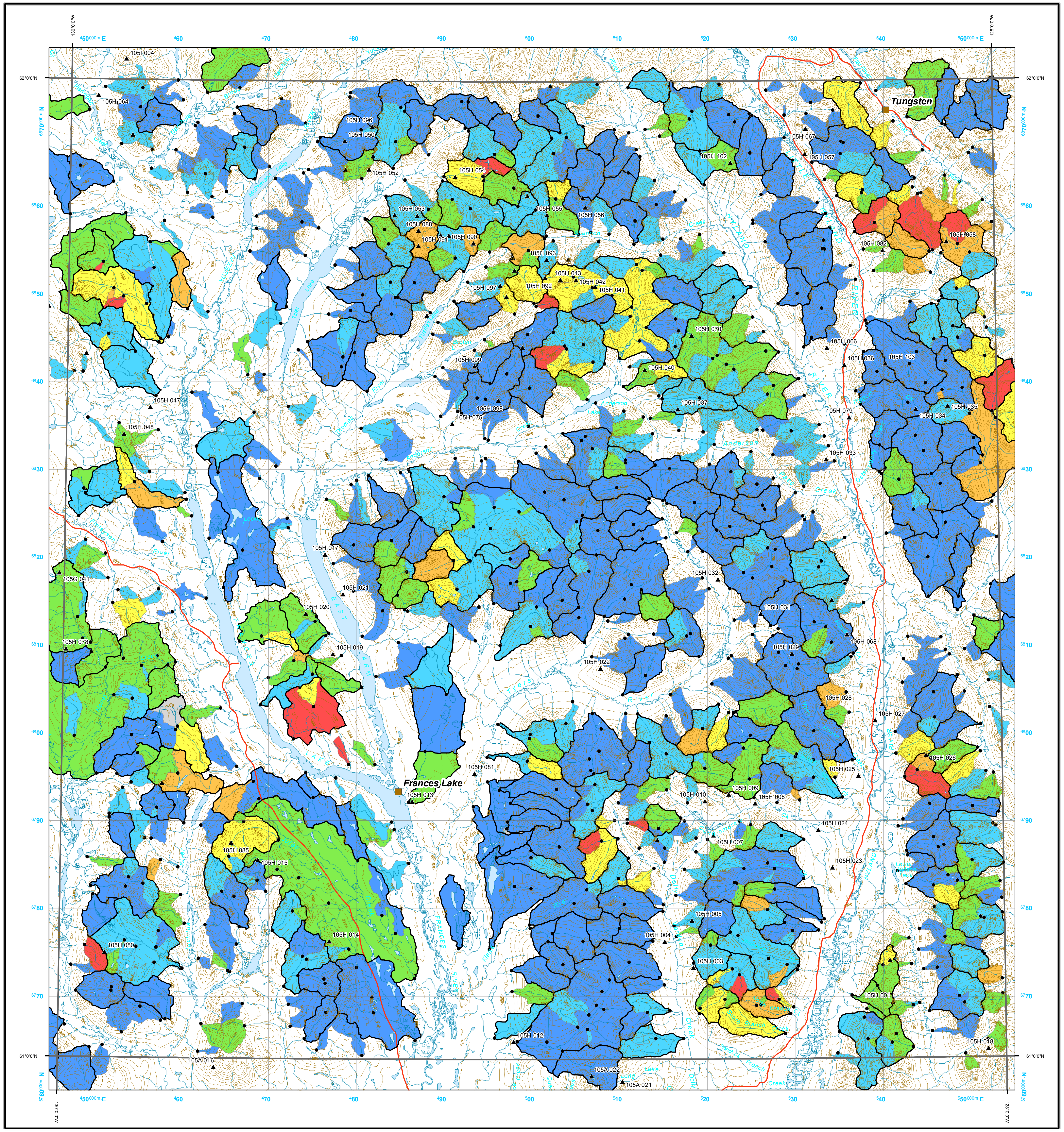
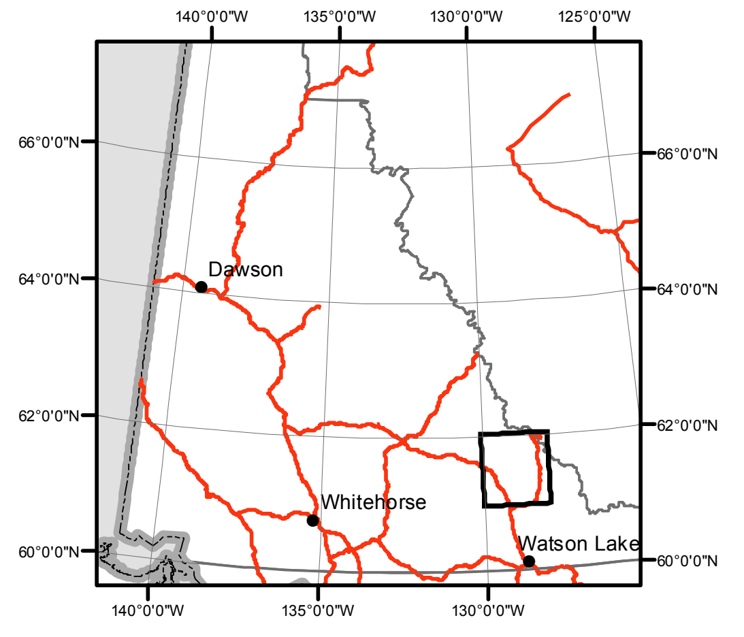




1:250 000-scale topographic base data produced
by
CENTRE FOR TOPOGRAPHIC INFORMATION,
NATURAL RESOURCES CANADA

ONE THOUSAND METRE GRID
Universal Transverse Mercator Projection
North American Datum 1983
Zone 9

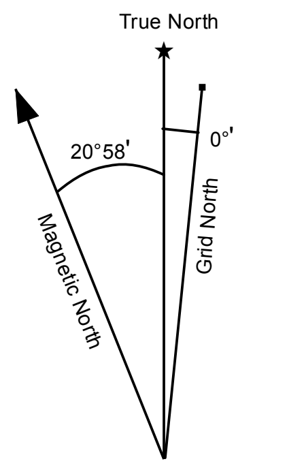
CONTOUR INTERVAL 100 FEET
Elevations in metres above Mean Sea Level

Porphyry Mo Deposits
Weighted sums model
(Geology Levelled)
Sheet 5 of 15

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

105J SHELDON LAKE	105I LITTLE NAHANNI RIVER	095L GLACIER LAKE
105G FINLAYSON LAKE	105H **THIS MAP**	095E FLAT RIVER
105B WOLF LAKE	105A WATSON LAKE	095D COAL RIVER

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 accompanying 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 Frances Lake map area (105H) were collected at a reconnaissance scale in 1987 as part of the Canada-Yukon Mineral Development Agreement (Hornbrook & Friske, 1988). Field descriptions and initial geochemical data for 917 sites were released in Geological Survey of Canada ("GSC") Open File 1649. New geochemical data from the re-analysis of archived sample material were released in GSC Open File 6043 and Yukon Geological Survey ("YGS") Open File 2009-1. The reader is referred to these open files 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 Frances Lake map sheet as shown in Table 1 (YGS MINFILE, 2015). Skarn is dominant style of mineralization documented in the area and includes W (Tai, Woah and Susan deposits), Pb-Zn (Max, Miko, Fir Tree, and Lee deposits) and Cu (Jan Prospect) types. The producing Cantung W-skarn mine, currently operated by North American Tungsten Corporation, occurs in the north-eastern corner of the map area within Northwest Territories. In addition to skarn mineralization, intrusion-related gold mineralization has also been documented within the map area (Justin Deposit). The Finlayson Lake Zn-Pb-Cu-Ag VMS district and the Tintina polymetallic Ag-Pb-Zn deposit occur in the adjacent map area towards the west (105G).

WEIGHTED SUMS MODELLING

As described in the report accompanying this map (Mackie *et al*., 2015), two approaches have been used to subdue effects related to changes in underlying geology. One uses data levelled by the dominant geology mapped within each catchment. The other uses residuals calculated from regression against principal components interpreted to represent geologic horizons that exhibit a strong influence on the distribution of commodity and pathfinder elements. Weighted sums models (WSM) have been generated using the processed data. Importance rankings used in Weighted Sums Models (WSM) for a variety of deposit types 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. A WSM is presented for epithermal Au-Ag mineralization, however given the lack of occurrences of this type within the map area the model could not be validated and therefore should be used with caution.

Exploratory data analysis of both raw element data and principal components indicate that the distribution of many commodity and pathfinder elements is strongly influenced by lithological variation. The first principal component shows high positive loadings for Sb, Se, Hg, Ni, Ag, Cu, As, Cd, Ba and Zn; and negative loadings for K, Ti, Na, Al, Bi and U. Respectively, these groupings form geochemical domains that match the transition from sedimentary and volcanic rocks in the west to felsic intrusive rocks in the east. The second principal component shows high negative loadings for Co, Fe, Cr, Ni, Cu and Mg which forms a spatial pattern matching the mapped distribution of the Hyland Group sedimentary rocks. Regression analysis of selected metals against the relevant principal component(s) effectively filters these 'terrane-effects' while preserving responses related to known occurrences. Levelling by the dominant mapped geology has a more subdued effect on filtering the interpreted lithological control for certain (*e.g.*, Ba, Cd, Hg and Ag). In order to reduce the impact these elements had in the WSM they were assigned low importance rankings or were omitted for certain deposit types. Negative rankings were assigned to certain variables to help differentiate deposit types with similar metal associations. For most deposit types the WSM models generated using the two approaches are quite similar.

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^2). Catchments that cover larger areas are interpreted to have been under-sampled and thus require further sampling to properly evaluate geochemical anomalism. Given the likelihood that a mineralization 'signal' would be progressively diluted with increase in catchment size, marginally high WSM scores for large catchments could also be of interest.

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	Ni	Cu	Mo	Zn	Pb	Ag	Au[1]	As	Ba	Cd	Sn	Sb	Te	Hg	Tl	Bi	F	W
Pb-Zn skarn	VMS, SEDEX, MVT, Polymetallic Ag-Pb-Zn							3	4	1				1						1		
VMS (Zn-rich)	SEDEX, Pb-Zn skarn, MVT, Polymetallic Ag-Pb-Zn					2		4	2	1				2								-2
Cu skarn	Porphyry Cu, Cu-Ag qtz vein					4				2							1			1		
W skarn	Porphyry Mo						2													1		3
Porphyry Mo	Porphyry Cu, W skarn					1	4															2
Intrusion-related Au	Epithermal Au-Ag										3	2				1				1		
Epithermal Au-Ag	Intrusion-related Au, Polymetallic Ag-Pb-Zn									3	2	3										

[a] VMS = volcanic hosted/associated massive sulphide; SEDEX = sedimentary exhalative; MVT = Mississippi Valley Type; Polymetallic Ag-Pb-Zn type includes both vein and manto styles.

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

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

Number	Name	Type	Status	Commodities
105H 001	JAN	Skarn Cu	Prospect	Copper, Gold
105H 002	MIDAS	Skarn Cu	Showing	Copper, Zinc, Lead, Silver
105H 003	KEE	Unknown	Unknown	
105H 004	COX	Vein Polymetallic Ag-Pb-Zn±Au	Unknown	Lead, Silver, Zinc
105H 005	FLIP	Skarn Pb-Zn	Drilled Prospect	Copper, Lead, Tungsten, Zinc, Silver, Gold
105H 006	DC	Skarn Pb-Zn	Drilled Prospect	Copper, Silver, Lead, Zinc
105H 007	VAGAS	Unknown	Anomaly	Lead, Zinc
105H 008	MIKO	Skarn Pb-Zn	Drilled Prospect	Copper, Silver, Zinc, Gold, Lead
105H 009	GLENNA	Skarn Pb-Zn	Drilled Prospect	Lead, Zinc, Silver
105H 010	STEELE	Skarn Pb-Zn	Showing	Copper, Silver, Zinc, Lead
105H 011	MAX	Skarn Pb-Zn	Drilled Prospect	Copper, Gold, Lead, Silver, Tungsten, Zinc
105H 012	KLATZA	Unknown	Anomaly	Tungsten
105H 013	FRANCES	Vein Cu±Ag Quartz	Showing	Copper
105H 014	LIND	Ultramafic Mafic Jade (Nephrite)	Producer	Jade/Nephrite
105H 015	DOUG	Vein Cu±Ag Quartz	Showing	Copper
105H 016	TUCHITUA	Ultramafic Mafic Jade (Nephrite)	Past Producer	Chrysotile, Gold, Lead, Silver, Zinc, Jade/Nephrite, Copper
105H 017	EAST ARM	Unknown	Showing	
105H 018	GALE	Skarn Pb-Zn	Prospect	Copper, Silver, Zinc, Lead
105H 019	MAY	Skarn Pb-Zn	Showing	Cobalt, Copper, Molybdenum, Nickel, Zinc, Silver, Gold
105H 020	MAPEL	Vein Polymetallic Ag-Pb-Zn±Au	Showing	Copper, Lead, Gold, Silver, Zinc
105H 021	MATT BERRY	Volcanogenic Massive Sulphide (VMS) Kuroko Cu-Pb-Zn	Deposit	Gold, Lead, Zinc, Antimony, Silver
105H 022	FLUKE	Skarn Pb-Zn	Showing	Lead, Silver, Zinc
105H 023	LUCY	Unknown	Unknown	
105H 024	CANYON	Skarn Pb-Zn	Drilled Prospect	Gold, Zinc, Lead, Silver
105H 025	STU	Skarn W	Showing	Copper
105H 026	TERRY	Skarn W	Prospect	Tungsten
105H 027	CORRIE	Unknown	Drilled Prospect	Bismuth, Zinc, Silver, Nickel, Copper, Gold
105H 028	BLACK JACK	Skarn Pb-Zn	Drilled Prospect	Bismuth, Gold, Silver, Zinc, Lead, Cadmium
105H 029	FIR TREE	Skarn Pb-Zn	Drilled Prospect	Copper, Zinc, Silver, Gold, Lead
105H 030	MONTSE	Skarn W	Unknown	Tungsten
105H 031	RON	Skarn Pb-Zn	Prospect	Cadmium, Lead, Silver, Zinc, Copper, Gold
105H 032	HELEN	Skarn W	Unknown	Bismuth, Silver, Tungsten, Gold
105H 033	BROD	Skarn Pb-Zn	Prospect	Lead, Zinc, Silver
105H 034	NEEBING	Plutonic Related Au	Showing	Gold, Arsenic, Lead
105H 035	JUSTIN	Plutonic Related Au	Drilled Prospect	Copper, Gold, Tungsten, Silver, Lead, Molybdenum, Zinc, Bismuth, Arsenic
105H 036	ROAD	Vein Au-Quartz	Drilled Prospect	Arsenic, Silver, Gold
105H 037	TOY	Skarn Pb-Zn	Showing	Copper, Lead, Silver, Zinc, Gold
105H 040	CREE	Skarn Mo	Showing	Molybdenum
105H 041	BR	Skarn W	Showing	Copper, Tungsten
105H 042	TANYA	Skarn W	Drilled Prospect	Copper, Silver, Zinc, Tungsten, Lead
105H 043	GUY	Skarn W	Showing	Copper, Tungsten
105H 044	RENA	Porphyry Mo (Low F-Type)	Showing	Molybdenum, Tungsten
105H 045	FULCHER	Unknown	Anomaly	Lead, Zinc
105H 046	TUSTLES	Unknown	Anomaly	Copper
105H 047	FIN	Sediment hosted Sedimentary Exhalative Zn-Pb-Ag (Sedex)	Drilled Prospect	Barite, Zinc, Lead, Silver
105H 048	TED	Vein Barite	Prospect	Barite, Silver, Zinc, Gold, Lead
105H 049	NARCHILLA	Skarn W	Prospect	Copper, Silver, Zinc, Gold, Lead
105H 050	LEE	Skarn Pb-Zn	Drilled Prospect	Copper, Zinc, Lead, Silver
105H 051	YUSEZYU	Skarn W	Showing	Copper, Tungsten
105H 052	DODGE	Skarn Mo	Showing	Molybdenum, Tungsten
105H 053	TILLEI	Porphyry Mo (Low F-Type)	Showing	Lead, Molybdenum, Zinc, Tungsten
105H 054	HITCH-HIKER	Manto Polymetallic Ag-Pb-Zn	Showing	Lead, Zinc, Copper, Silver
105H 055	ZEUS	Skarn W	Showing	Copper, Silver, Tungsten, Zinc, Lead
105H 056	CARBIDE	Skarn W	Showing	Molybdenum, Tungsten
105H 057	RICARDO	Unknown	Anomaly	
105H 058	ALM	Skarn Pb-Zn	Unknown	
105H 059	BUS	Skarn W	Prospect	Copper, Molybdenum, Tungsten, Zinc
105H 064	MARKHAM	Skarn Pb-Zn	Showing	Copper, Zinc, Lead
105H 066	3ACE	Plutonic Related Au	Drilled Prospect	Gold, Arsenic
105H 067	GOLDEN CULVERT	Orogenic Au	Showing	Gold, Arsenic
105H 068	SUSAN	Skarn W	Drilled Prospect	Copper, Silver, Tungsten, Zinc, Lead
105H 070	CALI	Skarn W	Drilled Prospect	Copper, Silver, Tungsten
105H 072	WOAH	Skarn W	Drilled Prospect	Tungsten
105H 073	TAI	Skarn W	Drilled Prospect	Tungsten
105H 075	MAXI	Sediment hosted Sedimentary Exhalative Zn-Pb-Ag (Sedex)	Drilled Prospect	Barite, Gypsum, Lead, Silver, Zinc, Copper
105H 077	ZEUT	Skarn W	Showing	Tungsten
105H 078	JULIA	Volcanogenic Massive Sulphide (VMS) Besshi Cu-Zn	Drilled Prospect	Copper, Gold, Silver, Zinc
105H 079	TINY	Unknown	Unknown	
105H 080	KNEIL	Vein Polymetallic Ag-Pb-Zn±Au	Showing	Copper, Silver, Zinc, Lead
105H 081	TYERS	Vein Cu±Ag Quartz	Showing	Copper
105H 082	TUNA	Porphyry Mo (Low F-Type)	Showing	Antimony, Gold, Silver, Tungsten, Molybdenum, Copper, Arsenic, Bismuth
105H 084	CHAP	Skarn W	Showing	Copper, Tungsten, Zinc, Lead
105H 085	BEANS	Unknown	Unknown	
105H 086	CERRO	Skarn W	Showing	Copper, Tungsten, Molybdenum
105H 087	MIG	Unknown	Unknown	Zinc
105H 088	BILLINGS	Skarn W	Showing	Molybdenum, Tungsten
105H 089	WO	Skarn Pb-Zn	Showing	Lead, Zinc
105H 090	WE	Skarn W	Showing	Lead, Zinc, Tungsten
105H 091	PINK	Skarn Cu	Showing	Copper
105H 092	SHAN	Skarn Pb-Zn	Showing	Lead, Zinc, Tungsten
105H 093	SEBASTIAN	Skarn Pb-Zn	Showing	Lead, Tungsten, Zinc
105H 094	MT. BILLINGS	Skarn Pb-Zn	Showing	Lead, Tungsten, Zinc
105H 095	COME	Sediment hosted Sedimentary Exhalative Zn-Pb-Ag (Sedex)	Showing	Zinc
105H 096	MCPHERSON	Skarn Pb-Zn	Showing	Copper, Silver, Zinc, Lead
105H 097	TUS	Porphyry Mo (Low F-Type)	Showing	Molybdenum, Tungsten
105H 098	ANDERSON	Skarn W	Showing	Tungsten
105H 099	BROTEN	Skarn W	Showing	Tungsten
105H 100	MINI	Skarn W	Showing	Tungsten
105H 102	FER	Vein Au-Quartz	Showing	Arsenic, Lead, Zinc, Copper, Gold
105H 103	SPROGGE	Vein Au-Quartz	Prospect	Gold, Bismuth, Arsenic, Antimony

LEGEND

■	Town
▲	Mineral Occurrence
—	Road
—	Contour
~	River
▭	NTS map sheet
▨	Water Body
▨	Wetland
●	Sample Location
▭	Catchment
▭	Catchment > 10km²

REFERENCES

Hornbrook, E.H.W. and Friske, P.W.B., 1988. Regional stream sediment and water geochemical data, southeastern Yukon (NTS 105H). Geological Survey of Canada, Open File 1649.

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.

McCurdy, M.W., Day, S.J.A., Friske, P.W.B., McNeil, R.J. and Hornbrook, E.H.W., 2009. Regional Stream Sediment and Water Geochemical Data, Frances Lake area, southeastern Yukon (NTS 105H). Geological Survey of Canada, Open File 6043, Yukon Geological Survey Open, File 2009-1.

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., 2015. Weighted sums model for Porphyry Mo deposits levelled by geology. In: Enhanced interpretation of stream sediment geochemical data for NTS 105H. Yukon Geological Survey, Open File 2015-27, scale 1:250 000, sheet 5 of 15.

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 purchased 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.

Yukon Geological Survey
Energy, Mines and Resources
Government of Yukon

Open File 2015-27

Weighted sums model for Porphyry Mo deposits levelled by mapped geology (NTS 105H)
Sheet 5 of 15

by

Rob Mackie, Dennis Arne,
and Chris Pennimpede