



NWT Open Report 2014-012

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Recommended Citation: Falck, H., Day, S., Pierce, K.L., and Cairns, S., 2014. Geochemical, Mineralogical and Indicator Mineral Data for Stream Silt Sediment, Heavy Mineral Concentrates and Waters, Cranswick River area Northwest Territories, (part of NTS 106F); Northwest Territories Geoscience Office, NWT Open Report 2014-012. Digital files.

**Northwest Territories Geoscience Office
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**Geochemical, Mineralogical and Indicator Mineral Data for Stream Silt
Sediment, Heavy Mineral Concentrates and Waters, Cranswick River area,
Northwest Territories, (part of NTS 106F)**

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INTRODUCTION

As part of the Northwest Territories Geoscience Office (NTGO)'s ongoing drainage geochemistry program, a new regional bulk stream sediment, silt and water geochemical survey was carried out during the 2012 field season, in the northernmost Mackenzie Mountains, centered roughly 250 km west of Norman Wells, Northwest Territories (NT; Fig. 1). The focus of this new survey was to augment the heavy-mineral concentrate (HMC) and indicator-mineral dataset already publically available for much of the Mackenzie Mountains (Fig. 2). This release complements Geological Survey of Canada (GSC) Open File 6721 (Day et.al., 2012), which contains only stream silt and water geochemical data.

This publication contains site-specific field observations, chemical analyses of stream silt and water samples as well as HMC indicator mineral data for stream sites visited in August 2012. In total, 80 stream silt and water samples and 53 bulk stream-sediment samples were collected from 75 sites.

The study area covered approximately 4,290 square kilometres of the northern Mackenzie Mountains of the western NT. As the aim of the program was to evaluate large areas, target sites were selected on the basis of higher-order streams to represent sediment input from several watersheds. Bulk samples were collected at a nominal density of 26 square kilometres, half of the density of the concurrent silt and water sampling.

There are no communities within the study area. Supplies and access to the region were via Twin Otter aircraft based out of Norman Wells. Movement around the study area was exclusively by helicopter. A fly-camp on Misfortune Lake served as basecamp during the sample-collection aspect of the survey. Upon completion of the survey, all empty drums and left-over fuel was removed from the field.

This survey was funded through the NTGO using funds awarded under the Strategic Initiatives in Northern Economic Development program of Canadian Northern Economic Development Agency, Aboriginal Affairs and Northern Development Canada and the Polar Continental Shelf Project. Logistical and analytical contracts were arranged through the NTGO and the Government of the Northwest Territories. The GSC provided assistance in the form of geoscientific expertise and project management experience in the conduction of regional geochemical field surveys and support through the Targeted Geoscience Initiative 4 Program.

The protocols utilized throughout the survey are those developed for the National Geochemical Reconnaissance (NGR) program. By utilizing a standard set of sample collection and analytical techniques, the value of the national database of geochemical surveys is enhanced. The national database has been constructed to supply data for resource assessments, mineral exploration, geological mapping and environmental studies. The sample collection, preparation procedures, and analytical methods are strictly specified and monitored to ensure a high level of quality assurance and quality control, which ensures consistent and reliable results regardless of the area, date of the survey, or the analytical laboratory utilized (Friske and Hornbrook, 1991).

The use of HMC as an exploration tool is by no means a new idea. One has only to recall the stereotypical image of the prospector hunched over a gold pan to recognize the longevity and successfulness of this approach at finding new mineral resources. Modern techniques are somewhat different, but embody the same basic principals as used by the prospectors of old. With only a single bulk sample, precious metals, base metals and diamond indicator minerals can all be prospected for simultaneously.

Metallic minerals, economically significant sulphide minerals, and silicate minerals associated with ore deposits, are often denser than the more common rock-forming minerals. By using density as the arbitrator, a large volume of material can be efficiently sorted and the minerals of interest isolated. While

the commodity of interest can be the separated mineral itself, as in the case of gold panning, more often in modern exploration, the separated minerals are indicator minerals that signal the proximity of a mineral deposit such as a diamond-bearing kimberlite.

The initial stream-sediment program conducted made it clear that this type of survey offers a highly efficient and cost-effective tool for the evaluation of mineral potential across large regions (Day et al., 2012). However, due to financial constraints, the initial survey of this area of the Mackenzie Mountains focused on the collection of stream silt and water samples alone (Fig. 2). During the evaluation of the results, several observations indicated that this approach was not ideal for comprehensively evaluating the mineral potential of this large and very remote region. One of the identified issues was that in carbonate-dominated watersheds, zinc is not very mobile and therefore zinc mineralization is hard to detect. As zinc showings are numerous in the Mackenzie Mountains and known to exist in this region (Dewing et al., 2006; Fischer, 2012) and have represented one of the primary exploration targets, this is a serious problem. A second issue is the potential for either an over- or under-representation of gold in silt samples due to the limited amount of material analysed in a standard silt analyses and the likelihood of the “nugget effect”. Finally, standard silt-geochemistry techniques are not well-suited for identifying kimberlites, as many of the elemental concentrations in kimberlite are not sufficiently distinctive from the background values of the other rocks. The Mackenzie Mountains region was a formative area for the development of the diamond exploration, efforts that ultimately resulted in the discovery of the Ekati and Diavik Mines (Godwin and Price, 1986). Consequently, it was decided to collect larger “bulk” samples for HMC analysis, to augment the previously collected silt and water samples.

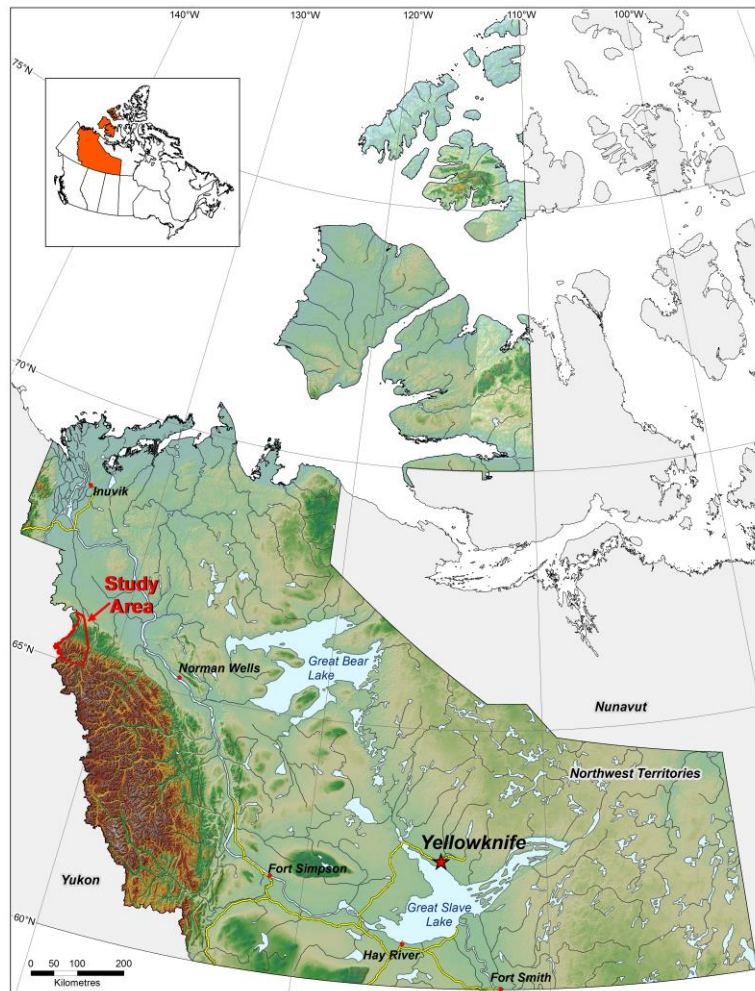


Figure 1. Physiographic relief map of the Northwest Territories, showing the location of the study area (outlined in red) in the Mackenzie Mountains. Inset map indicates the location of the Northwest Territories within Canada.

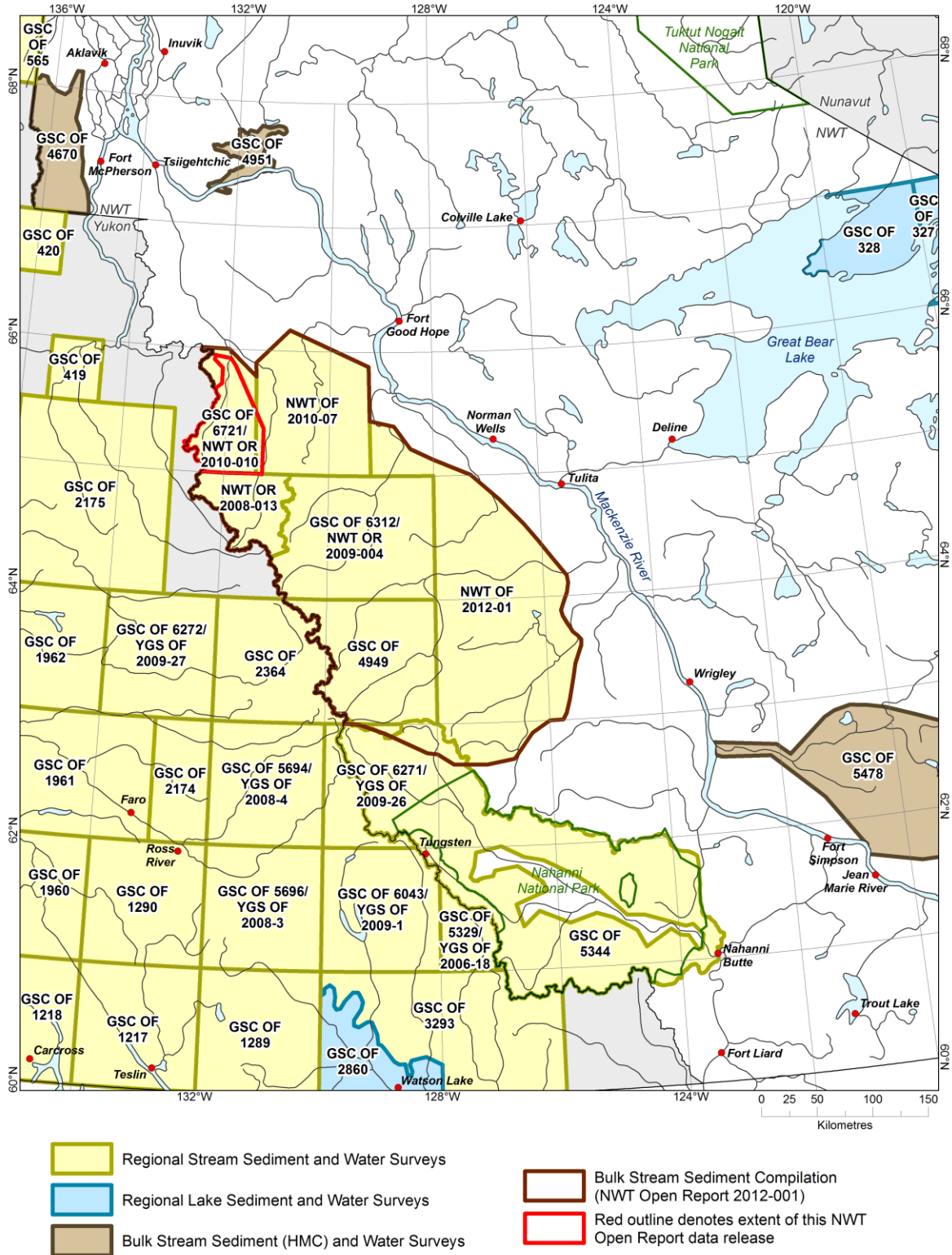


Figure 2. Map of the surrounding National Geochemical Reconnaissance coverage in the Northwest Territories and Yukon. GSC OF = Open File series published by the Geological Survey of Canada (Ottawa). NWT OF = NWT Open file series published by the Northwest Territories Geoscience Office. YGS OF = Open File series published by the Yukon Geological Survey.

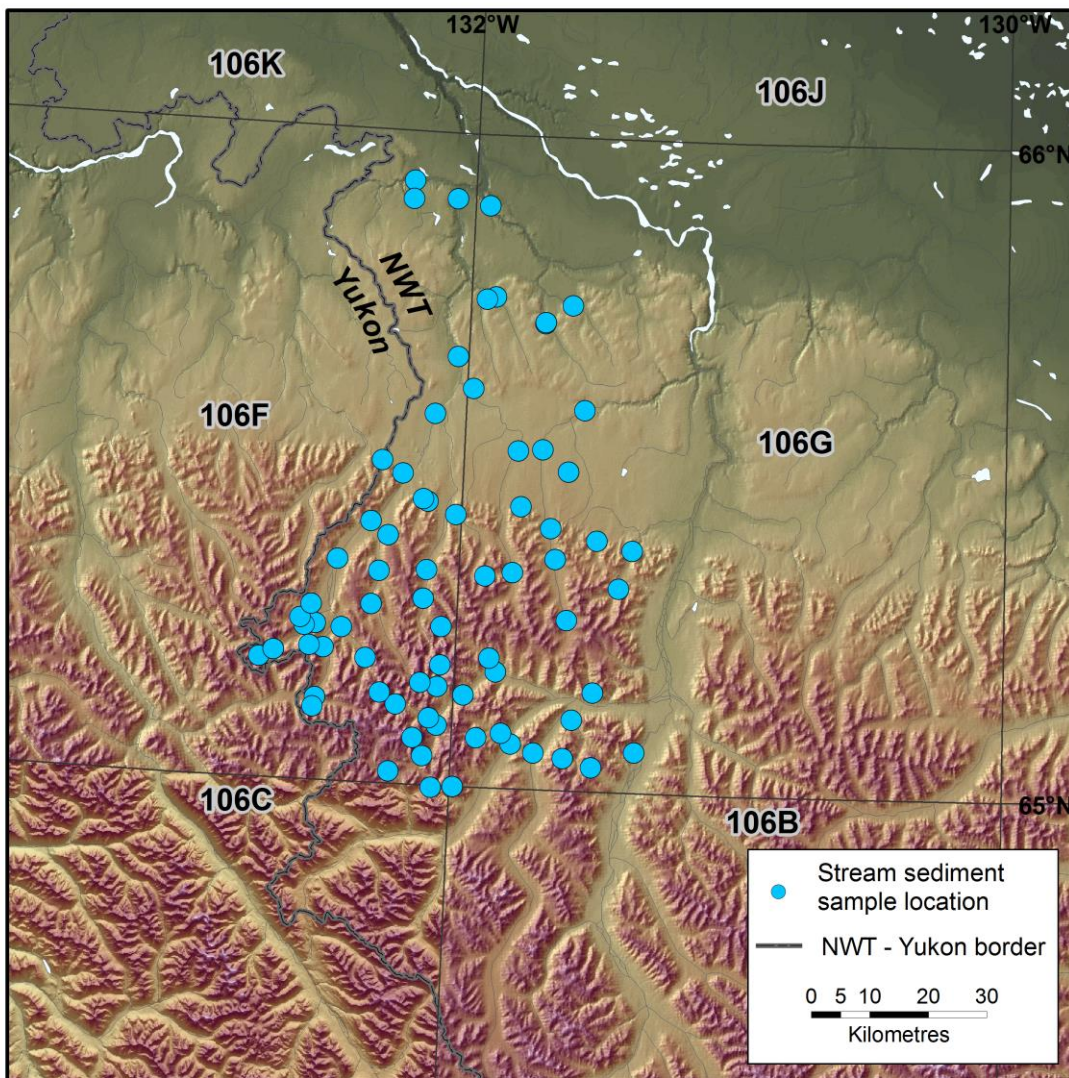


Figure 3. Physiographic relief map showing the locations of samples collected during the 2012 field seasons.

SAMPLE COLLECTION

Sample Numbering and Quality Control Systems

Following NGR protocols, target sample sites were selected prior to initiation of the survey, and every sample collected, analysed and ultimately archived, was assigned a unique sample number at collection. This unique identifier follows the sample through the analyses and publication cycle and any subsequent

sample re-analyses. The NGR sample number is a concatenation of National Topographic System (NTS) mapsheet, year of collection, field party number, and a three-digit sequential number. For example, “106F-2012-1002” represents sample 002 collected by field party number 1 in 2012 in the NTS mapsheet 106F. Bulk-sediment sample unique identifiers were assigned an additional appendix of BS, for example “106F-2012-1002BS”.

At the time of collection, each sample number is assigned a Replicate Status (Rep Stat) value, which indicates the nature of a sample. Routine, field duplicate (FD) pair, blind (or lab) duplicate (BD) and control reference (CR) samples are the four categories of Replicate Status (Rep Stat), which are designated 0, 10 (first sample of field duplicate pair), 20 (second sample of field duplicate pair), 80, and 90 respectively.

A block of twenty sequential sample numbers is used as a data management unit (Fig. 4). The block is made up of 16 routine samples from 16 sites, a field duplicate pair where 2 samples were collected several meters apart from at the one site, a control reference sample of certified material, and a blind (or lab or pulp) duplicate sample.

Unique Identity <i>(UniqueID)</i>	Replicate Status <i>(RepStat)</i>	Control Reference Material <i>(CRMID)</i>	Field Duplicates <i>(FDpointer)</i>	Blind (Lab/Pulp) Duplicates <i>(BDpointer)</i>
106F-2012-1001	80			106F-2012-1012
106F-2012-1002	0			
106F-2012-1003	0			
106F-2012-1004	0			
106F-2012-1005	0			
106F-2012-1006	0			
106F-2012-1007	0			
106F-2012-1008	0			
106F-2012-1009	0			
106F-2012-1010	0			
106F-2012-1011	0			
106F-2012-1012	10		106F-2012-1013	106F-2012-1001
106F-2012-1013	20		106F-2012-1012	
106F-2012-1014	90	STSD4		
106F-2012-1015	0			
106F-2012-1016	0			
106F-2012-1017	0			
106F-2012-1018	0			
106F-2012-1019	0			
106F-2012-1020	0			

Figure 4. Chart showing breakdown of a “Block of 20” sample numbers, highlighting routine, control reference, field duplicate and blind duplicate samples.

The goal of this sample and data management system is to ensure data integrity by the careful use of quality control measures.

Field Data

At each sample site, a series of site-specific field observations were recorded. Data collection during this survey was duplicated, as a new tablet-based protocol (Pierce et al., 2012) was tested alongside the paper-based method of the past. For the paper-based method, a standardized form developed for NGR surveys ensured that the observations would be comprehensive and consistent for every site (Fig. 5), and locations were recorded using a Garmin GPSMAP 76 series global positioning unit.

NTS SHEET	YEAR	SAMPLE NUMBER	REP. STAT.	WIDTH	DEPTH	DATE DAY	DATE MO	TIME	COLLECTORS																																															
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Figure 5. Example of form used to collect site-specific field data. Full form, complete with field code explanation, is in Appendix A.

The tablet-based protocol utilized an Apple iPad3 with a number of associated apps (Pierce et al., 2012). Target sample sites selected prior to initiation of the survey, were uploaded to the GlobalScout app, which was used to navigate to the sample sites, maintain helicopter track and speed data, and record sample locations. A custom data-entry form, that emulated the paper forms, was designed and compiled with FileMaker Pro 12. By using this software, data could be auto-entered, and validated, and calculations performed to populate fields, thus creating a database with fewer data entry errors. The corresponding FileMaker Go app collected field observations on the iPad, in addition to recording location coordinates from the iPads' internal GPS and storing two database-embedded site photographs taken with the iPad's built-in camera. Screen shots of the data-entry forms are shown below (Fig. 6). The FileMaker database was then converted to an Excel file, eliminating the need for manual data transcription.



Figure 6. Example of FileMaker forms used to collect field data and site photographs.

Stream Waters

Water samples were collected by wading to a mid-channel site with active flowing water. The sample was collected after the sample bottle had been rinsed three times in flowing water. Bottles were 125 ml Nalgene high-density polyethylene bottles. Samples were collected by dipping the bottle into the water and holding it well below the surface on the upstream side of the sampler. The bottle was filled to capacity leaving no air space in the neck.

Stream Sediments (Silts)

At each site, a pre-labelled Hubco New Sentry spunbonded polyester fabric (18 cm x 32 cm) sample bag (Fig. 8) was two-thirds filled with silt and fine sand collected from the active stream channel. Commonly, the sampler collected handfuls of silt from various points in the active stream channel while moving gradually upstream. If the stream channel consisted of clay or coarse sediments from which suitable sample material was scarce or absent, moss mat from the stream channel, which commonly contains trapped silt, may have been added to the sample and noted. The silt sample was collected after the water samples were taken.

Bulk Stream Sediments (for Heavy Mineral Concentrates)

HMC sample locations were chosen with a preference for larger drainages, while maintaining the idealized density of 1 sample per 26 square kilometres. In contrast to the silt-sampling procedure, where very fine-grained particles of silt or clay are collected from quiet water deposits, high-energy depositional environments are the preferred sediment source for heavy minerals analysis. The targeted location for a sample is at a point in the water flow path where a disruption to the flow causes the water column to lose velocity, resulting in a reduction in the water's carrying capacity and causing heavy minerals to drop out of suspension. The samples were collected from a wide variety of environments including large gravel bars (longitudinal and point bars) in rivers, boulder traps, and tiny pools of sediment in rocky narrow creeks. Where possible, the upstream noses of active longitudinal bars were preferentially selected.

HMC fractions were collected as part of a larger bulk stream-sediment sample. Sandy to cobble-rich material was hand-shoveled out of a single hole using a spade, into a sieve placed on top of a 20-litre plastic pail (Fig.7).



Figure 7. HMC Sample collection including sieving and washing the sandy material from river gravels into a plastic bag lining the inside of the pail.

The pail was lined with a heavy-duty polyethylene plastic bag (18x24 inch, 5 Mil) and the material was wet-sieved through a 12-mesh (1.68 millimetre) stainless steel sieve capturing the finer material and discarding the coarse sands and gravels. When approximately 12 kilograms of material had been collected, the sample water was decanted and the plastic bag was sealed with black electrical tape. A second numbered and sealed sample bag was then used to further protect the sample from punctures and spillage during transportation. At the base camp, samples were catalogued and packed to fill 20-litre plastic pails for direct shipping to a commercial lab where they underwent preparation and analysis (Fig. 9).



Figure 8. Examples of typical tools used during bulk sampling for HMC concentrates, silt and water sampling. A sample suite is shown, including a 12-kilogram sample contained in the polyethylene bag to the left of the 20-litre plastic white pail. The sieve and plastic gold pan used during the wet sieving are sitting to the right of the short-handled spade used for excavating the material. A silt sample is contained in a Hubco sack (white with yellow tag in front of gold pan). Water samples are in 125 ml Nalgene bottles within the zip-lock bags. Also shown are Garmin GPS to identify and record sample locations and a checklist form to record observations on waterproof paper.



Figure 9. Sample pails filled and labeled for shipping to the commercial laboratory.

SAMPLE PREPARATION AND IN-FIELD MEASUREMENTS

Stream Waters

Within 24 hours of collection, water samples were filtered through single-use Millipore Sterivex-HV 0.45 µm filter units attached to 50 ml sterile plastic syringes. Approximately 50 ml of the 125 ml of collected water was filtered into new 60 ml bottles that had been rinsed with an initial 25 ml aliquot of filtered sample water. Using an Eppendorf pipette repeater with disposable plastic tips, 0.5 ml of 8M ultrapure HNO₃ was added to filtered water samples. Syringes were re-used after rinsing with distilled, de-ionized water, but replaced daily. At this stage of the process, control reference samples (filter, acid and travel blanks) were inserted into each block of 20 water samples. Filter (sample) blanks are 60 ml bottles filled with the same de-ionized water used in the field that has been filtered and acidified at the same time as routine samples. Acid blanks are samples of the de-ionized water from the batch used in the field and acidified (but not filtered) at the same time as routine samples. Travel blanks are bottles of de-ionized water pre-filled at the lab in advance of field collection and stored with the acidified routine samples in the field. There were no blind duplicate water samples. Filtered and acidified waters were kept in a cool dark place until shipment to the lab.

The remainder of each unfiltered water sample was used for the determination of pH and conductivity before being discarded. The pH of stream waters was determined using an WTW MultiLine® P3 pH/LF-SET with automatic temperature compensation, a range of -2.00 to +16.0 pH, resolution of 0.01 pH and an accuracy of ±0.01 pH. Meters were calibrated using commercial buffer solutions with pH values of 4.0, 7.0, and 10.0. Conductivity of stream waters was determined using an WTW MultiLine® P3 pH/LF-SET with automatic temperature compensation and a range of 500 µS/cm, a resolution of 1 µS/cm and a full-scale accuracy of ±1%. Meters were calibrated using commercial conductivity standards.

Acidified and filtered stream water samples were analysed for trace metals.

Stream Silt Sediments

The Hubco sample bags containing the silt samples were partially air-dried in the field. After allowing the samples to dry as much as possible, they were then placed into pre-labeled plastic bags that were closed with electrical tape. Upon enumeration, samples were shipped directly to a commercial lab, where they were air-dried to completion at temperatures below 40° C, then sieved through an 80-mesh (177 µm) screen. Prior to analyses, control reference and blind duplicate samples were inserted into each block of twenty sediment samples.

Bulk Stream Sediments

The bulk sediment samples did not receive any processing in the field. Prior to shipping samples to the lab, a number of blank and/or spiked samples were inserted into the sample population.

ANALYTICAL PROCEDURES

Stream Waters

Filtered and acidified stream-water samples were analyzed for trace metal at GSC laboratories in Ottawa. A complete list of elements and stated detection limits are given in Table 1.

Table 1. Analytes determined in stream water samples

Parameter	Method	Method	units	Detection Limit
pH	meter	DIRECT	unit	0.1
Conductivity	meter	DIRECT	µS/cm	10
Alkalinity	PC-Titrate	as CaCO3	ppm	1
Ag	ICP-MS	DIRECT	ppb	0.005
Al	ICP-MS	DIRECT	ppb	2
As	ICP-MS	DIRECT	ppb	0.1
B	ICP-MS	DIRECT	ppb	0.5
Ba	ICP-MS	DIRECT	ppb	0.2
Be	ICP-MS	DIRECT	ppb	0.005
Bi	ICP-MS	DIRECT	ppb	0.02
Cd	ICP-MS	DIRECT	ppb	0.02
Ce	ICP-MS	DIRECT	ppb	0.01
Co	ICP-MS	DIRECT	ppb	0.05
Cr	ICP-MS	DIRECT	ppb	0.1
Cs	ICP-MS	DIRECT	ppb	0.01
Cu	ICP-MS	DIRECT	ppb	0.1
Dy	ICP-MS	DIRECT	ppb	0.005
Er	ICP-MS	DIRECT	ppb	0.005
Eu	ICP-MS	DIRECT	ppb	0.005
Ga	ICP-MS	DIRECT	ppb	0.01
Gd	ICP-MS	DIRECT	ppb	0.005
Ge	ICP-MS	DIRECT	ppb	0.02
Hf	ICP-MS	DIRECT	ppb	0.01
Ho	ICP-MS	DIRECT	ppb	0.005
In	ICP-MS	DIRECT	ppb	0.01
La	ICP-MS	DIRECT	ppb	0.01
Li	ICP-MS	DIRECT	ppb	0.02
Lu	ICP-MS	DIRECT	ppb	0.005
Mn	ICP-MS	DIRECT	ppb	0.1
Mo	ICP-MS	DIRECT	ppb	0.05
Nb	ICP-MS	DIRECT	ppb	0.01
Nd	ICP-MS	DIRECT	ppb	0.005
Ni	ICP-MS	DIRECT	ppb	0.2
Pb	ICP-MS	DIRECT	ppb	0.01
Pr	ICP-MS	DIRECT	ppb	0.005
Rb	ICP-MS	DIRECT	ppb	0.05
Re	ICP-MS	DIRECT	ppb	0.005
Sb	ICP-MS	DIRECT	ppb	0.01
Se	ICP-MS	DIRECT	ppb	1
Sm	ICP-MS	DIRECT	ppb	0.005

Parameter	Method	Method	units	Detection Limit
Sn	ICP-MS	DIRECT	ppb	0.01
Sr	ICP-MS	DIRECT	ppb	0.5
Ta	ICP-MS	DIRECT	ppb	0.01
Tb	ICP-MS	DIRECT	ppb	0.005
Te	ICP-MS	DIRECT	ppb	0.02
Th	ICP-MS	DIRECT	ppb	0.02
Ti	ICP-MS	DIRECT	ppb	0.5
Tl	ICP-MS	DIRECT	ppb	0.005
Tm	ICP-MS	DIRECT	ppb	0.005
U	ICP-MS	DIRECT	ppb	0.005
V	ICP-MS	DIRECT	ppb	0.1
W	ICP-MS	DIRECT	ppb	0.02
Y	ICP-MS	DIRECT	ppb	0.01
Yb	ICP-MS	DIRECT	ppb	0.005
Zn	ICP-MS	DIRECT	ppb	0.5
Zr	ICP-MS	DIRECT	ppb	0.05
Br	ICP-ES	DIRECT	ppm	0.05
Ca	ICP-ES	DIRECT	ppm	0.02
Cl	ICP-ES	DIRECT	ppm	0.1
Fe	ICP-ES	DIRECT	ppm	0.005
K	ICP-ES	DIRECT	ppm	0.05
Mg	ICP-ES	DIRECT	ppm	0.005
Na	ICP-ES	DIRECT	ppm	0.05
P	ICP-ES	DIRECT	ppm	0.05
S	ICP-ES	DIRECT	ppm	0.05
Sc	ICP-ES	DIRECT	ppm	0.001
Si	ICP-ES	DIRECT	ppm	0.02

Trace metal analyses were performed using a Thermo X Series 2 quadrupole inductively coupled plasma mass spectrometer (ICP-MS) with Xt cones, PlasmaScreen fitted, standard concentric nebulizer and Peltier cooled conical impact bead spray chamber (3°C) using Rh and Ir as internal standards. The isotopes included in the measurements and corrections for spectral interferences are detailed in Hall et al. (1995, 1996).

Stream Silts

Instrumental Neutron Activation Analysis (INAA)

Neutron activation is a non-destructive analytical method that is often utilized for accurate gold measurements. As the analysis does not rely on an acid dissolution and extraction it gives a total value for the contained elements, which is important for elements that are difficult to dissolve such as gold, barium and tungsten. Weighed and encapsulated samples, normally 30 g per vial, were assembled as bundled packages with internal and international reference standards. The 30 centimetre-long bundles were then

irradiated with neutron flux monitors at the McMaster Nuclear Reactor. The bundles were inserted into the core of a nuclear reactor for up to twenty minutes where they were exposed to a flux of 8×10^{12} neutrons/cm²/s. The irradiation of the sample causes many of the contained elements to become radioactive and begin to emit gamma radiation with energies (or wavelengths) that are characteristic of each contained element.

After a decay period of usually six days, the irradiated samples were loaded onto the counting system. The radiation from each sample was measured over a 20- to 30-minute counting time by a gamma-ray spectrometer with a high resolution, coaxial germanium detector. Gamma rays radiate continuously and the interaction of the rays with the detector leads to discrete voltage pulses, whose strength is proportional to the energy of the incident gamma-rays. A multichannel analyser classified the voltage pulses from the detector according to their energy and digitally constructed a spectrum of gamma-ray energies versus intensities. Using peaks determined from library standards, the spectral peak positions and areas from each element were qualitatively and quantitatively identified. The results of the analysis were computed and data reports were generated.

The elements determined using neutron activation are identified in Table 2.

Inductively Coupled Plasma Spectrometry

Sixty-five elements were determined by inductively coupled plasma (ICP) spectrometry. For these determinations, a 0.5 gram sample was leached with 6 mL/g of concentrated HCl, HNO₃ and demineralised water (2:2:2 v/v) at 95° C in a beaker for one hour. After cooling the solution was made up to a final volume with 5% HCl. The ratio of sample weight to solution volume was 0.5 g per 10 ml. The sample solution was analysed by ICP emission spectroscopy (ICP-ES) and ICP mass spectroscopy (ICP-MS).

Loss-on-ignition (LOI) was determined using a one-gram sample. Each sample, in a Leco® crucible, was placed into a 100°C muffle furnace and brought up to 500° C for one hour. The oven was then cooled to 100°C and the crucibles transferred to a desiccator followed by cooling to room temperature. The crucibles were re-weighed to determine the loss-on-ignition.

Table 2. Analytes by method determined in stream silt samples

Parameter	Method	Units	Detection Limit
Ag	INA	ppm	2
Ag	ICP-MS	ppb	2
Al	ICP-MS	pct	0.01
As	INA	ppm	0.5
As	ICP-MS	ppm	0.1
Au	INA	ppb	2
Au	ICP-MS	ppb	0.2
B	ICP-MS	ppm	1
Ba	INA	ppm	50
Ba	ICP-MS	ppm	0.5
Be	ICP-MS	ppm	0.1
Bi	ICP-MS	ppm	0.02
Br	INA	ppm	0.5
Ca	ICP-ES	pct	0.01
Cd	INA	ppm	5
Cd	ICP-MS	ppm	0.01
Ce	INA	ppm	5
Ce	ICP-MS	ppm	0.1
Co	INA	ppm	5
Co	ICP-MS	ppm	0.1
Cr	INA	ppm	20
Cr	ICP-MS	ppm	0.5
Cs	INA	ppm	0.5
Cs	ICP-MS	ppm	0.02
Cu	ICP-MS	ppm	0.01
Eu	INA	ppm	1
Fe	INA	pct	0.2
Fe	ICP-ES	pct	0.01
Ga	ICP-MS	ppm	0.1
Ge	ICP-MS	ppm	0.1
Hf	INA	ppm	1
Hf	ICP-MS	ppm	0.02

Parameter	Method	Units	Detection Limit
Hg	ICP-MS	ppb	5
In	ICP-MS	ppm	0.02
Ir	INA	ppb	50
K	ICP-ES	pct	0.01
La	INA	ppm	2
La	ICP-MS	ppm	0.5
Li	ICP-MS	ppm	0.1
LOI	GRAV	pct	0.1
Lu	INA	ppm	0.2
Mg	ICP-ES	pct	0.01
Mn	ICP-ES	ppm	1
Mo	INA	ppm	1
Mo	ICP-MS	ppm	0.01
Na	INA	pct	0.02
Na	ICP-MS	pct	0.001
Nb	ICP-MS	ppm	0.02
Ni	INA	ppm	10
Ni	ICP-MS	ppm	0.1
P	ICP-MS	pct	0.001
Pb	ICP-MS	ppm	0.01
Pd	ICP-MS	ppb	10
Pt	ICP-MS	ppb	2
Rb	INA	ppm	5
Rb	ICP-MS	ppm	0.1
Re	ICP-MS	ppb	1
S	ICP-MS	pct	0.02
Sb	INA	ppm	0.1
Sb	ICP-MS	ppm	0.02
Sc	INA	ppm	0.2
Sc	ICP-MS	ppm	0.1
Se	INA	ppm	5
Se	ICP-MS	ppm	0.1
Sm	INA	ppm	0.1
Sn	INA	ppm	100
Sn	ICP-MS	ppm	0.1

Parameter	Method	Units	Detection Limit
Sr	ICP-MS	ppm	0.5
Ta	INA	ppm	0.5
Ta	ICP-MS	ppm	0.05
Tb	INA	ppm	0.5
Te	INA	ppm	10
Te	ICP-MS	ppm	0.02
Th	INA	ppm	0.2
Th	ICP-MS	ppm	0.1
Ti	INA	ppm	500
Ti	ICP-MS	pct	0.001
Tl	ICP-MS	ppm	0.02
U	INA	ppm	0.2
U	ICP-MS	ppm	0.1
V	ICP-MS	ppm	2
W	INA	ppm	1
W	ICP-MS	ppm	0.1
Weight	INA	g	0.1
Y	ICP-MS	ppm	0.01
Yb	INA	ppm	2
Zn	INA	ppm	100
Zn	ICP-MS	ppm	0.1
Zr	INA	ppm	200
Zr	ICP-MS	ppm	0.1

Bulk Sediment Samples and Heavy Mineral Concentrates

HMC were progressively separated out of the bulk sediment samples at Overburden Drilling Management Ltd.’s (ODM) Ottawa facility. All samples were tabled to obtain a preliminary concentrate, which was then refined by sink-float separation in methylene iodide and subjected to a ferromagnetic separation as described in Fig. 11.

The samples were catalogued and weighed upon receipt at the laboratory. A 500-gram character sample was removed from each sample while the remaining 10-12 kilograms of sample were processed on a gravity table (shaker table) to separate out ultra-dense minerals such as gold or platinum group metal

(PGM) grains, and produce a preliminary concentrate. Gold grains derived from the sample were collected and counted at this stage followed by measurement of their size and classification of the degree of wear to assess transport distances. The collection of the gold grains was done directly or from a micro-panned fraction of the table concentrate. The table reject was re-tabled to ensure that kimberlite indicator minerals and sulphide indicator minerals were captured.

The table concentrate was dried and sieved through a 0.25 mm mesh with the fine-pass-through portion stored for geochemical analyses. The >0.25mm fraction is immersed in a methylene iodide liquid, which had been diluted with acetone to a specific gravity (SG) of 3.2. Denser minerals will tend to sink in this fluid while lighter minerals, which form the majority of the concentrate, will be floated off. Magnetite was removed using a ferromagnetic separator, after the heavy liquid separation and the remaining dense or “heavy” fraction was then cleaned of oxidation stains using oxalic acid.

Upon drying, the non-ferromagnetic SG >3.2-fraction was sieved into several size fractions (<0.25 mm, 0.25mm to <0.5mm, 0.5mm to <1.0 mm, 1.0 mm to 2.0 mm) and the fine (0.25 mm to <0.5 mm) heavy mineral fraction. The latter fraction is normally the largest fraction by weight and generally contains the greatest number of mineral grains than the coarser fractions, was electromagnetically partitioned into four subfractions – three paramagnetic (>1.0 amp, 1.0 to 0.8 amp, <0.8 amp) and one nonparamagnetic using a Carpco drum magnetic separator.

Mineral grains were then logged and visually identified in each of the size fractions and their sub-fractions. Those subfractions that exceeded 100 grams were characterized by a 100-gram split and then normalized to represent the total sample weight. As an additional step which can act as a check on the 100-gram splits, the 0.25 to <0.5 mm fraction was further characterized by counting and classifying all grains belonging to a set of 100 mineral grains. The identity of unusual or difficult-to-identify indicator minerals were resolved by a scanning electron microscope with energy dispersive x-ray analyser. The use of the kimberlite indicator mineral (KIM) process and the Magmatic or Metamorphosed Massive Sulphide Indicator Mineral (MMSIMs®) process ensured the identification of every mineral in the sample, not just specific targeted indicators and allowed the compilation of unique “assemblages” that aid in the recognition of the sample provenance. Each of the fractions and the identified grains are summarized in the excel spreadsheet and the column header identifies the source fraction.

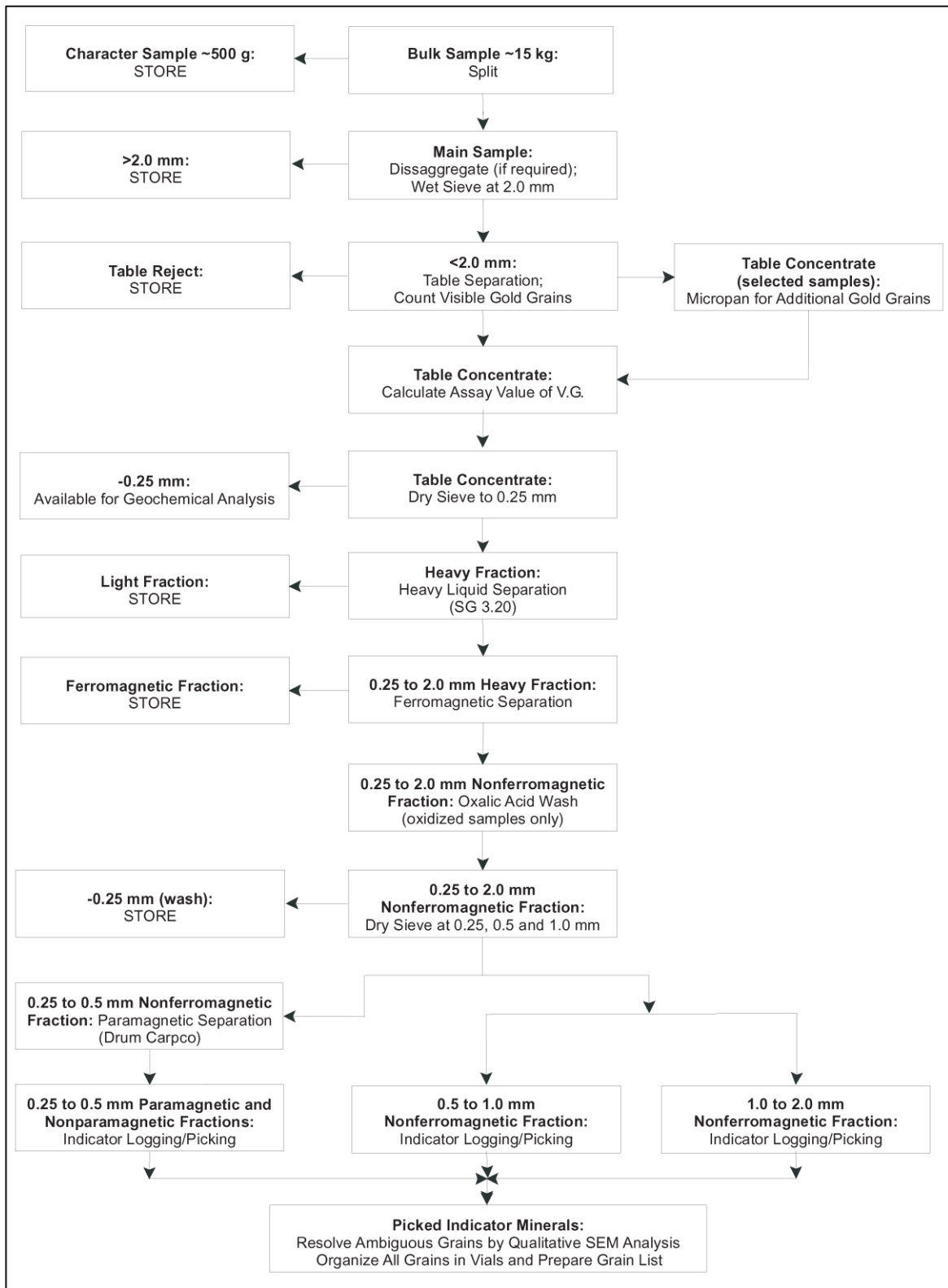


Figure 11. Flow sheet for separation of Kimberlite Indicator Minerals, Metamorphic Massive Sulphide Indicator Minerals[®], and gold grains.

GEOCHEMICAL ANALYSES OF HEAVY MINERAL FRACTIONS

While picked grains offer a wealth of information, additional information and quality assurance checks were gained utilizing both INAA and ICP-MS analyses on the unused *unwashed* <0.25 mm HMC size-fractions. These aliquots were shipped from Overburden Drilling management to Acme Analytical Laboratories, Vancouver for ICP-MS and to Becquerel Laboratory, Mississauga for INAA.

Instrumental Neutron Activation Analysis (INAA)

At Becquerel Laboratory, weighed and encapsulated samples, normally 30 g, were packaged for irradiation along with international reference materials, field duplicates and analytical duplicates. Samples and quality-control insertions were irradiated together with neutron flux monitors in a two-megawatt pool type reactor. After a seven-day decay period, samples were measured with a high-resolution germanium detector. Typical counting times were 500 seconds.

The elements determined using neutron activation are listed in Table 3. As the samples analysed in this study contained abundances of heavy minerals, which have high levels of response to the irradiation, an extended decay period was often required before measurements could be made. The density and composition of the samples combined with small weights often resulted in greater uncertainties and elevated detection limits when compared with rock or silt samples.

Inductively Coupled Plasma Spectrometry

An aliquot of the <0.25mm HMC was also sent to Acme lab for ICPMS and other analysis. The HMC fractions were catalogued upon arrival at the laboratory. A weighed portion of each sample was pulverized in a ceramic bowl and sieved through a minus 80-mesh screen. The fine-pass-through portion was then split into three sub samples for analysis.

A sample split of 0.5 g, was digested with a modified Aqua Regia solution of equal parts concentrated HCl, HNO₃ and de-ionized water for one hour on a heating block in a hot water bath. The sample solution was diluted to 20 ml with HCL and analysed by ICP-MS on a Perkin-Elmer Elan instrument. Elements analysed and their detection limits are presented in Table 3.

A second split was analysed for tin by Lithium metaborate/tetraborate fusion, as a detection limit of 1 ppm was required for Sn. A minimum of 0.2 g of sample was mixed with a LiBO₂/Li₂B₄O₇ flux in a graphite crucible and heated to fusion. The cooled bead was dissolved in ACS-grade nitric acid and analysed by ICP-MS on a Perkin-Elmer Elan instrument.

A final split was submitted for fluoride analysis by ion selective electrode, as a detection limit of 10 ppm was required. A sample split of at least 0.2 g was weighed into a crucible and mixed with 1:1 NaOH and then fused. After cooling, the fused sample was dissolved in de-ionized water, H₂SO₄ and NH₄ Citrate in a hot water bath. Solutions were then analysed with ion selective electrode.

Table 3. Analytes, analytical methods and detection limits used on the <0.25-mm fractions of heavy mineral concentrates. Detection limits shown for INAA are based on unmineralized samples as the majority of concentrated samples were highly mineralized the actual detection limits are higher. Abbreviations for methods are defined in the text.

Parameter	Method	Unit	Detection Limit
Wt	ICP-MS	g	0.01
Wt	INAA	g	0.01
Ag	ICP-MS	ppb	2
Ag	INAA	ppm	2
Al	ICP-MS	pct	0.01
As	ICP-MS	ppm	0.1
As	INAA	ppm	0.5
Au	ICP-MS	ppb	0.2
Au	INAA	ppb	2
B	ICP-MS	ppm	20
Ba	ICP-MS	ppm	0.5
Ba	INAA	ppm	50
Be	ICP-MS	ppm	0.1
Bi	ICP-MS	ppm	0.02
Br	INAA	ppm	0.5
Ca	ICP-MS	pct	0.01
Cd	ICP-MS	ppm	0.01
Cd	INAA	ppm	5
Ce	ICP-MS	ppm	0.1
Ce	INAA	ppm	5
Co	ICP-MS	ppm	0.1
Co	INAA	ppm	5
Cr	ICP-MS	ppm	0.5
Cr	INAA	ppm	20
Cs	ICP-MS	ppm	0.02
Cs	INAA	ppm	0.5
Cu	ICP-MS	ppm	0.01
Eu	INAA	ppm	1
F	Fusion	ppm	10
Fe	ICP-MS	pct	0.01
Fe	INAA	pct	0.2
Ga	ICP-MS	ppm	0.1
Ge	ICP-MS	ppm	0.1
Hf	ICP-MS	ppm	0.02
Hf	INAA	ppm	1
Hg	ICP-MS	ppb	5
In	ICP-MS	ppm	0.02
Ir	INAA	ppb	50
K	ICP-MS	pct	0.01
La	ICP-MS	ppm	0.5

Parameter	Method	Unit	Detection Limit
La	INAA	ppm	2
Li	ICP-MS	ppm	0.1
Lu	INAA	ppm	0.2
Mg	ICP-MS	pct	0.01
Mn	ICP-MS	ppm	1
Mo	ICP-MS	ppm	0.01
Mo	INAA	ppm	1
Na	ICP-MS	pct	0.001
Na	INAA	pct	0.05
Nb	ICP-MS	ppm	0.02
Ni	ICP-MS	ppm	0.1
Ni	INAA	ppm	10
P	ICP-MS	pct	0.001
Pb	ICP-MS	ppm	0.01
Pd	ICP-MS	ppb	10
Pt	ICP-MS	ppb	2
Rb	ICP-MS	ppm	0.1
Rb	INAA	ppm	5
Re	ICP-MS	ppb	1
S	ICP-MS	pct	0.02
Sb	ICP-MS	ppm	0.02
Sb	INAA	ppm	0.1
Sc	ICP-MS	ppm	0.1
Sc	INAA	ppm	0.2
Se	ICP-MS	ppm	0.1
Se	INAA	ppm	5
Sm	INAA	ppm	0.1
Sn	Fusion	ppm	1
Sn	ICP-MS	ppm	0.1
Sn	INAA	ppm	100
Sr	ICP-MS	ppm	0.5
Ta	ICP-MS	ppm	0.05
Ta	INAA	ppm	0.5
Tb	INAA	ppm	0.5
Te	ICP-MS	ppm	0.02
Te	INAA	ppm	10
Th	ICP-MS	ppm	0.1
Th	INAA	ppm	0.2
Ti	ICP-MS	pct	0.001
Ti	INAA	ppm	500
Tl	ICP-MS	ppm	0.02
U	ICP-MS	ppm	0.1
U	INAA	ppm	0.2
V	ICP-MS	ppm	2
W	ICP-MS	ppm	0.1
W	INAA	ppm	1

Parameter	Method	Unit	Detection Limit
Y	ICP-MS	ppm	0.01
Yb	INAA	ppm	2
Zn	ICP-MS	ppm	0.1
Zn	INAA	ppm	100
Zr	ICP-MS	ppm	0.1
Zr	INAA	ppm	200

DATA PRESENTATION

Data are presented in an Excel-format spreadsheet with multiple tabs. Field observations are provided on the Field Data tab; the remaining tabs hold analytical results as indicated by their names. The full sample number and coordinate location of each sample in latitude, longitude, and datum is carried onto every tab. Header rows explain the data, while abbreviations used in these rows and in the data cells are explained on the Abbreviations tab.

Analyses of silt and water samples are presented in the Silt Geochemistry and Water Geochemistry tabs, respectively. Below the sample analyses are duplicate analyses. The remaining tabs detail the results of the HMC work, in roughly the order of processing: gold and platinum-group mineral picks (Gold Summary and PGM tabs) from the initial <2.0 mm table separation, descriptions of the tabled material (Tabling Data tab), kimberlite-indicator mineral picks from the 0.25-0.5 fraction – see Fig. 11

To ease import of the data into a GIS, a single header row on each tab contains DBF-compatible headers; this row can be retained and the other header rows deleted in a copy of the file intended for import.

RESTRICTIONS

The data in this release may be viewed and modified by users of the product, but the original source of the data must be acknowledged. Redistribution of these data, in whole or in part, in its original or modified form, is prohibited without explicit written consent from the Northwest Territories Geoscience Office.

ACKNOWLEDGEMENTS

The authors wish to thank: Brent Robinson of Trinity Helicopters for his steady flying and enthusiasm, as well as North-wright Airways Ltd for their fixed wing support. The assistance and logistical support by Bob Greek of Matco Transportation Systems is also gratefully acknowledged and appreciated.

REFERENCES

Day, S.J.A., Lariviere, J.M., Friske, P.W.B., Gochnauer, K.M., MacFarlane, K.E., McCurdy, M.W., and McNeil, R.J., 2005. National Geochemical Reconnaissance (NGR): regional stream sediment and water geochemical data, Macmillan Pass–Sekwi Mountains, Northwest Territories: Geological Survey of Canada, Open File 4949, 1 CD-ROM.

Day, S.J.A., Falck, H., Friske, P.W.B., Pronk, A.G., McCurdy, M.W., McNeil, R.J., Adcock, S.W., and Grenier, A.G., 2009. Regional Stream Sediment and Water Geochemical Data, Mount Eduni area, northern Mackenzie Mountains NT (NTS 106A and part of 106B); Geological Survey of Canada, Open File 6312 / Northwest Territories Geoscience Office, NWT Open Report 2009-004, 1 CD-ROM.

Day, S.J.A., Falck, H., McCurdy, M.W., and McNeil, R.J., 2012. Regional Stream Sediment and Water Geochemical Data, Cranswick River Area, Northwest Territories (parts of NTS 106F and G); Geological Survey of Canada, Open File 6721 / NWT Geoscience Office, NWT Open Report 2010-010, 1 CD-ROM.

Dewing, K., Sharp, R.J., Ootes, L., Turner, E.C., and Gleeson, S., 2006. Geologic assessment of known Zn-Pb showings, Mackenzie Mountains, Northwest Territories: Geological Survey of Canada, Current Research 2006-A4, 14 p.

Falck, H. and Day, S.J.A., 2008. Preliminary Regional Stream Sediment and Water Geochemical Data, Backbone Ranges area, west-central Northwest Territories (parts of NTS 106B and C); Northwest Territories Geoscience Office, NWT Open Report 2008-013, 12 p.

Fischer, B.J., 2012. Carbonate-hosted Zn-Pb mineralization in the lower Cambrian Sekwi Formation, Mackenzie Mountains, NWT: Stratigraphic, structural and lithological controls, and constraints on ore fluid characteristics. Unpublished M. Sc. Thesis Laurentian University, Sudbury Ontario, 296 p.

Friske, P.W.B. and Hornbrook, E.H.W., 1991. Canada's National Geochemical Reconnaissance programme: Transactions of the Institution of Mining and Metallurgy, London Section B; Volume 100, p. 47-56.

Hall, G.E.M., Vaive, J.E., and McConnell, J.W., 1995. Development and application of a sensitive and rapid analytical method to determine the rare-earth elements in surface waters; *Chemical Geology*, Vol. 120, Nos. 1-2, pp. 91-109.

Hall, G.E.M., Vaive, J.E., and Pelchat, J.C., 1996. Performance of inductively coupled plasma – mass spectrometric methods used in the determination of trace elements in surface waters in hydrogeochemical surveys; *Journal of Analytical Atomic Spectrometry*, Vol. 11, pp. 779-786.

Godwin, C.I., and Price, B.J., 1986. Geology of the Mountain Diatreme, north-central Mackenzie Mountains, district of Mackenzie, NWT. *CIM Special Volume 37*, p. 298-310.

Ozyer, C.A., 2010. Ts'ude niline Tu'eyeta (Ramparts River and Wetlands) Candidate Protected Area Phase II Non-renewable Resource Assessment – Minerals, Northwest Territories, Canada; Northwest Territories Geoscience Office, NWT Open File 2010-07, 47 p. and 1 CD.

Ozyer, C.A., 2012. Shúhtagot'ine Néné Candidate Protected Area Phase II Non-renewable Resource Assessment – Minerals, Northwest Territories, Canada; Northwest Territories Geoscience Office, NWT Open File 2012-01, 47 p. and 1 CD.

Pierce, K.L, Rentmeister, K., and Falck, H., 2012. Tablets: a Peek into the Future of Field Data Collection, *in* Watson, D.M. (compiler), 40th Annual Geoscience Forum Abstracts, YKGSF Abstracts Volume 2012; Northwest Territories Geoscience Office, Yellowknife, p. 67-68.