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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

### Intrusion-related Au Deposits Weighted sums model (Principal Component Residuals) Sheet 11 of 17

SCALE 1:250 000  
0 1 2 3 4 5  
kilometres

True North  
21°16'  
0°  
Magnetic North  
Use diagram only to obtain numerical values  
APPROXIMATE MEAN DECLINATION 2015  
FOR CENTRE OF MAP

105N LANSING RANGE	105O NODDLY LAKE	105P SEKUI MOUNTAIN
105K TAY RIVER	105J THIS MAP	105I THIS MAP
105F QUIET LAKE	105G FRANZOSIN LAKE	105H FRANCES 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

Stream sediment and water samples from the Little Nahanni River (105I) and Sheldon Lake (105J) map areas were collected and analyzed in several stages. The Little Nahanni River map area (105I) was sampled at reconnaissance-scale in 1981 (Goodfellow, 1982). Field descriptions and initial geochemical data for 984 sites were released by the Geological Survey of Canada ("GSC") Open File 888. Archived sample materials from this survey were re-analyzed in two subsequent projects as outlined by Friske *et al.* (1999) and McCurdy *et al.* (2009). Only samples located within Yukon are included in the current assessment. The Sheldon Lake map area (105J) was sampled in 1989 (Hornbrook *et al.*, 1990). Field descriptions and initial geochemical data for 886 samples were released in GSC Open File 2173. The re-analysis of archive sample materials is described by Friske *et al.* (2008) in GSC Open File 5694 and Yukon Geological Survey ("YGS") Open File 2008-4. 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 base and precious-metal mineralization deposit types are known to occur in the region as shown in Table 1 (Yukon MINFILE, 2015). Five main deposit types occur within the study area including sedimentary exhalative Pb-Zn (Howards Pass and Anniv deposits), Pb-Zn skarn (Riddell, Hensch and Nar prospects), W skarn (Dragon and Clea prospects), Polymetallic Ag-Pb-Zn veins (Norken and Nom prospects), and Cu-Ag veins (Pike Deposit). The Tom and Jason Pb-Zn SEDEX and Mactung W skarn deposits occur in the adjacent map area to the north, further supporting the prospectivity of the region for these types of deposits.

## WEIGHTED SUMS MODELING

As described in the report accompanying this map (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. 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.

Exploratory data analysis of both raw element data and principal components shows that lithological variation has a strong influence on the distribution of many commodity and pathfinder elements. The first principal component, accounting for 30% of the total variation, shows high positive loadings for Cd, Mo, Ag, Hg, Sb, Ba, Zn and V, and matches the distribution of Road River Group sedimentary rocks that include shale horizons that are likely to be elevated in these metals. The second principal component shows high positive loadings in Ni, As, Zn, Co and Cu, and corresponds to regions of classic sedimentary rocks of the Eam and Hyland groups. The Hyland Group rocks are also associated with elevated Mn and Fe as indicated by the element groupings in the third principal component. Regression analysis of these metals against the relevant principal component effectively filters the lithological control while preserving, and in some cases enhancing, responses related to known occurrences.

For certain pathfinder elements (e.g., Cd, Mo and Ag), levelled by dominant mapped geology has a more subdued effect on filtering the interpreted lithological control. In order to reduce this effect in the WSM, these elements were given lower importance rankings, or in some cases were omitted. Strong responses for Zn and Pb related to SEDEX mineralization prevented using these elements as pathfinders for other deposit types. In fact, to subdue the contributions related to this style of mineralization, Pb and Zn were given negative importance rankings for other deposit styles. In the case of the WSM for porphyry copper using data levelled by mapped geology, a negative importance was assigned to Zn to minimize responses related to remaining lithological effects.

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 anomalism. Given the likelihood that a mineralization 'signal' would be progressively diluted with increasing catchment size, marginally high WSM scores for samples with large catchments may also be significant.

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

Target Deposit Type <sup>a</sup>	Other Deposit Type <sup>a</sup>	Mn	Fe	Co	Ni	Cu	Mo	Zn	Pb	Ag	Au	As	Ba	Cd	Sn	Sb	Te	Hg	Tl	Bi	W	W <sup>b</sup>
Polymetallic Ag-Pb-Zn	SEDEX (high Ag); VMS				2			3	4		1		1	1	1				1			
Pb-Zn skarn; VMS	SEDEX Pb-Zn				-3			3	4				2	2	1	-2						-3
SEDEX Pb-Zn	Polymetallic Ag-Pb-Zn																					
Sediment-hosted Ni-Mo-Zn					4		3	1														
Intrusion-related Au	Epithermal Au-Ag						-1	-1		4	2									2		
Epithermal Au-Ag	Intrusion-related Au						-1	-1	4	3	2					1		3				
Porphyry Cu-Mo	Cu-Au porphyry; Cu skarn; Mo porphyry						4	3	-1	-1	2	1										-2
W skarn																					2	3
Hydromorphic 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 both vein and matrix types; VMS = volcanic hosted/associated massive sulphide; SEDEX = sedimentary exhalative; Hydromorphic Anomaly = principal component 5.

<sup>b</sup> For heavily censored elements raw data are used, rather than residuals, 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>

## Weighted sums model (PC residuals)

### Intrusion-related Au deposits

### Incomplete element suite

### 0-50th percentile

### 50-75th percentile

### 75-90th percentile

### 90-95th percentile

### 95-98th percentile

### 98-100th percentile

### 98-100th percentile

### 98-100th percentile

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### 98-100th percentile

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

Number	Names	Type	Status	Commodities
105I 004	NAR	Skarn Pb-Zn	Drilled Prospect	Copper, Silver, Tungsten
105I 006	CLEA	Skarn W	Drilled Prospect	Copper, Tungsten
105I 007	BIRIR	Skarn Cu	Showing	Barite, Copper
105I 008	NOM	Vein Polymetallic Ag-Pb-ZnAu	Drilled Prospect	Copper, Silver, Gold
105I 012	XY DEPOSITS	Sediment hosted Sedimentary Exhalative Zn-Pb-Ag (Sedex)	Deposit	Zinc, Lead
105I 020	SUMMIT	Sediment hosted Sedimentary Exhalative Zn-Pb-Ag (Sedex)	Anomaly	Lead
105I 032	HP DEPOSIT	Sediment hosted Sedimentary Exhalative Zn-Pb-Ag (Sedex)	Deposit	Zinc, Lead, Silver, Vanadium
105I 037	ANNIV DEPOSITS	Sediment hosted Sedimentary Exhalative Zn-Pb-Ag (Sedex)	Deposit	Copper, Cadmium, Nickel
105I 038	ABSEY	Sediment hosted Sedimentary Exhalative Zn-Pb-Ag (Sedex)	Drilled Prospect	Lead, Zinc, Silver
105I 040	VINKEE	Unknown	Drilled Prospect	Lead, Zinc
105I 041	NESS	Unknown	Anomaly	Lead, Zinc, Nickel
105I 042	GALL	Sediment hosted Sedimentary Exhalative Zn-Pb-Ag (Sedex)	Anomaly	Copper, Zinc, Lead
105I 043	DIANNE	Sediment hosted Sedimentary Exhalative Zn-Pb-Ag (Sedex)	Showing	Barite, Copper, Zinc
105I 044	TAMU	Sediment hosted Shale-Hosted Ni-Zn-Mo-PGE (Nick)	Anomaly	Copper, Nickel, Silver, Zinc
105I 045	OP JONES	Sediment hosted Sedimentary Exhalative Zn-Pb-Ag (Sedex)	Deposit	Zinc, Lead
105I 046	ROCK	Skarn W	Showing	Copper, Tungsten, Zinc
105I 052	BILL	Vein Polymetallic Ag-Pb-ZnAu	Showing	Copper, Lead, Zinc, Silver
105I 053	PKED	Vein Cu-Au-Quartz	Deposit	Silver, Copper, Zinc, Gold, Lead
105I 054	NORKEN	Vein Polymetallic Ag-Pb-ZnAu	Drilled Prospect	Copper, Zinc, Lead, Silver
105I 056	TAC	Porphyry Mo (Low F-Type)	Anomaly	Copper, Molybdenum
105I 057	DRAGON	Skarn W	Drilled Prospect	Arsenic, Copper, Tungsten, Lead, Silver, Gold
105I 058	MT SHELTON	Unknown	Showing	Arsenic, Gold, Silver, Tungsten, Tin, Tellurium, Bismuth, Copper
105I 059	RIDDELL	Skarn Pb-Zn	Drilled Prospect	Copper, Gold, Silver, Zinc, Lead
105I 010	SPEARHEAD	Vein Polymetallic Ag-Pb-ZnAu	Showing	Copper, Gold
105I 011	IVOR	Sediment hosted Sedimentary Exhalative Zn-Pb-Ag (Sedex)	Prospect	Copper, Gold, Silver, Zinc
105I 012	ROG	Sediment hosted Sedimentary Exhalative Zn-Pb-Ag (Sedex)	Drilled Prospect	Zinc
105I 013	CLYDE	Sediment hosted Sedimentary Exhalative Zn-Pb-Ag (Sedex)	Prospect	Copper, Zinc, Tungsten, Lead
105I 014	PREVOST	Skarn W	Prospect	Tungsten
105I 015	GUN	Skarn Pb-Zn	Showing	Barite, Zinc, Copper
105I 016	ITSI	Manto & Stockwork Sn	Drilled Prospect	Copper, Lead, Tin, Tungsten, Zinc, Silver, Gold
105I 017	COSTIN	Vein Polymetallic Ag-Pb-ZnAu	Showing	Gold, Zinc, Lead, Silver
105I 018	CAROLYN	Coal	Unknown	Coal
105I 019	VARISCITE	Skarn Cu	Showing	Copper
105I 023	PETE	Sediment hosted Stratiform Barite	Drilled Prospect	Barite, Zinc, Copper, Lead
105I 024	COCO	Sediment hosted Stratiform Barite	Showing	Barite
105I 025	ST GODARD	Sediment hosted Sedimentary Exhalative Zn-Pb-Ag (Sedex)	Showing	Barite
105I 029	HENCH	Skarn Pb-Zn	Drilled Prospect	Copper, Silver, Zinc, Lead
105I 030	MARYLOU	Skarn Pb-Zn	Prospect	Copper, Silver, Tungsten, Zinc, Lead, Molybdenum
105I 033	FORTIN	Unknown	Gold	Copper, Gold, Lead, Molybdenum, Silver, Zinc
105I 035	SASK	Skarn Mo	Showing	Gold, Silver
105I 036	GULF	Skarn W	Showing	Copper, Tungsten
105I 038	FLOOD	Epithermal Au-Ag-Low Sulphidation	Anomaly	Gold, Silver
105I 039	WENDY	Vein Au-Quartz	Showing	Arsenic, Gold, Silver
105I 040	NARL	Skarn Pb-Zn	Showing	Copper, Lead, Zinc
105I 043	VG	Vein Au-Quartz	Showing	Gold, Silver
105I 048	RITZ	Sediment hosted Sedimentary Exhalative Zn-Pb-Ag (Sedex)	Drilled Prospect	
105I 051	FULLER	Unknown	Unknown	
105I 055	MAKOO	Unknown	Unknown	
105I 034	DYAK	Sediment hosted Sedimentary Exhalative Zn-Pb-Ag (Sedex)	Anomaly	
105I 032	CANOL	Unknown	Anomaly	
105I 045	CANDY	Unknown	Anomaly	
105I 057	FWM	Unknown	Unknown	
105I 056	BRODELL	Sediment hosted Sedimentary Exhalative Zn-Pb-Ag (Sedex)	Deposit	Zinc, Lead
105I 067	HC DEPOSITS	Sediment hosted Sedimentary Exhalative Zn-Pb-Ag (Sedex)	Deposit	Zinc, Lead
105I 068	ION DEPOSITS	Sediment hosted Sedimentary Exhalative Zn-Pb-Ag (Sedex)	Deposit	Zinc, Lead
105I 069	PELLY NORTH	Sediment hosted Sedimentary Exhalative Zn-Pb-Ag (Sedex)	Deposit	Zinc, Lead
105I 036	ORO	Sediment hosted Stratiform Barite	Drilled Prospect	Barite, Zinc, Lead
105I 040	DORITA	Sediment hosted Sedimentary Exhalative Zn-Pb-Ag (Sedex)	Anomaly	Copper, Zinc, Lead
105I 051	GRECOE	Unknown	Anomaly	
105I 035	TULLY	Unknown	Unknown	
105I 035	DG TIMBER	Unknown	Anomaly	
105I 020	MACRAE	Unknown	Anomaly	
105I 028	BOJO	Unknown	Anomaly	
105I 039	THE MASCO	Unknown	Anomaly	
105I 034	BLACK GANT	Sediment hosted Sedimentary Exhalative Zn-Pb-Ag (Sedex)	Anomaly	

## RECOMMENDED CITATION

MACKIE, R., ARNE, D. AND PENNIMPEDE, C., 2015. Weighted sums model for Intrusion-related Au deposits using principal component residuals. In: Enhanced interpretation of stream sediment geochemical data for NTS map sheet 105I and 105J. Yukon Geological Survey, Open File 2015-31, scale 1:250 000, sheet 11 of 17.

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.

A digital PDF (Portable Document File) of this map may be downloaded free of charge from the Yukon Geological Survey website: <http://www.geology.gov.yk.ca>.

Yukon Geological Survey  
Energy, Mines and Resources  
Government of Yukon

Open File 2015-31

## Weighted sums model for Intrusion-related Au deposits using principal component residuals (NTS 105I and 105J) Sheet 11 of 17

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