

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 Watson Lake and Coal River areas (NTS 105A and 95D, respectively) were collected at a reconnaissance scale in 1995 as part of the Canada-Yukon Mineral Resource Development Cooperation Agreement (Friskie et al., 1996). Field descriptions and initial geochemical data for 1117 sites were released in Geological Survey of Canada (GSC) Open File 3293. New geochemical data from the re-analysis of archive sample material from 824 sites were released in Yukon Geological Survey (YGS) Open File 2012-10 (Jackman, 2012). The reader is referred to these reports for detailed descriptions of sampling techniques, analytical procedures, and quality control measures. The current assessment includes only those samples that have been re-analyzed by inductively coupled plasma mass spectrometry (ICP-MS) and as such, the eastern half of NTS map sheet 95D is excluded.

MINERAL OCCURRENCES

A variety of types of base and precious-metal mineralization are known to occur in the Watson Lake and Coal River area as shown in Table 1 (Yukon MINFILE, 2015). The most significant deposits are classed as intrusion-related gold (Hyland Deposit), Polymetallic Ag-Pb-Zn manto (past producing Mt. Hundere Mine & McMillan deposit) and W-Skarn (Bailey deposit). Other types of mineralization include various Pb-Zn deposits and prospects such as the Raitco (Skarn), Baton (SEDEX), Jet and Jeri-North (SEDEX or MVT), and Sambo (VMS). The volcanic and sedimentary package that hosts VMS mineralization in the Finlayson Lake district extends into the Watson Lake map area indicating a high prospectivity for this style of mineralization.

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.

Weighted sums models were not generated for porphyry Cu-Mo and epithermal Au-Ag deposit types because no such deposits are known to exist in the region and exploratory data analysis revealed no obvious anomalies in the expected commodity and pathfinder elements. Similarly, given a lack of evidence for scavenging of metal ions by secondary Fe or Mn-oxides a WSM for hydromorphic anomalies was also not produced.

Exploratory data analysis using both raw element data and principal components indicate that the distribution of many commodity and pathfinder elements is strongly influenced by lithological variation. The first principal component accounts for ~27% of the total geochemical variation and shows high positive loadings for Cd, Se, Sb, Ba, Hg, Zn and Ag, and negative loadings for, amongst other elements, Rb, Al, Sn, La, Co and K. Respectively, these groupings form spatial patterns that match the distribution of chert and clastic sedimentary rocks of the Rabbitkettle Formation and intermediate intrusive rocks of the Hyland Suite. The second principal component, accounting for ~13% of the total variation, shows high positive loadings for Co, Fe and Cu, and high negative loadings for Ti, Nb, Ca, Ti, Na and Sr, and forms domains matching the mapped distribution of clastic sedimentary rocks of the Hyland Group and the carbonate rocks of the Rabbitkettle Formation, respectively. Regression analysis of selected metals against the relevant principal component(s) effectively filters these terrane-effects while preserving responses related to known occurrences. Leveling by mapped geology has a more subdued effect on filtering the interpreted lithological control on the distribution of certain pathfinder elements (e.g., Sb, Ba and Cd). In order to reduce the impact this has on the WSM using this approach, certain elements were given low importance rankings or, in some cases, were omitted for certain deposit types.

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 (15 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 1: List of Mineral Occurrences for NTS map sheet 105A/95D (Yukon MINFILE, 2015)

Number	Name	Type	Status	Commodities
0950 001	TOGBALLY	Unknown	Showing	
0950 002	COULEY	Volcanogenic Sulphide - type not determined	Showing	Copper
0950 003	IRA	Unknown	Showing	
0950 004	ME	Unknown	Showing	
0950 005	MEL	Sediment-hosted Mississippi Valley Type Pb-Zn (MVT)	Deposit	Barite, Zinc, Lead, Copper
0950 006	MILLIKAN	Manto Polymetallic Ag-Pb-Zn	Showing	Lead, Zinc, Silver
0950 007	CHU	Skarn Pb-Zn	Showing	Lead, Zinc
0950 008	PLUMBER	Volcanogenic Sulphide - type not determined	Showing	
0950 011	HYLAND GOLD	Plumbeo-Sulphate Au	Deposit	Copper, Silver, Barium, Lead, Arsenic
0950 012	SOVDEIN	Unknown	Showing	
0950 013	SUCH	Manto Polymetallic Ag-Pb-Zn	Showing	Lead, Silver, Zinc
0950 014	WATFIST	Unknown	Anomaly	
0950 015	ASBURY	Unknown	Anomaly	Zinc, Lead
0950 017	SPOKOR	Unknown	Unknown	
0950 018	LUCIFER	Skarn W	Unknown	
0950 019	BERAPHAM	Unknown	Anomaly	Zinc
0950 021	KOONING	Volcanogenic Sulphide - type not determined	Anomaly	Barite, Zinc, Lead
0950 022	HEPHERS	Skarn W	Unknown	Tungsten
0950 023	COLE	Unknown	Showing	Copper
0950 028	SHAFETHO	Coal	Deposit	Coal
0950 029	PLAY	Sediment-hosted Mississippi Valley Type Pb-Zn (MVT)	Showing	Barium, Lead, Zinc, Silver
0950 030	CH	Sediment-hosted Sedimentary Lubatite Zn-Pb-Ag (Skarn)	Unknown	Zinc, Lead
0950 031	CLUZ	Vein Au Quartz	Showing	Antimony, Arsenic, Barium, Gold
0950 032	JE	Unknown	Anomaly	Lead, Silver
0950 033	LEBUNDORTH	Sediment-hosted Mississippi Valley Type Pb-Zn (MVT)	Drifted Prospect	Lead, Zinc
0950 036	JELLY	Unknown	Anomaly	
0950 038	COULBY	Sediment-hosted Mississippi Valley Type Pb-Zn (MVT)	Unknown	Lead, Zinc
0950 039	BLWOOD	Unknown	Anomaly	
0950 040	FERRERETTE	Unknown	Anomaly	
0950 041	ARJIC	Unknown	Anomaly	Copper, Molybdenum, Nickel, Manganese
0950 042	TOREIL	Skarn	Unknown	
0950 043	HY	Unknown	Unknown	
0950 044	WREDFALL	Unknown	Unknown	
0950 045	WATSON	Manto Polymetallic Ag-Pb-Zn	Drifted Prospect	Lead, Zinc, Silver
0950 046	NAKSO	Vein Polymetallic Ag-Pb-Zn	Drifted Prospect	Barite, Copper, Zinc, Silver, Lead
0950 047	ALBERT	Coal	Drifted Prospect	Coal
0950 048	ALBERT	Coal	Drifted Prospect	Coal
0950 049	BARCHE	Unknown	Showing	
0950 050	BARCHE	Unknown	Showing	
0950 051	CARNESE	Manto Polymetallic Ag-Pb-Zn	Past Producer	Lead, Zinc, Silver, Fluorite
0950 052	MT HUNDERE	Manto Polymetallic Ag-Pb-Zn	Past Producer	Lead, Zinc, Silver
0950 053	SADENA HES	Skarn Pb-Zn	Unknown	
0950 054	BALPHI	Unknown	Unknown	
0950 055	SIMPSON	Unknown	Showing	
0950 056	HESZ	Unknown	Showing	
0950 057	BAILEY	Skarn W	Deposit	Tungsten, Tungsten Trioxide, Copper, Molybdenum
0950 058	BARON	Sediment-hosted Sedimentary Lubatite Zn-Pb-Ag (Skarn)	Prospect	Calcium, Zinc, Lead, Copper, Gold
0950 059	CANADA	Skarn W	Showing	Tungsten
0950 060	MARION	Skarn W	Showing	Calcium, Zinc, Lead, Copper, Gold
0950 061	NOIT	Porphyry Mo Low F Type	Drifted Prospect	Copper, Lead, Gold, Zinc, Tungsten, Silver
0950 062	BOURGET	Vein Polymetallic Ag-Pb-Zn	Showing	Copper, Tungsten
0950 063	WARRINGTON	Vein Polymetallic Ag-Pb-Zn	Showing	Copper, Silver, Gold, Lead
0950 064	OLGA	Unknown	Unknown	
0950 065	IMBERTY	Unknown	Unknown	
0950 066	HYLAND	Unknown	Anomaly	Zinc
0950 067	ANT	Unknown	Anomaly	Zinc
0950 068	SHALE	Unknown	Unknown	
0950 069	ALLEGRETTO	Unknown	Anomaly	Zinc
0950 070	LENGSIT	Unknown	Anomaly	Lead, Zinc
0950 071	PUW	Unknown	Unknown	
0950 072	GREEN	Vein Polymetallic Ag-Pb-Zn	Unknown	Copper, Gold, Lead, Silver
0950 073	KILJAK	Unknown	Unknown	
0950 074	HOWARD	Unknown	Unknown	
0950 075	TLE	Unknown	Anomaly	
0950 076	LODGO	Coal	Prospect	Coal
0950 077	MIDDLE CANNON	Coal	Showing	Coal
0950 078	SHILL	Unknown	Unknown	
0950 079	ALBUI	Manto Polymetallic Ag-Pb-Zn	Unknown	Copper, Zinc, Gold, Silver
0950 080	SHOHEE	Unknown	Unknown	
0950 081	PLS	Unknown	Unknown	
0950 082	SLEET	Unknown	Unknown	
0950 083	CLAMBER	Unknown	Anomaly	
0950 084	HERRAWAY	Unknown	Anomaly	
0950 085	LEWIS	Unknown	Anomaly	
0950 086	TAFFE	Porphyry Mo Low F Type	Anomaly	Molybdenum
0950 087	WATSON	Volcanogenic Massive Sulphide (VMS) Kururo Cu-Pb-Zn	Unknown	Copper, Zinc, Gold, Silver, Lead
0950 088	ITCH	Unknown	Anomaly	Copper, Zinc, Lead, Silver
0950 089	LITTLE JAW	Volcanogenic Sulphide - type not determined	Showing	Copper, Zinc, Lead, Silver
0950 090	BLANT	Unknown	Anomaly	Copper, Zinc, Gold, Lead

Table 2: Importance rankings for weighted sums models using residuals on principal components.

Target Deposit Type	Other Deposit Types	Mn	Fe	Co	Ni	Cu	Mo	Zn	Pb	Ag	Au	As	Ba	Cd	Sn	Sb	Te	Hg	Tl	Bi	W	
Polymetallic Ag-Pb-Zn	SEDEX, VMS (Zn-rich), MVT, Pb-Zn skarn							2	4	2		1			1	1					2	
VMS (Zn-rich)	SEDEX, Pb-Zn skarn, MVT, VMS (Cu-rich), Polymetallic Ag-Pb-Zn					2		4	3	1			1	1							1	
VMS (Cu-rich)	Cu skarn		2																			1
Porphyry Mo	Porphyry Cu			2	4																	1
W skarn	Porphyry Mo																					1
Intrusion-related Au	Epithermal Au-Ag											3	3									1

¹ Polymetallic Ag-Pb-Zn type includes vein and manto styles; SEDEX = sedimentary exhalative Pb-Zn (Ag); VMS = volcanic-hosted/associated massive sulphide deposits; MVT = Mississippi Valley-type Pb-Zn deposits
² Raw data following a log10 transformation

LEGEND

Weighted sums model (PC residuals)

VMS Zn-Pb-Cu deposits

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

Other Legend:

- Town
- Mineral Occurrence
- Road
- Contour
- River
- NTS map sheet
- Water Body
- Wetland
- Sample Location
- Catchment
- Catchments >15 km²

RECOMMENDED CITATION

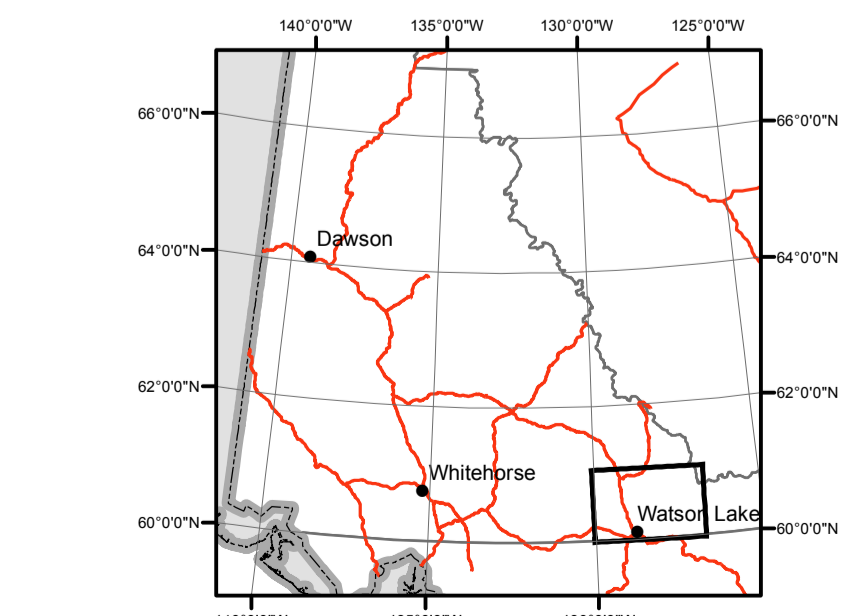
MACKIE, R., ARNE, D. AND PENNIMPEDE, C., 2015. Weighted sums model for VMS Zn-Pb-Cu deposits using principal component residuals. In: Enhanced interpretation of stream sediment geochemical data for NTS 95D and 105A, Yukon Geological Survey, Open File 2015-30, scale 1:250 000, sheet 10 of 13.

Catchment basin polygons generated by the Yukon Geological Survey (J. O. Bruce).

Any revisions or additional geologic information known to the user would be welcomed by the Yukon Geological Survey.

Paper copies of this map and the accompanying report may be purchased 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.

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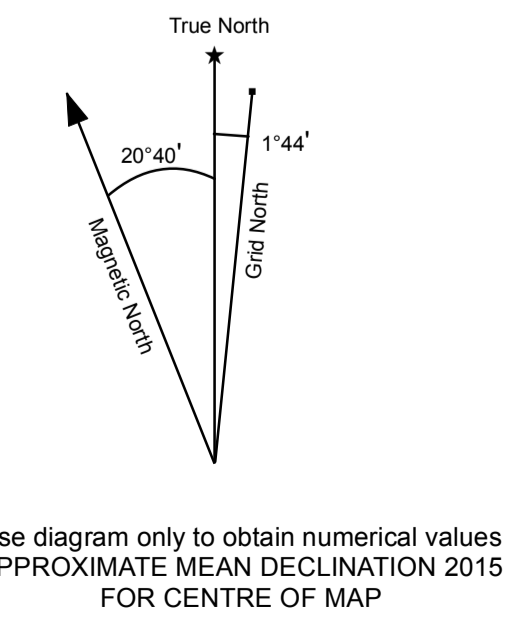
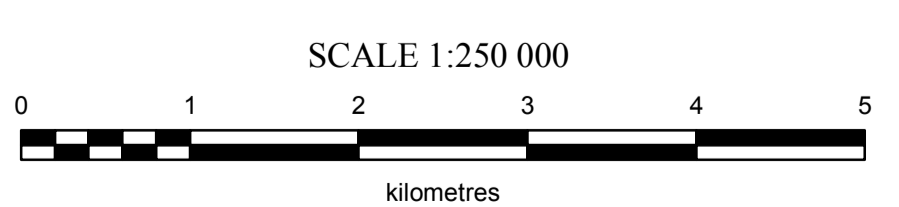


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ONE THOUSAND METRE GRID Universal Transverse Mercator Projection North American Datum 1983 Zone 9

CONTOUR INTERVAL 100 FEET Elevations in metres above Mean Sea Level

VMS Zn-Pb-Cu Deposits Weighted sums model (Principal Component Residuals) Sheet 10 of 13



105G	105H	095E
FINLAYSON LAKE	FRANCES LAKE	FLAT RIVER
105B	105A	095D
WOLF LAKE	THIS MAP	THIS MAP
104P	094M	094N
MCDIAME	RABBIT RIVER	TOAD RIVER

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Open File 2015-30

Weighted sums model for VMS Zn-Pb-Cu deposits using principal component residuals (NTS 95D and 105A) Sheet 10 of 13

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