

Large areas of Canada have been covered by stream and sake surveys carried out under the Ballantyne, S.B. National Geochemical Reconnaissance (NGR) program. The goal of this program is to establish and 1991: Stream sediment geochemistry in the Canadian Cordillera: conventional and future maintain a nationally consistent database of field and analytical data derived from drainage sediment and water samples. Toward this end, systematic surveys have been conducted since 1973. To date (1997), more than 200 surveys have been completed to NGR standards, representing over 190 000 sites covering

Cameron, E.M., and Ballantyne, S.B. 2.3 million km2 throughout Canada (Figure 1). These were carried out mainly by the Geological Survey of Canada, either independently or in cooperation with provinces and territories, under various funding Consistent methods of sample collection, sample preparation and chemical analysis developed and employed at the GSC are the hallmark of NGR surveys (Friske and Hornbrook, 1991). Geochemical

surveys that fulfil these criteria carried out by provincial and territorial agencies also qualify as NGR At present, data for each NGR survey are available in hard copy and digital form. However, to Coker, W.B., Hornbrook, E.H.W. and Cameron, E.M. simplify access to such a substantial collection of diverse information, a digital database is being created using Microsoft ACCESS software. As entry of large contiguous blocks of data (e.g. all Labrador lake

sediment and water data) is completed, geochemical maps and reports are being produced that display and summarize the data. The aim of this second generation of publications is to increase awareness of Davenport, P.H., Christopher, T.K., Vardy, S. and Nolan, L.W. NGR data and enhance applications not only to mineral exploration but in other areas as well, such as public health and environmental studies. This map summarizes the distribution of gold from 18 793 lake sites and 1 131 stream sites in Labrador sampled between 1977 and 1986. Figure 2 shows the individual open files that make up the Davenport, P.H. and Friske, P.W.B. Labrador compilation. Detailed, site-specific information is available in these open files.

SURVEY METHODOLOGY A detailed description of the NGR survey methodology is given in Friske and Hornbrook (1991).

Below is a brief summary, with particular reference to the Labrador lake and stream sediment and water

Sample collection is carried out by a two-person sampling crew in a helicopter mounted on floats. An ideal sample comes from a lake less than 5 km2 in size and greater than 3 metres deep, with a single central basin that is the focus of drainage in the area around the sample site. Sediment is collected from a centre-lake profundal basin using a hollow-pipe, bottom-valve sampler (85 cm long x 10 cm diameter) attached to an external winch and rope system mounted on the fuselage of the helicopter. Generally, the full length of the sampler penetrates into the bottom sediment and the sample represents a 30 to 35 cm section from several tens of centimetres below the sediment-water interface. However, if relatively clastic-rich material is encountered, the sampler may not penetrate its full Friske, P.W.B. and Hornbrook, E.H.W. length, and some surface material is included. The ideal sample material is an organic-rich sediment (avttia), commonly a greenish-brown to grey thixotropic gel, but clay, marl and/or sandy samples may also be encountered. At each site, field observations such as lake size, lake depth and local relief are

Lake waters are routinely collected at all lake sediment sites. Rectangular wide-mouth polyethylene bottles (250 ml) are used to sample water from depths of 20 cm or more below the surface of the lake. The inclusion of suspended materials is avoided as much as possible.

The regional stream sediment and water survey shown on this map was carried out in northern Labrador in 1986. This was the only major stream sediment survey carried out in Labrador by the GSC,

Garrett, R.G. except for a small survey in the Makkovik area completed in 1987. Stream sediment surveys are typically undertaken in mountainous or hilly terrain where streams occur more frequently than lakes. Samples are collected from a helicopter by a two-person crew Garrett, R.G., Banville, R.M.P. and Adcock, S.W. consisting of a navigator/data recorder and a collector.

Ideal samples consist of silt (1/16 - 1/256 mm) gathered at a point on a primary or secondary stream just below a 'break', a point where the grade decreases, the flow of water slows, and sediments are deposited. After a 250-ml water sample is collected in a wide-mouth polyethylene bottle, sediments are Geological Survey of Canada gathered as much as possible from the active main channel, usually from the lee side of stationary rocks or other channel obstructions. Obvious bank sediments, sand, pebbles, sticks, etc. are avoided. At some sites, clumps of moss growing in the main channel are collected, as suitable sediments often accumulate within the root mass. Site characteristics (water depth, stream width, water colour, bank composition, unusual stains or precipitates, etc.) are noted and passed along to the navigator/data recorder by the

Sample Preparation and Analysis Both lake sediment and stream sediment samples are initially field-dried. Sample preparation for Johnson, M.G., Culp, L.R. and George S.E. lake sediments consists of crushing the fully dried sample into small (5 mm or less) fragments, followed by further reduction in ceramic mills. Stream sediments are sieved, and the -80 mesh portion (177 micron) reduced to -200 mesh (74 micron) in ceramic mills. Any material not milled or used in the Jonasson, I.R.

analytical procedures is put into long-term storage. The existence of an NGR sample archive allows the GSC to take full advantage of improvements and developments in the field of analytical chemistry, and since 1977 Labrador lake and stream Kerr, A. and Davenport, P.H. sediments have been analyzed and reanalyzed for a considerable range of elements. At all sites, data are available for Ag, As, Au, Ba, Br, Ce, Co, Cr, Cs, Cu, Eu, F, Fe, Hf, Hg, La, Lu, LOI (loss-on-ignition), Mn, Mo, Na, Ni, Pb, Rb, Sb, Sc, Sm, Ta, Tb, Th, U, W, Yb, and Zn. Vanadium and cadmium data exist for some areas, and stream sediment surveys include analytical data for Sn. All water samples were analyzed for U, F, and pH. Analytical procedures are a combination of Instrumental Neutron Activation analysis (INAA), atomic absorption spectrometry (AAS), and specific techniques. Data for the elements 1990: Provisional elemental values for eight new geochemical lake sediment and stream sediment determined and the methods used are included in individual open files for each area (Fig. 2).

Gold data are available for areas shown on the contour and proportional spot maps. The analytical Weighed and encapsulated samples are packaged for irradiation along with internal standards and 1977: Geochemical methods applied to uranium exploration in southwest Baffin Island; The Canadian international reference materials. Samples and standards are irradiated together with neutron flux monitors in a two-megawatt pool-type reactor. After a seven-day decay period, samples are measured on McConnell, J.W. a high-resolution germanium detector and the results converted to concentrations. Typical counting times **Quality Control**

One of the most important characteristics of NGR surveys is the structure of the sampling routine. McConnell, J.W. and Batterson, M.J. Each block of 20 consecutive field numbers consists of 17 routine field samples, a field duplicate sample, a blind (analytical) duplicate sample and a control reference sample. The field duplicate sample is a separate sample collected at one of the 17 routine sites, at the discretion of the sampling team. One number, always the first in a block of 20 (i.e. 001, 021, 041, etc.) is reserved for a blind duplicate. The sample preparation laboratory splits a sample in the block, preferably one of the field duplicate samples, and places one of the splits into the blind duplicate position. A randomly pre-selected number within a block of 20 is reserved for a control reference sample. Control reference samples are lake or stream Plant, J.A., Hale, M. and Ridgeway, J.

Field duplicates, blind duplicates and control reference samples are incorporated in every block of 20 samples, and are used to monitor and control sampling and analytical variance. As a result of stringent quality control and consistency of analytical methods over time, it is possible to generate a regional compilation for gold without any significant boundary effects between the different surveys. A 10 ppb gold Ramsey, M.H., Thompson, M. and Hale, M. value from a lake sediment analyzed in 1977 is directly comparable to a 10 ppb gold value determined in 1986, not only from Labrador, but from any NGR lake sediment survey across Canada.

sediments with well-established analytical values.

Data Presentation Relative concentrations of gold in Labrador drainage sediments are illustrated with two types of graphic images created using ARC/INFO geographic information system (GIS) software. The smaller contour plots represent smoothed surfaces depicting broad regional trends in the data. Actual values at specific sites are represented with proportional dot plots. Proportional dot plots display more detailed information and indicate the location of anomalous values. This style of presentation also facilitates the

use of the bedrock geology as a background, allowing easy visual evaluation of the relationship between geology and element distribution. Contour plots are created using the IDW (inverse distance weighting) and FILTER functions within ARC/INFO. Gold data are converted to log₁₀ values, and interpolated to a 1.0 km² grid surface from the irregularly spaced sample sites. The data are then further smoothed with the FILTER function, which passes a 3 X 3 filter over the grid. The 'low' option is used, which results in 9 element values being weighted equally to calculate a new value for each grid cell. This filter is passed over the grid 6 times. The 1.0 km² cells are then assigned colours based on cell values to create contour maps. Proportional dot plots are created using the SPOTSIZE function. The maximum spot diameter corresponds to the value of the 98th percentile (6 ppb for lakes, 8 ppb for streams). Sites with values greater than or equal to the 98th percentile are represented by circles with the maximum diameter. The smallest diameter corresponds to the minimum value, set to 1 ppb (one-half detection limit). Values between the minimum and maximum correspond to diameters fitting an exponential curve y=x2.

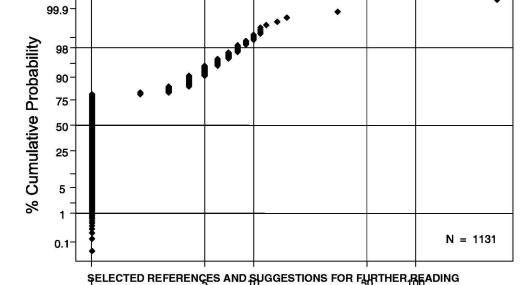
Percentile values shown for the contour map and the proportional dot map may differ. Weighted distance averages for grid cells determined from log10 values were used to calculate percentiles for the contour map, whereas element concentration data from each site were used in the calculation of percentiles for the proportional dot map. The geological base to this map depicts the geology of Labrador solely on the basis of rock type. It was prepared by R.J. Wardle of the Newfoundland Geological Survey, Department of Mines and Energy,

Government of Newfoundland and Labrador, using unpublished material from a new 1:1 000 000 scale geological compilation of Labrador currently in preparation. Geological boundaries demarcated by

straight lines indicate limits of detailed mapping.

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