Yukon Geological Survey
CSA Global
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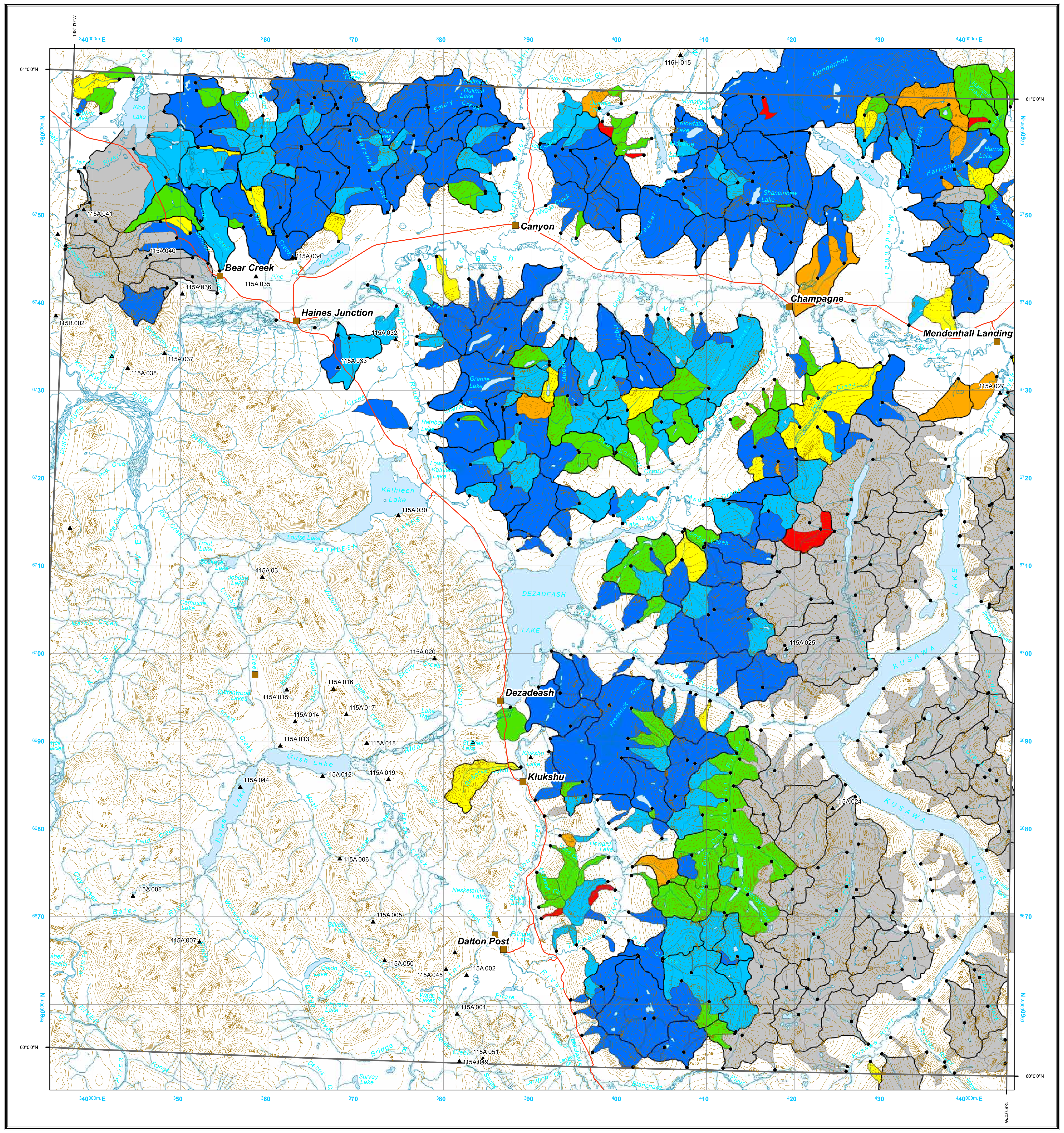
Yukon
Energy, Mines and Resources



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 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 Dezadeash Range area (NTS 115A) were collected at a reconnaissance scale in 1992 as part of the Canada-Yukon Mineral Development Agreement (Friske *et al.*, 2001). Field descriptions and initial geochemical data for 587 sites were released in Geological Survey of Canada (GSC) Open File 2859 (Friske *et al.*, 2001). New geochemical data from the re-analysis of archive sample material were released in Yukon Geological Survey (YGS) Open File 2016-05 (Jackaman, 2016). Samples from sites located within currently protected areas were excluded from re-analysis. The current assessment examines only data for the 397 sites that are located outside of these protected areas. The reader is referred to these reports for detailed descriptions of sampling techniques, analytical procedures and quality control measures.

MINERAL OCCURRENCES

The Dezadeash Range area contains relatively few mineral occurrences compared to other regions of Yukon. Most of the occurrences are located within lands that are now protected (Kluane National Park and Kusawa Natural Environment Park). As listed in Table 1 (Yukon MINFILE, 2015) the most developed occurrences are classed as polymetallic Ag-Pb-Zn (Kane deposit), Cu±Ag quartz vein (Johobo deposit; and Mush and Jackpot prospects), Zn-Pb±Ag volcanogenic massive sulphide (Kloo, Elgin and Wren prospects) and Au quartz vein (Archibald showing). The Whitehorse Copper (Cu skarn) and Mount Skukum epithermal Au-Ag deposit occur in the adjacent NTS map area to the east supporting the prospectivity of the region for these deposit types. Although the Wrangellia terrane, which hosts the Wellgreen Ni-Cu-PGE deposit, transects the Dezadeash Range area it is within the Kluane National Park.

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. It is important to note that given the lack of mineral occurrences in the area of re-analyzed samples the presented models cannot be validated. Additionally, many of the sample sites are located in topographically subdued and low-lying areas which are not ideal stream sediment sample locations given the potential for the inclusion of Quaternary alluvial and glacial lacustrine sediments. These regions are also potential sites of secondary scavenging of metal ions by organic material, clays and/or Fe-Mn oxides. Given these complicating factors the geochemical data and presented models for this map area should be used with caution and verification sampling should be conducted.

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. The principal component (PC1) accounts for ~30% of the total geochemical variation. Positive PC1 shows high loadings in Sb, Hg, Cd, Ca, loss-on-ignition (LOI), Sr, As and Cu; and coincides with a low-lying region east of the Denali fault zone. Using LOI as a proxy for organic carbon it is interpreted that this component represents scavenging by accumulated organic material. Negative PC1 shows high loadings in Ti, K, Rb, Li, Tl and Al corresponding to areas mapped as Ruby Range Suite felsic plutonic rocks. The second component (PC2) shows high positive loadings for U, La, Y, Mo, Tl, Th and Ag; and high negative loadings for Co, V, Cr, Ni, Mg, Sc, Cu and Fe. Respectively, these element groupings correspond to areas of felsic and mafic lithologies. The third component shows high loadings in Ag, loss-on-ignition (LOI), Ba, Tl, Hg, Cd and Zn; and is also interpreted to reflect scavenging by organic material. The fourth component with high loadings in Bi, Pb, Ag and Cu, may be related to skarn-style mineralization although no occurrences exist in the highlighted drainages and therefore this interpretation cannot be validated. The fifth component shows high loadings in Pb, As, Fe and Mn, and is interpreted to represent scavenging by secondary Fe and Mn oxides/hydroxides.

Regression analysis of selected metals against the relevant principal component(s) effectively filters the interpreted scavenging and lithological controls. For the 'geology levelled' products, owing to the strong influence of scavenging, many of the WSM variables are residuals calculated from regression against LOI, Fe and/or Mn (Table 2). Only a few elements were levelled by dominant catchment geology. Negative rankings are used for elements that are expected to be low in a given deposit type and also 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 km^2). 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 115A (Yukon MINFILE, 2015)

Number	Name	Type	Status	Commodities
115A 001	JACKPOT	Vein Cu±Ag Quartz	Drilled Prospect	Copper, Silver
115A 003	KANE	Vein Polymetallic Ag-Pb-Zn±Au	Past Producer	Lead, Zinc, Silver
115A 005	PHOTO	Vein Cu±Ag Quartz	Showing	Antimony, Cobalt, Copper, Gold
115A 006	MUSH	Vein Cu±Ag Quartz	Prospect	Copper, Gold
115A 007	BATES	Vein Polymetallic Ag-Pb-Zn±Au	Prospect	Gold, Lead, Silver
115A 012	CAVE	Porphyry Cu-Mo-Au	Prospect	Copper, Silver
115A 013	SHAFT	Volcanogenic Sulphide - type not determined	Showing	Copper
115A 015	BELOUD	Vein Cu±Ag Quartz	Showing	Copper
115A 016	HUSKY	Volcanogenic Sulphide - type not determined	Showing	Copper
115A 018	KEL	Volcanogenic Sulphide - type not determined	Prospect	Copper
115A 024	DEVILHOLE	Porphyry Cu-Mo-Au	Showing	Copper, Lead, Molybdenum
115A 025	KUSAWA	Skarn Cu	Showing	Copper
115A 031	JOHOBO	Vein Cu±Ag Quartz	Past Producer	Copper, Silver
115A 032	REX	Ultramafic-hosted asbestos	Deposit	Asbestos
115A 035	ELGIN	Volcanogenic Sulphide - type not determined	Drilled Prospect	Copper
115A 036	ARCHIBALD	Vein Au-Quartz	Showing	Copper, Gold
115A 037	STRIDE	Ultramafic Mafic Podiform Chromite	Showing	Chromium, Iron
115A 039	FERGUSON	Unknown	Unknown	Gold
115A 041	KLOO	Volcanogenic Sulphide - type not determined	Drilled Prospect	Copper, Molybdenum, Nickel, Silver, Gold, Mercury
115A 043	SOUTHER	Porphyry Cu-Mo-Au	Showing	Copper, Molybdenum, Zinc, Silver, Lead
115A 044	ISLAND	Ultramafic-hosted asbestos	Showing	Asbestos
115A 045	TATSHENSHINI	Porphyry Cu-Mo-Au	Showing	Copper, Molybdenum
115A 049	DOLLIS	Vein Au-Quartz	Prospect	Gold
115A 040	DECOELI	Ultramafic Mafic Gabbroid Cu-Ni-PGE	Showing	
115A 021	BOUNTY	Unknown	Anomaly	
115A 017	WREN	Volcanogenic Sulphide - type not determined	Showing	
115A 020	SHORTY	Porphyry Cu-Mo-Au	Anomaly	
115A 014	ROBIN	Unknown	Showing	
115A 038	SUGDEN	Coal	Showing	
115A 027	CHAMPAGNE	Unknown	Anomaly	
115A 033	DEZ	Unknown	Anomaly	
115A 051	BEATON	Unknown	Unknown	
115A 030	MILLHOUSE	Volcanogenic Sulphide - type not determined	Unknown	
115A 008	FENTON	Vein Cu±Ag Quartz	Showing	
115A 022	KLUKSHU	Volcanogenic Sulphide - type not determined	Anomaly	
115A 034	MARL	Unknown	Unknown	
115A 019	SICKLE	Unknown	Anomaly	
115A 029	MENDENHALL	Unknown	Anomaly	
115A 050	CASHIN	Vein Au-Quartz	Unknown	
115A 002	DALTON	Porphyry Cu-Mo-Au	Drilled Prospect	

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

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

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

[1]Calculated residual from regression against loss-on-ignition. For Cu, the calculated residual was also levelled by dominant geology

[2]Calculated residual from regression against Fe and Mn. For Pb, the calculated residual was also levelled by dominant geology

[3]Raw data following a $\log_{10}$ transformation

LEGEND

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

Weighted sums model (geology levelled)

Pb-Zn skarn deposits

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

RECOMMENDED CITATION

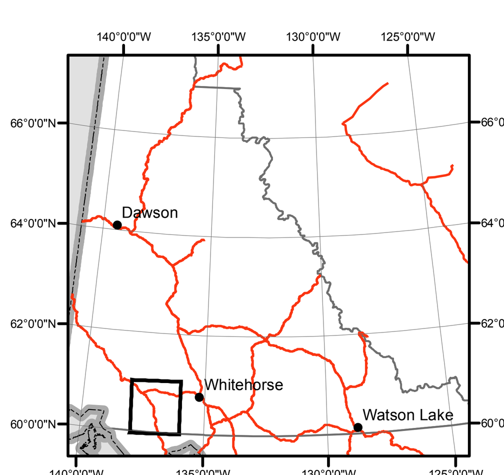
MACKIE, R., ARNE, D. AND PENNIMPEDE, C., 2016. Weighted sums model for Pb-Zn skarn deposits levelled by geology. In: Enhanced interpretation of stream sediment geochemical data for NTS map sheet 115A. Yukon Geological Survey, Open File 2016-29, scale 1:250 000, sheet 5 of 13.

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.



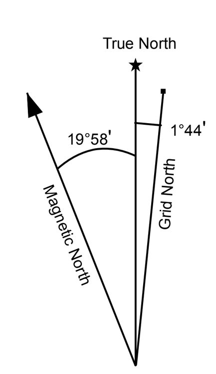
ONE THOUSAND METRE GRID
Universal Transverse Mercator Projection
North American Datum 1983
Zone 8

CONTOUR INTERVAL 100 FEET
Elevations in metres above Mean Sea Level

Pb-Zn skarn
Weighted sums model
(Geology Levelled)
Sheet 5 of 13

SCALE 1:250 000

0 1 2 3 4 5
kilometres



Use diagram only to obtain numerical values
APPROXIMATE MEAN DECLINATION 2016
FOR CENTRE OF MAP

115G KLUANE LAKE	115H AISHIHIK LAKE	105E LAKE LABERGE
115B MOUNT ST ELIAS	115A THIS MAP	105D WHITEHORSE
114O YAKUTAT	114P TATSHENSHINI RIVER	104M SKAGWAY

REFERENCES

Friske, P.W.B., Day, S.J.A. and McCurdy, M.W., 2001. Regional Stream Sediment and Water Geochemical Data, southwestern Yukon (parts of NTS 115A and B). Geological Survey of Canada, Open File 2859.

Jackaman, W., 2016. Regional Stream Sediment Geochemical Data, Dezadeash Range area, southern Yukon (NTS 115A). Yukon Geological Survey, Open File 2016-05.

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.

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Government of Yukon

Open File 2016-29

Weighted sums model for Pb-Zn skarn deposits levelled by mapped geology (NTS 115A) Sheet 5 of 13

by

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