



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 (Jackman, 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 Skunkum deposits), Polymetallic Ag-Pb-ZnAu (Past Producing Union Mines, Venetius and Big Thole deposits) and unclassified quartz-vein related Au (Rose, Charleson, 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 Krest 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 intrusions 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 anomalies. 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.

Number	Name	Type	Status	Commodities
1050 026	ALBERT	Vein Au-Quartz	Prospect	Copper, Gold, Silver, Lead
1050 027	ALBERTA	Vein Au-Quartz	Prospect	Copper, Gold, Silver, Lead
1050 028	ALBERTA	Vein Au-Quartz	Prospect	Copper, Gold, Silver, Lead
1050 029	ALBERTA	Vein Au-Quartz	Prospect	Copper, Gold, Silver, Lead
1050 030	ALBERTA	Vein Au-Quartz	Prospect	Copper, Gold, Silver, Lead
1050 031	ALBERTA	Vein Au-Quartz	Prospect	Copper, Gold, Silver, Lead
1050 032	ALBERTA	Vein Au-Quartz	Prospect	Copper, Gold, Silver, Lead
1050 033	ALBERTA	Vein Au-Quartz	Prospect	Copper, Gold, Silver, Lead
1050 034	ALBERTA	Vein Au-Quartz	Prospect	Copper, Gold, Silver, Lead
1050 035	ALBERTA	Vein Au-Quartz	Prospect	Copper, Gold, Silver, Lead
1050 036	ALBERTA	Vein Au-Quartz	Prospect	Copper, Gold, Silver, Lead
1050 037	ALBERTA	Vein Au-Quartz	Prospect	Copper, Gold, Silver, Lead
1050 038	ALBERTA	Vein Au-Quartz	Prospect	Copper, Gold, Silver, Lead
1050 039	ALBERTA	Vein Au-Quartz	Prospect	Copper, Gold, Silver, Lead
1050 040	ALBERTA	Vein Au-Quartz	Prospect	Copper, Gold, Silver, Lead
1050 041	ALBERTA	Vein Au-Quartz	Prospect	Copper, Gold, Silver, Lead
1050 042	ALBERTA	Vein Au-Quartz	Prospect	Copper, Gold, Silver, Lead
1050 043	ALBERTA	Vein Au-Quartz	Prospect	Copper, Gold, Silver, Lead
1050 044	ALBERTA	Vein Au-Quartz	Prospect	Copper, Gold, Silver, Lead
1050 045	ALBERTA	Vein Au-Quartz	Prospect	Copper, Gold, Silver, Lead
1050 046	ALBERTA	Vein Au-Quartz	Prospect	Copper, Gold, Silver, Lead
1050 047	ALBERTA	Vein Au-Quartz	Prospect	Copper, Gold, Silver, Lead
1050 048	ALBERTA	Vein Au-Quartz	Prospect	Copper, Gold, Silver, Lead
1050 049	ALBERTA	Vein Au-Quartz	Prospect	Copper, Gold, Silver, Lead
1050 050	ALBERTA	Vein Au-Quartz	Prospect	Copper, Gold, Silver, Lead

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

^a Polymetallic Ag-Pb-Zn type includes vein and manto styles; SEDEX = sedimentary exhalative Pb-Zn (Ag); VMS = volcanic-hosted/associated massive sulphide deposits

^b Raw data following a log₁₀ transformation

LEGEND

- ▲ Town
- ▲ Mineral Occurrence
- Road
- Contour
- River
- NTS map sheet
- Water Body
- Wetland
- ⬚ Catchment > 14 km²
- ⬚ Catchment
- Sample Location

Weighted sums model (PC residuals)

Polymetallic Ag-Pb-Zn 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.

Jackman, 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](http://www.geology.gov.yk.ca), accessed May 2015.

RECOMMENDED CITATION

MACKIE, R., ARNE, D. AND PENNIMPEDE, C., 2016. Weighted sums model for Polymetallic Ag-Pb-Zn deposits using principal component residuals. 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 11 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) file of this map may be downloaded free of charge from the Yukon Geological Survey website: <http://www.geology.gov.yk.ca>.

Yukon Geological Survey
Energy, Mines and Resources
Government of Yukon

Open File 2016-26

**Weighted sums model for Polymetallic Ag-Pb-Zn deposits
using principal component residuals (NTS 105D)
Sheet 11 of 13**

by
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1:250 000-scale topographic base data produced
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ONE THOUSAND METRE GRID
Universal Transverse Mercator Projection
North American Datum 1983
Zone 8

CONTOUR INTERVAL 100 FEET
Elevations in metres above Mean Sea Level

**Polymetallic Ag-Pb-Zn
Weighted sums model
(Principal Component Residuals)**
Sheet 11 of 13

SCALE 1:250 000

kilometres

Use diagram only to obtain numerical values
APPROXIMATE MEAN DECLINATION 2015
FOR CENTRE OF MAP

11SH	10SE	10SF
ASHHIK LAKE	LAKE LABERGE	QUIET LAKE
11SA	THIS MAP	10SC
DEZADASH RANGE		TESLIN
11AP	10AM	10AN
TATSHENSHI RIVER	SKAGWAY	ATLIN