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Ministry of Northern Development and Mines

Ontario

MINES AND MINERALS DIVISION ONTARIO GEOLOGICAL SURVEY

MAP 80807

GEOCHEMICAL SURVEY

PANCAKE LAKE AREA

NTS References: 41 N/1, 41 N/2, 41 K/15 and 41 K/16

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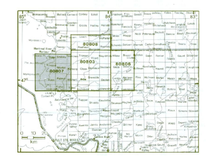
This project is part of the five-year Canada–Ontario 1985 Mineral Development Agreement (COMDA), a subsidiary agreement to the Economic and Regional Development Agreement (ERDA), signed by the governments of Canada and Ontario.



"Geochemical maps can be used in: (1) mineral exploration, (2) pollution studies, (3) environmental health, and (4) agriculture, and are, therefore, of great value in regional planning."

R.T. Ottosen and B. Bölviken (1988, p.47)

INTRODUCTION

The Pancake Lake geochemical map area is a part of a regional geochemical survey of the entire Batchawana greenstone belt being completed by the Ontario Geological Survey (OGS) over a multi-year period (see location map). The east margin of this map abuts the west margin of the Trout Lake map (Fortescue and Vida 1989). A third map in the series, covering an area to the east of the Trout Lake area, was released in late 1990 (Fortescue and Vida 1990b).

The Pancake Lake map is based on results obtained using standardized field, laboratory and data processing methodologies (Figure 3). Every effort has been made to standardize the format of geochemical maps in this series, as discussed by Fortescue, Vida and Nakashima (1988).

Regional geochemical maps are primarily designed for mineral resource appraisal purposes. They provide a more accurate description of the geochemistry of an area than the traditional reconnaissance geochemical mapping techniques applied in Ontario during the 1970s and 1980s (Friske 1988). Another general aim of the OGS maps is to provide geochemical information of a comparable scientific standard to regional geological and geophysical maps¹completed in the same area. This is particularly important when geoscience image processing and geographical information systems (GIS) are applied to a multidisciplinе data base (Figure 2).

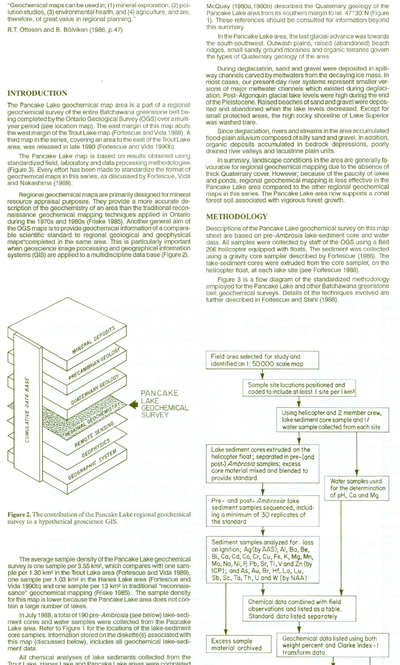


Figure 2. The contribution of the Pancake Lake regional geochemical survey to a hypothetical geoscience GIS.

The average sample density of the Pancake Lake geochemical survey is one sample per 3.33 km², which compares with one sample per 1.30 km² in the Trout Lake area (Fortescue and Vida 1989), one sample per 1.03 km² in the Hanes Lake area (Fortescue and Vida 1990b) and one sample per 13 km² in traditional "reconnaissance" geochemical mapping (Friske 1988). The sample density for this map is lower because the Pancake Lake area does not contain a large number of lakes.

In July 1988, a total of 190 pre–*Ambrosia* (see below) lake-sediment cores and water samples were collected from the Pancake Lake area. Refer to Figure 1 for the locations of the lake-sediment core samples. Information stored on the lake-sediment cores at this map (discussed below), includes all geochemical lake-sediment data.

All chemical analyses of lake sediments collected from the Trout Lake, Hanes Lake and Pancake Lake areas were completed by Chemex Labs Ltd. of Mississauga, under contract to the OGS. Identical sample preparation techniques and methods of chemical analysis were employed by the contractor for all the projects (Figure 3).

The concentrations of 35 elements (plus loss on ignition (LOI)) were determined in each of the lake-sediment samples. The pH of cooled lakewater samples was measured within 24 hours of their collection. Levels of Ca and Mg in the water were determined by the OGS Geoscience Laboratories in Toronto.

The entire Pancake Lake geochemical map data base is available on diskette(s) in ASCII format on request from the Geophysics/Geochemistry Section, OGS. **Note:** information stored on the diskette(s) includes some tabulated data referred to in the marginal notes, but not appearing on this geochemical map.

For readers without access to a computer, a list of the 50 highest geochemical results for each of the 35 elements included in the survey is provided on Table 1 (on the reverse side of this map). Table 1 was assembled by 1) ranking, from highest to lowest, all 190 sample results for each element (in ppm and Clarke Index units) with their respective sample code information, and 2) listing the top 50 values for all elements (see below). The lake codes facilitate fast location of sample sites of interest listed on Table 1 and plotted on Figure 1 (see Table 1 title for explanation).

Table 1 also lists the pH data for 49 lakewater samples. They include the lowest 24 and the highest 25 pH values within the entire data set. All pH values are accompanied by their respective Ca and Mg values. Similarly, the LOI data were ranked from the lowest (i.e., mineral-rich) to highest (i.e., organic-rich) and with an ecological overlist 50 LOI values are included in Table 1 to indicate mineral-rich lakes.

A comprehensive interpretation of the geochemical data base, using advanced statistics, image processing and Geographic Information system (GIS) is beyond the scope of this brochure.

Geochemical sampling in support of this map sheet was carried out during July 1988 by J.A.Z. Fortescue, and H. Stahl. The broadsheet was prepared during the winter and spring of 1990–91 by E.A. Vidi and J.A.Z. Fortescue.

OBJECTIVES

The Pancake Lake geochemical survey had the following objectives:

1. to complete a regional-level, mineral resource appraisal, geochemical survey of a 27 km by 30 km area in the western part of the Batchawana greenstone belt. (Figure 1 map frame includes the Lake Superior coast (810 km²), but the area sampled is approximately 674 km².)
2. to determine the concentrations of 35 elements (Ag, Al, As, Au, Ba, Be, Bi, Br, Ca, Cd, Co, Cr, Cu, Fe, Hf, K, La, Lu, Mg, Mn, Mo, Na, Ni, P, Pb, Sb, Sc, Sr, Ta, Th, Ti, U, V, W and Zn), plus LOI, in pre–*Ambrosia* lake sediments collected from all lakes and ponds in the survey area, and to determine the pH, and Ca and Mg contents of lakewaters collected from each sample site
3. using a standardized format, to provide an introduction to the interpretation of patterns in the geochemical data base at the global province-wide), regional and detailed levels
4. to identify geochemical patterns of possible importance in mineral exploration

DESCRIPTION OF THE PANCAKE LAKE AREA

Location

The Pancake Lake area is situated at the west end of the Batchawana greenstone belt and 62 km northwest of Sault Ste. Marie (see location map).

The 674 km² map area includes all of Kincaid, Nicolet, Ryan and Palmer townships, most of Slater, Smiley, Norberg, Wishart, Herrick and Fisher townships, and parts of Tolmonen and Tilley townships.

Bedrock Geology

As a part of the Batchawana Synoptic Project, Grunsky (1981, 1982, 1983, 1987a, 1987b, in prep.), described the general bedrock geological setting of the Pancake Lake area. The Mamainse Point–Batchawana Bay and Batchawana Bay–Goulais Bay sheets provide a 1:50 000-scale preliminary geological maps for the entire Pancake Lake area (Grunsky 1987a, 1987b).

The geology of the entire Batchawana greenstone belt, including the Pancake Lake area, is described in and comprehensive report by Grunsky (in prep.). Details of age relationships among the lithologic units of the Batchawana greenstone belt were described by Corfu and Grunsky (1987). These references should be consulted for detailed geological information on the Pancake Lake area.

The Pancake Lake map area includes the western limit of the Batchawana greenstone belt, which is bounded by granitic terranes to the north and to the southeast. The greenstone belt is composed of Archean metavolcanic and metasedimentary rocks (Figure 4). These rocks were structurally deformed, metamorphosed, hydrothermally altered, faulted and intruded by felsic plutonic rocks. A minor period of mafic intrusion (gabbro) occurred in the area during the middle Precambrian. In the late Precambrian, the Keweenawan formations were deposited and the breccia pipes were formed. During the Cambrian, the Mica Bay and then the Jacobsville Formations were deposited (Grunsky, in prep.).

Figure 1 shows the general geology of the Pancake Lake area. Diabase dikes were omitted from Figure 1 because they contribute little to the volume and geochemistry of the rocks in catchment areas where they are found.

The geology of the Batchawana greenstone belt and its surrounding granitic rocks was divided by Card (1979), Card et al. (1980, 1981) and Grunsky (1983) into 4 major lithotectonic assemblages. Three of these domains, 1) the Algoma plutonic domain, 2) the Ramsey gneiss domain, and 3) the Batchawana metavolcanic domain underlie the Pancake Lake area.

Granitic rocks of the Algoma plutonic domain occur in the southeastern part of the Pancake Lake area. Gneissic rocks of the Ramsey gneiss domain are located along the northern boundaries of the map area (Figure 1). The western metavolcanic domain, which is the oldest volcanic cycle in the Batchawana greenstone belt, extends eastward from the central part of the Pancake Lake map area. The rocks in this unit range in composition from mafic to felsic. Minor amounts of metasedimentary rocks are found in the western metavolcanic domain. Keweenawan rocks overlie the Archean metavolcanic and felsic intrusive rocks in the western part of the map area (Grunsky, in prep.). Rocks of Keweenawan age include 1) mafic volcanic rocks, 2) sedimentary rocks and 3) felsic intrusive and volcanic rocks. Breccia pipes were discovered throughout the western mafic metavolcanic domain. Minor occurrences of the Mica Bay Formation sedimentary rocks (siltstone, shale and arkose) are located in the northwest part of the map area. Also, similar sedimentary rocks of the Jacobsville Formation occur in the south of the map area. East-striking iron formations occur in northern Ryan Township and in the northwest part of Palmer Township.

Faulting in the Pancake Lake area is extensive. For this reason, only the major faults were delineated on Figure 1.

Further details of geology, geochemistry and age relationships among different rock types in the Pancake Lake area are described in the references cited above.

A total of 141 mineral occurrences are plotted on Figure 1. Further details of these occurrences may be obtained from the Resident Geologist's office, Ministry of Northern Development and Mines, Sault Ste. Marie.

Quaternary Geology

McQuay (1980a, 1980b) described the Quaternary geology of the Pancake Lake area from its southern margin to lat. 47°30'N (Figure 1). These references should be consulted for information beyond this summary.

In the Pancake Lake area, the last glacial advance was towards the south-southwest. Outwash plains, raised (abandoned) beach ridges, small sandy ground moraines and organic tentanes govern the types of Quaternary geology of the area.

During deglaciation, sand and gravel were deposited in spillway channels carved by meltwaters from the decaying ice mass. In most cases, our present-day river systems represent smaller versions of major meltwater channels which existed during deglaciation. Post-Algonquin glacial lake levels were high during the end of the Pleistocene. Raised beaches of sand and gravel were deposited and abandoned when the lake levels decreased. Except for small protected areas, the high rocky shoreline of Lake Superior was washed bare.

Since deglaciation, rivers and streams in the area accumulated flood-plain alluvium composed of silty sand and gravel. In addition, organic deposits accumulated in bedrock depressions, poorly drained river valleys and lacustrine plain units.

In summary, landscape conditions in the area are generally favourable for regional geochemical mapping due to the absence of thick Quaternary cover. However, because of the paucity of lakes and ponds, regional geochemical mapping is less effective in the Pancake Lake area compared to the other regional geochemical maps in this series. The Pancake Lake area now supports a zonal forest soil associated with vigorous forest growth.

METHODOLOGY

Descriptions of the Pancake Lake geochemical survey on this map sheet are based on pre–*Ambrosia* lake-sediment core and water data. All samples were collected by staff of the OGS using a Bell 206 helicopter equipped with floats. The sediment was collected using a gravity core sampler described by Fortescue (1986). The lake-sediment cores were extruded from the core samples, on the helicopter float, at each lake site (see Fortescue 1986).

Figure 3 is a flow diagram of the standardized methodology employed for the Pancake Lake and other Batchawana greenstone belt geochemical surveys. Details of the techniques involved are further described in Fortescue and Stahl (1988).

Figure 3. Standardized regional geochemistry methodology flow diagram.

Pre–*Ambrosia* Sediment

Detailed paleynological investigations of lake-sediment cores collected from central Ontario (completed by Professor Dickman and his research team from Brock University working with the OGS) indicated that the "*Ambrosia* pollen rise" in mid-basin lake-sediment cores is dated at 14 to 15 cm below the water-sediment interface (Dickman and Fortescue 1984; Fortescue 1985a). This "*Ambrosia* pollen rise" is associated with an ecological event which took place over 100 years ago.

Geochemical studies by limnologists, and others, have established that after deposition, vertical movement of elements in certain lake-sediment sequences is minimal. Consequently, mid-lake-basin pre–*Ambrosia* material is the preferred sample medium for regional geochemical mapping.

Chemical Analyses of Lake-Sediment Samples

Prior to chemical analyses, each sample was 1) dried at 60° C, 2) pulverized (using a zirconium oxide ring pulverizer) and, for some elements, 3) subjected to a hot aqua regia (including HF). The concentrations of 35 elements were determined in each sample using a combination of atomic absorption spectroscopy (AAS), instrumental neutron activation analysis (INAA) methods (see Table 1). Note that Zr is not determined in the lake-sediment samples using this methodology.

The Clarke Index-I

The Pancake Lake geochemical data set is described in these notes using weight % units (i.e., % or ppm) and Clarke index units (K) (see Table 1), in order to simplify the interpretation of regional geochemical patterns; weight % data for each element were normalized using the Clarke Index-1 (Fortescue 1982b). The Clarke Index-1 values were derived from Ronov and Yaroshevski (1972) and Bowen (1979) and they have been used in all OGS geochemical mapping publications since 1980.

RESULTS AND DISCUSSION

The diskette(s) available with this broadsheet contain(s) *N.J.* records (1 lv water and lake-sediment geochemistry, 2) locational information (i.e., latitude and longitude and universal transverse mercator (UTM) co-ordinates), and 3) field observations (e.g., Secchi depth and lake depth), for the 190 sample sites in the Pancake Lake area. The chemical data recorded in the data base are exactly as they were received from the contractor and are assumed to be correct. **None of the data have been verified by resampling or by repeat analysis of selected samples.**

General information on the abundance of each element in the entire Pancake Lake data set is provided in the summary statistics printed below each element column on Table 1. The Clarke Index-1 values in ppm units are also included in Table 1.

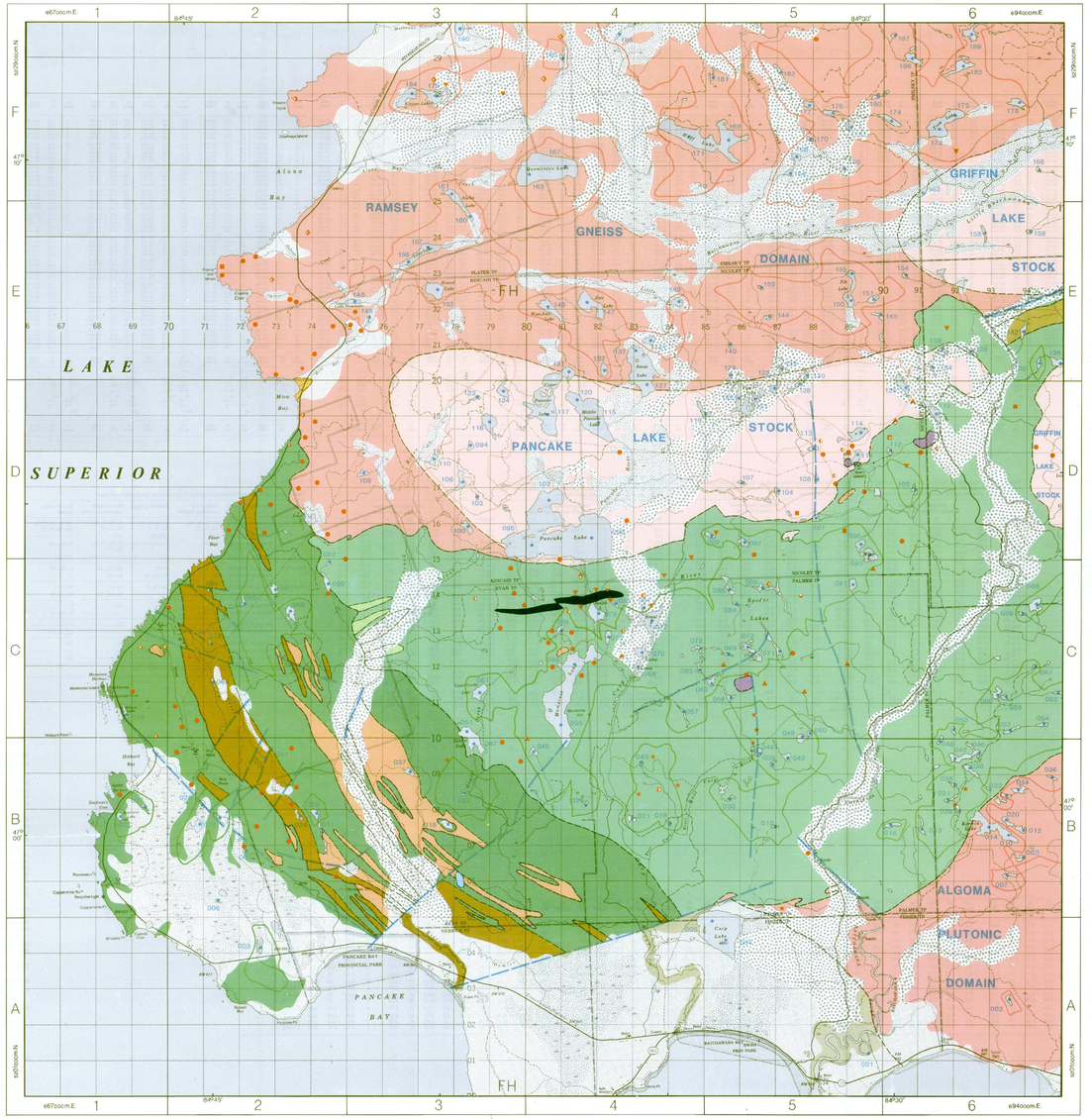


Figure 1. Generalized geological map showing the location of lake-sediment and water sample sites within the Pancake Lake area.

The map border identifies an index grid useful for locating the lake codes printed in all the tables (e.g., B1-027 in Table 1 and Figure 1).

UPPER CASE LETTER (northing index lines) — the first letter in the lake code column in the tables.

SECOND NUMBER (easting index lines) — the second number in the lake code column in the tables.

LEGEND

CENOZOIC

QUARTERNARY

- **Morainal:** ground moraine
- **Glaciofluvial:** outwash plain, valley train
- **Glaciolacustrine:** raised (abandoned) beach ridge
- **Organic:** organic terrane

UNCONFORMITY

PALEOZOIC

CAMBRIAN

- **Jacobsville Formation:** sandstone, siltstone, shale, conglomerate
- **Mica Bay Formation:** arkose, siltstone, shale

UNCONFORMITY

PRECAMBRIAN

PROTEROZOIC

LATE PRECAMBRIAN

- **Alkalic Rock-Carbonatite Complex:** breccia pipe

KEWEENAWAN

- **Felsic Intrusive and Volcanic Rocks**
- **Sedimentary Rocks:** conglomerate, sandstone, siltstone
- **Mafic Volcanic Rocks:** basalts

MIDDLE PRECAMBRIAN

- **Mafic Intrusive Rocks:** gabbro

UNCONFORMITY

EARLY PRECAMBRIAN

ARCHEAN

- **Massive Felsic Intrusive Rocks**
- **Felsic Intrusive and Metamorphic Rocks**
- **Clastic Metasediments**
- **Felsic Metavolcanic Rocks**
- **Mafic Metavolcanic Rocks**
- **Iron Formation**

SYMBOLS

- Geological contact
- Fault
- 123 Sediment core sample location, with reference number

MINERAL OCCURRENCES

- Au: Au,Cu; Au,Ag; Au,Cd,Cu,Ag; Au,Ag,Ipn,Cu,py
- Clay; it; swp; sh
- Cp,py; Cu,Au,Ag,Cu
- cp,py
- Cu; Cu(float); Cu,Ag; Cu,cp; Cu,Pb; Cu,Bo; Cu,Pb; Cu,py; Cu,Mo; Cu,Zn
- Cu,cp,py; Cu,Mo,cp; Cu,Mo,W; Cu,cp,Au,py; Cu,cp,py,Au,Ag; Cu,Mo,cp,sp,gn, shee,Ag
- Fe, hem; mag
- IF,Cu
- Mg
- Mo
- p,o,cp; po,cp,py
- Pb; Pb,Zn; Pb,Zn,Cu; Pb,Zn,Ag,Cu; Pb,Zn,Ag,Au,Cu
- py; py,Mg; py,cp,Cu
- U

ABBREVIATIONS

Ag	silver	Mg	magnesium
Au	gold	Mo	molybdenum
bn	bornite	Pb	lead
Clay	clay	py	pyrrhotite
Co	cobalt	py	pyrite
cp	chalcopyrite	serp	serpentine
Cu	copper	sh	shale
Fe	iron	shee	scheelite
gn	galena	sp	sphalerite
hem	hematite	U	uranium
IF	iron formation	W	tungsten
it	ilmenite	Zn	zinc
mag	magnetite		

2. REGIONAL GEOCHEMICAL-GEOLOGICAL MAP STRIPS

A visual link between Figure 6 (lakemet map data just described) and the geochemical-geological map strips (described below) in Figures 6 and 9 is provided in Figure 7. Visual relationships between these figures should be comprehended before continuing further.

Geochemical-Geological Map Strips (G-GMS) are a second method of presenting regional interpretation of lake-sediment survey. The G-GMS are used in 2 ways: 1) to display regional relationships between the lakewater data and the Quaternary geological data for an entire map area (Fortescue and Vida 1990b), and 2) to display regional relationships between the lake-sediment geochemical data and the geological data for an entire map area (Fortescue and Vida 1990c).

Figures 8 (a to f) display the water pH, water Ca and water Mg G-GMS, plotted with 5 km map strips showing the Quaternary geology of the Pancake Lake area and sample sites. Figures 8(a to f) is displaying LOI and Ni elements (Ag, Al, As, Ba, Be, Bi, Br, Ca, Cd, Co, Cr, Cu, Fe, Hf, K, La, Mg, Mn, Mo, Na, Ni, P, Pb, Sb, Sc, Sr, Ta, Th, Ti, U, W and Zn) plus loss on ignition (LOI) and Ni. The upper strip is used for plotting geochemical data for elements and waters in this, and other, regional geochemical maps are listed in Table 5.

In order to create a single G-GMS for a selected parameter 1) an uncontoured 1:50 000 map of the area is reduced to 1:250 000 map size, 2) the reduced map is cut into six 5 km (west to east) by 30 km (south to north) strips, 3) the Pancake Lake pre–*Ambrosia* geochemical data base is separated into the same 5 km strips from west to east, and 4) each 5 km strip is plotted on a 5 km by 30 km graph x" at the tops of Figures 8(a to b)'c and Figures 9(a to b)'c, and "map strip (Swelvoph graph)" f" at the bottoms. The west border of Figure 1 is located at the top of the G-GMS. "Map strip a" is mainly composed of the Pancake Lake map area coastline. Because there are only 3 sample sites in this strip, map strip a was omitted from Figures 8 and 9. Refer to Figure 7 for a visual explanation for creating the G-GMS.

The G-GMS for the water pH, water Ca, water Mg, LOI and 18 selected elements are described below. For more detailed information, consult Figure 1, Figures 6a to 5d, Figures 6b to 9b, Table 1, Table 9 and the data base diskette(s).

To facilitate the description of geochemical patterns in Figures 8/a to 8/c and Figures 9/a to 9/c, element peaks and geochemical provinces are identified by a simple element number code. For example, the positive Mo values in Figure 9/m are identified as [Mo:4] on map strip d.

LAKEWATERS

Water pH

The pH levels in the Pancake Lake area range between 4 and 10. On Figure 8/a, map strip f, pattern [water pH:1] identifies a low pH site which is probably due to the organic terrane deposits found at this location. Pattern [water pH:2] on map strip d, contains some very low pH values in an area of mineral occurrences clustering and iron formations. On map strip e, pattern [water pH:2] is situated in an area of mineral occurrences but no iron formations. Water pH results on map strip e intimate that the iron formation located on map strip d may extend further east than is currently mapped. The few high points on map strip d at [water pH:2] could be attributed to the outwash plain found at Cedar Lake and Brant Lake. Areas of high pH were previously established to be associated with calcium-rich glacial deposits (Fortescue and Vida 1986, 1990c). Such areas are ground moraines and outwash plains.

High Ca levels in the lakewaters (Figure 8/b) mirror the pH patterns but at lower levels. The peak on map strip b on the northern shoreline is likely to be an isolated marl lake.

As expected, the Mg levels in the lakewaters are consistently low throughout the Pancake Lake area (Figure 8/c).

Figure 7. Visual link between Figures 6 and 9.

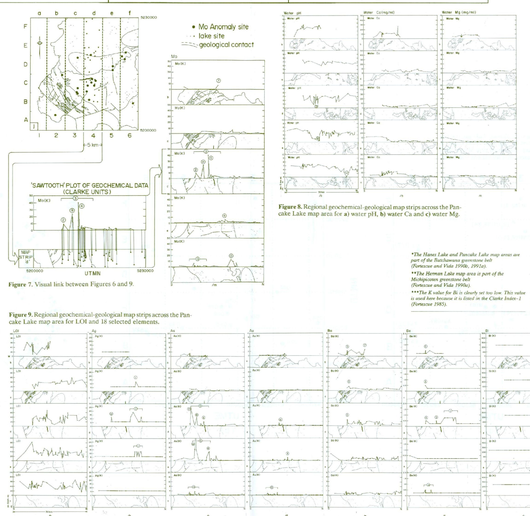


Figure 8. Regional geochemical-geological map strips across the Pancake Lake map area for a) water pH, b) water Ca and c) water Mg.

PERFORMANCE OF THE ANALYTICAL METHOD

Twenty-two replicates of one lake-sediment reference standard were subjected to the Pancake Lake unknown samples for quality control purposes. The data derived from these standards are included on the data base diskette(s) as 1) the raw quality control data ("Std-Pan" file) and 2) summary statistics (Table 2). The performance of the analytical methods is based on these results.

During geochemical mapping and interpretation, it is important to know the reliability of data for each element. Consequently, each regional geochemical mapping project includes appropriate rules for describing the performance of the analytical methods. Acceptable¹ element data sets for detailed statistical analysis are identified using these criteria. The data listed on Table 2 (or the data base diskette(s)) were used for assessing details of the performance of the chemical methodology on an element-to-element basis.

In the current OGS regional geochemical map series, data for an element are considered acceptable if the coefficient of variation (C.V.) for that element in a reference standard is less than 15%. Using this criterion, 22 elements (As, Co, Cu*, La*, Mo, Ni, Sc*, Th*, U* and Zn* in Table 2; Ag*, Ca*, Fe*, K*, Mg*, Mn*, P*, Na*, Mn*, Nn*, I'*, G* and T* in the second grouping; and Bi* and Lu in the third grouping were "acceptable" in the Pancake Lake sediment standard. The asterisks (*) represent elements which are also "acceptable" from the Trout Lake data for processing, using this criterion. Barium and U are not "acceptable" in the Pancake Lake data, because their C.V. is greater than 15%. Hafnium is also not "acceptable" in the Trout Lake data (Fortescue and Vida 1989).

On the Trout Lake map sheet, a Global Datum Signature (GDS) was created from 19 "acceptable" analytical performance quality control elements (As, Ba, Bi, Ca, Cu, Fe, K, La, Mg, Mn, Na, P, Sc, Sr, Th, Ti, U, V and Zn (Fortescue and Vida 1989). The GDS explained below was used for comparative purposes among the lake-sediment data sets. Because the analytical performance of the Pancake Lake standard was very similar to the performance measured previously, it was decided to use the "acceptable" elements from the Trout Lake data to make identical geochemical signatures for all map sheets in the Batchawana greenstone belt.

Other elements have 1) low levels in the standards, 2) a small range of values and 3) a relatively High C.V. This group includes Ag, Sb, and U (Table 2) which are clearly close to the detection limit of the analytical methods.

Data for Ag and As are particularly important for the success of regional geochemistry. The ranges of Ag levels (0.50 minimum to 1.00 maximum) listed in Table 2 is clearly unsatisfactory. The coefficient of variation for Ag is 36.11% at the 0.68 ppm mean. For this reason, only Ag values greater or equal to 2 ppm are considered to be "acceptable" in the Pancake Lake data. The good values in the quality control data set have a relatively high detection limit of around 2 ppm. The level of variation of 53.22% at the 2.68 ppm mean level indicates the performance of the analytical method at these low Ag ppb levels. Only 3 Au values were greater than or equal to 5 ppb in the unknown samples from the Pancake Lake data set. Gold values greater than 10 ppb level are considered "acceptable" for consideration in mineral resource appraisal.

Previous work has shown that Br is usually accumulated by organic lake sediments independently of the presence of mineral deposits (Fortescue and Vida 1969, 1960a). For this reason, this element was included in the third group in Table 2, even though the Br data were relatively reliable. Because analyses have consistently given their C.V. is less than 15%, Co and Ni will be placed in the GDS after the release of the final maps in the Batchawana greenstone belt series.

Regional Level

INTRODUCTION

The regional-level interpretation of the Pancake Lake geochemical data base is in 3 parts: 1) a description of **regional-level patterns for a)** pH, Ca and Mg levels in water samples and b) high values of selected elements in sediments; 2) a description of **geochemical-geological relationships for selected waters and elements** within 5 km map strips for the entire map; and 3) a **principal components analysis (PCA)** of relationships among the 190 pre–*Ambrosia* lake-sediment samples.

1. REGIONAL PATTERNS

When the pH, Ca and Mg values of the waters and selected element results from the Pancake Lake geochemical survey (Table 1) are plotted, some exhibit more distinct patterns than others. In this section, we draw attention to a few representative patterns which may relate to mineral resource appraisal and/or the environmental geochemistry of the area. Table 4 lists the lower limits used to plot regional patterns of high values for elements and waters in the entire Batchawana greenstone belt map sheets (Fortescue and Vida 1989, 1990c) and the Michipicoten greenstone belt map sheet (Fortescue and Vida 1990c).

Lakewaters

Three parameters, pH, Ca and Mg, were measured in the Pancake Lake area waters. These parameters were plotted on base maps showing Quaternary deposits and lake sample sites (Figure 5).

Water pH values greater than or equal to 7.0 are plotted in Figure 5a. In the southeast part of the map area, the clustering of high pH values in the Pancake area is no evidence of glacial deposits found in the area. Previous work has demonstrated the occurrence of high water pH and water Ca levels in areas of ground moraine (Fortescue and Vida 1989, 1990a, 1990c). Therefore, the clustering observed in the southeast part of the map area in Figure 5a could indicate an area of ground moraine not previously mapped.

Relatively high "Ca" values, greater than or equal to 10 mg/mL in the Pancake Lake water samples are plotted in Figure 5b. Cluster ing of high Ca water values in the southeast part of the map area supports the hypothesis of an unmapped ground moraine in the area.

Water pH values less than or equal to 6.0 in Figure 5c show a cluster of acidic lakes in the map area. These lakes can be traced northeast in a definite path terminating in the Pancake Lake area (Fortescue and Diamond 1984).

Values of water Mg, greater than or equal to 1.0 mg/mL in Figure 5d delineate an unusual pattern of high "Mg" values in lakewaters. The pattern tends to mimic the shoreline, particularly in the north west part of the Ramsey gneiss domain. It is unknown at the time o writing why this pattern occurs.

Table 4. Lower limits for element levels (Clarke Index units (K)) used for the presentation of regional geochemical patterns on OGS maps.

ELEMENT	TROUT* LAKE 1989 (K)	HERMAN** LAKE 1990a (K)	HANES* LAKE 1990b (K)	PANCAKE* LAKE 1991 (K)
Ag	15.00	25.00	7.50	12.50
Al	–	–	–	–
As	7.00	10.00	2.00	2.00
Au	2.00	3.00	2.00	6.75
Ba	–	–	–	–
Be	–	0.50	–	0.50
Bi***	437.50	–	437.50	437.50
Br	–	–	–	–
Ca	–	–	–	–
Cd	–	–	12.50	–
Co	–	–	–	0.44
Cr	–	–	–	–
Cu	1.30	2.00	1.00	1.45
Hf	–	0.30	–	–
K	2.00	–	1.70	1.70
La	2.50	2.00	2.00	2.00
Lu	–	–	–	–
Mg	–	–	0.18	–
Mn	–	1.00	–	–
Mo	5.00	5.00	5.00	4.10
Na	–	–	–	–
Ni	–	–	–	–
P	2.00	1.50	2.00	2.00
Pb	3.00	2.50	1.50	1.50
Sb	–	–	–	–
Sc	–	–	–	–
Sr	–	–	–	–
Th	1.00	1.00	0.70	0.70
Ti	–	–	–	–
U	18.00	5.00	8.00	6.00
V	–	5.00	–	–
W	5.00	5.00	5.00	1.67
Zn	2.50	2.00	2.00	1.90

Limits for regional map patterns in waters.

Water pH > =	7.50	7.50	7.00
Water pH < =	5.30	6.00	6.00
Water Ca > =	–	20.00	10.00
Water Mg > =	–	3.00	1.50

*The Trout Lake, Hanes Lake and Pancake Lake map areas are a part of the Batchawana greenstone belt (Fortescue and Vida 1989, 1990c)

**Herman Lake map area is part of the Michipicoten greenstone belt (Fortescue and Vida 1990a).

***The K value for Bi is clearly set too low. This value is used here because it is listed in the Clarke Index-1 (Fortescue 1985).

Upper limits for single-element map strips in Lower limits for single-element map strips in Clarke units (K).

Water pH	–	4–10	4–10
Water Ca	–	20.00	10.00
Water Mg	–	25.00	10.00

Figure 9. Regional geochemical-geological map strips across the Pancake Lake map area for LOI and 18 selected elements.

Table 5. Upper limits in Clarke units (K) for the single-element map strips in the various Batchawana greenstone belt map sheets* and the Michipicoten greenstone belt map sheet**.

ELEMENT	HERMAN LAKE 1990a (K)	HANES LAKE 1990b (K)	PANCAKE LAKE 1991 (K)
LOI	100	100	100
Ag	80.00	–	80.00
Al	–	–	–
As	20.00	20.00	20.00
Au	10.00	10.00	10.00
Ba	–	–	5.00
Bi	5.00	–	5.00
Bi***	–	–	500.00
Br	–	80.00	–
Ca	–	2.00	–
Cd	–	–	38.00
Co	–	–	38.00
Cr	10.00	5.00	5.00
Cu	–	–	5.00
Fe	–	–	–
La	–	2.00	–
Mg	10.00	38.00	10.00
Mn	–	2.00	–
Mo	–	–	–
Na	50.00	50.00	50.00
Ni	–	2.00	–
Sc	–	–	–
P	–	5.00	–
Pb	10.00	15.00	20.00
Sr	25.00	10.00	5.00
Th	–	–	–
Ti	5.00	5.00	5.00
U	–	–	–
V	15.00	15.00	20.00
W	–	50.00	10.00
Zn	10.00	10.00	10.00

*The Trout Lake, Hanes Lake and Pancake Lake map areas are a part of the Batchawana greenstone belt (Fortescue and Vida 1989, 1990c).

**The Herman Lake map area is part of the Michipicoten greenstone belt (Fortescue and Vida 1990a).

***The K value for Bi is clearly set too low. This value is used here because it is listed in the Clarke Index-1 (Fortescue 1985).

LAKE-SEDIMENT GEOCHEMISTRY

Loss on Ignition

LOI for the pre–*Ambrosia* lake-sediment samples ranges from 2.6% (mineral rich) to greater than 80% (organic rich). The data on Figure 5/a show little evidence of a cohesive pattern for LOI across the map area.

Silver

Silver patterns in Figure 6/b peak in the Pancake Lake stock and the western mafic metavolcanic rocks. Pattern [Ag:1] on map strips c, d and e defines 2 parallel linear features which were also represented by [Bi-1], [U-1] and [W-1]. Pattern [Ag:2] on map strip a is found in the vicinity of known Au, Ag, Cu and Co occurrences.

Arsenic

Arsenic patterns in Figure 8/c are more pronounced than for Au (Figure 8/b). Map strips c, d and f show relatively high As levels in the western mafic metavolcanic rocks. Pattern [As:2] occurs just south of the known Au, Ag, Cu and Cu mineral showing. An As "geochemical province" is defined in pattern [As:3] on map strips d and e in the western mafic metavolcanic rocks. The fault observed on map strip e (eastern map border), at the granite-greenstone contact, may extend further west than is currently mapped. Pattern [As:4] on map strips d and e supports this supposition. Values of [Au:4], [Cd:4], [Co:4], [Cu:4], [La:4], [Mo:4], [Pb:4], [Sb:4], [Th:4], and [W:4] all show this linear feature on map strips d, e and f. Another linear feature is delineated by pattern [As:5] on map strips d and e. This feature is also detected in the values [Cd:6], [Cu:6], [Mo:6], [Sb:6] and [Th:6]. Figure 1 indicates any of the major faults, but it should be noted that the western mafic metavolcanic rocks and the Keweenawan rocks are also crossed by many minor faults of varying orientation which are included on the preliminary geological maps (see Grunsky 1987a, 1987b).

Gold

The Au patterns are similar to those for As, but lower in contrast. For example, the weak Au patterns [Au:4] (Figure 8/d), mimic the As linear patterns discussed above.

Barium, Beryllium and Bismuth

In Figure 8/e, concentrations of Ba are variable throughout the Pancake Lake area, except in the Keweenawan rocks. Pattern [Ba:2] on map strips b, c and d delineates a weak linear feature extending through the Keweenawan formations. The pea [Ba:3] on map strip b may be associated with an old abandoned mine and waste sites. The same pattern can be observed in the values [Be:5], [Cr:5], [Sb:5], [Th:5] and [Ui:5]. The peak [Ba:7] on map strip b is related to the Keweenawan/ Zn value at this location. Other high elements values which support the single Zn "anomaly" are [Cd:7], [Cu:7], [Mo:7] and [Pb:7].

Except for a few peaks, the concentrations of Be (figure 8/f), are below detection limits throughout the Pancake Lake map area. The few exceptions are 1) a small "geochemical province" detected in pattern [Be:1], occurring in the Pancake Lake stock, and 2)the peak [Be:3] which may be associated with the mineral occurrence clustering below the iron formation.

Bismuth concentrations (Figure 9/g) are consistently below the detection limit within the Pancake Lake area, except just north of the Pancake Lake stock. A small Bi province is shown by pattern [Bi:6], which is found just north (i.e., to the right) of the pattern [Bo:1] (Figure 9/f

Table 1. General summary table to the Pancake Lake sediment and water geochemical data base.

ALL LAKE SAMPLE SITE CODES a have letter number dash three digit numbers (e.g. "B1–027").
The LETTER NUMBER code (e.g. "B1") indicates a 5 km square in Figure 1, in which the sample site is located.
"B" indicates the 5 km northing index.
"1" indicates the 5 km easting index.
"027" refers to the sample within the 5 km square in Figure 1 (printed in blue).

LAKE CODE	WATER pH	WATER Ca (mg/ml)	WATER Mg (mg/ml)	LOI (%)	LAKE CODE	Ag (ppm)	Ag (K)	LAKE CODE	Al (%)	Al (K)	LAKE CODE
B1-027	3.7	2.3	0.8	2.6	A5-001	1.5	18.75	D4-102	6.59	0.79	A5-001
F6-162	4.2	1.9	0.5	7.2	B4-021	1.0	12.50	D5-128	6.54	0.78	B4-021
C5-089	4.4	3.2	0.5	7.8	D4-102	1.0	12.50	D5-125	5.79	0.69	D4-102
C5-084	4.4	1.7	0.4	10.0	B2-041	1.0	12.50	D5-122	5.72	0.68	D5-125
C4-081	4.5	0.5	0.2	10.2	B2-022	1.0	12.50	D5-121	5.63	0.67	B2-041
A2-003	4.6	3.3	0.9	12.0	B3-033	1.0	12.50	D5-114	5.48	0.66	F3-190
C5-088	4.7	2.5	0.4	13.2	D4-098	1.0	12.50	D5-111	5.39	0.64	B2-022
C4-072	4.7	1.8	0.4	14.0	D5-125	1.0	12.50	D5-108	5.33	0.64	F6-178
F6-166	4.8	2.3	0.5	14.2	D4-127	1.0	12.50	D4-127	5.27	0.63	C4-055
C5-071	4.8	2.3	0.4	14.2	E4-137	1.0	12.50	D4-098	5.20	0.62	B3-033
C4-065	4.9	1.9	0.4	15.6	F6-178	1.0	12.50	D3-110	5.11	0.61	C1-056
C5-073	4.9	2.8	0.6	16.2	F5-181	1.0	12.50	B4-021	5.10	0.61	D4-098
C5-069	4.9	1.6	0.3	16.8	D4-120	0.5	6.25	F6-189	4.86	0.58	E5-130
C5-063	5.0	2.0	0.4	18.4	E5-130	0.5	6.25	F6-187	4.83	0.58	D4-127
D5-113	5.2	2.9	0.4	19.4	C1-056	0.5	6.25	F6-186	4.81	0.58	E4-137
C5-058	5.2	2.2	0.4	19.4	D4-115	0.5	6.25	F6-183	4.80	0.57	C4-068
E6-159	5.4			21.2	C4-076	0.5	6.25	F6-178	4.78	0.57	F5-181
E6-154	5.5	2.1	0.4	21.6	C4-055	0.5	6.25	F6-175	4.71	0.56	D4-120
F6-187	5.5	2.2	0.4	22.0	B2-028	0.5	6.25	F6-174	4.64	0.56	F6-172
E5-145	5.6	2.2	0.5	22.4	C5-091	0.5	6.25	F6-172	4.50	0.54	C2-074
E4-141	5.6	4.3	0.8	22.8	B3-047	0.5	6.25	F6-166	4.43	0.53	D5-128
D5-118	5.7	1.5	0.3	23.4	E5-150	0.5	6.25	F6-162	4.40	0.53	C5-049
E4-149	5.7	4.4	0.7	24.0	C5-063	0.5	6.25	F5-182	4.35	0.52	B2-028
F6-189	5.8	1.5	0.4	24.0	F5-170	0.5	6.25	F5-181	4.30	0.51	D4-115
—	—	—	—	24.2	F6-187	0.5	6.25	F5-180	4.25	0.51	F5-170
D5-093	7.3	4.6	0.5	24.6	D4-095	0.5	6.25	F5-177	4.14	0.50	E6-135
C6-079	7.3	12.5	0.6	24.8	D5-101	0.5	6.25	F5-176	4.07	0.49	D4-095
B6-013	7.3	12.0	0.7	24.8	D5-111	0.5	6.25	F5-173	3.99	0.48	D5-111
B2-011	7.3	13.8	1.2	24.8	F4-171	0.5	6.25	F5-170	3.98	0.48	F5-176
B6-038	7.3	11.5	0.9	25.0	F5-168	0.5	6.25	F5-169	3.97	0.47	F4-167
F4-171	7.3	3.5	0.7	25.2	C4-068	0.5	6.25	F5-168	3.97	0.47	B6-010
B6-046	7.3	7.4	0.8	25.2	E5-144	0.5	6.25	F5-165	3.88	0.46	E6-136
B6-010	7.3	4.5	0.7	25.4	F3-190	0.5	6.25	F5-164	3.87	0.46	E3-152
C6-085	7.3	7.7	0.5	25.6	E5-140	0.5	6.25	F4-188	3.86	0.46	F6-175
B6-042	7.3	7.7	0.8	26.0	F4-167	0.5	6.25	F4-185	3.84	0.46	E5-140
C2-086	7.3	26.5	1.6	26.8	A2-003	0.5	6.25	F4-171	3.79	0.45	C4-070
B6-048	7.4	13.6	0.8	26.8	F5-169	0.5	6.25	F4-167	3.73	0.45	D5-097
B2-024	7.4	9.9	0.7	27.6	B6-010	0.5	6.25	F4-163	3.72	0.44	C4-072
C6-060	7.4	12.5	0.6	27.6	F6-172	0.5	6.25	F3-190	3.70	0.44	F6-186
C4-075	7.4	3.9	0.6	27.8	D6-112	0.5	6.25	F3-184	3.70	0.44	C5-091
C2-090	7.4	8.4	1.5	27.8	F5-180	0.5	6.25	F3-179	3.70	0.44	B3-047
B1-023	7.4	12.8	2.1	28.0	D6-126	0.5	6.25	F3-161	3.68	0.44	C3-051
B3-018	7.4	6.5	1.1	28.2	C5-088	0.5	6.25	E6-159	3.67	0.44	C4-077
C1-056	7.5	30.3	2.2	28.6	B3-018	0.5	6.25	E6-158	3.66	0.44	F6-187
B2-025	7.5	13.0	1.0	28.6	D6-105	0.5	6.25	E6-154	3.62	0.43	B3-018
B6-014	7.6	4.3	0.7	28.8	D5-104	0.5	6.25	E6-142	3.59	0.43	E3-157
F4-163	7.6	8.0	2.1	28.8	F5-165	0.5	6.25	E6-139	3.56	0.43	C4-076
A5-004	7.6	12.2	1.3	29.0	D5-108	0.5	6.25	E6-138	3.54	0.42	D5-107
A5-005	7.7	12.5	1.3	29.0	E4-131	0.5	6.25	E6-136	3.54	0.42	C5-088
F4-167	7.8	7.9	2.0	29.4	D5-121	0.5	6.25	E6-135	3.51	0.42	F5-180

As (ppm)	As (K)	LAKE CODE	Au (ppb)	Au (K)	LAKE CODE	Ba (ppm)	Ba (K)	LAKE CODE	Be (ppm)	Be (K)	LAKE CODE	Bi (ppm)	Bi (K)	LAKE CODE	Br (ppm)	Br (K)	LAKE CODE
69	38.33	C5-049	6	1.50	D5-097	610	1.56	A5-001	1.5	0.75	D4-127	4	487.80	E5-153	71.5	28.60	B2-025
29	16.11	B4-029	5	1.25	C6-060	590	1.51	C2-092	1.5	0.75	D4-120	4	487.80	E5-144	68.4	27.36	B6-038
19	10.56	B5-043	5	1.25	C4-068	540	1.38	B4-021	1.5	0.75	D4-115	4	487.80	E5-140	68.0	27.20	B6-042
18	10.00	C5-050	4	1.00	C2-090	540	1.38	B2-041	1.5	0.75	D4-102	4	487.80	E4-149	67.4	26.96	F6-183
18	10.00	B5-044	4	1.00	B6-010	470	1.21	C4-072	1.5	0.75	D4-098	4	487.80	E4-146	64.2	25.68	C5-073
15	8.33	D5-096	3	0.75	D5-108	460	1.18	B2-022	1.5	0.75	D4-095	4	487.80	E4-137	63.7	25.48	B6-016
14	7.78	D5-093	3	0.75	C5-091	430	1.10	D4-102	1.5	0.75	B1-023	2	243.90	F6-189	61.6	24.64	B6-014
14	7.78	C4-055	3	0.75	C4-077	420	1.08	F6-181	1.0	0.50	D4-117	2	243.90	F6-187	60.5	24.20	F6-186
8	4.44	D5-113	3	0.75	C2-086	420	1.08	F3-190	1.0	0.50	C4-068	2	243.90	F6-186	60.4	24.16	B6-013
7	3.89	C4-077	3	0.75	B6-048	410	1.05	C4-055	1.0	0.50	B6-046	2	243.90	F6-183	59.3	23.72	A6-002
7	3.89	B1-023	3	0.75	B6-014	400	1.03	F6-178	1.0	0.50	B6-014	2	243.90	F6-178	57.7	23.08	B6-020
6	3.33	C5-091	3	0.75	B5-043	390	1.00	E4-137	1.0	0.50	B6-010	2	243.90	F6-175	57.4	22.96	C6-054
6	3.33	B6-042	2	0.50	F5-180	390	1.00	D5-125	1.0	0.50	B4-029	2	243.90	F6-174	55.6	22.24	C6-085
5	2.78	B6-010	2	0.50	E6-154	380	0.97	D4-127	1.0	0.50	B4-021	2	243.90	F6-172	55.3	22.12	C4-081
5	2.78	B5-039	2	0.50	E5-140	380	0.97	D4-098	1.0	0.50	B3-018	2	243.90	F6-166	54.0	21.60	C6-060
5	2.78	B4-040	2	0.50	E5-130	380	0.97	B3-033	1.0	0.50	B2-041	2	243.90	F6-162	53.8	21.52	C6-052
5	2.78	B2-024	2	0.50	E4-149	370	0.95	B2-028	1.0	0.50	B2-022	2	243.90	F5-182	53.4	21.36	C4-066
5	2.78	A5-005	2	0.50	D4-115	360	0.92	F5-170	1.0	0.50	A5-001	2	243.90	F5-181	52.0	20.80	B6-012
4	2.22	D6-105	2	0.50	D3-124	360	0.92	D4-120	0.5	0.25	F6-189	2	243.90	F5-180	49.4	19.76	B6-048
4	2.22	D5-101	2	0.50	D3-123	360	0.92	C2-074	0.5	0.25	F6-187	2	243.90	F5-177	49.1	19.64	B1-023
4	2.22	C6-059	2	0.50	C6-059	350	0.90	C5-088	0.5	0.25	F6-186	2	243.90	F5-176	48.7	19.48	D3-124
4	2.22	C4-068	2	0.50	C6-052	350	0.90	C5-049	0.5	0.25	F6-183	2	243.90	F5-173	48.5	19.40	E6-136
4	2.22	C3-051	2	0.50	C5-058	350	0.90	C4-068	0.5	0.25	F6-178	2	243.90	F5-170	48.0	19.20	C4-077
4	2.22	B4-019	2	0.50	C4-076	340	0.87	B6-010	0.5	0.25	F6-175	2	243.90	F5-169	48.0	19.20	B2-017
4	2.22	B3-018	2	0.50	C4-065	330	0.85	F6-172	0.5	0.25	F6-174	2	243.90	F5-168	47.3	18.92	C4-070
4	2.22	B2-017	2	0.50	C2-087	330	0.85	C4-076	0.5	0.25	F6-172	2	243.90	F5-165	45.3	18.12	B2-024
4	2.22	B2-011	2	0.50	C2-080	320	0.82	F6-187	0.5	0.25	F6-166	2	243.90	F5-164	44.5	17.80	B6-010
4	2.22	B2-006	2	0.50	B6-032	320	0.82	D4-115	0.5	0.25	F6-162	2	243.90	F4-188	43.6	17.44	E4-141
4	2.22	A5-004	2	0.50	B6-020	320	0.82	C1-056	0.5	0.25	F5-182	2	243.90	F4-185	43.1	17.24	B1-027
3	1.67	F4-167	2	0.50	B2-011	310	0.79	E5-140	0.5	0.25	F5-181	2	243.90	F4-171	42.9	17.16	F3-179
3	1.67	F4-163	1	0.25	F6-189	310	0.79	E5-130	0.5	0.25	F5-180	2	243.90	F4-167	42.5	17.00	C4-055
3	1.67	E4-147	1	0.25	F6-187	300	0.77	F4-167	0.5	0.25	F5-177	2	243.90	F4-163	41.2	16.48	F5-173
3	1.67	D5-114	1	0.25	F6-186	300	0.77	D5-128	0.5	0.25	F5-176	2	243.90	F3-190	40.4	16.16	D5-097
3	1.67	D5-108	1	0.25	F6-183	300	0.77	C5-091	0.5	0.25	F5-173	2	243.90	F3-184	40.4	16.16	C2-092
3	1.67	D5-097	1	0.25	F6-178	290	0.74	F6-183	0.5	0.25	F5-170	2	243.90	F3-179	39.1	15.64	C5-071
3	1.67	C4-070	1	0.25	F6-175	290	0.74	E5-153	0.5	0.25	F5-169	2	243.90	F3-161	38.8	15.52	D5-093
3	1.67	B6-016	1	0.25	F6-174	290	0.74	C5-063	0.5	0.25	F5-168	2	243.90	E6-159	38.7	15.48	C6-059
3	1.67	B5-030	1	0.25	F6-172	280	0.72	F5-168	0.5	0.25	F5-165	2	243.90	E6-158	38.6	15.44	C6-079
3	1.67	B5-015	1	0.25	F6-166	280	0.72	F5-165	0.5	0.25	F5-164	2	243.90	E6-154	38.0	15.20	C4-057
3	1.67	B3-047	1	0.25	F6-162	280	0.72	D5-111	0.5	0.25	F4-188	2	243.90	E6-142	37.8	15.12	D3-116
3	1.67	B3-037	1	0.25	F5-182	280	0.72	C4-077	0.5	0.25	F4-185	2	243.90	E6-139	37.7	15.08	D4-095
3	1.67	B3-033	1	0.25	F5-181	270	0.69	F6-175	0.5	0.25	F4-171	2	243.90	E6-138	37.2	14.88	C2-087
3	1.67	B2-025	1	0.25	F5-177	270	0.69	F5-180	0.5	0.25	F4-167	2	243.90	E6-136	37.1	14.84	C3-051
2	1.11	F6-189	1	0.25	F5-176	270	0.69	E5-144	0.5	0.25	F4-163	2	243.90	E6-135	36.2	14.48	D5-096
2	1.11	F6-186	1	0.25	F5-173	270	0.69	E3-156	0.5	0.25	F3-190	2	243.90	E6-134	36.0	14.40	C6-067
2	1.11	F6-183	1	0.25	F5-170	260	0.67	F5-176	0.5	0.25	F3-184	2	243.90	E5-155	35.9	14.36	D4-117
2	1.11	F4-185	1	0.25	F5-169	260	0.67	C5-058	0.5	0.25	F3-179	2	243.90	E5-151	35.9	14.36	C2-090
2	1.11	F3-179	1	0.25	F5-168	260	0.67	C4-070	0.5	0.25	F3-161	2	243.90	E5-150	35.0	14.00	B6-034
2	1.11	F3-161	1	0.25	F5-165	260	0.67	B3-018	0.5	0.25	E6-159	2	243.90	E5-145	34.3	13.72	C2-064
2	1.11	E5-130	1	0.25	F5-164	250	0.64	D6-105	0.5	0.25	E6-158	2	243.90	E5-133	34.1	13.64	B6-032

Ca (%)	Ca (K)	LAKE CODE	Cd (ppm)	Cd (K)	LAKE CODE	Co (ppm)	Co (K)	LAKE CODE	Cr (ppm)	Cr (K)	LAKE CODE	Cu (ppm)	Cu (K)	LAKE CODE	Fe (%)	Fe (K)	LAKE CODE
2.37	0.51	C1-056	6.0	37.50	D3-123	27	0.93	E6-135	180	1.48	A2-003	441	6.49	C4-055	14.91	2.40	B1-023
1.98	0.42	A5-001	2.5	15.63	D6-119	27	0.93	C4-077	146	1.20	B2-028	225	3.31	C3-061	4.68	0.75	F6-183
1.63	0.35	C2-086	2.5	15.63	C3-061	22	0.76	C1-056	145	1.19	B2-022	215	3.16	B1-023	3.39	0.55	B6-010
1.53	0.33	B4-021	2.0	12.50	D5-096	21	0.72	C5-049	120	0.98	C1-056	202	2.97	E3-156	2.75	0.44	C1-056
1.46	0.31	D4-102	2.0	12.50	D3-124	20	0.69	B6-038	120	0.98	B3-018	192	2.82	C4-068	2.66	0.43	C4-077
1.33	0.29	F4-167	2.0	12.50	C2-092	20	0.69	B5-044	115	0.94	B3-033	165	2.43	C3-051	2.46	0.40	D4-095
1.33	0.29	C2-074	2.0	12.50	B6-042	19	0.66	C4-068	111	0.91	B6-046	142	2.09	B4-029	2.34	0.38	F3-190
1.30	0.28	B2-041	2.0	12.50	B6-038	17	0.59	C6-059	111	0.91	B1-027	137	2.01	B2-009	2.14	0.34	A5-001
1.28	0.27	F6-178	2.0	12.50	A2-003	16	0.55	C4-055	91	0.75	B3-047	120	1.76	B3-047	2.11	0.34	D4-098
1.26	0.27	B5-015	1.5	9.38	F6-186	15	0.52	B6-046	90	0.74	B4-029	118	1.74	C6-060	2.10	0.34	C6-059
1.24	0.27	D4-098	1.5	9.38	E6-136	14	0.48	D5-097	90	0.74	A5-001	115	1.69	D5-114	2.09	0.34	B4-029
1.24	0.27	C5-049	1.5	9.38	E6-135	14	0.48	B6-032	81	0.66	B5-043	113	1.66	B2-022	1.98	0.32	C4-068
1.21	0.26	B3-033	1.5	9.38	D6-105	13	0.45	F6-189	79	0.65	B2-011	107	1.57	C2-086	1.97	0.32	B6-014
1.20	0.26	C2-064	1.5	9.38	D5-114	13	0.45	F6-175	75	0.61	C2-090	101	1.49	C2-090	1.96	0.32	B6-032
1.19	0.26	D5-125	1.5	9.38	D5-097	13	0.45	E6-139	72	0.59	B1-023	93	1.37	C4-066	1.93	0.31	E6-135
1.19	0.26	C6-060	1.5	9.38	D5-093	13	0.45	E3-160	69	0.57	B3-037	89	1.31	B6-010	1.90	0.31	D4-120
1.17	0.25	F6-172	1.5	9.38	D3-116	13	0.45	E3-156	67	0.55	B4-021	85	1.25	C2-092	1.82	0.29	B4-021
1.16	0.25	D4-127	1.5	9.38	C6-060	13	0.45	D5-093	66	0.54	C2-074	82	1.21	D6-119	1.72	0.28	E4-137
1.15	0.25	E4-137	1.5	9.38	C6-054	13	0.45	C4-066	66	0.54	B5-044	82	1.21	C1-056	1.72	0.28	B6-046
1.12	0.24	B4-029	1.5	9.38	C3-051	13	0.45	B5-030	64	0.52	B2-041	81	1.19	C6-053	1.71	0.27	D4-102
1.12	0.24	B2-022	1.5	9.38	B6-046	12	0.41	E6-136	61	0.50	B6-042	80	1.18	E6-139	1.69	0.27	B6-038
1.09	0.23	C6-059	1.5	9.38	B6-036	12	0.41	D5-114	57	0.47	B6-031	77	1.13	B4-045	1.67	0.27	E3-156
1.09	0.23	B6-042	1.5	9.38	B6-020	12	0.41	D5-096	56	0.46	E3-156	74	1.09	C6-059	1.67	0.27	D4-127
1.08	0.23	B6-048	1.5	9.38	B6-016	12	0.41	C6-054	55	0.45	B2-006	74	1.09	B5-044	1.66	0.27	E3-160
1.06	0.23	B6-010	1.5	9.38	B5-039	12	0.41	C6-053	55	0.45	A5-004	72	1.06	D6-105	1.65	0.27	D4-115
1.05	0.23	D4-120	1.5	9.38	A6-002	12	0.41	B6-026	54	0.44	F3-190	70	1.03	B6-048	1.57	0.25	B3-033
1.05	0.23	D4-095	1.0	6.25	F6-189	12	0.41	B5-043	53	0.43	B2-017	68	1.00	B2-025	1.54	0.25	C4-055
1.02	0.22	C6-054	1.0	6.25	F6-183	12	0.41	B3-047	52	0.43	D4-098	66	0.97	E3-143	1.51	0.24	E6-139
1.02	0.22	C4-072	1.0	6.25	F6-175	11	0.38	F6-172	52	0.43	D4-095	66	0.97	D5-093	1.46	0.23	E3-152
1.02	0.22	B3-018	1.0	6.25	F6-174	11	0.38	F3-190	52	0.43	C4-055	66	0.97	C6-054	1.46	0.23	C5-049
1.00	0.21	B6-046	1.0	6.25	F5-177	11	0.38	D5-107	52	0.43	C2-064	66	0.97	C5-049	1.45	0.23	B3-018
0.99	0.21	B2-028	1.0	6.25	F4-185	11	0.38	D4-102	51	0.42	D4-127	65	0.96	D5-096	1.44	0.23	C2-074
0.99	0.21	B2-011	1.0	6.25	F3-179	11	0.38	C5-050	51	0.42	B6-010	65	0.96	C4-077	1.41	0.23	B2-022
0.98	0.21	E3-156	1.0	6.25	F3-161	11	0.38	C4-070	50	0.41	D4-102	65	0.96	C4-075	1.39	0.22	E4-146
0.98	0.21	E3-152	1.0	6.25	E6-139	11	0.38	B6-042	50	0.41	B6-048	64	0.94	C4-070	1.31	0.21	D5-125
0.98	0.21	D4-115	1.0	6.25	E6-134	11	0.38	B6-013	49	0.40	B2-025	63	0.93	C4-076	1.30	0.21	B6-026
0.98	0.21	C6-053	1.0	6.25	E5-151	11	0.38	B6-008	49	0.40	A5-005	62	0.91	C6-052	1.28	0.21	E4-131
0.97	0.21	B6-032	1.0	6.25	E4-149	10	0.34	F6-183	48	0.39	E4-137	59	0.87	B4-021	1.28	0.21	B3-047
0.96	0.21	F5-181	1.0	6.25	E4-147	10	0.34	F6-178	48	0.39	D4-120	57	0.84	B5-043	1.27	0.20	F6-172
0.96	0.21	B6-038	1.0	6.25	E4-132	10	0.34	F6-174	47	0.39	B6-035	53	0.78	C4-072	1.27	0.20	C3-051
0.95	0.20	C6-052	1.0	6.25	E3-157	10	0.34	F5-177	47	0.39	B4-040	53	0.78	B6-038	1.27	0.20	B2-006
0.95	0.20	B5-043	1.0	6.25	E3-156	10	0.34	E4-132	46	0.38	C6-059	52	0.76	D5-097	1.26	0.20	E3-157
0.94	0.20	F6-175	1.0	6.25	E3-152	10	0.34	E4-131	45	0.37	F6-172	52	0.76	B6-042	1.25	0.20	F6-178
0.94	0.20	F3-190	1.0	6.25	D6-112	10	0.34	D4-098	45	0.37	D4-115	51	0.75	B2-011	1.25	0.20	C4-070
0.94	0.20	B6-026	1.0	6.25	D5-128	10	0.34	D4-095	45	0.37	C6-060	50	0.74	E4-132	1.25	0.20	B6-048
0.93	0.20	D5-097	1.0	6.25	D5-122	10	0.34	D3-124	45	0.37	C4-068	50	0.74	C6-062	1.24	0.20	F4-167
0.92	0.20	C6-067	1.0	6.25	D5-108	10	0.34	C6-085	44	0.36	E3-160	49	0.72	C6-085	1.20	0.19	F6-175
0.89	0.19	F5-170	1.0	6.25	D4-117	10	0.34	C6-060	44	0.36	B6-026	49	0.72	C4-078	1.20	0.19	C5-073
0.88	0.19	D5-111	1.0	6.25	D4-095	10	0.34	C4-075	44	0.36	A6-002	48	0.71	B6-014	1.20	0.19	B2-041
0.88	0.19	B1-023	1.0	6.25	D3-110	10	0.34	C3-061	43	0.35	F6-178	47	0.69	F6-189	1.15	0.18	F6-189

Hf (ppm)	Hf (K)	LAKE CODE	K (%)	K (K)	LAKE CODE	La (ppm)	La (K)	LAKE CODE	Lu (ppm)	Lu (K)	LAKE CODE	Mg (%)	Mg (K)	LAKE CODE	Mn (ppm)	Mn (K)	LAKE CODE
7	2.50	F6-178	1.45	0.79	A5-001	177	5.12	E6-139	1.0	1.85	E3-160	2.05	0.74	C1-056	1158	1.09	E6-135
7	2.50	E3-156	1.35	0.73	B2-041	167	4.83	E3-156	0.9	1.67	E3-156	0.86	0.31	A5-001	745	0.70	C4-068
7	2.50	D4-102	1.23	0.67	D4-102	158	4.57	E3-160	0.7	1.30	B2-024	0.75	0.27	F3-190	630	0.59	B6-038
6	2.14	F5-181	1.17	0.64	B4-021	110	3.18	D5-114	0.7	1.30	B2-011	0.74	0.27	B4-021	630	0.59	B1-023
6	2.14	B4-021	1.05	0.57	E4-137	102	2.95	F5-173	0.6	1.11	F3-179	0.67	0.24	B3-033	623	0.59	D4-098
6	2.14	B2-041	1.00	0.54	F5-181	97	2.80	F5-182	0.6	1.11	E6-139	0.62	0.22	D4-102	543	0.51	E3-160
5	1.79	F6-187	0.99	0.54	D5-125	95	2.75	C2-086	0.6	1.11	D5-114	0.59	0.21	C2-074	539	0.51	B6-042
5	1.79	F6-172	0.97	0.53	F3-190	92	2.66	F6-189	0.6	1.11	B4-029	0.56	0.20	E4-137	507	0.48	C4-055
5	1.79	F5-180	0.97	0.53	D4-127	90	2.60	B4-029	0.6	1.11	B2-025	0.56	0.20	D4-127	486	0.46	B3-047
5	1.79	F5-177	0.95	0.52	D4-098	79	2.28	F6-183	0.5	0.93	F6-189	0.56	0.20	D4-098	473	0.45	F6-183
5	1.79	F5-170	0.94	0.51	F6-178	77	2.23	B2-017	0.5	0.93	F6-175	0.53	0.19	D4-115	462	0.44	C6-059
5	1.79	F4-167	0.90	0.49	D4-120	75	2.17	D5-121	0.5	0.93	F6-174	0.52	0.19	F6-172	456	0.43	B6-046
5	1.79	E5-153	0.90	0.49	B2-022	74	2.14	F6-175	0.5	0.93	F6-172	0.52	0.19	D4-120	443	0.42	E3-156
5	1.79	E5-130	0.87	0.47	F5-170	74	2.14	F6-172	0.5	0.93	F5-182	0.52	0.19	B2-022	442	0.42	C2-074
5	1.79	E4-146	0.86	0.47	B3-033	74	2.14	F5-180	0.5	0.93	F5-173	0.50	0.18	D5-125	442	0.42	B6-032
5	1.79	E4-137	0.85	0.46	B2-028	73	2.11	C4-066	0.5	0.93	F3-184	0.50	0.18	C4-055	418	0.39	B6-048
5	1.79	D5-128	0.83	0.45	D4-115	71	2.05	D6-126	0.5	0.93	E4-131	0.49	0.18	F6-178	417	0.39	D4-102
5	1.79	D5-125	0.79	0.43	F4-167	67	1.94	B2-011	0.5	0.93	C4-066	0.49	0.18	F4-167	406	0.38	C4-077
5	1.79	D5-111	0.76	0.41	F6-172	66	1.91	E6-135	0.5	0.93	C2-086	0.49	0.18	C2-064	400	0.38	B6-010
5	1.79	D4-098	0.76	0.41	C4-055	62	1.79	B2-024	0.5	0.93	B2-017	0.47	0.17	B2-041	397	0.37	C3-051
5	1.79	B6-010	0.75	0.41	E5-140	61	1.76	E3-157	0.5	0.93	B1-023	0.45	0.16	D4-095	386	0.36	A5-001
5	1.79	A5-001	0.75	0.41	E5-130	59	1.71	E3-143	0.4	0.74	F5-169	0.45	0.16	C4-068	352	0.33	C1-056
4	1.43	F6-175	0.73	0.40	C2-074	58	1.68	F5-168	0.4	0.74	F5-168	0.45	0.16	B6-026	348	0.33	B6-014
4	1.43	F5-176	0.73	0.40	B6-010	58	1.68	E5-150	0.4	0.74	F5-164	0.44	0.16	F5-170	343	0.32	D4-120
4	1.43	F5-169	0.71	0.39	A2-003	57	1.65	C4-055	0.4	0.74	F4-188	0.44	0.16	E5-130	343	0.32	A6-002
4	1.43	F5-168	0.69	0.38	D5-128	56	1.62	F5-176	0.4	0.74	F4-171	0.43	0.16	B1-023	340	0.32	F3-190
4	1.43	F5-165	0.64	0.35	D5-111	54	1.56	E3-152	0.4	0.74	E6-135	0.42	0.15	F5-181	340	0.32	C2-064
4	1.43	F4-171	0.63	0.34	F5-168	53	1.53	B2-025	0.4	0.74	E5-150	0.42	0.15	B6-032	323	0.30	B6-026
4	1.43	E5-140	0.63	0.34	C4-068	52	1.50	E5-155	0.4	0.74	E4-146	0.42	0.15	B6-010	304	0.29	E6-136
4	1.43	D6-105	0.61	0.33	D4-095	52	1.50	D3-100	0.4	0.74	E4-132	0.41	0.15	F5-169	303	0.29	C6-054
4	1.43	D5-114	0.61	0.33	C5-088	52	1.50	C4-081	0.4	0.74	E3-143	0.39	0.14	F6-175	300	0.28	B4-021
4	1.43	D5-108	0.60	0.33	E5-153	51	1.47	E6-134	0.4	0.74	D5-121	0.39	0.14	F5-168	294	0.28	D4-095
4	1.43	D4-127	0.60	0.33	E3-156	51	1.47	E4-132	0.4	0.74	D3-124	0.38	0.14	E3-156	291	0.27	E6-139
4	1.43	D4-120	0.60	0.33	C4-076	50	1.45	E4-131	0.4	0.74	D3-100	0.38	0.14	B3-047	281	0.27	E4-137
4	1.43	D4-115	0.60	0.33	C4-072	49	1.42	F4-171	0.4	0.74	C4-081	0.37	0.13	F6-187	278	0.26	D4-115
4	1.43	C5-088	0.60	0.33	B4-029	49	1.42	B4-019	0.4	0.74	C4-055	0.37	0.13	B3-018	274	0.26	B6-016
4	1.43	C5-049	0.59	0.32	F6-187	48	1.39	F6-174	0.4	0.74	B6-014	0.36	0.13	D5-128	271	0.26	D5-125
4	1.43	C4-076	0.57	0.31	F5-169	48	1.39	E3-148	0.4	0.74	B6-010	0.36	0.13	C6-053	271	0.26	C5-049
4	1.43	C4-072	0.57	0.31	C1-056	47	1.36	F3-179	0.4	0.74	B2-006	0.36	0.13	C2-090	262	0.25	D4-117
4	1.43	C4-055	0.56	0.30	D6-105	46	1.33	F5-169	0.3	0.56	F6-186	0.35	0.13	F5-176	258	0.24	C6-060
4	1.43	C2-074	0.54	0.29	F5-165	46	1.33	E6-136	0.3	0.56	F6-183	0.35	0.13	D5-111	252	0.24	D4-127
3	1.07	F4-188	0.54	0.29	E5-144	46	1.33	E4-146	0.3	0.56	F6-178	0.35	0.13	C5-049	246	0.23	C3-061
3	1.07	F4-185	0.54	0.29	C5-091	45	1.30	F6-178	0.3	0.56	F5-180	0.35	0.13	C4-072	245	0.23	B2-041
3	1.07	F3-161	0.54	0.29	C5-049	45	1.30	F5-177	0.3	0.56	F5-177	0.34	0.12	D6-126	244	0.23	F4-171
3	1.07	E6-158	0.54	0.29	B3-018	45	1.30	F3-161	0.3	0.56	F5-176	0.33	0.12	F5-180	242	0.23	C6-052
3	1.07	E6-142	0.53	0.29	D5-108	44	1.27	E5-144	0.3	0.56	F5-165	0.33	0.12	F4-171	237	0.22	F6-178
3	1.07	E6-139	0.52	0.28	E4-146	44	1.27	E5-140	0.3	0.56	F4-185	0.33	0.12	E5-140	236	0.22	E3-157
3	1.07	E5-144	0.51	0.28	F6-175	43	1.24	F6-186	0.3	0.56	F4-163	0.33	0.12	E4-146	235	0.22	B6-013
3	1.07	E4-131	0.51	0.28	F5-180	43	1.24	F4-185	0.3	0.56	F3-161	0.33	0.12	C6-060	235	0.22	B3-033
3	1.07	E3-160	0.51	0.28	D5-113	43	1.24	D3-124	0.3	0.56	E6-134	0.33	0.12	C5-088	227	0.21	B2-022

Mo (ppm)	Mo (K)	LAKE CODE	Na (%)	Na (K)	LAKE CODE	Ni (ppm)	Ni (K)	LAKE CODE	P (ppm)	P (K)	LAKE CODE
48.0	40.00	C4-068	2.58	1.14	A5-001	79	0.80	C1-056	4700	4.20	F6-183
28.0	23.33	C4-055	2.27	1.00	D4-102	31	0.31	E3-156	2810	2.51	C4-077
16.0	13.33	D6-119	2.27	1.00	B4-021	27	0.27	B6-046	2360	2.11	D5-097
12.0	10.00	D6-126	2.16	0.95	D5-125	25	0.25	C2-090	2140	1.91	C5-073
11.0	9.17	B4-029	1.99	0.88	B2-041	21	0.21	B6-031	2030	1.81	B6-014
9.0	7.50	E6-139	1.86	0.82	B3-033	21	0.21	B6-026	1950	1.74	F6-186
9.0	7.50	C2-092	1.83	0.81	B2-022	19	0.19	F6-172	1870	1.67	D5-096
8.0	6.67	D3-123	1.77	0.78	D4-098	19	0.19	F3-190	1800	1.61	D5-093
8.0	6.67	C4-075	1.68	0.74	E4-137	19	0.19	C6-059	1770	1.58	D4-117
8.0	6.67	B6-010	1.64	0.72	F6-178	19	0.19	C4-055	1750	1.56	C4-070
7.0	5.83	D5-108	1.59	0.70	B2-028	19	0.19	C2-064	1750	1.56	C4-055
7.0	5.83	C4-066	1.52	0.67	D4-127	19	0.19	B6-042	1710	1.53	B6-042
6.0	5.00	C4-083	1.50	0.66	E5-140	19	0.19	B3-033	1680	1.50	D3-124
5.0	4.17	E4-132	1.49	0.66	F5-181	18	0.18	F6-189	1640	1.46	B6-020
5.0	4.17	D5-101	1.42	0.63	F4-167	18	0.18	F6-175	1640	1.46	A6-002
5.0	4.17	C4-077	1.41	0.62	D4-120	18	0.18	E6-135	1630	1.46	B6-010
5.0	4.17	C3-061	1.32	0.58	E5-130	18	0.18	C4-068	1580	1.41	E6-136
5.0	4.17	C3-051	1.31	0.58	D5-111	18	0.18	C2-074	1570	1.40	E3-152
5.0	4.17	B3-047	1.30	0.57	F5-170	18	0.18	B5-043	1570	1.40	C3-061
5.0	4.17	A2-003	1.29	0.57	D4-115	18	0.18	A5-001	1530	1.37	B6-016
4.0	3.33	F6-189	1.24	0.55	C2-074	17	0.17	D5-114	1520	1.36	B6-038
4.0	3.33	F6-174	1.20	0.53	F6-172	17	0.17	D4-120	1470	1.31	F5-176
4.0	3.33	E4-146	1.12	0.49	D5-128	17	0.17	B4-021	1460	1.30	E5-130
4.0	3.33	E3-156	1.06	0.47	C1-056	17	0.17	B1-023	1460	1.30	C6-052
4.0	3.33	D5-125	1.04	0.46	F3-190	16	0.16	F5-177	1460	1.30	C3-051
4.0	3.33	D5-111	1.01	0.44	C5-088	16	0.16	E6-142	1450	1.29	F5-173
4.0	3.33	D5-096	0.97	0.43	F6-187	16	0.16	E5-151	1450	1.29	C5-071
4.0	3.33	D4-095	0.96	0.42	C5-049	16	0.16	D4-115	1450	1.29	B6-012
4.0	3.33	D3-116	0.96	0.42	B6-010	16	0.16	C4-072	1440	1.29	C5-049
4.0	3.33	D3-100	0.95	0.42	B3-018	16	0.16	C2-082	1430	1.28	D5-128
4.0	3.33	C4-078	0.94	0.41	C4-068	15	0.15	E6-159	1400	1.25	D5-107
3.0	2.50	F6-175	0.94	0.41	B4-029	15	0.15	D4-127	1400	1.25	D4-095
3.0	2.50	F4-167	0.93	0.41	C4-055	15	0.15	C6-060	1390	1.24	C4-068
3.0	2.50	E5-151	0.92	0.41	D4-095	15	0.15	C5-050	1380	1.23	B2-025
3.0	2.50	E5-144	0.91	0.40	C4-076	15	0.15	C2-087	1320	1.18	E6-135
3.0	2.50	E5-133	0.90	0.40	F5-165	15	0.15	B6-010	1290	1.15	E3-157
3.0	2.50	E4-147	0.89	0.39	D6-105	15	0.15	B4-045	1280	1.14	B5-044
3.0	2.50	E3-152	0.88	0.39	F5-168	15	0.15	B3-047	1270	1.13	C6-059
3.0	2.50	E3-143	0.88	0.39	C4-072	15	0.15	B3-037	1260	1.13	C2-092
3.0	2.50	D5-121	0.85	0.37	F5-169	15	0.15	B3-018	1240	1.11	C6-079
3.0	2.50	D5-114	0.83	0.37	F5-180	14	0.14	F6-178	1230	1.10	D6-119
3.0	2.50	D5-104	0.83	0.37	E5-153	14	0.14	F6-174	1230	1.10	B6-032
3.0	2.50	D5-097	0.82	0.36	E3-156	14	0.14	F3-161	1210	1.08	E5-153
3.0	2.50	D5-093	0.80	0.35	F6-175	14	0.14	E6-139	1210	1.08	B5-030
3.0	2.50	D4-117	0.80	0.35	C5-091	14	0.14	E4-137	1200	1.07	C5-089
3.0	2.50	D4-098	0.79	0.35	E5-144	14	0.14	E4-131	1190	1.06	B3-047
3.0	2.50	D3-124	0.77	0.34	E4-146	14	0.14	D6-126	1170	1.04	F3-190
3.0	2.50	D3-094	0.76	0.33	D5-108	14	0.14	D4-098	1170	1.04	C2-074
3.0	2.50	C6-054	0.73	0.32	B3-047	14	0.14	D3-109	1160	1.04	E6-134
3.0	2.50	C4-081	0.72	0.32	E6-142	14	0.14	C6-054	1160	1.04	D4-098

Pb (ppm)	Pb (K)	LAKE CODE	Sb (ppm)	Sb (K)	LAKE CODE	Sc (ppm)	Sc (K)	LAKE CODE	Sr (ppm)	Sr (K)	LAKE CODE	Ta (ppm)	Ta (K)	LAKE CODE	Th (ppm)	Th (K)	LAKE CODE
224	17.23	C3-061	0.4	2.00	D6-105	18.6	0.74	B1-023	317	0.83	A5-001	2	1.18	F6-189	25.5	3.15	E3-156
104	8.00	C4-076	0.4	2.00	B4-029	16.0	0.64	E3-156	254	0.66	D4-102	2	1.18	F6-187	13.5	1.67	D5-114
82	6.31	C4-068	0.3	1.50	E4-147	14.9	0.60	B2-006	247	0.64	B2-041	2	1.18	F6-186	12.9	1.59	B4-029
36	2.77	C5-091	0.3	1.50	D6-119	14.8	0.59	B2-017	234	0.61	B4-021	2	1.18	F6-183	12.8	1.58	B2-017
32	2.46	D5-097	0.3	1.50	D5-101	14.1	0.56	C1-056	228	0.59	F6-178	2	1.18	F6-178	12.1	1.49	F6-189
32	2.46	C4-077	0.3	1.50	D5-096	11.7	0.47	C2-086	207	0.54	D5-125	2	1.18	F6-175	10.3	1.27	F5-182
28	2.15	D5-096	0.3	1.50	C5-091	11.6	0.46	B6-014	207	0.54	B2-022	2	1.18	F6-174	9.9	1.22	B2-006
28	2.15	C3-051	0.3	1.50	C4-055	11.6	0.46	B6-010	203	0.53	E4-137	2	1.18	F6-172	9.4	1.16	F5-168
28	2.15	C2-092	0.3	1.50	B6-042	11.3	0.45	B2-022	201	0.52	F5-181	2	1.18	F6-166	8.3	1.02	E3-160
26	2.00	D6-105	0.3	1.50	B5-015	10.7	0.43	C6-060	198	0.52	D4-127	2	1.18	F6-162	7.9	0.98	F5-176
26	2.00	C4-070	0.3	1.50	B2-028	10.7	0.43	C2-074	198	0.52	D4-098	2	1.18	F5-182	7.4	0.91	C4-055
26	2.00	B2-028	0.3	1.50	B2-006	10.4	0.42	D5-114	184	0.48	B2-028	2	1.18	F5-181	7.2	0.89	F5-173
24	1.85	D5-101	0.2	1.00	F6-189	9.9	0.40	C4-055	179	0.47	C1-056	2	1.18	F5-180	7.2	0.89	F4-188
22	1.69	C5-058	0.2	1.00	F6-187	9.8	0.39	E3-160	179	0.47	B3-033	2	1.18	F5-177	7.2	0.89	E4-137
22	1.69	B5-015	0.2	1.00	F6-186	9.6	0.38	B4-029	177	0.46	F4-167	2	1.18	F5-176	7.1	0.88	F6-172
20	1.54	B2-022	0.2	1.00	F6-183	9.6	0.38	A5-001	174	0.45	D4-120	2	1.18	F5-173	6.9	0.85	F5-181
18	1.38	D5-113	0.2	1.00	F6-178	9.3	0.37	E4-146	171	0.45	D4-095	2	1.18	F5-170	6.9	0.85	E4-131
18	1.38	D4-117	0.2	1.00	F6-175	9.2	0.37	E6-139	169	0.44	F5-180	2	1.18	F5-169	6.9	0.85	B2-022
18	1.38	D3-110	0.2	1.00	F6-174	9.1	0.36	E6-135	168	0.44	F5-170	2	1.18	F5-168	6.8	0.84	D6-126
18	1.38	C5-088	0.2	1.00	F6-172	9.1	0.36	C2-090	168	0.44	C2-074	2	1.18	F5-165	6.7	0.83	D4-115
18	1.38	C5-063	0.2	1.00	F6-166	9.1	0.36	B4-021	161	0.42	D4-115	2	1.18	F5-164	6.6	0.81	B2-009
18	1.38	C4-066	0.2	1.00	F6-162	8.9	0.36	F6-189	159	0.41	F6-172	2	1.18	F4-188	6.5	0.80	F4-171
18	1.38	C4-065	0.2	1.00	F5-182	8.9	0.36	C6-053	157	0.41	E5-140	2	1.18	F4-185	6.3	0.78	F5-170
18	1.38	C4-057	0.2	1.00	F5-181	8.8	0.35	C6-059	147	0.38	E5-130	2	1.18	F4-171	6.3	0.78	F5-169
18	1.38	C2-064	0.2	1.00	F5-180	8.4	0.34	D3-100	141	0.37	D5-128	2	1.18	F4-167	6.3	0.78	F3-179
16	1.23	E4-146	0.2	1.00	F5-177	8.3	0.33	D4-102	138	0.36	D5-111	2	1.18	F4-163	6.3	0.78	D4-120
16	1.23	E4-137	0.2	1.00	F5-176	8.1	0.32	F6-172	138	0.36	B6-010	2	1.18	F3-190	6.2	0.77	E4-146
16	1.23	E3-160	0.2	1.00	F5-173	8.1	0.32	E4-131	132	0.34	F6-187	2	1.18	F3-184	6.2	0.77	E4-132
16	1.23	D6-112	0.2	1.00	F5-170	8.0	0.32	C4-068	130	0.34	F3-190	2	1.18	F3-179	6.1	0.75	E3-143
16	1.23	D5-114	0.2	1.00	F5-169	8.0	0.32	B2-009	126	0.33	F5-165	2	1.18	F3-161	6.1	0.75	D4-098
16	1.23	D4-115	0.2	1.00	F5-168	7.9	0.32	E3-143	125	0.33	C5-088	2	1.18	E6-159	6.1	0.75	D4-095
16	1.23	D3-109	0.2	1.00	F5-165	7.8	0.31	D6-126	123	0.32	F5-168	2	1.18	E6-158	6.0	0.74	E3-157
16	1.23	C6-059	0.2	1.00	F5-164	7.8	0.31	B3-033	122	0.32	B4-029	2	1.18	E6-154	5.9	0.73	D4-127
16	1.23	C5-050	0.2	1.00	F4-188	7.7	0.31	E4-132	121	0.32	F5-169	2	1.18	E6-142	5.9	0.73	D4-102
16	1.23	C4-072	0.2	1.00	F4-185	7.7	0.31	D5-125	120	0.31	E3-156	2	1.18	E6-139	5.8	0.72	E5-153
16	1.23	C1-056	0.2	1.00	F4-171	7.7	0.31	D4-098	120	0.31	C4-072	2	1.18	E6-138	5.7	0.70	E6-139
16	1.23	B4-029	0.2	1.00	F4-167	7.7	0.31	C2-087	119	0.31	C4-076	2	1.18	E6-136	5.6	0.69	F6-175
16	1.23	B2-041	0.2	1.00	F4-163	7.7	0.31	B6-026	117	0.30	E5-153	2	1.18	E6-135	5.6	0.69	E5-129
16	1.23	B2-006	0.2	1.00	F3-190	7.6	0.30	B6-046	117	0.30	D6-105	2	1.18	E6-134	5.5	0.68	D5-121
16	1.23	A2-003	0.2	1.00	F3-184	7.5	0.30	E4-137	117	0.30	C5-049	2	1.18	E5-155	5.4	0.67	F6-162
14	1.08	F5-176	0.2	1.00	F3-179	7.5	0.30	B2-028	115	0.30	F6-175	2	1.18	E5-153	5.4	0.67	F5-177
14	1.08	F5-164	0.2	1.00	F3-161	7.4	0.30	F5-168	115	0.30	C4-055	2	1.18	E5-151	5.4	0.67	F4-185
14	1.08	F4-185	0.2	1.00	E6-159	7.4	0.30	D4-120	113	0.29	E5-144	2	1.18	E5-150	5.4	0.67	E3-152
14	1.08	E6-135	0.2	1.00	E6-158	7.3	0.29	F6-178	110	0.29	C2-064	2	1.18	E5-145	5.4	0.67	B6-010
14	1.08	E3-148	0.2	1.00	E6-154	7.3	0.29	C6-052	110	0.29	B3-018	2	1.18	E5-144	5.3	0.65	F6-186
14	1.08	D5-125	0.2	1.00	E6-142	7.3	0.29	B3-018	109	0.28	D5-108	2	1.18	E5-140	5.3	0.65	F3-184
14	1.08	D5-107	0.2	1.00	E6-139	7.2	0.29	B6-032	108	0.28	C4-068	2	1.18	E5-133	5.3	0.65	E5-150
14	1.08	D5-093	0.2	1.00	E6-138	7.1	0.28	F6-175	106	0.28	D5-113	2	1.18	E5-130	5.3	0.65	E5-144
14	1.08	D4-102	0.2	1.00	E6-136	7.1	0.28	D4-115	105	0.27	F5-177	2	1.18	E5-129	5.3	0.65	D3-100
14	1.08	D4-098	0.2	1.00	E6-135	7.1	0.28	B2-025	104	0.27	C5-091	2	1.18	E4-149	5.3	0.65	B1-023

Ti (%)	Ti (K)	LAKE CODE	U (ppm)	U (K)	LAKE CODE	V (ppm)	V (K)	LAKE CODE	W (ppm)	W (K)	LAKE CODE	Zn (ppm)	Zn (K)	LAKE CODE
0.28	0.44	C1-056	32.3	14.04	F3-179	116	0.85	B4-029	6	5.00	C4-075	646	8.50	C2-092
0.27	0.43	B4-021	24.0	10.43	E3-160	96	0.71	B1-023	4	3.33	E3-156	274	3.61	C3-061
0.25	0.40	B2-028	24.0	10.43	B2-024	90	0.66	B2-006	4	3.33	B4-029	192	2.53	B6-046
0.24	0.38	D4-102	20.0	8.70	B2-011	84	0.62	C1-056	3	2.50	E6-135	192	2.53	B6-038
0.24	0.38	B2-041	19.1	8.30	F3-184	79	0.58	E6-139	3	2.50	E3-160	179	2.36	A6-002
0.23	0.36	B2-022	18.0	7.83	E3-156	76	0.56	D4-095	3	2.50	D5-114	176	2.32	C6-059
0.23	0.36	A5-001	18.0	7.83	B2-025	73	0.54	F3-190	3	2.50	B6-014	167	2.20	B6-042
0.22	0.35	F3-190	16.9	7.35	F4-188	73	0.54	B2-017	3	2.50	B6-010	164	2.16	F6-186
0.22	0.35	B3-033	15.0	6.52	D3-123	70	0.51	B6-010	3	2.50	B3-037	161	2.12	C4-068
0.21	0.33	E4-137	14.0	6.09	B3-037	68	0.50	B2-025	3	2.50	B2-025	157	2.07	C6-060
0.21	0.33	D5-125	13.2	5.74	F5-165	64	0.47	B4-021	3	2.50	B2-009	154	2.03	C6-052
0.20	0.32	D4-127	13.0	5.65	B4-029	62	0.46	C4-081	2	1.67	E3-143	148	1.95	F6-189
0.20	0.32	D4-098	12.0	5.22	F6-174	61	0.45	D4-098	2	1.67	D4-098	148	1.95	E6-135
0.19	0.30	E5-130	12.0	5.22	E6-159	59	0.43	B6-032	2	1.67	D4-095	148	1.95	E6-134
0.19	0.30	D4-120	12.0	5.22	E5-150	58	0.43	D3-124	2	1.67	C5-091	148	1.95	B6-016
0.18	0.28	F6-178	12.0	5.22	D3-124	58	0.43	C3-051	2	1.67	C4-083	144	1.89	C6-054
0.18	0.28	F5-181	11.8	5.13	F5-182	56	0.41	F6-183	2	1.67	C4-078	143	1.88	D5-096
0.18	0.28	D4-115	11.6	5.04	F5-180	56	0.41	B6-014	2	1.67	C4-076	141	1.86	B6-026
0.17	0.27	F5-170	11.4	4.96	F5-177	56	0.41	A5-001	2	1.67	C4-072	140	1.84	D6-119
0.17	0.27	C4-055	11.0	4.78	E6-158	55	0.40	D6-126	2	1.67	C4-068	140	1.84	C4-075
0.16	0.25	F6-172	11.0	4.78	E5-155	55	0.40	C4-077	2	1.67	C4-055	140	1.84	B3-047
0.16	0.25	F5-168	11.0	4.78	E4-131	54	0.40	B3-033	2	1.67	C3-051	139	1.83	D5-097
0.16	0.25	D5-128	10.0	4.35	E5-151	54	0.40	B3-018	2	1.67	C2-086	139	1.83	C4-081
0.16	0.25	D4-095	10.0	4.35	E4-132	53	0.39	E4-146	2	1.67	C2-082	137	1.80	B6-010
0.16	0.25	C4-068	10.0	4.35	D5-114	53	0.39	E3-152	2	1.67	B6-042	131	1.72	C6-067
0.16	0.25	C2-074	10.0	4.35	D4-117	53	0.39	C4-055	2	1.67	B6-031	129	1.70	D5-114
0.16	0.25	B3-018	9.9	4.30	F4-171	53	0.39	C2-074	2	1.67	B2-028	129	1.70	C3-051
0.15	0.24	C5-088	9.6	4.17	F5-169	52	0.38	D5-097	2	1.67	B2-022	128	1.68	D5-093
0.15	0.24	C5-049	9.6	4.17	F5-168	51	0.38	D4-117	2	1.67	B2-017	128	1.68	C6-079
0.15	0.24	C2-064	9.0	3.91	E4-147	51	0.38	B3-047	2	1.67	B2-011	127	1.67	C6-085
0.15	0.24	B6-010	9.0	3.91	D3-110	50	0.37	E5-133	2	1.67	B1-023	121	1.59	B6-014
0.14	0.22	F6-187	9.0	3.91	C4-066	50	0.37	D4-120	1	0.83	F6-189	120	1.58	E3-152
0.14	0.22	F4-167	9.0	3.91	B3-018	50	0.37	C4-068	1	0.83	F6-187	120	1.58	B6-032
0.14	0.22	E5-153	8.9	3.87	F6-175	50	0.37	B6-042	1	0.83	F6-186	119	1.57	E4-131
0.14	0.22	E4-146	8.8	3.83	F5-176	49	0.36	D4-115	1	0.83	F6-183	119	1.57	C4-055
0.14	0.22	D6-105	8.8	3.83	F4-163	49	0.36	C2-090	1	0.83	F6-178	118	1.55	C4-070
0.14	0.22	D5-111	8.3	3.61	F6-172	48	0.35	E3-160	1	0.83	F6-175	118	1.55	B6-020
0.14	0.22	C5-091	8.0	3.48	E4-146	48	0.35	B6-038	1	0.83	F6-174	117	1.54	C4-078
0.14	0.22	B6-026	8.0	3.48	D3-100	47	0.35	E4-137	1	0.83	F6-172	116	1.53	D4-095
0.13	0.21	F6-175	7.8	3.39	F5-173	47	0.35	C5-049	1	0.83	F6-166	115	1.51	B6-036
0.13	0.21	F5-176	7.6	3.30	F6-189	47	0.35	B6-046	1	0.83	F6-162	115	1.51	B5-030
0.13	0.21	F5-169	7.0	3.04	E6-154	46	0.34	F6-189	1	0.83	F5-182	113	1.49	F6-175
0.13	0.21	E3-160	7.0	3.04	E6-135	46	0.34	D4-127	1	0.83	F5-181	112	1.47	E4-132
0.13	0.21	D6-126	7.0	3.04	E5-145	45	0.33	E6-136	1	0.83	F5-180	112	1.47	D3-100
0.13	0.21	C4-072	7.0	3.04	E5-144	45	0.33	D4-102	1	0.83	F5-177	112	1.47	C5-049
0.13	0.21	B3-047	7.0	3.04	E4-149	44	0.32	E6-135	1	0.83	F5-176	110	1.45	E6-136
0.12	0.19	F5-180	7.0	3.04	E3-157	44	0.32	E3-156	1	0.83	F5-173	110	1.45	B5-039
0.12	0.19	F5-165	7.0	3.04	D3-116	44	0.32	C2-087	1	0.83	F5-170	109	1.43	B6-048
0.12	0.19	E5-144	7.0	3.04	C2-086	43	0.32	D5-114	1	0.83	F5-169	108	1.42	F6-174
0.12	0.19	E5-140	6.7	2.91	F5-164	43	0.32	C2-086	1	0.83	F5-168	108	1.42	D3-124

Summary of statistics (Table 1):

	LOI (%)	Ag (ppm)	Ag (K)	Al (%)	Al (K)	As (ppm)	As (K)	Au (ppb)	Au (K)	Ba (ppm)	Ba (K)	Be (ppm)	Be (K)	Bi (ppm)	Bi (K)	Br (ppm)	Br (K)
CLARKE INDEX–1**		0.08		8.36		1.80		4		390		2.00		0.0082		2.50	
MEAN	37.80	0.53	6.68	2.89	0.35	2.76	1.54	1.27	0.32	213.37	0.55	0.57	0.28	2.06	251.60	26.96	10.78
VARIANCE	178.85	0.02	2.92	1.36	0.02	35.43	10.94	0.57	0.04	10784.36	0.07	0.05	0.01	0.12	1828.88	238.29	38.13
STANDARD DEVIATION	13.37	0.14	1.71	1.17	0.14	5.95	3.31	0.75	0.19	103.85	0.27	0.22	0.11	0.35	42.77	15.44	6.17
C.V.(%)	35.38	25.57	25.57	40.43	40.43	215.42	215.42	59.41	59.41	48.67	48.67	38.41	38.41	17.00	17.00	57.27	57.27
n	190	190	190	190	190	190	190	190	190	190	190	190	190	190	190	190	190
MINIMUM	2.60	0.50	6.25	0.59	0.07	1.00	0.56	1.00	0.25	60.00	0.15	0.50	0.25	2.00	243.90	1.30	0.52
MAXIMUM	82.80	1.50	18.75	6.59	0.79	69.00	38.33	6.00	1.50	610.00	1.56	1.50	0.75	4.00	487.80	71.50	28.60
ANALYTICAL METHOD***		AAS		ICP		NAA		NAA		ICP		ICP		ICP		NAA	
DETECTION LIMIT	0.1	0.5		0.01		1		1		10		0.5		2		0.5	

	Ca (%)	Ca (K)	Cd (ppm)	Cd (K)	Co (ppm)	Co (K)	Cr (ppm)	Cr (K)	Cu (ppm)	Cu (K)	Fe (%)	Fe (K)	Hf (ppm)	Hf (K)	K (%)	K (K)	La (ppm)	La (K)	Lu (ppm)	Lu (K)
CLARKE INDEX–1**	4.66		0.16		29.0		122		68.0		6.22		2.80		1.84		34.6		0.54	
MEAN	0.75	0.16	0.84	5.23	7.98	0.28	39.54	0.32	43.65	0.64	1.01	0.16	2.79	1.00	0.40	0.22	34.63	1.00	0.27	0.49
VARIANCE	0.09	0.00	0.33	12.70	17.13	0.02	602.88	0.04	2181.02	0.47	1.39	0.04	1.38	0.18	0.06	0.02	687.95	0.57	0.02	0.07
STANDARD DEVIATION	0.30	0.07	0.57	3.56	4.14	0.14	24.55	0.20	46.70	0.69	1.18	0.19	1.18	0.42	0.25	0.14	26.23	0.76	0.15	0.27
C.V.(%)	40.61	40.61	68.13	68.13	51.87	51.87	62.10	62.10	107.00	107.00	117.11	117.11	42.17	42.17	62.62	62.62	75.74	75.74	55.60	55.60
n	190	190	190	190	190	190	190	190	190	190	190	190	190	190	190	190	190	190	190	190
MINIMUM	0.25	0.05	0.50	3.13	2.00	0.07	13.00	0.11	6.00	0.09	0.17	0.03	2.00	0.71	0.10	0.05	6.00	0.17	0.10	0.19
MAXIMUM	2.37	0.51	6.00	37.50	27.00	0.93	180.00	1.48	441.00	6.49	14.91	2.40	7.00	2.50	1.45	0.79	177.00	5.12	1.00	1.85
ANALYTICAL METHOD***	ICP		ICP		ICP		ICP		ICP		ICP		NAA		ICP		NAA		NAA	
DETECTION LIMIT	0.01		0.5		1		1		1		0.01		2		0.01		1		0.1	

	Mg (%)	Mg (K)	Mn (ppm)	Mn (K)	Mo (ppm)	Mo (K)	Na (%)	Na (K)	Ni (ppm)	Ni (K)	P (ppm)	P (K)	Pb (ppm)	Pb (K)	Sb (ppm)	Sb (K)	Sc (ppm)	Sc (K)	Sr (ppm)	Sr (K)
CLARKE INDEX–1**	2.764		1060		1.20		2.27		99.0		1120		13.0		0.20		25.0		384	
MEAN	0.27	0.10	185.07	0.17	2.68	2.23	0.56	0.25	12.58	0.13	961.2	0.86	12.89	0.99	0.21	1.04	6.14	0.25	81.09	0.21
VARIANCE	0.04	0.00	23019.07	0.02	18.91	13.13	0.24	0.05	38.21	0.00	257049.8	0.20	345.54	2.04	0.00	0.02	6.33	0.01	2892.42	0.02
STANDARD DEVIATION	0.19	0.07	151.72	0.14	4.35	3.62	0.49	0.22	6.18	0.06	507.0	0.45	18.59	1.43	0.03	0.15	2.52	0.10	53.78	0.14
C.V.(%)	71.75	71.75	81.98	81.98	162.31	162.31	88.43	88.43	49.14	49.14	52.7	52.75	144.16	144.16	14.45	14.45	40.96	40.96	66.32	66.32
n	190	190	190	190	190	190	190	190	190	190	190	190	190	190	190	190	190	190	190	190
MINIMUM	0.06	0.02	21.00	0.02	1.00	0.83	0.04	0.02	4.00	0.04	190.00	0.17	2.00	0.15	0.20	1.00	2.00	0.08	17.00	0.04
MAXIMUM	2.05	0.74	1158.00	1.09	48.00	40.00	2.58	1.14	79.00	0.80	4700.00	4.20	224.00	17.23	0.40	2.00	18.60	0.74	317.00	0.83
ANALYTICAL METHOD***	ICP		ICP		ICP		ICP		ICP		ICP		ICP		NAA		NAA		ICP	
DETECTION LIMIT	0.01		1		1		0.01		1		10		2		0.2		0.1		1	

	Ta (ppm)	Ta (K)	Th (ppm)	Th (K)	Ti (%)	Ti (K)	U (ppm)	U (K)	V (ppm)	V (K)	W (ppm)	W (K)	Zn (ppm)	Zn (K)
CLARKE INDEX–1**	1.70		8.10		0.632		2.30		136		1.20		76.0	
MEAN	2	1.18	4.27	0.53	0.10	0.16	4.71	2.05	34.28	0.25	1.25	1.04	89.57	1.18
VARIANCE	0	0	7.07	0.11	0.00	0.01	25.46	4.81	300.97	0.02	0.44	0.31	3103.65	0.54
STANDARD DEVIATION	0	0	2.66	0.33	0.05	0.08	5.05	2.19	17.35	0.13	0.66	0.55	55.71	0.73
C.V.(%)	0	0	62.33	62.33	49.08	49.08	107.07	107.07	50.60	50.60	53.25	53.25	62.20	62.20
n	190	190	190	190	190	190	189	189	190	190	190	190	190	190
MINIMUM	2.00	1.18	1.10	0.14	0.02	0.03	1.00	0.43	9.00	0.07	1.00	0.83	14.00	0.18
MAXIMUM	2.00	1.18	25.50	3.15	0.28	0.44	32.30	14.04	116.00	0.85	6.00	5.00	646.00	8.50
ANALYTICAL METHOD***	NAA		NAA		ICP		NAA		ICP		NAA		ICP	
DETECTION LIMIT	2		0.5		0.01		0.5		1		2		2	

* *Blank cells or –999 indicate missing values.*
** *Clarke Index–1 values are given in the units of the element column in which they are found.*
*** *Analytical Method*
AAS = Atomic Absorption Spectroscopy
ICP = Inductively Coupled Plasma Analysis
NAA = Neutron Activation Analysis

Elements are arranged in the same order as on the data base disk.
Results in boxed areas refer to Clarke Index–1 values included in the regional map panels in Figure 6.
Summary of statistics below Table 1 summarizes results for the complete Pancake Lake data base.

3. PRINCIPAL COMPONENTS ANALYSIS

In previous map sheet analyses, only catchments without significant Quaternary cover were selected for inclusion in Principal Components Analysis (PCA) (Fortescue and Vida 1989, 1990a, 1990b). In the Pancake Lake area, catchments with and without Quaternary cover were used because of the relatively small number of sample sites in the area.

The PCA technique called for 1) normality inspections of all frequency distributions for parameters to be included, 2) a log transform to be applied if the data were skewed, and 3) a varimax rotation to be applied on preliminary PCA results. In all cases, the outcome of the PCA indicated that the first 6 factors accounted for about 80% of the variation in a data set. The 6 factors obtained from each PCA are listed in full on Tables 6a, 6b and 7 (*see* data base diskette(s)). All the PCA data are summarized here on Table 8.

Because of the relatively small number of sample sites (190) in the Pancake Lake area, a PCA was first calculated for all the sample points. Catchments underlain by 1) one rock type and 2) more than one rock type, were used for the PCA in Table 6a; Geology (all catchment basins).

Table 6b lists the PCA results for catchments representing the major rock types of the entire Pancake Lake area. Data for general geology (Table 6b, and summarized in Table 8) included a random selection of 128 samples drawn from 1) the western mafic metavolcanic rocks (54 samples), 2) the Keweenawan mafic volcanic rocks (basalts) (10 samples), 3) the Ramsey gneiss domain (43 samples), 4) the massive felsic intrusive rocks (14 samples) and 5) the Algoma plutonic domain (7 samples).

The PCA results for groups of lake sediments derived from catchments underlain by a single rock type are tabulated in Table 7 and summarized in Table 8. These are 1) the western mafic metavolcanic rocks and 2) the Ramsey gneiss domain. Other rock types were not included because fewer than the required 29 sample sites were available for PCA calculations.

PCA RELATIONSHIPS WITHIN THE GEOLOGY (ALL CATCHMENT BASINS) OF THE PANCAKE LAKE MAP AREA

Factor 1 (Tables 6a and 8), which accounts for 37.1% of the variance, includes 1) 7 elements (Al, Ba, K, Mg, Na, Sr and Ti) which are strongly and positively correlated , 2) 2 elements, Ca and Fe, which are weakly and positively correlated, 3) LOI, which is strongly and negatively correlated, and 4) Br which is weakly and negatively correlated. These results show that the higher the level of mineral matter in lake sediments, the lower the LOI (provided significant amounts of marl are absent, *see* Table 1).

Factor 2, which accounts for 16.0% of the variance, includes La, Th, and U (strongly and positively correlated) with Sc (weakly and positively). The granitic factor is defined by the correlation between La, Th and U (Fortescue and Vida 1989).

Factor 3 accounts for 9.5% of the variance, and includes P and Zn (strongly and positively) correlated with Br and Co (weakly and positively).

Factor 4, which accounts for 6.1% of the variance, includes pH (strongly and positively correlated) with Co and Ni (weakly and positively).

Factor 5 accounts for 4.8% of the variance and includes 4 elements (Cr, Fe, Sc and V) which are weakly and positively correlated with each other. The occurrence of these elements together may reflect the presence an iron formation or a secondary accumulation of these elements.

Factor 6 accounts for 4.0% of the variance and includes As, Cu and Pb which are weakly and positively correlated.

PCA RELATIONSHIPS WITHIN THE GENERAL GEOLOGY OF THE PANCAKE LAKE MAP AREA

Factor 1 (Tables 6b and 8), which accounts for 35.9% of the variance, includes 1) 7 elements (Al, Ba, K, Mg, Na, Sr and Ti), which are strongly and positively correlated, and 2) LOI and Br, which are strongly and negatively correlated. These results show that the higher the level of mineral matter in lake sediments, the lower the LOI (provided significant amounts of marl are absent, *see* Table 1).

Factor 2, which accounts for 16.9% of the variance, includes Fe and V (strongly and positively) correlated with Cr, Mn and Sc (weakly and positively). The occurrence of these elements together may reflect the presence of iron formations in the area, or a secondary accumulation of these elements.

Factor 3 accounts for 10.0% of the variance and includes strongly and positively correlated La, Th and U. The granitic factor is reflected by this correlation of elements (Fortescue and Vida 1989).

Factor 4, which accounts for 5.8% of the variance, includes pH (strongly and positively) correlated with Co, Ni and Zn (weakly and positively). This factor may reflect mineral occurrence associations in the area.

Factor 5 accounts for 5.2% of the variance and includes P strongly and positively correlated.

Factor 6 accounts for 4.4% of the variance and includes Pb (strongly and positively) correlated with As, Cu and Mo (weakly and positively). Mineral occurrence associations in the area may be reflected in this factor also.

PCA RELATIONSHIPS AMONG THE PANCAKE LAKE AREA ROCK TYPES

As in the general geology PCA just described, Factor 1 (Tables 7 and 8) is explained by **the negative relationship between LOI and mineral matter**. Factor 1 accounts for 43.1% and 37.1% variance in the rock types listed in Tables 7a and 7b, respectively. In the Ramsey gneiss domain, LOI was weakly and negatively correlated and not strongly and negatively correlated as was always resolved in previous PCAs (Fortescue and Vida 1989, 1990a, 1990b).

The **granitic factor** (Fortescue and Vida 1989) is reflected in Factor 3 in Table 7a (western mafic metavolcanic rocks) and Factor 2 in Table 7b (Ramsey gneiss domain). The percentage of variation from rock type to rock type accounts for this change in factors. In previous map sheets (Fortescue and Vida 1989, 1990a, 1990b) the granitic factor was missing from the mafic metavolcanic rocks. In the Pancake Lake area, the granitic factor was detected as Factor 3 in the western mafic metavolcanic rocks. The presence of this factor may be due a combination of many U mineral occurrences and/or glacial smearing in the area.

Factor 2 in the western mafic metavolcanic rocks (Table 7a) accounts for 16.2% of the variance. Cobalt, Zn and pH are strongly and positively correlated while Mn and Ni are weakly and positively correlated.

Factor 2 in the Ramsey gneiss domain (Table 7b) accounts for 17.9% of the variance. Lanthanum, Sc and Th are strongly and positively correlated, while U is weakly and positively correlated. As discussed above, these elements reflect the granitic factor in the Ramsey gneiss domain.

Element relationships within other factors are less clearly defined. For example, the correlation of Au as Factor 6 in all the rock types (Table 8) is unknown. It should be noted that Au is strongly correlated (0.89) in Factor 6 from the general geology of the Trout Lake area (Fortescue and Vida 1989) and also strongly correlated (0.86) in Factor 6 in the northern granites of the Herman Lake area (Fortescue and Vida 1990a). In the felsic intrusive rocks of the Hanes Lake area, Mo is strongly and positively correlated in Factor 6 (Fortescue and Vida 1990b).

SUMMARY

The PCA for 2 data sets, 1) for the entire Pancake Lake area (190 samples) utilizing catchment basins underlain by one or more rock types, and 2) representative of the entire Pancake Lake area (128 samples), was described and compared with PCA data obtained from catchments underlain exclusively by the western mafic metavolcanic rocks or the Ramsey gneiss domain. Several interesting element groupings were common to both the area-wide PCAs and the 2 individual rock type PCAs.

COMMENTS

The PCA reveals general statistical relationships between groups of elements in the Pancake Lake pre-*Ambrosia* sediments. This information is a preliminary step to a detailed interpretation of the geochemical data. Also, the PCA is important for comparative purposes with other map sheets in this series.

Table 6a. Varimax-rotated factor matrix for the Pancake Lake area which includes all single and multiple catchment basins for: i) pre-*Ambrosia* sediments; ii) LOI; and iii) pH of the lakewaters.

Variable	1	2	3	4	5	6
	Principal Components: Geology (All catchment basins)					
LOI	−0.80	−0.10	0.18	−0.19	0.18	0.05
pH	−0.05	0.12	0.03	0.80	0.12	0.04
Log Al	0.89	0.10	0.30	0.08	0.17	0.05
Log As	−0.10	−0.00	−0.03	0.16	0.18	0.65
Log Au	0.05	−0.06	0.17	−0.10	0.16	0.49
Log Ba	0.89	0.06	0.17	−0.11	0.14	0.09
Log Br	−0.66	0.02	0.50	0.07	0.30	0.13
Log Ca	0.56	−0.10	−0.02	0.45	0.38	0.07
Log Co	0.27	0.06	0.53	0.58	0.05	0.13
Log Cr	0.48	−0.04	−0.19	0.28	0.57	0.26
Log Cu	−0.27	0.09	0.16	0.49	0.15	0.63
Log Fe	0.52	0.11	0.33	0.27	0.60	0.14
Log K	0.96	0.12	−0.06	−0.01	0.11	0.02
Log La	0.02	0.92	0.08	0.10	0.09	0.01
Log Mg	0.85	0.06	−0.01	0.29	0.32	−0.01
Log Mn	0.49	0.01	0.46	0.35	0.48	0.09
Log Mo	0.05	0.33	0.44	0.22	−0.32	0.42
Log Na	0.96	0.08	−0.05	0.04	0.12	0.02
Log Ni	0.41	−0.09	0.10	0.58	0.28	0.08
Log P	−0.02	−0.08	0.90	−0.10	0.10	0.08
Log Pb	0.34	−0.21	0.09	−0.03	−0.24	0.66
Log Sc	0.33	0.50	−0.07	0.36	0.53	0.21
Log Sr	0.94	0.11	−0.01	−0.00	0.15	−0.04
Log Th	0.35	0.85	−0.12	−0.01	0.16	0.05
Log Ti	0.93	0.09	0.02	0.01	0.26	0.05
Log U	0.03	0.80	−0.02	−0.04	−0.09	−0.25
Log V	0.31	0.28	0.34	0.23	0.66	0.22
Log Zn	−0.17	−0.05	0.70	0.48	−0.01	0.17
Eigenvalue	10.40	4.47	2.65	1.70	1.36	1.12
% Variation	37.1	16.0	9.5	6.1	4.8	4.0
Cum. % Variance	37.1	53.1	62.6	68.6	73.5	77.5

Table 6b. Varimax-rotated factor matrix for the Pancake Lake area for: i) pre-*Ambrosia* sediments (selected element data); ii) LOI; and iii) pH of the lakewaters.

Variable	1	2	3	4	5	6
	Principal Components: General Geology					
LOI	−0.77	0.12	−0.16	−0.12	0.23	−0.05
pH	−0.13	0.11	0.15	0.83	−0.13	0.03
Log Al	0.83	0.27	0.13	0.11	0.35	0.10
Log As	−0.08	0.34	−0.08	0.10	−0.10	0.61
Log Au	0.06	0.02	−0.12	0.06	0.28	0.49
Log Ba	0.87	0.25	0.07	−0.13	0.26	0.09
Log Br	−0.74	0.26	0.01	0.07	0.43	0.08
Log Ca	0.48	0.38	−0.15	0.46	−0.01	0.04
Log Co	0.12	0.17	0.12	0.64	0.45	0.27
Log Cr	0.45	0.66	−0.11	0.07	−0.27	0.12
Log Cu	−0.15	0.43	0.06	0.45	0.02	0.57
Log Fe	0.37	0.74	0.10	0.23	0.27	0.05
Log K	0.95	0.16	0.12	−0.04	−0.05	0.06
Log La	0.09	0.16	0.91	0.13	0.07	−0.03
Log Mg	0.84	0.35	0.09	0.27	−0.02	−0.03
Log Mn	0.36	0.58	0.00	0.41	0.37	0.07
Log Mo	−0.00	0.02	0.40	0.20	0.18	0.58
Log Na	0.95	0.18	0.07	0.03	−0.08	0.05
Log Ni	0.38	0.34	−0.01	0.62	0.08	−0.01
Log P	−0.11	0.07	−0.06	0.08	0.91	0.13
Log Pb	0.27	−0.16	−0.20	−0.08	0.02	0.74
Log Sc	0.28	0.62	0.49	0.30	−0.14	0.06
Log Sr	0.92	0.20	0.13	−0.04	−0.00	−0.04
Log Th	0.32	0.27	0.84	−0.05	−0.14	0.01
Log Ti	0.91	0.31	0.08	−0.04	−0.00	0.05
Log U	0.07	−0.15	0.87	0.02	−0.03	−0.02
Log V	0.22	0.78	0.27	0.18	0.26	0.12
Log Zn	−0.24	0.07	0.01	0.67	0.48	0.25
Eigenvalue	10.05	4.73	2.80	1.62	1.45	1.23
% Variation	35.9	16.9	10.0	5.8	5.2	4.4
Cum. % Variance	35.9	52.8	62.8	68.6	73.8	78.2

Table 7. Varimax-rotated factor matrix tables for Pancake Lake i) pre-*Ambrosia* sediments (selected element data); ii) LOI; and iii) pH of lakewaters obtained from catchments underlain by: a) Western mafic metavolcanic rocks and b) Ramsey gneiss domain.

Variable	1	2	3	4	5	6
	Principal Components: Western mafic metavolcanic rocks					
LOI	−0.77	−0.17	−0.20	0.39	0.31	−0.06
pH	−0.19	0.79	0.22	−0.18	0.35	0.02
Log Al	0.88	0.19	0.20	0.25	−0.07	0.18
Log As	0.03	0.19	0.36	−0.06	0.23	0.36
Log Au	0.18	0.10	−0.08	0.30	−0.24	0.59
Log Ba	0.92	−0.11	0.07	0.19	−0.08	0.17
Log Br	−0.47	0.26	0.06	0.70	0.07	−0.11
Log Ca	0.24	0.26	0.03	0.02	0.88	0.07
Log Co	0.20	0.76	0.23	0.32	0.05	0.08
Log Cr	0.56	0.43	0.22	−0.09	0.43	−0.16
Log Cu	0.19	0.45	0.57	0.12	0.12	0.38
Log Fe	0.63	0.31	0.33	0.49	0.25	−0.02
Log K	0.92	−0.06	0.19	−0.13	0.13	0.14
Log La	0.36	0.14	0.83	0.05	−0.00	−0.02
Log Mg	0.90	0.18	0.18	−0.05	0.19	−0.02
Log Mn	0.45	0.56	0.18	0.44	0.27	0.02
Log Mo	0.05	0.28	0.69	0.16	−0.15	0.35
Log Na	0.93	−0.01	0.14	−0.18	0.19	0.15
Log Ni	0.56	0.68	0.00	0.00	0.08	−0.25
Log P	−0.01	0.13	−0.05	0.84	−0.15	0.32
Log Pb	0.21	−0.12	0.18	0.01	−0.17	0.81
Log Sc	0.68	0.36	0.41	0.11	0.24	−0.16
Log Sr	0.91	−0.06	0.15	−0.11	0.26	0.15
Log Th	0.62	0.03	0.69	0.03	−0.03	0.06
Log Ti	0.95	0.01	0.14	0.02	0.03	0.10
Log U	0.18	−0.01	0.86	−0.09	0.11	−0.05
Log V	0.58	0.28	0.42	0.45	0.29	−0.01
Log Zn	−0.20	0.82	0.04	0.38	−0.01	0.13
Eigenvalue	12.08	4.53	2.28	2.09	1.26	1.06
% Variation	43.1	16.2	8.2	7.5	4.5	3.8
Cum. % Variance	43.1	59.3	67.4	74.9	79.4	83.2

Variable	1	2	3	4	5	6
	Principal Components: Ramsey gneiss domain					
LOI	−0.63	−0.12	0.45	0.33	0.21	0.12
pH	0.01	0.13	0.23	−0.18	0.59	−0.53
Log Al	0.85	0.02	0.06	0.33	−0.20	−0.11
Log As	−0.27	−0.15	0.24	0.20	0.67	0.06
Log Au	−0.01	−0.01	−0.03	−0.07	0.06	0.90
Log Ba	0.88	0.00	−0.05	0.34	−0.10	0.01
Log Br	−0.67	0.12	0.20	0.42	0.12	0.08
Log Ca	0.82	−0.09	0.26	0.03	0.26	0.18
Log Co	0.25	0.22	0.64	0.43	0.06	0.22
Log Cr	0.85	0.28	0.22	0.24	0.11	−0.17
Log Cu	−0.25	0.42	0.66	0.20	0.14	−0.04
Log Fe	0.62	0.04	0.21	0.64	0.20	0.05
Log K	0.98	0.01	−0.03	0.34	0.03	−0.02
Log La	−0.06	0.89	0.11	0.29	−0.03	0.08
Log Mg	0.97	0.01	0.06	−0.01	0.04	−0.07
Log Mn	0.69	0.14	0.01	0.55	0.20	0.03
Log Mo	0.03	0.12	0.84	−0.10	0.09	−0.05
Log Na	0.96	0.05	−0.03	−0.09	0.03	0.03
Log Ni	0.54	0.15	0.56	0.05	−0.26	0.03
Log P	−0.10	−0.22	0.13	0.87	−0.17	−0.03
Log Pb	0.18	0.11	−0.19	−0.03	0.65	0.04
Log Sc	0.25	0.86	0.24	−0.01	0.13	−0.06
Log Sr	0.92	−0.05	−0.08	0.05	−0.02	0.19
Log Th	0.15	0.91	0.09	−0.10	0.05	−0.11
Log Ti	0.97	0.03	−0.08	0.05	0.00	−0.04
Log U	−0.20	0.65	0.14	−0.24	−0.08	0.02
Log V	0.42	0.15	0.35	0.61	0.19	−0.16
Log Zn	−0.09	0.15	0.77	0.31	−0.11	−0.21
Eigenvalue	10.38	5.01	2.95	1.67	1.42	1.28
% Variation	37.1	17.9	10.5	5.9	5.1	4.6
Cum. % Variance	37.1	55.0	65.5	71.5	76.6	81.1

Table 8. Summary of Principal Components Analysis (PCA) Results for the Pancake Lake Area.*

Factor	Correlation Strength	Geology (all catchment basins)	General Geology	Western mafic metavolcanic rocks	Ramsey gneiss domain
Factor 1	Strongly & Positively (> = 0.7)	Al, Ba, K, Mg, Na, Sr, Ti	Al, Ba, K, Mg Na, Sr, Ti	Al, Ba, K, Mg Na, Sr, Ti	Al, Ba, Ca, Cr, K, Mg, Na, Sr, Ti
	Strongly & Negatively	LOI	LOI, Br	LOI	————
	Weakly & Positively (> 0.5 & < 0.7)	Ca, Fe	————	Cr, Fe, Ni, Sc, Th, V	Fe, Mn, Ni
	Weakly & Negatively	Br	————	————	LOI, Br
Factor 2	Strongly & Positively	La, Th, U	Fe, V	pH, Co, Zn	La, Sc, Th
	Weakly & Positively	Sc	Cr, Mn, Sc	Mn, Ni	U
Factor 3	Strongly & Positively	P, Zn	La, Th, U	La, U	Mo, Zn
	Weakly & Positively	Br, Co	————	Cu, Mo, Th	Co, Cu, Ni
Factor 4	Strongly & Positively	pH	pH	Br, P	P
	Weakly & Positively	Co, Ni	Co, Ni, Zn	————	Fe, Mn, V
Factor 5	Strongly & Positively	————	P	Ca	————
	Weakly & Positively	Cr, Fe, Sc, V	————	————	pH, As, Pb
Factor 6	Strongly & Positively	————	Pb	Pb	Au
	Weakly & Positively	As, Cu, Pb	As, Cu, Mo	Au	————
	Weakly & Negatively	————	————	————	pH

* *Refer to Tables 6 and 7 on the data base diskette(s) for the complete PCA.*

Table 9. Detailed geochemistry of 16 "anomalous" pre-*Ambrosia* sediment samples from the Pancake Lake area.

ANOMALOUS ELEMENTS	LAKE CODE	LATITUDE	LONGITUDE	UTM EASTINGS	UTM NORTHINGS	SECCHI DEPTH (m)	WATER DEPTH (m)	WATER pH	WATER Ca (mg/ml)	WATER Mg (mg/ml)	GEOLOGY	LOI (%)	Ag (ppm)	Ag (K)	Al (%)	Al (K)	As (ppm)	As (K)	Au (ppb)	Au (K)	Ba (ppm)	Ba (K)
As	C5–049	47 1 9.5	84 31 47.7	687725	5210050	3.0	12.8	6.4	5.6	0.6	1a	36.0	0.5	6.25	4.40	0.53	69	38.33	1	0.25	350	0.90
Au	D5–097	47 4 6.7	84 32 57.7	686075	5215475	2.5	12.2	5.9	3.4	0.4	1a	55.8	0.5	6.25	3.73	0.45	3	1.67	6	1.50	210	0.54
Cu,Mo	C4–055	47 1 28.4	84 37 6.6	680975	5210425	6.0	12.2	7.2	3.0	0.5	1a	21.6	0.5	6.25	5.27	0.63	14	7.78	1	0.25	410	1.05
La	E6–139	47 6 55.8	84 28 27.8	691600	5220875	2.5	3.7	6.4	4.0	0.6	–	42.0	0.5	6.25	2.77	0.33	1	0.56	1	0.25	150	0.38
La,Th	E3–156	47 8 30.1	84 40 9.6	676725	5223325	2.0	2.4	6.9	5.7	1.1	5a	36.6	0.5	6.25	3.06	0.37	1	0.56	1	0.25	270	0.69
La,U	E3–160	47 9 10.6	84 38 49.4	678375	5224625	0.6	0.6	6.5	4.1	1.0	5a	33.0	0.5	6.25	2.62	0.31	2	1.11	1	0.25	230	0.59
Mo	C4–068	47 2 20.6	84 36 45.3	681375	5212050	5.5	21.6	7.0	3.0	0.5	1a	25.2	0.5	6.25	4.80	0.57	4	2.22	5	1.25	350	0.90
Ni	C1–056	47 1 47.2	84 46 41.4	668825	5210650	1.8	1.8	7.5	30.3	2.2	–	19.4	0.5	6.25	5.11	0.61	1	0.56	1	0.25	320	0.82
Pb	C4–076	47 2 53.4	84 37 4.0	680950	5213050	1.2	1.2	6.0	3.0	0.5	1a	21.2	0.5	6.25	3.56	0.43	1	0.56	2	0.50	330	0.85
Pb,Zn	C3–061	47 1 58.2	84 38 54.3	678675	5211275	4.0	8.2	7.1	3.9	0.6	1a	38.2	0.5	6.25	3.41	0.41	1	0.56	1	0.25	230	0.59
U	B2–024	47 0 10.4	84 42 54.6	673700	5207800	2.7	2.7	7.4	9.9	0.7	–	48.4	0.5	6.25	2.01	0.24	5	2.78	1	0.25	140	0.36
U	F3–179	47 10 59.1	84 39 28.6	677450	5227950	2.0	2.7	6.4	3.0	0.7	5a	50.2	0.5	6.25	2.22	0.27	2	1.11	1	0.25	150	0.38
W	C4–075	47 2 47.2	84 36 0.3	682300	5212900	0.5	4.0	7.4	3.9	0.6	1a	39.8	0.5	6.25	1.96	0.23	1	0.56	1	0.25	110	0.28
Zn	B6–038	47 0 37.1	84 28 7.8	692400	5209200	2.0	11.3	7.3	11.5	0.9	1a	47.6	0.5	6.25	2.58	0.31	2	1.11	1	0.25	120	0.31
Zn	B6–046	47 0 51.4	84 27 55.2	692650	5209650	2.0	4.0	7.3	7.4	0.8	1a	32.0	0.5	6.25	3.32	0.40	2	1.11	1	0.25	250	0.64
Zn	C2–092	47 3 59.5	84 42 8.1	674475	5214900	2.0	4.9	6.6	4.2	1.^	–	65.8	0.5	6.25	1.52	0.18	1	0.56	1	0.25	590	1.51

LAKE CODE	Be (ppm)	Be (K)	Bi (ppm)	Bi (K)	Br (ppm)	Br (K)	Ca (%)	Ca (K)	Cd (ppm)	Cd (K)	Co (ppm)	Co (K)	Cr (ppm)	Cr (K)	Cu (ppm)	Cu (K)	Fe (%)	Fe (K)	Hf (ppm)	Hf (K)	K (%)	K (K)	La (ppm)	La (K)	Lu (ppm)	Lu (K)	Mg (%)	Mg (K)
C5–049	0.5	0.25	2	243.90	26.0	10.40	1.24	0.27	0.5	3.13	21	0.72	41	0.34	66	0.97	1.46	0.23	4	1.43	0.54	0.29	23	0.66	0.2	0.37	0.35	0.13
D5–097	0.5	0.25	2	243.90	40.4	16.16	0.93	0.20	1.5	9.38	14	0.48	27	0.22	52	0.76	1.13	0.18	2	0.71	0.23	0.13	22	0.64	0.2	0.37	0.15	0.05
C4–055	0.5	0.25	2	243.90	42.5	17.00	0.83	0.18	0.5	3.13	16	0.55	52	0.43	441	6.49	1.54	0.25	4	1.43	0.76	0.41	57	1.65	0.4	0.74	0.50	0.18
E6–139	0.5	0.25	2	243.90	23.0	9.20	0.54	0.12	1.0	6.25	13	0.45	33	0.27	80	1.18	1.51	0.24	3	1.07	0.33	0.18	177	5.12	0.6	1.11	0.22	0.08
E3–156	0.5	0.25	2	243.90	14.8	5.92	0.98	0.21	1.0	6.25	13	0.45	56	0.46	202	2.97	1.67	0.27	7	2.50	0.60	0.33	167	4.83	0.9	1.67	0.38	0.14
E3–160	0.5	0.25	2	243.90	16.4	6.56	0.67	0.14	0.5	3.13	13	0.45	44	0.36	22	0.32	1.66	0.27	3	1.07	0.42	0.23	158	4.57	1.0	1.85	0.24	0.09
C4–068	1.0	0.50	2	243.90	26.4	10.56	0.78	0.17	1.0	6.25	19	0.66	45	0.37	192	2.82	1.98	0.32	3	1.07	0.63	0.34	29	0.84	0.3	0.56	0.45	0.16
C1–056	0.5	0.25	2	243.90	27.4	10.96	2.37	0.51	0.5	3.13	22	0.76	120	0.98	82	1.21	2.75	0.44	3	1.07	0.57	0.31	17	0.49	0.3	0.56	2.05	0.74
C4–076	0.5	0.25	2	243.90	5.4	2.16	0.71	0.15	0.5	3.13	4	0.14	32	0.26	63	0.93	0.76	0.12	4	1.43	0.60	0.33	22	0.64	0.2	0.37	0.30	0.11
C3–061	0.5	0.25	2	243.90	30.9	12.36	0.57	0.12	2.5	15.63	10	0.34	33	0.27	225	3.31	0.87	0.14	2	0.71	0.26	0.14	22	0.64	0.2	0.37	0.19	0.07
B2–024	0.5	0.25	2	243.90	45.3	18.12	0.76	0.16	0.5	3.13	6	0.21	41	0.34	32	0.47	0.54	0.09	2	0.71	0.19	0.10	62	1.79	0.7	1.30	0.13	0.05
F3–179	0.5	0.25	2	243.90	42.9	17.16	0.42	0.09	1.0	6.25	7	0.24	25	0.20	35	0.51	0.36	0.06	2	0.71	0.18	0.10	47	1.36	0.6	1.11	0.12	0.04
C4–075	0.5	0.25	2	243.90	29.9	11.96	0.49	0.11	1.0	6.25	10	0.34	21	0.17	65	0.96	0.52	0.08	2	0.71	0.18	0.10	21	0.61	0.2	0.37	0.15	0.05
B6–038	0.5	0.25	2	243.90	68.4	27.36	0.96	0.21	2.0	12.50	20	0.69	36	0.30	53	0.78	1.69	0.27	2	0.71	0.18	0.10	19	0.55	0.2	0.37	0.13	0.05
B6–046	1.0	0.50	2	243.90	32.8	13.12	1.00	0.21	1.5	9.38	15	0.52	111	0.91	47	0.69	1.72	0.28	2	0.71	0.45	0.24	19	0.55	0.2	0.37	0.31	0.11
C2–092	0.5	0.25	2	243.90	40.4	16.16	0.57	0.12	2.0	12.50	4	0.14	32	0.26	85	1.25	0.53	0.09	2	0.71	0.15	0.08	19	0.55	0.1	0.19	0.14	0.05

LAKE CODE	Mn (ppm)	Mn (K)	Mo (ppm)	Mo (K)	Na (%)	Na (K)	Ni (ppm)	Ni (K)	P (ppm)	P (K)	Pb (ppm)	Pb (K)	Sb (ppm)	Sb (K)	Sc (ppm)	Sc (K)	Sr (ppm)	Sr (K)	Ta (ppm)	Ta (K)	Th (ppm)	Th (K)	Ti (%)	Ti (K)	U (ppm)	U (K)	V (ppm)	V (K)	W (ppm)	W (K)	Zn (ppm)	Zn (K)	LAKE CODE	ANOMALOUS ELEMENTS
C5–049	271	0.26	2.0	1.67	0.96	0.42	13	0.13	1440	1.29	12	0.92	0.2	1.00	5.9	0.24	117	0.30	2	1.18	3.1	0.38	0.15	0.24	2.0	0.87	47	0.35	1	0.83	112	1.47	C5–049	As
D5–097	208	0.20	3.0	2.50	0.23	0.10	11	0.11	2360	2.11	32	2.46	0.2	1.00	4.3	0.17	49	0.13	2	1.18	2.7	0.33	0.09	0.14	1.0	0.43	52	0.38	1	0.83	139	1.83	D5–097	Au
C4–055	507	0.48	28.0	23.33	0.93	0.41	19	0.19	1750	1.56	14	1.08	0.3	1.50	9.9	0.40	115	0.30	2	1.18	7.4	0.91	0.17	0.27	3.0	1.30	53	0.39	2	1.67	119	1.57	C4–055	Cu,Mo
E6–139	291	0.27	9.0	7.50	0.38	0.17	14	0.14	1000	0.89	8	0.62	0.2	1.00	9.2	0.37	59	0.15	2	1.18	5.7	0.70	0.10	0.16	2.0	0.87	79	0.58	1	0.83	88	1.16	E6–139	La
E3–156	443	0.42	4.0	3.33	0.82	0.36	31	0.31	390	0.35	4	0.31	0.2	1.00	16.0	0.64	120	0.31	2	1.18	25.5	3.15	0.12	0.19	18.0	7.83	44	0.32	4	3.33	95	1.25	E3–156	La,Th
E3–160	543	0.51	1.0	0.83	0.54	0.24	8	0.08	720	0.64	16	1.23	0.2	1.00	9.8	0.39	87	0.23	2	1.18	8.3	1.02	0.13	0.21	24.0	10.43	48	0.35	3	2.50	77	1.01	E3–160	La,U
C4–068	745	0.70	48.0	40.00	0.94	0.41	18	0.18	1390	1.24	82	6.31	0.2	1.00	8.0	0.32	108	0.28	2	1.18	4.3	0.53	0.16	0.25	2.0	0.87	50	0.37	2	1.67	161	2.12	C4–068	Mo
C1–056	352	0.33	1.0	0.83	1.06	0.47	79	0.80	330	0.29	16	1.23	0.2	1.00	14.1	0.56	179	0.47	2	1.18	2.5	0.31	0.28	0.44	1.0	0.43	84	0.62	1	0.83	75	0.99	C1–056	Ni
C4–076	135	0.13	1.0	0.83	0.91	0.40	10	0.10	580	0.52	104	8.00	0.2	1.00	5.3	0.21	119	0.31	2	1.18	4.1	0.51	0.12	0.19	2.0	0.87	23	0.17	2	1.67	59	0.78	C4–076	Pb
C3–061	246	0.23	5.0	4.17	0.28	0.12	10	0.10	1570	1.40	224	17.23	0.2	1.00	5.0	0.20	47	0.12	2	1.18	3.0	0.37	0.08	0.13	2.0	0.87	39	0.29	1	0.83	274	3.61	C3–061	Pb,Zn
B2–024	87	0.08	1.0	0.83	0.13	0.06	11	0.11	640	0.57	10	0.77	0.2	1.00	4.6	0.18	35	0.09	2	1.18	4.1	0.51	0.05	0.08	24.0	10.43	41	0.30	1	0.83	78	1.03	B2–024	U
F3–179	72	0.07	2.0	1.67	0.12	0.05	12	0.12	1120	1.00	8	0.62	0.2	1.00	5.6	0.22	37	0.10	2	1.18	6.3	0.78	0.05	0.08	32.3	14.04	38	0.28	1	0.83	85	1.12	F3–179	U
C4–075	96	0.09	8.0	6.67	0.15	0.07	11	0.11	920	0.82	8	0.62	0.2	1.00	3.7	0.15	32	0.08	2	1.18	2.7	0.33	0.05	0.08	2.0	0.87	21	0.15	6	5.00	140	1.84	C4–075	W
B6–038	630	0.59	2.0	1.67	0.12	0.05	13	0.13	1520	1.36	4	0.31	0.2	1.00	5.5	0.22	28	0.07	2	1.18	2.1	0.26	0.05	0.08	1.0	0.43	48	0.35	1	0.83	192	2.53	B6–038	Zn
B6–046	456	0.43	1.0	0.83	0.68	0.30	27	0.27	700	0.63	4	0.31	0.2	1.00	7.6	0.30	102	0.27	2	1.18	3.4	0.42	0.10	0.16	1.0	0.43	47	0.35	1	0.83	192	2.53	B6–046	Zn
C2–092	111	0.10	9.0	7.50	0.12	0.05	13	0.13	1260	1.13	28	2.15	0.2	1.00	4.8	0.19	69	0.18	2	1.18	1.8	0.22	0.06	0.09	1.0	0.43	33	0.24	1	0.83	646	8.50	C2–092	Zn

The geology column above indicates sample sites below one rock type. The dashes represent sample sites (and catchment basins) below more than one lithologic unit.

PALEOZOIC
CAMBRIAN
12 = Jacobsville Formation: sandstone, siltstone, shale, conglomerate
11 = Mica Bay Formation: arkose, siltstone, shale
UNCONFORMITY
PRECAMBRIAN
PROTEROZOIC
LATE PRECAMBRIAN
10 = Alkalic Rock-Carbonatite Complex: breccia pipe
KEWEENAWAN
9 = Felsic Intrusive and Volcanic Rocks
8 = Sedimentary Rocks: conglomerate, sandstone, siltstone
7 = Mafic Volcanic Rocks
UNCONFORMITY
EARLY PRECAMBRIAN
ARCHEAN
6 = Massive Felsic Intrusive Rocks: Pancake Lake stock
5 = Felsic Intrusive and Metamorphic Rocks
5a = Ramsey gneiss domain
5b = Algoma plutonic domain
4 = Chemical Metasediments**
3 = Clastic Metasediments
2 = Felsic Metavolcanic Rocks
1 = Mafic Metavolcanic Rocks
1a = Western mafic metavolcanic rocks

**Although these rocks are present in the Batchawana greenstone belt, none occur in the Pancake Lake map area.

Detailed Level

Sixteen "geochemical anomalies" among the 190 Pancake Lake pre-*Ambrosia* lake-sediment samples were selected for detailed discussion (Table 9). Results in Table 9 are printed as obtained from the contractor and have not been verified by re-analysis of the original samples or from results obtained after resampling. It should be noted that these "geochemical anomalies" are not very high when compared with similar results obtained in the Hanes Lake (Fortescue and Vida 1990b) and Trout Lake (Fortescue and Vida 1989) map sheets. Therefore, any results described here should be used with caution during mineral resource appraisal.

Table 9 includes data for 1) "anomalous" elements in each of the 16 samples and 2) corresponding background levels for the remaining elements, which may be used for comparative purposes.

Identification of "anomalous" element occurrences with their ppm values in brackets, and sample site locations for the 16 samples from Table 9, are plotted on Figures 10a and 10b. For comparison, the mineral occurrences in the Pancake Lake area (including the more important geological contacts, iron formations, and faults), are included in Figure 10c. All geochemical results in the Pancake Lake map area should be examined carefully for subtle clues concerning patterns for elements of interest.

Not all of the "anomalous" values listed on Table 9 and positioned on Figure 10a are of equal importance for mineral exploration. For example, sample C2-092, with "anomalous" Zn was collected near an area of known Cu mineral occurrences (Figure 1). Copper and Zn often occur together as accessory minerals. Similarly, sample C1-056, apparently collected in the vicinity of a large diabase dike, was found to contain "anomalous" Ni and high Cr.

THE PROBLEM OF SECONDARY Fe AND Mn

It has been shown in previous geochemical maps in this series (Fortescue and Vida 1989, 1990a), that significant levels of secondary Fe and Mn in samples may complicate the interpretation of "anomalous" element values in pre-*Ambrosia* lake sediments. High Fe and Mn oxides may scavenge trace elements from lakewaters and accumulate secondary geochemical "anomalies".

In the Trout Lake area (Fortescue and Vida 1989), pre-*Ambrosia* levels of Fe and Mn greater than or equal to 2.5% and/or 500 ppm were considered to be associated with secondary geochemical anomalies. Using this criteria for the Pancake Lake area data, it was discovered that only 5 iron-rich and 8 manganese-rich samples from Table 1 were present, and 1 iron-rich and 4 manganese-rich samples were present in Table 9. None of the samples from Table 9 included both high Fe and Mn. If a sample contains both high Fe and Mn, we recommend that the analyses of a lake sample should not be included in a detailed statistical analysis of the entire data set.

"ANOMALOUS" GEOCHEMICAL RESULTS WHICH REQUIRE VERIFICATION

Samples containing "anomalous" concentrations for elements of interest are grouped alphabetically by element on Table 9. Each group will now be described briefly, sample by sample.

Arsenic

One "anomalous" As value (C5-049 (69 ppm)) is included in Table 9 with 36.0% LOI, 112 ppm Zn, 1.46% Fe and 271 ppm Mn.

Gold

In previous map sheets (Fortescue and Vida 1989, 1990a, 1990b), Au was considered "anomalous" if the values were greater than or equal to 10 ppb. In the Pancake Lake area, the 3 highest Au concentrations were equal to 5 and 6 ppb Au (6 ppb in D5-097, 5 ppb in C6-060 and 5 ppb in C4-068; *see* Table 1). Sample D5-097 includes moderate amounts of P (2360 ppm) and Zn (139 ppm) (Table 9). Both Fe (1.13%) and Mn (208 ppm) were low, suggesting this sample is not a product of secondary accumulation. Also, high concentrations of Mn were discovered in sample C4-068 (745 ppm) with low Fe (1.98%).

Copper and Molybdenum

One "anomalous" Cu and 2 "anomalous" Mo values were discovered in the Pancake Lake area. Copper values greater than or equal to 1.0 K (68 ppm) are plotted on Figure 6k. Molybdenum values greater than or equal to 4.1 K (4.92 ppm) are plotted on Figure 6j. In the Pancake Lake area pre-*Ambrosia* lake sediments, the mean for Cu is 43.65 ppm and the mean for Mo is 2.68 ppm, respectively. One sample, C4-055, contains "anomalous" Cu (441 ppm), "anomalous" Mo (28 ppm), moderately low LOI (21.6%), and moderate levels of As (14 ppm), Ba (410 ppm) and Zn (119 ppm). Manganese levels are high (507 ppm) for this sample with low concentrations of Fe (1.54%).

Although the Pancake lake area appears to be a Cu and U province, the geochemical map data (Figure 10a) do not show very many "anomalous" Cu occurrences. Similarly, the locations of the Tribag Mine (Cu, W), the Mamainse Mine (Cu), or the Copper Corporation Mines (Cu) are not associated with "anomalous" Cu values. However, Figure 10a does show the "anomalous" Cu and Mo locations south of the iron formations, where most of Pancake Lake mineral occurrences cluster.

The other "anomalous" Mo sample is C4-068, which contains Mo at 48.0 ppm with 25.2% LOI, 5 ppb Au, 192 ppm Cu, 82 ppm Pb and 161 ppm Zn. Manganese concentrations are high (745 ppm Mn) with relatively low Fe (1.98%).

Lead and Zinc

One samples with "anomalous" Pb, and another with "anomalous" Pb and Zn are included here. Sample C4-076 has 104 ppm Pb with 21.2% LOI, 63 ppm Cu, and 59 ppm Zn. Sample C3-061 has 224 ppm Pb with 38.2% LOI, 225 ppm Cu, and 274 ppm Zn. Both samples contain low Fe and Mn. Figures 6i and 6g plot Pb greater than or equal to 2.0 (26 ppm) and Zn greater than or equal to 1.9 (144.4 ppm), respectively.

Three "anomalous" Zn values were found among the Pancake Lake samples. These include samples B6-038 (192 ppm), B6-046 (192 ppm), and C2-092 (646 ppm). Sample B6-038 has 20 ppm Co, low Fe (1.69%) and high Mn (630 ppm). Sample B6-046 contains 15 ppm Co and low Fe (1.72%) and Mn (456 ppm).

The highest "anomalous" Zn sample was found just south of 2 Cu mineral occurrences (Figures 1 and 10c). Sample C2-092 contains "anomalous" Zn (646 ppm) with 590 ppm Ba, 85 ppm Cu and 28 ppm Pb. Both Fe (0.53%) and Mn (111 ppm) are low, suggesting secondary accumulation of Fe and Mn are not a factor in this sample.

Tungsten

One sample, C4-075, contained 6 ppm W along with 140 ppm Zn. Secondary accumulation in this sample was not a factor since both Fe and Mn were low (0.52% Fe and 96 ppm Mn).

Nickel

In the Pancake Lake area, sample C1-056 contains 79 ppm Ni along with 19.4% LOI, 120 ppm Cr, high Fe (2.75%) and low Mn (352 ppm). A diabase dike in the area may account for these values.

Uranium, Lanthanum and Thorium

The "anomalous" results for U, La, and Th are of general interest and their significance in mineral exploration is as yet unclear. It should be noted that there are numerous U occurrences in the area which suggests the area is a U province as well as a Cu province (*see* Figure 1).

In the Pancake Lake area, 10 samples contain high U levels (greater than or equal to 13.8 ppm, Figure 6c). Samples B2-024 occurs in the Keweenawan rocks and F3-179 occurs in the Ramsey gneiss domain. Both sites were considered "high" or "anomalous" with 24.0 ppm U and 32.3 ppm U, respectively. Lanthanum was high in both samples (62 ppm La and 47 ppm La, respectively).

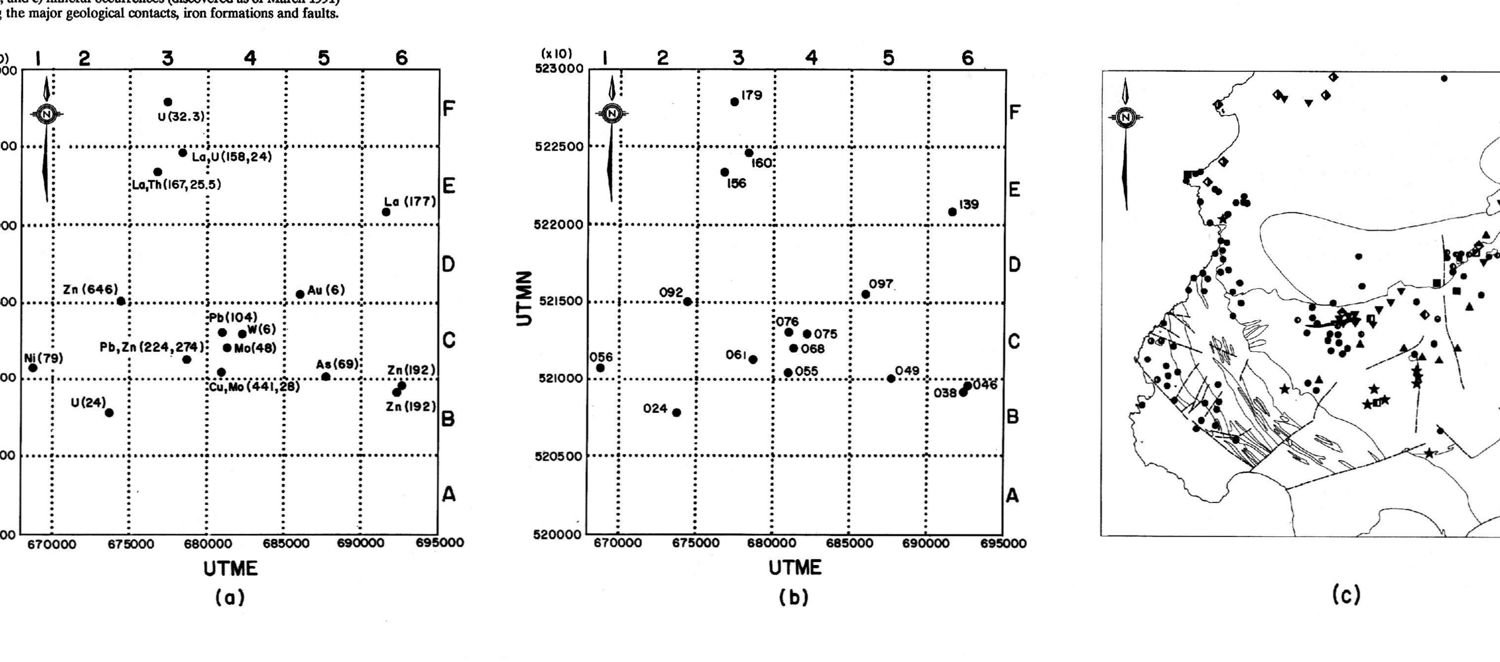
Three samples contain "anomalous" La (E6-139 (177 ppm), E3-156 (167 ppm) and E3-160 (158 ppm)). Of these, the second sample also has "anomalous" Th (25.5 ppm) and the third has "anomalous" U (24.0 ppm)). Seventeen samples have La levels greater than 69.2 ppm in total (*see* Figure 6b). These "anomalous" samples are located on the far northwest map border of the Ramsey gneiss domain.

SUMMARY

Very few lake-sediment sample analyses in the Pancake Lake area have produced results that can be considered very high or "anomalous". Accordingly, 16 "anomalous" lake-sediment samples were selected to be of interest for mineral exploration in the Pancake Lake area.

Also, the above detailed descriptions should be interpreted in conjunction with regional geological and geophysical maps of the area. It is strongly recommended that all "anomalous" values described here are should be verified by resampling during the mineral resource appraisal.

Figure 10. Detailed map delineating in the Pancake Lake area: a) the 16 "anomalous" samples and locations, b) sample site codes and their locations, and c) mineral occurrences (discovered as of March 1991) including the major geological contacts, iron formations and faults.



MINERAL OCCURRENCES

- ★ Au; Au,Co; Au,Ag,Cu; Au,Co,Cu,Ag; Au,cp,bn,Co,py
- Clay; it; serp; sh
- Co,cp,py; Co,Au,Ag,Cu
- cp,py
- Cu; Cu(float); Cu,Ag; Cu,cp; Cu,Fe; Cu,Mo; Cu,Pb; Cu,py; Cu,W; Cu,Zn
- Cu,cp,py; Cu,Mo,cp; Cu,Mo,W; Cu,cp,Au,py; Cu,cp,py,Au,Ag; Cu,Mo,cp,sp,gn, shee, Ag
- ▼ Fe; hem; mag
- IF,Cu
- Mg
- Mo
- po,cp; po,cp,py
- Pb,Zn,Ag; Pb,Zn,Cu; Pb,Zn,Ag,Cu; Pb,Zn,Ag,Au,Cu
- ▲ py; py,Mg; py,cp,Cu
- U

ABBREVIATIONS

Ag	silver	Mg	magnesium
Au	gold	Mo	molybdenum
bn	bornite	Pb	lead
Clay	clay	po	pyrrhotite
Co	cobalt	py	pyrite
cp	chalcopyrite	serp	serpentine
Cu	copper	sh	shale
Fe	iron	shee	scheelite
gn	galena	sp	sphalerite
hem	hematite	U	uranium
IF	iron formation	W	tungsten
it	illite	Zn	zinc
mag	magnetite		

SUMMARY FOR THE PANCAKE LAKE REGIONAL GEOCHEMICAL SURVEY

The geochemical map area is located at the western limit of the Batchawana greenstone belt. The survey area also includes some granitic terrane along the northern border, and to the southeast of the greenstone belt. Keweenawan rocks cover the western portion of the map area.

The Pancake Lake regional geochemical survey is based on data obtained from pre-*Ambrosia* sediments and water samples collected from 190 sites. The lake-sediment samples were all collected using a gravity core sampler. Thirty-five elements were determined in each pre-*Ambrosia* sediment sample.

Medium to large lakes in the Pancake Lake area required the accumulation of not more than 2 samples. Because of the paucity of lakes and ponds in the map area, an average density of one sample per 3.55 km² was obtainable. This compares with an average one sample per 1.30 km² in the Trout Lake area (Fortescue and Vida 1989), one sample per 1.03 km² in the Hanes Lake area (Fortescue and Vida 1990b) and one sample per 13 km² in traditional "reconnaissance" geochemical mapping (Friske 1985).

In these marginal notes, 3 methods were used to discover and interpret patterns in the geochemical data base. Some patterns are regional ("geochemical provinces"), while others are due to point sources ("geochemical anomalies"). Both of these pattern types are of potential importance for mineral exploration.

The data for 16 "geochemical anomalies" within the 190 lake-sediment samples were described. Verification of these geochemical results is desirable prior to their use in mineral exploration.

CONCLUSIONS

METHODOLOGY

1. The application of a quality control procedure to the entire batch of Pancake Lake sediment samples revealed that:
   a. The geochemical data for 19 elements (Mg, Ti, Na, Mn, Fe, K, Sr, V, Sc, Ca, Al, Ba, Th, Cu, U, La, P, Zn and Br) are acceptable for detailed statistical analysis, image processing and entry into a geoscience GIS. (In spite of minor inconsistencies, these elements were also used in global geochemical signatures for Trout Lake and Hanes Lake regional geochemical map data, *see* Fortescue and Vida 1989, 1990b).
   b. The Pancake Lake geochemical data for 16 other elements (Ag, As, Au, Be, Bi, Cd, Co, Cr, Hf, Lu, Mo, Ni, Pb, Sb, Ta and W) are of variable quality and should not be subjected to detailed statistical analysis, image processing or incorporated into a geoscience GIS without careful consideration.

LAKE-SEDIMENT GEOCHEMISTRY

2. It is concluded from the **global-level** study of the Pancake Lake geochemical data that:
   a. A GDS provides an effective basis of comparison for geochemical signatures obtained from 4 different rock types in the Pancake Lake area and a general geology GDS for the area
   b. A unique 19-element global signature was described for each of the 4 rock types in the Pancake Lake area. The signatures were based on geochemical data obtained from a minimum of 10 catchments all entirely underlain by one rock type. Global geochemical signatures provide a relatively simple basis for comparisons of geochemistry among varying rock units in the Pancake Lake area. These geochemical signatures can also be used for direct comparisons with other OGS regional geochemical maps for this greenstone belt.
3. Several conclusions were drawn from a regional level of interpretation of the Pancake Lake geochemical data base.
   a. **Regional Geochemical Map Patterns**
      It is concluded from an analysis of regional map patterns for selected elements using Pancake Lake area pre-*Ambrosia* sediments that:
      i. Patterns for 10 elements, Ag, As, Au, Co, Cu, Mo, Pb, U, W and Zn may be of direct interest in mineral exploration (Figure 6).
      ii. Patterns for 6 other elements, Be, Bi, Hf, La, Sb and Th are of less significance for mineral exploration (Figure 6).
   b. **Regional Geochemical-Geological Map Strips**
      It is concluded on the basis of information obtained from LOI and 18 selected regional geochemical-geological map strips that:
      i. Patterns for one or more of Ag, Au, As, Co, Cu, Mo, Pb, U, W and Zn (Figure 9) may indicate possible exploration targets. These results should be verified by resampling before any action is taken.
   c. **Principal Components Analysis (PCA)**
      A PCA was applied to pre-*Ambrosia* geochemical data from 1) the Pancake Lake area (using catchment areas underlain by one or more rock types), 2) the Pancake Lake geology area based on catchment areas underlain by one rock type, to represent the general geology of the area, and 3) geochemical data sets representative of catchment areas underlain by principal rock types in the map area. It was concluded that:
      i. Factor 1 from each data set showed that LOI is always strongly and inversely correlated with mineral matter. As mineral matter increases in pre-*Ambrosia* sediment samples, organic matter decreases.
      ii. Iron and Mn may be strongly correlated with one or more trace elements in a single factor. (This evidence, which indicates secondary accumulation of Fe, Mn and other elements, is not as strong in the Pancake Lake area as in the Trout Lake area, *see* Fortescue and Vida 1989).
      iii. Uranium, Th and La are strongly correlated in a single factor which is associated with granitic terranes underlying catchment areas
      iv. In all the data sets examined, some factors were considered of minor importance.
4. At the **detailed level**, 16 samples with results identified as "geochemical anomalies" within the Pancake Lake data set (Table 1) were examined. It is concluded that:
   a. A small number of "anomalous" results for Ag, As, Au, Cu, Mo, Pb, U, W and Zn are of direct interest in mineral exploration in the Pancake Lake area.

The reader is reminded that 1) in comparison with the rest of the Batchawana greenstone belt, all the "anomalous" values in this data base were not truly "anomalous" values and 2) the 16 samples containing "anomalous" results described here have not been verified by resampling and/or re-analysis.

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CREDITS

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