

Canadian Geochemical Data on the Web

Canada is the second largest country in the world covering approximately 9.9 million square kilometres. Several thousand geochemical surveys have been undertaken across this large landmass since the 1950s, mainly in support of mineral exploration, but also for resource assessment and environmental research (Garrett et al. 2008). These surveys have been conducted by federal and provincial geological agencies as well as exploration companies, universities and consultancies. Surveys have been carried out in many parts of Canada at different scales, ranging from reconnaissance (>10 km sample spacing), to very detailed studies (<100 m spacing).

The composition of the surficial cover in Canada differs in one fundamental aspect 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 or at glacier margins.

Data for geochemical surveys carried out by the Geological Survey of Canada and provincial geological agencies are available via the Geoscience Data Repository (GDR) web site http://gdr.nrcan.gc.ca/index_e.php. The GDR is a Natural Resources Canada - Earth Sciences Sector initiative which allows discovery, viewing and downloading of information from a collection of geoscience databases. The Canadian Geochemical Surveys (CGS) catalogue on the GDR contains searchable metadata for over 800 geochemical surveys conducted across Canada since the 1950s as well as raw data for over 65 surveys. The catalogue includes data from many different sample media. It is currently biased towards till and lake and stream sediments. As it continues to grow, other sample media (particularly bedrock) will have a larger presence. The catalogue contains a multitude of cross references to original publications and online data, where available. It is also extensively cross-linked to other databases and geological organizations.

The CGS catalogue has recently been expanded to include raw geochemical data for over 65 till surveys across Canada as well as KML* files of these data that can be viewed with Internet Earth browsers such as Google Earth™. The addition of raw data and creation of KML geochemical layers is on going. (*KML, Keyhole Markup Language, is a data file format optimized for viewing geospatial data).

The catalogue is generated from an underlying relational database. All of the web pages presented via the GDR are derived from this database that stores both the metadata and raw geochemical data for the surveys. The following overview of the contents of the CGS catalogue can be found in more detail in Geological Survey of Canada Open File 5936, "The Canadian Database of Geochemical Surveys: User manual for the metadata website" (Spirito & Adcock 2009). The home page of the Canadian Geochemical Surveys catalogue can be found at: http://gdr.nrcan.gc.ca/geochem/index_e.php. There are four ways to look at the contents of the catalogue, and the home page is the starting point for

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searching the catalogue by the first three of the four methods listed below:

1. by VIEWING the map-based interface
2. by BROWSING index tables organized by category;
3. by QUERYING a periodic table interface; and
4. by USING Internet search engines e.g. Google™.

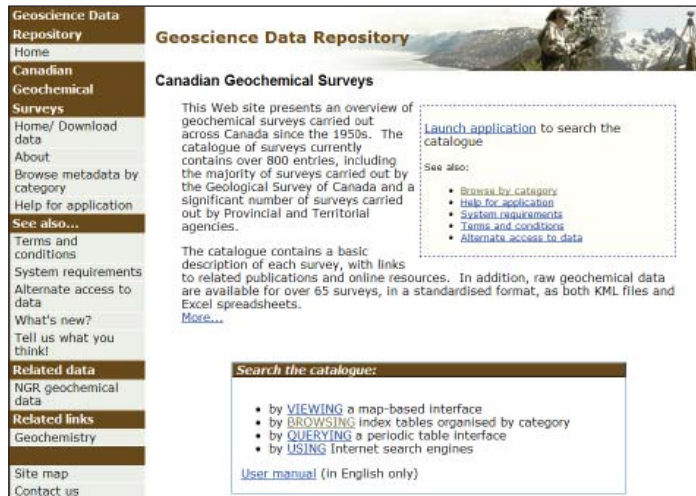


Figure 1. Canadian Geochemical Surveys home page on the GDR.

VIEWING: Map-based Interface

The first way to search the catalogue is by viewing the map-based interface from the home page.

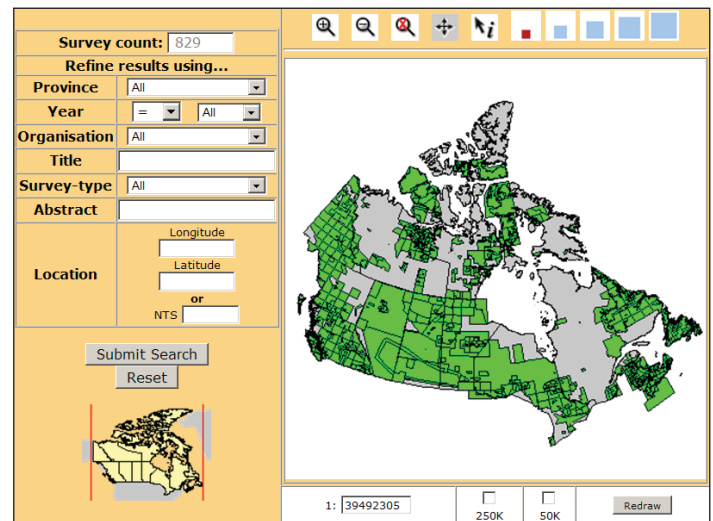



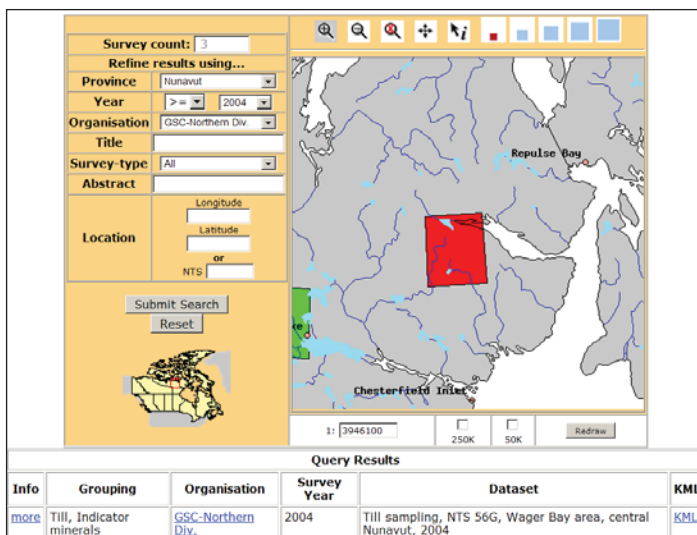
Figure 2. Map-based interface showing 829 geochemical surveys across Canada.

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Note: This EXPLORE article has been extracted from the original EXPLORE Newsletter. Therefore, page numbers may not be continuous and any advertisement has been masked.

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Using the tools provided with the interface (e.g. zoom, query or search parameters), an area of interest can be chosen and a survey selected. Once a survey (or surveys) is selected by using the query tool (), links to the metadata pages (“more”) and a KML location map (“KML”) are shown in the information grid below the interface map, as shown in Figure 3.



Info	Grouping	Organisation	Survey Year	Dataset	KML
more	Till, Indicator minerals	GSC-Northern Div.	2004	Till sampling, NTS 56G, Wager Bay area, central Nunavut, 2004	KML

Figure 3. Example of survey selected with the Query tool and corresponding information grid.

Using the “more” link, metadata for the selected survey (shown in red) are available on separate web pages for the survey, as well as associated publications and projects. These three types of pages are highly interconnected and can be accessed from each other. This interconnection allows the related metadata to be viewed independently of where the metadata search began.

BROWSING: Index Tables

The second way metadata can be searched is by browsing index tables organized by category (e.g. Surveys, Projects, Publications). The first three of these index tables display lists which link to metadata pages for survey information, project information and associated publications respectively.

A survey is the principal entity on which the metadata catalogue is based. A survey is carried out in a specific geographic area, over a defined period of time and by a certain organization. A survey can involve the collection of less than ten to several thousand samples from one or more sample media. In most cases, the data and other information related to the survey have been released in one or more publications. The survey metadata page provides a basic description of each survey, with links to related publications and online resources.

A project is an administrative concept and can be defined as a body of work (one or more surveys) related by organization, principal investigator, funding source or any other logical reason why the surveys should be grouped together. Projects are useful in establishing relationships between

different surveys. They also capture information related to reanalysis of samples and re-publication of data. The project metadata page provides a description of the project, lists the related surveys and the funding source and also links to the organization responsible for the data.

A publication is a public release of information that results from a specific survey and may or may not include the geochemical data from the survey. It is most often released as a published document, but can be an unpublished thesis or report. A survey may be published in one, many or no publications. The publication metadata page displays: a) the recommended citation; b) the link(s) to its associated survey(s); c) its GeoScan* record and a link to GeoPub**; d) a link to the publication's original GSC Release Notice, if it exists; and, e) a link to download older files that may not be in GeoPub.

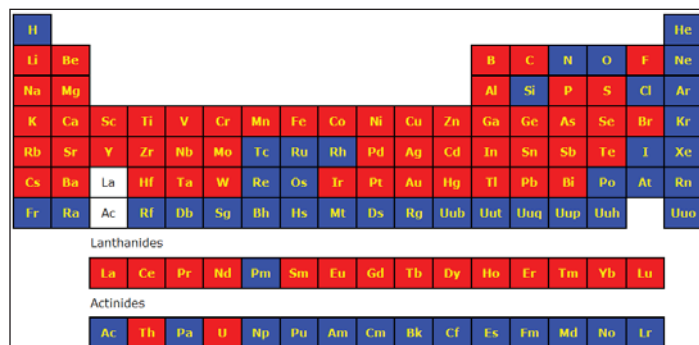
*GeoScan – a bibliographic database of GSC publications

**GeoPub – a database of downloadable GSC publications

QUERYING: Periodic Table Interface

In addition to metadata for over 800 surveys, the catalogue provides access to raw geochemical data for 65 till surveys across Canada, 39 of which are in the province of New Brunswick. The raw data have been compiled into a standardized format and are available as both KML files and Microsoft® Excel® spreadsheets.

From the Canadian Geochemical Surveys home page, KML index maps of the 65 surveys as well as all 800 surveys are available. The raw data can be viewed as KML files by using the Periodic Table Interface, which is the third way to access the catalogue. KML files can be viewed using Internet Earth browsers such as Google Earth™.



H																	He
Li	Be											B	C	N	O	F	Ne
Na	Mg											Al	Si	P	S	Cl	Ar
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe
Cs	Ba	La	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn
Fr	Ra	Ac	Rf	Db	Sg	Bh	Hs	Mt	Ds	Rg	Uub	Uut	Uuq	Uup	Uuh	Uuu	Uuq
Lanthanides																	
La Ce Pr Nd Pm Sm Eu Gd Tb Dy Ho Er Tm Yb Lu																	
Actinides																	
Ac Th Pa U Np Pu Am Cm Bk Cf Es Fm Md No Lr																	

Figure 4. Periodic table interface.

The Periodic Table Interface displays elements in red and blue. The red elements are those for which raw data (from at least one of 65 surveys) are available in a standardized format (KML files or MS-Excel® spreadsheets). The blue elements are those for which no raw data exist. When one of the red elements is selected, for example Cu, a KML index map is displayed showing which surveys include data for Cu. When the KML index map is displayed, the extent of each survey that has data for the selected element is shown. Survey 210008 is one of the surveys for which copper data are available. When the star at the centre of the survey outline

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is clicked, a balloon appears with information about the raw data for that survey.

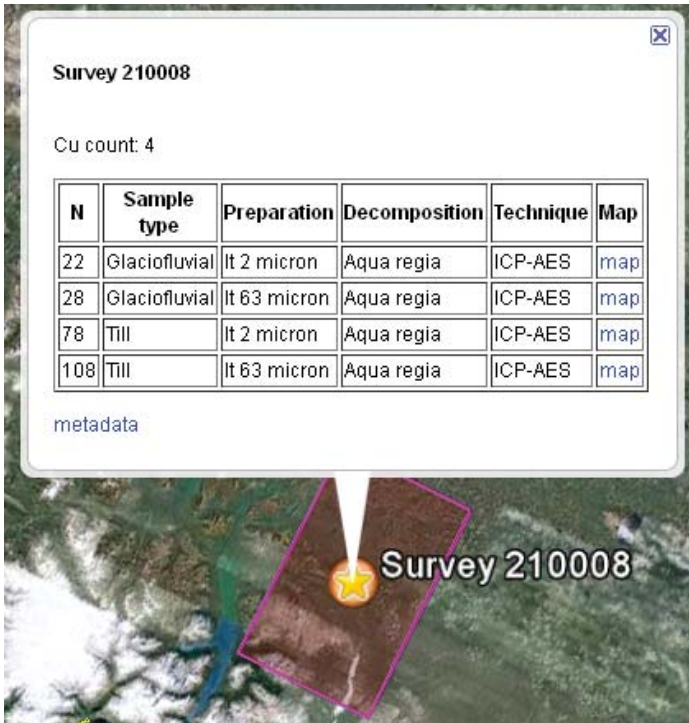


Figure 5. KML map for Cu showing analytical parameters for the survey.

There are four copper (Cu) datasets for Survey 210008, as shown in Figure 5. There are two sample media, glaciofluvial sediments and till, and each sample type has been sieved into two size fractions: <math><2\ \mu\text{m}</math> and <math><63\ \mu\text{m}</math>. The table shows the number of samples (N) of each sample type and sample preparation, and also shows that the samples were digested with aqua regia before being analyzed by ICP-AES.

The “metadata” hyperlink in the bottom left corner of the balloon displays the corresponding Survey Metadata Page on the GDR. The “map” hyperlink in the last column links to a KML map which can display the analytical value for the selected element at each sample site. The cross symbol marking the location of each sample is coloured according to its quartile value: \oplus (75 -100th), \oplus (50-75th), \oplus (25-50th), \oplus (0-25th).

In Figure 6, the Cu values for till in the <math><63\ \mu\text{m}</math> fraction are shown. The legend to the left of the map shows the data broken down into 20 percentile groups (0-5th, 5-10th etc.) as well as the number of samples that fall into each group. Each of the four quartile ranges covers five of these percentile groups. On the legend, values in specific percentile ranges can be toggled on or off. For example, only samples with Cu values in the 90th percentile range or higher can be displayed. When the map is first loaded from the “map” link shown in Figure 5, the data are loaded with “Symbols only” by default. At the bottom of the legend, there is an entry “Cu; n=108, Symbols plus value”. When this is toggled on, the actual Cu value at each site will be displayed.

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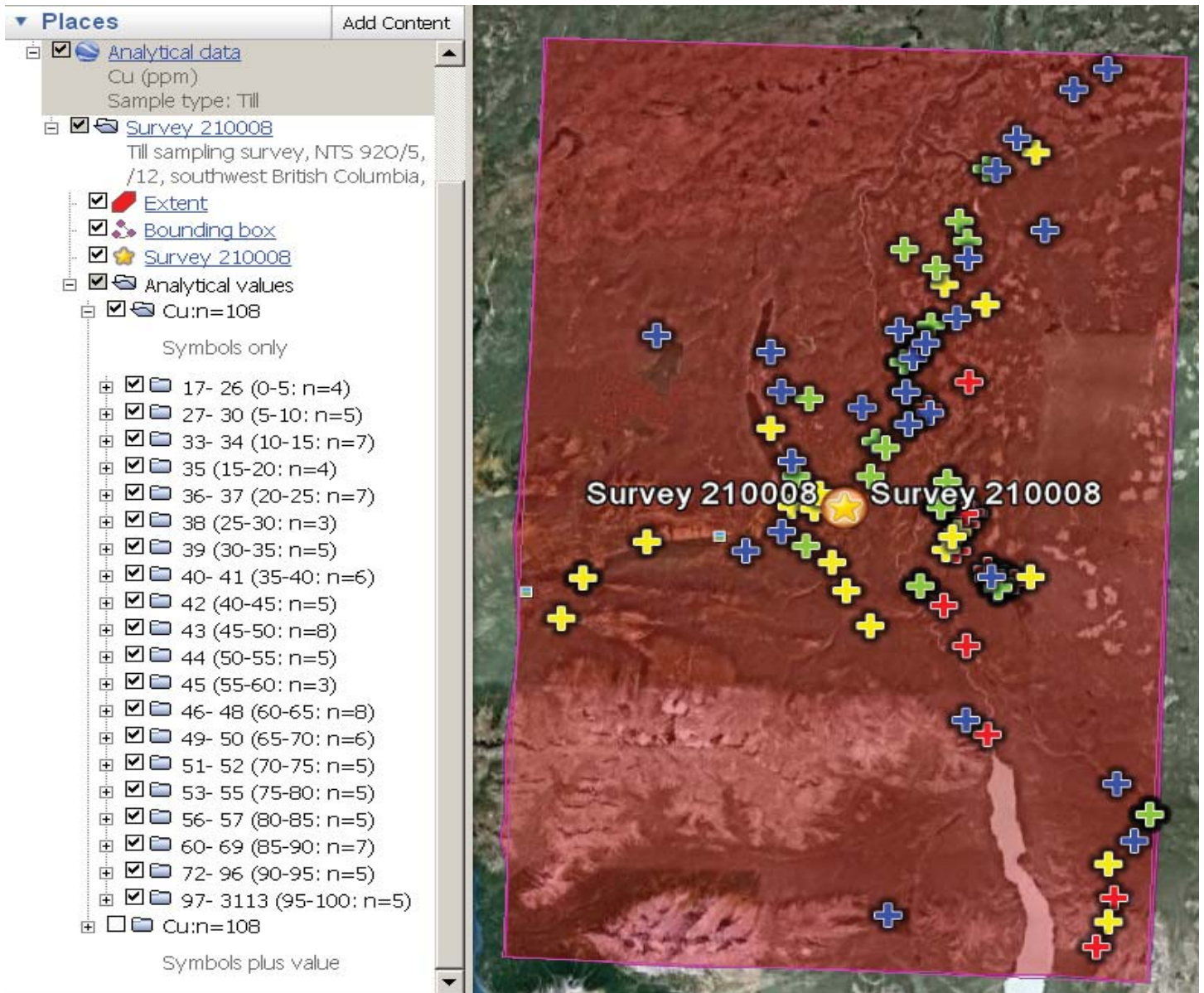


Figure 6. KML map of Cu values, coloured by quartile.

The KML maps described above can also be accessed from the Survey Metadata pages in addition to the Periodic Table interface. These Survey Metadata pages which can be accessed via the map-based interface or the Surveys Index table, provide extra information for the 65 surveys for which the raw data have been compiled. These surveys have *Extended Metadata* sections on the Survey Metadata web pages as shown in Figure 7.

This section provides a more complete breakdown of the sample count by map sheet; the number of samples for each type of sample material (if more than one medium was col-
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Extended Metadata	
Sample locations	
Sample material	
Preparation laboratory sample material	
Analytical History	

Figure 7. Excerpt from Survey Metadata page showing Extended Metadata section.

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lected); the way the sample was prepared; and, the Analytical History, including specific details about laboratory packages used to analyze the samples. From the Analytical History section, more details about the types of geochemical analyses can be found and spreadsheets of the raw data, in a standardized format, can be downloaded. This section also provides links to KML maps that display the analytical data for each element that was analyzed in the selected package. The maps are the same as those displayed via the Periodic Table interface.

USING: Internet Search Engines

The final way to view the metadata catalogue is by using

Internet search engines, such as Google™. The metadata pages have been indexed by the major Internet search engines. Judicious selection of search terms will often take you directly to a relevant survey, project or publication web page. Hyperlinks within the web page will then direct you to additional information.

For example, if you know the author(s) of a publication, then using their surnames as search terms will often result in a link to the publication metadata page. Alternatively, using the phrase “canadian geochemical surveys” as the first search term, in combination with other search terms (authors’ surnames, place names, geochemical terms) should result in several links to pages within the web site, as shown in Figure 8.

Figure 8. Links to Canadian Geochemical Surveys metadata pages as search results from Google™.

Additional Information

Geological Survey of Canada Open File 5936 (Spirito & Adcock 2009) is a comprehensive user manual for the website and can be viewed directly from the home page (http://gdr.nrcan.gc.ca/geochem/index_e.php). It includes references to additional publications which describe various facets of the catalogue in greater detail.

Acknowledgements

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References

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