily discerned by examining the sample in the transparent plastic tube. The top two inches (5 cm) of the sample is discarded to avoid the effects of any redox reactions near the sediment-water interface (Coker and Nichol, 1975). This results in a generally reduced sample (Timperley and Allen, 1974), which should not have been greatly affected by seasonal variations in lake water chemistry and should also avoid any recent pollution if it has occurred. Approximately one pound (500 gm) of sample is collected from each sample site, which generally requires three to five sampling runs. Typically, 10 to 20 cm of sample is retained in the plastic sample tube per sample run. As a result, a composite sample is collected, and each sample site represents a sample area due to boat drift.

For each sample site the water color, water depth, shoreline vegetation, topography, glacial deposit type(s), slope, boulder type(s), and rock type(s) in outcrop were recorded when available. For each sample, the degree of H_2S scent, sediment quality, color, and texture were recorded. At some sample sites, the surface water and sediment pH and temperature were measured.

Sampling was conducted from a boat, canoe, rubber raft, or helicopter, depending upon access to the lake. The number of samples taken from each lake depended on the size of the lake, care being taken to include major bays or basins within a lake, generally sampling the greatest depth within the area. An electronic depth finder was used to determine water depth and to locate the deeper areas.

A total of 1096 samples were collected, resulting in a sample density of one sample per 2.5 mi^2 (6.47 km^2). Sample locations with sample numbers are shown on Plate 11.

TABLE 1: Analytical Results From Freeze-Dried and Oven-Dried Samples

	FREEZE-DRIED						OVEN-DRIED					
Sample #	Co	Cu	Ni	Zn	Fe	Mn	Co	Cu	Ni	Zn	Fe	Mn
7335	10	33	13	97	1.05	86	10	39	22	104	1.30	104
7342	16	42	28	140	2.45	410	20	47	30	138	3.10	410
7354	16	48	29	56	1.93	361	16	52	28	54	2.14	336
7358	13	40	19	79	1.08	297	11	39	22	73	1.05	285
7365	14	71	33	69	.92	92	11	71	30	70	1.00	94
7371	18	62	32	110	1.54	285	12	59	26	106	1.66	270
7372	23	65	38	153	2.04	370	19	62	33	120	1.86	333
7373	14	48	20	101	2.38	491	16	48	29	101	3.07	500
7374	23	63	23	130	4.24	770	27	67	33	135	5.46	767
7376	18	35	20	107	7.48	930	15	35	23	104	4.79	744
7377	9	48	18	72	.81	48	9	79	29	78	1.47	109
7378	11	44	15	69	1.07	133	7	43	16	70	1.56	149
7383	6	19	17	41	.25	61	5	19	15	40	.13	68
7388	11	22	25	92	.76	160	9	26	26	99	1.08	130
7410	17	74	37	72	1.26	610	13	57	31	62	1.58	457
7416	14	19	24	92	1.01	305	12	20	23	92	1.16	330
7418	13	40	20	106	.78	249	13	27	21	103	1.14	314
7420	8	98	15	69	.23	40	7	98	18	72	.42	43
7422	6	50	23	73	.44	66	11	51	27	74	.57	69
7426	8	60	18	62	.26	43	10	40	25	55	.40	49
7430	7	41	12	79	.48	111	12	31	23	74	.61	111
7440	7	73	17	47	.36	17	7	56	20	39	.51	23
7444	7	37	11	56	.49	87	9	35	18	59	.95	111
7481	6	26	11	76	.43	109	6	22	16	71	.52	107
7488	6	25	11	73	.23	74	4	21	19	63	.42	73
7490	16	42	19	127	3.20	599	17	34	28	121	3.38	602
7495	12	47	24	92	3.43	303	16	50	36	92	2.99	317
7497	8	42	14	79	1.19	156	7	37	29	65	1.05	144
7544	13	64	33	71	1.71	214	17	67	43	79	1.84	218
7547	6	11	12	48	.04	76	5	12	18	58	.35	80
7548	5	7	14	57	.14	97	5	8	17	64	.28	101

TABLE 2: Statistical Analysis Comparing Freeze-Dried and Oven-Dried Samples

Metal	$\bar{x}_1$	S_1	S_1^2	N_1	$\bar{x}_2$	S_2	S_2^2	N_2	F*	F Test†	t_e**	"t" Test†
Co	11.64	4.96	24.68	31	11.54	5.16	26.63	31	.93	+	.11	+
Cu	45.03	20.00	400.28	31	43.61	20.20	408.17	31	.98	+	.39	+
Ni	20.80	7.75	60.15	31	24.96	6.50	42.28	31	1.42	+	3.23	–
Zn	83.70	27.24	742.14	31	81.77	25.45	648.11	31	1.15	+	.41	+
Fe	1.40	1.50	2.27	31	1.54	1.28	1.65	31	1.38	+	.56	+
Mn	246.77	226.42	51270.36	31	240.25	199.89	39958.38	31	1.28	+	.17	+

*For F Test: $F(\alpha \div 2) = .482$, $F[(1 - \alpha) \div 2] = 2.07$, where $\alpha = 5\%$
† + indicates pass, – indicates fail
** For "t" Test: $A \pm = \pm 2.000$, where $\alpha = 5\%$

SAMPLE PREPARATION AND CHEMICAL ANALYSIS

The majority of the lake sediment samples taken for this survey were prepared for chemical analysis by oven-drying, the remainder being prepared by freeze-drying.

The oven-dried samples were dried at less than 80° C for 48 hours. Since oven drying of the samples resulted in the samples becoming extremely hard, the dried samples were disaggregated with a stainless steel rolling pin and then ground to –80 mesh (177 micron) with a Braun pulverizer equipped with ceramic plates. The entire dried sample was processed so that it all passed the 80 mesh screen.

The freeze-dried samples were first air-dried for approximately 72 hours, resulting in a loss of approximately 30 percent of the water contained in the sample. Next, the samples were frozen in a freezer and then placed in a freeze-drying unit. The freeze-drying process took approximately 72 hours, after which the samples were in a fine powdery state. The freeze-drying method did not produce the disaggregation problems encountered with oven-drying, so pulverization of the samples was not required. The samples were sieved to –80 mesh, and any fibric organic material retained on the screen was discarded.

A comparison of the analytic results indicated that samples prepared by oven-drying and those prepared by freeze-drying were statistically comparable. The analytical results of 31 samples prepared by both methods are listed in Table 1. Table 2 lists the results of a statistical comparison made by using the "F" test and the "t" test. Table 3 contains the correlation coefficients of the two sets of data.

The –80 mesh sample was leached for analysis of Ag, Co, Cu, Ni, Pb, Zn, Fe, and Mn by placing 1000 mg of sample in a solution of 10 mls of 4M HNO_3 and 10 mls of 1M HCl for two hours at 90° C. This solution was then diluted to 100 mls with deionized water filtered through #40 Whatman filter paper and analyzed with a Perkin-Elmer 603 atomic absorption spectrophotometer. This method has been shown to provide the greatest and most consistent contrast of anomaly over background of several techniques researched (Meineke, Vadis, and Klaysmat, 1976).

Arsenic was analyzed by leaching 500 mgs of sample in 1 ml of concentrated nitric acid and 2 mls of 30 percent hydrogen peroxide and digesting overnight at ambient temperatures for six hours at 70° C. Next, 50 mls of 6N HCl was added, and the solution was brought to 100 mls with deionized water. Arsenic was then analyzed by the use of an arsine generator and atomic absorption. Loss-on-ignition (LOI) was determined by igniting a 1000 mg sample at 500° C.

The determination of analytical variability was accomplished by two methods. The first method was to analyze a cut from a precision lake sediment sample with each batch of 20 samples. The precision sample was a large, homogeneous sample prepared by the same method used for lake sediments and is the same sample type so that a similar sample-acid matrix was obtained. From these precision samples, the analytical precision was calculated at the 95 percent confidence level for the "t" distribution. The second method used for determination of analytical variability was by reanalysis of one sample from each batch of 20 samples, resulting in 45 reanalyzed samples. The analytical precision was calculated by a method adapted from Garrett (1969 and 1973). The results of the calculations of analytical precision for these samples by both methods are shown on Table 4. Most Ag values were below detection limits for the sample weight used; therefore, analytical precision was not calculated for Ag.

The analytical detection limits are given in Table 5. The number in parenthesis is the value used in reporting an analysis below the detection limit.

The complete analytical data for all 1096 samples is given in Appendix A.

TABLE 3: Correlation Coefficients for Freeze-Dried and Oven-Dried Samples

Element	R^2
Co vs. Co	.84
Cu vs. Cu	.90
Ni vs. Ni	.72
Zn vs. Zn	.95
Fe vs. Fe	.92
Mn vs. Mn	.98

TABLE 4: Analytical Precision for Lake Sediment Samples

Element	Analytical Precision From Precision Samples	Analytical Precision From Reanalyzed Samples
As	±15%	±13%
Co	±17%	±23%
Cu	±6%	±11%
Ni	±13%	±12%
Pb	±21%	±21%
Zn	±8%	±5%
Fe	±5%	±10%
Mn	±4%	±4%
LOI	. . .	±2%

TABLE 5: Analytical Detection Limits

Element	Detection Limit
Ag	1 ppm (0)
As	.1 ppm (<.1)
Co	1 ppm (0)
Cu	1 ppm (<1)
Ni	1 ppm (<1)
Pb	5 ppm (0)
Zn	1 ppm (<1)
Mn	1 ppm (<1)
Fe	.0% (0)

STATISTICAL ANALYSIS

A statistical analysis of the elements, LOI, and other parameters was undertaken to identify various relationships and characteristics that may assist in the interpretation of the survey for mineral potential purposes. The parameter distributions were examined for normality compared to lognormality to determine whether log-transformation was necessary in order to linearize the relationship of lognormal data prior to scatter diagram, correlation, regression, and residual analysis. Various statistical parameters of the elements were compared for the three major bedrock geologic subdivisions of the survey area to determine if the bedrock chemistry was reflected in the lake sediments. Inter-element and other parameter relations were examined by correlation coefficients, scatter diagrams, and interval scatter diagrams to determine if there were relationships present that would aid in interpreting the data.

Analysis of Data Distribution

An analysis of the total data set was performed to determine if the elements and certain other parameters, such as LOI, approximate a normal or lognormal distribution. For the analysis of lognormality versus normality, a combination of statistics such as the mean, variance, skewness, and coefficient of variation along with visual examination of histograms and cumulative frequency distributions was used. This analysis was performed to determine if log-transformation of the element data was necessary prior to correlation, regression, residual, and scatter diagram analysis. The total survey data consisting of element concentrations and LOI are given in Appendix A.

The range, arithmetic mean, $\log_{10}$ mean, standard deviation, median, and coefficient of variation for the elements, LOI, and water depth are given in Table 6. The histograms and cumulative frequency distributions for the elements are given on Plates 3 to 10, and for LOI on Figure 5.

Through this analysis it was concluded that the elements As, Co, Cu, Ni, Pb, Zn, Fe, Mn, and water depth at the sample site approximate a lognormal distribution and were $\log_{10}$ transformed for subsequent statistical analysis. LOI more closely approximates a normal distribution and was not transformed.

These results are comparable to results from a lake sediment survey in Cook County, adjacent to this survey area (Vadis and Meineke, 1980).

Relation of Bedrock to Lake Sediment Chemistry

Lake sediments should reflect variations in bedrock chemistry to be useful indicators of economic mineralization and favorable geologic units. Therefore, the relation of the metal concentrations in the lake sediments overlying the three major geologic subdivisions in the survey area were investigated and compared.

The three major geologic subdivisions are the North Shore Volcanic Group, the Duluth Complex, and the Virginia Formation. These geologic subdivisions within the survey area are based on Plate 1, adapted from Green (1972, rev. 1978), Sims et al. (1970), Morey (1975), and Morey et al. (1976), and are shown on Plates 3 to 10. The general lithologies of the geologic subdivisions are described on Plates 3 to 10 with a more detailed lithologic description on Plate 1.

Table 7 presents the range, arithmetic mean, $\log_{10}$ mean, standard deviation, and coefficient of variation for all samples within each of the three major geologic subdivisions. Table 7 shows a general difference in element concentrations in lake sediments over the three major geologic subdivisions. The relative differences are generally comparable to those expected of the rock types present in their respective areas (Hawkes and Webb, 1962; Levinson, 1974). Similar relations have been described by Meineke et al. (1976), Vadis et al. (1980), Hornbrook and Garrett (1976), and others. This suggests that lake sediments within the survey area should reflect economic mineralization and economically favorable geologic units because the variation in bedrock chemistry is generally reflected in the lake sediments.

Correlation and Inter-Parameter Relations

Correlation coefficients were calculated for the total data set ($N = 1096$) using a univariate linear model (Table 8) to determine if any inter-parameter relations exist. The elements which approximate a lognormal distribution were $\log_{10}$ transformed prior to correlation and to constructing scatter diagrams. LOI and water depth at the sample site were also correlated with the elements. The correlation of certain other quantitative parameters, such as lake acreage, sediment and water pH, and sediment and water temperature for Cook County, which is adjacent to the survey, covered herein are discussed by Vadis and Meineke (1980).

The LOI correlation shows a relatively weak negative relationship with As, Co, Cu, Ni, Fe, and Mn. The scatter diagrams for these elements and LOI (not included in this report) show a very weak and often erratic relationship. The negative relation between these elements and LOI indicates a preferential accumulation of elements in the inorganic fraction of the sample. This relation has been found elsewhere in Minnesota (Meineke, Vadis, and Klaysmat, 1976; Vadis and Meineke, 1980).

The correlation of the total data set for Fe and Mn to the other elements shows a weak to moderate positive correlation for depth of water at sample sites, As, Co, Ni, and Zn (see Table 8). The correlation of Fe to Mn is strong at 0.79. The scatter diagram for Fe and Mn to these parameters shows a somewhat diffuse but distinctive relationship. The scavenging effect of Fe and Mn can create falsely anomalous trace metal concentrations which must be recognized when interpreting the data. The normalization of the effect of Fe and Mn scavenging will be covered in the following section.

Elements which are commonly associated in bedrock sources show a moderate to strong correlation (Table 8), especially Ni and Co (.61) and Ni and Cu (.32); Zn and Co, Zn and Ni, and Co and As also show some correlation.

Normalization of the Effects of Fe, Mn, and LOI

False anomalies can be created by chemical processes that may concentrate the elements, thereby falsely en-

TABLE 6: Summary Statistics

	* Range	Arith. $\bar{x}$	$Log_{10}\bar{x}$	Std. Dev.	Median	C.V.%*
Depth (ft)	1-95	11.6	8.83	9.63	8	83
As (ppm)	.1-20.2	2.9	2.02	2.73	2.0	94
Co (ppm)	0**-48	9.01	7.22	6.87	7.0	76
Cu (ppm)	5-219	31.78	28.03	18.57	28.5	58
Ni (ppm)	2-121	21.42	18.71	12.47	19.0	58
Pb (ppm)	0**-70	8.48	8.37	5.34	9.0	63
Zn (ppm)	5-552	86.39	76.96	44.54	78	52
Fe (%)	.03-26.89	1.48	.89	2.26	.88	153
Mn (ppm)	6-9500	325.11	174.55	635.88	158	196
LOI (%)	4.28-90.49	45.51	...	15.98	43.52	...

*Coefficient of Variation, % = Std. Dev. × 100 /Arith. $\bar{x}$
**Below detection limit

TABLE 7: Summary Statistics of Lake Sediments by Bedrock Type

Element	Range	Arith $\bar{x}$	$Log_{10}\bar{x}$ *	Std. Dev.	C.V.%**
		DULUTH COMPLEX (N = 818)			
As (ppm)	.1-20	2.81	1.92	2.76	98
Co (ppm)	0-48	8.70	7.06	6.32	73
Cu (ppm)	5-150	31.08	27.67	16.80	54
Ni (ppm)	4-119	21.12	18.53	12.13	57
Pb (ppm)	0-70	8.41	8.60	5.55	66
Zn (ppm)	15-552	84.79	75.81	44.18	52
Fe (%)	.03-26.89	1.35	.85	1.87	139
Mn (ppm)	6-9500	284.22	161.59	525.21	185
		SEDIMENTS (VIRGINIA FM) (N = 110)			
As (ppm)	.2-20.2	3.62	2.63	3.25	90
Co (ppm)	3-43	13.83	10.85	10.45	76
Cu (ppm)	5-53	29.58	27.54	10.08	34
Ni (ppm)	2-121	26.85	23.42	14.93	56
Pb (ppm)	2-34	9.49	8.17	5.41	57
Zn (ppm)	5-305	98.22	84.26	51.94	53
Fe (%)	.15-21	3.17	1.67	4.34	137
Mn (ppm)	43-7600	801.35	434.97	1267.82	158
		NORTH SHORE VOLCANICS (N = 155)			
As (ppm)	.2-10.4	2.82	2.20	2.06	73
Co (ppm)	0-20	6.72	5.80	3.74	56
Cu (ppm)	7-219	37.30	30.50	28.89	77
Ni (ppm)	5-84	18.23	16.33	9.73	53
Pb (ppm)	0-20	8.43	7.86	4.01	48
Zn (ppm)	23-219	86.71	78.01	44.33	51
Fe (%)	.06-12.74	.92	.65	1.12	122
Mn (ppm)	11-770	168.63	126.27	140.89	84

* $Log_{10}\bar{x}$ Analysis log-transformed prior to calculation and anti-log taken after calculation
** Coefficient of Variation, % = Std. Dev. × 100 /Arith. $\bar{x}$

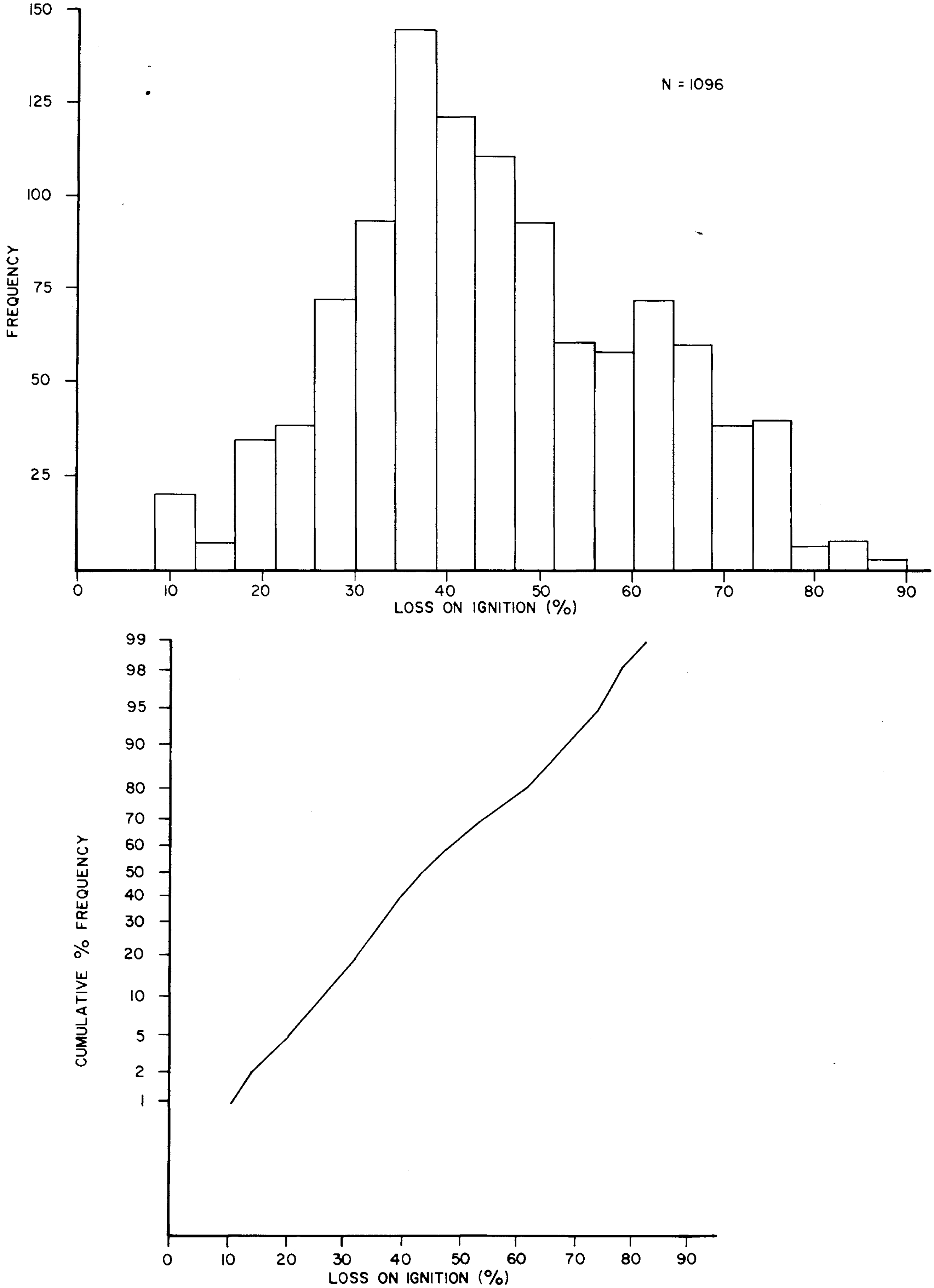


FIGURE 5: Histogram and cumulative frequency distribution of loss-on-ignition (LOI).

hancing the reflection of the bedrock chemistry in the lake sediment. The weak to moderate positive relationship demonstrated by Fe and Mn to the trace elements noted earlier may be the result of scavenging and coprecipitation by Mn and/or Fe hydroxides. Scavenging and coprecipitation by Fe and Mn hydroxides has been discussed by Hawkes and Webb (1962), Levinson (1974, 1980), and others, and for lake sediment in particular by Coker et al. (1979). However, for lake sediment surveys conducted in Saskatchewan (Hornbrook and Garrett, 1976) and in areas of Minnesota (Vadis and Meineke, 1980, and Meineke et al., 1976) it has been found that Fe and Mn hydroxides do not play a dominant role in the scavenging of trace elements.

In order to suppress these effects, an attempt was made to normalize the influence of Fe, Mn, and LOI on trace element concentrations. Two major statistical techniques used in the past to normalize lake sediment data are ratioing, e.g. Cu/Mn (Coker and Nichol, 1975, 1976; Jackson and Nichol, 1975) and regression residuals (Spilsbury, 1974; Davenport et al., 1975; and Hornbrook and Garrett, 1976). Ratios and univariate residuals were examined and evaluated for this survey, but multiparameter residuals were not attempted although they may deserve consideration because of the multiparameter relations observed.

Scatter and interval scatter diagrams* of Fe, Mn, and LOI were plotted against trace elements and evaluated. The use of interval scatter diagrams for geochemical data was demonstrated by Coker and Nichol (1976). The trend of the points on an interval scatter diagram is often very similar to a least squares regression line fit to the total data. An anlaysis of scatter diagrams is necessary because the correlation coefficients (Table 8) in themselves may indicate false relations which result from spurious values, data clustering, or the effect of more than one variable (Chapman, 1976). All elements were $\log_{10}$ transformed for the scatter and interval scatter diagrams to linearize the relationships for ease of evaluation.

*An interval scatter diagram, as defined here, is a scatter diagram in which each point represents a number of data points and, in effect, more clearly depicts the trend of a two-parameter relationship. Fe, Mn, LOI, and other parameters (on the X-axis) are divided into intervals, and the arithmetic mean of the corresponding trace elements for each data point within the interval are calculated and plotted as the ordinate value.

The relationship between two lognormal parameters or a lognormal and a normal parameter is exponential. If lognormal data are not log-transformed, the data plots as an exponential curve (see Fig. 6). As a result, the scatter in the data which has not been $\log_{10}$ transformed may lead to false interpretation of changes in the mathematical relationships over the range of the parameter values. Figure 6a demonstrates that the relationship between these parameters, which are $\log_{10}$ transformed, is approximately exponential. If the relation is both exponential and directly proportional, the untransformed data will plot as an approximate straight line.

For ratioing of geochemical data to be useful in removing bias from the data, the parameters must demonstrate a consistent mathematical relationship. This is demonstrated on Figure 7 where line "A" has been fit to data for the interval scatter diagram for Cu and Fe from a lake sediment survey in Cook County (Vadis and Meineke, 1980). This line shows a non-proportional relationship for the two elements over the range of the data, as indicated by a ratio of 109 at lower concentration ranges and a ratio of 16 at upper concentration ranges. In order for ratios to normalize the geochemical data for the elements and Mn, Fe, and LOI, there must be a proportional relationship between the two parameters plotted similar to the situation depicted in hypothetical line "B" of Figure 7. Here we see a proportional ratio across the entire range of data.

The analysis of the ratioing of the trace elements to Fe, Mn, and LOI indicated no proportional relationships or ratios that would significantly improve upon the raw data. Therefore, ratios were not used to normalize the effect of Fe, Mn, or LOI.

In an attempt to normalize the negative relationship of Co, As, and Ni to LOI, the Co, As, and Ni concentrations were converted to the inorganic weight of each sample using the LOI value (i.e. 100(Co)/(100–LOI)). As the samples were not ashed prior to analysis, this conversion would be similar to chemically analyzing the ashed sample without regard to possible element loss during ignition (Peachey, 1976). This procedure is similar to ratioing but is not directly influenced by the proportionality problems previously outlined. The results of this procedure indicated no significant normalization of the effect of LOI on the trace elements by the conversion to metal concentration based

TABLE 8: Correlation Coefficient Matrix

	LOI	Mn	Fe	Zn	Pb	Ni	Cu	Co	As
depth	.0	.41	.37	.33	.0	.20	.24	.33	.14
As	–.36	.42	.50	.20	.0	.17	.22	.39	
Co	–.40	.68	.69	.48	.14	.61	.28		
Cu	–.24	.10	.32	.14	.0	.32			
Ni	–.36	.40	.51	.36	.17				
Pb	–.14	.14	.14	.14					
Zn	.0	.52	.45						
Fe	–.42	.79							
Mn	–.30								
LOI									

NOTE: All data $\log_{10}$ transformed prior to calculation of correlation coefficient, except LOI.

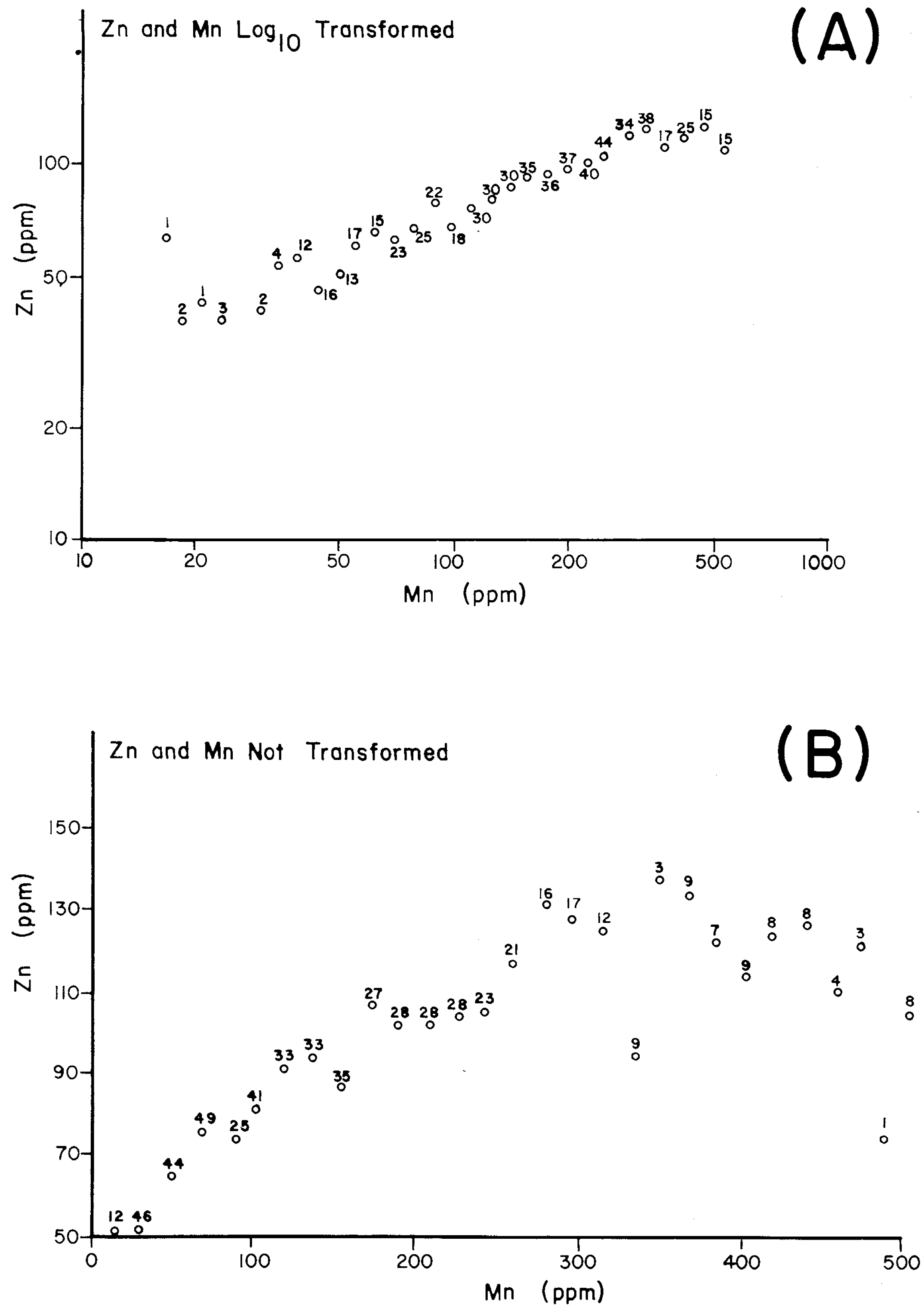


FIGURE 6: Interval scatter diagrams of Zn and Mn. Numbers represent sample frequency of plotted point for each inteval. (Vadis and Meineke, 1982)

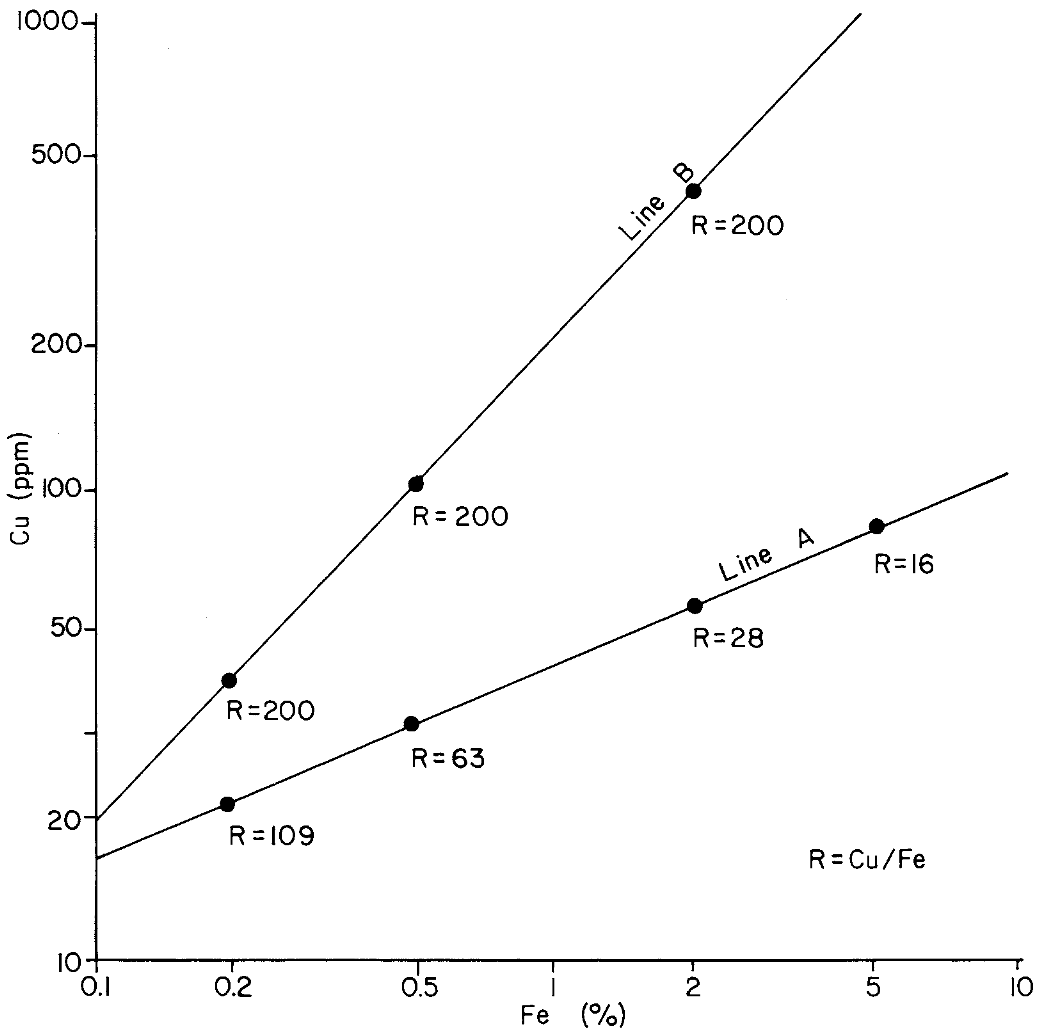


FIGURE 7: Cu/Fe ratios along regression line. Line A is regression line from analytical data. Line B is a hypothetical line representing a proportional relation between Cu and Fe (Vadis and Meinke, 1982).

on inorganic fractions. This is probably due to the relatively weak correlation of LOI to the elements.

Finally, univariate residuals were examined for the relationships of the trace elements (As, Co, Cu, Ni, and Zn) to Fe, Mn, and LOI. The residuals did not normalize the data to the extent that there was a significant improvement over the raw element data. As a result, residuals were not used to represent or interpret the element data.

SURVEY RESULTS AND DISCUSSION

The statistical analysis performed on the survey data was done to identify relationships and characteristics of the element data and other parameters that would assist in the interpretation of this survey for mineral potential purposes. It was found that the bedrock chemistry of the survey area is reflected in the organic-rich lake sediments, a necessary condition for application of this geochemical method. Relationships exist between the trace elements and Fe, Mn, and LOI. This suggests that chemical processes may be enhancing the trace element concentrations and thereby producing variable backgrounds and creating false anomalies. However, ratios, inorganic concentration conversions, and univariate regression residuals were unable to normalize the element data for the effects of Fe, Mn, or LOI to a degree which significantly improved the use of raw element data for interpretation. Some of the relationships and characteristics of the data identified by the statistical analysis should assist in interpretation; however, it was concluded that the data in the raw element form should be used for interpretation of this survey. Some of the factors which may be responsible for the relationships of Mn, Fe, and LOI to the trace elements are reviewed by Vadis and Meineke (1982) for Cook County, which is adjacent to this survey area and for which similar results were obtained.

Symbol maps, using symbols designed and used by the Geological Survey of Canada, were constructed to depict the concentrations of As, Co, Cu, Ni, Pb, Zn, Fe, and Mn (Plates 3-10 in pocket). The symbols were selected to represent ranges of concentrations that were determined by ranges of percentiles of the cumulative frequency distribution for each element. The range of values selected, represented by each symbol, were as small as possible in order to reflect variations in the bedrock chemistry and regional trends but were constrained by analytical precision (Table 4). The range of concentration for each symbol was selected so that the analytical variability when applied to the median of the ranges did not cause drastic overlap into adjacent ranges (Table 9). Ten percent ranges were used for As, Cu, Zn, Fe, and Mn while 20 percent ranges were used for Pb, Ni, and Co. Only a small percentage of the 1096 total samples were above the analytical detection limit for Ag (Plate 2). At the highest concentrations, the ranges were reduced to illustrate the relation and distribution of the anomalous samples. Plate 2, in addition to displaying all Ag values which are above the analytical detection limit, also shows where two or more elements exceed 90 percent cumulative frequency. This may be useful for identifying multi-element anomalies and element associations.

TABLE 9: Percent Ranges of Percentiles for Element Concentration Symbol Maps

Element	Percent of Map Symbol Range[1]	Percent Confidence of Range[2]
Ag	ppm concentration	. . .
As	10%	95%
Co	20%	95%
Cu	10%	95%
Ni	20%	95%
Pb	20%	95%
Zn	10%	80%
Fe	10%	95%
Mn	10%	95%

[1]The percentage of the total data represented by each element concentration range (Plates 3-10)

[2]Percent confidence that the median of range is within the range boundary, based on the "t" distribution, and calculated for the 40-60% interval for 20% ranges, and the 40-50% or 50-60% interval for 10% ranges.

The element concentrations for any sample can be determined by first locating the sample site and sample number on Plate 11 and referring to Appendix A where concentrations are listed.

A number of relationships and characteristics of the data identified by the statistical analysis should be considered during interpretation of this survey. The effects of Fe and Mn scavenging and coprecipitation or the effect of organic complexing appears to be relatively insignificant compared to the effect of the bedrock and related glacial deposits in the area for lake sediments. As indicated in Table 7, a distinct difference of element concentrations in the lake sediments is noted between samples taken from the three generalized bedrock types in the survey area. It is entirely possible that lower concentration anomalies over a lower background may be as or more significant than high concentration anomalies over a high background. Anomaly to background contrast must, therefore, be considered. Also, the lake sediment element analysis is a reflection of the glacial drift of the area in addition to the bedrock chemistry. The glacial drift is derived from predominantly local bedrock, but the proportion of chemical influence of the glacial drift versus the bedrock on trace element concentrations in lake sediment is dependent upon the geologic, hydrologic, and chemical conditions of the environment. The influence of glacial erosion and dispersion in lake sediment geochemistry has been reported by Coker and Nichol (1975), Meineke, Vadis, and Klaysmat (1976), and must be considered, at least locally, for the interpretation of this survey.

The percentile maps (Plates 3-10) illustrate the relative element concentrations in the lake sediments over the three major bedrock geologic subdivisions. Certain trace elements, especially Fe and Mn, show the variation of concentrations over the various bedrock types on the percentile maps. For these elements, the Virginia Formation appears highest in trace element concentration, the Duluth Complex being intermediate, and the North Shore Volcanics being the lowest. Some effects of glacial smearing may be present as indicated by the anomalous concentrations of sediments in all of Birch Lake, part of which is over known Cu-Ni mineralization and part of which is over Virginia Formation.

Plate 2 illustrates all sample sites where two or more elements are in the upper 10th percentile of the data. The Duluth Complex contains some of the most interesting anomalies with generally the highest contrast above background of all the geologic subdivisions considered. The most prominent anomalies for multiple element anomalies with more than one anomalous sample per lake are in the areas of the following lakes: Birch, Pequaywan, Boulder, Isabella, Grouse, Mitawan, McDougal, Slate, August, Big, Pine, Thomas, and Shafer.

Some of the more anomalous lakes are reservoirs, which may suggest that they may be subject to metal accumulation processes which vary from naturally occurring lakes. However, most of these reservoirs fall along the western contact of the Duluth Complex, and the anomalous concentrations in these reservoirs may also be reflecting the known mineralization along the western contact of the complex.

SUMMARY AND CONCLUSIONS

An exploration lake sediment geochemical survey was conducted in parts of Lake and St. Louis counties in Minnesota as part of a program to evaluate the mineral potential of the bedrock geology of the region. During the program, 1096 samples were collected from an area of 2770 mi^2 (7175 km^2). After collection the samples were dried, either by oven- or freeze-drying methods, then sieved to −80 mesh (177 microns). The samples were leached for analysis of Ag, Co, Cu, Ni, Pb, Zn, Fe, and Mn in a solution of 4M HNO_3 and 1M HCl. Arsenic was leached in a solution of concentrated nitric acid and 30% hydrogen peroxide with a later addition of 6N HCl. After digestion the solutions were analyzed using an atomic absorption spectrophotometer.

Statistical analysis including ratioing and univariate regression residuals was performed on the lake sediment data in an attempt to identify relationships and characteristics of the element data and other parameters that could assist in the interpretation of the survey for mineral potential purposes. Some of the resulting observations and suggestions could vary with chemical and analytical methods differing from those used in this survey.

The statistical analysis indicated that Fe and Mn display a positive relation with all elements, and LOI a negative relation with most elements. Ratios, inorganic element concentration conversions based on LOI, and univariate regression residuals were attempted in order to normalize the trace element data for the effects of Fe, Mn, and LOI, but it was found that these normalization techniques did not provide any significant improvement over the raw element data. These results are comparable with results obtained by Vadis and Meineke (1982) in Cook County, which is east of the survey area.

The trace elements displayed a nonproportional, approximately exponential relation to Fe, Mn, and LOI, which results in a decrease of the ratio (trace element/Fe, Mn, or LOI) with an increase in Fe, Mn, or LOI. This nonproportional relation precluded the use of ratios for normalization of data. Fe-Mn hydroxides and organic complexing do have the potential of creating false trace element anomalies in lake sediments, but this phenomenon is not indicated by this survey.

The statistical analysis also indicated the bedrock chemistry is reflected in the element concentrations of the lake sediments. This suggests that economic mineralization should also be reflected in lake sediments under favorable geologic, hydrologic, and chemical conditions. The reflection of bedrock chemistry results in a variable element background for the survey area, which should be considered in the interpretation of the data for mineral potential purposes.

Several multi-element anomalies were indicated by this survey, the most interesting of which fall over the Duluth Complex, and deserve further consideration in relation to possible mineralization.

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APPENDIX

SAMPLE NUMBER	SAMPLE DEPTH ft	Ag ppm	As ppm	Co ppm	Cu ppm	Ni ppm	Pb ppm	Zn ppm	Fe %	Mn ppm	LOI %
7072	21	0	1.4	0	36	4	0	158	1.99	328	64.55
7073	15	0	.8	0	33	4	0	108	1.33	312	61.77
7074	12	0	3.0	0	31	6	0	51	.53	140	46.07
7075	13	0	3.0	0	29	6	0	46	.38	134	42.96
7094	3	0	1.0	3	29	9	2	57	.62	45	54.29
7095	6	0	1.6	5	31	13	7	61	1.14	91	49.11
7096	7	0	1.2	6	39	12	6	63	.81	99	55.02
7097	5	0	1.4	7	33	15	9	66	.97	128	51.15
7098	22	0	1.8	8	44	19	12	83	1.46	262	42.95
7099	10	0	1.0	11	42	20	8	95	1.05	218	42.43
7100	30	0	3.2	11	49	26	12	76	1.18	308	24.48
7101	31	0	1.8	11	48	23	8	80	1.01	323	25.27
7102	30	0	2.0	8	30	17	7	62	1.13	238	12.65
7103	50	0	2.4	11	40	21	9	62	1.10	239	19.01
7131	3	0	2.2	1	26	5	5	56	.75	74	55.97
7132	14	0	2.4	4	15	9	14	81	0.90	251	38.59
7133	5	0	2.2	5	18	11	5	91	1.14	290	39.35
7134	2	0	2.6	5	14	11	9	97	1.21	367	43.25
7135	5	0	1.8	4	17	18	13	81	.66	230	54.08
7136	10	0	1.4	7	20	21	16	93	.58	184	45.43
7137	10	0	1.6	6	19	23	16	107	.67	206	44.07
7138	3	0	1.4	3	13	6	6	55	0.50	63	61.63
7139	6	0	1.0	4	23	6	2	53	.35	28	54.26
7140	5	0	1.6	1	18	8	7	47	.29	39	57.74
7141	6	0	1.2	3	24	12	9	57	.65	80	66.21
7142	5	0	1.0	4	25	11	7	57	.57	75	59.17
7143	3	0	1.6	4	26	13	6	64	.86	100	50.51
7144	20	0	1.6	7	34	14	13	70	.77	134	60.58
7145	12	0	3.0	8	26	18	9	80	.82	115	40.11
7146	6	0	2.2	3	24	9	6	69	.81	93	41.37
7162	32	0	8.6	6	29	13	6	64	1.1	145	27.69
7163	48	0	5.2	8	38	13	9	65	0.9	222	33.58
7164	40	0	5.0	5	28	13	8	56	0.9	142	30.17
7165	3	0	2.4	4	22	16	6	69	0.6	188	34.30
7166	3	0	3.4	8	23	17	8	94	0.8	213	33.64
7188	3	0	1.8	3	21	9	6	31	0.13	21	38.02
7189	5	0	1.6	3	22	8	5	29	0.13	25	35.98
7190	4	0	2.4	6	18	14	10	80	0.7	132	40.47
7191	6	0	2.0	7	16	13	8	86	0.7	145	36.34
7192	5	0	2.2	9	17	15	7	88	0.7	209	38.05
7193	5	0	3.8	6	16	11	8	93	0.6	439	48.90
7208	7	0	4.4	4	26	13	4	56	1.5	394	51.40
7209	8	0	6.2	7	19	16	4	80	3.0	1400	58.99
7210	28	0	7.8	8	41	15	10	73	3.7	806	54.04
7211	10	0	.8	6	19	15	2	91	0.7	100	64.72
7212	10	0	.6	7	35	16	10	98	0.7	91	65.65
7213	10	0	.6	5	13	13	2	75	0.9	95	65.02
7214	10	0	.8	7	27	13	8	65	1.0	107	63.19
7215	20	0	.8	7	32	14	5	73	0.9	218	56.52
7216	5	0	13.0	13	47	19	7	88	8.5	200	58.15
7217	6	0	12.6	10	34	17	5	70	8.1	338	47.55
7218	5	0	2.4	2	22	7	4	62	0.3	62	54.40
7219	4	0	1.2	2	19	9	3	52	0.3	52	50.30
7220	7	0	.8	4	25	10	1	37	.13	37	21.26

NOTE: ND = No Data

SAMPLE NUMBER	SAMPLE DEPTH ft	Ag ppm	As ppm	Co ppm	Cu ppm	Ni ppm	Pb ppm	Zn ppm	Fe %	Mn ppm	LOI %
7221	8	0	.6	4	34	12	4	65	0.7	61	37.01
7222	8	0	.8	3	32	13	5	54	0.3	60	36.70
7223	5	0	4.2	10	45	24	8	128	2.6	370	40.29
7224	5	0	2.0	7	35	22	9	114	1.7	227	49.20
7225	27	0	2.2	7	21	17	7	103	0.6	422	37.13
7226	27	0	2.4	6	14	15	2	100	0.3	437	33.70
7227	25	0	3.0	9	39	20	10	119	2.6	412	38.72
7228	8	0	.6	4	26	12	7	113	1.3	124	71.49
7229	25	0	1.2	3	18	10	5	75	0.8	178	58.21
7237	8	0	.6	4	22	14	10	83	0.22	68	64.35
7238	10	0	.4	5	35	12	0	80	.14	68	61.84
7239	10	0	.4	5	30	12	10	84	.13	76	65.15
7240	6	0	1.8	5	20	10	10	58	.19	80	64.49
7241	4	0	.8	6	21	17	10	74	.44	92	62.06
7242	21	0	9.4	10	30	12	10	61	7.86	633	52.62
7243	15	0	8.4	11	48	14	10	77	6.54	690	61.08
7245	4	0	.8	2	19	9	10	43	0.15	44	37.81
7246	4	0	1.2	4	22	10	10	51	.39	39	38.20
7247	4	0	1.4	2	20	8	10	44	.24	44	38.07
7248	5	0	1.8	9	29	18	10	64	1.21	220	26.87
7249	5	0	1.6	8	25	12	10	59	.90	197	23.42
7253	5	0	2.4	9	25	17	20	ND	1.23	21	19.92
7254	5	0	2.8	10	29	19	10	78	1.30	265	26.47
7255	5	0	2.4	9	33	16	0	74	1.19	360	33.92
7257	11	0	1.4	9	43	18	10	86	1.49	28	28.06
7267	9	0	1.8	11	43	25	10	94	1.88	285	28.83
7268	7	0	1.8	7	37	16	0	67	.92	108	32.48
7269	6	0	1.2	10	43	19	10	77	.72	155	28.59
7270	6	0	1.2	7	28	12	0	63	.59	148	36.46
7271	6	0	1.2	7	30	14	0	68	.69	146	35.57
7287	15	0	2.0	7	33	14	10	44	.87	197	12.14
7288	15	0	1.8	11	35	22	10	63	2.43	268	11.90
7289	40	0	2.0	10	41	18	10	66	2.51	273	14.61
7290	28	0	1.6	13	36	18	10	66	2.30	321	12.85
7296	17	0	1.8	9	41	16	10	81	1.37	257	34.73
7297	13	0	2.2	12	44	21	10	100	2.41	369	31.17
7298	12	0	2.0	8	42	17	10	89	1.97	330	32.81
7301	4	0	8.0	6	21	7	10	55	.74	145	48.03
7302	3	0	10.4	8	24	6	10	80	.88	370	43.37
7303	6	0	2.4	2	20	8	10	60	.11	45	55.50
7304	6	0	2.2	3	17	7	10	55	.11	49	57.86
7325	4	0	1.8	3	23	11	0	56	.25	31	51.65
7326	8	0	.6	7	40	21	0	69	.88	110	33.53
7327	7	0	.8	8	40	27	0	78	.86	106	31.98
7328	50	0	4.4	17	65	24	10	87	2.62	400	36.43
7329	12	0	2.8	12	65	32	0	102	1.28	361	29.28
7332	3	0	2.0	5	21	13	0	54	.26	26	49.39
7337	3	0	.8	6	37	13	0	49	.61	73	26.83
7338	3	0	.8	8	117	16	0	28	.90	188	52.28
7339	3	0	.8	6	42	9	0	121	.51	71	63.02
7340	10	0	1.8	13	33	24	0	124	2.40	326	26.93
7341	10	0	2.2	14	43	28	0	137	2.97	371	28.40
7342	10	0	1.4	14	39	28	0	136	2.99	402	28.77
7343	12	0	2.2	15	38	24	0	141	2.83	436	30.31

7344	12	0	1.8	16	38	26	0	151	2.73	414	30.93
7345	12	0	3.6	19	47	30	0	100	3.36	400	34.78
7346	8	0	1.8	9	32	25	0	81	2.14	361	39.68
7347	8	0	1.2	13	61	34	0	100	2.14	244	35.83
7348	37	0	1.6	16	47	22	10	107	1.96	346	31.53
7349	26	0	1.8	15	36	18	10	107	2.65	500	29.63
7350	4	0	2.6	2	19	10	0	32	.26	34	43.10
7351	4	0	2.2	4	12	6	10	58	.28	56	44.25
7352	8	0	.4	10	32	23	0	76	1.16	288	42.98
7353	7	0	.6	6	30	23	0	57	.47	54	41.46
7354	7	0	3.0	14	5	31	0	57	.70	363	4.28
7355	9	0	1.2	12	53	25	0	95	1.51	222	38.36
7356	9	0	1.6	14	55	28	10	111	2.01	304	37.73
7357	10	0	1.0	11	54	33	0	102	2.27	241	37.01
7358	2	0	1.4	5	29	14	0	58	.36	46	33.03
7359	2	0	2.8	13	30	23	0	81	1.47	219	29.35
7360	11	0	.6	3	15	5	0	49	.14	44	51.20
7361	2	0	18.8	48	25	25	0	47	6.81	6200	29.33
7362	3	0	4.6	1	97	21	0	33	.32	6	36.53
7363	14	0	12.6	8	47	17	0	55	1.07	91	45.40
7364	7	0	6.6	8	79	27	0	44	.65	28	44.79
7365	22	0	10.2	9	54	19	0	65	.85	75	46.94
7366	25	0	8.6	7	55	23	0	68	1.03	76	45.33
7367	25	0	10.0	7	61	24	0	74	1.26	97	43.57
7368	7	0	1.0	5	19	10	0	46	.38	28	11.78
7369	8	0	.6	4	38	12	0	91	.20	40	46.91
7370	17	0	1.8	16	41	23	0	115	2.86	600	26.26
7371	8	0	1.8	14	48	30	0	106	1.67	263	34.55
7372	9	0	2.4	11	49	31	0	115	1.80	321	34.18
7373	12	0	1.4	11	39	19	0	97	3.06	488	37.80
7374	10	0	3.2	19	50	24	0	124	4.44	500	41.49
7375	9	0	13.0	6	23	17	0	87	2.31	415	55.21
7376	20	0	15.6	11	27	20	0	101	4.36	500	55.75
7377	8	0	2.2	9	69	32	0	81	1.52	97	51.33
7378	13	0	.8	7	33	10	0	68	1.40	126	52.38
7379	1	0	2.2	5	13	12	0	50	1.14	299	32.88
7380	1	0	1.0	9	15	17	0	62	1.59	237	32.09
7381	3	0	1.2	0	12	9	0	32	.34	113	32.64
7382	3	0	1.2	4	16	11	0	42	.22	96	34.30
7383	3	0	4.0	5	14	15	0	39	.28	58	37.83
7384	4	0	2.4	2	25	20	0	52	.55	45	38.85
7385	3	0	2.8	8	26	17	0	59	1.05	95	18.16
7386	3	0	2.6	6	19	17	0	97	.86	220	39.85
7387	3	0	1.8	1	18	17	0	85	.75	186	37.06
7388	3	0	5.0	0	22	24	0	98	1.11	115	41.75
7389	3	0	1.8	6	9	8	0	44	.49	198	59.51
7390	4	0	7.4	3	10	9	0	64	.16	16	72.91
7391	21	0	1.0	0	16	13	0	92	.34	126	72.83
7392	14	0	1.2	5	17	15	0	135	.24	115	74.19
7393	3	0	1.2	5	18	9	0	63	.75	120	76.23
7394	35	0	1.8	7	18	10	0	51	.68	177	50.24
7395	3	0	1.2	11	18	10	0	71	.87	246	73.91
7396	30	0	3.0	7	20	11	0	60	.64	167	52.86
7397	18	0	2.8	7	30	13	0	84	.86	157	54.93
7398	10	0	.8	5	29	14	0	57	.99	173	67.02
7399	20	0	3.0	7	19	7	10	47	.57	145	59.38
7400	4	0	1.0	7	17	12	0	35	.46	83	33.25
7401	15	0	.8	7	54	11	0	88	.86	116	47.05
7402	4	0	2.4	15	25	12	0	50	.72	217	48.48
7403	13	0	.6	12	21	10	0	132	.22	124	72.47
7404	6	0	3.4	11	32	24	0	68	1.14	68	25.34
7405	5	0	2.0	12	35	25	0	70	1.12	76	27.85
7406	5	0	2.8	11	29	21	0	53	.86	65	17.75
7407	ND	0	2.0	4	20	10	0	58	1.12	161	68.84
7408	20	0	2.2	8	14	9	0	49	.50	136	61.78
7409	13	0	2.8	9	21	11	0	54	.48	103	61.82
7410	10	0	1.6	18	45	29	10	59	1.32	438	51.64
7411	14	0	1.8	18	44	22	0	63	1.91	484	51.64
7412	9	0	1.4	20	45	23	0	69	2.16	483	48.72
7413	15	0	1.2	17	47	23	0	61	1.50	472	49.94
7414	3	0	2.4	11	16	16	0	83	.65	228	34.67
7415	3	0	2.4	12	12	11	0	68	.66	227	32.13
7416	5	0	3.0	9	18	15	8	88	1.06	326	38.94
7417	5	0	3.6	14	22	16	7	96	1.06	339	38.76
7418	15	0	5.8	12	26	10	9	99	.90	305	40.27
7419	7	0	7.2	16	27	14	7	107	.97	281	34.80
7420	13	0	.8	11	96	9	5	70	.23	39	39.67
7421	5	0	1.0	13	44	20	11	60	.29	62	46.46
7422	5	0	1.0	15	53	20	10	76	.38	67	46.69
7423	5	0	1.2	6	47	19	7	73	.38	65	45.66
7424	5	0	.8	5	47	17	8	54	.14	35	41.92
7425	5	0	.8	3	39	15	6	60	.26	48	45.11
7426	5	0	.8	7	43	17	9	60	.18	44	43.97
7427	5	0	2.0	4	21	15	6	51	.04	42	44.71
7428	5	0	1.8	4	21	10	10	47	.03	38	44.50
7429	5	0	2.6	6	32	12	9	78	.47	113	54.89
7430	5	0	1.8	6	34	10	5	77	.39	110	56.18
7431	5	0	2.2	6	31	8	11	91	.46	115	54.02
7432	5	0	1.6	4	23	6	6	56	.25	55	49.20
7433	5	0	2.4	5	27	8	4	64	.42	74	54.40
7434	10	0	1.6	4	20	9	3	45	.14	41	68.64
7435	20	0	1.4	5	15	5	0	38	.14	20	64.17
7436	20	0	2.6	4	15	9	0	39	.10	15	67.95
7437	2	0	4.8	8	50	12	0	46	.32	6	33.59
7438	3	0	4.0	5	81	13	0	51	.56	14	35.58
7439	8	0	6.6	6	58	13	0	40	.57	23	31.89
7440	15	0	6.4	9	48	8	0	35	.37	9	41.04
7441	4	0	10.0	7	22	10	0	58	.69	107	45.38
7442	4	0	2.4	8	32	12	0	48	.45	89	56.97
7443	8	0	2.0	8	55	16	0	82	.56	96	55.49
7444	20	0	11.0	8	29	11	0	57	.75	96	48.21
7445	11	0	1.2	7	25	8	0	66	.40	48	62.00
7446	11	0	1.2	9	31	10	0	74	.35	56	64.11
7447	2	0	3.0	7	21	11	0	76	.53	34	41.78
7448	7	0	1.2	8	18	12	0	45	.27	45	40.85
7449	ND	0	.8	5	19	8	0	46	.35	43	39.10
7450	6	0	1.0	8	21	13	0	61	.33	34	19.46
7451	5	0	1.4	6	20	10	5	47	.29	143	28.02
7452	5	0	1.0	6	16	9	7	38	.19	88	25.45
7453	8	0	.8	7	19	10	7	28	.32	60	31.10
7454	6	0	1.0	8	22	15	3	50	.58	92	40.80
7455	8	0	2.2	17	32	19	10	144	1.42	750	38.93
7456	6	0	3.2	19	31	17	7	83	1.52	988	40.07
7457	4	0	2.0	25	36	37	11	144	5.49	812	39.32
7458	7	0	2.0	25	35	31	13	121	5.33	761	37.52
7459	2	0	3.8	18	24	14	10	79	1.02	764	31.97

NOTE: ND = No Data

SAMPLE NUMBER	SAMPLE DEPTH ft	Ag ppm	As ppm	Co ppm	Cu ppm	Ni ppm	Pb ppm	Zn ppm	Fe %	Mn ppm	LOI %
7460	13	0	1.0	12	33	15	13	73	.38	148	45.11
7461	5	0	1.6	3	18	8	8	40	.85	200	29.20
7462	5	0	2.4	4	26	12	7	63	1.65	256	35.43
7463	8	0	2.2	2	29	14	4	52	.93	111	39.52
7464	7	0	2.2	3	27	14	6	49	.78	100	39.72
7465	7	0	1.8	1	24	13	8	34	.76	79	34.56
7466	8	0	2.6	8	46	31	11	68	2.25	143	33.21
7467	5	0	3.4	8	43	26	10	72	1.49	125	44.53
7468	14	0	1.6	5	26	13	15	68	.48	80	32.23
7469	23	0	2.4	4	21	11	11	104	.25	67	73.51
7470	20	0	1.2	5	19	9	10	91	.24	70	73.05
7471	15	0	1.2	4	25	8	9	89	.64	144	69.84
7472	14	0	1.4	6	25	11	11	87	.44	112	64.84
7473	ND	0	1.2	7	20	11	11	74	.44	9500	50.50
7474	4	0	11.6	13	14	12	8	69	.67	242	12.00
7475	10	0	6.2	40	30	23	9	105	5.75	816	20.33
7476	20	0	4.2	16	40	18	11	115	2.50	565	38.01
7477	15	0	3.2	20	36	19	10	108	2.32	654	32.95
7478	7	0	4.8	22	36	19	10	115	3.06	826	34.19
7479	9	0	4.2	13	25	12	9	70	1.15	443	23.43
7480	20	0	8.6	7	34	12	7	47	.88	108	37.76
7481	15	0	4.6	5	25	9	7	75	.56	102	54.20
7482	20	0	3.6	5	24	8	8	73	.45	112	53.85
7483	8	0	.4	7	25	8	8	90	.18	52	59.24
7484	8	0	1.0	3	30	5	8	61	.24	36	48.37
7485	2	0	2.0	5	15	10	13	88	1.33	152	62.59
7486	2	0	1.8	4	17	9	12	90	1.60	152	60.31
7487	2	0	2.4	6	15	8	14	101	1.47	116	62.82
7488	5	0	.4	4	24	11	8	64	.46	71	63.78
7489	5	0	.2	3	21	10	9	71	.33	76	66.72
7490	12	0	6.0	8	34	17	9	122	3.26	608	37.17
7491	15	0	3.0	10	31	19	8	121	3.13	509	35.97
7492	9	0	5.6	11	33	20	7	122	2.26	703	38.09
7493	4	0	5.8	13	24	18	4	107	2.00	522	21.74
7494	3	0	8.6	11	57	26	6	104	1.42	508	38.48
7495	6	0	6.0	7	52	22	6	94	2.99	310	43.40
7496	7	0	6.0	13	60	27	6	112	3.98	320	45.85
7497	8	0	3.2	3	40	21	5	69	1.17	142	61.50
7498	5	0	2.2	4	27	14	3	50	.64	127	45.66
7499	8	0	1.6	5	24	14	7	47	.78	80	57.16
7500	8	0	2.0	5	22	14	9	43	.66	72	57.79
7509	5	0	5.4	9	21	22	5	123	.75	236	40.72
7510	6	0	6.0	13	26	37	6	133	.98	237	35.51
7511	8	0	7.2	11	23	26	5	120	.88	240	34.70
7512	7	0	4.2	10	24	25	6	130	.95	249	32.66
7513	8	0	4.4	9	22	25	5	130	.94	211	41.03
7514	6	0	7.6	15	29	36	9	123	1.02	297	31.15
7515	9	0	3.4	9	30	20	8	100	.93	216	38.90
7516	6	0	7.0	13	19	31	8	118	1.09	246	38.56
7517	7	0	1.6	12	28	38	9	122	1.04	269	32.84
7518	6	0	5.8	10	30	24	10	137	.91	242	40.99
7519	6	0	5.6	12	27	25	11	112	.86	282	40.07
7520	6	0	5.2	13	29	34	9	118	1.04	313	49.19
7521	6	0	5.2	14	49	50	8	96	1.74	186	75.48

NOTE: ND = No Data

SAMPLE NUMBER	SAMPLE DEPTH ft	Ag ppm	As ppm	Co ppm	Cu ppm	Ni ppm	Pb ppm	Zn ppm	Fe %	Mn ppm	LOI %
7522	6	0	5.7	8	26	33	11	77	.94	385	38.24
7523	7	0	6.8	16	35	40	13	130	3.10	366	31.12
7524	7	0	4.0	7	20	21	6	100	1.22	252	37.57
7525	7	0	7.4	10	25	26	6	140	1.99	321	42.78
7526	5	0	4.2	9	40	21	9	94	1.43	199	47.04
7527	5	0	2.6	8	49	22	8	73	1.04	160	36.83
7528	6	0	4.8	13	20	19	10	152	1.32	887	36.83
7529	7	0	4.0	14	20	21	12	133	1.56	673	37.73
7530	7	0	6.6	19	19	23	8	168	2.01	1355	36.80
7531	8	0	5.8	13	33	17	13	82	1.44	620	36.13
7532	4	0	.6	4	33	9	11	108	.24	95	42.15
7533	4	0		1.8	4	32	8	11	58	.80	87
7534	3	0	1.8	5	38	12	9	60	.54	92	33.39
7535	3	0	1.2	4	20	11	11	64	.29	78	60.51
7536	4	0	1.4	3	22	11	12	61	.30	63	60.78
7537	13	0	.8	6	40	17	6	50	1.50	149	46.51
7538	14	0	1.0	5	40	16	6	45	1.48	138	46.58
7539	3	0	2.2	6	22	15	7	61	1.90	79	45.28
7540	7	0	7.6	18	18	21	11	173	1.95	1155	36.95
7541	7	0	7.2	17	18	22	10	163	1.99	1175	36.91
7542	20	0	1.2	5	32	16	8	69	.87	240	50.24
7543	50	0	3.2	11	79	30	18	82	1.59	135	38.64
7544	35	0	2.0	11	69	30	17	76	1.92	211	39.48
7545	15	0	4.0	4	42	17	14	63	.65	66	43.08
7546	5	0	.8	3	14	11	8	57	.36	74	54.73
7547	6	0	.5	4	14	11	8	56	.38	76	53.06
7548	5	0	.6	4	10	13	10	71	.27	92	58.66
7549	5	0	2.2	3	11	11	10	63	.18	81	55.19
7550	5	0	.3	5	22	16	6	35	.28	50	62.81
7551	5	0	.6	4	24	16	8	36	.28	64	65.71
7552	3	0	.5	3	16	13	8	75	.51	104	49.05
7553	3	0	1.4	3	16	10	9	68	.50	100	47.89
7554	35	0	3.6	10	59	20	8	78	1.69	361	38.38
7555	35	0	3.8	16	56	20	12	86	3.10	512	41.32
7556	15	0	1.4	3	40	10	8	52	.23	40	42.40
7557	8	0	1.8	2	41	10	10	44	.28	32	47.88
7558	5	0	1.8	5	27	13	9	50	.41	75	46.74
7559	8	0	2.0	4	31	14	12	54	.35	68	44.07
7560	5	0	1.4	5	29	16	8	59	.27	65	67.56
7561	5	0	1.4	6	31	17	9	67	.37	75	65.74
7562	8	0	1.0	5	29	18	8	74	.31	72	64.30
7563	8	0	.8	4	20	9	6	65	.15	64	53.26
7564	8	0	.8	4	23	10	5	55	.36	61	66.11
7565	10	0	.8	4	23	9	5	58	.28	50	72.93
7566	10	0	.8	4	23	9	6	54	.27	58	66.52
7567	10	0	1.8	5	18	11	4	41	.42	119	53.85
7568	15	0	2.4	6	24	15	9	96	.66	113	32.93
7569	3	0	2.6	4	42	10	5	55	.81	58	44.01
7570	ND	0	2.4	6	41	12	4	72	1.19	98	46.29
7571	5	0	4.4	16	42	21	36	27	.49	43	12.60
7572	6	0	5.6	4	27	11	3	44	.46	40	42.44
7573	10	0	.2	6	35	18	9	85	.25	63	62.69
7574	5	0	.6	3	29	13	9	38	.14	81	36.21
7575	5	0	.4	3	28	13	7	32	.14	64	38.31

7576	8	0	.1	4	22	16	11	78	.32	68	47.92
7577	8	0	.2	6	28	16	11	60	.30	64	50.35
7578	5	0	2.4	3	22	11	8	41	.57	67	36.83
7579	2	0	2.6	3	31	17	12	46	.67	32	51.27
7580	3	0	3.8	2	35	17	7	31	.68	31	59.71
7581	5	0	5.0	3	42	21	9	39	.62	39	60.11
7582	ND	0	5.8	4	40	25	10	41	.82	47	53.99
7583	4	0	1.2	7	20	16	12	56	1.85	93	43.67
7584	9	0	1.2	18	35	24	14	100	10.08	370	54.27
7585	10	0	.4	17	26	23	9	76	15.27	440	47.58
7586	10	0	.1	8	26	78	9	55	1.77	117	34.92
7587	10	0	.1	8	26	19	8	49	1.37	138	34.63
7588	6	0	.1	6	28	20	8	18	.95	77	40.46
7589	6	0	3.8	12	47	18	17	89	1.26	768	47.24
7590	ND	0	3.2	11	41	18	17	86	1.05	587	40.47
7591	3	0	2.6	10	46	14	18	83	1.25	671	46.76
7592	ND	0	3.6	11	48	14	13	79	1.08	451	44.25
7593	8	0	.8	4	18	12	5	31	.58	66	34.22
7594	8	0	1.2	4	18	16	6	28	.35	57	35.10
7595	3	0	2.8	7	24	15	8	42	1.01	82	40.42
7596	4	0	.3	4	16	10	7	25	.52	136	33.69
7597	5	0	1.0	5	20	10	8	36	.72	193	42.95
7598	23	0	1.0	6	30	16	13	161	.25	94	72.09
7599	23	0	.8	5	29	16	11	146	.26	101	72.12
7600	5	0	2.0	5	20	10	5	35	.46	59	32.59
7601	20	0	.8	5	35	12	7	88	.65	76	60.00
7602	25	0	20.0	13	15	10	11	17	26.90	2645	29.43
7603	4	0	5.8	6	30	15	8	50	1.48	322	64.01
7604	8	0	4.4	3	22	10	8	38	.33	19	50.13
7605	7	0	7.0	5	22	11	8	48	.25	33	64.99
7606	6	0	1.2	4	23	11	7	53	.35	46	58.58
7607	4	0	1.2	7	23	17	12	98	.80	111	22.05
7608	4	0	1.2	6	34	15	8	29	1.03	196	40.17
7609	4	0	6.2	20	24	25	6	86	5.20	213	24.84
7610	4	0	16.0	23	30	29	8	106	9.50	268	32.75
7611	10	0	.6	4	21	9	7	47	.46	55	70.98
7612	10	0	.6	4	23	11	8	58	.42	56	72.37
7613	7	0	.8	2	10	7	6	55	.12	39	50.43
7614	6	0	.8	5	120	19	7	35	.20	16	14.17
7615	4	0	1.2	7	33	23	12	33	.87	87	31.47
7616	6	0	.6	4	20	15	7	77	.30	87	68.19
7617	6	0	1.0	3	22	16	9	113	.33	80	64.13
7618	10	0	.8	10	46	25	9	102	.74	60	61.10
7619	ND	0	1.0	11	44	26	10	98	.76	57	60.51
7620	4	0	6.8	4	28	14	6	64	1.97	326	67.17
7621	4	0	.6	3	34	13	7	58	.55	97	51.53
7622	5	0	1.0	3	43	13	10	55	.67	103	44.44
7623	5	0	.8	8	46	13	9	15	1.00	107	50.53
7624	6	0	1.0	7	49	15	5	52	.62	82	41.87
7625	6	0	.8	8	49	17	7	54	.62	98	42.91
7626	5	0	.4	4	43	15	8	51	.56	134	49.16
7627	5	0	.6	7	41	15	11	70	.53	168	50.37
7628	15	0	.1	5	17	7	11	129	.19	123	83.42
7629	4	0	8.0	6	55	25	8	53	1.55	57	51.13
7630	6	0	4.8	5	39	12	8	39	.56	42	44.33
7631	10	0	6.4	8	47	16	11	45	1.03	60	57.84
7632	5	0	2.8	19	16	23	11	79	.87	455	21.73
7633	5	0	2.4	12	18	17	12	83	.81	478	28.40
7634	5	0	2.0	7	22	19	11	87	.79	469	40.54
7635	5	0	2.6	7	20	19	14	88	.84	524	43.56
7636	5	0	2.8	9	21	23	17	92	.84	428	44.43
7637	5	0	3.2	10	21	25	15	92	.79	400	40.05
7638	5	0	1.8	6	22	21	10	88	.78	369	40.43
7639	5	0	2.6	9	21	23	13	90	.84	416	41.09
7640	5	0	.6	4	16	32	10	37	.46	47	67.10
7641	ND	0	.8	4	15	31	11	45	.42	69	67.75
7642	5	0	.4	4	13	23	13	33	.44	64	65.31
7643	5	0	.4	3	14	25	12	35	.43	65	64.50
7644	10	0	3.0	8	53	22	14	76	1.55	197	25.29
7645	15	0	2.4	7	55	27	11	78	1.51	196	23.93
7646	19	0	2.4	9	60	27	13	76	1.45	190	24.69
7647	20	0	3.2	8	55	24	15	78	1.39	177	24.40
7648	15	0	1.8	7	44	23	9	66	1.46	188	19.07
7649	20	0	2.8	4	43	20	14	58	1.24	268	33.30
7650	19	0	3.0	6	45	20	14	62	1.23	268	35.90
7651	10	0	1.4	4	42	18	11	61	.87	107	50.31
7652	8	0	1.8	5	47	21	10	68	.92	98	50.55
7653	15	0	1.8	4	40	18	12	71	.91	106	44.39
7654	13	0	1.8	5	36	17	11	67	.98	94	45.23
7655	14	0	1.6	6	28	12	7	146	.52	187	61.45
7656	7	0	1.6	4	22	14	3	84	.45	142	53.21
7657	5	0	1.6	4	26	9	5	79	.49	64	50.00
7658	5	0	1.6	3	26	10	8	83	.49	74	49.01
7659	5	0	4.8	7	25	13	8	110	1.23	58	45.08
7660	25	0	3.0	8	54	22	9	63	1.31	190	45.39
7661	4	0	1.6	5	33	13	7	35	.75	122	40.18
7662	5	0	1.6	6	36	22	10	71	1.01	140	30.09
7663	10	0	2.0	8	39	17	12	81	1.19	185	31.73
7664	20	0	2.4	8	38	17	11	85	1.18	178	29.50
7665	10	0	2.4	8	34	19	9	77	.81	142	41.59
7666	15	0	2.0	7	32	22	11	82	.94	137	37.44
7667	11	0	1.0	18	22	119	14	127	.80	121	55.67
7668	19	0	1.4	11	23	63	12	104	.44	75	70.49
7669	8	0	1.6	4	128	15	3	49	.70	44	23.33
7670	5	0	9.0	13	27	22	15	141	2.34	535	28.83
7671	6	0	9.0	12	31	21	15	142	2.14	460	22.82
7672	6	0	10.2	7	31	20	13	105	.42	89	32.80
7673	5	0	1.4	5	39	17	11	76	.50	63	61.11
7674	14	0	.6	5	42	16	7	69	.32	39	50.77
7675	20	0	1.6	13	26	65	13	117	4.16	469	52.51
7676	5	0	2.4	4	30	8	10	63	.33	69	51.78
7677	ND	0	2.0	3	21	8	10	40	.30	66	47.12
7678	9	0	3.5	3	18	14	20	46	.25	19	44.24
7679	8	0	3.8	1	20	16	10	42	.36	20	47.56
7680	18	0	4.4	5	39	16	7	83	.76	121	53.34
7681	20	0	5.5	4	34	15	20	81	.61	128	60.69
7682	5	0	3.9	3	26	11	10	40	.74	168	40.54
7683	4	0	3.9	6	26	14	10	48	.73	121	35.66
7684	4	0	1.0	7	39	13	12	79	.91	258	81.98
7685	20	0	1.9	9	42	25	10	176	1.40	209	58.21
7686	2	0	2.7	1	20	24	10	50	1.23	69	53.04
7687	4	0	3.2	2	27	29	10	43	1.40	54	58.31
7688	4	0	1.6	3	20	16	4	27	.42	38	48.19
7689	25	0	4.5	6	31	19	10	79	1.25	480	46.63
7690	7	0	1.7	4	111	13	10	38	.30	38	25.99
7691	8	0	1.8	3	146	10	10	25	.19	113	19.77

NOTE: ND = No Data

SAMPLE NUMBER	SAMPLE DEPTH ft	Ag ppm	As ppm	Co ppm	Cu ppm	Ni ppm	Pb ppm	Zn ppm	Fe %	Mn ppm	LOI %
7692	20	0	1.0	7	36	8	10	267	7.97	349	60.62
7693	5	0	.9	3	15	7	10	71	.22	64	69.31
7694	5	0	1.0	2	15	8	10	71	.22	69	68.18
7695	5	0	1.2	5	19	14	10	66	.52	125	17.45
7696	0	0	1.5	3	22	13	10	73	.34	117	45.99
7697	6	0	.5	4	22	19	3	33	.38	83	45.04
7698	3	0	1.3	3	15	11	8	47	.37	42	49.82
7699	6	0	1.6	3	19	11	10	71	.65	57	55.20
7700	3	0	4.8	3	21	13	10	55	.95	79	48.20
7701	5	0	1.6	2	15	36	3	36	.45	46	37.77
7702	6	0	5.6	23	22	35	14	212	2.98	733	34.52
7703	4	0	2.4	19	9	24	10	117	1.20	395	8.96
7704	5	0	3.0	18	20	26	10	142	1.85	841	31.99
7705	5	0	4.6	21	21	30	10	164	2.03	974	32.56
7706	4	0	2.2	3	28	30	10	73	.88	73	45.61
7707	4	0	1.8	2	20	22	10	44	.44	54	36.61
7708	3	0	3.8	2	29	17	10	40	1.08	26	37.07
7709	3	0	5.8	4	38	10	ND	93	.42	53	57.70
7710	5	0	1.4	1	21	10	10	60	.35	55	62.95
7711	9	0	1.4	2	22	11	10	64	.29	48	63.41
7712	10	0	6.0	1	56	12	10	48	.42	19	47.84
7713	9	0	1.0	4	25	12	10	49	.61	87	75.20
7714	9	0	.8	3	25	12	10	52	.77	81	75.60
7715	19	0	1.4	3	19	7	10	180	2.18	189	69.73
7716	3	0	2.0	3	14	10	8	46	1.07	118	31.92
7717	3	0	1.4	3	13	10	10	43	1.04	109	32.49
7718	6	0	1.0	4	26	14	10	90	.62	98	45.74
7719	3	0	.4	4	40	65	8	50	.32	52	51.32
7720	3	0	3.6	1	13	10	10	46	.29	37	37.53
7721	10	0	.2	6	11	30	10	136	.25	106	85.12
7722	12	0	.4	7	19	36	10	97	.43	68	75.52
7723	15	0	.2	6	18	45	10	92	.30	65	84.09
7724	5	0	.4	6	36	23	10	90	.68	87	41.35
7725	5	0	.4	3	34	18	10	61	.60	74	20.33
7726	18	0	.2	6	19	30	10	121	.46	98	76.35
7727	10	0	.2	6	19	31	10	114	.41	98	76.57
7728	10	0	.2	3	13	21	10	121	.23	76	78.80
7729	5	0	.7	5	23	35	10	95	.59	69	59.19
7730	5	0	.8	1	13	18	10	48	.25	31	64.08
7731	5	0	3.1	6	19	20	12	82	.86	173	37.57
7732	15	0	.2	5	12	32	10	121	.30	85	78.65
7733	5	0	2.8	6	18	21	10	107	.97	219	77.00
7734	5	0	1.6	5	21	15	11	38	.25	45	68.03
7735	25	0	.6	5	32	15	10	73	1.05	296	57.10
7736	8	0	.8	6	22	20	6	129	.33	82	61.69
7737	6	0	1.2	3	16	13	8	53	.14	32	73.01
7738	19	0	.6	6	38	13	10	130	1.65	325	53.22
7739	19	0	.6	6	41	13	10	154	1.40	326	55.13
7740	17	0	2.0	21	55	34	10	116	4.60	574	22.12
7741	17	0	1.8	20	56	34	10	103	4.16	544	19.22
7742	14	0	1.8	24	57	37	10	109	4.80	648	18.64
7743	10	0	2.0	21	58	37	10	92	4.25	584	17.85
7744	9	0	.2	1	15	9	10	38	.29	83	76.20
7745	4	0	1.9	6	38	26	8	66	.50	72	38.57
7746	7	0	1.2	4	36	17	10	64	.57	68	37.55
7749	22	0	1.2	3	33	11	10	58	.84	125	33.86
7750	23	0	1.4	4	38	11	10	62	.94	148	34.60
7751	16	0	.9	5	56	12	10	77	1.44	139	47.47
7752	15	0	1.0	4	51	12	10	68	1.02	108	46.93
7753	15	0	1.1	2	34	46	8	63	.89	99	36.43
7754	13	0	.6	2	25	11	10	42	.50	65	28.92
7755	3	0	.9	2	32	32	5	110	.29	40	30.45
7756	5	0	2.0	6	31	16	10	122	.82	138	49.39
7757	7	0	.8	5	27	15	10	94	.72	137	44.48
7773	5	0	1.2	4	35	18	10	66	.73	120	59.55
7774	5	0	1.6	2	19	8	10	59	1.26	245	37.01
7776	4	0	.6	1	12	7	10	38	.24	70	31.36
7777	9	0	.4	6	48	18	10	57	.82	94	43.44
7778	6	0	.8	3	20	13	10	42	.55	57	60.07
7779	4	0	1.0	4	36	18	10	48	.63	70	36.79
7780	9	0	1.2	16	59	36	10	77	3.73	200	30.25
7781	3	0	.4	4	25	13	10	43	.33	64	43.63
8367	10	0	.4	9	23	28	10	40	1.16	128	35.00
8368	10	0	.6	19	28	80	10	61	1.91	271	32.73
8369	15	0	1.8	29	42	100	10	85	3.34	400	36.70
8370	7	0	.4	14	22	56	10	62	1.14	110	53.05
8371	11	0	.4	9	29	24	10	50	1.03	183	43.37
8372	22	0	.4	15	36	27	10	58	1.82	240	46.47
8382	8	0	.8	19	31	43	10	80	1.36	155	36.61
8383	12	0	.4	18	150	49	10	62	1.54	162	41.00
8384	14	0	1.8	14	28	35	10	63	1.26	218	38.58
8385	13	0	2.2	10	25	28	10	52	.85	115	30.54
8386	7	0	.7	8	31	28	10	24	.85	100	48.84
8387	7	0	1.0	4	22	24	20	40	.34	38	38.83
8388	8	0	.9	6	14	25	10	82	.50	127	52.73
8389	25	0	6.0	32	45	59	10	165	9.73	2060	28.46
8390	15	0	6.4	23	38	44	10	117	5.60	1600	28.44
8401	23	0	4.2	34	41	49	10	180	8.95	2180	26.90
8409	23	0	4.2	34	43	50	10	174	10.23	2420	27.07
8410	23	0	3.8	39	44	121	10	172	10.33	2260	26.26
8411	20	0	3.4	38	42	50	10	161	9.58	2300	23.40
8412	23	0	2.6	34	40	44	10	186	9.46	2000	27.62
8413	16	0	3.8	18	32	32	10	91	3.97	1040	19.58
8414	23	0	2.4	32	42	43	10	198	8.67	1820	29.39
8415	7	0	1.6	4	23	20	10	22	.25	13	35.75
8416	ND	0	.8	12	45	31	10	66	1.07	208	46.24
8417	10	0	.6	11	45	32	10	57	.89	200	46.61
8419	15	0	2.3	14	24	38	10	59	1.01	148	34.76
8420	12	0	2.2	10	20	49	10	67	.52	101	73.14
8421	10	0	.8	7	15	17	10	79	.44	95	77.38
8422	7	0	.7	6	14	19	10	73	.51	87	76.67
8423	10	0	.9	8	14	20	10	68	.59	93	74.14
8424	10	0	.9	11	15	57	10	36	.73	131	43.27
8425	20	0	.7	8	28	20	10	90	.37	65	71.61
8426	12	0	1.0	8	18	20	10	141	.44	215	73.86
8427	15	0	1.1	10	16	38	10	99	.62	101	68.91
8428	21	0	3.0	41	46	49	10	202	10.50	2060	29.28
8429	20	0	3.0	43	43	49	10	210	9.29	2000	28.67

NOTE: ND = No Data

8430	22	0	3.8	42	42	48	10	202	9.20	2080	27.92
8431	21	0	3.8	43	39	48	10	203	8.47	2280	26.79
8432	17	0	3.4	39	39	50	10	210	7.16	2040	30.01
8433	15	0	3.4	35	31	43	10	201	4.70	2040	28.95
8434	13	0	3.4	35	37	47	10	222	7.20	2280	30.55
8435	13	0	5.2	41	40	55	10	210	8.38	2200	29.10
8436	15	0	3.9	40	35	46	10	237	6.09	1680	29.91
8437	17	0	3.8	40	32	47	10	237	6.19	1700	28.67
8438	17	0	5.6	39	28	43	10	177	5.82	1340	22.37
8439	19	0	5.7	37	30	45	10	186	6.03	1700	22.99
8440	17	0	3.5	40	32	46	10	231	6.54	1840	28.12
8441	15	0	8.3	43	37	57	10	197	8.77	2040	25.77
8442	18	0	2.8	35	40	46	10	195	6.56	1040	25.07
8443	23	0	2.4	34	42	38	10	154	4.68	909	23.68
8444	29	0	2.1	29	21	28	10	91	3.20	568	8.87
8445	20	0	2.7	23	28	29	10	80	3.07	621	11.43
8446	5	0	2.2	5	28	26	10	73	1.27	233	32.46
8447	7	0	3.6	11	34	41	10	130	2.49	527	39.56
8448	13	0	4.1	19	30	52	10	166	4.67	967	32.51
8449	12	0	4.2	19	31	53	10	180	4.76	959	33.22
8450	8	0	2.7	7	20	26	10	53	.83	46	49.78
8451	9	0	2.7	6	18	33	10	44	.89	41	40.30
8452	10	0	2.9	10	21	35	10	46	.83	49	42.26
8453	16	0	1.4	5	14	24	10	60	.39	53	69.28
8454	5	0	2.2	2	5	10	10	80	.31	54	67.61
8455	15	0	.6	4	13	10	10	49	.71	261	73.91
8456	4	0	.6	12	15	77	10	64	1.16	83	22.46
8457	3	0	.4	7	11	44	10	35	.83	63	25.59
8458	15	0	.8	3	26	23	10	49	.49	113	61.67
8459	7	0	.6	5	18	41	10	65	.66	70	64.37
8460	10	0	1.1	1	18	22	10	62	.55	156	46.61
8461	7	0	.9	3	52	29	10	46	.80	109	39.15
8462	6	0	1.4	5	40	33	10	54	1.02	220	44.09
8463	7	0	.7	5	56	30	10	51	1.23	126	36.00
8464	6	0	.8	3	38	32	10	59	1.20	103	37.80
8467	4	0	1.8	6	68	36	10	91	1.00	150	63.95
8468	11	0	.7	3	37	15	4	46	.71	131	40.54
8469	11	0	.7	6	37	13	5	44	.71	143	40.57
8470	7	0	.4	4	26	50	6	54	.27	170	48.99
8471	26	0	1.2	7	51	18	13	131	.94	146	63.27
8472	5	0	.8	2	25	27	13	52	.42	69	49.35
8473	7	0	1.5	6	16	28	8	163	.95	579	57.85
8474	4	0	.8	6	20	90	12	69	1.04	102	17.83
8475	2	0	2.1	23	16	60	8	92	1.81	414	21.50
8476	21	0	.8	6	25	12	11	232	6.01	499	65.49
8477	4	0	.7	2	15	47	7	71	.62	150	30.94
8478	10	0	.4	3	23	25	8	204	1.58	230	74.86
8479	13	0	.8	4	24	18	6	63	1.44	215	50.49
8480	12	0	.7	10	21	19	5	124	3.65	267	61.77
8481	13	0	.6	5	24	33	8	111	1.19	143	69.93
8482	12	0	1.1	12	48	46	9	75	1.73	223	38.22
8483	10	0	1.1	15	51	54	8	76	1.68	245	35.86
8484	2	0	.9	10	14	70	16	56	1.07	116	32.97
8485	26	0	1.2	8	45	22	13	81	1.57	248	36.17
8486	14	0	1.7	10	44	19	14	84	1.77	336	33.70
8487	12	0	1.3	10	53	20	10	85	1.78	332	44.39
8488	4	0	1.3	5	30	27	10	66	.46	60	35.42
8489	2	0	1.2	11	27	38	18	83	1.17	148	16.91

8490	4	0	1.6	4	25	27	19	44	.69	156	33.05
8491	5	0	1.7	3	27	8	8	72	.53	76	34.11
8492	4	0	1.5	2	24	9	5	69	.50	67	33.97
8493	5	0	2.8	5	20	19	10	117	1.57	298	35.05
8494	5	0	3.7	7	26	20	12	137	2.36	310	38.23
8495	5	0	3.6	4	22	22	12	125	1.84	323	36.88
8496	18	0	1.8	6	39	19	13	156	1.40	328	41.78
8497	30	0	1.5	4	50	17	9	160	1.23	369	65.15
8498	9	0	1.3	9	46	30	13	88	.72	95	59.23
8499	18	0	1.5	7	39	27	15	80	.70	80	57.37
8500	15	0	1.5	10	40	28	14	81	.71	89	54.25
8501	ND	0	1.0	9	27	52	19	101	1.15	104	19.32
8502	5	0	1.3	6	27	15	13	29	.42	116	51.91
8503	6	0	1.1	3	29	16	8	24	.44	92	51.87
8504	12	0	1.2	7	23	24	6	87	1.36	232	61.43
8505	9	0	1.8	8	23	26	6	86	1.27	225	64.65
8506	4	ND	2.3	9	24	45	6	31	.57	65	21.16
8507	2	0	1.4	8	23	45	6	63	.57	76	33.77
8508	5	0	2.0	4	13	11	6	98	.58	149	63.60
8509	7	0	2.5	5	12	11	8	109	1.02	125	59.03
8510	7	0	.8	5	15	39	7	79	.35	211	63.89
8511	20	0	1.6	2	21	16	7	97	.68	310	71.90
8512	15	0	.8	2	15	13	10	147	.19	103	82.15
8513	12	0	1.0	3	37	24	10	78	.71	137	53.10
8514	15	0	2.5	5	39	26	10	78	1.09	276	29.85
8515	15	0	7.3	8	29	27	8	74	1.20	321	21.97
8516	19	0	5.2	6	39	28	10	85	1.18	297	31.81
8517	20	0	5.6	9	43	29	11	88	1.30	330	33.17
8518	15	0	7.8	8	55	35	8	86	1.42	497	41.76
8519	6	0	7.0	5	25	19	7	82	.90	184	35.03
8520	8	0	8.2	6	30	21	7	80	.93	158	35.45
8521	3	0	.9	3	13	15	6	50	.30	145	47.61
8522	4	0	1.6	4	17	13	10	60	.73	231	56.02
8523	3	0	1.5	1	16	14	13	38	.30	69	56.13
8524	13	0	1.0	11	30	71	12	160	.62	105	33.91
8525	16	0	1.2	6	23	14	7	55	.90	114	48.89
8526	4	0	1.8	9	29	13	4	73	1.22	363	37.78
8527	15	0	5.6	11	34	23	8	92	1.02	189	42.77
8528	10	0	5.4	10	34	22	5	92	.89	193	45.70
8529	12	0	1.1	7	23	12	5	101	.72	305	49.03
8530	12	0	4.5	13	35	24	6	143	2.10	699	40.51
8531	9	0	4.8	14	35	25	10	155	2.21	768	40.95
8532	13	0	4.1	13	32	23	7	134	2.06	770	38.42
8533	3	0	1.0	5	16	14	5	31	.31	55	56.00
8534	7	0	.7	5	12	14	4	42	.38	119	57.81
8535	4	0	2.5	9	22	21	6	145	1.08	243	36.85
8536	7	0	.7	4	26	10	3	53	.30	78	43.52
8537	8	0	5.0	14	30	27	7	150	1.87	397	37.73
8538	5	0	6.2	11	31	22	6	108	1.31	320	45.94
8539	6	0	9.8	13	35	25	9	118	1.93	469	48.41
8540	7	0	7.6	14	30	26	7	163	2.33	550	36.54
8541	15	0	1.0	8	37	20	6	93	.75	109	60.41
8542	7	0	.9	5	26	9	6	38	.30	151	59.13
8543	22	0	4.2	6	25	11	25	79	.99	286	66.42
8544	7	0	.9	5	27	12	3	45	.38	134	79.83
8545	5	0	4.0	4	30	14	7	38	.35	117	40.81
8546	4	0	5.2	7	44	21	8	63	1.08	124	46.79
8547	20	0	7.6	7	44	17	18	79	.76	119	52.37

NOTE: ND = No Data

SAMPLE NUMBER	SAMPLE DEPTH ft	Ag ppm	As ppm	Co ppm	Cu ppm	Ni ppm	Pb ppm	Zn ppm	Fe %	Mn ppm	LOI %
8548	4	ND	2.7	10	71	21	7	97	1.00	212	33.60
8549	4	0	3.3	9	53	22	7	92	1.25	151	38.60
8550	3	0	5.6	10	55	23	13	97	1.97	342	42.08
8551	15	0	1.0	7	29	15	6	119	.39	131	75.46
8552	10	0	1.2	10	42	27	10	124	.89	144	55.37
8553	8	0	.9	9	38	24	8	100	.73	123	63.01
8554	2	0	4.0	11	25	23	7	135	.83	238	39.78
8555	2	0	9.3	10	30	23	7	160	1.17	185	37.35
8556	10	0	1.4	9	26	21	4	107	1.00	140	43.94
8557	8	0	1.0	8	34	21	10	120	.79	190	57.71
8558	5	0	1.2	10	30	22	12	102	.90	123	46.43
8559	14	0	1.3	8	27	16	10	230	.87	150	68.79
8560	35	0	8.8	13	70	22	15	80	2.14	14.43	39.12
8561	25	0	10.1	13	104	32	13	94	2.37	725	42.21
8562	38	0	11.6	10	60	18	14	58	7.90	3040	35.58
8563	14	0	1.0	6	16	10	8	273	.79	96	74.85
8564	6	0	1.0	11	34	30	13	135	1.09	134	36.50
8565	6	0	1.1	12	31	31	10	134	1.26	168	38.69
8566	6	0	1.2	10	47	22	8	131	.97	118	36.20
8567	10	0	4.0	19	41	37	10	196	2.50	465	28.25
8568	11	0	3.0	17	36	34	9	197	2.19	436	33.27
8569	16	0	3.3	20	34	34	10	215	2.77	511	30.85
8570	14	0	5.1	9	42	22	10	75	2.10	199	35.14
8571	11	0	6.4	9	48	22	7	71	1.67	142	46.13
8572	11	0	1.1	8	36	19	7	122	.81	111	63.23
8573	22	0	6.3	12	68	24	9	90	2.14	505	39.72
8574	15	0	12.8	17	73	36	10	155	8.96	1093	36.81
8575	30	0	10.4	23	60	28	9	102	9.25	970	26.67
8576	25	0	6.9	13	63	25	14	89	4.40	519	33.57
8577	18	0	6.6	14	70	29	9	109	2.93	615	36.33
8578	33	0	5.0	12	46	26	17	78	1.82	415	27.40
8579	20	0	7.8	12	59	26	9	67	1.67	441	34.97
8580	42	0	13.0	10	67	21	9	60	10.67	3175	39.80
8581	25	0	12.8	12	94	33	10	93	2.21	725	50.03
8582	8	0	9.2	8	43	22	7	58	1.79	568	36.85
8583	9	0	1.0	7	33	19	11	77	.66	73	25.07
8584	15	0	1.3	11	35	27	10	113	1.28	327	35.49
8585	19	0	1.2	12	31	18	10	78	.31	65	66.06
8586	3	0	4.5	3	190	23	10	23	.27	11	29.55
8587	9	0	4.1	5	81	17	5	27	.45	41	28.96
8588	12	0	4.9	9	42	20	10	66	.56	125	44.85
8589	7	0	2.7	6	48	22	1	68	1.53	266	57.54
8590	14	0	2.4	7	45	19	2	58	1.55	230	55.38
8591	7	0	2.6	9	34	18	1	59	1.16	153	46.00
8592	6	0	2.6	11	45	24	3	82	1.68	192	44.95
8593	20	0	2.2	6	45	22	2	51	.67	140	38.36
8594	16	0	2.5	11	52	26	1	62	1.03	135	39.77
8595	4	0	1.8	4	71	17	15	68	.34	67	22.31
8596	5	0	1.3	7	13	21	3	50	.50	147	59.11
8597	4	0	2.2	8	14	15	5	77	.58	192	38.98
8598	8	0	3.9	4	81	20	1	37	.44	37	29.07
8599	7	0	4.6	4	77	22	2	38	.46	56	36.79
8600	2	0	3.8	6	74	27	6	63	1.02	70	44.12
8601	3	0	4.9	7	84	29	4	92	1.64	119	48.53
8602	3	0	5.1	10	83	30	8	98	1.84	118	48.50
8603	3	0	6.0	8	72	21	17	85	1.40	104	49.22
8604	4	0	2.4	5	68	22	9	64	1.17	88	48.35
8605	3	0	2.4	4	68	23	10	66	1.08	88	44.90
8606	14	0	2.8	7	101	22	10	71	.75	145	33.19
8607	17	0	1.5	16	87	38	10	73	1.42	159	15.35
8608	21	0	1.5	16	132	38	16	95	1.23	148	27.85
8609	12	0	4.0	4	52	84	16	46	.38	46	50.24
8610	4	0	2.9	7	58	18	10	44	.39	63	30.12
8611	5	0	2.9	8	61	19	6	49	.42	75	29.71
8612	20	0	7.9	11	46	17	16	75	12.74	633	53.78
8613	4	0	2.4	9	36	20	13	61	.40	99	31.32
8614	4	0	2.0	7	27	25	10	62	.78	156	37.91
8615	5	0	2.3	7	16	10	8	28	.63	44	65.54
8616	10	0	3.4	12	34	26	10	93	1.10	347	41.59
8617	16	0	2.9	12	35	24	10	89	1.12	299	43.45
8618	3	0	1.9	9	20	22	6	67	.65	143	34.91
8619	15	0	1.2	8	29	16	1	105	.56	70	64.74
8620	10	0	5.6	23	33	29	10	102	2.80	422	17.50
8621	32	0	1.4	7	31	17	6	77	.92	147	57.66
8622	9	0	1.2	6	26	15	9	61	.59	92	73.64
8623	6	0	2.6	11	40	23	1	63	1.07	184	49.63
8624	12	0	5.1	13	48	24	11	98	1.93	305	45.87
8625	8	0	4.4	8	31	21	10	64	1.24	219	46.68
8626	9	0	2.4	6	21	12	16	104	.40	87	73.58
8627	7	0	1.9	5	17	10	20	65	.60	142	70.52
8628	4	0	1.0	9	17	14	20	45	.23	83	59.97
8629	3	0	4.4	9	19	15	8	62	.72	188	35.88
8630	14	0	3.1	9	16	16	7	163	.40	149	72.70
8631	4	0	1.1	3	14	11	10	42	.34	85	54.74
8632	4	0	3.1	2	18	12	10	40	.23	65	41.89
8633	4	0	4.0	10	21	18	10	81	.85	240	27.93
8634	11	0	3.1	7	27	30	9	92	1.17	253	36.31
8635	19	0	4.2	11	30	18	2	91	2.00	479	38.09
8636	12	0	3.4	13	30	20	6	85	1.39	425	41.10
8637	2	0	1.7	11	48	28	9	99	1.00	151	49.50
8638	3	0	1.3	10	46	29	5	93	1.00	133	49.92
8639	3	0	1.7	11	44	30	10	94	.95	136	47.35
8640	3	0	1.8	10	44	28	10	89	.93	126	47.81
8641	5	0	1.3	6	18	15	4	43	.40	78	52.99
8642	12	0	1.7	11	44	26	11	94	.57	115	62.45
8643	5	0	8.6	11	33	21	6	100	1.10	91	56.56
8644	7	0	7.2	8	25	11	10	55	.48	57	42.03
8645	13	0	1.2	8	46	17	2	116	1.60	317	64.49
8646	18	0	1.9	6	46	23	5	110	1.44	342	50.63
8647	23	0	1.4	5	35	15	9	122	1.19	376	50.76
8648	24	0	2.1	3	63	13	10	149	1.13	164	56.40
8649	17	0	1.5	3	30	14	16	100	.20	66	63.71
8650	14	0	1.4	4	32	13	18	110	.22	62	64.86
8651	3	0	1.9	9	50	27	2	103	.84	116	51.17
8652	3	0	1.4	11	39	26	10	89	1.08	117	48.86
8653	2	0	4.2	10	36	24	20	85	.89	129	48.27
8654	4	0	3.6	5	34	7	20	80	.40	90	37.81
8655	12	0	5.1	5	105	18	11	63	.31	137	38.92

NOTE: ND = No Data

8656	40	0	1.1	3	31	14	10	219	.64	316	73.95
8657	ND	0	1.6	5	54	17	10	170	.93	236	62.04
8658	10	0	.6	1	7	6	10	49	.07	82	87.30
8659	10	0	.5	1	8	6	11	77	.07	114	90.49
8660	2	0	2.0	4	19	20	10	91	.26	120	45.25
8661	22	0	2.5	3	70	21	10	134	.72	142	56.45
8662	21	0	2.1	8	74	20	10	178	.80	180	51.95
8663	16	0	1.4	6	57	18	9	151	.63	196	63.62
8664	7	0	1.6	7	34	14	8	82	.66	151	34.81
8665	6	0	.9	3	20	15	2	27	.14	61	62.12
8666	13	0	1.2	7	23	12	20	105	.55	272	59.42
8667	13	0	6.0	4	13	16	10	52	.08	48	73.91
8668	5	0	.8	3	21	12	6	35	.22	55	40.91
8669	4	0	1.5	3	219	15	10	40	.34	47	39.84
8670	5	0	3.5	7	55	21	10	77	.79	80	31.05
8671	4	0	1.4	4	25	16	9	77	.62	126	41.66
8672	28	0	3.5	9	70	21	11	77	1.75	267	37.85
8673	26	0	3.4	9	76	22	7	71	1.99	300	38.45
8674	8	0	1.2	3	15	14	10	65	.30	70	50.92
8675	4	0	2.2	4	20	13	8	78	.31	69	50.80
8676	3	0	1.1	3	15	15	9	27	.30	118	39.90
8677	11	0	.7	3	15	12	8	100	.33	166	71.49
8678	6	0	.9	4	15	13	7	30	.41	65	68.84
8679	7	0	2.4	4	19	17	11	65	.84	122	40.09
8680	6	0	3.4	6	20	19	12	117	.93	258	33.08
8681	7	0	4.5	7	24	21	21	103	1.20	344	40.13
8682	10	0	.9	1	10	13	9	74	.23	36	63.45
8683	5	0	.7	1	18	12	8	28	.14	26	41.79
8684	9	0	.6	1	14	10	12	33	.14	42	66.51
8685	12	0	1.0	3	27	19	10	175	.28	86	67.53
8686	35	0	6.9	18	34	30	30	143	3.61	670	16.58
8687	50	0	6.4	20	42	32	6	114	2.97	874	17.23
8688	45	0	6.4	16	34	29	16	100	3.22	764	12.10
8689	50	0	6.0	27	35	34	10	160	4.83	1419	22.95
8690	7	0	3.3	4	17	17	22	122	.85	275	41.47
8691	7	0	2.4	4	14	23	7	142	.92	277	41.60
8692	7	0	3.3	5	18	21	11	132	.98	300	39.81
8693	7	0	4.0	5	20	16	10	86	1.34	296	28.00
8694	45	0	6.5	29	35	34	11	163	5.82	1936	22.29
8695	45	0	5.0	37	35	37	10	192	7.22	2511	24.85
8696	36	0	4.9	9	26	16	10	70	.98	406	34.82
8697	40	0	4.4	14	26	24	2	64	1.97	711	9.52
8698	9	0	5.5	9	23	21	17	103	1.46	377	39.01
8699	8	0	2.5	6	14	17	9	116	.82	179	27.43
8700	8	0	6.4	10	19	20	10	100	1.35	241	27.35
8701	6	0	2.2	6	13	19	11	126	.83	279	38.39
8702	7	0	1.9	4	15	10	10	62	.57	131	18.61
8703	95	0	10.5	30	41	32	10	169	6.94	1790	28.66
8704	11	0	4.6	7	26	13	32	66	1.41	536	59.91
8705	34	0	5.0	14	40	33	32	202	2.40	702	27.28
8706	55	0	4.0	15	26	27	20	150	2.47	612	10.56
8707	30	0	4.0	13	29	29	19	175	2.40	820	17.49
8708	28	0	5.8	14	35	32	30	245	2.47	860	25.97
8709	28	0	10.4	10	24	19	10	87	1.49	451	54.28
8710	7	0	1.2	4	11	19	9	37	.16	56	69.84
8711	8	0	1.0	3	10	14	8	142	.30	330	67.59
8712	7	0	.8	2	10	12	3	51	.14	61	68.06
8713	7	0	1.4	7	30	20	10	109	.94	238	64.41
8714	9	0	1.0	5	21	19	70	105	1.00	308	74.48
8715	5	0	1.4	5	15	12	4	85	1.27	286	42.47
8716	5	0	1.2	6	40	23	10	115	.22	83	37.36
8717	4	0	.8	6	40	23	2	132	.77	177	42.83
8718	35	0	1.8	5	21	18	8	552	.49	139	43.76
8719	50	0	3.2	5	30	20	4	189	.70	157	11.95
8720	25	0	1.6	7	32	15	7	305	.84	368	74.51
8721	6	0	1.0	10	32	24	11	92	.55	197	38.83
8722	9	0	3.6	13	24	20	6	93	1.20	349	32.75
8723	25	0	1.9	5	14	17	9	37	1.16	365	9.12
8724	4	0	1.0	3	39	12	12	265	.15	75	57.81
8725	10	0	.8	3	23	16	7	74	.21	64	77.03
8726	13	0	1.2	8	23	21	10	104	.53	159	68.07
8727	20	0	.8	7	25	10	8	104	.55	207	73.41
8728	22	0	1.8	12	22	12	7	259	1.11	249	73.39
8729	3	0	1.0	13	14	17	3	60	.40	215	65.46
8730	4	0	1.2	9	35	22	8	130	.60	98	36.12
8731	40	0	7.2	23	40	36	24	111	3.33	980	17.54
8732	24	0	4.2	10	21	14	17	62	.69	237	63.77
8733	28	0	4.1	11	29	15	6	116	1.16	339	71.96
8734	15	0	5.4	14	36	27	20	89	2.00	720	31.15
8735	6	0	3.5	10	27	20	5	111	1.34	359	36.06
8736	2	0	4.9	5	20	18	12	78	.74	160	36.89
8737	6	0	2.5	18	20	28	10	117	3.36	833	49.86
8738	6	0	.2	5	5	2	5	5	.21	368	89.67
8739	6	0	2.3	5	23	12	1	57	.45	86	69.29
8740	8	0	2.2	12	39	27	11	120	.97	222	51.89
8741	10	0	14.0	13	43	20	7	76	5.00	1100	46.97
8742	35	0	10.0	20	68	38	10	109	3.50	1098	35.97
8743	25	0	13.0	21	51	36	11	99	3.90	1225	28.38
8744	20	0	2.7	12	46	15	7	206	1.76	239	69.85
8745	18	0	1.7	11	30	17	6	144	1.04	382	64.88
8746	13	0	.9	13	38	18	3	107	.50	187	70.00
8747	10	0	1.3	15	33	21	5	204	.80	386	61.88
8748	25	0	20.0	17	26	13	3	173	13.09	1512	56.10
8749	17	0	1.4	15	35	23	2	182	.37	91	69.07
8750	30	0	5.2	14	54	31	11	97	1.80	194	46.27
8751	30	0	4.0	15	56	33	12	99	1.30	190	48.25
8752	29	0	7.9	12	30	21	30	78	1.50	302	59.81
8753	10	0	3.2	10	17	14	7	152	1.00	131	74.49
8754	22	0	2.2	12	16	17	6	48	.97	274	10.93
8755	18	0	2.6	14	17	23	10	48	1.72	247	8.99
8756	16	0	3.4	13	27	21	12	52	1.85	445	15.00
8757	16	0	3.8	14	21	25	14	69	1.75	299	14.62
8758	34	0	2.0	11	46	27	7	41	.82	172	50.09
8759	25	0	5.0	13	29	21	17	84	1.36	353	50.40
8760	13	0	4.8	13	29	22	34	77	1.60	395	34.49
8761	18	0	1.6	6	12	9	12	21	.53	265	76.71
8762	12	0	1.4	8	42	13	12	30	.76	210	60.53
8763	17	0	2.6	15	26	20	20	68	1.53	273	21.55
8764	14	0	2.0	13	20	18	10	43	1.35	291	17.28
8765	14	0	1.8	8	35	18	4	105	1.03	178	52.92
8766	19	0	1.1	6	47	23	3	91	.41	71	65.77
8767	11	0	.9	8	31	19	2	110	.27	112	63.89
8768	6	0	.9	7	22	14	2	20	.35	108	74.82
8769	6	0	3.7	4	19	11	4	65	.49	149	55.89
8770	12	0	8.5	18	44	27	10	100	2.76	459	32.17
8771	12	0	7.3	13	38	25	8	77	1.92	430	20.48

NOTE: ND = No Data

SAMPLE NUMBER	SAMPLE DEPTH ft	Ag ppm	As ppm	Co ppm	Cu ppm	Ni ppm	Pb ppm	Zn ppm	Fe %	Mn ppm	LOI %
8772	10	0	1.5	6	15	12	5	30	.23	85	76.52
8773	19	0	6.4	5	30	13	3	57	.73	131	68.62
8774	10	0	5.1	5	22	11	6	42	.38	113	60.13
8775	20	0	.9	6	32	15	6	92	.38	114	63.31
8776	7	0	.7	6	29	18	5	26	.24	127	76.52
8777	18	0	.5	7	23	12	7	126	.21	162	56.52
8778	25	0	5.5	18	28	25	13	107	2.62	602	19.05
8779	30	0	7.0	20	41	22	23	126	4.26	741	32.35
8780	22	0	1.7	7	18	8	6	136	.28	171	75.86
8781	7	0	7.6	8	40	18	7	109	.84	321	53.16
8782	22	0	2.6	13	61	19	6	174	.37	258	65.98
8783	4	0	.8	5	15	11	4	47	.21	57	79.14
8784	8	0	.8	5	13	9	5	36	.15	55	78.70
8785	9	0	8.3	10	31	22	8	97	2.14	230	43.05
8786	8	0	7.2	10	22	21	4	80	1.57	264	39.39
8787	6	0	.7	3	19	14	7	70	.23	50	67.40
8788	19	0	15.4	8	33	11	3	31	1.16	44	42.47
8789	9	0	1.1	7	17	15	6	38	.18	82	73.36
8790	25	0	2.5	7	40	23	8	131	.62	123	70.98
8791	5	0	1.0	5	36	21	7	43	.36	66	68.64
8792	5	0	1.5	6	22	9	8	23	.86	224	83.10
8793	8	0	.7	6	34	18	4	41	.33	103	41.38
8794	20	0	1.8	5	56	20	9	249	.89	126	66.49
8795	6	0	2.6	9	28	19	18	88	1.27	422	30.11
8796	8	0	1.3	7	14	28	8	141	.15	43	70.47
8797	12	0	9.4	12	43	51	6	84	.90	228	43.52
8798	11	0	5.1	14	33	51	15	116	.90	263	47.26
8799	10	0	2.4	12	30	30	6	113	.97	322	47.61
8800	10	0	1.9	17	20	31	4	107	1.11	318	43.01
8801	15	0	2.1	13	28	30	8	111	1.34	322	46.42
8802	7	0	2.5	13	28	29	13	93	1.12	370	50.22
8803	9	0	3.0	8	17	15	8	58	.47	101	41.78
8804	19	0	1.3	10	48	24	11	115	.52	75	66.71
8805	5	0	8.3	5	23	11	5	43	.16	41	58.02
8806	10	0	2.3	12	15	31	9	82	.89	154	22.27
8807	10	0	3.7	16	18	46	9	115	1.13	209	26.66
8808	8	0	4.0	15	22	38	5	117	1.22	242	31.20
8809	10	0	1.1	13	30	25	8	123	.68	137	67.08
8810	15	0	20.2	17	16	10	8	132	19.11	821	47.29
8811	2	0	1.8	18	22	26	12	84	1.47	394	19.67
8812	6	0	1.9	10	21	19	6	83	1.12	320	37.29
8813	5	0	1.0	13	23	19	11	82	.40	124	37.29
8814	15	0	3.4	12	22	32	9	106	2.21	492	39.95
8815	6	0	2.8	7	14	19	6	59	.79	228	36.37
8816	15	0	2.4	10	17	25	8	99	1.84	390	30.58
8817	15	0	3.8	12	27	37	11	125	2.84	527	40.05
8818	16	0	4.0	11	22	30	9	110	1.83	431	30.73
8819	16	0	4.7	13	26	34	10	137	2.20	480	32.73
8820	15	0	4.4	14	23	31	6	133	1.99	414	30.00
8821	15	0	1.3	15	46	61	14	151	.88	122	56.10
8822	10	0	.7	10	33	42	9	173	.50	121	60.00
8823	2	0	1.6	11	15	37	6	58	.66	143	62.36
8824	50	0	12.0	10	45	34	9	80	18.0	1800	38.38
8825	70	0	1.2	14	19	26	9	96	15.0	7500	39.21

NOTE: ND = No Data

SAMPLE NUMBER	SAMPLE DEPTH ft	Ag ppm	As ppm	Co ppm	Cu ppm	Ni ppm	Pb ppm	Zn ppm	Fe %	Mn ppm	LOI %
8826	60	0	15.0	11	17	26	8	61	21.0	7200	36.39
8827	65	0	15.0	13	20	31	9	86	19.0	7600	37.01
8828	6	0	12.0	7	6	14	9	74	3.22	575	72.84
8829	6	0	1.2	6	10	18	3	127	.81	145	53.04
8830	5	0	4.1	5	14	12	4	48	.79	372	44.82
8831	8	0	5.1	14	28	45	7	125	1.14	235	35.66
8832	7	0	2.8	11	24	46	9	102	1.02	194	38.70
8833	3	0	3.5	10	17	40	10	78	1.03	166	28.46
8834	4	0	1.6	6	20	28	12	28	.94	79	28.93
8835	35	0	2.9	13	39	35	16	124	2.10	725	44.47
8836	20	0	2.6	14	23	32	6	75	1.36	404	26.48
8837	40	0	10.0	6	31	20	12	145	2.13	441	69.32
8838	ND	0	3.7	25	27	31	8	90	3.03	653	32.65
8839	10	0	2.8	33	12	32	8	116	2.48	482	12.80
8840	20	0	2.7	30	33	39	7	102	2.80	790	36.71
8841	24	0	2.5	33	31	35	6	99	3.38	814	37.01
8842	15	0	3.2	26	33	38	7	107	2.47	924	36.90
8843	9	0	1.0	4	33	20	6	85	.52	67	67.10
8844	20	0	1.1	4	30	15	6	66	.36	64	62.99
8845	10	0	.8	4	35	21	6	70	.48	70	66.05
8846	14	0	2.9	5	35	18	5	108	.57	88	39.03
8847	9	0	12.0	4	144	29	5	54	.55	11	21.77
8848	4	0	1.7	8	17	17	5	52	.77	177	71.27
8849	3	0	.7	7	11	14	4	112	.37	189	77.04
8850	5	0	4.0	9	23	20	6	84	1.58	257	32.04
8851	4	0	1.9	4	23	16	3	35	.46	26	35.01
8852	6	0	.9	6	25	13	10	52	.59	243	66.22
8853	6	0	.4	4	17	7	4	78	.40	458	85.20
8854	2	0	1.9	6	18	26	8	40	.37	105	52.97
8855	7	0	.9	5	11	19	5	21	.33	51	64.19
8856	22	0	7.8	6	10	5	5	173	14.0	2700	55.71
8857	3	0	.8	3	13	8	9	47	.24	83	49.52
8858	13	0	.6	4	17	10	3	97	.20	85	79.94
8859	5	0	2.1	6	14	10	14	61	.74	171	17.46
8860	7	0	3.7	5	33	21	3	25	.51	306	43.25
8861	10	0	1.0	9	53	28	4	107	.65	163	38.71
8862	5	0	3.0	14	29	23	5	89	1.73	307	18.17
8863	5	0	3.9	17	18	12	19	92	1.10	1040	42.48
8864	8	0	1.9	7	37	28	6	65	1.03	191	50.80
8865	10	0	5.7	9	43	22	3	79	3.05	389	53.39
8866	6	0	3.6	8	33	26	2	65	1.63	230	47.13
8867	15	0	2.5	11	41	34	3	97	1.70	433	44.59
8868	15	0	2.3	11	32	32	5	96	2.00	626	41.34
8869	15	0	1.9	10	36	32	4	90	1.44	453	43.02
8870	20	0	3.7	11	38	28	8	72	1.24	451	48.62
8871	5	0	2.9	6	19	12	4	41	.60	120	38.92
8872	10	0	1.0	4	24	12	5	47	.32	127	47.61
8873	25	0	1.0	4	17	12	3	100	.27	96	75.09
8874	35	0	1.6	9	20	14	4	186	1.36	492	72.64
8875	35	0	.8	3	11	6	3	115	.73	79	83.75
8876	25	0	5.6	12	32	20	11	95	1.41	519	38.02
8877	25	0	7.7	13	33	20	11	110	1.73	593	36.93
8878	20	0	8.0	13	34	20	9	109	1.61	667	38.58
8879	15	0	7.5	15	35	21	11	134	1.71	770	44.43

8880	15	0	6.0	11	33	19	11	105	1.35	641	49.28
8881	25	0	7.4	12	31	17	17	116	2.10	792	42.61
8882	11	0	7.6	14	37	18	6	107	1.44	477	45.24
8883	18	0	6.6	6	35	17	8	116	1.89	596	41.74
8884	9	0	2.8	9	26	16	18	75	1.45	500	30.82
8885	9	0	3.3	10	28	18	29	80	1.50	403	26.11
8886	5	0	4.4	8	30	16	9	105	.99	363	38.90
8887	3	0	1.2	5	24	19	13	79	.49	171	45.34
8888	10	0	.7	3	21	10	9	132	.31	202	72.65
8889	12	0	.6	2	12	7	8	126	.35	222	81.29
8890	13	0	.7	3	26	15	3	174	.38	248	73.54
8891	22	0	1.7	12	67	26	6	106	.75	128	57.87
8892	14	0	.6	3	24	11	2	102	.27	113	75.64
8893	22	0	1.3	10	60	25	6	113	.61	90	59.27
8894	4	0	.8	3	20	15	5	42	.30	82	65.04
8895	28	0	9.2	12	42	35	4	94	3.15	708	23.12
8896	52	0	8.3	8	38	26	9	79	2.37	797	25.09
8897	25	0	6.1	12	37	30	10	96	2.14	504	18.34
8898	35	0	6.9	8	43	26	11	100	1.62	428	27.86
8899	6	0	2.9	4	20	17	2	60	1.03	545	48.61
8900	11	0	3.2	10	24	24	4	81	2.03	536	37.00
8901	12	0	2.5	10	28	24	6	83	1.70	440	47.23
8902	19	0	2.7	9	30	25	5	89	2.21	467	47.77
8903	9	0	2.9	5	32	20	11	43	1.11	570	63.75
8904	16	0	1.2	4	29	19	10	171	.82	265	65.63
8905	25	0	3.7	13	21	17	8	222	12.00	2400	57.44
8906	25	0	.7	4	30	19	20	204	.75	282	73.24
8907	10	0	.4	3	10	11	9	130	.70	66	72.83
8908	12	0	1.9	9	11	22	8	51	1.43	241	11.10
8909	23	0	3.0	14	17	30	4	79	2.10	542	20.03
8910	25	0	2.0	11	12	26	6	42	1.58	162	12.11
8911	15	0	3.5	10	35	35	19	73	1.50	671	45.18
8912	15	0	2.7	8	23	25	20	63	1.32	364	53.00
8913	33	0	2.3	10	18	25	20	60	1.45	381	31.45
8914	33	0	2.8	7	18	24	13	56	.88	270	42.80
8915	33	0	2.4	15	24	32	28	95	1.91	431	24.71
8916	33	0	2.8	13	20	32	28	94	2.56	380	17.51
8917	25	0	2.6	14	18	26	12	65	1.65	487	29.88
8918	15	0	1.7	4	23	20	11	28	1.27	305	44.75
8929	4	0	1.1	4	13	7	6	35	.26	48	69.15
8930	1	0	1.5	5	11	9	13	55	.35	102	45.57
8931	20	0	2.0	11	90	43	11	87	1.53	440	56.37
8932	7.5	0	1.7	9	17	22	10	80	.78	245	45.94
8933	7	0	2.9	12	18	30	10	116	1.25	352	41.71
8934	6.5	0	3	12	20	34	10	118	1.26	294	42.25
8935	7	0	3.5	12	19	33	10	124	1.18	300	44.21
8936	9	0	2.5	10	26	26	10	75	.85	296	43.74
8937	6	0	4	5	12	12	10	73	.36	74	58.01
8938	4	0	8	8	18	28	10	64	.35	82	63.16
8939	2	0	1.6	10	14	16	10	74	.62	158	19.4
8940	9	0	1.2	3	8	5	10	53	.26	70	76.88
8941	6	0	7	11	13	14	10	122	.58	354	52.63
8942	1	0	5.6	10	19	10	10	109	.62	218	39.4
8943	4	0	1.6	6	13	12	10	54	.22	80	46.03
1	ND	ND	ND	ND	8	22	17	72	1.03	500	24.3
2	ND	ND	ND	14	12	27	30	106	1.12	600	41.3
3	ND	ND	ND	22	36	45	38	87	1.55	365	43.6
4	ND	ND	ND	15	27		44	27	72	1.34	323

NOTE: ND = No Data

3733	8	0	1.4	9	17	14	2	70	1.10	178	68.8
3734	16	0	1.2	7	17	10	4	68	.53	174	64.2
3735	11	0	1.6	7	18	16	4	66	.70	164	66.9
3736	6	0	2.0	10	26	23	3	42	.81	300	62.0
3737	11	0	1.6	9	30	20	10	59	.95	295	48.2
3738	13	0	1.3	9	28	20	2	56	1.00	253	46.8
3739	12	0	1.8	8	30	18	8	63	.81	267	46.8
3740	7	0	1.6	10	30	21	7	62	.51	205	51.5
3924	24	0	5.2	30	36	61	7	135	6.84	1574	29.5
3925	20	0	4.6	25	34	58	9	119	5.46	1624	31.7
3926	21	0	4.3	22	33	53	3	109	4.35	1425	32.0
3927	21	0	4.5	24	30	51	4	108	4.37	1560	30.5
3928	24	0	5.1	27	32	55	7	120	4.77	1528	28.3
7250	3	0	.8	2	11	7	0	48	.34	86	39.84
7251	3	0	1.2	4	12	10	0	44	.36	93	41.56
7236	20	0	1.6	10	32	18	10	89	2.38	420	61.43
7275	10	0	1.6	4	35	17	0	54	.98	170	29.56
7276	10	0	1.6	9	38	22	10	66	1.14	187	22.28
7277	15	0	1.6	12	39	26	10	79	2.18	214	17.84
7291	3	0	1.4	3	22	10	10	45	0.46	126	35.05
7292	17	0	1.8	6	33	12	10	82	1.26	197	29.55
7294	18	0	1.8	9	46	20	10	103	2.35	258	31.64
7988	8	0	2.5	12	26	42	12	94	.62	238	44.86
7991	10	0	3.4	12	12	38	11	150	.42	92	62.44
7992	8	0	.8	12	10	18	13	128	.44	80	68.82
7993	8	0	1	6	12	20	14	166	.46	78	66.3
7994	10	0	.9	8	12	18	10	154	.58	66	66.8
7995	12	0	.8	16	10	34	10	188	.54	114	64.46
7997	6	0	3	10	22	36	16	68	1.16	164	47.52
7998	8	0	5.7	6	30	32	14	48	1.1	80	63.92
7999	4	0	3.6	10	30	60	13	48	1.96	174	44.28
8000	7	0	4.9	20	36	50	11	68	1.5	390	33.24
8001	12	0	1.9	16	40	46	12	102	1.06	208	42.24
8002	9	0	1.4	16	40	42	10	106	1.08	256	40.44