


**YUKON NGR
STREAM SEDIMENT DATABASE
ASSESSMENT PROJECT**

Prepared for
Yukon Geological Survey
Whitehorse, Yukon

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Attachments (on disk)

2010 Report	Complete PDF version of this document
Digital Data	Complete listing (XLS) of data used to produce figures and diagrams, ARC SHP files used to produce the figures plus quality control sample location information
Open File Text	Original Open File summary text provided in PDF

EXECUTIVE SUMMARY

Historical regional geochemical survey (RGS) information continues to be a valuable tool for the ongoing development and support of mineral exploration in the Yukon. Government funded stream sediment and water surveys have been conducted in the Yukon since 1976 and the resulting database includes field and multi-element analytical information for over 31,000 samples. Completed to federal national geochemical reconnaissance (NGR) program standards¹, the survey work now covers over 80% of the territory (Figure 1). Unfortunately, relative to information generated by current laboratory techniques (e.g. ICPMS), original analytical data has become outdated due to poor detection levels and the limited number of key metals determined. Fortunately, many of the original samples have been saved and this material could be reanalyzed to take advantage of lower detection levels and an improved range of analytes routinely offered by modern laboratories. Experience in other jurisdictions has determined this type of work to be an extremely cost-effective means of improving regional geochemical databases and is highly regarded by groups that utilize this type of exploration resource.

Information compiled as part of the Yukon NGR Database Assessment Project will be used to formulate future analytical strategies and targeted research. This documented understanding of the overall state of the digital information and the condition of archived samples will help support future structural and analytical upgrades aimed at maximizing the utility of the database.

In order to summarize the status of the Yukon NGR program this report provides details on the collection, preparation and analysis of stream sediment samples located within the Yukon territorial boundary; the current condition of the published digital database; and, the type quality and quantity of archived sediment pulps saved from previous NGR surveys. Based on the findings of this study, recommendations are offered on possible maintenance and upgrades to the digital database, the sample archive and the current analytical element package.

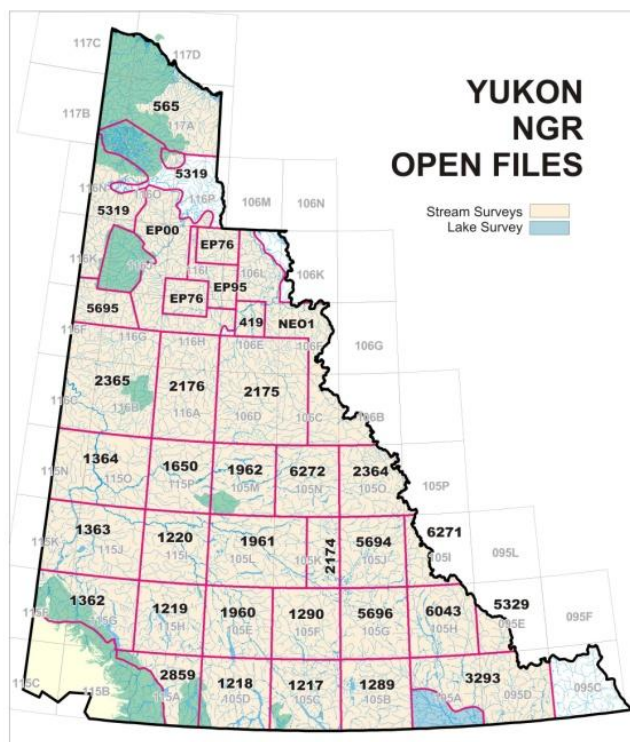


Figure 1. Map showing the location of current Yukon NGR Open Files.

¹ Friske, P.W.B. and Hornbrook, E.H.W. (1991) Canada's National Geochemical Reconnaissance programme; *in* Transactions of the Institution of Mining and Metallurgy, Section B; Volume 100, p. 47-56

YUKON NGR HISTORY

Sample Collection

The Yukon NGR program was initiated in 1976 and the most recent field survey was completed in 2006. These surveys were financially supported and managed in varying degrees by both the Geological Survey of Canada (GSC) and the Yukon Geological Survey (YGS). In order to maintain continuity between multiple surveys utilizing different contract services, all aspects of the projects were conducted to NGR standards and protocols.

Currently, the results of the stream based surveys are published in 34 Open Files (Figure 1 and Table 1) and include field and multi-element analytical information for a total of 31,386 samples sites located within the Yukon. This site total includes 2,199 stream sites that are currently located in protected areas. A single lake based survey comprised of 205 sample sites was completed in 1993 in parts of NTS map sheet 105A². This project has not been included in this report. A more detailed list of Open Files is provided in appendix A.

Table 1. List of published stream based Yukon NGR Open Files.

NGR OF	YEAR	NTS MAPS	SITES	NGR OF	YEAR	NTS MAPS	SITES
OF 0419	1976	106E	121	OF 2176	1976,77	116A,H	1218
OF 0565	1978	117A,B,C,D	1860	OF 2364	1990	105O,P	957
OF 1217	1985	105C	865	OF 2365	1976,77	116B,C,F,G	1738
OF 1218	1985	105D	1003	OF 2859	1993	115A,B	623
OF 1219	1985	115H	934	OF 3293	1995	095D,105A	1117
OF 1220	1985	115I	951	OF 5319	2004	116J,K,N,O,P,117B	655
OF 1289	1978	105B	959	OF 5329	2005	095E	171
OF 1290	1978	105F	877	OF 5694	1989	105J	886
OF 1362	1986	115G,F	1005	OF 5695	2006	116F,G,K	355
OF 1363	1986	115J,K	1305	OF 5696	1987	105G	914
OF 1364	1986	115O,N	1392	OF 6043	1987	105H	899
OF 1650	1987	115P	841	OF 6271	1981	105I	323
OF 1960	1988	105E	908	OF 6272	1990	105N	783
OF 1961	1988	105K,L	1378	OF EP00	2000	106E,116G,H,I,J,O,P	753
OF 1962	1987	105M	861	OF EP76	1976	106L,116H,I	609
OF 2174	1989	105K	467	OF EP95	1995	106E,L,116I	304
OF 2175	1976,77	106C,D,E,F	2058	OF NE01	2001	106B,C,E,F,L,K	1296

The surveys cover a total area of 416,387 square kilometres or 85% of the land mass of the Yukon. The overall average sample site density is 1 site in every 13.3 square kilometres. A 1978 survey (OF 0565) provides the highest samples density at 1 site in 11 square kilometres and only 7 surveys list average sample densities of less than 1 site in 15 square kilometers. Figure 2 shows the distribution of stream based sites and figure 3 provides a contoured image that illustrates the overall density of sampling in the Yukon.

² Friske, P.W.B., McCurdy, M.W., Day, S.J., Gross, H., Balma, R.G., Lynch, J.J., Durham, C.C. (1994): National Geochemical Reconnaissance Lake Sediment and Water Data, Southeastern Yukon (Parts of NTS 105A), Geological Survey of Canada Open File 2860

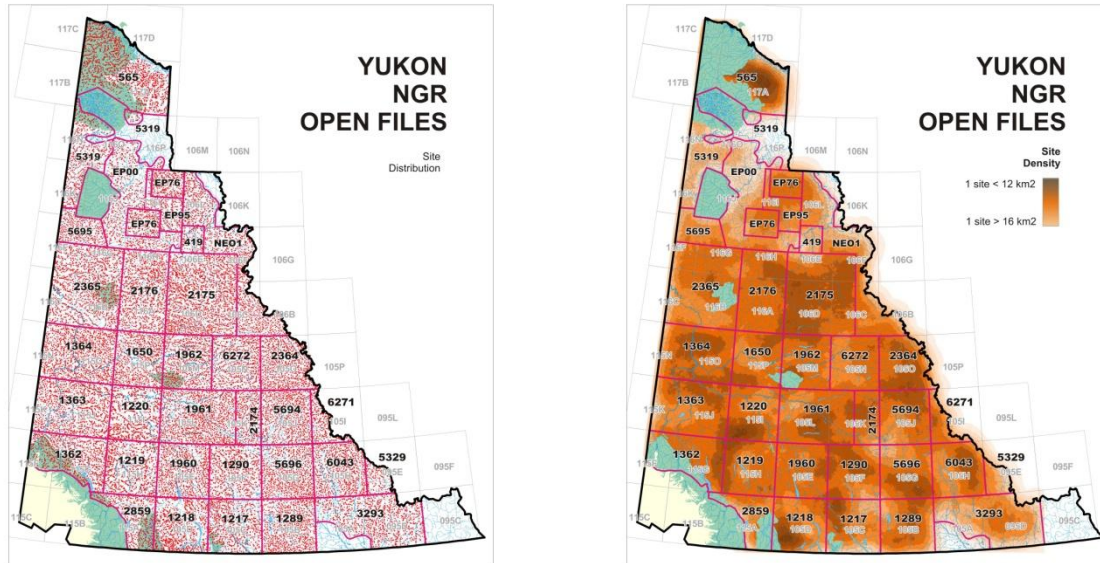


Figure 2 and 3. Maps showing the current stream sample site distribution and the sample site density for NGR survey work conducted within the Yukon territorial boundary.

Sample Preparation

Based on recorded field observations, sediment samples were generally comprised of fine grained silt-clay material that included varying amounts of coarser sands, small gravels and organics. Over 90% of the samples report fines content of at least 25% and the average loss on ignition (LOI) of 8.8% indicate a generally low organic component.

Characteristic to the design of NGR style surveys, only a relatively limited amount of sample material is available for analytical work. As a result, to obtain a representative sample for analysis, a portion of the raw sediment samples were sieved to -80 mesh (177 micron) and then ball-milled. The ball-milled pulps were used for the various multi-element and other analytical determinations.

To monitor analytical accuracy and precision, quality control measures including field duplicate samples, blind duplicate samples and standard reference materials were included in the analytical work. Prior to the release of the data packages a thorough evaluation of the quality control data was completed by GSC personnel. The results of this work are not published and are maintained at the GSC. As per NGR protocols, each batch of 20 samples include a field duplicate pair, a blind duplicate pair and a standard. These samples are inserted as part of the sample sequence. Currently the Yukon database includes about 1,835 field duplicate pairs, 1,835 blind duplicate pairs and 1,835 control reference samples.

Field duplicate pairs are often reported as part of NGR publication, but for the early Yukon surveys the second of the pair has not been included in the database.

As part of this report, a request has been made to access the quality control data. These data will assist future data leveling exercises and the quality control sample locations will be used for any subsequent reanalysis work.

Sample Analysis – Multi-Element Determinations in Stream Sediments

Analytical strategies used depend on the technologies available and the associated costs at the time of the original surveys. Initial Yukon survey work included a relatively rudimentary analytical package of 10 metals in sediments by atomic absorption spectrometry (AAS) plus tungsten by colorimetry (COL) and uranium by delayed neutron activation (NADNC). The analytical work was quickly enhanced over time to include other elements and determinations such as gold by fire assay, arsenic, antimony and loss on ignition. The new elements were recognized as being valuable for various targeted exploration and data mining activities. Twenty-nine surveys (28,156 samples sites) conducted from 1976 to 1996 include a range of metals determined by these methods (Figure 4). This work was completed by 4 different analytical laboratories; Chemex, Barringer, Bondar-Clegg and Cantech (Figure 5).

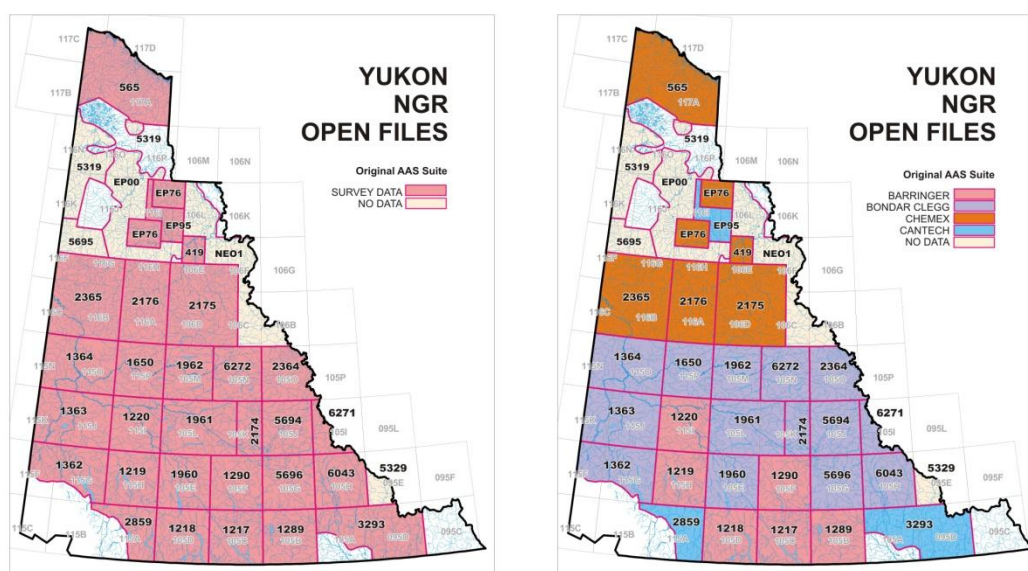


Figure 4 and 5. The map on the left shows the distribution of the original analytical work and the map on the right shows the distribution of the original analytical work subset by lab.

In 1990, instrumental neutron activation analysis (INAA) was introduced as a supportive analytical approach and added gold, pathfinder metals and rare earth elements to the NGR database. New surveys incorporated the technique and efforts were initiated to reanalyze pulps from previous (older) surveys. Currently, 18 surveys (14,434 sample sites) include data determined by INAA (Figure 6). Six of these projects (6,067 sample sites) were included in INAA reanalysis initiatives. This work was completed by 3 different labs; Activation, Becquerel and Bondar-Clegg (Figure 7).

The technique offered by Activation (thermal INAA) is slightly different from the other labs and as a result there are variations in lower detection levels for some elements. Some metals are also determined by both AAS and INAA. Detailed information on the relationship of these values can be found in the original Open File documents (included in this package).

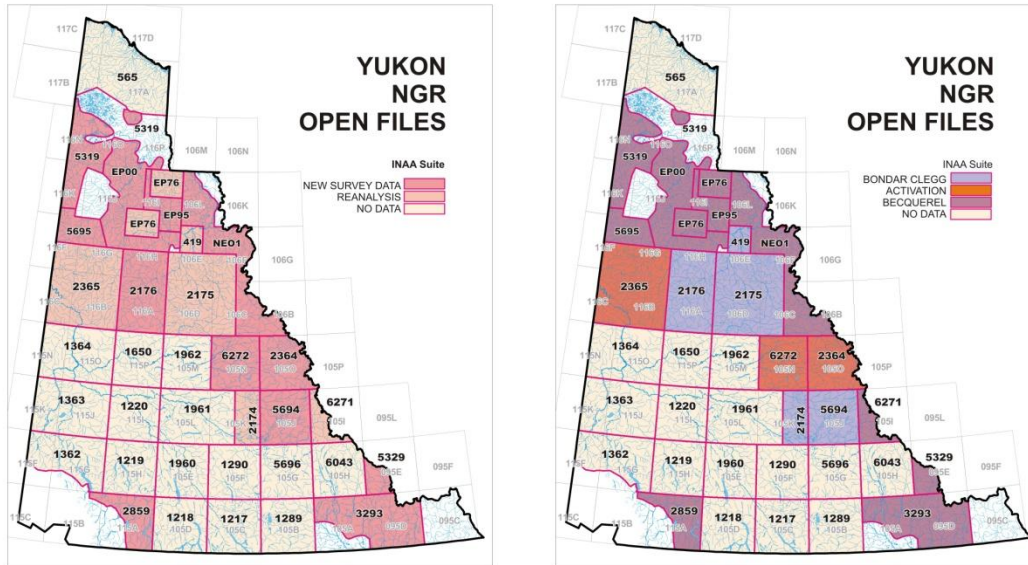


Figure 6 and 7. Maps showing the distribution of the INAA work subset by survey type and lab.

In 2001, inductively coupled plasma mass spectrometry (ICPMS) was recognized as the most effective analytical technique for trace elements and began to replace the use of AAS. A much wider range of analytes combined with considerably lower detection levels positioned this technique as the current standard. Although the method duplicates some of the AAS data, results for some elements such as Ag and Mo are significantly improved. The advantages provided by ICPMS have encouraged the reanalysis of pulps from previous surveys. Ten surveys (7,035 sample sites) include data determined by ICPMS. Five of these projects (3,805 sample sites) were included in ICPMS reanalysis initiatives (Figure 8). Acme Laboratories has completed all ICPMS work to date.

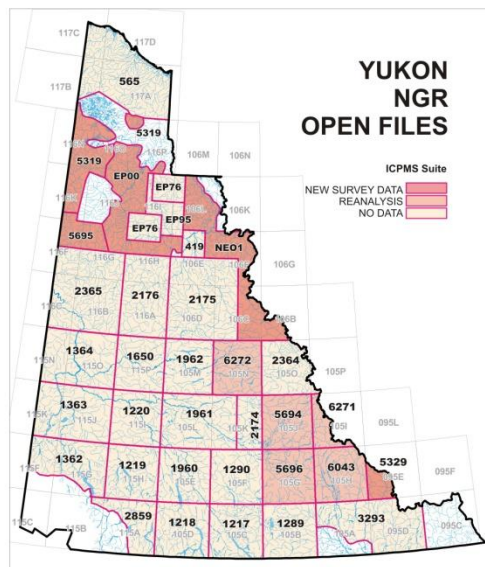


Figure 8. Map showing the distribution of the ICPMS work subset by survey type.

Sample Analysis – Gold in Stream Sediments

Gold data in stream sediments was determined on 10 gram and 5 gram samples by fire assay and was published for 20,715 samples sites. Gold by INAA is provided for 14,434 sample sites (figure 9). Sample weights for INAA samples are not consistently reported and when listed appear to average from 7 to 30 grams. In some cases, samples were analyzed twice for gold (1,609 sample sites). Four surveys include both FA and INAA gold data and survey Open File 0565 does not include any gold data.

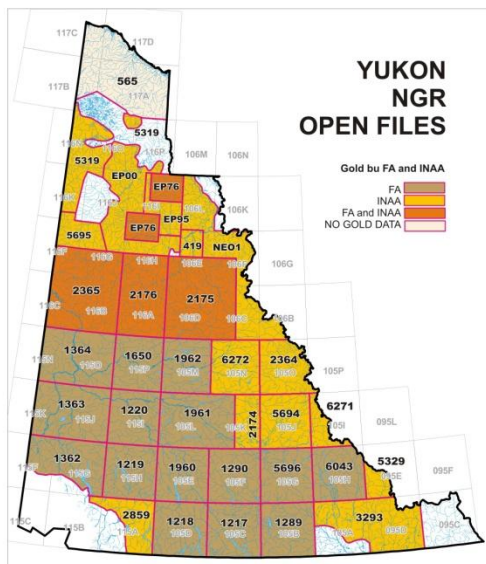


Figure 9. Map showing the distribution of the gold determinations by FA and INAA.

Sample Analysis – Other Comments

Some elements determined by both INAA and ICPMS packages are not necessarily published. This is due to inadequate detection limits and/or precision associated with the methods. Analytes by INAA that are often excluded from the reports include Ag, Cd, Ir, Mo, Ni, Se, Sn, Te, Zn, and Zr. For ICPMS, Au and B are usually not included in the published reports.

In addition to the multi-element stream sediment data, the surveys also report determinations for pH, fluoride and uranium in waters. Sulphate, conductivity and trace metal determinations were included in more recent surveys.

A summary of analytical information published for each NGR report is provided in Appendix A and maps showing the coverage of associated sample sites, summary statistics and element distribution maps are provided in Appendix B. The digital data file used to produce the tables and figures presented in this report is also provided. Specific details on analytical methods can be found in the original Open File documents (provided in package)

SAMPLE ARCHIVE - STORAGE

Initial survey design recognized the potential for analytical upgrades. To accommodate these opportunities, portions of both the ball-milled pulps and original unprocessed sediment samples have been saved and stored in Ottawa (Photos 1 and 2).



Photos 1 and 2. Photos showing ball-milled stream sediment pulps stored in vials and raw (unprocessed) steam sediment sorted in freezettes.

Ball-milled pulps are stored in plastic vials (~30 dram) and unprocessed (raw) sediment material is stored in plastic freezettes. The weights of the ball-milled pulps range from 0 to 30 grams and the weights of the freezettes average 350 grams. Saved unprocessed samples include a range of material from very coarse grained sands and gravels to fine grained silts and clays. Varying amounts of organics are also present (Photos 3 and 4)



Photos 3 and 4. Photos showing examples of saved raw samples that range from fine to coarse grained material. The darker sample on the far left indicates some organic content.

In most cases, sample containers from surveys conducted before 2000 are stored in trays. Each tray accommodates a single layer of about 180 vials or two layers of 36 freezettes (up to 72 total). The trays are stored by original survey year and by NTS map sheet. The containers are placed on the trays in sample id order (Photos 5 and 6).



Photos 5 and 6. Photos showing trays of stored vials and freezettes.

Several surveys include two complete sets of vials. In some cases, samples that have been determined by INAA are still stored in the sample pucks used for the technique. Being a non-destructive method and having sufficiently ‘cooled’ from the irradiation process, this material is now also available for future analysis work. There are also some miscellaneous boxes that appear to contain additional envelopes of sample material. Figure 13 shows the location of samples at the archive storage facility in Ottawa.

Within the collection are small blocks of samples that were not published as part of the original survey reports. The trays are marked with ‘not NGR samples’ and are found in Open File sets 2175, 2176 and 2365.

SAMPLE ARCHIVE - RECOVERY

In terms of sample recovery, it is estimated that most survey sets will have over 90% of the samples provide at least 5 grams to a maximum of 30 grams of ball-milled material. Over 80% of the raw samples will provide a -80 mesh size fraction (or smaller) weighing from 10 to 30 grams.

Only vials from OF 6271 appear to have limited ball-milled material available. The original survey was completed in 1982 and the samples have since been used for both INAA and ICP reanalysis upgrades. It is expected that some material may be available in INA pucks but the associated boxes were not found at the archive. The survey does have unprocessed material stored in freezette containers.

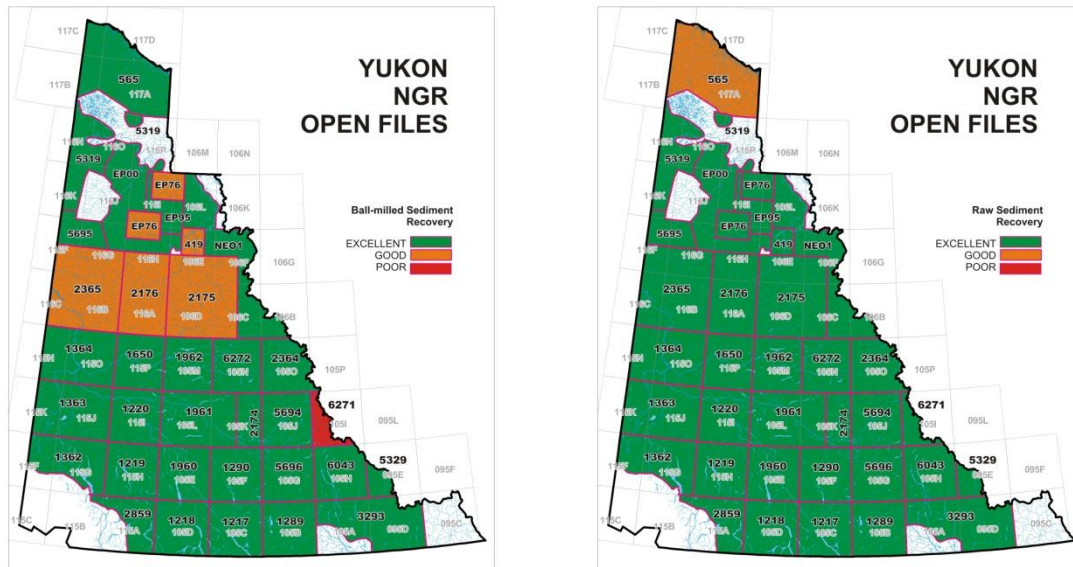


Figure 10 and 11. Maps showing the potential recovery of ball-milled and raw sediment.

It should be emphasized that archive material will not be available for all samples. This is due to a number of factors including a limited amount of fine grained material or quality of the original sample, the use of material for previous reanalysis work, and the loss of the sample due to storage container failure. Due to the age of some of the storage containers, the plastic has been damaged which potentially compromises the original condition and integrity of the sample (Photos 7 and 8).



Photos 7 and 8. Photos showing broken vials and freezettes.

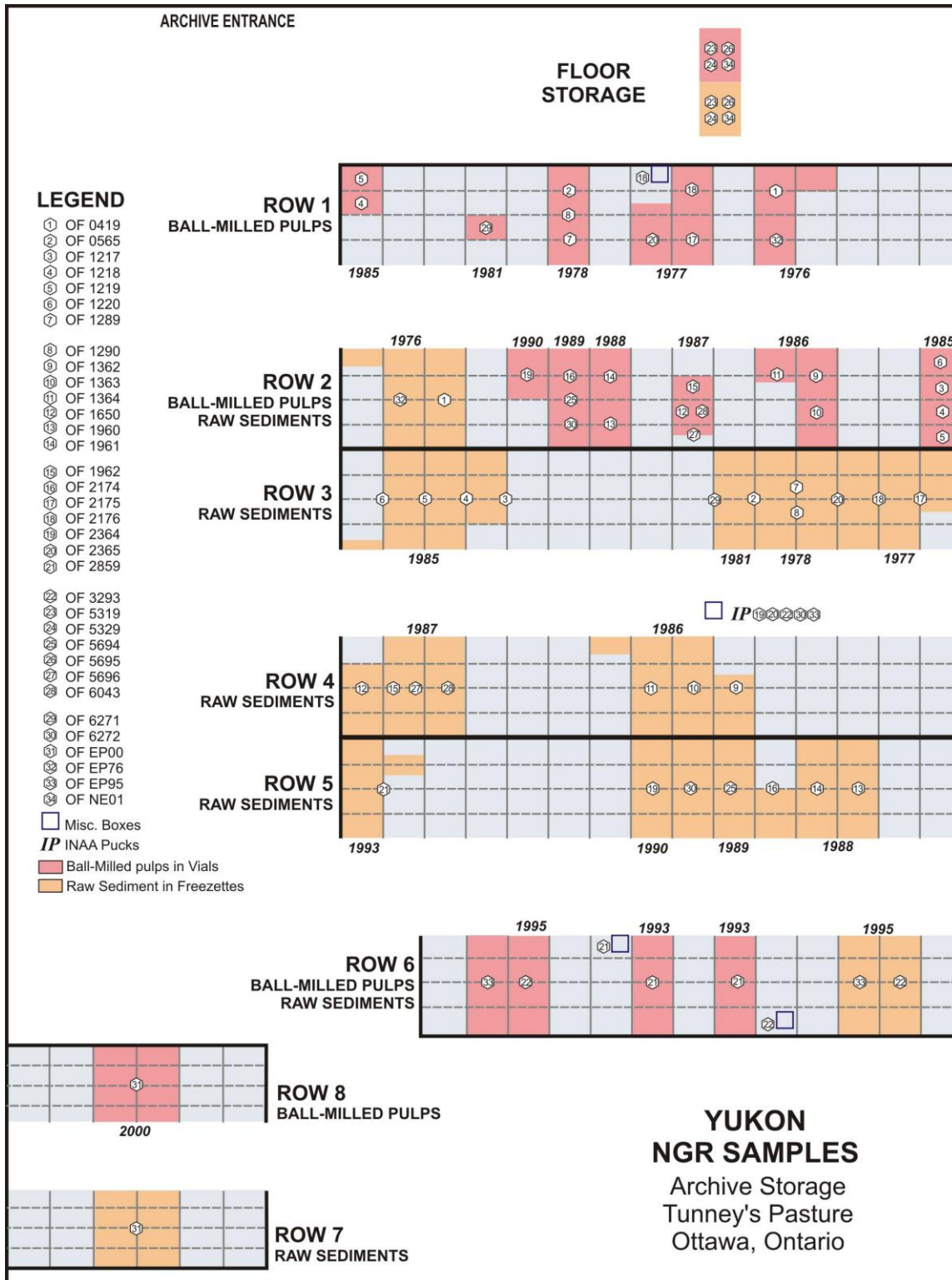


Figure 12. Map showing the location of samples at the archive storage facility.

PROPOSED RECOMMENDATIONS

Database

Large and complex datasets such as the Yukon NGR package are inherently disjointed. Compiled from multiple surveys that have been conducted over a 35 year time period will generate inconsistencies in both data structure and recorded field information (e.g. sample composition, field duplicates and INAA weights). Efforts should be made to check and verify the completeness of the information, plus provide consistent data structure and reporting for all survey results.

With the advent of GIS technologies, attributing point data such as NGR sample sites with other geosciences information has become relatively easy. Providing new data fields such as underlying bedrock geology, surficial geology and land use status could improve the utility of the database.

Data errors are also a common issue with many large datasets. With NGR style work, data confidence is a key to successful follow-up investigations particularly with sample location information. During a quick review of the data, several locations were questioned: OF 5319 IDs 1008, 1009 2006, 2095, 2066; OF 2859 ID 1006; and, OF NE01 ID 1059. To assist with the verification of site locations, scanning and georeferencing original field survey sample location maps would be very useful tool.

The current Yukon digital database is available through the YGS web site, the Natural Resources Canada (NRC) web site and GSC retail outlets. Unfortunately, the entire database is not available from a single source and associated metadata are often not up-to-date. To improve public access to the resource, efforts should be made to consolidate the information into a single dataset.

It has been suggested that access to original results for quality control samples would assist studies aimed at leveling original analytical data as well as other research. Although the data was requested as part of this compilation, the GSC wants to maintain control over the distribution of this information and is very hesitant to provide the results without specific details regarding possible research activities.

Archive

Due to the age of some of the storage containers, parts of the Yukon archive are at risk due to broken storage containers (Photos 7, 8). Previous efforts have been made to update the conditions at the storage facility but limited resources have hampered its completion. Further work should be completed to secure existing samples to current NGR storage standards and to re-archive sample used for previous reanalysis work.

Reanalysis

The sample archive could provide a multitude of value-added analytical upgrades to the Yukon NGR database. Over the last 20 years the archive has supported both INAA and ICPMS reanalysis projects which have added new analytical information for several previously surveyed areas. As part of this assessment, it has been determined that there is sufficient material for most of the survey areas to support additional analytical work. Although material is available either from original processed pulps or recovery from raw samples, the amount of sample will remain a controlling factor in any future analytical strategies. The probability of recovering 5 grams of material for a large percentage (>90%) of

the samples is reasonable, but the number of samples that will provide 30 grams of material will be considerably less.

For more common re-analysis activities (e.g. INAA and ICPMS) it would be suggested that the work utilize the ball-milled sample pulp when available. This would maintain the original analytical protocols associated with obtaining a representative sample as well as continuity with other completed lab work. In addition, the raw sample can then be saved for other strategies. Table 2 outlines the current status of the analytical database for each Open File report.

Table 2. The table provides a summary of completed analytical determinations (green) and determinations not currently available (red) for each Open File. Cells shaded in orange represent elements that are available from other analytical techniques (e.g. AAS and ICPMS).

OPEN FILE	A	C	C	F	H	M	M	N	P	Z	C	S	V	F	L	A	S	U	W	B	B	S	A	A
	G	O	U	E	G	N	O	I	B	N	D	N			O	S	B			A	I	E	U	U
	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	N	C	A	A	A	F	I
	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	O	A	A	A	A	N
	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	D	L	S	S	S	A	A
565																								
1217																								
1218																								
1219																								
1220																								
1289																								
1290																								
1362																								
1363																								
1364																								
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2174																								
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3293																								
EP95																								
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EP76																								
2175																								
2176																								
2365																								
5696																								
6043																								
5694																								
6272																								
6271																								
5319																								
5329																								
5695																								
EP00																								
NE01																								

INAA Analytes in sediments

AU, AS, BA, BR, CE, CO, CR, CS, EU, FE, HF, LA, LU,
MO, NA, NI, RB, SB, SC, SM, TA, TB, TH, U, W, YB

ICPMS Analytes in sediments

AG, AL, AS, B, BA, BI, CA, CD, CO, CR, CU, FE, GA, HG, K, LA, MG, MN, MO, NA, NI,
LA, MG, MN, MO, NA, NI, P, PB, S, SB, SC, SE, SN, SR, TH, TI, TL, U, V, W, ZN

Potentially, up to 24,351 samples could be rerun by ICPMS to provide a 37 or 51 suite of elements determined using low detection levels. The method is considered a very cost-effective means of upgrading geochemical databases with a wide range of new analytical information. Requiring only a 1 gram sample of the ball-milled pulp, this method would also ensure maximum sample inclusion and will not significantly reduce the overall availability of material for other options. Figure 13 provides an example of the ICPMS package offered by Acme Labs (Vancouver, BC). ALS Chemex (Vancouver, BC) offers a similar option.

Geochemical
Ultratrace Aqua Regia Digestion

Group 1F-MS
Ultratrace by ICP Mass Spec

ICP Mass Spec analysis of a 0.5, 15 or 30g sample after Aqua Regia digestion for low to ultra-low determinations on soils, sediments and lean rocks.

Larger splits (15 or 30g) give a more representative analysis of elements subject to nugget effect (e.g. Au). Au solubility can be limited in refractory and graphitic samples.

Sample minimum 1g pulp.

Acme Labs now offers analysis of Pb isotopes (Pb_{204} , Pb_{206} , Pb_{207} , Pb_{208}) suitable for geochemical exploration of U and other commodities where gross differences in natural to radiogenic Pb ratios, is a benefit. Isotope values can be reported in both concentrations and intensities.

Code	Group 1F-MS	Cdn
1F01	Basic Suite (37 elements) 0.5g	\$17.55
1F02	Basic Suite (37 elements) 15g	\$21.55
1F03	Basic Suite (37 elements) 30g	\$25.05
+1F08	Pd and Pt (add on)	\$2.00
+1F09	REEs (add on)	\$6.00
1F04	Full Suite (53 elements) 0.5g	\$20.70
1F05	Full Suite (53 elements) 15g	\$24.70
1F06	Full Suite (53 elements) 30g	\$28.20
+1F07	Lead isotope (add on)	\$12.00

*Some elements will report partial concentrations due to refractory minerals.

†Detection limit = 1 ppm for 15g / 30g analysis.

	Group 1F Detection	Upper Limit
Basic Suite		
Au*	0.2 ppb	100 ppm
Ag*	2 ppb	100 ppm
Al*	0.01 %	10 %
As	0.1 ppm	10000 ppm
B*	20 ppm	2000 ppm
Ba*	0.5 ppm	10000 ppm
Bi	0.02 ppm	2000 ppm
Ca*	0.01 %	40 %
Cd	0.01 ppm	2000 ppm
Co	0.1 ppm	2000 ppm
Cr*	0.5 ppm	10000 ppm
Cu	0.01 ppm	10000 ppm
Fe*	0.01 %	40 %
Ga*	0.1 ppm	1000 ppm
Hg	5 ppb	50 ppm
K*	0.01 %	10 %
La*	0.5 ppm	10000 ppm
Mg*	0.01 %	30 %
Mn*	1 ppm	10000 ppm
Mo	0.01 ppm	2000 ppm
Na*	0.001 %	5 %
Ni*	0.1 ppm	10000 ppm
P*	0.001 %	5 %
Pb	0.01 ppm	10000 ppm
S*	0.02 %	5 %
Sb	0.02 ppm	2000 ppm
Sc*	0.1 ppm	100 ppm
Se	0.1 ppm	100 ppm
Si*	0.5 ppm	10000 ppm
Te	0.02 ppm	1000 ppm
Th*	0.1 ppm	2000 ppm
Ti*	0.001 %	5 %
Tl	0.02 ppm	1000 ppm
U*	0.05 ppm	2000 ppm
V*	2 ppm	10000 ppm
W*	0.05 ppm	100 ppm
Zn	0.1 ppm	10000 ppm
Full Suite		
Be*	0.1 ppm	1000 ppm
Ce*	0.1 ppm	2000 ppm
Cs*	0.02 ppm	2000 ppm
Ge*	0.1 ppm	100 ppm
Hf*	0.02 ppm	1000 ppm
In	0.02 ppm	1000 ppm
Li*	0.1 ppm	2000 ppm
Nb*	0.02 ppm	2000 ppm
Rb*	0.1 ppm	2000 ppm
Re	1 ppb	1000 ppb
Sn*	0.1 ppm	100 ppm
Ta*	0.05 ppm	2000 ppm
Y*	0.01 ppm	2000 ppm
Zr*	0.1 ppm	2000 ppm
Pt*	2 ppb	100 ppm
Pd*	10 ppb	100 ppm

Figure 13. ICPMS package offered by Acme Labs (Vancouver, BC).
<http://acmelab.com/>

A total of up to 16,952 samples could be reanalyzed by INAA for gold, pathfinder metals and rare earth elements (REEs). This method would require at minimum of 10 grams of ball-milled material and for improved gold data, samples greater than 25 grams would be advised. The higher sample requirement may reduce the number of samples that will be included, but the method is non-destructive so the samples can be returned to the archive once they have 'cooled'. Figure 14 provides an example of the INAA package offered by Becquerel Labs (Mississauga, ONT).

Becquerel LABORATORIES

COMPANY PROFILE | ISO 17025 | CERTIFICATIONS | PEOPLE | CONTACT

PACKAGE: Au+33

Geological Exploration (for Soils, Sediments, Rocks and Drill Core)

An inexpensive package that is useful for geochemical exploration, it provides total analysis where elements are activated even when they are in the most refractory minerals. The method does not require fine pulverising and is therefore less vulnerable to loss of gold onto pulveriser surfaces or sample loss. This is an extremely sensitive (low ppb to low ppm range) trace method but it is not just a trace element technique since NAA is also capable of reporting at per cent levels.

Element	Unit	Typical Stream Sediment*
Antimony (Sb)	ppm	4.1
Arsenic (As)	ppm	27
Barium (Ba)	ppm	1400
Bromine (Br)	ppm	25
Cadmium (Cd)	ppm	<5
Cerium (Ce)	ppm	62
Cesium (Cs)	ppm	5.1
Chromium (Cr)	ppm	66
Cobalt (Co)	ppm	18
Europium (Eu)	ppm	2
Gold (Au)	ppb	7
Hafnium (Hf)	ppm	6
Iridium (Ir)	ppb	<50
Iron (Fe)	%	5.1
Lanthanum (La)	ppm	41
Lutetium (Lu)	ppm	0.3
Molybdenum (Mo)	ppm	5
Nickel (Ni)	ppm	32
Rubidium (Rb)	ppm	60
Samarium (Sm)	ppm	5.9
Scandium (Sc)	ppm	13
Selenium (Se)	ppm	<5
Silver (Ag)	ppm	<2
Sodium (Na)	%	1.4
Tantalum (Ta)	ppm	0.8
Tellurium (Te)	ppm	<10
Terbium (Tb)	ppm	1.1
Thorium (Th)	ppm	7.6
Tin (Sn)	ppm	<100
Tungsten (W)	ppm	3
Uranium (U)	ppm	9.7
Ytterbium (Yb)	ppm	3
Zinc (Zn)	ppm	210
Zirconium (Zr)	ppm	240

The Value of Independent Analysis

"Neutron Activation Analysis is based on physical processes and can provide an independent analysis for confirmation or verification."

Robert Allen
Supervisor, NAA

ISO 17025[®]
For Testing of Environmental No. 402

* For illustrative purposes. Actual analysis will vary.

Figure 14. INAA package offered by Becquerel Labs (Mississauga, ONT).
<http://www.becquerellabs.com/>

Reanalysis - Gold

Gold data is available for all reports except Open File 0565. For some survey areas, it has been suggested that the gold results are unexpectedly low. Original gold determinations by fire assay and INAA used the ball-milled pulps which should have improved the overall precision provided the gold is fine-grained such as that associated with chalcopyrite. However, milling may not have improved precision if there were larger gold nuggets in the sample³.

Analyzing a different size fraction acquired from the raw sample by fire assay and/or INAA may provide a better understanding of the original gold values. The work could target complete batches of samples or focus on samples that reported high gold and/or pathfinder numbers. For key areas (e.g. NTS 115 surveys) good quality and quantity of raw sample is available and can be expected to provide 20 to 30 grams of -80 mesh material for a large percentage (> 80%) of the samples.

Preparation of archived raw samples for other jurisdictions is often completed by Overburden Drilling Management Limited (ODM) located in Ottawa. The cost of this service is approximately \$8 per sample.

Although very rare in stream sediment surveys comprised of regionally spaced sample sites, high concentrations of certain elements and metals such as chromite, base metal sulphides, oxides, selenides and tellurides could interfere with the fire assay method causing low precious metal recoveries. To address this concern, the reanalysis by ICPMS could provide additional information for some of the metals that could be interfering with the fire assay work.

Reanalysis – Quality Control

To monitor analytical accuracy and precision it is strongly recommended that quality control samples are included in any reanalysis work. This would include verifying the availability of original field and analytical duplicate samples plus the insertion of new control reference material. Control reference material should include a combination of certified reference materials (CANMET - <http://www.nrcan.gc.ca/smm-mms/tect-tech/faq-faq-eng.htm>) and other appropriate stream sediment standards such as BC's Red Dog standard.

The NGR quality control protocol calls for the inclusion of three QC samples for every 17 routine samples. This addition will add 15% more samples to the total submitted to a lab as well as add to the cost of preparing the samples and analysis.

³ Ray Lett, personal communication, 2010.

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WWW ACCESS

Natural Resources Canada Geoscience Data Repository

<http://www.geology.gov.yk.ca/index.html>

Yukon Geological Survey Web Site

<http://www.geology.gov.yk.ca/index.html>

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