Yukon Geological Survey

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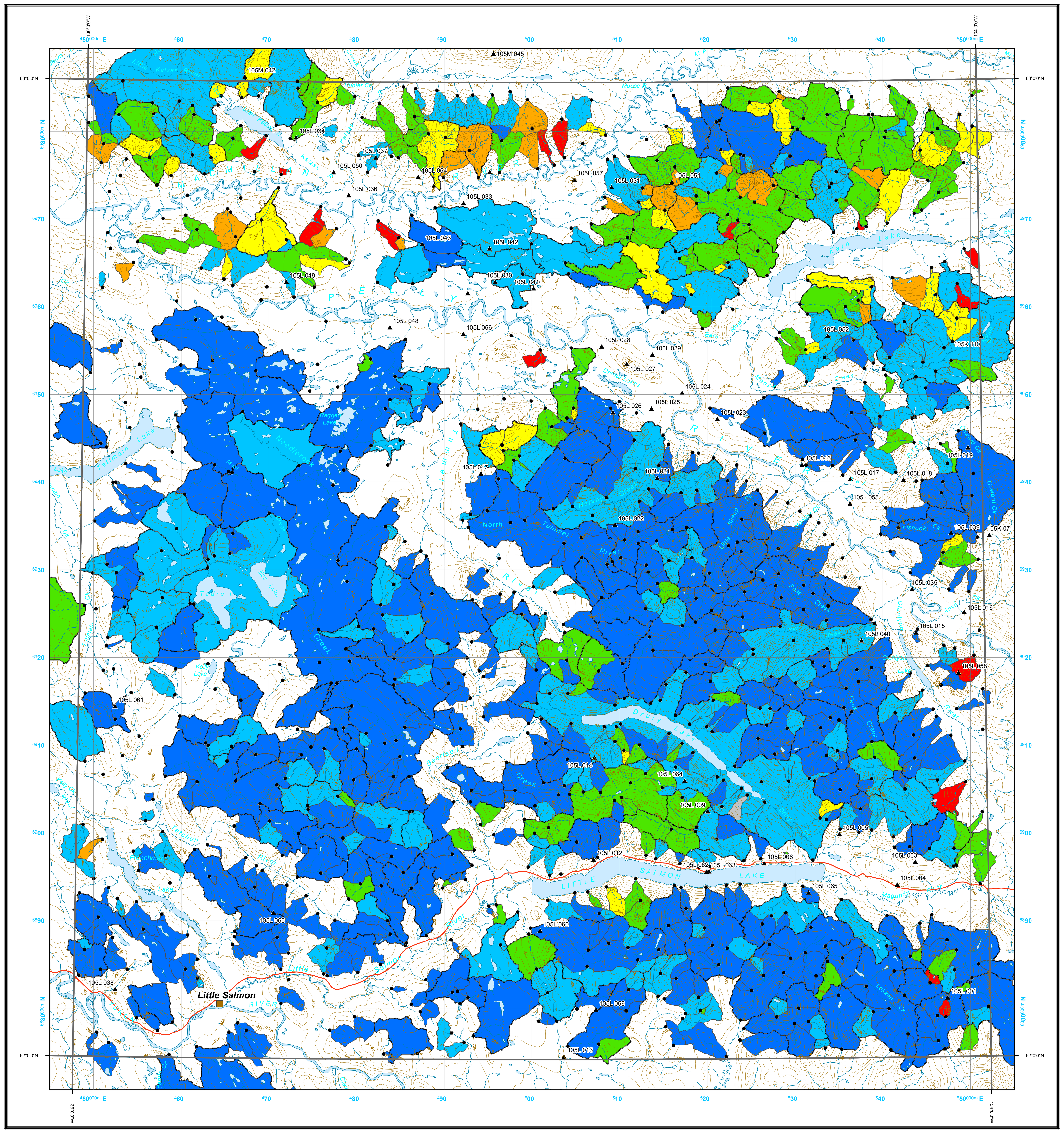
Yukon
Energy, Mines and Resources



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 report accompanying 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 portion of Yukon.

SAMPLING AND ANALYSIS PROGRAMS

Stream sediment and water samples from the Glenlyon map area (NTS 105L) were collected at a reconnaissance scale in 1988 as part of the Canada-Yukon Mineral Development Agreement (Friske & Hornbrook, 1989). This survey also covered the western part of the adjacent map sheet to the east (105K) however the current assessment deals only with samples located within NTS 105L (905 sites). Field descriptions and initial geochemical data were release in Geological Survey of Canada (GSC) Open File 1961. Re-analysis of archived sample material was completed in two stages and the final geochemical data were released in Yukon Geological Survey Open File (Jackaman, 2015). The reader is referred to these open files for detailed descriptions of sampling techniques, analytical procedures and quality control measures.

While the database for this area contains 905 sample sites, only 795 samples are included in this assessment as catchment basins (provided by the YGS) were only generated for those samples that could be reasonably assigned to a specific stream polyline. This unusually high proportion of 'missing' catchments reflects both the inaccuracy of the location data from the historic sampling programs and the difficulty in defining catchment basins in areas of subdued topography.

MINERAL OCCURRENCES

As shown in Table 1 (Yukon MINFILE, 2015), the most significant metal mineral occurrences documented within the Glenlyon map area are of the sedimentary exhalative Zn-Pb-Ag type (Clear Lake deposit; Hackey, Lobo and McArthur prospects). Other types of mineralization include polymetallic Ag-Pb-Zn vein (Front, Hub and Muir prospects), W skarn (Felix and Dromedary prospects), Pb-Zn Skarn (Carlson and Little Salmon prospects), volcanogenic massive sulphide Zn-Pb (Government and Highway showings) and Cu-Ag vein (Frenchman and Oobird showings). The past producing Faro and Vangorda Zn-Pb-Ag mines (Anvil SEDEX district) are located in the adjacent NTS map area to the east (105K). The Minto Cu-Au-Ag Mine and Williams Creek Cu-Au-Ag-Mo and Mt. Nansen Cu-Au-Mo deposits are located in the adjacent NTS map area to the west (115I).

WEIGHTED SUMS MODELING

As described in the report accompanying this map (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 principal components. Weighted sums models (WSM) were generated using the processed data for a variety of deposit types. 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. Notably, only a few of the known deposits are located within delineated catchment basins limiting the ability to validate the models.

For certain elements (*e.g.,* Cd, Ag, Sb and Zn) levelling by dominant lithology did not fully subdue the interpreted stratigraphic control on the spatial distribution of these elements. In order to reduce this impact in the WSMs these elements were given lower importance rankings (or were omitted) for certain deposit types. Negative rankings were assigned to certain variables to help differentiate deposit types with similar metal associations. Despite these efforts this approach generates WSM models that preferentially highlight catchments within the northern part of the map area.

The first principal component, accounting for ~30% of the total variation, shows high positive loadings for Se, Cd, Hg, Ag, Sb, Mo, Ba, Cu and Zn; and high negative loadings for Ce, La, Rb, Li, Al, Ti, Y and Sn. These associations for spatial groups that match the distribution of Earn and Askin group and Mount Christie Formation sedimentary rocks in the northern part of the map area, and felsic intrusive rocks of the Cassiar Suite in the central portion of the map area, respectively. The second principal component, accounting for ~17% of the total variation, shows high negative loadings for Mg, Ca, Sr, Na, Zr and Cr forms a spatial trend matching the distribution of Carmacks suite mafic volcanic rocks and adjacent Laberge Group sedimentary rocks in the southern part of the map area. The third principal component shows high negative loadings for Ni, Co, As, Cr and Cu and matches the distribution of Klinkit Group metamorphosed mafic-intermediate volcanic and sedimentary rocks. Regression analysis of these metals against the relevant principal component effectively subdued these terrane-effects while preserving and in some cases enhancing responses related to known occurrences.

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 (10 square km). Catchments that larger than this 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 area, large catchments with marginally high WSM scores may also be of interest.

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

Target Deposit Type[a]	Other Deposit Types[a]	Mn	Fe	Co[1]	Ni	Cu	Mo	Zn	Pb	Ag	Au[2]	As	Ba	Cd	Sn	Sb	Te	Hg	Tl	Bi	W
Polymetallic Ag-Pb-Zn	SEDEX (high Ag); VMS (felsic); Pb-Zn skarn							2	3	4		2			1	1					
SEDEX Pb-Zn	VMS (felsic); Pb-Zn skarn; Polymetallic Ag-Pb-Zn					1		3	4	1			1	1					1		-2
VMS (mafic)	Cu skarn			2		3	-1	1													-1
Intrusion-related Au	Epithermal Au-Ag										4	2				2				1	
Epithermal Au-Ag	Intrusion-related Au				-2					4	3	1				1		1			
Porphyry Cu-Mo	Cu skarn; Cu-Ag vein; Porphyry Mo				-2	4	1			1	1	1									
W skarn	Porphyry Mo						1								1					2	4

[a]Polymetallic Ag-Pb-Zn type includes vein and manto styles; SEDEX = sedimentary exhalative; VMS (felsic) = Zn-rich volcanic-hosted/associated massive sulphide deposits (i.e., Kuroko type); VMS (mafic) = Cu-rich volcanic-hosted/associated massive sulphide (i.e., Cyprus and Besshi types)
[1]Co residual following regression against Fe and Mn; [2] Au data is not levelled by dominant geology, instead raw data is used following a log10 transformation.

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

NUMBER	NAME	DEP_TYPE	DEP_STATUS	COMMODITY
105L 001	LOKKEN	Skarn Pb-Zn	Prospect	Lead, Silver, Zinc
105L 003	LITTLE SALMON	Skarn Pb-Zn	Drilled Prospect	Arsenic, Gold, Lead, Silver, Tin, Zinc
105L 012	BRANDY	Unknown	Unknown	Copper
105L 013	JUMPONT	Coal	Showing	Coal
105L 015	GLENLYON LAKE	Unknown	Showing	Copper, Lead
105L 017	LOBO	Sediment hosted Sedimentary Exhalative Zn-Pb-Ag (Sedex)	Drilled Prospect	Copper
105L 019	STONE	Unknown	Showing	Lead, Zinc, Silver
105L 022	TUMMEL	Skarn W	Showing	Tungsten
105L 023	MUIR	Vein Polymetallic Ag-Pb-Zn±Au	Drilled Prospect	Copper, Gold, Silver
105L 024	HUB	Vein Polymetallic Ag-Pb-Zn±Au	Drilled Prospect	Copper, Gold, Silver
105L 025	FRONT	Vein Polymetallic Ag-Pb-Zn±Au	Drilled Prospect	Copper, Gold, Silver, Zinc
105L 026	SEARFOSS	Vein Polymetallic Ag-Pb-Zn±Au	Prospect	Copper, Silver, Gold
105L 027	GE	Unknown	Showing	Copper, Silver
105L 028	MCCOWAN	Iron Formation	Drilled Prospect	Copper, Silver
105L 030	HACHEY	Sediment hosted Sedimentary Exhalative Zn-Pb-Ag (Sedex)	Drilled Prospect	Copper, Lead, Zinc
105L 031	CARLSON	Skarn Pb-Zn	Drilled Prospect	Lead, Silver, Zinc
105L 032	HORSFALL	Sediment hosted Sedimentary Exhalative Zn-Pb-Ag (Sedex)	Anomaly	Barite, Lead
105L 035	FISH HOOK	Coal	Unknown	Coal
105L 036	DUO	Coal	Unknown	Coal
105L 037	MCARTHUR	Sediment hosted Sedimentary Exhalative Zn-Pb-Ag (Sedex)	Prospect	Gold, Lead, Silver, Zinc
105L 038	EUGENE	Coal	Unknown	Coal
105L 039	ALPHABET	Sediment hosted Sedimentary Exhalative Zn-Pb-Ag (Sedex)	Drilled Prospect	Copper, Zinc, Lead
105L 040	FELIX	Skarn W	Drilled Prospect	Tungsten, Zinc
105L 045	CLEAR LAKE	Sediment hosted Sedimentary Exhalative Zn-Pb-Ag (Sedex)	Deposit	Lead, Silver, Zinc, Titanium, Barite, Phosphorus
105L 046	SAP	Unknown	Anomaly	Zinc
105L 051	DROMEDARY	Skarn W	Drilled Prospect	Arsenic, Copper, Silver, Tungsten, Zinc, Lead, Barite
105L 054	KAL	Sediment hosted Stratiform Barite	Prospect	Barite, Silver, Zinc, Gold, Lead
105L 055	HODDER	Porphyry Mo (Low F-Type)	Showing	Molybdenum
105L 056	TUM	Sediment hosted Sedimentary Exhalative Zn-Pb-Ag (Sedex)	Drilled Prospect	Zinc
105L 057	LONE MOUNTAIN.	Vein Polymetallic Ag-Pb-Zn±Au	Showing	Lead, Silver, Zinc
105L 058	LITTLE FISH HOOK	Vein Barite-Fluorite	Showing	Fluorite, Gold
105L 060	MARBLE	Unknown	Anomaly	Gold
105L 061	OOBIRD	Porphyry Alkalic Cu-Au	Showing	Copper, Silver
105L 062	GOVERNMENT	Volcanogenic Massive Sulphide (VMS) Kuroko Cu-Pb-Zn	Showing	Copper, Zinc, Lead, Silver
105L 063	HIGHWAY	Volcanogenic Massive Sulphide (VMS) Kuroko Cu-Pb-Zn	Showing	Copper, Gold, Lead
105L 064	JASPY	Vein Polymetallic Ag-Pb-Zn±Au	Showing	Copper, Silver, Zinc, Lead
105L 065	GLAD	Vein Cu±Ag Quartz	Showing	Copper, Gold, Silver
105L 052	ANACONDA	Sediment hosted Stratiform Barite	Prospect	Arsenic, Zinc, Silver, Lead, Copper, Barite
105L 005	TRUITT	Unknown	Drilled Prospect	
105L 047	RAGGED	Unknown	Unknown	
105L 016	JAR	Unknown	Anomaly	
105L 034	FLU	Unknown	Anomaly	
105L 033	NELS	Unknown	Unknown	
105L 043	CONWEST	Unknown	Drilled Prospect	
105L 021	HARVEY	Unknown	Showing	
105L 009	WHEELTON	Unknown	Anomaly	
105L 018	SPAR	Plutonic Related Au	Anomaly	
105L 066	FRENCHMAN	Vein Cu±Ag Quartz	Anomaly	
105L 049	HUGH	Unknown	Anomaly	
105L 048	GRAF	Unknown	Unknown	
105L 004	MOULE	Unknown	Anomaly	
105L 014	DRURY	Unknown	Unknown	
105L 008	ULRIKE	Unknown	Anomaly	
105L 042	TREDGER	Unknown	Drilled Prospect	
105L 050	HANK	Sediment hosted Stratiform Barite	Showing	
105L 041	KELLY	Sediment hosted Sedimentary Exhalative Zn-Pb-Ag (Sedex)	Drilled Prospect	
105L 029	EARN	Unknown	Anomaly	
105L 059	GOO	Volcanogenic Massive Sulphide (VMS) Kuroko Cu-Pb-Zn	Anomaly	

LEGEND

Town
Mineral Occurrence
Road
Contour
River
NTS map sheet
Water Body
Wetland
Sample Location
Catchement
Catchments >14 km^2

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

RECOMMENDED CITATION

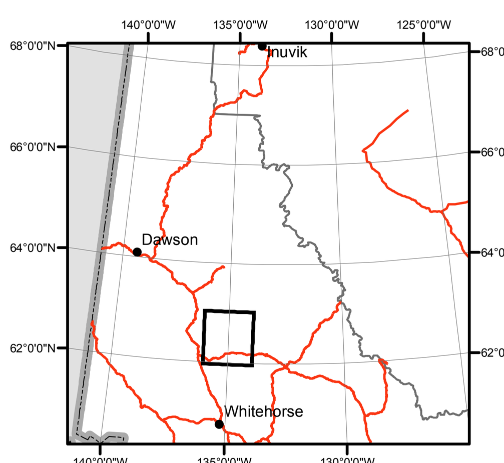
MACKIE, R., ARNE, D. AND PENNEPEDE, C., 2016. Weighted sums model for Epithermal Au-Ag deposits levelled by geology. In: Enhanced interpretation of stream sediment geochemical data for NTS 105L. Yukon Geological Survey, Open File 2016-10, scale 1:250 000, sheet 1 of 15.

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.



1:250 000-scale topographic base data produced by CENTRE FOR TOPOGRAPHIC INFORMATION, NATURAL RESOURCES CANADA

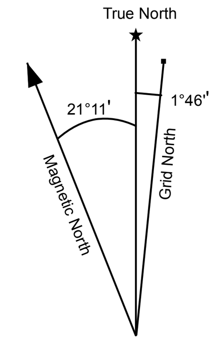
ONE THOUSAND METRE GRID
Universal Transverse Mercator Projection
North American Datum 1983
Zone 8

CONTOUR INTERVAL 100 FEET
Elevations in metres above Mean Sea Level

Epithermal Au-Ag Weighted sums model (Geology Levelled) Sheet 1 of 15

SCALE 1:250 000

0 1 2 3 4 5
kilometres



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

115P MCQUESTEN	105M MAYO	105N LANSING RANGE
115I CARMACKS	105L THIS MAP	105K TAY RIVER
115H AISHIHIK LAKE	105E LAKE LABERGE	105F QUIET LAKE

REFERENCES

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Government of Yukon

Open File 2016-10

Weighted sums model for Epithermal Au-Ag deposits levelled by geology (NTS 105L) Sheet 1 of 15

by

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