Geological Survey of Canada

Open File 4703

Compilation of Soil and Till Geochemical Metadata for Canada

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How to Use the CD

From the introductory screen the following buttons are listed:

START HERE	describes how the survey metadata pages can be accessed from the map of Canada
REPORT	displays a PDF file of Open File 4703
PUBLICATION SOURCES	displays a list of web pages for locating Canadian geoscience publications (HTM)
SURVEYS	displays a summary list of the surveys found in this open file (PDF)
MAPS	displays a map of Canada showing the location of the soil and till surveys; the soil and till survey metadata web pages can be accessed by clicking on the survey location box on the map as described both below and at the START HERE button.

Each till or soil survey in the metadata catalogue is given a separate html page which lists the following: the survey type, year and location, its geographic extent, a description of the survey, the number of samples collected, the types of geochemical analyses and the size fractions analyzed, other types of analyses undertaken, publications associated with the survey and the form of the report and data set (i.e. digital or paper). Any abbreviations used in the html pages to describe analytical procedure, etc., are explained in Section II of Open File 4703 (accessed from the REPORT button on the introductory screen).

The survey data are packaged on the CD in a format, which allows them to be searched by geographic extent, using standard browser software such as Internet Explorer or Netscape. The format used is "Scalable Vector Graphics", which requires a "plug-in" to be downloaded from Adobe, before the images can be viewed (analogous to the procedure required for viewing PDF documents). In addition, the data are stored on the CD in ESRI shape file (.shp) format in the directory \maps\SHPFiles (coordinates expressed as lat/long NAD83), so that they can be imported into most desktop GIS software programs.

To search the catalogue geographically, click on the MAPS button on the introductory screen, then click on the region of interest and then zoom in on the area of interest. The survey html page described above is displayed by clicking on its corresponding polygon.

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Geological Survey of Canada

Compilation of Soil and Till Geochemical Metadata for Canada:

Background Information and Explanation of Terms

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2004

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Abstract

In Canada systematic regional geochemical sampling of soils and tills have been undertaken since the 1960s (Brummer et al., 1987) primarily for mineral exploration but also for resource assessment and environmental research purposes. These surveys have been conducted by the mineral exploration industry, and by federal and provincial geological agencies. The Geological Survey of Canada (GSC) has developed a catalogue of metadata for these geochemical surveys. The GSC and the provincial geological agencies have generated more than 200 geochemical data sets that are potentially useful to scientists and regulators in other government agencies who are working on environmental issues.

In the catalogue each survey is given a separate html page which lists the survey type, year and location, a description of the survey, including its geographic extent, the number of samples collected (if available), the types of geochemical analyses and size fractions analyzed, other types of analyses undertaken, publications associated with the survey and the form of the dataset (i.e. digital or paper). There is also a link on the html page to the organization responsible for collecting the data for that survey. Publications associated with the survey can be obtained from that organization. A html page, accessible from the CD-ROM's introductory window directs the user to the appropriate page on the organization's web site. Included on the CD is a 1:7 500 000 map of Canada (~77 x 62 cm) showing the areas covered by the surveys. It can be accessed from a link in section V of this report or from a link on the national scale map (viewed by clicking on the Maps button on the introductory screen of the CD). Also included on the CD is a browser-based mapping application which allows the user to search the catalogue geographically, by zooming in on the part of Canada that is of interest. The survey html page described above is displayed by clicking on its corresponding polygon.

The abbreviations used in the html pages to describe analytical procedure, etc., are explained in the text of this report. This report contains background information on the distribution and compositional characteristics of tills and other surficial sediments and the methodologies used for sample collection and geochemical analysis. This report is included on the CD and is accessible from the CD's introductory window.

Introduction

In Canada systematic geochemical sampling surveys have been undertaken since the 1960s mostly for mineral exploration but also for resource assessment and environmental research purposes (e.g., Brummer et al., 1987, Shilts, 1993; McClenaghan, 1992, 1994; Klassen and Thompson, 1993; Kettles and Shilts, 1994; Batterson and Liverman, 2000; McMartin et al., 1999, 2001). Regional surveys have been conducted by the federal and provincial geological agencies and by mining and mineral exploration companies, though much of the data from the latter are unavailable to the public (McClenaghan et al., 2000). As well as till and soils, sample media have consisted of stream and lake bottom sediments, rocks and different types of vegetation. Surveys have been carried out in many areas of Canada at different scales: reconnaissance with sample spacing at 10 to 25 km, regional (4-10 km spacing), local (1-2 km spacing) and detailed (25-100m spacing) (McMartin and McClenaghan, 2001). Numerous government departments and geoscience organizations have published the geochemical data generated from these sampling surveys but, in many cases, the existence of these data sets is not widely known outside the geoscience community. In recent years there has been increased interest in understanding and regulating metals introduced or redistributed in the landscape through human activities (e.g., Forstner, 1981, Adriano, 2001). Geochemical data are frequently used as a tool to recognize and solve these problems. The current literature review has captured information for 186 geochemical surveys carried out by the Geological Survey of Canada (GSC) and provincial geological agencies.

The GSC is aware of the need to make these surficial sediment geochemical data more widely known and accessible, and has entered into a partnership with Environmental Health Assessment Services at Health Canada to pursue this goal. Specifically, this project aims to provide data that can be used to determine “background” levels of metallic elements in soils and tills around contaminated sites across Canada. A particular objective is to provide information on the range of natural background levels of naturally occurring metals and metalloids in surface materials to support risk assessments and risk management decision-making. Results from the geochemical surveys show that there is great variation in the naturally occurring levels of elements in the surface sediments covering the Canadian landmass. These regional differences reflect the diverse composition of the underlying bedrock, the effects of glacial processes, and also postglacial modification and weathering of the sediment cover.

To achieve the major goals of the Health Canada-Geological Survey of Canada project it is first necessary to have an up-to-date inventory of the geochemical surveys undertaken in Canada. In this component of the project, we have concentrated on till (the predominant surficial material) and soil surveys and have developed a catalogue of pertinent data sets generated by the Geological Survey of Canada and provincial agencies. The catalogue lists the till and soil surveys, including information on the number of samples, location of survey, types of analyses generated, form of the resultant data and associated publications. The catalogue is accompanied by this report and an interactive map keyed to the survey locations. This report includes brief descriptions of soil, till and other surficial sediment types, methods of sample collection and preparation, the geochemical analytical techniques used, and the structure of the accompanying catalogue.

There is considerable variation in the scientific literature in the terminology used to describe the unlithified cover of surface sediments that overlie bedrock. In studies where bedrock geology or mineral exploration is the primary focus, the entire surficial layer is commonly referred to as overburden, drift or soil. In this project, the term till is used to denote those sediments deposited either directly from, or in close association with, glacial ice. Where sediments other than till have been sampled they are identified as described below. The term soil is reserved for the true solum that has developed on the surface of tills or other sediments and specific soil horizons are distinguished.

It should also be noted that there were differences in the methodologies used to generate geochemical data from soil and till surveys. The surveys were mostly "stand alone" projects undertaken over more than 25 years for numerous purposes and, as a result, the methods of sample collection, preparation and analysis have varied. As described in more detail later in this report, the actual range of element concentrations determined for samples collected from different soil horizons or sediments types, from different grain size fractions of the same sample, or from different analytical procedures on the same size fraction differ significantly. As a result, it is not possible to compare directly the geochemical data from one study with those of other studies without considering carefully the methodologies used for each study.

Background Information on Soil, Till and Other Surficial Sediments

The composition of the surficial cover in Canada differs in several important aspects from most other parts of the world where soils have developed from the in-situ weathering of bedrock. More than 95% of Canada was covered by glaciers periodically during the last 2 000 000 years and, as a result, the cover of surface sediments consists of materials that were eroded, transported and deposited by glaciers (Shilts, 1993; DiLabio, 1989; Dyke et al., 1989). This surface cover is composed of unweathered fragments of crushed bedrock mixed with reworked older soils and sediments. The clay- to boulder-size materials forming these deposits were mostly eroded from the underlying or nearby bedrock (0 to 10s of kilometres) but there is also a component of exotic material transported 100s to 1000s of km by glacial ice or meltwaters before being deposited. Once deposited, these sediments have only been exposed to surface weathering and soil forming processes for the 8 000 to 10 000 years since the last glaciers melted. Since this is a very short period with respect to geologic time, the physical and chemical effects of weathering are generally confined to the uppermost 0-2 m.

Till

Figure 1 shows the distribution of surficial sediments over the Canada landmass. The most widespread surficial deposits are diamictons, which are referred to collectively as till (Fulton, 1989; Dyke and Dredge, 1989; Shilts, 1993). They have been deposited either directly from, or in close association with, glacial ice (Figs. 2 and 3). Tills are composed of pebble- to boulder-size clasts of bedrock in a matrix of variable amounts of fine sand, silt, and clay. Over many parts of Canada, especially over the Canadian Shield, till forms a discontinuous veneer, 0-1.5 m thick, which mantles and reflects the morphology and structure of underlying bedrock. In other areas e.g., parts of the Prairies, the till cover is thicker, from several metres to more than 100 metres thick. At a regional scale, till deposits are thickest in areas such as southern Ontario and the Prairies that are underlain by sedimentary bedrock (Karrow, 1989; Klassen, 1989). The flat lying, finely bedded, fine-grained nature, and weak cementation (lithification) of these bedrock strata made them more susceptible to glacial erosion than the massive crystalline bedrock that composes most of the Canadian Shield. The textural and lithologic composition of till depends mostly on the bedrock sources from which it originated. Where the till was derived from coarsely crystalline bedrock such as Precambrian granites it is commonly

stony and sandy, whereas in areas such as southern Ontario where it was derived from Paleozoic limestones and dolomites, it is enriched in silt and clay and is more cohesive.

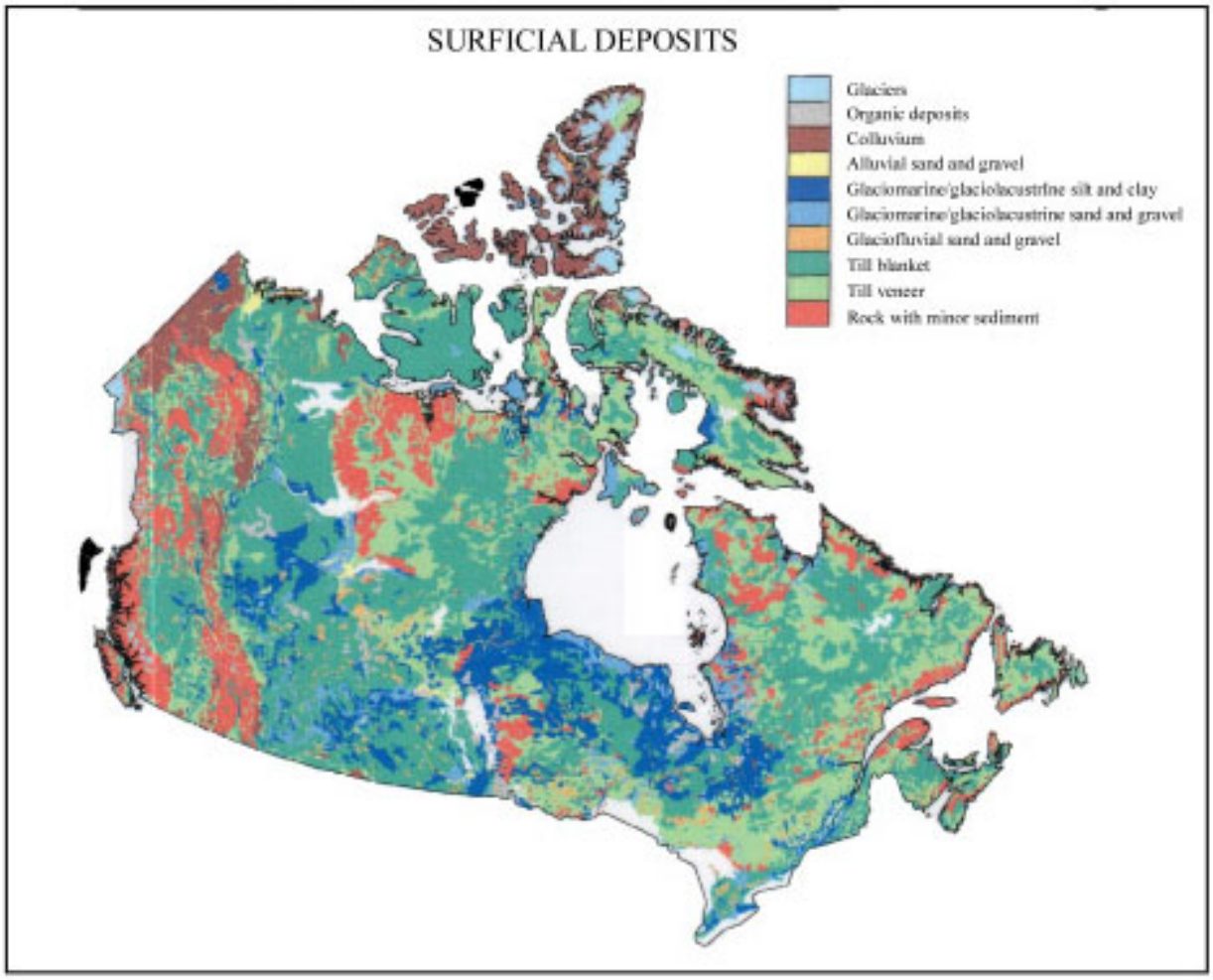

Figure 1. Distribution of surficial sediments in Canada (after Fulton, 1995).

Figure 2. Road cut exposure of till (in the vicinity of sampler) overlain by glaciolacustrine finely bedded fine sand and silt (bottom right). Both types of sediment were deposited over rugged Precambrian shield bedrock in south-central Ontario.

Figure 3. Exposure of fine-grained till bearing clasts of Paleozoic limestone and dolomite sampled near Manitouwadge, northeastern Ontario. The limestone and dolomite clasts were eroded and glacially transported from sedimentary bedrock in the James Bay Lowlands before being deposited on Precambrian shield terrain in northern Ontario.

In some places glacial sediments have been reworked by meltwaters from the retreating glaciers and other post-glacial processes (Dredge and Cowan, 1989). Glaciofluvial deposits are composed of complexly bedded and faulted, coarse bouldery to cobbly gravel interbedded with sand, gravel, and, in some places, bedded fine sand and silt (Fig. 4). They are found in the landscape in various forms - eskers, kames, kame terraces, subaqueous fan deposits and outwash plains.

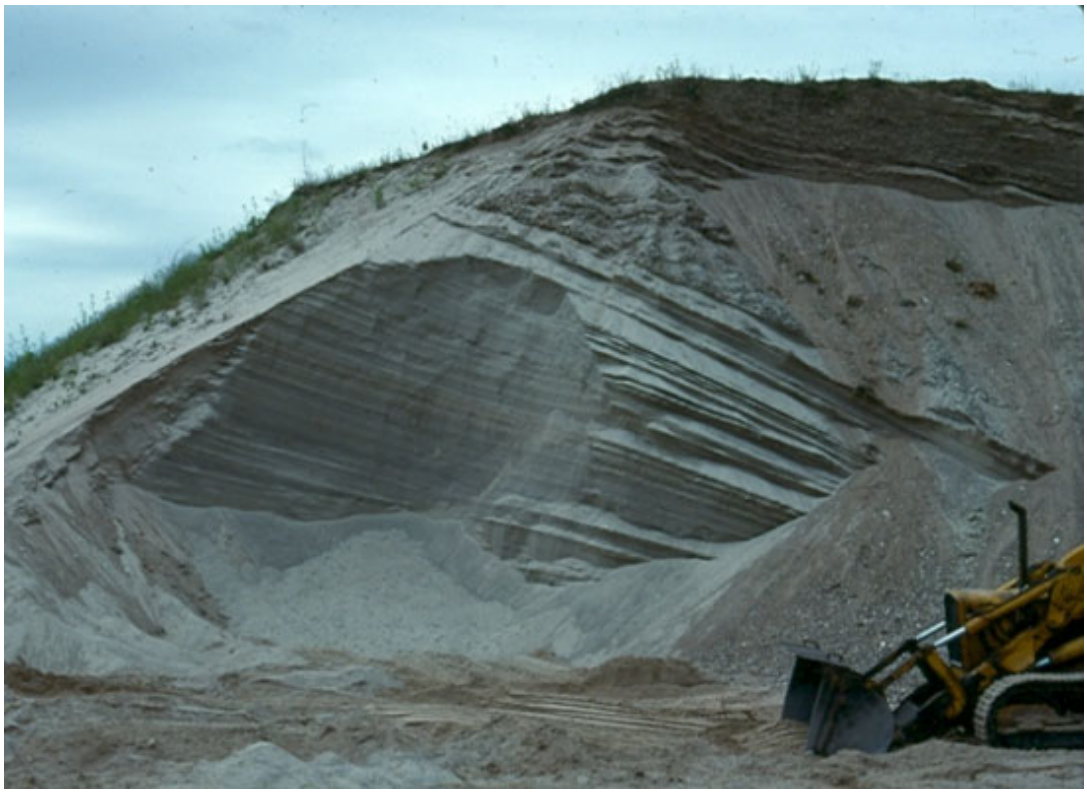

Figure 4. Borrow pit where glaciofluvial sand and gravel are being excavated from eastern Ontario.

In some parts of Canada, tills or the bedrock surface are overlain by a cover of glacial lake or marine sediments consisting of thin (centimeters) to thick (more than 100 metres) deposits of rhythmically bedded clay and silt to fine sand or stratified gravel (Dyke and Dredge, 1989) (Fig. 5). Some glacial lakes were local and small while others existed at the scale of the present day Great Lakes. During the last deglaciation geographically vast areas were covered by Lake Agassiz in the Prairie provinces, Lake Barlow-Ojibway in northern Ontario and Quebec, Lake Iroquois and Lake Algonquin in southern Ontario, and Lake McConnell in the western Northwest Territories (Dyke and Prest, 1987). In addition, marine waters invaded the isostatically depressed lowland

coastal areas. The Tyrrell Sea occupied the Hudson Bay basin covering present-day coastal areas of Nunavut, Manitoba, Ontario and Quebec whereas the Champlain Sea invaded the St. Lawrence River and Ottawa River valleys (Dyke and Prest, 1987).

Figure 5. Deposit of glaciomarine silt, sand and clay in eastern Ontario.

Along some river and stream valleys there are older and modern alluvium deposits composed of silt, sand and gravel with minor organic materials (Dredge and Cowan, 1989). In places there are sand dunes and other types of wind blown deposits derived from alluvium or other fine-grained sediments (Wolfe, 2002). Organic deposits composed of peat and muck are also widespread (Tarnocai et al., 2000) (Fig. 6).

Figure 6. Deposit of peat excavated from a peat hummock near Rouyn-Noranda, Quebec.

Postglacial modification of glacial sediments and soil formation

Soil-forming processes have altered the uppermost 2 m of till or other surficial materials. Below the upper 1 m or so these deposits may show only minor effects of weathering. These are most commonly marked by signs of oxidation, which include colour changes from grey to brown, the presence of Fe-Mn oxide precipitates along the joints and fissures in the sediment, and the presence of disaggregated bedrock clasts (Shilts and Kettles, 1990; McMartin and McClenaghan, 2001).

Soil is defined as the naturally occurring, unconsolidated material or organic material at least 10 cm thick that is capable of supporting plant growth (Soil Classification Working Group, 1998). Canadian soils have been classed based on kinds, degree of development and the sequence of soil horizons and other layers in the surface cover. The major mineral horizons of mineral soils are A, B, and C (Fig. 7) (Soil Classification Working Group, 1998). A-horizon is the mineral horizon formed at or near the surface in the zone of leaching or eluviation, or of maximum in-situ accumulation of organic matter (humus), or both. The B is the next lower horizon characterized by enrichment in organic matter, sesquioxides, or clays and characterized by a change in colour denoting hydrolysis or oxidation. The C is a mineral horizon comparatively

unaffected by pedogenic processes and is considered as weathered the parent material commencing soil development.

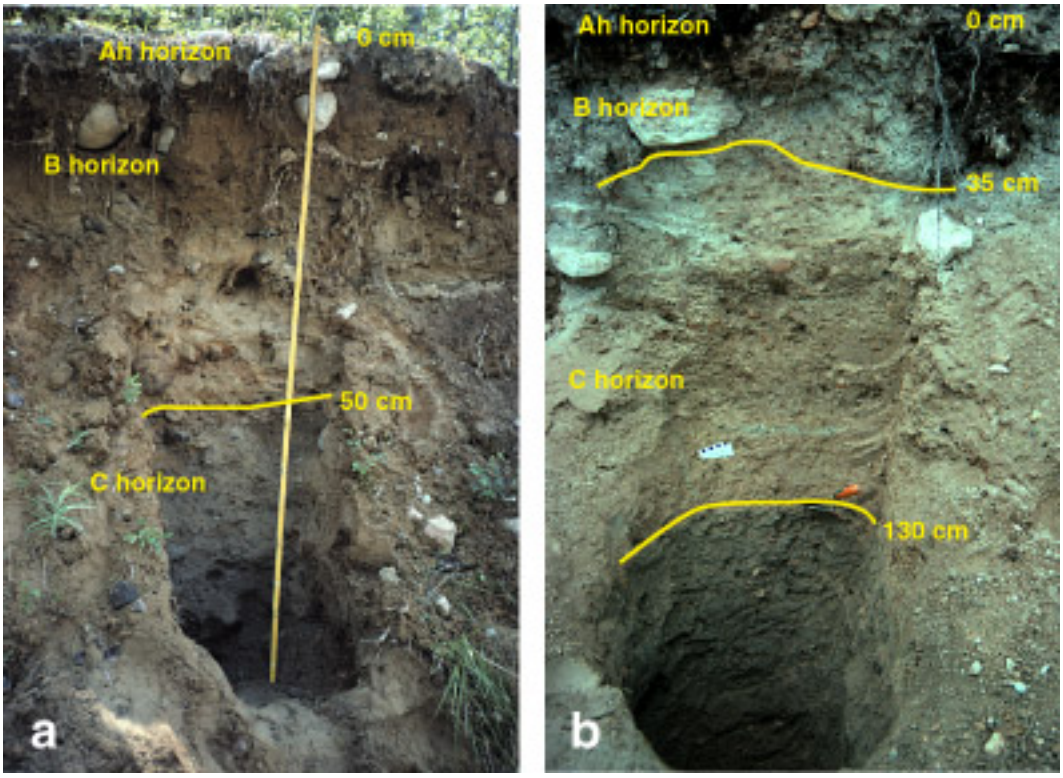

Figure 7. Photographs of (a) a typical soil profile developed in till near Flin Flon, Manitoba, and (b) a soil profile in strongly calcareous till near The Pas, Manitoba, showing the A_h horizon. In soil sampling surveys samples were commonly collected from the A_h (humus) and B horizons (photo from McMartin and McClenaghan, 2001).

Sample Collection and Preparation

Techniques of sample collection and preparation have been summarized and reviewed in McMartin and McClenaghan (2001) (Fig. 8). In areas with a thick till cover, samples were commonly collected in profile from the till surface to the underlying bedrock. Where the till cover was thin, care was taken to collect till that was as unweathered as possible. Where soils were sampled in addition to till, or instead of till, samples were collected consistently from the selected horizons (e.g. Henderson et al., 2002).

Figure 8. Soil and till sampling in northern Ontario (photo by M.B. McClenaghan).

For surface sediments in the vast permafrost areas of Canada, there is little chemical weathering at the deposit surface but there are pronounced physical changes due to frost action (Shilts, 1973). Frost action causes the vertical mixing of the soils (cryoturbation) where surface organic horizons and weathered material are redistributed at depth in the active layer. In permafrost areas, frost boils, also known as mudboils or non-sorted circles, formed in poorly sorted, silt- or clay-rich sediments such as till or fine-grained marine or lacustrine sediments. Where present in survey areas, mudboils have been sampled because they bring relatively unweathered till to the surface.

Most samples were collected by the hand digging of pits with shovels or picks. In most cases about 3 to 10 kg of material was excavated and stored in labelled plastic bags. Samples were commonly collected from road cuts, borrow pits, off-road sites, and along streams and lakeshores. In those many regions of Canada with no roads, the sampling projects had helicopter or fixed-wing support, or the area was accessed by boat traverses along navigable streams and lakeshores. In most areas relatively unweathered till was reached at depths of 1 to 2 metres or less. In regions where the till cover was thick (2 to 3 metres or more) samples were collected from exposures along streams or by backhoe, trenching or drilling so that till samples could be collected continuously through the

deposit to bedrock. The types of drills most commonly used were reverse circulation rotary, rotasonic, and portable (McMartin and McClenaghan, 2001).

In the laboratory the bulk sample was sub-sampled for geochemical and other analyses. The splits used for geochemical analysis were air or oven-dried at temperatures less than 40^{o} C to prevent the volatilization of Hg. The dried split was then dry sieved to obtain the silt plus clay (<0.063 mm), or coarser fractions (e.g., <2 mm), or put into a water suspension and centrifuged to obtain the clay-sized (<0.002 mm) fraction (Lindsay and Shilts, 1995). For samples from the organic horizons of soil (humus) and peat, the sample was sieved to <0.177 mm, or left whole.

Choice of sediment size fractions analyzed

Emphasis on the composition of the different fractions of till and other glacial sediments has arisen from chemical partitioning studies that indicate the greatest concentrations of specific minerals occur within certain grain sizes in glacial sediments (Shilts, 1975, 1984; Plouffe, 2001). In practice, however, there are conflicts between the ideal and practical choices, and the size fractions analyzed tend to be the ones that achieve the most useful information on a routine basis at an affordable cost.

Shilts (1975, 1984) determined that the most effective fraction to analyze for evaluating regional variations for many trace elements in till is the clay-sized fraction (<0.002 mm; sometimes reported as <2 μm) which typically yields greater trace element concentrations than the coarser fractions of till. However, the use of clay-sized material is not suitable for all elements, including Au, W and the platinum group elements. The clay-sized fraction is dominated by phyllosilicate minerals that have higher concentrations of trace elements in their lattices than do quartz and feldspar, which dominate the coarser fractions. Although clay-sized particles may comprise only a small part of the till, they may have a disproportionate effect on local geochemical environments (Shilts, 1984). The clay-size fraction has great potential to react to natural and anthropogenically generated acids due to the large amount of particle surface area available for reaction and its enhanced metal concentrations. The clay-sized component (< 0.002 mm fraction) was analyzed in a large number of the earlier studies.

Despite the advantages associated with analysis of the clay-sized fraction, the silt and clay-sized fraction (<0.063 mm; sometimes reported as <63 μm) has been commonly

used since the mid-1990s, mostly for economic reasons. Silt and clay-sized material can be recovered easily and cheaply by dry sieving unlike the clay-sized fraction which requires a labour and time-intensive wet centrifuge procedure (Lindsay and Shilts, 1995). Data from the silt and clay-sized fractions have been found to broadly define the same regional geochemical variations in till composition (Klassen and Knight, 1995). In a small number of studies the coarser <2 mm fraction was analyzed for trace metals to correspond to procedures used in some health, agricultural and environmental studies (Thorleifson, and Garrett, 1997).

As mentioned previously, it is not possible to directly compare the geochemical data obtained from analysis of one size fraction of sediment with those data obtained from another size fraction. Although the regional-scale patterns of element dispersal based on different size fractions may be broadly similar, the actual range of element concentrations obtained from one fraction differ significantly from the ranges obtained by analyzing others. For example, concentrations of trace metals are commonly several fold higher in the clay-sized (<0.002 mm) compared to the silt and clay-sized fraction (<0.063 mm) of the same till sample because, as mentioned above, a large proportion of silt-sized materials is composed of metal-poor quartz and feldspar. Table 1 shows some results from a geochemical partitioning study in till (Shilts, 1991). Concentrations of some elements may be several to more than 10-fold higher in the fine compared to coarser fractions.

Table 1. Examples of Element Partitioning in Till (from Shilts, 1991)

Sample of near surface basal till, central District of Keewatin

Size Fraction	Pb (ppm)	As (ppm)	U (ppm)	Mo (ppm)
Bulk (<6 mm)	136	23	1.7	8
2-6 mm	168	5	0.9	8
0.25 - 2.0 mm	74	7	1.1	4
0.044 - 0.25 mm	44	8	1.2	6
0.004 - 0.044 mm	102	25	5.5	6
0.001-0.004 mm	570	76	8	15
<0.001 mm	1300	112	2.6	26

Sample of oxidized, sandy, granite-rich till, near Tangier Lake, Nova Scotia

Size Fraction	W (ppm)	Cu (ppm)	As (ppm)
Bulk (<6 mm)	500	106	8
2-6 mm	60	31	2

0.25 - 2.0 mm	360	53	3
0.044 - 0.25 mm	500	90	6
0.004 - 0.044 mm	550	167	13
0.001-0.004 mm	1800	500	45
<0.001 mm	>2000	600	80

Sample of sandy, clay-poor pebbly till, Grenville Province of Canadian Shield in eastern Ontario, Canada

Size Fraction	As (ppm)	Zn (ppm)	Cu (ppm)
Bulk (<6 mm)	42	56	15
2-6 mm	2	40	7
0.25 - 2.0 mm	21	38	8
0.044 - 0.25 mm	12	42	8
0.004 - 0.044 mm	189	65	16
0.001-0.004 mm	630	385	165
<0.001 mm	not analyzed	830	440

The content of carbonate minerals in surficial sediments is commonly measured for environmental research purposes because these minerals strongly affect the capacity of the sediments to buffer the effects of acid loading from acid rain, mine-waste or industrial contaminants (Kettles and Shilts, 1994). The greatest concentrations of carbonate minerals occur in the silt-sized grains in glacial sediments (Dreimanis and Vagners, 1971). In practice, however, the silt plus clay-sized component of glacial sediments was generally analyzed for its carbonate content because it was virtually impossible to separate all clay from silt-clay mixtures.

Heavy (high density) minerals were also recovered from surficial sediments, although more commonly for mineral prospecting rather than environmental research purposes (Averill, 2001; Thorleifson and Kristjansson, 1993; Thorleifson and Garrett, 1997; McClenaghan and Kjarsgaard, 2001). These included diamond indicator minerals, gold grains and other ore minerals predominantly found in the fine sand-sized fraction of the sediment sample.

Geochemical Analytical Methods

Sample decomposition techniques

Many methods of geochemical analysis require the sample to be decomposed using acids or a fusion to break up the crystal lattices before the sample is analyzed for element content. Sample decomposition techniques are described in Hall (1991, 1997) and Amor et al. (1998). The two most widely used acid treatments are partial extractions with aqua regia (3 parts HCl to 1 part HNO_3) or Laforte, reverse aqua regia, (1 part HCl to 3 parts HNO_3). Aqua regia and reverse aqua regia dissolve base metals in the majority of earth materials, but the major rock-forming silicates are only partially digested. In some studies, samples were treated with multi-acid digestions such as the four acid "near-total" digestion (HF-HNO_3-$HClO_4$ acid digestion, HCl leach). The near-total digestion leaves only the most resistive minerals such as zircons, chromites and some rare-earth minerals undigested.

With the increased application of geochemistry to environmental problems, the use of selective partial leaches to target the element content of specific components of soil and sediment samples has increased (Hall et al., 1996). Selective partial digestions were used either singly or in sequence because analyses based on these treatments yield more information on the potential bioavailability of specific elements than do results obtained after a near-total digestion. One sequential extraction scheme used in a number of studies consisted of a four-step process of sample decomposition and subsequent analysis: (1) sample leached with sodium acetate to obtain the easily extractable component (adsorbed and exchangeable material, carbonates, some phosphates) (Henderson et al., 1998; Kettles et al., 2003; McMartin et al., 2003); (2) the remaining leachate treated with sodium pyrophosphate to target the soluble organic component (humic and fulvic phases); (3) decomposition of remaining materials with aqua regia to break down the refractory organic materials, sulphides, crystalline iron oxides (e.g., hematite, goethite, magnetite) and partial silicates, and (4) digestion of the residue with a near-total multi-acid (HF-HCl-HNO_3-HCl) to attack the resistant mineral phases and residual crystalline fraction.

The fusion treatments used in some of the studies provided a complete digestion by fusing the sample at high temperatures with a flux such as Na_2CO_3, $Li_2B_40_7$ and, more

commonly, $LiBO_2$. Samples analyzed by the fire assay method for gold and other precious metals required a fusion step.

Element analysis techniques

Samples from the soil and till surveys listed in this catalogue were analyzed using the techniques described below. These methods are summarized in Hall (1991, 1997) and Amor et al. (1998). The growth of interest in environmental and mineral exploration geochemistry since the 1970s is mirrored by advances in analytical techniques. With new inventions, some techniques employed routinely in the earlier studies are no longer popular or are used for special purposes only. Different techniques have markedly different capacities for detecting very low levels of specific elements including U, As and Hg. The techniques used for different studies reflected the project objectives and, hence, were selected on the basis of their capacity for making adequate determinations of elements critical to the study.

Data generated by partial and total extractions, or by different analytical methods, even for the same sediment size fractions, can not be directly compared. The quantities of metals determined differ depending on how the sample is decomposed and what analytical technique is used.

ICP-AES, ICP-OES, DCP-AES

Beginning in the 1990s the majority of samples from the different surveys were analyzed by inductively coupled plasma atomic emission spectrometry (ICP-AES), sometimes referred to as optical plasma emission spectrometry (ICP-OES). In some cases, another type of spectrometer was used where the inductively coupled plasma was replaced by a direct current plasma (DCP). Prior to analysis samples were decomposed using a partial or near-total extraction. A typical suite of elements analyzed using ICP-AES, based on information from the ALS-Chemex web site, is shown in Table 2. Examples of detection limits are also shown, but it should be noted that these differ from one laboratory to the next and over time within the same laboratory.

Table 2. Example of ICP-AES Analysis Element Suite			
Ag (0.2 - 100 ppm)*	Co (1 - 10,000 ppm)	Mn (5 - 10,000 ppm)	Sr (1 - 10,000 ppm)
Al (0.01% - 15%)	Cr (1 - 10,000 ppm)	Mo (1 - 10,000 ppm)	Ti (0.01% - 10%)
As (2 - 10,000 ppm)	Cu (1 - 10,000 ppm)	Na (0.01% - 10%)	Tl (10 - 10,000 ppm)
B (10 - 10,000 ppm)	Fe (0.01% - 15%)	Ni (1 - 10,000 ppm)	U (10 - 10,000 ppm)
Ba (10 - 10,000 ppm)	Ga (10 - 10,000 ppm)	P (10 - 10,000 ppm)	V (1 - 10,000 ppm)
Be (0.5 - 100 ppm)	Hg (1 - 10,000 ppm)	Pb (2 - 10,000 ppm)	W (10 - 10,000 ppm)
Bi (2 - 10,000 ppm)	K (0.01% - 10%)	S (0.01% - 10%)	Zn (2 - 10,000 ppm)
Ca (0.01% - 15%)	La (10 - 10,000 ppm)	Sb (2 - 10,000 ppm)	
Cd (0.5 - 500 ppm)	Mg (0.01% - 15%)	Sc (1 - 10,000 ppm)	
* lower and upper detection limits shown in brackets			

AAS, F-AAS, GF-AAS

Another solution-based technique - atomic absorption spectroscopy (AAS) - was used routinely up until the early 1990s. With this method digested samples are aspirated into a variety of flame types or injected into a graphite furnace (GF-AAS). Before being analyzed samples were decomposed using a partial or near-total extraction. Mercury was determined by cold vapour AAS. Table 3 shows the elements typically determined using the AAS method (Kaszycki and DiLabio, 1986).

Table 3. Example of an AAS Analysis Element Suite		
Cu (1 ppm)*	Ni (2 ppm)	Mn (1 ppm)
Pb (2 ppm)	Ag (0.1 ppm)	Fe (0.1 %)
Zn (1 ppm)	Cr (2 ppm)	Cd (0.1 ppm)
Co (2 ppm)	Mo (1 ppm)	Hg (2 ppb)
* lower detection limit shown in brackets		

NAA or INAA

Neutron activation analysis or instrumental neutron activation analysis (NAA or INAA) requires the irradiation of samples in a nuclear reactor after which the induced radio-isotopes are measured by gamma-ray spectrometry. With this technique samples are analyzed directly without being decomposed and the results are total element concentrations. Table 4, based on information from the ACTLABS web site, shows the elements typically determined using this method.

Table 4. Example of an INAA Element Suite		
Au (5 - 30000 ppb)*	Hf (1 ppm)	Se (5 ppm)
Au (5-100000 ppm)	Hg (1 ppm)	Sr (0.01%)
As (2 ppm)	Ir (5 ppb)	Sm (0.1 – 10000 ppm)
Ba (100 ppm)	La (1-10000 ppm)	Sn (0.05 – 10 %)
Br (1 ppm)	Lu (0.05 ppm)	Ta (1 – 10000 ppm)
Ca (1 %)	Mo (5 – 10000 ppm)	Th (0.5 - 10000 ppm)
Ce (3-10000 ppm)	Na (0.05 – 10%)	Tb (0.5 ppm)
Co (5 – 5000 ppm)	Nd (5 – 10000 ppm)	U (0.5 – 10000 ppm)
Cr (10 - 100000 ppm)	Ni (50 – 10000 ppm)	W (4 – 10000 ppm)
Cs (2 ppm)	Rb (30 ppm)	Yb (0.2 ppm)
Eu (0.2 ppm)	Sb (0.2 – 10000 ppm)	Zn (50-100000 ppm)
Fe (0.02 %)	Sc (0.1 ppm)	
* lower and, where appropriate, upper detection limits shown in brackets		

XRF

Samples from a small number of studies were analyzed for major oxides in the sediment matrix using X-ray fluorescence spectrometry (XRF). This multi-element technique is referred to as "whole rock analysis" and is used on solid samples in powder form or on fused disks of samples following borate fusions. Table 5 shows a typical suite of elements measured using this method from the ALS-Chemex web site.

Table 5. Example of an XRF Element Suite			
Si	SiO_2 (0.01 - 100 %)*	Cr	Cr_2O_3 (0.01 - 100 %)
Al	Al_2O_3 (0.01 - 100 %)	Ti	TiO_2 (0.01 - 100 %)
Fe	Fe_2O_3 (0.01 - 100 %)	Mn	MnO (0.01 - 100 %)
Ca	CaO (0.01 - 100 %)	P	P_2O_5 (0.01 - 100 %)
Mg	MgO (0.01 - 100 %)	Sr	SrO (0.01 - 100 %)
Na	Na_2O (0.01 - 100 %)	Ba	BaO (0.01 - 100 %)
K	K_2O (0.01 - 100 %)		
* lower and upper detection limits shown in brackets			

ICP-MS

Inductively coupled plasma mass spectrometry (ICP-MS) was used to measure the rare earth metals after the samples were treated with a lithium borate fusion. Table 6 shows a typical suite of elements measured with this technique, based on information from the ALS-Chemex web site.

Table 6. Example of an ICP-MS Element Suite			
Ce (0.5 - 10,000 ppm)*	Ho (0.1 - 1,000 ppm)	Pr (0.1 - 1,000 ppm)	Tm (0.1 - 1,000 ppm)
Dy (0.1 - 1,000 ppm)	La (0.5 - 10,000 ppm)	Sm (0.1 - 1,000 ppm)	U (0.5 - 1,000 ppm)
Er (0.1 - 1,000 ppm)	Lu (0.1 - 1,000 ppm)	Tb (0.1 - 1,000 ppm)	Y (0.5 - 1,000 ppm)
Eu (0.1 - 1,000 ppm)	Nd (0.5 - 10,000 ppm)	Th (1 - 1,000 ppm)	Yb (0.1 - 1,000 ppm)
Gd (0.1 – 1,000 ppm)			
* lower and upper detection limits shown in brackets			

Colourimetry and Fluorometry

Arsenic was detected by colourimetric techniques following HNO3-HClO4 (nitric perchloric) digestion, and uranium by fluorometric treatments after a K2CO3 (potassium carbonate) fusion.

Other Types of Analysis

Carbonate analysis

Leco Method

In many studies, carbonate levels in the silt plus clay fraction (<0.063 mm) were determined using an electric induction furnace-combustion gas carbon analyzer (LECO) after a method modified from Foscolos and Barefoot (1970). Using this method, two splits of the same sample – one treated with an acid solution and the other unleached-were processed in the LECO analyzer to determine the content of organic and total carbon. The content of non-organic carbon is then calculated by difference and converted to percent $CaCO_3$ equivalent. The $CaCO_3$ equivalent is derived by assuming that all carbon that is driven off by acid dissolution of a sample is present in calcite. In fact, dolomite, siderite and other carbonates may be present and are not distinguished using this method.

Chittick Method

The <0.063 mm or other fractions were analyzed for carbonate minerals using a Chittick gasometric apparatus according to the method of Dreimanis (1962). This procedure determined the concentrations of calcite and of dolomite, based on the different reaction rates of those minerals in hydrochloric acid and also on assumptions

about the typical occurrences of calcite and dolomite in geological materials. Samples were dissolved in hydrochloric acid and the amount of gas produced at 30 seconds and after several tens of minutes is measured and used to calculate the content of calcite and dolomite, respectively.

Grain-size analysis

In most studies where grain-size analysis was carried out, the <2 mm fraction of the sediment was used. The sand fractions were quantified by dry sieving (>0.063 mm) while the <0.063 mm fraction was determined by pipette analysis (Gee and Bauder, 1986). Results are reported as percentages of sand (2mm-0.063 mm), silt (0.063 mm – 0.004 mm) and clay (<0.004 mm) in the <2 mm fraction. Classic grain size determinations are now commonly carried out with a laser particle size analyzer in conjunction with sieving (Percival and Lindsay, 1997; Lindsay et al., 1998).

Loss-on-ignition analysis

A measure of the amount of organic matter in a sample was obtained by putting a weighed sample in an ashing furnace at 500^{o} C for an hour and calculating the loss of organic carbon on ignition based on the weight of the residue.

Pebble lithologies analysis

Bedrock clasts recovered from till and other sediment samples were examined and classified according to lithologic groups to provide information on the bedrock sources of glacial transported debris (Shilts, 1993; Thorleifson and Kristjansson, 1993). There was much variation in the range of clast sizes examined from one study to the next, but the 5.6 to 16 mm size range was commonly chosen because the clasts are large enough to be easily identified. In most studies several hundred clasts per samples were identified.

Heavy mineral determination and analysis

The recovery and examination of heavy minerals was generally undertaken for mineral exploration purposes to look for minerals that were indicative of gold, kimberlite, or other ore minerals (Averill, 2001). The fine sand fraction was analyzed for heavy minerals because this size fraction spans the range in which heavy minerals preferentially occur (Shilts, 1975). In some studies this fraction was obtained by wet sieving. In others

the <2 mm material was passed repeatedly over a shaker table to obtain a sample split of fine sand-size light and heavy minerals (McClenaghan and Kjarsgaard, 2001). Gold grains observed during the tabling process were recovered and examined. After tabling, the sample split was screened to 0.5 mm and the heavy minerals separated using methylene iodide diluted a specific gravity of 3.2. The ferromagnetic fraction was removed using a hand magnet.

In some studies a part of the heavy mineral fraction was mounted on slides and the minerals examined with a microscope were identified and counted (e.g., Thorleifson and Kristjansson, 1993). In a few studies individual grains recovered from these examinations were analyzed further using an electron microprobe or scanning electron microscope (e.g., McMartin and Pringle, 1994). In other cases some of the heavy mineral fraction was pulverized and analyzed using similar methodology to that used for the finer fractions of the sediment matrix (e.g., Shilts and Wyatt, 1989) or analysed directly by INAA (Garrett and Thorleifson, 1995).

Data Presentation in Geochemical Data Sets

Geochemical data have been released as lists in appendices in paper form in the older studies, whereas since the 1990s, these data have been released in digital as well as paper forms. Results from some of the most recent studies are available only on CD-ROM. In the last few years there has been a marked increase in the amount of information on existing published geoscience reports available on the internet. Most reports are described and listed for purchase on websites developed by the Geological Survey of Canada and the provincial geoscience organizations. Some useful websites are listed in Table 7 below.

The till and soil geochemistry reports typically contain data lists, geochemical quality control data, summary statistics based on the data and a description of the project. In some studies the geochemical data were plotted on maps only with no supporting appendices of data. The majority of reports have proportional symbol, contour maps or colour-coded symbol maps showing the dispersal of selected elements in various fractions of the till or soils. Figures 9 and 10 are typical examples of maps showing element dispersal.

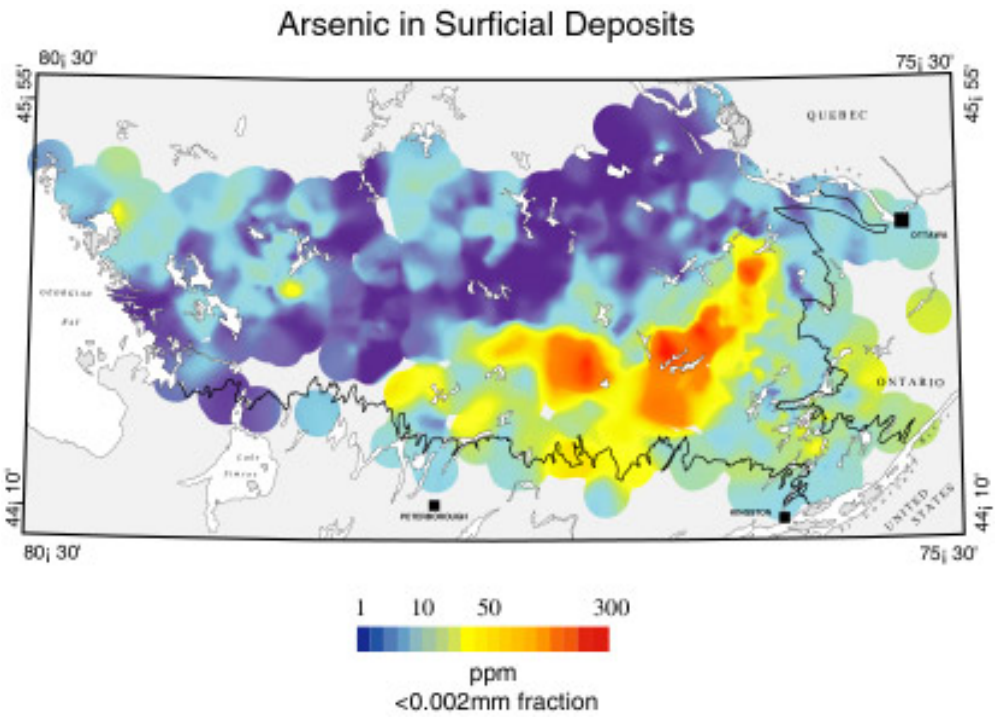

Figure 9. Colour contour map showing the distribution of arsenic in the clay-sized fraction of till in southeastern Ontario (after Kettles and Shilts, 1996). The black line denotes the eastern and southern boundaries of the Canadian Shield in the map area.

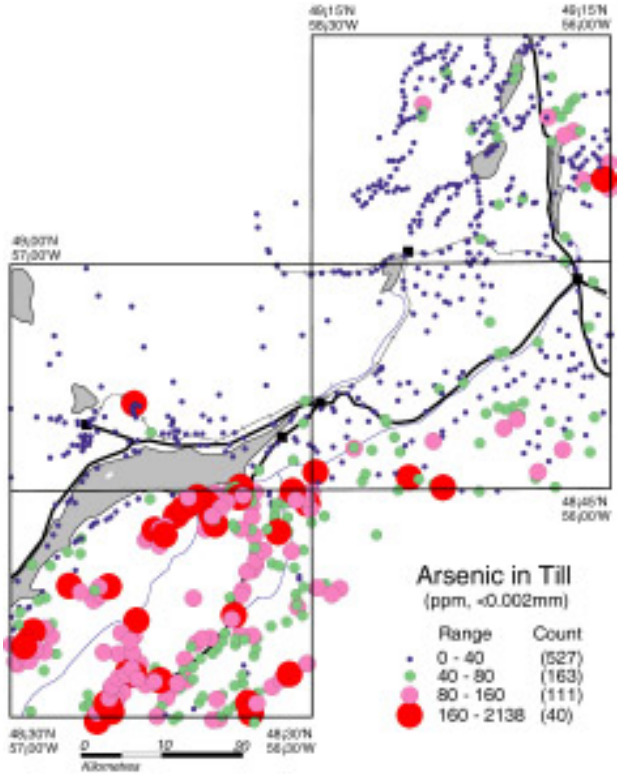

Figure 10. Proportional symbol map showing the dispersal of arsenic in the clay-sized fraction of till in central Labrador (after Knight and Klassen, 2001).

Table 7. Web-based Sources of Information on Surficial Sediments and Till and Soil Geochemical Surveys		
Country or Province	**Organization**	**Web Site**
Canada	Natural Resources Canada – Earth Sciences Sector, Geological Survey of Canada	Geological Survey of Canada main site: http://www.nrcan.gc.ca/gsc/index_e.html; Other pertinent Geological Survey of Canada sites: Terrain Sciences: http://sts.gsc.nrcan.gc.ca/clf/science_new.asp Mineral Resources Division: http://www.nrcan.gc.ca/gsc/mrd/index_e.html Geological Survey of Canada Bookstore: http://www.nrcan.gc.ca/gsc/bookstore/index_e.html Earth Science Sector publication search site (GEOSCAN): http://www.nrcan.gc.ca/ess/esic/geoscan_e.html
British Columbia	British Columbia Ministry of Energy, Mines and Petroleum Resources, Geological Survey and Development	http://www.em.gov.bc.ca/Mining/Geolsurv/default.htm
Alberta	Alberta Energy and Utilities Board – Alberta Geological Survey	http://www.ags.gov.ab.ca/
Saskatchewan	Saskatchewan Industry and Resources	http://www.ir.gov.sk.ca/
Saskatchewan	Saskatchewan Research Council	http://www.src.sk.ca/index.cfm
Manitoba	Manitoba Industry, Economic Development and Mines, Geological Survey	http://www.gov.mb.ca/itm/mrd/geo/index.html
Ontario	Ontario Department of	http://www.mndm.gov.on.ca/MNDM/MINES/ogs/

	Northern Development and Mines, Ontario Geological Survey	default_e.asp
Quebec	Québec Ressources naturelles, Faune et Parcs	http://www.mrn.gouv.qc.ca/english/mines/index.jsp
New Brunswick	New Brunswick Department of Natural Resources	http://www.gnb.ca/0078/index-e.asp
Nova Scotia	Nova Scotia Department of Natural Resources, Mineral Resources Branch	http://www.gov.ns.ca/natr/meb/index.htm
Newfoundland and Labrador	Newfoundland and Labrador Department of Natural Resources, Mines and Energy Branch, Geological Survey	http://www.gov.nl.ca/mines&en/geosurvey/
Prince Edward Island	Government of Prince Edward Island	http://www.gov.pe.ca/infopei/Government/GovInfo/Primary_Resources/ (general provincial website, limited geoscience information)
Northwest Territories	C.S. Lord Geoscience Centre, Yellowknife	http://www.nwtgeoscience.ca/index.html
Nunavut	Government of Nunavut	http://www.gov.nu.ca/Nunavut/ (general website; limited geoscience information)
Yukon Territory	Yukon Energy, Mines and Resources, Geological Survey	http://www.geology.gov.yk.ca/

Other Helpful Publications

The following books and articles contain background information on the distribution and physical and chemical characteristics of soils, tills, and other surficial sediments. Within these publications there are discussions of the rationale behind the

design of sampling surveys, the methods used for sample collection and analysis, and the interpretation and presentation of the resulting data.

Amor, S., Bloom, L., and Ward, P.
1998: Practical application of exploration geochemistry; Proceedings of a short course presented by the Prospectors and Developers Association of Canada, March, 1998, Toronto, Canada.

Franklin, J.M., Duke, J.M., Shilts, W.W., Coker, W.B., Friske, P.W.B., Maurice, Y.T., Ballantyne, S.B., Dunn, C.E., Hall, G.E.M., and Garrett, R.G.
1991: Exploration geochemistry workshop; Geological Survey of Canada, Open File 2390.

Fulton, R.J.
1989: Quaternary Geology of Canada and Greenland; Geological Survey of Canada, Geology of Canada 1, 839 p.

Kabata-Pendias, A. and Pendias, H.
2001: Trace Elements in Soils and Plants, 3rd edition. CRC Press, Boca Raton, 315 p.

Kujansuu, R. and Saarnisto, M. (Editors)
1990: Glacial Indicator Tracing. A.A. Balkema, Rotterdam, 252 p.

McClenaghan, M.B., Bobrowsky, P.T., Hall, G.E.M., and Cook, S.J. (Editors)
2001: Drift Exploration in Glaciated Terrain; Geological Society Special Publication No. 185, 350 p.

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1984: Till geochemistry in Finland and Canada; Journal of Geochemical Exploration, v. 21, p. 95-117.

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List of Web Sites for Locating Canadian Geoscience Publications

Geological Survey of Canada Bookstore
http://www.nrcan.gc.ca/gsc/bookstore/index_e.html

Yukon Geological Survey – Yukon Energy and Mines
http://www.geology.gov.yk.ca/publications/index.html

C.S. Lord Northern Geoscience Centre – Yellowknife, NWT
http://www.nwtgeoscience.ca/services/

British Columbia Geological Survey - British Columbia Ministry of Energy and Mines
http://www.em.gov.bc.ca/Mining/Geolsurv/Publications/default.htm

Alberta Geological Survey – Alberta Energy and Utilities Board
http://www.ags.gov.ab.ca/publications/publications_alberta_geological_survey.shtml

Saskatchewan's Mineral Resources - Saskatchewan Industry and Resources
http://www.ir.gov.sk.ca/Default.aspx?DN=3440,3385,2936,Documents

Manitoba Geological Survey - Manitoba Industry, Economic Development and Mines
http://www.gov.mb.ca/itm/mrd/info/libmin/pubsales.html

Ontario Geological Survey - Ministry of Northern Development and Mines
http://www.mndm.gov.on.ca/mndm/mines/ims/pub/default_e.asp

Ressources naturelles, Faune et Parcs - Québec
http://www.mrn.gouv.qc.ca/english/products-services/mines.jsp

New Brunswick Department of Natural Resources
http://www.gnb.ca/0078/minerals/publication-e.asp

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http://www.gov.ns.ca/natr/meb/pubs/pubshome.htm#pubdb

Newfoundland and Labrador Mines and Energy
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List of Surveys (Organisational Unit IDs are defined at the end of the table)

Organisational Unit ID	Survey ID	Survey Title	Survey Description
3	1	Till sampling survey in the Aylmer Lake area (76C), Northwest Territories and Nunavut, 1993.	194 samples, mostly till from mud boils, and a small number of fine grained esker sediment samples were collected in 1993. Data published in GSC Open File 2867. Final report including kimberlite indicator mineral and gold grain analyses published in GSC Open File 3120.
3	2	Regional till and soil sampling survey, NTS 63J,K,L,M,N,O, north-central Manitoba and Saskatchewan, 1991-1995.	2536 till and 1639 humus samples collected in Saskatchewan and the area surrounding Flin Flon, Manitoba in 1991-1995. Data published in GSC Open Files 2844 and 3277.
3	3	Till sampling and ice flow survey, NTS 12A/10,15,16, 12H/1), central Newfoundland, 1991 and 1992.	841 till samples collected from C-horizon till or lower B-horizon of soil in central Newfoundland in 1991 and 1992. Data published in GSC Open File 2823. These samples (including 36 that have been reanalyzed) are also included in element distribution maps published in Newfoundland Department of Natural Resources Open File Nfld/2596.
3	4	Till sampling survey, NTS 21G,J southwestern New Brunswick in 1983.	More than 170 till samples collected in southwestern New Brunswick in 1983. Data published in GSC Open File 1313 and GSC Current Research 85-1B.
3	5	Till sampling survey, NTS 93K, N, central British Columbia, 1990-1991.	Approximately 345 till samples collected in Manson River and Fort Fraser map areas, central British Columbia in 1990 and 1991. Data are published in GSC Open File 2593. These data have been republished in GSC Open File 3194 along with new data from the area collected in 1992-1994.
3	6	Till sampling survey, NTS 76D, Northwest Territories, 1992 and 1993.	209 till samples collected in the Lac de Gras area, Northwest Territories in 1992 and 1993. Data published in GSC Open Files 2868 and 3205.
3	7	Till sampling survey, NTS 86A, Northwest Territories and Nunavut in 1993.	117 till samples collected in Winter Lake area (NTS 86A), Northwest Territories and Nunavut in 1993. Data published in GSC Open Files 2908 and 3206.
3	8	Till sampling survey, NTS 92O/5, /12, southwest British Columbia, 1992 and 1993.	118 till and 26 glaciofluvial sediment samples were collected in 1992 and 1993 in the Mount Tatlow and Elkin Creek area, southwest British Columbia. The data are published in GSC Open File 2909.
3	9	Till and soil sampling survey, NTS 62P/01, 52M/04, southeastern Manitoba in 1992 and 1993.	210 till and 186 humus samples collected in 1992 and 1993 in Bissett-English Brook area, southeastern Manitoba. The data are published in GSC Open File 2910.
3	10	Till and soil sampling survey, NTS 63L/9, /16, 63K/12, /13, east central Saskatchewan, 1992-1994.	More than 350 till samples and 285 humus samples were collected in the Annabel Lake-Amisk Lake area, east central Saskatchewan, between 1992 to 1994. The data are published in GSC Open File 3026.
3	11	Till sampling survey, NTS 46I,J,K,L.M,N,O,P, southern Melville Peninsula, Nunavut in 1990 and 1991.	280 till samples collected in southern Melville Peninsula, Nunavut in 1990 and 1991. Data are published in GSC Open File 3091 and GSC Bulletin 561.
3	12	Till sampling survey, NTS 86I, Nunavut, 1994.	190 till samples collected in the Napaktulik Lake area, Nunavut in 1994. Data are published in GSC Open File 3316. Kimberlite indicator mineral distribution and composition are published in GSC Open File 3355.
3	13	Till sampling survey, NTS 86H, Northwest Territories and Nunavut, 1994.	196 till samples collected in the Point Lake map area, Northwest Territories and Nunavut (NTS 86H) in 1994. Data published in GSC Open File 3317.
3	14	Till sampling survey, NTS 47A,B,C,D, northern Melville Peninsula, Nunavut in 1985, 1986 and 1988.	More than 500 samples collected on northern Melville Peninsula in 1985, 1986, and 1988. Data are published in GSC Bulletin 484 and GSC Open File 3637.

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3	15	Till sampling survey, NTS 54M, northeastern Manitoba, 1977.	43 till samples collected in northeastern Manitoba (NTS 54M) in 1977. Data published in GSC Current Research Paper 82-1A.
3	16	Till sampling survey, NTS 64C, northwestern Manitoba, 1983 and part of 1984.	Till samples were collected in the Granville Lake area (NTS 64C) in northwestern Manitoba in 1983 and part of 1984. The data are published in GSC Open File 1204.
3	17	Till sampling survey, NTS 64F, northwestern Manitoba, 1984.	Till samples were collected in the Brochet area (NTS 64F) in northwestern Manitoba in 1984. The data are published in GSC Open File 1205.
3	18	Till sampling survey, NTS 64B,C,F,G, 63N,O,K, northwestern Manitoba, 1983-1988.	More than 1800 till samples were collected in northwestern Manitoba between 1983-1988. The data are published in GSC Open File 2118. Data from NTS 64C are also published in GSC Open File 1204. Data from NTS 64F are also published in GSC Open File 1205.
3	19	Till sampling survey, NTS 31F,G,J,K,N,O, southwestern Quebec, 1982.	Samples (mostly till but also glaciomarine sediments) were collected in southwestern Quebec in 1982. The data are published in GSC Open File 1899. These data were also released as part of a big Ontario-Quebec summary and interpretation in GSC Bulletin 463.
3	20	Till sampling survey, NTS 41H/1,8,9, 31E/4,5,13, Muskoka area, Ontario, 1985.	More than 200 samples (mostly till but also glaciofluvial sand and gravels and glaciolacustrine silty clay) collected in 1985 in the Muskoka area, Ontario. The data are published in GSC Open File 1792. This OF has been superseded by GSC Open File 3175 which is a digital compilation of data from OFs 1792, 947 and part of 2274. The data from OF 1792 have also been released as part of a big Ontario-Quebec summary and interpretation in GSC Bulletin 463.
3	21	Till sampling survey, NTS 31F/2, 31C/9,15,16, Clyde Forks – Westport area, Ontario, 1986-88.	520 till samples were collected in the Clyde Forks – Westport area, Ontario in 1986-88. The data are published in GSC Open File 2274. This open file also republishes data for 400 archived samples from NTS 31C/10 (Tichborne) and 31F/1 (Carleton Place) previously published in GSC Open File 947. Some data from OF 2274 has been included in GSC Open File 3175, a digital compilation of data from OFs 1792, 947 and part of 2274. Some of the data from OF 2274 have also been released as part of a big Ontario-Quebec summary and interpretation in GSC Bulletin 463.
3	22	Till sampling survey, NTS 30M,N, 31B,C,D,E,F,G in southeastern Ontario, 1980-81.	Till samples were taken on the Frontenac Arch and surrounding areas in southeastern Ontario in 1980-1981. The data are published in GSC Open File 947. This open file has been superseded by a digital release, GSC Open File 3175 which also includes data from OFs 1792 and 2274. The data from OF 947 have also been released as part of a big Ontario-Quebec summary and interpretation in GSC Bulletin 463.
3	23	Till sampling survey, NTS 76M, Hepburn Lake area, Nunavut, 1992.	Till samples were collected in the Hepburn Lake area, Nunavut in 1992. The data are published in GSC Open File 2668.
3	24	Till and clay sampling survey, Timiskaming region, Ontario and Quebec, 1983-1989.	380 till samples and 200 glaciolacustrine clay samples collected between 1983-1989 in the Timiskaming area of Ontario and Quebec. Data are published in GSC Bulletin 476.
3	25	Till sampling survey, NTS 52E,F, Lake of the Woods region, northwestern Ontario, 1986-1988.	More than 220 samples were collected in the Lake of the Woods region, northwestern Ontario between 1986 and 1988. The data are published in GSC Memoir 436.
3	26	Till sampling survey, NTS 85J,I,O and P, Yellowknife area, Northwest Territories, 1999.	61 till samples collected in the Yellowknife area, Northwest Territories, 1999. Data published in GSC Open File 4019.
3	27	Till sampling, NTS 55M, 65P, Baker Lake area, Nunavut, 1975-1976.	More than 2000 samples were collected in 1975 and 1976 in the Baker Lake area, Nunavut. The data were published in GSC Open File 1335. The samples were reanalyzed using improved analytical methods and republished in GSC Open File 3243. A Quaternary framework for drift prospecting in the area was published in GSC Bulletin 485.

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3	28	Till sampling survey, Kaminak Lake area, Nunavut, 1970-1975.	More than 2000 samples were collected in the Kaminak Lake-area, Nunavut between 1970 and 1975. Data are published in GSC Open File 146 and new geochemical data (gold, platinum-group elements, trace elements) for these samples were published in GSC Open File 2132.
3	29	Till sampling survey, Turquetil Lake area, Nunavut, 1988.	To augment the Kaminak Lake till sampling survey (1970-75), 200 additional samples were collected in 1988 in an area of known gold showings around Turquetil Lake. The data are published in GSC Open File 2132.
3	30	Till sampling survey, Wollaston Peninsula, Victoria Island, Nunavut and Northwest Territories, 1982, 1983 and 1987.	Approximately 200 till samples were collected on the Wollaston Peninsula, southwest Victoria Island in 1983, 1983 and 1987. The data are published in GSC Memoir 434.
3	31	Ultra -low-density till and soil sampling survey, Manitoba, Saskatchewan and Alberta, 1991.	Two ultra-low density orientation survey soil and till traverses were completed across the southern Canadian prairies in 1991. Eighty-eight soil samples were taken from the A_{20} and C horizons and 50 till samples were collected from road cuts, spoil pits etc. Three vertical soil profiles and a horizontal A_{20} soil traverse were also collected. The data are published in GSC Open File 2685.
3	32	Ultra -low-density till and soil sampling survey, Manitoba, Saskatchewan and Alberta, 1992.	An ultra-low density till and soil survey was carried out in 1992 over the southern Canadian prairies. Samples were taken from randomly selected 1x1 km target cells. Only the till data are reported in GSC Open File 2745.
3	33	Till from drill core, NTS 73H/7, near Smeaton, Saskatchewan, 1992.	Till sampled over a kimberlite southwest of Smeaton, Saskatchewan. 96.3m of rotasonic drill core was collected and 40 till, 5 sand and 19 fine-grained sediment samples were taken from the drill core. Data published in GSC Bulletin 551.
3	34	Till sampling survey and overburden drilling, NTS 62H, 52E, southeastern Manitoba, 1991-1992.	465 till samples were collected in southeastern Manitoba over the drift-covered rocks of the Wabigoon Belt in 1991 and 1992. 297 samples were from drill holes, 142 from surface sites and 26 from river sections. 195 sand samples were also taken from the drill core. The data are published in GSC Open File 2750.
3	35	Overburden drilling and till geochemistry survey, 3 areas in northern and western New Brunswick, 1986-1987.	Till samples were collected from boreholes drilled in three areas: Bathurst, Grand Falls-Edmunston and Woodstock-Fredericton (St. John Valley) in New Brunswick in 1986 and 1987. The data are published in GSC Open File 2149.
3	36	Till samples from a trenching survey, NTS 21J/10, central New Brunswick, 1986 and 1987.	Till samples were collected from more than 250 trenches opened up in the summer of 1986. Twenty-five of those trenches were reopened in the summer of 1987. The data are published in GSC Open File 2217.
3	37	Till sampling survey, northern Miramichi Zone, NTS 21O,P, New Brunswick, 1985.	Till samples from 974 sites were collected over the northern Miramichi Zone in New Brunswick in 1985. The data are published in GSC Open File 2236. A final report on the Miramichi Zone, including stratigraphy and till geochemistry was published in GSC Bulletin 433. Some samples from 21O/15,16 were re-analysed and published in New Brunswick Department of Natural Resources and Energy Open File 2002-9.
3	38	Till sampling survey, central Miramichi Zone, NTS 21O,P,J, New Brunswick, 1985-1987.	Over 1700 till samples were collected in 1985-1987 in the central Miramichi Zone and vicinity in New Brunswick. The data are published in GSC Open File 2237. A final report on the Miramichi Zone, including stratigraphy and till geochemistry was published in GSC Bulletin 433. 89 samples from NTS 21O/2 were reanalyzed by XRF and published in GSC Open File 2246. 161 samples from NTS 21O/1 were reanalyzed by XRF and published in GSC Open File 2560.
3	39	Till sampling survey, southern Miramichi Zone, NTS 21J,G, New Brunswick, 1985.	873 samples were collected in 1985 from 704 sites in the southern Miramichi Zone and vicinity, New Brunswick. The data are published in GSC Open File 2238. A final report on the Miramichi Zone, including stratigraphy and till geochemistry was published in GSC Bulletin 433.

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3	40	Till sampling survey, NTS 93K, N, central British Columbia, 1992-1994.	Approximately 500 till samples collected in Manson River and Fort Fraser map areas, central British Columbia between 1992 and 1994. Data published in GSC Open File 3194. Included in the open file are data from samples collected in 1990-1991 and previously published in GSC Open File 2593.
3	41	Till sampling survey, NTS 76E (S½), Northwest Territories, 76E/12,13, Nunavut, 1994.	143 till samples collected from the southern and northwest Contwoyto Lake area, Northwest Territories and Nunavut in 1994. The data are published in GSC Open File 3387.
3	42	Till sampling survey, NTS 76E (N½), Nunavut, 1996.	112 till samples collected from the northern Contwoyto Lake map area, Nunavut in 1996. The data are published in GSC Open File 3654.
3	43	Till sampling survey, NTS 76E, Northwest Territories, 1994	Detailed till sampling (82 samples) was carried out in 1994 around the Ranch Lake kimberlite, Northwest Territories. The data are published in GSC Open File 3924.
3	44	Till sampling survey, NTS 86O, Nunavut, 1995	86 till samples were collected in 1995 the Coppermine area, Nunavut. The data are published in GSC Open File 3412.
3	45	Till sampling, NTS 42E, 52H, Beardmore-Geraldton area, northern Ontario, 1986-1989.	A total of 900 till samples were collected in the Beardmore-Geraldton area, northern Ontario in 1986-1989. 505 were collected from surface excavations and 395 from rotasonic drill core . Samples of glaciofluvial sediments were also collected at 87 sites. The data are published in GSC Open File 2266 and GSC Memoir 435.
3	46	Till sampling, NTS 11F, southeastern Cape Breton Island, Nova Scotia, 1990.	An orientation survey was carried out in the Mira-Framboise area, Cape Breton Island in 1990 to determine the best sampling medium for the regional till sampling survey to be carried out in 1991. Approximately 130 till samples were collected from 4 sections along the coast and from 25 smaller sections sampled in detail around Yava, Deep Cove, MacIntyre Lake, Copper Shaft and Blue Mountain base metal occurrences. The data from the 1990 orientation survey and from the 1991 regional survey are published in GSC Open File 2533.
3	47	Till sampling, NTS 11F, southeastern Cape Breton Island, Nova Scotia, 1991.	324 regional till samples were collected in the Mira-Framboise area of southeastern Cape Breton Island. An additional 169 samples were collected from closely spaced sites around an inactive base metal mine and 2 mineralized bedrock occurrences. The data from this survey and the 1990 orientation survey are published in GSC Open File 2533.
3	48	Till sampling, NTS 52N,K, Red Lake-Woman Lake area, northwestern Ontario, 1991.	138 till and 40 glaciofluvial sand samples were collected in the Red Lake-Woman Lake area, northwestern Ontario in 1991. The data are published in GSC Open File 2583.
3	49	Till sampling, NTS 42C,E,F, Manitouwadge area, northern Ontario, 1991.	283 till samples and 18 gravel samples were collected in 1991 in the Manitouwadge area, northern Ontario. The data are published in GSC Open File 2616. Some of these samples were analysed for Hg in 1999 and published in GSC Open File 3790.
3	50	Till sampling, NTS 42C,E,F, Manitouwadge - Hornepayne area, northern Ontario, 1992.	444 till samples and 40 glaciofluvial sand and gravel samples were collected in 1992 in the Manitouwadge -Hornepayne area, northern Ontario. This survey included some detailed sampling near the Geco Mine and several abandoned Cu-Zn mines. The data are published in GSC Open File 2933. Some of these samples were analysed for Hg in 1999 and published in GSC Open File 3790.
3	51	Till sampling survey, NTS 42F/4, Manitouwadge area, northern Ontario, 1967.	43 till samples were collected in 1967 in the Manitouwadge area. In addition, 134 soil and 281 till samples were collected from vertical profiles at sites along two exploration trenches. The original data were reanalyzed (no Hg) to take advantage of improved geochemical techniques and published in GSC Open File 3562. Some samples were then analysed for mercury and the data are published in GSC Open File 3790 and GSC Current Research 1995-E and further discussed in GSC Current Research 1997-C.

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3	52	Till sampling survey, NTS 13N, eastern Labrador, 1984.	About 600 till samples were collected in 1984 in the Flowers River area, eastern Labrador. The area was chosen because of its potential for rare earth element mineralization and for Sn, Zn, Pb, U and W mineralization. The data are published in GSC Open File 1282.
3	53	Till sampling, NTS 13J, central Labrador, 1982-1984.	About 100 till samples were collected in the Rigolet area, central Labrador. The data are published in GSC Open File 1318.
3	54	Till sampling survey, NTS 13K, central Labrador, 1984-1985.	Approximately 550 till samples were collected in the Snegamook Lake area, central Labrador. The data are published in GSC Open File 1319.
3	55	Till sampling survey, NTS 13L, central Labrador, 1984-1985.	Approximately 314 till samples were collected in the Kasheshibaw Lake area, central Labrador. The data are published in GSC Open File 1320.
3	56	Till sampling survey, NTS 23I,J,O,P, western Labrador and northeastern Quebec, 1986.	Till samples were collected in the Dyke Lake area, Labrador and Quebec. The data are published in GSC Open File 1901.
3	57	Till sampling survey, NTS 64K, northwestern Manitoba, 1980.	131 samples of till and esker sediments were collected in 1980 in the Whiskey Jack Lake area of northwestern Manitoba. The surficial sediments were collected along 8 east-west traverses and along one north-south traverse. The data are published in GSC Current Research 81-01A.
3	58	Till sampling survey, NTS 54E,F,L,K,M, 64I,J,K,N,O,P in northern Manitoba, 1977-1980.	About 400 till samples were collected in northern Manitoba in 1977-1980. The data are published in GSC Current Research Paper 83-01B and GSC Open File 931.
3	59	Till sampling survey, NTS 86P, Nunavut, 1995.	192 till samples were collected in the Kikerk Lake area, Nunavut in 1995. The data are published in GSC Open File 3360.
3	60	Till sampling survey, NTS 52N,K in northwestern Ontario, 1992.	278 till samples and 38 sand samples were collected in the Red Lake-Confederation Lake area, northwestern Ontario in 1992. The data are published in GSC Open File 3038.
3	61	Till sampling survey, Banks Island, Northwest Territories, 1974-1975.	More than 140 till samples were collected on Banks Island in 1974 and 1975. The data are published in GSC Memoir 405.
3	62	Till and soil sampling survey, NTS 55E,L, Kaminak Lake area, Nunavut, 1997.	Till and humus samples were collected in the Kaminak Lake area, Kivalliq region, Nunavut in 1997. The till samples were collected from 10 vertical profiles located along a transect cutting across base metal mineralization and potential Hg-rich rocks. Humus was collected from the surrounding organic rims at each transect site. The data are published in GSC Open File 4089.
3	63	Till and soil sampling survey, NTS 55E,L, Kaminak Lake area, Nunavut, 1999.	Till and humus samples were collected Kaminak Lake area, Kivalliq region, Nunavut in 1999. The samples were collected near Hg-rich sources identified in the 1997 survey. The data are published in GSC Open File 4089.
3	64	Till sampling survey, NTS 93F, central British Columbia, 1996-1997.	Approximately 400 till samples were collected in 996 and 1997 in the Nechako River map area, central British Columbia. The data are published in Geological Survey of Canada Open File 3687.
3	65	Soil sampling survey, Rouyn-Noranda area, Ontario and Quebec, 1997-1999.	Humus, upper B-horizon and C-horizon soils were sampled at 106 sites within 100 km radius of Horne Cu smelter at Rouyn-Noranda, Quebec during 1997-1999. Sampling density decreased with distance from the smelter. Detailed soil profile sampling was also undertaken at 12 sites. In 1997, sampling was focused along two transects extending east and west from the smelter. The bulk of the regional work was undertaken in 1998 and limited follow-up sampling was completed in 1999. The data are published in Geological Survey of Canada Open File 4169.
3	66	Till sampling survey, NTS 31L,M, 41P, northeastern Ontario, 2000.	73 till samples were collected in 2000 in the New Liskeard-Temagami region, Ontario. The data are published in Geological Survey of Canada Open File 4086.

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3	67	Soils and till sampling survey, NTS 42A, northeastern Ontario, 1995-1996.	77 humus and 120 till samples were collected in the Timmins-Kamiskotia area, northeastern Ontario in 1995 and 1996. The humus samples were collected in the southern half of the study area and the till samples across the whole area. The data are published in Geological Survey of Canada Open File 3675.
3	68	Till sampling survey NTS 42A, northeastern Ontario, 1993-1996.	Till samples were collected around 5 Archean lode gold deposits in the Timmins-Matheson area, northeastern Ontario between 1993 and 1996. The deposits studied were Davidson-Tisdale Mine, Bell Creek Mine, Pamour Mine, Nighthawk Mine and Hislop pit. The data are published in Geological Survey of Canada Open File 3707.
3	69	Till sampling survey, NTS 76O, 77A, Nunavut, 1997.	95 till samples were collected in 1997 in the Rideout Island and Elu Inlet areas, Nunavut. The data are published in Geological Survey of Canada Open File 3863.
3	70	Soil and till sampling survey, NTS 42A, 32D, northeastern Ontario, 1993.	Till samples were collected from 31 boreholes up and down-ice and over the C14, B30, A4 and Diamond Lake kimberlite pipes in the Kirkland Lake area, northeastern Ontario. Till samples were also collected over and down-ice from the Buffonta kimberlite dyke. Soil (humus, B- and –horizon) was collected over and down-ice from the C14 and Diamond Lake pipes and the Buffonta dyke. The data are published in Geological Survey of Canada Open File 3228.
3	71	Peat sampling survey, NTS 31M, 32D, Rouyn-Noranda area, Ontario and Quebec, 1997.	Profile samples were collected from peat hummocks and hollows at 41 sites and feather moss from 15 peatland sites within 100 km of the Horne smelter at Rouyn-Noranda, Quebec in 1997. The data are published in Geological Survey of Canada Open File 3882.
3	72	Till sampling survey, NTS M/5, Lake Timiskaming area, northeastern Ontario, 1999.	Till samples were collected at 30 sites in 1999 around the Peddie kimberlite, Lake Timiskaming area, northeastern Ontario. Four sites were sampled up-ice (north) of the kimberlite, and 26 sites were sampled down-ice (SW to SE). The data are published in Geological Survey of Canada Open File 4262. For comparison, the open file also includes data from 2 samples collected in a 1997 survey around the Peddie kimberlite and previously published in GSC OF 3775.
3	73	Till sampling survey, NTS M/5, Lake Timiskaming area, northeastern Ontario, 1997.	In 1997, glacial sediments (including till) were collected overlying, up-ice and down-ice of the Peddie kimberlite, Lake Timiskaming area, northeastern Ontario. Samples of weathered and fresh kimberlite were also collected. The data are published in Geological Survey of Canada Open File 3775. Two samples from this survey are included in Open File 4262 for comparison with the samples collected in 1999.
3	74	Peat and mineral sampling survey, NTS 95G,H,I,J, 96E, 106N, 107B, Mackenzie Valley, Northwest Territories, 1994-1997.	732 peat and 47 mineral sediment samples were collected between 1994 and 1997 in the Mackenzie Valley, Northwest Territories. The samples were collected by surface sampling and coring 14 peatland sites. The data are published in Geological Survey of Canada Open File 4007.
3	75	Peat sampling survey, NTS 42N,P, 32E, northeastern Ontario, 1994.	Peat and underlying mineral sediment were sub-sampled from cores collected at 3 sites (Kinosheo Lake bog, Detour Lake bogs #1 and #2) in northeastern Ontario in 1994. The data are published in Geological Survey of Canada Bulletin 545.
4	1	Till sampling survey, NTS 21A/6, Kejimkujik National Park area, Nova Scotia, 2000-2001.	97 till samples were collected in the Kejimkujik National Park area, southwestern Nova Scotia in 2000 and 2001. The data are published in Nova Scotia Minerals and Energy Branch Report 2002-1.
4	2	Till sampling survey, NTS 21A,H and 11D,E in central Nova Scotia, 1978.	More than 135 till samples were collected in central Nova Scotia in 1978. Data are published in Nova Scotia Department of Mines and Energy Map 81-01.
4	3	Till sampling survey, NTS 20O,P, 21A,B southwestern Nova Scotia, 1979.	More than 200 till samples were collected in southwestern Nova Scotia in approximately 1979. Data are published in Nova Scotia Department of Mines and Energy Map 82-10.

Organisational Unit ID	Survey ID	Survey Title	Survey Description
4	4	Till sampling, NTS 21A/16, central Nova Scotia	Till samples were collected on the South Mountain Batholith, in the Windsor map area. No sampling year is given. Data are published in Nova Scotia Department of Mines and Energy Open File Map 88-052.
4	5	Till sampling survey, NTS 11D,E,F, eastern Nova Scotia.	More than 450 till samples were collected in the Eastern Shore region of Nova Scotia. No sampling year was given. The data are published in Nova Scotia Department of Mines and Energy Paper 79-04.
4	6	Till sampling survey, NTS 20P, 21A, southwest Nova Scotia, 1979.	More than 90 till samples were collected in southwest Nova Scotia in approximately 1979. The data are published in Nova Scotia Department of Mines and Energy Map 82-01.
4	7	Till sampling, NTS 21H, northern Nova Scotia, 1981.	Till samples were collected from the western part of Cumberland County in Nova Scotia beginning in 1981. The data are published in Geological Survey of Canada Paper 85-17
4	8	Till sampling, NTS 21A,H, northern Nova Scotia, 1978.	Till samples were collected in northwest Nova Scotia beginning in approximately 1978. The data are published in Nova Scotia Department of Mines and Energy Open File Report 555.
4	9	Till sampling survey, NTS 11F, northern mainland Nova Scotia, 1985-1986.	Approximately 170 till samples were collected in 1985-1986 on northern mainland Nova Scotia. The data are published in Nova Scotia Department of Mines and Energy Open File Maps 88-050 (Map 13-1988) and 88-051 (Map 13-1988).
4	10	Till sampling survey, NTS 11D/13, central Nova Scotia, 1986.	43 till samples were collected in the Mt. Uniacke area, central Nova Scotia in about 1986. The data are published in Nova Scotia Department of Mines and Energy Open File Map 87-011.
4	11	Till sampling survey, NTS 21H, 11E, northern mainland Nova Scotia, 1982-1984.	Approximately 300 till samples were collected on northern mainland Nova Scotia in about 1982-1984. The data are published in Nova Scotia Department of Mines and Energy Open File Map 87-005 (Map 10-1987).
4	12	Till sampling survey, NTS 11E, northern mainland Nova Scotia, 1983-1984.	Approximately 222 till samples were collected on northern mainland Nova Scotia in 1983 and 1984. The data are published in Nova Scotia Department of Mines and Energy Open File Map 87-006 (Map 11-1987).
4	13	Till sampling survey, NTS 11E, northern mainland Nova Scotia and Pictou Island, 1984-1985.	Approximately 244 till samples were collected in 1984 and 1985 on northern mainland Nova Scotia and Pictou Island. The data are published in Nova Scotia Department of Mines and Energy Open File Maps 88-031 (Map 12-1988) and 88-032 (Map 12-1988).
5	1	Till and soil sampling survey, NTS 33N,O, northern Quebec, 1992.	Till and soil sampling from 100 sites, the Petite rivière de la Baleine area, northern Quebec in 1992. The data are published in GSC Open File 2871.
5	2	Till and soil sampling survey, NTS 33M, N, northern Quebec, 1993.	Till and soil sampling from 38 sites were collected in the Kuujjuarapik-Whapmagoostui area, northern Quebec in 1993. The data are published in GSC Open File 3269.
5	3	Till sampling survey, NTS 32G/7, west central Quebec, 1993.	635 till samples collected in 1993 in the Lac Surprise region, Chapais-Chibougamau area, west central Quebec. The data are published in GSC Open File 3285 and 3196.
5	4	Till sampling survey, NTS 21O/2, north central New Brunswick, 1990-91.	218 till samples were collected in the Serpentine Lake area, north central New Brunswick in 1990 and 1991. 89 archived till samples from a project in the same area (M. Lamothe's Miramichi) were also analysed and all the data were published in GSC Open File 2246.
5	5	Till sampling survey, NTS 21O/1, north central New Brunswick, 1990-1991.	145 till samples were collected in 1990 and 1991 in the Big Bald Mountain area, north central New Brunswick. 161 archived till samples from a project in the same area (M. Lamothe's Miramichi) were also analysed and all the data were published in GSC Open File 2560.
8	1	Till sampling survey, northern Alberta, 1992-1994.	Ultra low-density/reconnaissance till sampling survey carried out over northern Alberta in 1992-1994. The sample site distribution is not regular due to limited access to the area. The data are published in Alberta Geological Survey Open File Report 1996-7.

Organisational Unit ID	Survey ID	Survey Title	Survey Description
8	2	Till sampling survey, NTS 83L,E, northwestern Alberta, 1996-1997.	90 samples (mostly till) were collected in 1996-1997 in the Wapiti area, northwestern Alberta. The data are published in Alberta Energy and Utilities Branch Earth Sciences Report 2000-12.
10	1	Till sampling survey, NTS 12A, central Newfoundland, 1978.	More than 200 till samples were collected in 1978 in the Lake Ambrose and Noel Paul's Brook map areas in central Newfoundland. The data are published in Newfoundland Department of Mines and Energy Open File 12A/0212.
10	2	Till sampling survey, NTS 12A, 2D central Newfoundland, 1979.	Till samples were collected in 1979 in the Badger and Grand Falls map areas in central Newfoundland. The data are published in Newfoundland Department of Mines and Energy Open File Nfld/0093.
10	3	Till sampling survey, NTS 12A/15, central Newfoundland, 1982.	Till sampling was carried out in 1982 in the Buchans map area, central Newfoundland. The data are published in Newfoundland Department of Mines and Energy Open File 12A/0396.
10	4	Till sampling survey, NTS 13L/1,8 central Labrador, 1985.	176 till samples were collected in 1985 in the Letitia Lake area, central Labrador. The data are published in Newfoundland Department of Mines and Energy Open File 13L/0069.
10	5	Till sampling survey, NTS 13K, central Labrador 1987.	424 till samples were collected in the Moran Lake area, central Labrador. The data are published in Newfoundland Department of Mines and Energy Open File 13K/0180.
10	6	Till sampling survey, NTS 13/J,K, east central Labrador, 1986.	Approximately 350 till samples were collected in 1986 in the Melody Lake area, east central Labrador. The data are published in Newfoundland Department of Mines and Energy Open File Lab/0860.
10	7	Soil and till sampling survey, NTS 14D, 24A, western Labrador.	904 till, 91 esker/outwash, 6 glacial lake, 3 A-horizon soil, 339 B-horizon soil, 195 C-horizon and 209 mudboil samples were collected in the Strange Lake area, western Labrador. No sampling year was given. The data are published in Newfoundland Department of Mines and Energy Open File Lab/0843.
10	8	Till sampling survey, NTS 12A, central Newfoundland, 1978-1981.	217 till samples were collected in the Victoria Lake, Snowshoe Pond, Star Lake area, central Newfoundland in between 1978 and 1981. The data are published in Newfoundland Department of Mines and Energy Open File 12A/0347.
10	9	Till sampling survey, NTS 13K/10, central Labrador, 1984.	Approximately 24 till samples were collected on a property grid north of Moran Lake in the Moran Heights area of central Labrador. The data are published in Newfoundland Department of Mines and Energy Open File 13K/0164.
10	10	Till sampling survey, 23J/9,16, western Labrador, 1992.	270 till samples were collected in 1992 at a regional scale in the Cavers Lake-Hollinger Lake area in western Labrador over the eastern part of the Labrador Trough. In addition, 70 till samples were collected at a detailed scale near Martin Lake in the northern part of the study area. The data are published in Newfoundland Department of Mines and Energy Open File 23J/0303.
10	11	Till sampling survey, NTS 2E/5,12 and 12H/8, northern Newfoundland, 1994.	Nearly 400 samples (mostly till) were collected in 1994 in the Robert's Arm, Little Bay Island and Springdale map areas in northern Newfoundland. The data are published in Newfoundland Department of Natural Resources Open File Nfld/2513. These samples are also included in element distribution maps published in Open File Nfld/2596.
10	12	Till sampling survey, NTS 12A,H, 2E, northern Newfoundland, 1995.	Till sampling was carried out in the Buchans-Robert's Arm Belt, northern Newfoundland in 1995. The data are published in Newfoundland Department of Natural Resources Open File Nfld/2596.
10	13	Till sampling, NTS 1N,M, 2C, southeast Newfoundland, 2002.	1042 till samples were collected beginning in 2002 on the western Avalon and isthmus, southeast Newfoundland. Sampling density was controlled by access as well as surficial geology and averaged about 1 sample per 1 km^2 in areas with good access to 1 sample per 4 km^2 in areas where helicopter support was required. The data are published in Newfoundland Department of Mines and Energy Open File NFLD 2824.

Organisational Unit ID	Survey ID	Survey Title	Survey Description
10	14	Till sampling, NTS 12H/10,15, northeastern Newfoundland, 2002.	355 till samples were collected in 2002 in the White Bay area of northeastern Newfoundland. Sampling density was approximately 1 sample per 4 km^2 for most of the area. The data are published in Newfoundland Department of Mines and Energy Open File NFLD 2823.
10	15	Peat and soil sampling survey, NTS 13G/14, central Labrador, 1978 and 1979.	Peat and B-horizon soil samples were collected in 1978 and 1979 over a uranium occurrence in central Labrador. The samples were collected from the G-1 Grid located approximately 100 km northeast of Goose Bay. The data are published in Newfoundland Department of Mines and Energy Open File LAB 457.
11	1	Till sampling survey, NTS 74M, L, northeastern Alberta, 1993 and 1994.	111 samples (mostly till) collected in 1992, and 336 samples (mostly till) collected in 1993 and 1994 in northeastern Alberta. Data published in GSC Open Files 2747 and 3348 (final report).
11	2	Till sampling survey, NTS 94G, northeastern British Columbia, 1998-2000.	165 samples (mostly till but a few glacial outwash and glaciolacustrine sediments) were collected in the Trutch Lake area, northeastern British Columbia between 1998 and 2000. The data are published in GSC Open File 3815.
11	3	Till sampling survey, NTS 69A,B, 68G,H and 79A, Bathurst Island, Nunavut, 1995-1997.	69 samples of till diamicton, gravel and sand were collected on Bathurst Island, Nunavut between 1995 and 1997. The data are published in Geological Survey of Canada Open File 3714 (Part C).
12	1	Till sampling survey, NTS 93N/1, 93O/4, north central British Columbia, in the early 1990s.	121 till samples were collected in the Mount Milligan area of north central British Columbia in the early 1990s. The data are published in GSC Open File 3291/BC Geological Survey Open File 1996-22.
12	2	Till sampling survey, NTS 93L/9,16, 93M/1,2,7,8, west central Interior Plateau, British Columbia, 1995.	937 till samples collected in the Babine porphyry copper belt, west central part of the Interior Plateau, British Columbia in 1995. Data are published in British Columbia Geological Survey Bulletin 110.
12	3	Till sampling survey, NTS 92L/12, northern Vancouver Island, British Columbia, 1991.	183 till samples were collected in the Quatsino area, on northern Vancouver Island, British Columbia. In addition, an orientation survey was carried out near the Island Copper Mine during the regional sampling program. The orientation survey covered an area extending 8 km down ice (west) of the deposit. Samples from the orientation survey collected in map sheet 92L/12 were incorporated into the regional data set presented here. The data are published in British Columbia Geological Survey Open File 1992-21.
12	4	Till sampling survey, NTS 94H, east central British Columbia, 2000.	287 till samples were collected in 2000 in the Wells-Stony Lake area in east central British Columbia. The data are published in British Columbia Geological Survey Open File 2001-10.
12	5	Till sampling survey, NTS 92L, northern Vancouver Island, 1991, 1993 and 1994.	Approximately 450 till samples were collected on northern Vancouver Island in 1991, 1993 and 1994. The data are published in British Columbia Geological Survey Open File 1996-7.
12	6	Till sampling survey, NTS 92P, southern British Columbia, 1997.	331 till samples were collected in 1997 in the Louis Creek-Chu Chua Creek area, north of Kamloops in southern British Columbia. The data are published in British Columbia Geological Survey Open File 1998-6.
12	7	Till sampling survey, NTS 92P, southern British Columbia, 1998.	181 till samples were collected in 1998 in the Chu Chua-Clearwater area, north of Kamloops in southern British Columbia. The data are published in British Columbia Geological Survey Open File 2000-17.
12	8	Till sampling survey, NTS 82L, 83M, southern British Columbia, 1998.	Approximately 215 till samples were collected in 1998 in the Shuswap Highlands area, southern British Columbia. The data are published in British Columbia Geological Survey Open File 2000-18.
12	9	Till sampling survey, NTS 104N,O, northwest British Columbia, 1999.	45 bulk till samples were collected at six sites in 1999 in the Swift River area, northwest British Columbia. Basal till was the preferred media, although colluviated tills and colluvium were sampled where necessary. The data are published in British Columbia Geological Survey Paper 2000-1 (in Geological Field work, 1999).

Organisational Unit ID	Survey ID	Survey Title	Survey Description
12	10	Till sampling survey, NTS 93F, central British Columbia, 1993.	229 till samples were collected at 171 sites in 1993 in the Fawnie Creek area of central British Columbia. The samples were collected at approximately 1 sample per 4 km2. Higher density sampling was conducted in areas of perceived higher mineralization and around known mineral prospects. The data are published in British Columbia Geological Survey Open File 1994-18.
12	11	Till sampling survey, NTS 93F/7,8, central British Columbia, 1994-1995.	107 till samples were collected on the CH property on the Nechako Plateau in central British Columbia in 1994 and 1995. This survey was done in conjunction with surveys on the Davidson-Blackwater and Uduk Lake properties. The data are published in British Columbia Geological Survey Open File 1997-12.
12	12	Till sampling survey, NTS 93F/2, central British Columbia, 1994-1995.	41 till samples were collected on the Blackwater-Davidson property on the Nechako Plateau in central British Columbia in 1994 and 1995. This survey was done in conjunction with surveys on the CH and Uduk Lake properties. The data are published in British Columbia Geological Survey Open File 1997-12.
12	13	Till sampling survey, NTS 93F/12, central British Columbia, 1994-1995.	90 till samples were collected on the Uduk Lake property on the Nechako Plateau in central British Columbia in 1994 and 1995. This survey was done in conjunction with surveys on the CH and Davidson-Blackwater properties. The data are published in British Columbia Geological Survey Open File 1997-12.
12	14	Till sampling survey, NTS 93F/7, central British Columbia, 1995.	187 till samples were collected in 1995 in the Chedakuz Creek area in central British Columbia. The samples were collected at an average density of 1 sample per 5 km^2. The data are published in British Columbia Geological Survey Open File 1997-11.
12	15	Till sampling survey, NTS 93F/5,12, central British Columbia, 1997-1998.	273 till samples were collected in 1997-1998 in the Marilla-Tetachuck Lake area of the Nechako Plateau in central British Columbia. The samples were collected at an average density of 1 sample per 3.5 km^2. The data are published in British Columbia Geological Survey Open File 2002-11. Higher density sampling was conducted in areas of perceived higher mineral potential and around known mineral prospects. These data were not included in the regional data set.
12	16	Till sampling survey, NTS 82M/4,5 southeastern British Columbia, 1996.	Approximately 500 till samples were collected in 1996 in the Adams Plateau-North Barriere Lake area, southeastern British Columbia. The data are published in British Columbia Geological Survey Open File 1997-9.
13	1	Till and soil sampling survey, NTS 21G/1,2,7,8, southwest New Brunswick	Approximately 525 B-horizon and till samples collected in 1982 in the eastern Saint George Batholith area, southwest New Brunswick. Data published in New Brunswick Dept. of Natural Resources Report of Investigation 19.
13	2	Till and soil sampling survey, NTS 21O/7,8, north central New Brunswick, 1989-1991.	B-horizon and basal till samples were collected at 535 sites in the Nepisiguit Lakes and California Lake area, north central New Brunswick between 1989 and 1991. The data are published in NB DNRE Geoscience Report 94-3.
13	3	Till sampling survey, NTS 21O/3, northwestern New Brunswick, 1989.	291 till samples collected in the Riley Brook area, northwestern New Brunswick in 1989. Data published in New Brunswick Dept. of Natural Resources Geological Notes Series PM 89-71.
13	4	Till sampling survey, NTS 21G/12, 13 southwest New Brunswick, 1990.	Till samples were collected in 1990 at 77 sites in the Forest City area, southwest New Brunswick. 7 sites were sampled just above the northern boundary of the Forest City map area in the Fosterville map area (21G/13) to provide complete coverage of the northern part of the study area. The data are published in New Brunswick Department of Resources and Energy Open File Report 92-6. Data for the Fosterville samples were re-released with data for new samples also collected in the Fosterville area and published in New Brunswick Department of Natural Resources and Energy Open File Report 93-7.

Organisational Unit ID	Survey ID	Survey Title	Survey Description
13	5	Till sampling survey, NTS 21G/14 southwest New Brunswick, 1990-1991.	273 till samples were collected in the Canterbury area, southwest New Brunswick in 1990 and 1991. The data are published New Brunswick Department of Resources and Energy Open File Report 92-5. These data were republished as part of New Brunswick Department of Resources and Energy Map Plates 96-2A, 96-2B and 96-2C.
13	6	Till sampling survey, NTS 21O/6, northwest New Brunswick, 1983.	Approximately 30 samples collected in the Sisson Branch Reservoir area, northwest New Brunswick in 1983. Data published in New Brunswick Department of Natural Resources Open File Report 85-3.
13	7	Till sampling survey, NTS 21O/15, 22B/1,2, northern New Brunswick, 1987-1988.	Till samples were collected in or around 1988 in the Atholville, Escuminac and Oak Bay areas in northern New Brunswick. The data are published in New Brunswick Department of Natural Resources and Energy Geological Notes Series PM 88-10. Some samples from this area were re-analysed and published in New Brunswick Department of Natural Resources and Energy Open File 2002-9.
13	8	Till sampling survey, NTS 21H/11, southern New Brunswick, 1993-1994.	212 till samples were collected in 1993 and 1994 from the Waterford area in southern New Brunswick. 76 archived samples from the same area were also analysed and all the data are published in New Brunswick Department of Resources and Energy Open File Report 95-4.
13	9	Till sampling survey, NTS 21O, north central New Brunswick, 1998-1999.	A total of 171 till and humus samples were collected in the Atholville-Charlo area of north central New Brunswick in 1998 and 1999. An additional 157 archived samples from previous surveys (NBDNR Geological Notes Series PM 86-216 and 88-10; GSC Open File 2236) were re-analysed. The data are published in New Brunswick Department of Natural Resources and Energy Open File 2002-9.
13	10	Till sampling survey, NTS 21G/6, /7, southwestern New Brunswick, 2001-2002.	Approximately 430 till samples were collected in 2001 in the Rollingdam and McDougall Lake map areas, southwestern New Brunswick. The samples were collected at a density of 1 sample per 4 km^2. The data are published in New Brunswick Department of Natural Resources and Energy Open File 2002-4. In 2002, follow-up work was done in the Rollingdam area and all the data (2001 and 2002) were published in New Brunswick Department of Natural Resources and Energy Open File 2003-2.
13	11	Till sampling survey, NTS 21J/6, west central New Brunswick, 1998 and 2000.	117 till samples were collected from 108 sites in the west half of the Coldstream area of west central New Brunswick. The data are published in New Brunswick Department of Natural Resources and Energy Open File 2001-2.
13	12	Till sampling survey, NTS 21J/6, west central New Brunswick, 1998, 2000-2001.	188 till samples were collected in 1998, 2000 and 2001 from 177 sites in the eastern two-thirds of the Coldstream map area of west central New Brunswick. The data are published in New Brunswick Department of Natural Resources and Energy Open File 2002-5. This report includes some data from the eastern third of the west half of the study area, previously published in New Brunswick Department of Natural Resources and Energy Open File 2001-2.
13	13	Till sampling survey, NTS 21J/6,7, west central New Brunswick, 2002.	In 2002, 53 till samples were collected from 46 sites in the Coldstream map area and 40 samples from 38 sites in the southwestern part of the Napadogan map area in west central New Brunswick. The data are published in New Brunswick Department of Natural Resources and Energy Open File 2003-11.
13	14	Till sampling survey, NTS 21G/13, southwest New Brunswick, 1992.	Approximately 170 samples were collected in the Fosterville area in 1992 in southwest New Brunswick. The data are published in New Brunswick Department of Natural Resources and Energy Open File Report 93-7. The report also includes 14 samples collected in 1990 and previously released in New Brunswick Department of Natural Resources and Energy Open File Report 92-6.

Organisational Unit ID	Survey ID	Survey Title	Survey Description
13	15	Till sampling survey, NTS 21G/11, southwest New Brunswick, 1991-1994.	Approximately 343 sediment samples (mostly till) were collected between 1991 and 1994 in the McAdam area of southwest New Brunswick. The data are published in New Brunswick Department of Natural Resources and Energy Open File Report 95-5. The data were released digitally in Open File 2002-8.
13	16	Till sampling survey, NTS 21O/10, northern New Brunswick, 1986.	Till (C-horizon) and B-horizon samples were collected in the Upsalquitch Forks area in northern New Brunswick in 1986. The data are published in New Brunswick Department of Natural Resources and Energy Geological Notes Series P.M. 87-47.
13	17	Till sampling survey, NTS 21G/3, southwest New Brunswick, 2002.	Till samples were collected in 2002 in the St. Stephen map area in southwest New Brunswick at a sampling density of 1 sample per 4 km^2. The data are published in New Brunswick Department of Natural Resources and Energy Open File 2003-12.
13	18	Till sampling survey, NTS 21G/10, southwest New Brunswick, 2002.	Till samples were collected in 2002 in the Fredericton Junction map area in southwest New Brunswick at a sampling density of 1 sample per 4 km^2. The data are published in New Brunswick Department of Natural Resources and Energy Open File 2003-13.
13	19	Till sampling survey, NTS 21H/12, southern New Brunswick, 1995-1996.	Approximately 270 till samples were collected in the Sussex area of southern New Brunswick in 1995-1996 at a sampling density of 1 sample per 4 km^2. The data are published in New Brunswick Department of Natural Resources and Energy Open File 2003-16.
13	20	Till sampling survey, NTS 21O/9, northern New Brunswick, 1985.	In 1985, 265 till sites were sampled on a regularly spaced 2 km grid in the Tetagouche Lakes area of northern New Brunswick. B-horizon and C-horizon samples were taken. The data are published in New Brunswick Department of Forests, Mines and Energy Geological Notes Series P.M. 86-216. Some samples from this area were re-analysed and published in New Brunswick Department of Natural Resources and Energy Open File 2002-9.
13	21	Till sampling, NTS 21G/6, southwest New Brunswick, 1987.	Approximately 275 till samples were collected in 1987 in the Rollingdam area, southwest New Brunswick. The data are published in New Brunswick Department of Natural Resources and Energy Map Plates 88-15B and 88-15C.
13	22	Till sampling survey, NTS 21O/7, northern New Brunswick, 1983.	Approximately 36 till samples were collected in 1983 in the Nepisiguit Lakes area, northern New Brunswick. The data are published in New Brunswick Department of Natural Resources Map Plate 85-5.
13	23	Till sampling survey, NTS 21G/14, southwest New Brunswick, 1995.	Approximately 25 till samples were collected in 1995 in the Nepisiguit Lakes area, southwest New Brunswick. These new data, as well as data previously published in New Brunswick Department of Natural Resources and Energy Open File Report 92-5 are all published in New Brunswick Department of Natural Resources and Energy Map Plates 96-2A, 96-2B and 96-2C.
16	1	Till sampling survey, NTS 32D/4, 5, 42A/1, 8, Ontario and Quebec, 1978-1981..	73 till samples collected in the Kirkland Lake area, Districts of Cochrane and Timiskaming, Ontario and Quebec between 1978 and 1981. The data are published in Ontario Geological Survey Open File Report 5553.
16	2	Till sampling survey, NTS 31F/13, 31E/7,10,15,16 31L/1,2, Algonquin Park, Ontario, 1981-1983.	63 till samples collected in Algonquin Park, Ontario in 1981, 1982, and 1983. Data published in Ontario Geological Survey Open File Report 5600.
16	3	Multi-year (1979-1982) till sampling survey, Kirkland Lake area, Ontario.	Synthesis of geochemical data from 300 till samples from 171 reverse circulation holes drilled in the Kirkland Lake area in 1979, 1980, 1981, and 1982. (OGS Open Files 5335. 5356. 5355. 5394, 5395, 5456, and 5506). Report contains summary statistics, frequency histograms, probability plots and proportional circle maps for the till and bedrock data and graphic logs and geochemical data for <0.063 mm fraction fine and coarse non-magnet heavy mineral fractions. The data are published in Ontario Geological Survey Open File Report 5737.

Organisational Unit ID	Survey ID	Survey Title	Survey Description
16	4	Multi-year till (surface and from sonic drill core) sampling survey, Black River-Matheson, Ontario, 1984-1988.	282 surface tills and 1100 till samples from sonic drill core were collected between 1984-88 in the Black River-Matheson area, north of Kirkland Lake and east of Timmins, Ontario. The data are published in Ontario Geological Survey Open File Reports 5749 (surface tills) and 5800 (till from sonic drilling).
16	5	Till sampling survey, NTS 41P/10, 11, 14, Shining Tree area, Ontario, 1986-1989.	203 till samples were collected in 1986-1989 in the Shining Tree area of Ontario (NTS 41P/10, 11, 14). Data are published in Ontario Geological Survey Open File Report 5810.
16	6	Till sampling survey, NTS 41H/1,7,8,9,10,15, 31E/4,5,11,12,14, Parry Sound-Sundridge area, Ontario, 1986-1988.	276 till samples were collected in the Parry Sound-Sundridge area, Ontario in 1986, 1987 and 1988. Data are published in Ontario Geological Survey Open File Report 5796.
16	7	Till sampling survey, NTS 40J/2,3,6,7, 40G/10,15 in Essex County, southwestern Ontario, 1988 and 1989.	Approximately 60 till and 85 glaciolacustrine sand/silt samples collected in Essex County, southwestern Ontario in 1988 and 1989. Data published in Ontario Geological Survey Open File Report 5886.
16	8	Till sampling survey, NTS 31E/3,6, 31D/13,14, 41A/16, Huntsville-Penetanguishene area, central Ontario, 1990 and 1991.	154 surface till samples collected in Huntsville-Penetanguishene area, central Ontario in 1990 and 1991. Data published in Ontario Geological Survey Open File Report 5882.
16	9	Till sampling survey, NTS 31F/4, Bancroft area, southern Ontario, 1978-1979.	44 till samples and 23 glaciofluvial sand samples were collected in the Bancroft area, southern Ontario in 1978 and 1979. Data are published in Ontario Geological Survey Report 262.
16	10	Till and soil sampling 52A, northwestern Ontario, 1998.	Till and humus samples were collected in 1998 in the eastern part of the Shebandowan Greenstone Belt, northwestern Ontario. The data are published in Ontario Geological Survey Open File Report 5993.
16	11	Till sampling 52B, northwestern Ontario, 1999.	Till and humus samples were collected in 1999 in the western part of the Shebandowan Greenstone Belt, northwestern Ontario. The data are published in Ontario Geological Survey Open File Report 6012.
16	12	Till and soil sampling, NTS 41I, northern Ontario, 1992.	Approximately 450 humus, B-horizon soil and C-horizon till samples were collected in 1992 along the north and east ranges of the Sudbury basin in northern Ontario. The data are published in Ontario Geological Survey Open File Report 6033.
16	13	Till and soil sampling survey, NTS 42D,E, northwestern Ontario, 1999.	Humus B- and C-horizon samples of subglacial till were collected in 1999 over the Trans-Superior Tectonic Zone in the Killala Lake – Coldwell area of northwestern Ontario. The data are published in Ontario Geological Survey Open File Report 6056.
16	14	Till and soil sampling survey, NTS 42D,E, northwestern Ontario, 2000.	Humus B- and C-horizon samples of subglacial till were collected in 2000 in the Dickison Lake – Schreiber area of northwestern Ontario, west of the Trans-Superior Tectonic Zone. The Slate Islands located south of Terrace Bay and straddling the TSTZ were also sampled. The data are published in Ontario Geological Survey Open File Report 6056.
16	15	Till sampling survey, NTS 42A/2,3 northern Ontario, 1995.	414 samples of surface till were collected in 1995 in the Peterlong Lake-Radisson Lake area, northern Ontario. The data are published in Ontario Geological Survey Open Files Report 5941 and 5942. Lake sediment and water samples were also collected and published in Open File Report 5942 with the till data.
16	16	Soil and till sampling survey, NTS 52L, northwestern Ontario, 1992-1994.	Orientation surveys were carried out in the Werner Lake, Separation Lake, Helder Lake and Selwyn Lake areas in northwestern Ontario. Regional sampling was carried out over the entire area. B-horizon soil was collected in 1992 and humus, B-horizon soil and C-horizon till were collected in 1993 and 1994. The data are published in Ontario Geological Survey Open File Report 5939.

Organisational Unit ID	Survey ID	Survey Title	Survey Description
16	17	Soil and till sampling survey, NTS 31E,L central Ontario, 1994.	Humus and till samples were collected in 1994 at 43 sites centred on the Cal Graphite Mine site in Butt Township, Ontario. The data are published in Ontario Geological Survey Open File Report 5947.
16	18	Till sampling survey, NTS 43C,D,E,F,L, northern Ontario, 1996.	626 samples were collected in the Upper Attawapiskat and Ekwan River area, northern Ontario in 1996. 82 were till, 510 were modern alluvium and 34 were glaciofluvial sediments. The data are published in Ontario Geological Survey Open File Report 6097.
16	19	Till sampling survey, NTS 42A, 41P, northeastern Ontario, 1996.	216 C-horizon till samples were collected along the western extension of the Larder Lake-Cadillac Break, Matachewan area, northeastern Ontario in 1996 as part of a regional and property-scale sampling survey. The regional samples were collected at a density of just under 1 sample per 2 km^2. The data are published in Ontario Geological Survey Open File Report 5957.
16	20	Soil and till sampling survey, NTS 52C/9, Samuels Lake property, northwestern Ontario, 2000.	6 humus and 6 vegetation samples were collected on the Samuels Lake property in 2000. The think glacial drift over the property is not till and therefore was not sampled. The data are published in Ontario Geological Survey Open File Report 6054.
16	21	Soil and till sampling survey, NTS 52B/11, Nym Lake property, northwestern Ontario, 2000.	24 humus, 24 B-horizon soil and 40 till samples were collected on the Nym Lake property in 2000. Twenty-four sites were positioned over a 1300 m by 1600 m area of the mafic intrusion and related breccia. The data are published in Ontario Geological Survey Open File Report 6054.
16	22	Soil and till sampling survey, NTS 52B/9, Haines Township property, northwestern Ontario, 2000.	50 humus, 45 B-horizon soil, 41 till and 6 vegetation samples were collected on the Haines Township property in 2000. Samples were collected along 5 separate lines and spaced at 25 m intervals. The data are published in Ontario Geological Survey Open File Report 6054.
16	23	Soil and till sampling survey, NTS 52H/4, Buck Lake property, northwestern Ontario, 2000.	28 humus, 28 B-horizon soil and 18 till samples were collected on the Buck Lake property in 2000. Samples were collected along 2 separate lines. One line was parallel to ice flow direction with samples collected at 25 m intervals up and down-ice of known mineralization. The data are published in Ontario Geological Survey Open File Report 6054.
16	24	Soil and till sampling survey, NTS 52H/4, Baker Zone, Lac des Iles mine area, northwestern Ontario, 2000.	36 B-horizon soil and 56 till samples were collected in the Baker Zone in the Lac des Iles mines area in 2000. Two sampling lines, 50 m apart were run parallel to ice flow direction and extended up and down-ice from known mineralization. The data are published in Ontario Geological Survey Open File Report 6054.
16	25	Soil and till sampling survey, NTS 52H/4, Powerhouse Zone, Lac des Iles mine area, northwestern Ontario, 2000.	20 B-horizon soil and 42 till samples were collected in the Powerhouse Zone in the Lac des Iles mine area in 2000. Samples taken in this area extend 2500 m down-ice from the Roby pit at 200 m intervals. The data are published in Ontario Geological Survey Open File Report 6054.
16	26	Soil and till sampling survey, NTS 52H/4, Legris Lake property, northwestern Ontario, 2000.	32 humus, 30 B-horizon soil and 35 till samples were collected on the Legris Lake property in 2000. Two sampling lines over sites of greater than 300 ppb combined platinum and palladium were positioned parallel to the latest ice-flow direction. Samples were spaced at 25 m intervals and were taken up and down-ice of known mineralization. The data are published in Ontario Geological Survey Open File Report 6054.
16	27	Soil and till sampling survey, NTS 52H/2, Wolf Mountain property, northwestern Ontario, 2000.	4 humus, 11 B-horizon soil, 8 till and 12 vegetation samples were collected on the Wolf Mountain property in 2000. Samples were collected along existing trenches. The data are published in Ontario Geological Survey Open File Report 6054.
16	28	Till sampling NTS 52C,D, northwestern Ontario, 1986-1988.	Approximately 600 till samples were collected in the Fort Frances-Rainy River area, northwestern Ontario. In 1986 the till samples were collected as part of the regular mapping routine. In 1987 and 1988 backhoe trenching and sonic drilling programs were undertaken. The data are published in Ontario Geological Survey Study 56.

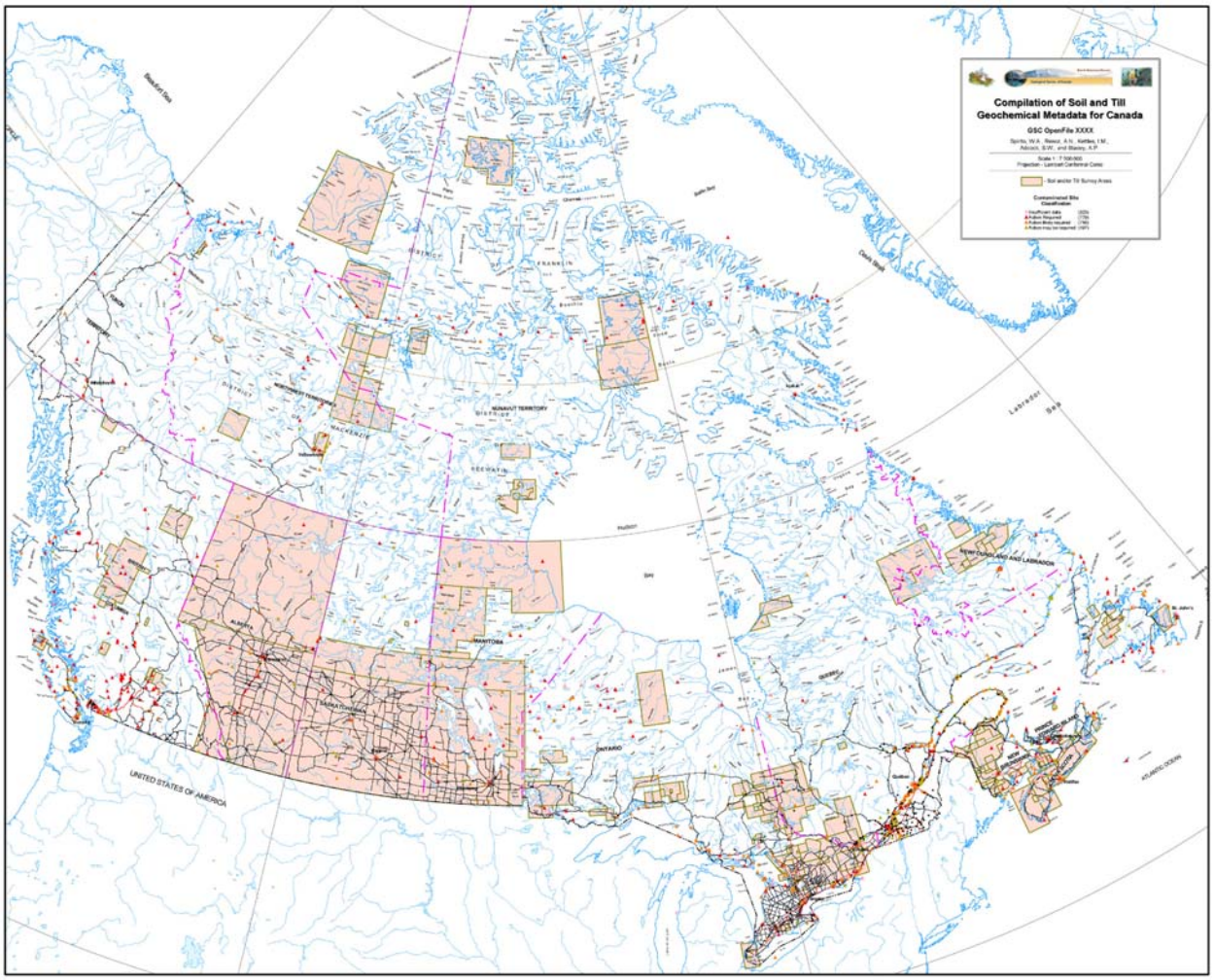
Organisational Unit ID	Survey ID	Survey Title	Survey Description
16	29	Till sampling survey, NTS 40I/15, southern Ontario, 1976.	74 till samples were collected in 1976 in the Tillsonburg area located in the south central part of southern Ontario. The data are published in Ontario Geological Survey Report 220.
16	30	Humus sampling survey, NTS 52H/4, Lac des Iles area, northwestern Ontario, 1986.	Humus samples were collected in 1976 at a detailed scale in the Lac des Iles area, district of Thunder Bay in northwestern Ontario. The data are published in Ontario Geological Survey Map 80-800.
17	1	Multi-year till sampling surveys, province of Alberta, 1953-1968.	Approximately 475 till samples were collected from over 65% of the province of Alberta during 1958-1963. Sampling was carried out over areas covered by the continental Keewatin ice sheet. The unsampled areas were covered by drift from the Rocky Mountains (i.e. along southwestern margin of the province), were difficult to access or were covered by deposits other than till as in northern Alberta where large areas are covered by lacustrine sediments. Some samples were collected by Alberta Soil Survey staff during the course of their fieldwork. The data are published in Research Council of Alberta Bulletin 26.
18	1	Till sampling survey, NTS 63L,K, east central Saskatchewan, 1986-1987.	112 till samples (including bulk tills) were collected in the east Amisk Lake area, east central Saskatchewan in approximately 1986-1987. The data are published in Saskatchewan Research Council Report R-842-59-E-88.
18	2	Till sampling survey, NTS 64D/4,5, east central Saskatchewan, 1985.	166 till samples were collected in the Waddy Lake area in 1985 in east central Saskatchewan. The data are published in Saskatchewan Research Council Technical Report R-842-1-E-86.
18	3	Till sampling survey, NTS 73P/7, central Saskatchewan, 1986.	130 till samples were collected in 1986 in the Sulphide-Hebden Lakes area, central Saskatchewan. The data are published in Saskatchewan Research Council Technical Report R-842-4-E-87.

Organisational Unit IDs

3 = Geological Survey of Canada, Terrain Sciences Division
4 = Nova Scotia Department of Natural Resources, Mineral Resources Branch
5 = Geological Survey of Canada, Quebec Geoscience Centre
8 = Energy and Utilities Branch, Alberta Geological Survey
10 = Department of Natural Resources, Geological Survey, Newfoundland and Labrador
11 = Geological Survey of Canada, Calgary, AB
12 = British Columbia Ministry of Energy and Mines, Geological Survey Branch
13 = New Brunswick Department of Natural Resources
16 = Ontario Geological Survey
17 = Alberta Research Council
18 = Saskatchewan Research Council

Map of Canada with Survey Outlines

Click on the map below to display the .PDF file of a map of Canada showing the outlines for all surveys listed in the metadata catalogue.

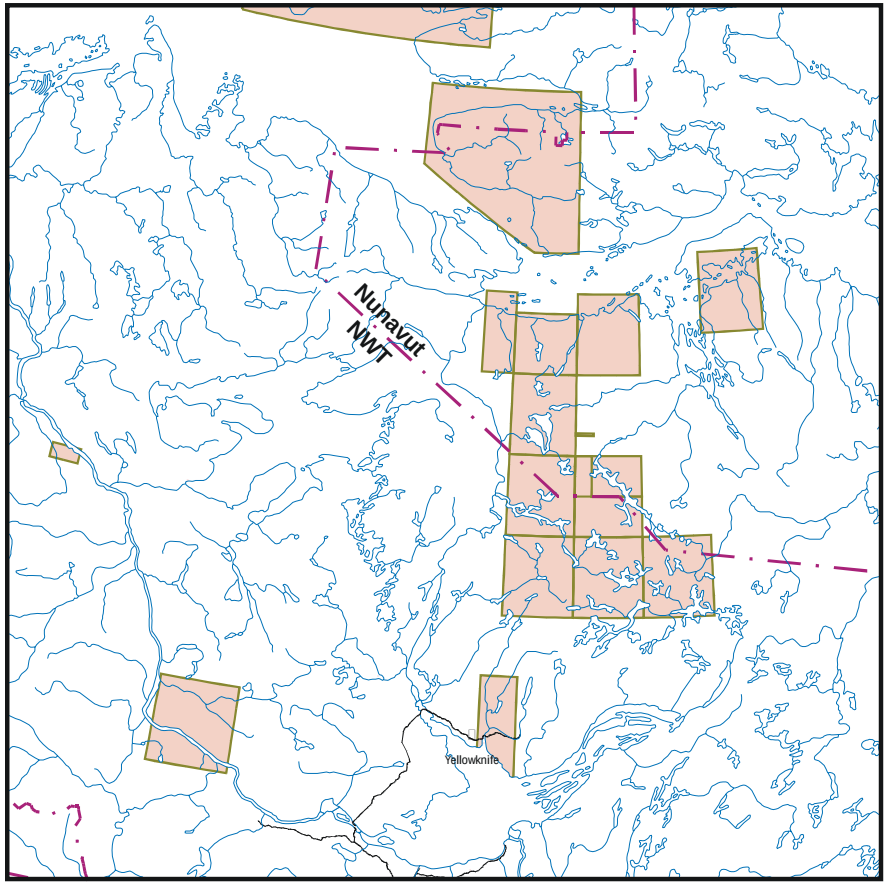


Survey Coverage by Regions

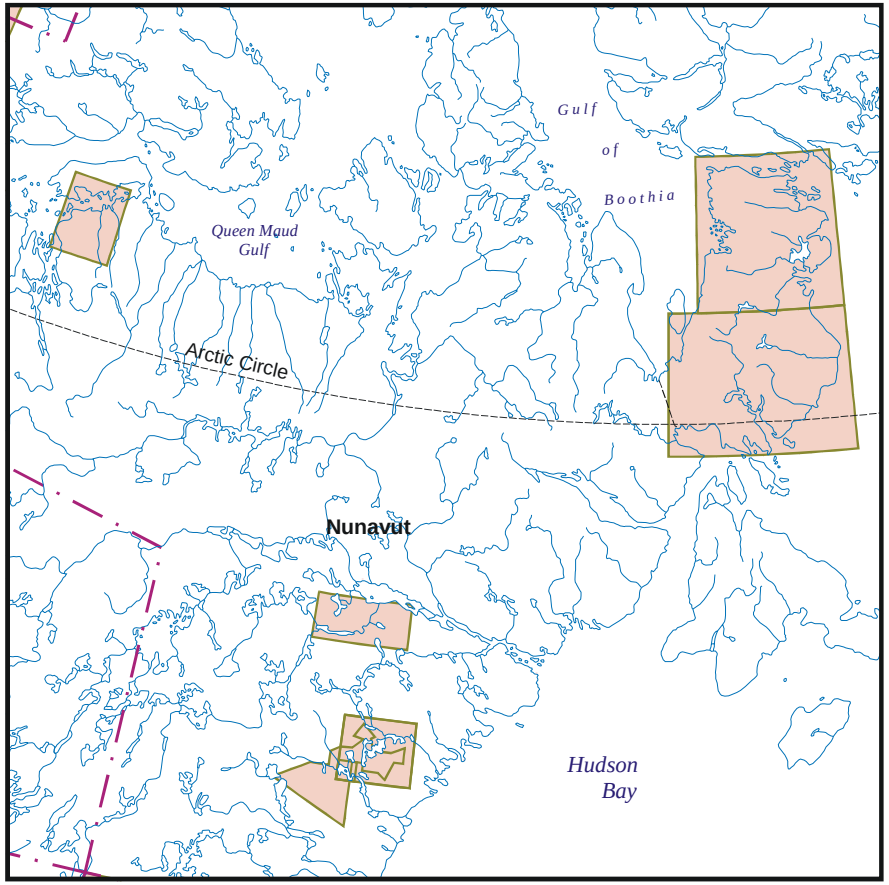
The large map of Canada (link from section V above and from MAPS button on introductory screen of CD) indicates the extents for all surveys at a 1:7 500 000 scale. The maps below indicate the survey extents in more detail. Maps are shown for the following regions:

Eastern Northwest Territories and Western Nunavut
Central Nunavut
Arctic Islands
British Columbia
Alberta
Saskatchewan
Manitoba
Northwestern Ontario
Southeastern Ontario/Western Quebec
Northern Quebec
New Brunswick and Nova Scotia
Labrador
Newfoundland

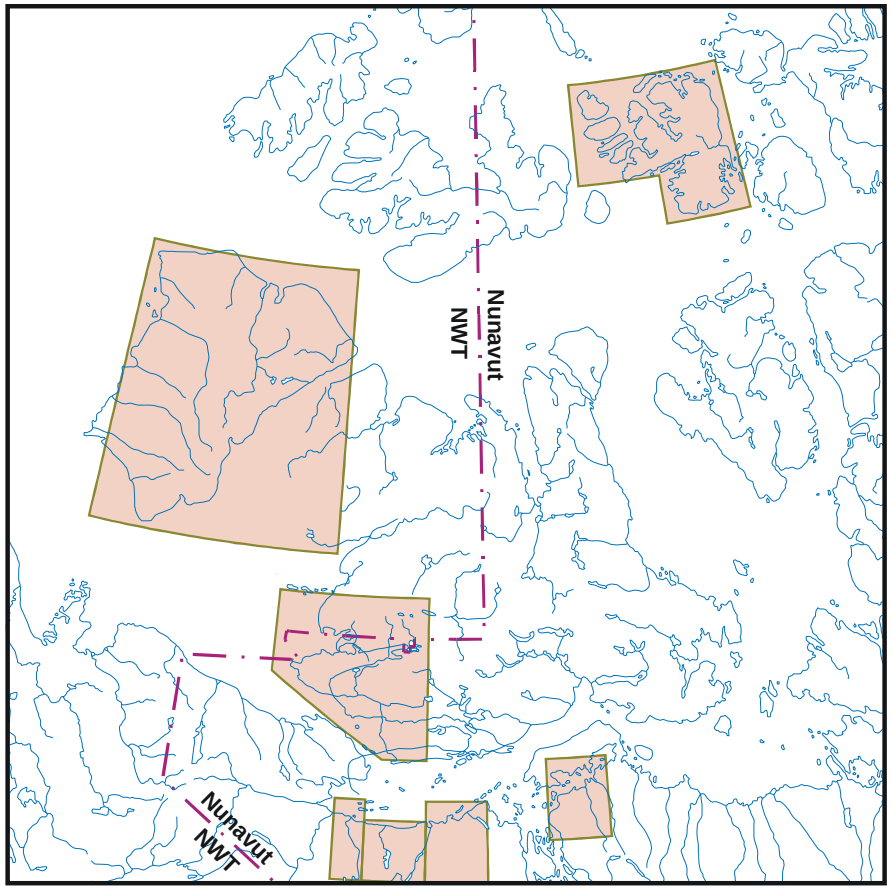
Eastern NWT/Western Nunavut



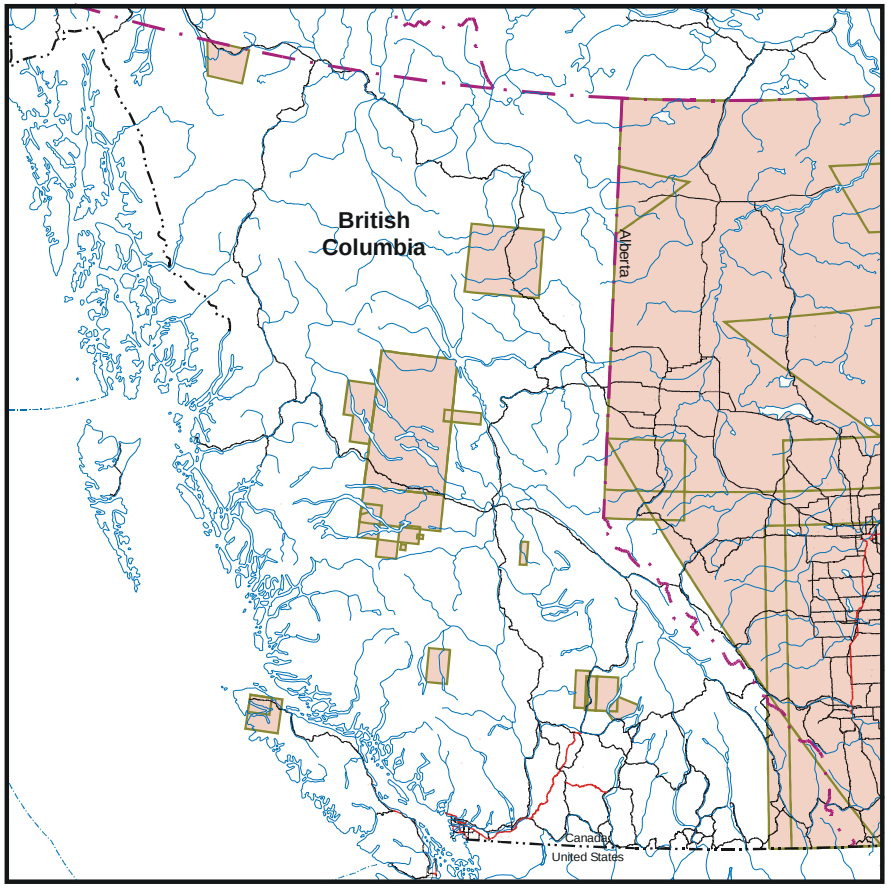
Central Nunavut



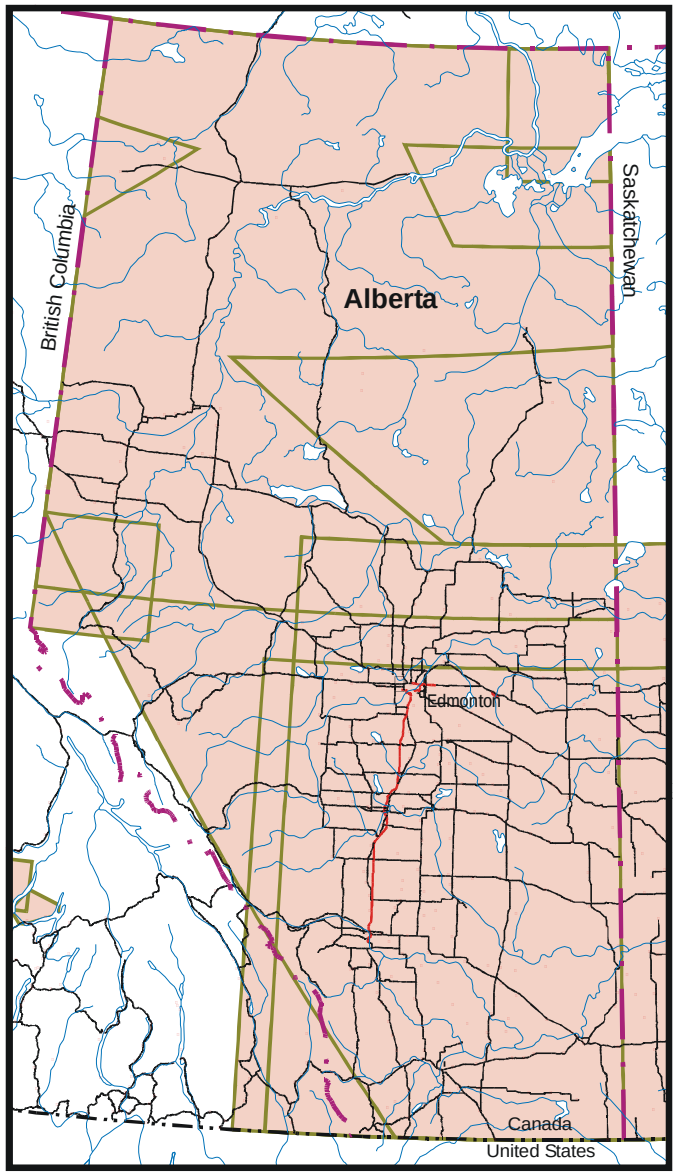
Arctic Islands



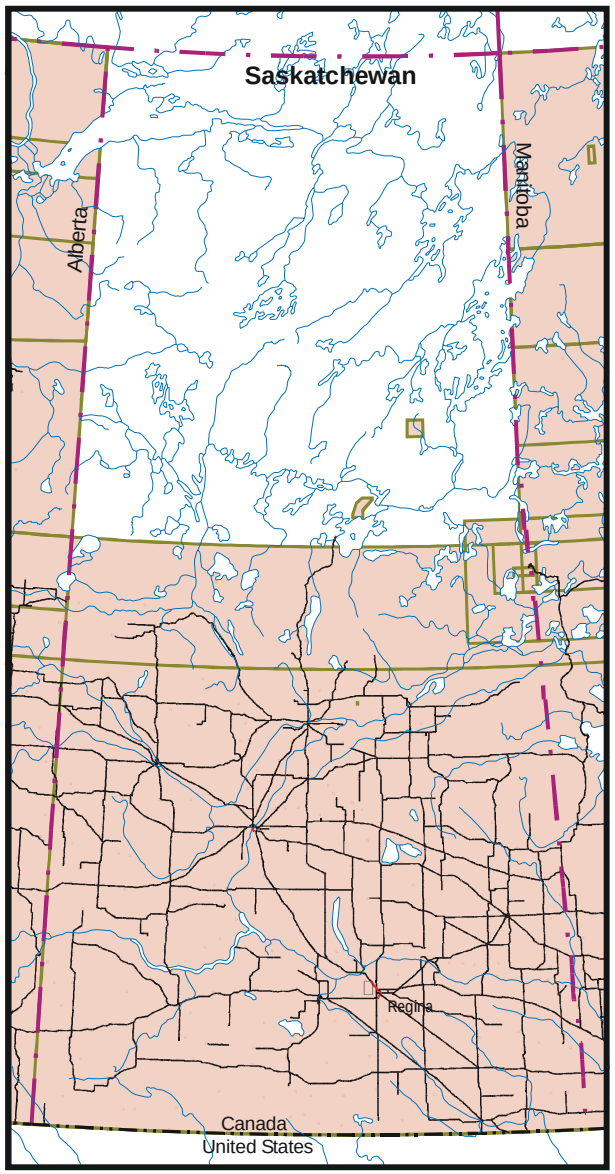
British Columbia



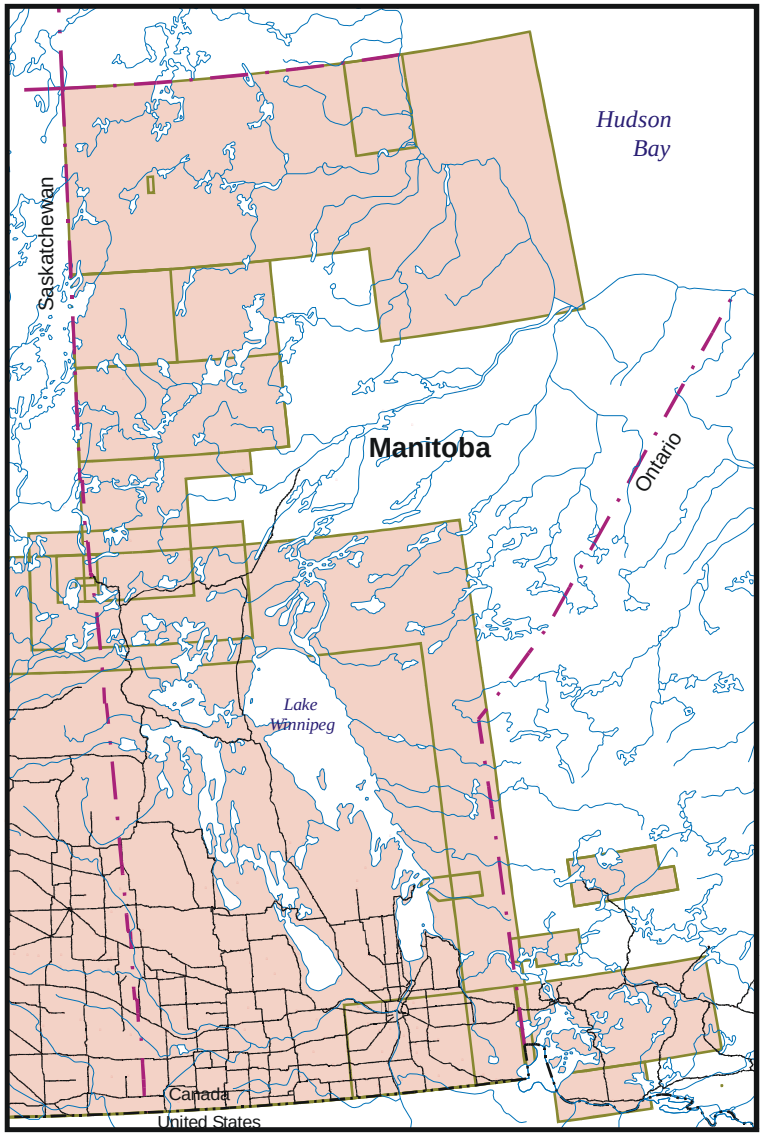
Alberta



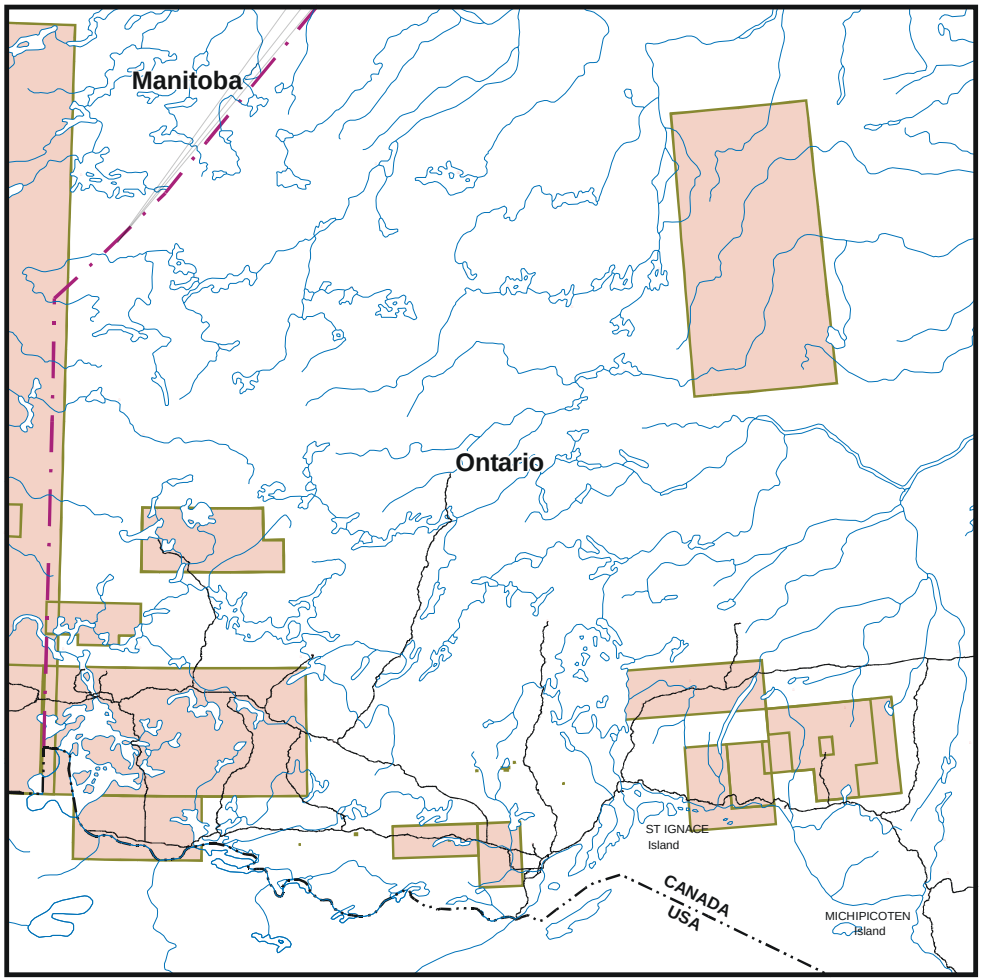
Saskatchewan



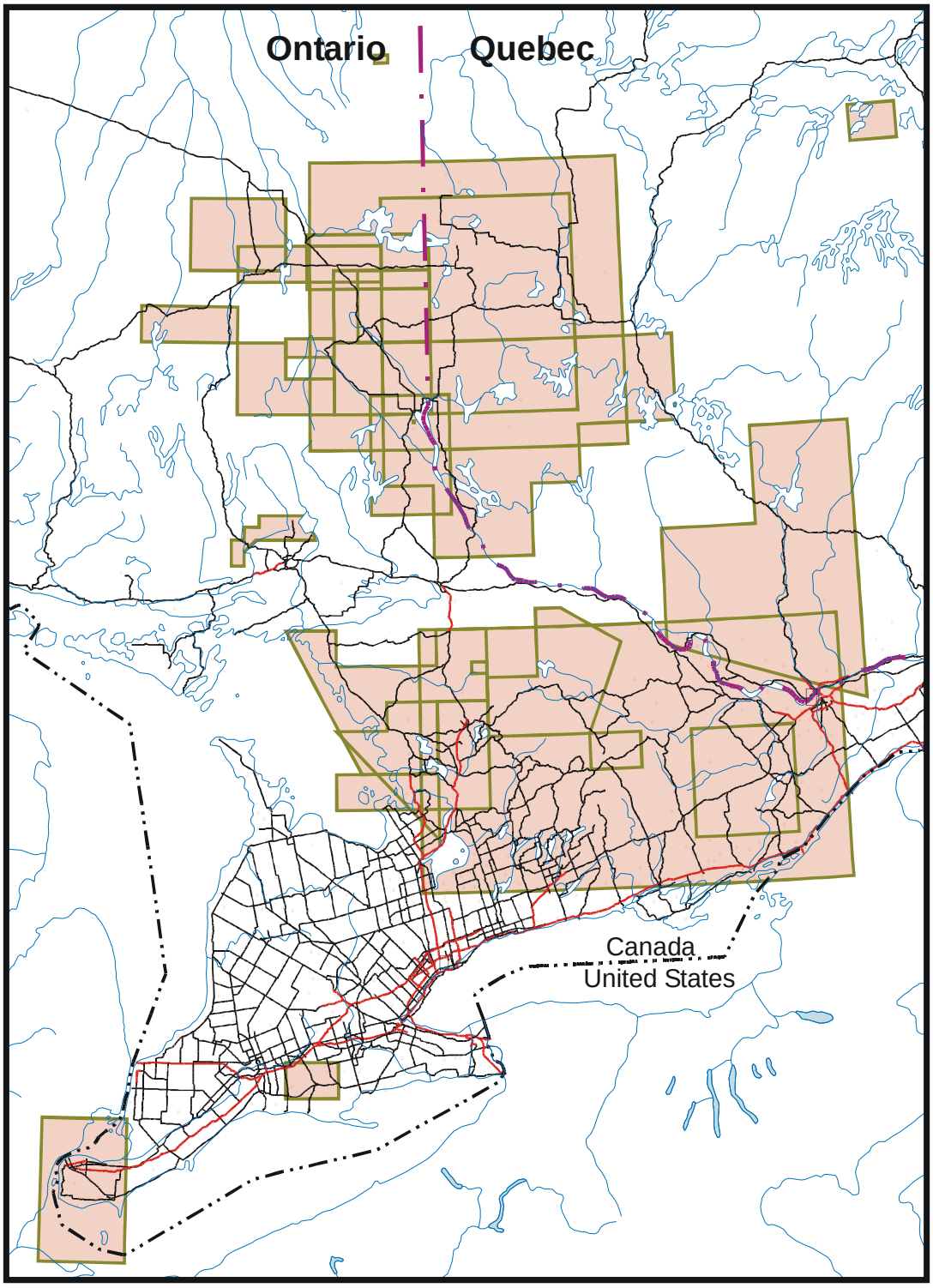
Manitoba



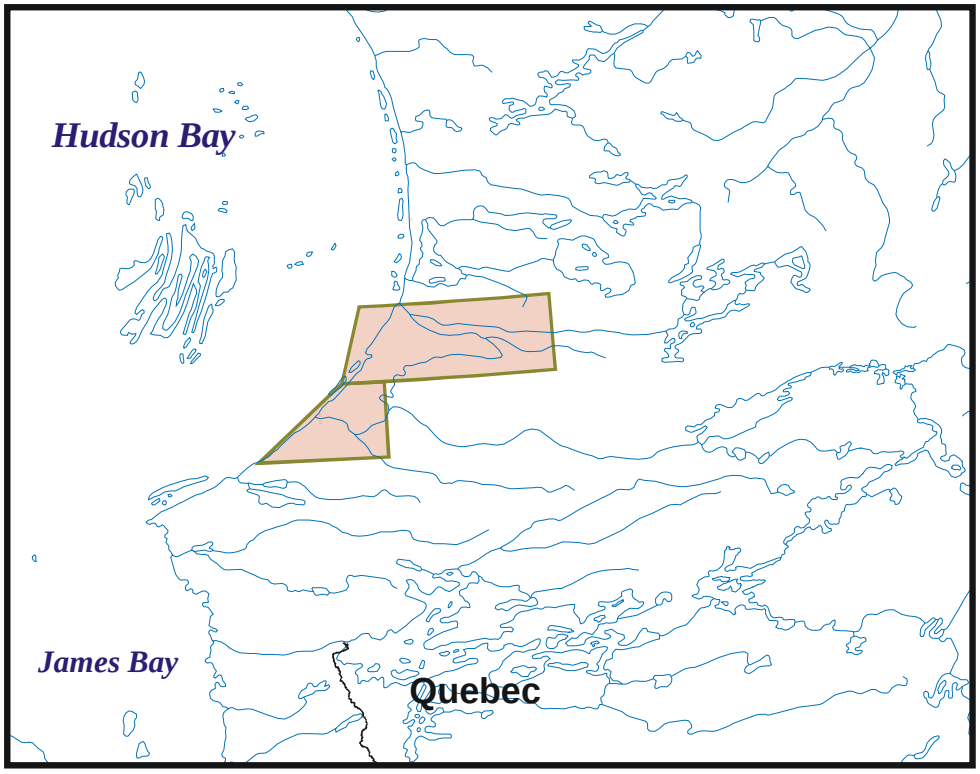
Northwestern Ontario



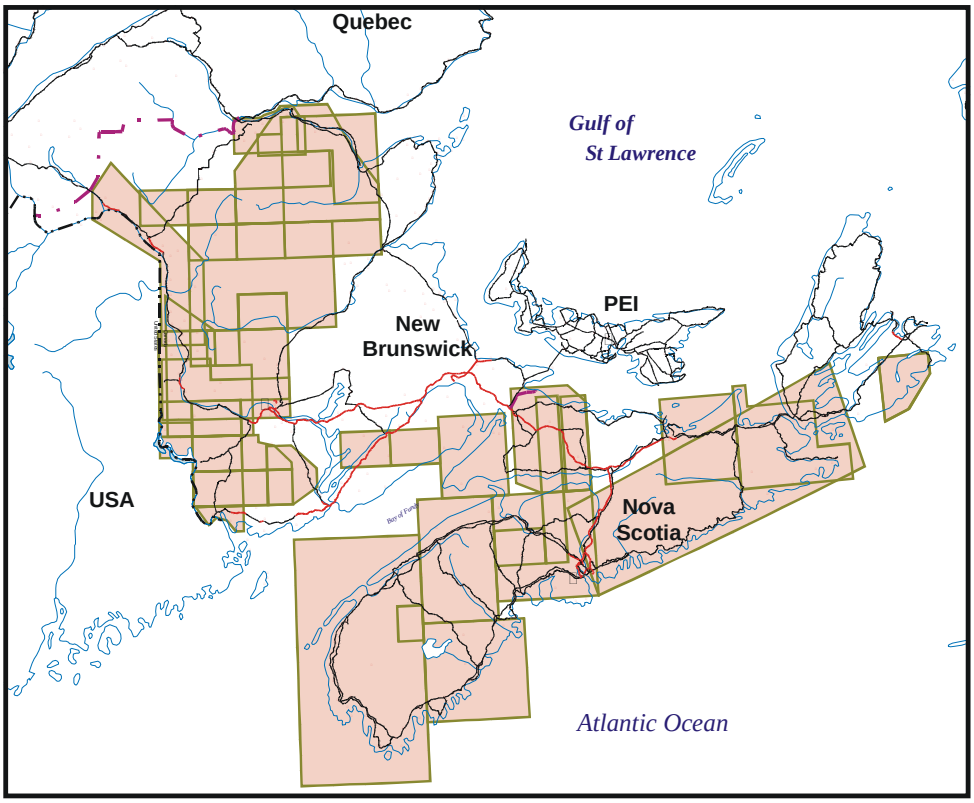
Southeastern Ontario/Western Quebec



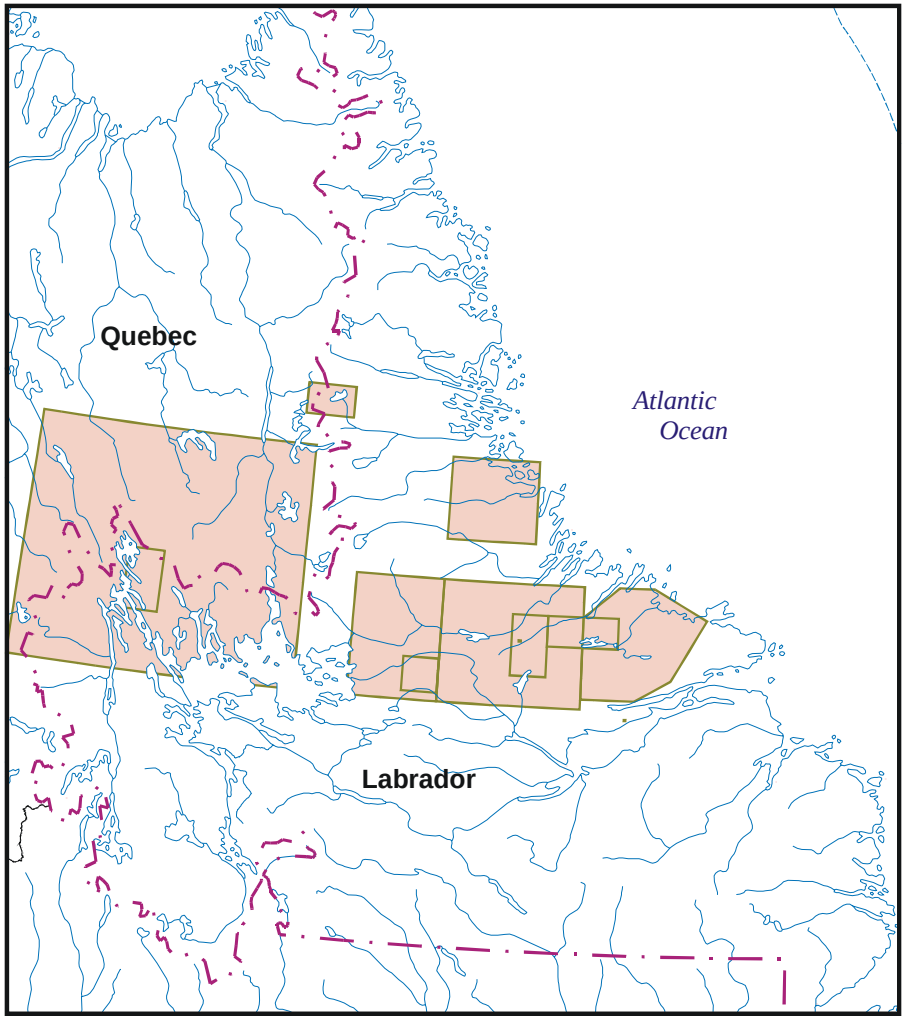
Northern Quebec



New Brunswick and Nova Scotia



Labrador



Newfoundland