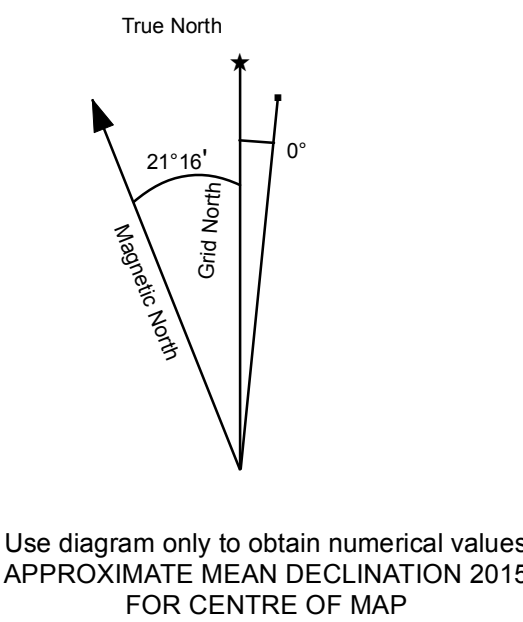
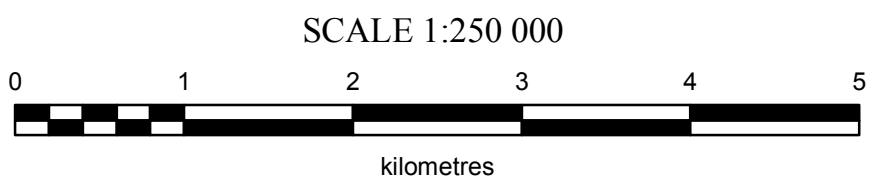


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Zone 9  
CONTOUR INTERVAL 100 FEET  
Elevations in metres above Mean Sea Level

### Sediment-hosted Ni-Mo Deposits Weighted sums model (Geology Levelled) Sheet 7 of 17



|                       |                        |                        |
|-----------------------|------------------------|------------------------|
| 105N<br>LANSING RANGE | 105O<br>NODDERY LAKE   | 105P<br>SEKWI MOUNTAIN |
| 105K<br>TAY RIVER     | 105J<br>THIS MAP       | 105I<br>THIS MAP       |
| 105F<br>QUIET LAKE    | 105G<br>FRANZOSIN LAKE | 105H<br>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 in Geological Survey of Canada ("GSC") Open File 868. 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, Hench 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 Jasco 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 clastic sedimentary rocks of the Earn 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 know occurrences.

For certain pathfinder elements (*e.g.*, Cd, Mo and Ag), leveling 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.

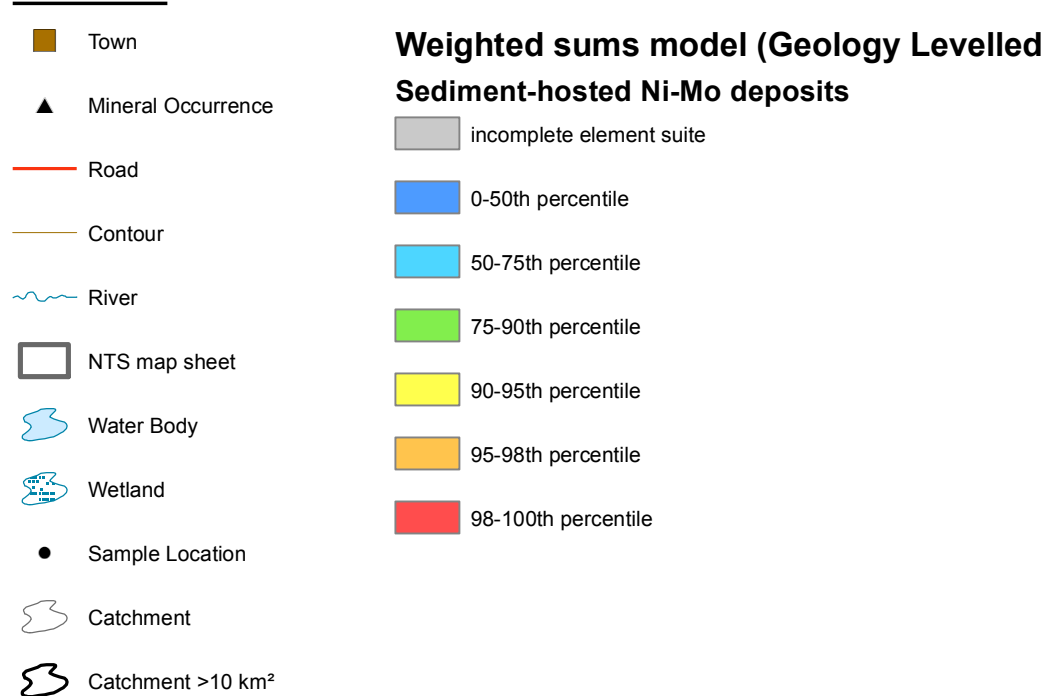
The effectiveness of historical sampling coverage has been assessed empirically using graphs of WSMs plotted against catchment surface area to determine the ideal maximum catchment size (10 km<sup>2</sup>). Catchments that cover larger areas (shown on the map with bold outlines) are interpreted to have 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 data levelled by dominant mapped geology.

| 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 | Sb | Te | Hg | Ti | Bi | W |
|----------------------------------|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|---|
| Polymetallic Ag-Pb-Zn            | SEDEX (high Ag); VMS                    |    |    |    |    | 2  | 3  | 3  | 4  |    | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  |   |
| SEDEX Pb-Zn                      | Pb-Zn skarn; VMS; Polymetallic Ag-Pb-Zn |    |    |    |    | -2 | 3  | 4  |    |    |    |    | 2  | 2  | 2  | 1  | -1 | 1  | 1  | -3 |   |
| Sediment-hosted Ni-Mo-Zn         |   |    |    |    | 4  |    | 2  | 1  |    |    |    |    |    |    |    |    |    |    |    |    |   |
| Intrusion-related Au             | Epithermal Au-Ag                        |    |    |    | -1 | -1 | -1 | 4  | 2  |    |    |    |    |    |    | 1  | 1  | 1  | 1  | 1  |   |
| Epithermal Au-Ag                 | Intrusion-related Au                    |    |    |    | -1 | -1 | 1  | 3  | 4  | 1  |    |    |    |    |    | 1  | 3  | 1  | 1  | 1  |   |
| Porphyry Cu-Mo                   | Cu-Au porphyry; Cu skarn; Mo porphyry   |    |    |    | 4  | 2  | -2 | 1  | 1  |    |    |    |    |    |    |    |    |    |    |    |   |
| W skarn                          |   |    |    |    |    |    | -1 | -1 | -1 |    |    |    |    |    |    |    |    |    | 2  | 3  |   |
| Hydromorphic Anomaly             |   | 4  | 4  | 4  |    |    |    |    |    |    | 4  | 2  |    |    |    |    |    |    |    |    |   |

<sup>a</sup>Polymetallic Ag-Pb-Zn type includes both vein and manto styles; VMS = volcanic hosted/associated massive sulphide; SEDEX = sedimentary exhalative  
<sup>a</sup>Au data are not levelled by dominant geology, instead log<sub>10</sub> transformed raw data are used.

## LEGEND



## REFERENCES

- Friske, P.W.B., Hornbrook, E.H.W., McCurdy, M.W., Day, S.J.A., McNeill, R.J., Lynch, J.J., Durham, C.C., Gross, H. and Galletta, A.C., 2008. Regional stream sediment and water geochemical data, Sheldon Lake area, east-central Yukon (NTS 105J). Geological Survey of Canada, Open File 5694, Yukon Geological Survey, Open File 2008-4.
- Friske, P.W.B., McCurdy, M.W., Day, S.J.A. and Durham, C.C., 1999. Reanalysis of stream sediments from the Little Nahanni River map sheet (105I), Yukon and Northwest Territories. Geological Survey of Canada, Open File D3772, 11 p.
- Goodfellow, W.D., 1982. Regional stream sediment and water geochemical reconnaissance Data, Nahanni map area (NTS 105I). Geological Survey of Canada, Open File 868.
- Hornbrook, E.H.W., Friske, P.W.B., Lynch, J.J., McCurdy, M.W., Gross, H., Galletta, A.C. and Durham, C.C., 1990. National Geochemical Reconnaissance Stream Sediment and Water Geochemical Data, East-Central Yukon (105J). Geological Survey of Canada, Open File 2173.
- 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., Friske, P.W.B., McNeill, R.J., Day, S.J.A. and Goodfellow, W.D., 2009. Regional Stream Sediment and Water Geochemical Data, western Yukon and western Northwest Territories (NTS 105I). Geological Survey of Canada, Open File 6271, Yukon Geological Survey, Open File 2009-26.
- 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.

| 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-Zn-Au                           | Drilled Prospect | Copper, Silver, Gold   |
| 105I 012 | XY DEPOSITS    | Sediment hosted Sedimentary Exhalative Zn-Pb-Ag (Sedes) | Deposit          | Zinc, Lead   |
| 105I 020 | SUMMIT         | Sediment hosted Sedimentary Exhalative Zn-Pb-Ag (Sedes) | Anomaly          | Lead   |
| 105I 032 | HP DEPOSIT     | Sediment hosted Sedimentary Exhalative Zn-Pb-Ag (Sedes) | Deposit          | Zinc, Lead, Silver, Vanadium                                     |
| 105I 037 | ANNIV DEPOSITS | Sediment hosted Sedimentary Exhalative Zn-Pb-Ag (Sedes) | Deposit          | Lead, Zinc, Silver   |
| 105I 038 | ABSEY          | Sediment hosted Sedimentary Exhalative Zn-Pb-Ag (Sedes) | Drilled Prospect | Lead, Zinc   |
| 105I 040 | VINKIE         | Unknown   | Drilled Prospect | Lead, Zinc   |
| 105I 041 | NESS           | Unknown   | Anomaly          | Lead, Zinc, Nickel   |
| 105I 042 | GAL            | Sediment hosted Sedimentary Exhalative Zn-Pb-Ag (Sedes) | Anomaly          | Copper, Zinc, Lead   |
| 105I 043 | DIANNE         | Sediment hosted Sedimentary Exhalative Zn-Pb-Ag (Sedes) | Showing          | Barite, Copper, Zinc   |
| 105I 044 | TAM            | Sediment hosted Shale-Hosted Ni-Zn-Mo-PGE (Nick)        | Anomaly          | Copper, Nickel, Silver, Zinc                                     |
| 105I 045 | OP ZONES       | Sediment hosted Sedimentary Exhalative Zn-Pb-Ag (Sedes) | Deposit          | Zinc, Lead   |
| 105I 046 | ROOK           | Skarn W   | Showing          | Copper, Tungsten, Zinc   |
| 105I 052 | BILL           | Vein Polymetallic Ag-Pb-Zn-Au                           | Drilling         | Copper, Lead, Zinc, Silver                                       |
| 105I 063 | PIKE           | Vein Cu-Ag-Quartz                                       | Deposit          | Silver, Copper, Zinc, Gold, Lead                                 |
| 105I 004 | NORKEN         | Vein Polymetallic Ag-Pb-Zn-Au                           | Drilled Prospect | Copper, Zinc, Lead, Silver                                       |
| 105I 006 | TAC            | Porphyry Mo (Low F-Type)                                | Anomaly          | Copper, Molybdenum   |
| 105I 007 | DRAGON         | Skarn W   | Drilled Prospect | Arsenic, Copper, Tungsten, Lead, Silver, Gold                    |
| 105I 008 | MT SHELTON     | Unknown   | Showing          | Arsenic, Gold, Silver, Tungsten, Tin, Tellurium, Bismuth, Copper |
| 105I 009 | RIDDELL        | Skarn Pb-Zn   | Drilled Prospect | Copper, Gold, Silver, Zinc, Lead                                 |
| 105I 010 | SPEARHEAD      | Vein Polymetallic Ag-Pb-Zn-Au                           | Showing          | Copper, Gold   |
| 105I 011 | IVOR           | Sediment hosted Sedimentary Exhalative Zn-Pb-Ag (Sedes) | Prospect         | Copper, Gold, Silver, Zinc                                       |
| 105I 012 | ROG            | Sediment hosted Sedimentary Exhalative Zn-Pb-Ag (Sedes) | Drilled Prospect | Zinc   |
| 105I 013 | CL VOE         | Sediment hosted Sedimentary Exhalative Zn-Pb-Ag (Sedes) | Prospect         | Copper, Zinc, Tungsten, Lead                                     |
| 105I 014 | PREVOST        | Skarn W   | Prospect         | Tungsten   |
| 105I 015 | GUN            | Skarn Pb-Zn   | Showing          | Barite, Zinc, Copper   |
| 105I 016 | TSI            | Manto & Stockwork Sn                                    | Drilled Prospect | Copper, Lead, Tin, Tungsten, Zinc, Silver, Gold                  |
| 105I 017 | COSTIN         | Vein Polymetallic Ag-Pb-Zn-Au                           | Showing          | Gold, Zinc, Lead, Silver   |
| 105I 018 | CAROLYN        | Coal  | Unknown          | Coal   |
| 105I 019 | VARSICITE      | Skarn Cu  | Showing          | Copper   |
| 105I 021 | RICH           | Unknown   | Anomaly          | Barite, Zinc, Copper, Lead                                       |
| 105I 023 | PETE           | Sediment hosted Stratiform Barite                       | Drilled Prospect | Barite, Lead, Zinc   |
| 105I 024 | COCO           | Sediment hosted Stratiform Barite                       | Showing          | Barite   |
| 105I 025 | ST GODARD      | Sediment hosted Sedimentary Exhalative Zn-Pb-Ag (Sedes) | 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   | Unknown          | Gold   |
| 105I 035 | SASK           | Skarn Mo  | Showing          | Copper, Gold, Lead, Molybdenum, Silver, Zinc                     |
| 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 058 | RITZ           | Sediment hosted Sedimentary Exhalative Zn-Pb-Ag (Sedes) | Drilled Prospect | Unknown  |
| 105I 061 | FULLER         | Unknown   | Anomaly          | Unknown  |
| 105I 065 | MAKOO          | Unknown   | Unknown          | Unknown  |
| 105I 034 | DYAK           | Sediment hosted Sedimentary Exhalative Zn-Pb-Ag (Sedes) | Anomaly          | Unknown  |
| 105I 032 | CANOL          | Unknown   | Anomaly          | Unknown  |
| 105I 065 | CANDY          | Unknown   | Anomaly          | Unknown  |
| 105I 067 | PIAW           | Unknown   | Unknown          | Unknown  |
| 105I 066 | BRODEUR        | Sediment hosted Sedimentary Exhalative Zn-Pb-Ag (Sedes) | Deposit          | Zinc, Lead   |
| 105I 067 | HC DEPOSITS    | Sediment hosted Sedimentary Exhalative Zn-Pb-Ag (Sedes) | Deposit          | Zinc, Lead   |
| 105I 068 | DON DEPOSITS   | Sediment hosted Sedimentary Exhalative Zn-Pb-Ag (Sedes) | Deposit          | Zinc, Lead   |
| 105I 069 | PULLY NORTH    | Sediment hosted Sedimentary Exhalative Zn-Pb-Ag (Sedes) | Deposit          | Zinc, Lead   |
| 105I 036 | ORO            | Sediment hosted Stratiform Barite                       | Drilled Prospect | Barite, Zinc, Lead   |
| 105I 045 | DORITA         | Sediment hosted Sedimentary Exhalative Zn-Pb-Ag (Sedes) | Anomaly          | Copper, Zinc, Lead   |
| 105I 051 | GREGGIE        | Unknown   | Anomaly          | Unknown  |
| 105I 055 | TULLY          | Unknown   | Unknown          | Unknown  |
| 105I 055 | DG TIMBER      | Unknown   | Anomaly          | Unknown  |
| 105I 020 | MACRAE         | Unknown   | Anomaly          | Unknown  |
| 105I 028 | BOJO           | Unknown   | Anomaly          | Unknown  |
| 105I 026 | THANAGO        | Unknown   | Anomaly          | Unknown  |
| 105I 034 | BLACK GANT     | Sediment hosted Sedimentary Exhalative Zn-Pb-Ag (Sedes) | Anomaly          | Unknown  |

## RECOMMENDED CITATION

MACKIE, R., ARNE, D. AND PENNIMPEDE, C., 2015. Weighted sums model for Sediment-hosted Ni-Mo deposits levelled by geology. 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 7 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](mailto: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 Sediment-hosted Ni-Mo deposits levelled by mapped geology (NTS 105I and 105J) Sheet 7 of 17

by

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