



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 9. CONTOUR INTERVAL 100 FEET. Elevations in metres above Mean Sea Level.

**Porphyry Cu-Mo Deposits Weighted sums model (Principal Component Residuals) Sheet 13 of 17**

SCALE 1:250 000

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

10K	10J	10I
TAY RIVER	SHELDON LAKE	LITTLE NAHANNI RIVER
10F	10G	10H
QUIET LAKE	<b>THIS MAP</b>	FRANCES LAKE
10C	10B	10A
TEBUN	WOLF LAKE	WATSON LAKE

**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**

Regional stream sediment and water samples from the Finlayson Lake map area (105G) were collected at a reconnaissance scale in 1987 as part of the National Geochemical Reconnaissance program. Field data for 914 sites and initial geochemical data were released in Geological Survey of Canada ("GSC") Open File 1648 (Friske and Hornbrook, 1988). In 2008, new geochemical data (ICP-MS) was released in GSC Open File 5696 (Friske et al., 2008a) and Yukon Geological Survey ("YGS") Open File 2008-3 (Friske et al., 2008b). The reader is referred to these open files for details regarding sampling techniques, analytical procedures and quality control and assurance. While the database contains information for 914 sample sites, only 871 have been 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 'omitted' sample sites is due to the difficulty of defining drainage basins in regions of subdued topography.

**MINERAL OCCURRENCES**

A variety of types of base and precious-metal mineralization have been documented in the map sheet as summarized in Table 1 (Yukon MINFILE, 2015). Several volcanogenic massive sulphide deposits have been discovered and encompass the Finlayson Lake VMS district. Various sub-classes or types have been documented including: volcanoclastic-hosted Wolverine-Lynx (Fetish Occurrence), Kuroko-type Kudz Ze Kayah (Tag Occurrence) and GP4F deposits, Besshi-type Frye Lake deposit and Cyprus-type Ice deposits. Other notable occurrences in the region include the Tintina (105G), Groundhog, Ketzakey and Stumpy (105F) polymetallic Ag-Pb-Zn deposits (105G), Ketsa River Au deposit (105F), Anvil district Pb-Zn-Ag SEDEX (105K) and Grew Creek epithermal Au-Ag deposits (105K).

**WEIGHTED SUMS MODELING**

As described in the report accompanying this map (Mackie et al., 2015), two approaches have been used to subdivide the influence of background lithological variation and secondary absorption on the composition of stream sediments. One uses data leveled by the dominant geology mapped within

each catchment. The other uses residuals calculated from regression against selected principal components. Weighted sums models (WSM) have been generated using the processed data. Importance rankings used in the WSM for a variety of deposit types are summarized in Table 2. Each model is optimized for a specific deposit type however multiple deposit types may be represented in a given model due to similarities in elemental abundances and associations. A WSM model is also presented for potential hydrothermal anomalies related to scavenging of metals by secondary Fe and Mn-oxides.

Exploratory data analysis of both raw element data and principal components indicates that the distribution of many commodity and pathfinder elements is strongly controlled by lithological variation. The first principal component, accounting for ~30% of the total variation, shows high positive loadings for Cd, Se, Sb, Hg, Ba, Ag, Mo and Zn, and forms a coherent spatial trend that follows stratigraphy (i.e., Earn, Askin and Jones Lake groups). The second principal component with high positive loadings in Ni, Cr, Co, Mg and Cu matches the distribution of mafic and ultramafic rocks. Regression analysis of selected metals against the relevant principal component(s) effectively removes these terrane-effects while preserving and in some cases enhancing, responses related to known occurrences. Leveling by dominant mapped lithology has a more subtle effect on filtering these the interpreted lithological control for certain elements (e.g., Ag, Cd, Sb, Hg, Ba and Mo). In order to reduce this impact in the WSM these elements were given low importance rankings (or were omitted) for certain deposit types. Additionally, strong responses for Zn, Pb and Ag related to VMS and polymetallic Ag-Pb-Zn vein mineralization prevented these elements as pathfinders for other deposit types. Negative rankings were assigned to certain variables to help differentiate deposit types with similar metal associations. For example, negative rankings for Pb and Zn are used in the WSM for Epithermal Au-Ag in order to reduce the contribution of Ag related to VMS mineralization.

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 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 for samples in large catchments are also of interest.

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

Target Deposit Type <sup>a</sup>	Other Deposit Types <sup>a</sup>	Mn	Fe	Co	Ni	Cu	Mo	Zn	Pb	Ag	Au	As	Ba	Cd	Sn	Te	Hg	Tl	Bi	W
Polymetallic Ag-Pb-Zn	SEDEX (high Ag); VMS							1	4	4	1	1	1	1	1	1	1	1	1	1
VMS (Zn-rich)	SEDEX (low Ag); Pb-Zn skarn						2	4	3	1										
VMS (Cu-rich)		3	4	-2	-1	-1								2	3					
Intusion-related Au	Epithermal Au-Ag						-2	-2	1	4	2					1				2
Epithermal Au-Ag	High and low sulphidation							-1	-1	4	3	2				1				2
Porphyry Cu-Mo	Cu-Au porphyry; Cu skarn					4	3	-1	-1	2	1									2
Hydrothermal Anomaly	W skarn and vein	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 manto styles; SEDEX = sedimentary exhalative; VMS = volcanic-hosted/associated massive sulphide deposits; Hydrothermal Anomaly = Principal Component 5.

<sup>b</sup>Raw data following a log<sub>10</sub> transformation.

**LEGEND**

- Town
- ▲ Mineral Occurrence
- Road
- Contour
- River
- Water Body
- Wetland
- Sample Location
- Catchment
- Catchment > 10 km<sup>2</sup>

**REFERENCES**

Friske, P.W. and Hornbrook, E.H., 1988. National Geochemical Reconnaissance Stream Sediment and Water Geochemical Data, South-Central Yukon (NTS 105G). Geological Survey of Canada, Open File 1648.

Friske, P.W.B., Hornbrook, E.H.W., McCurdy, M.W., Day, S.J.A. and McNeil, R.J., 2008a. Regional stream sediment and water geochemical data, Finlayson Lake area, southeastern Yukon (NTS 105G). Geological Survey of Canada, Open File 5696.

Friske, P.W.B., McCurdy, M.W., Day, S.J.A. and McNeil, R.J., 2008b. Regional stream sediment and water geochemical data, Finlayson Lake area, southeastern Yukon Territory (NTS 105G). Yukon Geological Survey, Open File 2008-3.

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 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.

**RECOMMENDED CITATION**

MACKIE, R., ARNE, D. AND PENNINGE, C., 2015. Weighted sums model for Porphyry Cu-Mo deposits using principal component residuals. In: Enhanced interpretation of stream sediment geochemical data for NTS 105G. Yukon Geological Survey, Open File 2015-26, scale 1:250 000, sheet 13 of 17.

Catchment basin polygons generated by the Yukon Geological Survey (J. O. Bruce). Any revisions or additional geological information noted to the user would be welcomed by the Yukon Geological Survey.

Paper copies of this map and the accompanying report may be purchased from the Yukon Geological Survey, Energy, Mines and Resources, Government of Yukon, Room 102-300 Main St., Whitehorse, Yukon, Y1A 2B5. Ph. 867-867-3201, Email [geology@gov.yk.ca](mailto: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>.

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

Number	Name	Type	Status	Commodities
105G 001	IMONT	Vein Polymetallic Ag-Pb-Zn-Au	Prospect	Copper, Silver
105G 003	BLUEBERRY	Vein Polymetallic Ag-Pb-Zn-Au	Drilled Prospect	Copper, Silver, Zinc, Tungsten, Gold, Lead
105G 005	BLAKE	Vein Polymetallic Ag-Pb-Zn-Au	Showing	Copper, Zinc
105G 006	TINTINA	Manto Polymetallic Ag-Pb-Zn	Deposit	Bismuth, Gold, Silver, Zinc, Lead, Cadmium, Copper
105G 007	PLUM	Sediment hosted Mississippi Valley Type Pb-Zn (MVT)	Showing	Lead, Silver, Zinc
105G 007	PLUM	Volcanogenic Massive Sulphide (VMS) Kuroko Cu-Pb-Zn	Deposit	Silver, Lead, Zinc, Copper, Barite, Gold
105G 009	MCNEIL	Volcanogenic Massive Sulphide (VMS) Besshi Cu-Zn	Showing	Copper
105G 010	HALLER	Vein Polymetallic Ag-Pb-Zn-Au	Showing	Copper
105G 011	JAKE	Vein Polymetallic Ag-Pb-Zn-Au	Showing	Barite, Copper, Silver
105G 013	HOOD	Skarn Pb-Zn	Drilled Prospect	Lead, Silver, Zinc
105G 014	CHER	Unknown	Anomaly	
105G 015	CHER	Volcanogenic Massive Sulphide (VMS) Besshi Cu-Zn	Showing	
105G 016	EL	Volcanogenic Massive Sulphide (VMS) Kuroko Cu-Pb-Zn	Showing	Arsenic, Silver, Zinc, Lead, Asbestos, Gold, Barite
105G 017	PIPK	Vein Polymetallic Ag-Pb-Zn-Au	Showing	Lead, Silver
105G 018	GRASS	Vein Polymetallic Ag-Pb-Zn-Au	Showing	Molybdenum, Tungsten
105G 019	RODIT	Skarn W	Drilled Prospect	Copper, Lead, Zinc, Tungsten
105G 020	RILEY	Unknown	Anomaly	Arsenic, Beryllium, Lead, Tungsten, Copper
105G 021	ZELNSKI	Vein Polymetallic Ag-Pb-Zn-Au	Showing	Arsenic, Beryllium, Fluorite, Lead, Zinc, Silver, Copper
105G 022	GIL	Unknown	Unknown	Copper, Zinc
105G 024	GOOD	Unknown	Anomaly	Copper, Zinc
105G 025	CHISHOLM	Unknown	Unknown	Anomaly
105G 026	RIVERA	Volcanogenic Massive Sulphide (VMS) Besshi Cu-Zn	Drilled Prospect	Copper, Zinc
105G 027	LEO	Vein Polymetallic Ag-Pb-Zn-Au	Prospect	Arsenic, Gold, Zinc, Lead, Copper
105G 028	COPP	Manto Polymetallic Ag-Pb-Zn	Prospect	Copper, Lead, Zinc
105G 029	GEE	Vein Polymetallic Ag-Pb-Zn-Au	Showing	
105G 030	FIT	Unknown	Showing	Copper, Silver, Gold, Uranium, Zinc
105G 031	ROCK	Vein Au-Quartz	Showing	Copper, Lead, Silver
105G 032	PAC	Volcanogenic Massive Sulphide (VMS) Kuroko Cu-Pb-Zn	Drilled Prospect	Beryllium, Chromium, Gold, Lead, Zinc, Silver, Copper
105G 033	TRAK	Unknown	Anomaly	Copper, Zinc
105G 034	FRYE	Volcanogenic Massive Sulphide (VMS) Besshi Cu-Zn	Showing	Cobalt, Copper, Zinc, Silver, Gold
105G 035	TOP	Vein Polymetallic Ag-Pb-Zn-Au	Showing	Cobalt, Copper, Lead, Silver, Zinc, Gold
105G 036	LOUB	Skarn Cu	Anomaly	Cobalt, Gold, Lead, Zinc, Silver, Copper
105G 037	BLACK	Unknown	Anomaly	Cobalt, Copper, Molybdenum, Zinc
105G 038	NORTH RIVER	Skarn Cu	Showing	Copper, Zinc, Lead, Silver
105G 039	VINCENT	Vein Polymetallic Ag-Pb-Zn-Au	Showing	Copper, Zinc, Silver, Lead
105G 040	JOE	Unknown	Drilled Prospect	Barite, Copper, Zinc
105G 041	FINLAYSON	Unknown	Unknown	Copper, Nickel, Zinc
105G 042	MCEVOY	Sediment hosted Sedimentary Exhalative Zn-Pb-Ag (Sedex)	Anomaly	
105G 043	ROST	Ultramafic-hosted asbestos	Showing	Asbestos
105G 044	MINK	Unknown	Unknown	Asbestos
105G 045	STARR	Unknown	Anomaly	
105G 046	FRAP	Unknown	Unknown	
105G 047	POP	Volcanogenic Massive Sulphide (VMS) Besshi Cu-Zn	Showing	Asbestos, Gold, Zinc, Lead, Copper
105G 049	COW	Unknown	Unknown	
105G 051	CHOW	Volcanogenic Sulphide - type not determined	Prospect	Copper, Zinc, Gold, Lead
105G 052	DOL	Volcanogenic Sulphide - type not determined	Prospect	Copper, Zinc, Silver
105G 053	CAMPBELL	Coal	Anomaly	Coal
105G 054	SUN	Unknown	Unknown	
105G 055	PAY	Vein Polymetallic Ag-Pb-Zn-Au	Drilled Prospect	Copper, Lead, Zinc, Silver, Gold
105G 056	PAY	Sediment hosted Sedimentary Exhalative Zn-Pb-Ag (Sedex)	Drilled Prospect	Gold, Silver, Zinc, Lead
105G 057	RIS	Vein Quartz	Showing	Copper
105G 058	QUED	Skarn Pb-Zn	Showing	Copper, Zinc
105G 060	JAKE	Skarn Pb-Zn	Showing	Copper, Zinc, Silver, Lead
105G 061	HOODE	Skarn Pb-Zn	Showing	Arsenic, Lead, Zinc, Silver, Gold
105G 062	WAP	Vein Polymetallic Ag-Pb-Zn-Au	Showing	Lead, Silver, Zinc
105G 063	WATERS	Vein Polymetallic Ag-Pb-Zn-Au	Showing	Copper, Lead, Zinc
105G 064	ZIMMER	Sediment hosted Mississippi Valley Type Pb-Zn (MVT)	Showing	Copper, Lead, Zinc
105G 065	ROSS	Vein Au-Quartz	Showing	Copper
105G 066	CW	Unknown	Anomaly	
105G 067	LAWN	Unknown	Unknown	
105G 068	ASH	Unknown	Drilled Prospect	Copper, Lead, Zinc
105G 069	HARMAN	Skarn Pb-Zn	Prospect	Barium, Silver, Zinc, Copper, Lead
105G 070	FRIEND	Sediment hosted Sedimentary Exhalative Zn-Pb-Ag (Sedex)	Prospect	Copper, Lead, Zinc, Silver
105G 071	BARIA	Skarn W	Prospect	Barium, Tin, Tungsten, Gold
105G 072	WOLVERINE	Volcanogenic Massive Sulphide (VMS) Kuroko Cu-Pb-Zn	Producer	Copper, Gold, Zinc, Silver, Lead
105G 073	QUANDARY	Unknown	Anomaly	Copper, Nickel, Zinc, Silver, Gold
105G 074	REED	Unknown	Anomaly	Chromium, Lead, Silver, Zinc, Nickel, Cobalt, Gold
105G 075	MONTOSH	Unknown	Anomaly	
105G 076	FREBERG	Unknown	Anomaly	Copper, Zinc
105G 077	FLIN	Volcanogenic Massive Sulphide (VMS) Kuroko Cu-Pb-Zn	Drilled Prospect	Copper, Lead, Zinc
105G 078	FLON	Unknown	Unknown	
105G 079	HUDSON	Unknown	Unknown	Copper, Zinc
105G 080	ARGORME	Unknown	Drilled Prospect	
105G 081	MONEY	Volcanogenic Massive Sulphide (VMS) Kuroko Cu-Pb-Zn	Drilled Prospect	Copper, Silver, Zinc, Lead
105G 082	AHLURST	Volcanogenic Sulphide - type not determined	Drilled Prospect	Barite, Copper, Silver, Zinc, Lead
105G 083	FY	Volcanogenic Massive Sulphide (VMS) Kuroko Cu-Pb-Zn	Drilled Prospect	Copper, Gold, Silver, Zinc, Lead
105G 084	BARK	Unknown	Drilled Prospect	
105G 085	GENUFLECT	Unknown	Unknown	
105G 086	IBEND	Unknown	Anomaly	
105G 087	KNOTT	Unknown	Drilled Prospect	
105G 088	COOKE	Volcanogenic Sulphide - type not determined	Anomaly	Chromium, Copper, Zinc, Lead
105G 089	HENEL	Unknown	Anomaly	Copper, Zinc, Gold, Lead
105G 090	CARBANK	Volcanogenic Massive Sulphide (VMS) Kuroko Cu-Pb-Zn	Anomaly	Copper, Silver, Zinc
105G 091	BOX	Volcanogenic Sulphide - type not determined	Anomaly	Copper, Lead
105G 092	COOPE	Unknown	Anomaly	
105G 093	REEDHAT	Sediment hosted Sedimentary Exhalative Zn-Pb-Ag (Sedex)	Drilled Prospect	Lead, Zinc
105G 094	DWONK	Sediment hosted Sedimentary Exhalative Zn-Pb-Ag (Sedex)	Drilled Prospect	Barite
105G 095	PELANUT	Unknown	Unknown	
105G 096	FRAD	Sediment hosted Sedimentary Exhalative Zn-Pb-Ag (Sedex)	Showing	Barium, Zinc, Lead, Silver
105G 097	FOG	Skarn W	Showing	Tungsten
105G 098	ANT	Volcanogenic Massive Sulphide (VMS) Kuroko Cu-Pb-Zn	Drilled Prospect	Copper, Zinc, Silver, Lead
105G 099	BRENDEX	Volcanogenic Sulphide - type not determined	Prospect	Barite, Copper, Lead, Silver, Zinc, Gold
105G 100	HARRIS	Volcanogenic Massive Sulphide (VMS) Besshi Cu-Zn	Prospect	Copper, Silver, Zinc, Gold, Lead
105G 101	ADJONSON	Unknown	Drilled Prospect	Copper, Lead, Zinc
105G 102	HONDEE	Skarn W	Showing	Copper, Silver, Tungsten, Gold
105G 103	FRISH	Unknown	Unknown	
105G 104	SANDERS	Skarn W	Drilled Prospect	Beryllium, Copper, Tungsten, Zinc, Lead, Chromium
105G 105	WHIT	Unknown	Anomaly	Copper, Zinc, Lead
105G 106	ST. CYR	Unknown	Anomaly	
105G 107	RIVER	Unknown	Anomaly	Copper, Lead, Gold, Molybdenum, Zinc
105G 108	WOLV	Unknown	Unknown	
105G 109	COPLAND	Unknown	Unknown	
105G 110	LETS	Unknown	Unknown	
105G 111	TOR	Unknown	Unknown	
105G 112	DESOTO	Unknown	Drilled Prospect	Copper, Lead, Zinc, Silver
105G 113	AZULS	Unknown	Anomaly	
105G 114	LADY LEE	Ultramafic Mafic Jade (Nephrite)	Showing	Jade/Nephrite
105G 115	EFF	Vein Polymetallic Ag-Pb-Zn-Au	Prospect	Lead, Zinc, Silver
105G 116	CHARLE	Unknown	Anomaly	Copper, Lead, Zinc, Silver
105G 117	KUDZ ZE KAYAH	Volcanogenic Massive Sulphide (VMS) Kuroko Cu-Pb-Zn	Deposit	Copper, Gold, Zinc, Silver, Lead
105G 118	ICE	Volcanogenic Massive Sulphide (VMS) Cyprus Cu-Zn	Showing	Copper, Silver, Gold, Cobalt
105G 119	SHOT	Skarn Pb-Zn	Showing	Copper, Zinc, Lead, Silver
105G 120	BLUE LINE	Volcanogenic Massive Sulphide (VMS) Kuroko Cu-Pb-Zn	Showing	Copper, Gold, Lead, Silver, Zinc
105G 121	NET	Volcanogenic Massive Sulphide (VMS) Kuroko Cu-Pb-Zn	Showing	Copper, Silver, Zinc, Lead, Silver
105G 122	OVERTIME	Volcanogenic Massive Sulphide (VMS) Kuroko Cu-Pb-Zn	Showing	Copper, Silver, Lead, Zinc
105G 123	GOA	Volcanogenic Massive Sulphide (VMS) Kuroko Cu-Pb-Zn	Prospect	Copper, Lead, Zinc, Silver
105G 124	RED LINE	Volcanogenic Massive Sulphide (VMS) Kuroko Cu-Pb-Zn	Drilled Prospect	Copper, Lead, Zinc, Silver
105G 125	GOON	Skarn Pb-Zn	Drilled Prospect	Copper, Zinc, Silver, Gold, Lead
105G 126	FBI	Volcanogenic Massive Sulphide (VMS) Besshi Cu-Zn	Drilled Prospect	Copper, Silver, Zinc, Lead, Nickel
105G				