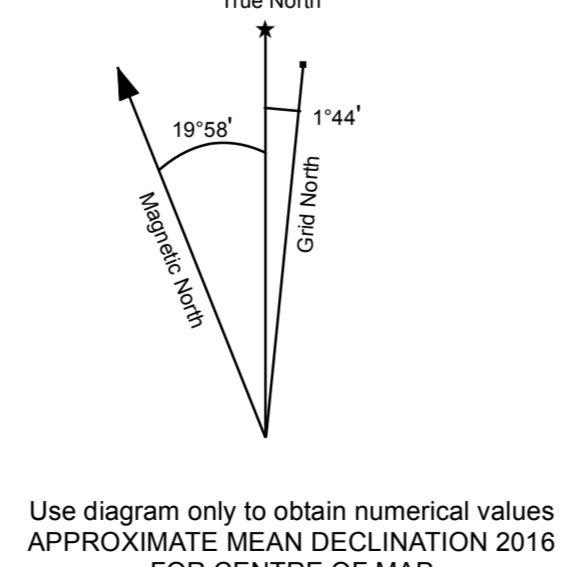


1:250 000-scale topographic base data produced by CENTRE FOR TOPOGRAPHIC INFORMATION, NATURAL RESOURCES CANADA. Copyright Her Majesty the Queen in Right of Canada. ONE THOUSAND METRE GRID Universal Transverse Mercator Projection North American Datum 1983 Zone 8. CONTOUR INTERVAL 100 FEET Elevations in metres above Mean Sea Level.

**Orogenic Au Weighted sums model (Principal Component Residuals) Sheet 10 of 13**  
SCALE 1:250 000  
kilometres



115G KLUANE LAKE	115H AISHIKH LAKE	105E LAKE LABERGE
115B MOUNT ST ELIAS	115A <b>THIS MAP</b>	105D WHITEHORSE
114C YAKUTAT	114P TATSHEHNSHINI RIVER	104M SKAGWAY

**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 Weilgreen 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, Ti, 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<sup>2</sup>). 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.

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

Target Deposit Type <sup>a</sup>	Other Deposit Types <sup>b</sup>	Mn	Fe	Co	Ni	Cu	Mo	Zn	Pb	Ag	Au <sup>c</sup>	As	Bd	Cd	Sr	Sb	Te	Hg	Tl	Bi	W <sup>d</sup>	
Polymetallic Ag-Pb-Zn	SEDEX, VMS, Pb-Zn skarn; Epithermal Au-Ag					-3	2	3	4	1						1						
Pb-Zn skarn	SEDEX, VMS, Polymetallic Ag-Pb-Zn								3	4		1	-2	2	1						1	2
Cu skarn	Porphyry Cu, Porphyry Mo, Cu-Ag vein					5	1		2	1		-3									1	2
Epithermal Au-Ag	Orogenic Au; Intrusion-related Au; Polymetallic Ag-Pb-Zn								4	3	2					3		1				
Orogenic Au	Intrusion-related Au; Epithermal Au-Ag									4	2					2					1	1
Hydrothermal Anomaly		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

<sup>a</sup>Polymetallic Ag-Pb-Zn type includes vein and mantle styles; SEDEX = sedimentary exhalative Pb-Zn(Ag); VMS = volcanic-hosted/associated massive sulfide  
<sup>b</sup>Raw data following a log<sub>10</sub> transformation

**RECOMMENDED CITATION**

MACKIE, R., ARNE, D. AND PENNIMPEDE, C., 2016. Weighted sums model for Orogenic Au deposits using principal component residuals. 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 10 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>.

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

Yukon Geological Survey  
Energy, Mines and Resources  
Government of Yukon

Open File 2016-29

**Weighted sums model for Orogenic Au deposits using principal component residuals (NTS 115A) Sheet 10 of 13**

by  
Rob Mackie, Dennis Arne,  
and Chris Pennimpede