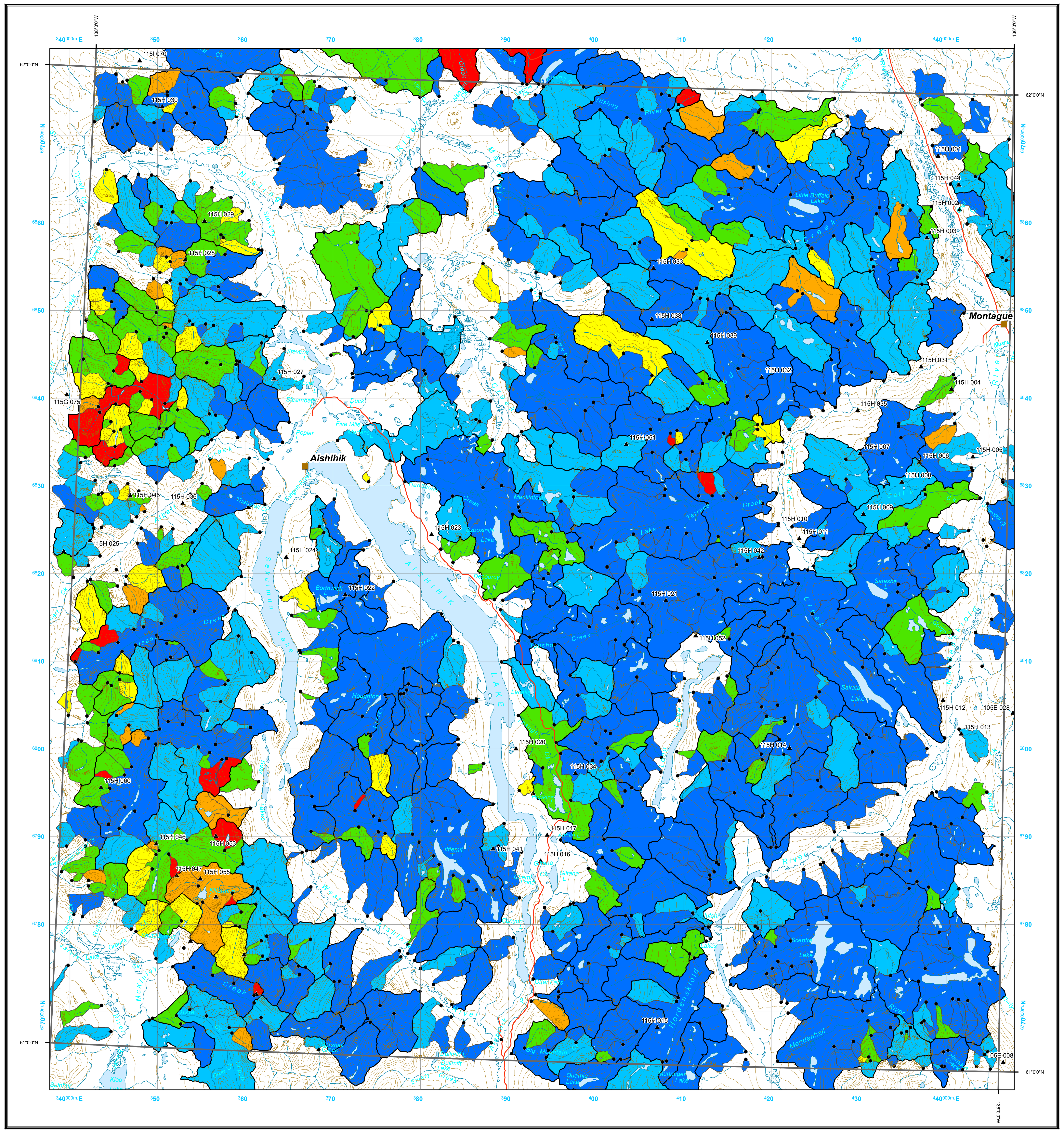
Yukon Geological Survey

CSA Global
Resource Industry Consultants

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 Aishihik Lake area (NTS 115H) were collected at a reconnaissance scale in 1986 as part of the Canada-Yukon Mineral Development Agreement (Geological Survey of Canada, 1986). Field descriptions and initial geochemical data for 934 sites were released in Geological Survey of Canada (GSC) Open File 1219. New geochemical data from the re-analysis of archive sample material were released in Yukon Geological Survey (YGS) Open File 2015-13 (Jackaman, 2015). 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 are known to occur in the Aishihik Lake area as shown in Table 1 (Yukon MINFILE, 2015). The most significant deposits are classed as Cu-Mo porphyry (Hopper deposit and Sato prospect), Cu skarn (Mack's, Janis and Thatch prospects) and quartz vein Au (Shut, Lib and Mom prospects). The Mt Nansen epithermal Au-Ag and Wellgreen Ni-Cu-PGE deposits are located in the adjacent map areas to the north and west, respectively.

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.

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. Additionally, there is evidence of scavenging of metals ions by secondary Fe and Mn-oxides/hydroxides, clays and/or organic material. The first principal component accounts for ~30% of the total geochemical variation and shows high positive loadings for Pb, La, Y, Bi, U, Cd and Ag; and high negative loadings for Mg, Sc, Cr, Co, V, Al and Ni. Respectively, these groupings form spatial patterns that match the distribution of felsic intrusions along the western edge of the map area and the Kluane Schist in the southwestern corner of the map area. While not a mappable unit, ultramafic bodies have been documented within the Kluane Schist consistent with noted element groupings. The second principal component shows high positive loadings in Tl, Rb and K, and has a spatial distribution matching the Kluane Schist. The third principal component (PC3) shows high positive loadings for Cu, loss-on-ignition (LOI), Hg and Ag. This grouping, using LOI as a proxy for carbon, is suggestive of scavenging by organic material. This interpretation is supported by the fact that the map pattern of PC3 coincides with low-lying regions where accumulation of organic material and/or clay is likely. Regression analysis of selected metals against the relevant principal component(s) effectively filters these effects 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 elements. 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 (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 significant.

Table 1: List of Mineral Occurrences for NTS map sheet 115H (Yukon MINFILE, 2015)

Number	Name	Type	Status	Commodities
115H 001	LOSCH	Coal	Prospect	Coal
115H 002	ANDESITE	Coal	Prospect	Coal, Uranium
115H 004	AH	Volcanogenic Massive Sulphide (VMS) Besshi Cu-Zn	Showing	Copper
115H 006	MACK'S COPPER	Skarn Cu	Drilled Prospect	Copper, Gold, Silver, Iron
115H 007	SNIPE	Porphyry Cu-Mo-Au	Showing	Copper
115H 012	VOWEL	Coal	Showing	Coal
115H 013	DIVISION	Coal	Deposit	Coal
115H 014	LION	Porphyry Mo (Low F-Type)	Drilled Prospect	Uranium
115H 015	MORAINE	Skarn Cu	Prospect	Cobalt, Copper, Silver, Tungsten, Gold
115H 016	GILTANA	Skarn Cu	Drilled Prospect	Copper, Molybdenum
115H 017	AISHIHIK	Skarn Cu	Prospect	Copper
115H 018	JANISIW	Skarn Cu	Drilled Prospect	Copper, Silver, Tungsten
115H 019	HOPPER SOUTH	Skarn Cu	Drilled Prospect	Copper, Gold, Silver, Molybdenum
115H 020	DERICON	Unknown	Anomaly	Copper
115H 021	SATO	Porphyry Cu-Mo-Au	Showing	Copper
115H 024	SEKULMUN	Skarn Cu	Drilled Prospect	Copper, Zinc
115H 025	KATHY	Porphyry Mo (Low F-Type)	Unknown	Copper, Molybdenum
115H 026	THATCH	Skarn Cu	Drilled Prospect	Copper, Tungsten, Silver, Molybdenum, Gold
115H 027	POPLAR	Porphyry Cu-Mo-Au	Anomaly	Molybdenum, Zinc
115H 028	STEVENS	Porphyry Cu-Mo-Au	Anomaly	Copper, Molybdenum
115H 029	OCCIDENT	Porphyry Cu-Mo-Au	Anomaly	Copper, Molybdenum
115H 033	BUFF	Porphyry Mo (Low F-Type)	Showing	Molybdenum
115H 035	SHAD	Volcanogenic Massive Sulphide (VMS) Besshi Cu-Zn	Showing	Copper
115H 038	TAHTE	Porphyry Cu-Mo-Au	Showing	Copper, Gypsum, Molybdenum, Fluorite, Gold
115H 041	ITTLEMIT	Porphyry Cu-Mo-Au	Showing	Copper, Molybdenum
115H 042	SNAP	Epithermal Au-Ag-Cu: High Sulphidation	Showing	Fluorite, Mercury
115H 044	POWER	Vein Polymetallic Ag-Pb-Zn±Au	Showing	Gold, Zinc, Silver, Lead
115H 045	AL	Vein Au-Quartz	Showing	Antimony, Silver, Gold
115H 047	SHUT	Vein Au-Quartz	Drilled Prospect	Arsenic, Gold
115H 052	LASCAS	Unknown	Showing	Silica
115H 055	LIB	Vein Au-Quartz	Drilled Prospect	Arsenic, Gold
115H 060	MOM	Vein Au-Quartz	Prospect	Arsenic, Gold
115H 053	BOWEN	Vein Au-Quartz	Anomaly	Arsenic, Gold
115H 049	MT. BARK	Vein Au-Quartz	Anomaly	
115H 039	TOSH	Unknown	Unknown	
115H 048	KILLERMUN	Unknown	Anomaly	
115H 050	KIN	Unknown	Anomaly	
115H 008	SATASHA	Unknown	Anomaly	
115H 005	ALICE	Unknown	Anomaly	
115H 011	KIRK	Volcanogenic Massive Sulphide (VMS) Besshi Cu-Zn	Showing	
115H 010	LAND	Unknown	Anomaly	
115H 058	MCKINLEY	Vein Au-Quartz	Anomaly	
115H 034	HOPPER NORTH	Porphyry Cu-Mo-Au	Prospect	Copper, Molybdenum
115H 036	BILQUIST	Porphyry Cu-Mo-Au	Unknown	
115H 046	LIVE	Unknown	Anomaly	
115H 051	MACINTOSH	Vein Au-Quartz	Anomaly	
115H 032	KIRI	Porphyry Cu-Mo-Au	Anomaly	
115H 023	BISET	Unknown	Anomaly	
115H 003	NIPPON	Porphyry Cu-Mo-Au	Showing	
115H 031	ORLOFF	Unknown	Anomaly	
115H 009	EMPRESS	Unknown	Anomaly	
115H 022	BRASS	Unknown	Unknown	
115H 030	SAUCE	Unknown	Anomaly	

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[3]	Tl	Bi	W
Porphyry Cu-Mo	Cu skarn; Porphyry Mo				-2	4	2			1	1	1			-1						
Polymetallic Ag-Pb-Zn	SEDEX, VMS, Pb-Zn skarn; Epithermal Au-Ag					2		3	3	1		1		1		1					-3
Magmatic Ni-Cu-PGE				1	4	3													-1		
Epithermal Au-Ag	Orogenic Au; Intrusion-related Au					1	-2			4	4	2				1		1			
Orogenic Au	Intrusion-related Au, Epithermal Au-Ag										4	2				1				1	1
Hydromorphic Anomaly		3	4	2				1				1									

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

[1]Residual from regression against Fe

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

[3]Residual from regression against Loss-on-ignition

LEGEND

Town

Mineral Occurrence

Road

Contour

River

NTS map sheet

Water Body

Wetland

Sample Location

Catchments > 14km²

Weighted sums model (Geology Levelled)

Epithermal Au-Ag Deposits

incomplete element suite

0-50th percentile

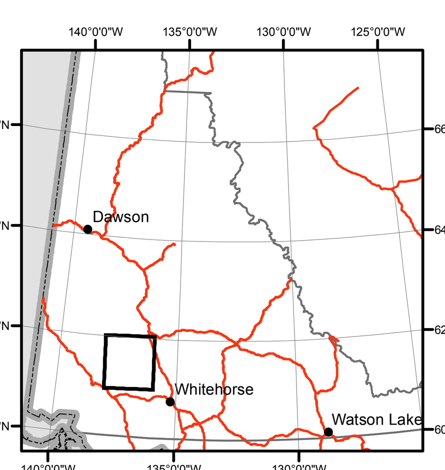
50-75th percentile

75-90th percentile

90-95th percentile

95-98th percentile

98-100th percentile



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

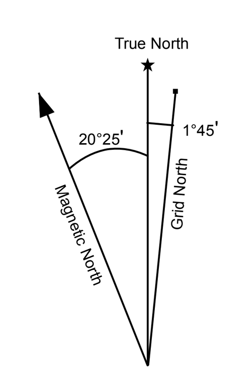
CONTOUR INTERVAL 100 FEET
Elevations in metres above Mean Sea Level

Epithermal Au-Ag Weighted sums model (Geology Levelled) Sheet 1 of 13

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

115J STEVENSON RIDGE	115I CARMACKS	105L GLENLYON
115G KLUANE LAKE	115H THIS MAP	105E LAKE LABERGE
115B MOUNT ST ELIAS	115A DEZADEASH RANGE	105D WHITEHORSE

RECOMMENDED CITATION

MACKIE, R., ARNE, D. AND PENNIMPEDE, C., 2016. Weighted sums model for Epithermal Au-Ag deposits levelled by geology. In: Enhanced interpretation of stream sediment geochemical data for NTS 115H. Yukon Geological Survey, Open File 2016-11, scale 1:250 000, sheet 1 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

Geological Survey of Canada, 1986. Regional Stream sediment and water geochemical reconnaissance data, southern Yukon (NTS 115H). Geological Survey of Canada, Open File 1219.

Jackaman, W., 2015. Regional stream sediment geochemical data, Askhihik Lake area, southern Yukon (NTS 115H). Yukon Geological Survey, Open File 2015-13.

Mackie, R., Arne, D. and Brown, O., 2015. Enhanced interpretation of regional stream sediment (RGS) geochemical data 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.

Yukon Geological Survey
Energy, Mines and Resources
Government of Yukon

Open File 2016-11

Weighted sums model for Epithermal Au-Ag deposits levelled by mapped geology (NTS 115H) Sheet 1 of 13

by

Rob Mackie, Dennis Arne, and Chris Pennimpede