Yukon Geological Survey

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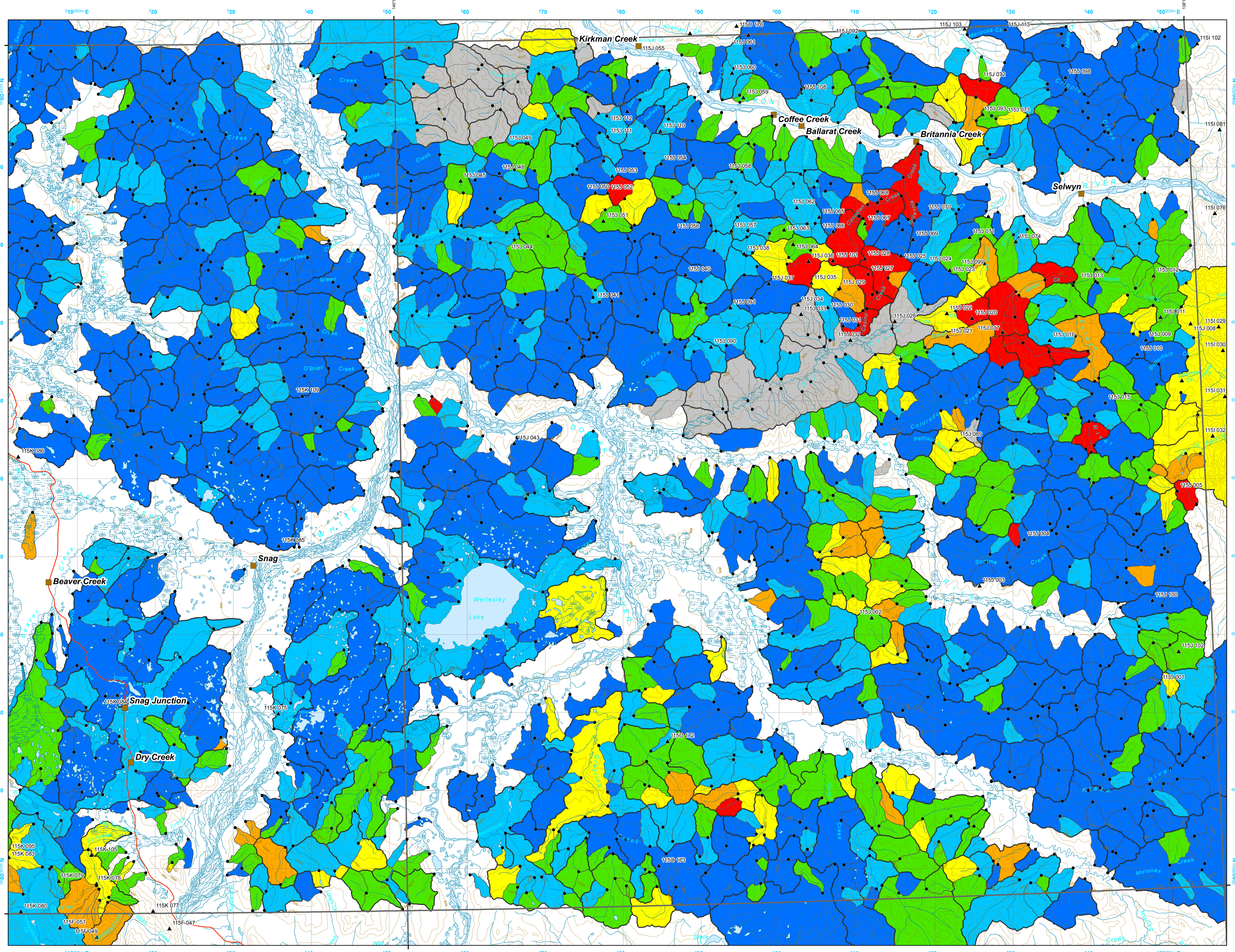
Energy, Mines and Resources



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 Stevenson Ridge Area (NTS 115J and part of 115K) were collected at a reconnaissance scale in 1986 as part of the Canada-Yukon Mineral Development Agreement (Geological Survey of Canada, 1987). Field descriptions and initial geochemical data for 1305 sites were released in Geological Survey of Canada (GSC) Open File 1363. New geochemical data from the re-analysis of archive sample material were released in Yukon Geological Survey (YGS) Open File 2011-28 (Jackaman, 2011). 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 has been identified in the Stevenson Ridge area as listed in Table 1 (Yukon MINFILE, 2015). The most significant deposits are classed as Cu-Mo porphyry (Casino deposit), Orogenic Au (Supremo deposit; Mascot and Boulevard prospects) and polymetallic Ag-Pb-Zn (Bomber deposit). Other deposit types within the area include Cu skarn (Nutzotin) and magmatic Ni-Cu-PGE (Snag showing). The Golden Saddle orogenic Au and Touleary Cu-Ag-Zn volcanogenic massive sulphide deposits occur in the adjacent map area to the north and the Wellgreen Ni-Cu-PGE deposit occurs in the adjacent map area to the south supporting the prospectivity of the region for these deposit types.

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 lithological variation and secondary scavenging influence the distribution of many commodity and pathfinder elements. However, much of the variability in the data for this map area can be linked to mineralization. The first principal component accounts for ~30% of the total geochemical variation and shows high positive loadings for Ca, loss-on-ignition, Sr, Mn, Hg, Cu, Co, As, Fe and Zn. Given a spatial relationship with a topographically subdued region in the southwestern part of the map area it is interpreted that this principal component reflects scavenging of metals by organic material and/or Fe-Mn oxides/hydroxides. High negative loadings for Th, Sn, La, Rb, Li, and Ce are clearly linked to regions mapped as felsic-intermediate intrusions. The second principal component shows high positive loadings for Mo, Cd, Ag, U, Bi and Tl. Spatially, this principal component can be linked to known occurrences suggesting it represents a mineralization signal. Similarly, the third principal component with high loadings in Cu, Ag and Pb is also spatially relatable to areas of mineralization.

Regression analysis of selected metals against the relevant principal component(s) effectively filters the scavenging and lithological controls 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 pathfinder 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. Negative weightings were assigned to Sn for several models in order to reduce contributions from alaskite composition intrusions with high background Ag and Zn values.

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 (16 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 2: Importance rankings for weighted sums models using residuals on principal components.

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

[a]Polymetallic Ag-Pb-Zn type includes vein and manto styles; SEDEX = sedimentary exhalative; VMS = volcanic-hosted/associated massive sulphide deposits; Hydromorphic Anomaly = principal component 1

[1]For heavily censored elements and those not strongly controled by geology as interpreted from principal component analysis, raw data are used following a log_{10} transformation.

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

Number	Name	Type	Status	Commodities
115J 001	BRACT	Unknown	Unknown	
115J 002	KLOT	Porphyry Cu-Mo-Au	Showing	Copper, Molybdenum, Uranium
115J 003	MIM	Porphyry Cu-Mo-Au	Prospect	Copper, Gold
115J 004	SOMME	Porphyry Mo (Low F-Type)	Anomaly	
115J 005	PRIDE	Vein Polymetallic Ag-Pb-Zn±Au	Showing	
115J 006	BURL	Unknown	Unknown	
115J 008	SONORA GULCH	Orogenic Au	Drilled Prospect	Antimony, Copper, Silver, Lead, Molybdenum, Gold
115J 009	STRAW	Unknown	Anomaly	Antimony, Arsenic, Copper
115J 010	YOG	Unknown	Unknown	
115J 011	GUESS	Plutonic Related Au	Anomaly	Molybdenum, Bismuth, Tin, Arsenic, Gold
115J 012	OATS	Unknown	Unknown	
115J 013	SELWYN	Unknown	Anomaly	
115J 015	CROCK	Porphyry Cu-Mo-Au	Unknown	Copper
115J 016	BATTLE	Unknown	Anomaly	
115J 017	COCKFIELD	Porphyry Cu-Mo-Au	Showing	Copper, Molybdenum
115J 020	HAXE	Vein Polymetallic Ag-Pb-Zn±Au	Anomaly	Copper, Molybdenum
115J 021	VIC	Unknown	Anomaly	
115J 022	RUDE CREEK	Vein Polymetallic Ag-Pb-Zn±Au	Showing	Gold, Silver, Lead, Zinc
115J 023	NORDEX	Vein Polymetallic Ag-Pb-Zn±Au	Unknown	Lead, Silver
115J 024	TOAD	Unknown	Unknown	
115J 025	PEG	Porphyry Cu-Mo-Au	Anomaly	Copper
115J 026	SABINA	Unknown	Unknown	
115J 027	BOMBER	Vein Polymetallic Ag-Pb-Zn±Au	Past Producer	Lead, Zinc, Silver
115J 028	CASINO	Porphyry Cu-Mo-Au	Deposit	Copper, Gold, Molybdenum, Silver
115J 029	HOLE	Porphyry Cu-Mo-Au	Anomaly	Copper, Molybdenum
115J 030	BRAN	Unknown	Anomaly	Copper
115J 031	CLEVELAND	Porphyry Cu-Mo-Au	Anomaly	Copper, Molybdenum
115J 032	RONGE	Porphyry Cu-Mo-Au	Anomaly	
115J 033	FIJI	Unknown	Unknown	
115J 034	GEP	Porphyry Cu-Mo-Au	Anomaly	Copper, Molybdenum
115J 035	AZTEC	Porphyry Cu-Mo-Au	Anomaly	Copper, Molybdenum
115J 036	ZAPPA	Porphyry Cu-Mo-Au	Drilled Prospect	Copper, Gold, Molybdenum
115J 037	DOYLE	Unknown	Unknown	
115J 038	ROCKLAND	Unknown	Unknown	
115J 040	BOREAL	Porphyry Cu-Mo-Au	Showing	Copper, Molybdenum, Silver
115J 041	JOG	Unknown	Unknown	
115J 043	MOG	Unknown	Anomaly	
115J 044	BID	Porphyry Cu-Mo-Au	Showing	Copper, Molybdenum
115J 045	VINA	Porphyry Cu-Mo-Au	Showing	Copper, Molybdenum
115J 048	HANNA	Porphyry Cu-Mo-Au	Anomaly	Gold, Arsenic, Copper
115J 049	POLARIS	Unknown	Anomaly	
115J 050	Boulevard	Orogenic Au	Drilled Prospect	Molybdenum, Antimony, Gold, Arsenic
115J 051	GOLD HAWK	Unknown	Unknown	
115J 052	TONI TIGER	Skarn Cu	Showing	Copper, Molybdenum, Silver, Tungsten
115J 053	LEO LION	Unknown	Anomaly	Copper, Silver, Lead
115J 054	OVERPROOF	Unknown	Unknown	Arsenic, Gold
115J 055	KIRKMAN	Unknown	Unknown	
115J 056	CORONATION	Unknown	Unknown	
115J 057	SANSON	Unknown	Anomaly	
115J 058	VEGAS	Unknown	Anomaly	Copper
115J 059	TULARE	Unknown	Unknown	
115J 060	ARLINGTON	Unknown	Unknown	
115J 061	BALLARAT	Plutonic Related Au	Anomaly	Galena, Gold, Silver
115J 062	SUGAR	Unknown	Anomaly	Gold
115J 063	FLUSH	Unknown	Unknown	
115J 064	LYON	Porphyry Cu-Mo-Au	Anomaly	
115J 065	TIJANA	Unknown	Unknown	
115J 066	NEWMAR	Unknown	Anomaly	Gold
115J 067	JIPPO	Unknown	Anomaly	
115J 068	ACROLL	Unknown	Unknown	
115J 069	EMPIRE	Unknown	Anomaly	Copper
115J 070	MARQUERITE	Vein Polymetallic Ag-Pb-Zn±Au	Showing	Gold, Silver, Copper
115J 071	BUCK	Plutonic Related Au	Prospect	Gold, Arsenic, Antimony, Mercury, Barium
115J 072	SCROGGIE	Porphyry Cu-Mo-Au	Showing	Copper, Molybdenum
115J 073	BAJA	Unknown	Unknown	
115J 074	MASCOT	Orogenic Au	Prospect	Gold, Silver, Arsenic
115J 089	PATTISON	Porphyry Cu-Mo-Au	Drilled Prospect	Copper, Molybdenum
115J 090	INDIANA	Porphyry Cu-Mo-Au	Drilled Prospect	Copper, Molybdenum
115J 091	AMOCO	Porphyry Cu-Mo-Au	Showing	Copper, Molybdenum
115J 092	HASL	Uranium	Anomaly	Uranium
115J 093	ONASICK	Uranium	Anomaly	Uranium
115J 098	SIZZLER	Vein Au-Quartz	Showing	Gold
115J 099	IDAHO	Vein Polymetallic Ag-Pb-Zn±Au	Showing	Antimony, Gold, Arsenic, Lead, Zinc, Silver
115J 100	SHADOW	Porphyry-related Au	Anomaly	Gold
115J 101	CANADIAN CREEK	Porphyry Cu-Mo-Au	Drilled Prospect	Copper, Gold, Molybdenum
115J 102	NOWHERE	Vein Au-Quartz	Showing	Gold, Silver
115J 103	GERTIE MAIN	Orogenic Au	Drilled Prospect	Gold, Bismuth, Arsenic, Molybdenum
115J 108	TOTAL	Unknown	Unknown	Gold
115J 110	COFFEE MAIN	Orogenic Au	Deposit	Gold, Antimony, Arsenic
115J 111	COFFEE WEST	Orogenic Au	Deposit	Gold
115J 112	DAN MAN	Orogenic Au	Drilled Prospect	Gold, Arsenic, Antimony
115J 113	Hackly Gold	Orogenic Au	Drilled Prospect	Gold, Bismuth, Molybdenum
115K 075	SNAG	Ultramafic Mafic Gabbroid Cu-Ni-PGE	Anomaly	
115K 077	ONION	Ultramafic Mafic Gabbroid Cu-Ni-PGE	Prospect	Copper, Iridium, Gold, Nickel, Palladium, Platinum, Rhodium
115K 078	CHAIR	Vein Polymetallic Ag-Pb-Zn±Au	Prospect	Copper, Zinc, Silver, Lead, Gold
115K 079	NUTZOTIN	Skarn Cu	Prospect	Copper, Silver
115K 080	CALIFORNIA	Plutonic Related Au	Unknown	
115K 081	WRANGELL	Porphyry Cu-Mo-Au	Anomaly	
115K 082	TRUDI	Porphyry Cu-Mo-Au	Drilled Prospect	Copper, Molybdenum
115K 083	RIP	Vein Cu±Ag Quartz	Showing	Copper, Gold
115K 084	BONZA	Ultramafic Mafic Gabbroid Cu-Ni-PGE	Anomaly	
115K 085	FAIRCLOUGH	Vein Cu±Ag Quartz	Showing	
115K 086	BATRICK	Vein and replacement Mn	Showing	Manganese
115K 095	NUTZ	Volcanogenic Sulphide - type not determined	Showing	
115K 105	YELLOW	Ultramafic Mafic Gabbroid Cu-Ni-PGE	Showing	
115K 109	BAKER	Unknown	Anomaly	Arsenic, Gold

LEGEND

- Town
- Mineral Occurrence
- Road
- Contour
- River
- NTS map sheet
- Water Body
- Wetland
- Sample Location
- Catchment
- Catchment > 16km²

Weighted sums model (PC residuals)

Porphyry Cu-Mo deposits

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

REFERENCES

Geological Survey of Canada, 1987. Regional Stream Sediment and Water Geochemical Reconnaissance Data, Yukon (115J & 115K). Geological Survey of Canada, Open File 1363.

Jackaman, W., 2011. Regional Stream Sediment Geochemical Data, Stevenson Ridge area, southwest Yukon (NTS 115J and 115K). Yukon Geological Survey, Open File 2011-28.

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.

RECOMMENDED CITATION

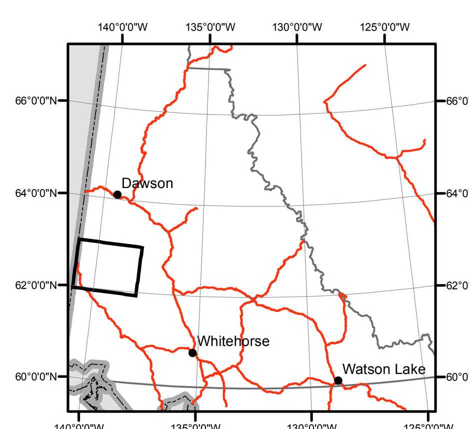
MACKIE, R., ARNE, D. AND PENNIMPEDE, C., 2016. Weighted sums model for Porphyry Cu-Mo deposits using principal component residuals. In: Enhanced interpretation of stream sediment geochemical data for NTS map sheet 115J and 115K. Yukon Geological Survey, Open File 2016-15, scale 1:250 000, sheet 12 of 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.



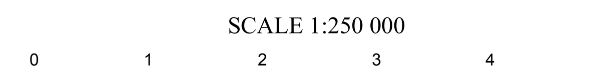
1:250 000-scale topographic base data produced by CENTRE FOR TOPOGRAPHIC INFORMATION, NATURAL RESOURCES CANADA

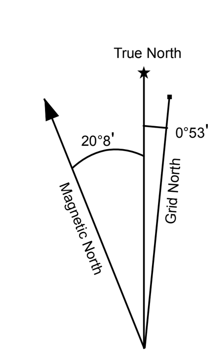
ONE THOUSAND METRE GRID
Universal Transverse Mercator Projection
North American Datum 1983
Zone 7

CONTOUR INTERVAL 100 FEET
Elevations in metres above Mean Sea Level

Porphyry Cu-Mo
Weighted sums model
(Principal Component Residuals)
Sheet 12 of 13

SCALE 1:250 000





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

115N PART OF 115O	115O STEWART RIVER	115P MCQUESTEN
115K THIS MAP	115J THIS MAP	115I CARMACKS
115F PART OF 115G	115G KLUANE LAKE	115H AISHIHIK LAKE

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Government of Yukon

Open File 2016-15

Weighted sums model for Porphyry Cu-Mo deposits using principal component residuals (NTS 115J and 115K) Sheet 12 of 13

by

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