



11SH	105E	105F
AISHHIK LAKE	LAKE LABERGE	QUIET LAKE
115A	105D	105C
DEJASEASH RANGE	THIS MAP	TESLIN
114P	104M	104N
TATSHENSHINI RIVER	SKAGWAY	ATLIN

INTRODUCTION

New geochemical data from re-analysis of archived stream sediment samples have been assessed using weighted sums modeling and catchment basin analysis as described in the methodology report that accompanies this map (Mackie et al., 2015). Both commodity and pathfinder element abundances are evaluated to highlight areas that show geochemical responses consistent with a variety of base and precious-metal mineral deposit types. The results of modeling, completed using two approaches, are presented as a series of catchment maps and associated data files. This release is part of a regional assessment of stream sediment geochemistry that covers a large part of Yukon.

SAMPLING AND ANALYSIS PROGRAMS

Stream sediment and water samples from the Whitehorse area (NTS 105D) were collected at a reconnaissance scale in 1985 as part of the Canada-Yukon Mineral Development Agreement (Geological Survey of Canada, 1986). Field descriptions and initial geochemical data for 1003 sites were released in Geological Survey of Canada (GSC) Open File 1218. New geochemical data from the re-analysis of archive sample material were released in Yukon Geological Survey (YGS) Open File 2015-12 (Jackaman, 2015). Samples from sites located within currently protected areas were excluded from re-analysis. The current assessment examines only data for the 913 sites that are located outside of these protected areas and have been re-analyzed. The reader is referred to these reports for detailed descriptions of sampling techniques, analytical procedures, and quality control measures.

MINERAL OCCURRENCES

A variety of types of base and precious-metal mineralization has been identified in the Whitehorse area as listed in Table 1 (Yukon MINFILE, 2015). The most significant deposits are classed as Cu skarn (Past Producing Whitehorse Cu deposit), Epithermal Au-Ag (Past Producing Tally-Ho and Mount Skukum deposits), Polymetallic Ag-Pb-Zn-Au (Past Producing Union Mines, Venus and Big Thine deposits) and unclassified quartz-vein related Au (Rose, Charleton, Gold Hill, Arscott and Joe Creek prospects). Many of the unclassified Au prospects contain elevated abundances of various other metals including Ag, Cu, Pb and Zn. Other deposit types within the area include porphyry Cu-Mo (Carcross prospect), porphyry Mo (Lime prospect), magmatic Ni-Cu-PGE (Lavalee and Marsh showings) and Pb-Zn skarn (Deb and Kraft prospects). The Red Mountain porphyry Mo deposit occurs in the adjacent NTS map area to the east supporting the prospectivity of the region for this deposit type.

WEIGHTED SUMS MODELING

As described in the methodology report (Mackie et al., 2015), two approaches have been used to subdue the influence of background lithological variation and secondary absorption on the composition of stream sediments. One uses data levelled by the dominant

geology mapped within each catchment, while the other uses residuals calculated from regression against selected principal components. Weighted sums models (WSM) have been generated using the processed data. The importance rankings used in WSMs are summarized in Table 2. Each model is optimized for a target deposit type however other deposit types may be represented in a given model due to similarities in elemental abundances and associations. Importantly, the area of Cu skarn mineralization in the vicinity of Whitehorse, given the low topographic relief, has not been effectively sampled which limits the ability to validate the model presented for this deposit type.

Exploratory data analysis using both raw element data and principal components indicate that lithological variation and secondary scavenging influence the distribution of certain commodity and pathfinder elements. However for this map area, signals related to mineralization are also prevalent. The first principal component, accounting for ~30% of the total geochemical variation, has high positive loadings in Cr, Ni, Co, Mg, V, Cu and Sc; and high negative loadings in Y, La, Ce, U, Bi, Pb, Th, Mo, Rb and Ag. Spatially, these groupings match the mapped distribution of mafic and felsic rocks respectively. The second component with high positive loadings for As, Cd, Ag and Sb accounts for ~15% of the variation shows a spatial match with epithermal Au-Ag and polymetallic Ag-Pb-Zn occurrences indicating it represents a mineralization signal. The third component shows high loadings in loss-on-ignition (LOI), Hg, Ca and Sr. Using LOI as a proxy for organic carbon it is interpreted that this component reflects predominantly scavenging by organic material. This interpretation is supported by the fact that this response corresponds to low-lying regions where it is likely that organic material would accumulate.

Regression analysis of selected metals against the relevant principal component(s) effectively filters the scavenging and lithological controls while preserving responses related to known occurrences. Levelling by mapped geology has a more subdued effect on filtering the interpreted lithological control on the distribution of certain pathfinder elements. In order to reduce the impact of this the WSMs, certain elements were given low importance rankings for certain deposit types. Negative rankings are used to help distinguish between deposit types with similar metal associations.

The effectiveness of historical sampling coverage has been assessed empirically using graphs of WSMs plotted against catchment surface area to determine the ideal maximum catchment size (14 km²). Catchments that cover larger areas (shown on the map with bold outlines) are interpreted to have been under-sampled and thus require further sampling to properly evaluate the area for geochemical anomalism. Given the likelihood that a mineralization signal would be progressively diluted with increasing catchment size, marginally high WSM scores in large catchments may also be of interest.

Table 2: Importance rankings for weighted sums models using data levelled by mapped geology.

Target Deposit Type ¹	Other Deposit Types ²	Min	Fe	Co	Ni	Cu	Mo	Zn	Pb	Ag	Au	As	Ba	Cd	Sn	Sb	Hg	Tl	Bi	W
Porphyry Mo	Cu skarn; Porphyry Cu					2	5													
Cu skarn	Porphyry Cu; Porphyry Mo					4	1		2	1				-1				-2	1	1
Polymetallic Ag-Pb-Zn	SEDEX, VMS, Pb-Zn skarn; Epithermal Au-Ag					1		3	3	3	1	-2	1		1					
Epithermal Au-Ag	Orogenic Au; Intrusion-related Au; Polymetallic Ag-Pb-Zn; Intrusion-related Au; Epithermal Au-Ag								4	4	1	1					1	2		-2
Orogenic Au	Cu skarn								-2	1	4	2	-2					1	1	
Magmatic Ni-Cu-PGE	Au-Ag					4	3		-1								-2	-2		

¹Polymetallic Ag-Pb-Zn type includes vein and mantle styles; SEDEX = sedimentary exhalative Pb-Zn (Ag); VMS = volcanic-hosted/associated massive sulphide deposits
²Raw data following a log₁₀ transformation
³Calculated residual from regression against loss-on-ignition

LEGEND

- Town
- Mineral Occurrence
- Road
- Contour
- River
- Water Body
- Wetland
- Catchment > 14 km²
- Catchment
- Sample Location

Weighted sums model (Geology Levelled)

Epithermal Au-Ag deposits

- incomplete element suite
- 0-50th percentile
- 50-75th percentile
- 75-90th percentile
- 90-95th percentile
- 95-98th percentile
- 98-100th percentile

REFERENCES

Geological Survey of Canada, 1986. Regional Stream Sediment and Water Geochemical Reconnaissance Data, Yukon (105D). Geological Survey of Canada, Open File 1218.
 Jackaman, W., 2015. Regional Stream Sediment Geochemical Data, Whitehorse area, southern Yukon (NTS 105D). Yukon Geological Survey, Open File 2015-12.
 Mackie, R., Arne, D. and Brown, O., 2015. Enhanced interpretation of regional stream sediment geochemistry from Yukon: catchment basin analysis and weighted sums modeling. Yukon Geological Survey, Open File Report 2015-10.
 Yukon MINFILE, 2015. Yukon MINFILE – A database of mineral occurrences. Yukon Geological Survey, www.data.geology.gov.yk.ca, accessed May 2015.

RECOMMENDED CITATION

MACKIE, R., ARNE, D. AND PENNIMPEDE, C., 2016. Weighted sums model for Epithermal Au-Ag deposits levelled by geology. In: Enhanced interpretation of stream sediment geochemical data for NTS map sheet 105D. Yukon Geological Survey, Open File 2016-26, scale 1:250,000, sheet 2 of 13.
 Catchment basin polygons generated by the Yukon Geological Survey (J. O. Bruce).
 Any revisions or additional geological information known to the user would be welcomed by the Yukon Geological Survey.
 Paper copies of this map and the accompanying report may be obtained from the Yukon Geological Survey, Energy, Mines and Resources, Government of Yukon, Room 102-300 Main St., Whitehorse, Yukon, Y1A 2B5. Ph. 867-667-3201, Email geology@gov.yk.ca.
 A digital PDF (Portable Document File) of this map may be downloaded free of charge from the Yukon Geological Survey website: <http://www.geology.gov.yk.ca>.

Table 1: List of Mineral Occurrences for NTS map sheet 105D (Yukon MINFILE, 2015)

Number	Name	Type	Status	Commodities
1050 001	ALBERTA	Vein Quartz	Project	Copper, Gold, Silver, Lead
1050 002	ALBERTA	Vein Quartz	Project	Copper, Gold, Silver, Lead
1050 003	ALBERTA	Vein Quartz	Project	Copper, Gold, Silver, Lead
1050 004	ALBERTA	Vein Quartz	Project	Copper, Gold, Silver, Lead
1050 005	ALBERTA	Vein Quartz	Project	Copper, Gold, Silver, Lead
1050 006	ALBERTA	Vein Quartz	Project	Copper, Gold, Silver, Lead
1050 007	ALBERTA	Vein Quartz	Project	Copper, Gold, Silver, Lead
1050 008	ALBERTA	Vein Quartz	Project	Copper, Gold, Silver, Lead
1050 009	ALBERTA	Vein Quartz	Project	Copper, Gold, Silver, Lead
1050 010	ALBERTA	Vein Quartz	Project	Copper, Gold, Silver, Lead
1050 011	ALBERTA	Vein Quartz	Project	Copper, Gold, Silver, Lead
1050 012	ALBERTA	Vein Quartz	Project	Copper, Gold, Silver, Lead
1050 013	ALBERTA	Vein Quartz	Project	Copper, Gold, Silver, Lead
1050 014	ALBERTA	Vein Quartz	Project	Copper, Gold, Silver, Lead
1050 015	ALBERTA	Vein Quartz	Project	Copper, Gold, Silver, Lead
1050 016	ALBERTA	Vein Quartz	Project	Copper, Gold, Silver, Lead
1050 017	ALBERTA	Vein Quartz	Project	Copper, Gold, Silver, Lead
1050 018	ALBERTA	Vein Quartz	Project	Copper, Gold, Silver, Lead
1050 019	ALBERTA	Vein Quartz	Project	Copper, Gold, Silver, Lead
1050 020	ALBERTA	Vein Quartz	Project	Copper, Gold, Silver, Lead
1050 021	ALBERTA	Vein Quartz	Project	Copper, Gold, Silver, Lead
1050 022	ALBERTA	Vein Quartz	Project	Copper, Gold, Silver, Lead
1050 023	ALBERTA	Vein Quartz	Project	Copper, Gold, Silver, Lead
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1050 025	ALBERTA	Vein Quartz	Project	Copper, Gold, Silver, Lead
1050 026	ALBERTA	Vein Quartz	Project	Copper, Gold, Silver, Lead
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1050 031	ALBERTA	Vein Quartz	Project	Copper, Gold, Silver, Lead
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1050 145	ALBERTA	Vein Quartz	Project	Copper, Gold, Silver, Lead
1050 146	ALBERTA	Vein Quartz	Project	Copper, Gold, Silver, Lead
1050 147	ALBERTA	Vein Quartz	Project	Copper, Gold, Silver, Lead