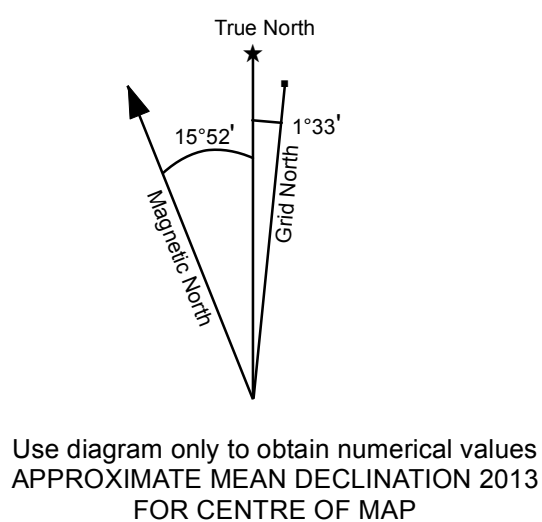
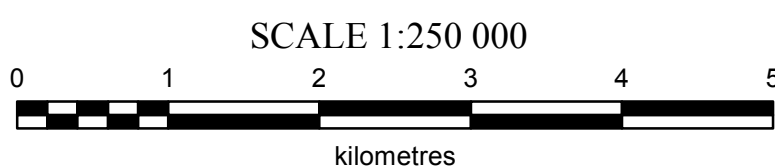


1:250 000-scale topographic base data  
produced by  
CENTRE FOR TOPOGRAPHIC  
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ONE THOUSAND METRE GRID  
Universal Transverse Mercator Projection  
North American Datum 1983  
Zone 8

CONTOUR INTERVAL 100 FEET  
Elevations in metres above Mean Sea Level

## WEIGHTED SUMS MODEL Cu (LEVELLED) YUKON



|                      |                         |                       |
|----------------------|-------------------------|-----------------------|
| 116A<br>LARSEN CREEK | 106D<br>NASH CREEK      | 106C<br>NADALEN RIVER |
| 115P<br>MCQUESTEN    | 105M<br><b>THIS MAP</b> | 105N<br>LANSING RANGE |
| 115I<br>CARMACKS     | 105L<br>GLENLYON        | 105K<br>TAY RIVER     |

## Weighted Sums Modelling

The application of Weighted Sums Modelling (WSM) to exploration geochemistry was described by Garrett and Grunsky (2001) as a means to model multi-element data using a priori knowledge of the mineralogy and element composition of the sought after mineral deposit (Kane, 1977; Garrett et al., 1980). In this procedure weights or relative importances are assigned to each variable, or a subset of variables, according to some geochemical or mineralogical model of the target mineral deposit type or geological process. Weighted sums (WS) are new variables calculated from the multi-element geochemical results. Like Principal Components Analysis (PCA) or Factor Analysis scores, WS scores have the form of normal or standardized scores with a mean of zero and a standard deviation of one. The main difference between WSM and traditional multivariate statistical methods is that the user assigns the variable weightings rather than determining them with a covariance/correlation matrix for the dataset, as is done in PCA. Furthermore WSM is a robust statistical technique that is not influenced by the presence of outliers (Beckman & Cook, 1983).

The reader is referred to Garrett and Grunsky (2001) for a description of the WS calculation. In summary, relative importance is assigned for each variable. A weighting of 3, for example, means that that particular element is three times more important than an element with a weighting of one. Weighting can be positive or negative. Positive weightings mean that the target model is associated with elevated concentrations of an element. Negative weightings indicate that low concentrations or depletions of an element are important.

Individual relative importance is converted into weights that sum to one by dividing each importance by the sum of the absolute values of importance (i.e., ignoring the negative signs). A requirement of the method is that the sums of the squares of the final weights also equal one. This is achieved by dividing each weight by the square root of the sum of the squares of the weights.

The next step involves calculation of the normal scores for the variables included in the model for each individual sample. To do this, robust estimates of the mean and standard deviation are used. The median (or 50th percentile) is used as a robust estimate of the mean and the inter-quartile range (IQR) multiplied by 0.7413 is used as a robust estimate of the standard deviation. IQR is the difference between the 75th and 25th percentiles of the data distribution and therefore covers a band of data 25% wide (or 0.67449 standard deviation units) on either side of the mean. The constant 0.7413 is used to convert the IQR, which covers a range of 1.3490 standard deviation units to an equivalent standard deviation<sup>1</sup>. Weighted sums are then calculated by multiplying the normal scores for each element by the element's corresponding weight and summing for each sample. The high resistance of the median and IQR to outliers mean that it is not usually necessary to trim outlier and far outliers from the dataset before calculation.

<sup>1</sup> For a normal distribution the standard deviation is equal to 0.7413\*IQR, where 0.7413 is the reciprocal of 1.349.

## Models and Weightings

Six mineral deposit types (SEDEX, Porphyry Cu, W-Skarn, IRCG, Polymetallic veins, and Carlin) that are either known or believed to occur in the map sheet areas and one geochemical process (hydromorphic dispersion) are modeled using the WS method. Included elements and their relative importance are presented in Table 1.

## Data Presentation

Results of each WS model are attached to the corresponding catchment basin polygons using a spatial join in ArcGIS. This process allows for the entire polygon to be assigned a colour based on its WS score. Colours are assigned on the basis of the following percentile breaks:

0-50% Dark blue  
50-75% Pale blue  
75-90% Pale green  
90-95% Yellow  
95-98% Orange  
98-100% Red

With this scheme, catchment basins with the hotter colours represent samples with geochemical characteristics consistent with the mineralization style being modelled.

Table 1: Table of Relative Importances used to calculate weighted sums models

| Deposit Type            | Ag | Au | As | Ba | Bi | Cd | Co | Cu | Cs | Fe | Hg | K | Mn | Mo | Ni | Pb | S | Sb | Ti | W | Zn |
|-------------------------|----|----|----|----|----|----|----|----|----|----|----|---|----|----|----|----|---|----|----|---|----|
| Polymetallic Veins      | 4  | 4  | 3  |    |    | 4  | 1  | 2  |    | 1  |    | 1 | 1  | 1  | 1  | 5  |   | 3  |    |   | 5  |
| W-Skarn                 |    |    | 3  |    | 3  |    |    |    |    | 1  |    | 3 |    |    | 3  |    |   |    |    |   | 5  |
| Porphyry Cu             | 2  | 2  |    |    |    |    | 5  | 3  |    |    |    |   |    |    |    |    | 2 |    |    |   |    |
| Intensive Related Cu-Au | 1  | 2  | 5  |    |    |    | 2  |    |    | 1  | 5  |   |    | 1  | 2  | 1  |   |    | 1  | 5 | 2  |
| SEDEX                   |    |    |    | 5  |    | 3  |    |    |    |    |    |   |    |    |    | 1  |   | 5  |    |   | 5  |
| Carlin                  | 2  | 1  | 5  | 2  |    |    |    |    |    | 4  |    |   |    | 5  | 2  | 4  | 2 |    | 1  |   | 3  |
| Hydromorphic Dispersion | 2  |    | 1  |    |    | 4  | 5  | 2  |    |    |    |   | 5  | 2  | 4  | 2  |   | 1  |    |   | 3  |

## LEGEND

- Regional Geochemistry Sample (RGS) location
- National Topographic System grid (1:250 000 scale)
- National Topographic System grid (1:50 000 scale)
- highway, paved
- highway, unpaved
- local road, paved
- local road, unpaved
- contour
- watercourse
- waterbody
- wetland

## Cu (Levelled)

WSM Percentiles: WSM Score, Number of RGS Samples

- 0 - 50%: -3.177 - -0.058, 422 samples
- 50 - 75%: -0.057 - 0.657, 214 samples
- 75 - 90%: 0.658 - 1.303, 127 samples
- 90 - 95%: 1.304 - 1.603, 42 samples
- 95 - 98%: 1.604 - 2.141, 26 samples
- 98 - 100%: 2.142 - 4.112, 16 samples

Table 2: List of Mineral Occurrences for NTS map sheets 1050 and part of 105P

| OCCURRENCE # | OCCURRENCE NAME      | ALIAS(S)   | DEPOSIT TYPE                    | STATUS           | ECONOMIC COMMODITIES | OTHER COMMODITIES         |
|--------------|----------------------|--|---------------------------------|------------------|----------------------|---------------------------|
| 105M001      | KENO HILL            |  | Polymetallic Veins Ag-Pb-Zn/-Au | Past Producer    | Pb, Ag, Zn           | Cu, Au, Sn                |
| 105M002      | FAITH                | BELKEND, ELA, KENO 200, LUCKY QUEEN, ONEK, SILVER KING | Polymetallic Veins Ag-Pb-Zn/-Au | Showing          |                      | Au, Pb, Ag, Zn            |
| 105M003      | QUANAN               |  | Polymetallic Veins Ag-Pb-Zn/-Au | Past Producer    | Pb, Ag               |                           |
| 105M004      | GOLDEN QUEEN         |  | Polymetallic Veins Ag-Pb-Zn/-Au | Drilled Prospect |                      | Sb, Pb, Ag                |
| 105M005      | SILVER BASIN         |  | Polymetallic Veins Ag-Pb-Zn/-Au | Prospect         | Ag                   | Au, Pb                    |
| 105M006      | MAISON               |  | Polymetallic Veins Ag-Pb-Zn/-Au | Showing          | Au, Pb, Ag           |                           |
| 105M007      | MONUMENT             |  | Polymetallic Veins Ag-Pb-Zn/-Au | Showing          |                      | Pb, Ag                    |
| 105M008      | COMETICKA            | LAURASSIA, RUM TUM                                     | Polymetallic Veins Ag-Pb-Zn/-Au | Prospect         |                      | Au, Pb, Ag                |
| 105M009      | APPEX                | PONCUPINE VEIN   | Polymetallic Veins Ag-Pb-Zn/-Au | Past Producer    | Pb, Ag, Zn           |                           |
| 105M010      | VAROGLAND            |  | Polymetallic Veins Ag-Pb-Zn/-Au | Past Producer    | Pb, Ag               |                           |
| 105M011      | HOMESTAKE            |  | Polymetallic Veins Ag-Pb-Zn/-Au | Drilled Prospect |                      | Au, Pb, Ag, Zn            |
| 105M012      | CHRISTINE            |  | Polymetallic Veins Ag-Pb-Zn/-Au | Showing          | Pb, Ag               |                           |
| 105M013      | MO                   |  | Polymetallic Veins Ag-Pb-Zn/-Au | Showing          |                      | Au, Pb, Ag                |
| 105M014      | MAYBURN              |  | Polymetallic Veins Ag-Pb-Zn/-Au | Past Producer    | Ag, Pb               |                           |
| 105M015      | HOGAN                |  | Polymetallic Veins Ag-Pb-Zn/-Au | Showing          |                      | Pb, Ag                    |
| 105M016      | BLUNDER              | MT. KENO   | Polymetallic Veins Ag-Pb-Zn/-Au | Past Producer    | Pb, Ag               |                           |
| 105M017      | WERNESKE             | RAULODAD   | Polymetallic Veins Ag-Pb-Zn/-Au | Drilled Prospect |                      | Au, Pb, Ag, Zn            |
| 105M018      | FORMO                | VALEND   | Polymetallic Veins Ag-Pb-Zn/-Au | Past Producer    | Pb, Ag, Zn           |                           |
| 105M019      | NOMAD                |  | Porphyry W                      | Anomaly          |                      |                           |
| 105M020      | PADIP                |  | Polymetallic Veins Ag-Pb-Zn/-Au | Past Producer    | Pb, Ag, Zn           |                           |
| 105M021      | EAGLE                |  | Polymetallic Veins Ag-Pb-Zn/-Au | Drilled Prospect |                      | Pb, Ag, Zn                |
| 105M022      | FISHER               |  | Polymetallic Veins Ag-Pb-Zn/-Au | Anomaly          |                      | Au, Pb, Ag, Zn            |
| 105M023      | PARIENT              |  | Unknown                         | Anomaly          |                      |                           |
| 105M024      | CREAM AND JEAN       |  | Polymetallic Veins Ag-Pb-Zn/-Au | Past Producer    | Pb, Ag               |                           |
| 105M025      | NEED                 |  | Polymetallic Veins Ag-Pb-Zn/-Au | Drilled Prospect |                      | Au, Pb, Ag, Zn            |
| 105M026      | GRUBTZHI             |  | Polymetallic Veins Ag-Pb-Zn/-Au | Drilled Prospect |                      | Pb, Zn, Ag                |
| 105M027      | TITAN                |  | Polymetallic Veins Ag-Pb-Zn/-Au | Drilled Prospect |                      | Pb, Ag, Zn                |
| 105M028      | SHANGHAI             | NORTH LUMB   | Polymetallic Veins Ag-Pb-Zn/-Au | Drilled Prospect |                      | Cu, Pb, Ag, Zn            |
| 105M029      | MCQUESTEN            | WAYNE  | Plutonic Related Au             | Past Producer    | Au, Pb, Ag, Zn       |                           |
| 105M030      | ARGENT               |  | Unknown                         | Anomaly          |                      |                           |
| 105M031      | STERNCHUK            | JOURMIRA   | Porphyry Sn                     | Prospect         |                      | Au, Cu, Pb, Ag, Sn, W, Zn |
| 105M032      | MT. HALDANE          | LOOKOUT  | Polymetallic Veins Ag-Pb-Zn/-Au | Past Producer    | Pb, Ag               |                           |
| 105M033      | LAVENDER             |  | Polymetallic Veins Ag-Pb-Zn/-Au | Anomaly          |                      | Au, Pb, Ag                |
| 105M034      | COBALT               |  | Polymetallic Veins Ag-Pb-Zn/-Au | Past Producer    | Pb, Ag               |                           |
| 105M035      | PATTERSON            |  | Unknown                         | Anomaly          |                      | Au, Cu, Au, Pb, Ag, Zn    |
| 105M036      | ETTA                 |  | Unknown                         | Anomaly          |                      |                           |
| 105M037      | GORDON               |  | Silicic Veins & Disseminations  | Prospect         |                      | Au, Au, Pb, Ag, Zn        |
| 105M038      | TWO BUTTES           |  | W-Skarn                         | Drilled Prospect |                      | W, Au, Bi, Au, Hg, Ag     |
| 105M039      | SHEEP SLIP           |  | Cu Skarn                        | Showing          |                      | Cu                        |
| 105M040      | GRAT KORN            |  | W-Skarn                         | Prospect         |                      | Cu, W, Zn                 |
| 105M041      | RAM                  |  | Unknown                         | Unknown          |                      |                           |
| 105M042      | KOTSPRING            |  | Polymetallic Veins Ag-Pb-Zn/-Au | Showing          |                      | Pb, Ag                    |
| 105M043      | LOST WERNESKE COPPER |  | Unknown                         | Unknown          |                      | Cu                        |
| 105M044      | ROOP                 |  | W-Skarn                         | Showing          |                      | Pb, Ag                    |
| 105M045      | ARL                  |  | Unknown                         | Unknown          |                      |                           |
| 105M046      | ANDON                |  | Polymetallic Veins Ag-Pb-Zn/-Au | Drilled Prospect |                      | Au, Pb, Ag, Zn            |
| 105M047      | MT. ALBERT           |  | Polymetallic Veins Ag-Pb-Zn/-Au | Showing          |                      | Pb, Ag                    |
| 105M048      | ARCAM                |  | Polymetallic Veins Ag-Pb-Zn/-Au | Showing          |                      | Ag                        |
| 105M049      | VAGA                 |  | Unknown                         | Anomaly          |                      |                           |
| 105M050      | NERO                 |  | Polymetallic Veins Ag-Pb-Zn/-Au | Showing          |                      | Pb, Ag                    |
| 105M051      | FRIESEN              |  | W-Skarn                         | Prospect         |                      | Cu, Au, Pb, Mo, Ag, W     |
| 105M052      | MT. HINTON           |  | Polymetallic Veins Ag-Pb-Zn/-Au | Drilled Prospect |                      | Au, Ag                    |
| 105M053      | AVONLE               |  | Polymetallic Veins Ag-Pb-Zn/-Au | Showing          |                      | Pb, Ag                    |
| 105M054      | CHANCE               |  | Silicic Veins & Disseminations  | Showing          |                      | Sn                        |
| 105M055      | YONK                 |  | Polymetallic Veins Ag-Pb-Zn/-Au | Showing          |                      | Au, Bi, Au, Pb, Ag, Sn, W |
| 105M056      | SUNDOWN              |  | Plutonic Related Au             | Showing          |                      |                           |
| 105M057      | GUSTAVUS             |  | Polymetallic Veins Ag-Pb-Zn/-Au | Showing          |                      | Pb, Ag                    |
| 105M058      | HALFWAY              | SNISTER  | Unknown                         | Drilled Prospect |                      | Au, Hg, W                 |
| 105M059      | RANKIN               |  | Unknown                         | Anomaly          |                      |                           |
| 105M060      | NEWBY                | AUREX  | W-Skarn                         | Drilled Prospect |                      | Au, Bi, Cu, Au, Pb, W, Zn |
| 105M061      | CHRISTAL             | DOROTHY  | Polymetallic Veins Ag-Pb-Zn/-Au | Showing          |                      | Pb, Ag, Zn                |
| 105M062      | SESSWORTH            | CARBON HILL  | Polymetallic Veins Ag-Pb-Zn/-Au | Past Producer    | Pb, Ag               |                           |
| 105M063      | IRON CLAD            |  | Polymetallic Veins Ag-Pb-Zn/-Au | Drilled Prospect |                      |                           |
| 105M064      | KALZAS               | FLUO   | W-Veins                         | Drilled Prospect |                      | Be, Pb, Mo, Ag, Sn, W     |
| 105M065      | CONRICE              |  | Unknown                         | Unknown          |                      |                           |
| 105M066      | WIASIL               |  | Unknown                         | Unknown          |                      |                           |
| 105M067      | GAMBLER              |  | Polymetallic Veins Ag-Pb-Zn/-Au | Past Producer    | Pb, Ag               |                           |
| 105M068      | HAYTERNAK            |  | Polymetallic Veins Ag-Pb-Zn/-Au | Showing          |                      | Zn, Pb, Ag                |
| 105M069      | DRILL                |  | W-Veins                         | Showing          |                      | W                         |
| 105M070      | BELLY                |  | Polymetallic Veins Ag-Pb-Zn/-Au | Drilled Prospect |                      | Pb, Ag, Zn                |
| 105M071      | BENNA                |  | Polymetallic Veins Ag-Pb-Zn/-Au | Showing          |                      | Au, Ag                    |
| 105M072      | WHITEMAN             |  | Unknown                         | Unknown          |                      |                           |
| 105M073      | THYRISLAND           |  | Unknown                         | Prospect         |                      |                           |
| 105M074      | GORDON               |  | Sediment-Hosted Barite          | Prospect         |                      | barite                    |
| 105M075      | BELEKNO              |  | Polymetallic Veins Ag-Pb-Zn/-Au | Prospect         | Pb, Ag, Zn, Au       | Cd, Sn                    |
| 105M076      | ELSA TAILINGS        |  | Tailings Reprocessing           | Deposit          | Au, Pb, Ag, Zn       |                           |
| 105M077      | ONEK                 |  | Polymetallic Veins Ag-Pb-Zn/-Au | Deposit          | Ag, Pb, Au, Zn       |                           |
| 105M078      | LUCKY QUEEN          |  | Deposit                         | Ag, Pb, Zn, Au   |                      |                           |
| 105M079      | BERMINGHAM           |  | Polymetallic Veins Ag-Pb-Zn/-Au | Deposit          | Pb, Zn, Ag, Au       |                           |
| 105M080      | FLAME & SNOT         |  | Unknown                         | Deposit          | Au, Ag, Pb, Zn       |                           |

- Mineral Occurrence Deposit Type (Total on map)**
- ◆ Sediment-Hosted Barite (1)
  - Cu Skarn (1)
  - ▼ Plutonic Related Au (2)
  - ◇ Polymetallic Veins Ag-Pb-Zn/-Au (49)
  - Porphyry Sn (1)
  - Porphyry W (1)
  - ◆ Stibnite Veins & Disseminations (2)
  - ▲ Tailings Reprocessing (1)
  - Unknown (15)
  - W Skarn (5)
  - ◆ W Veins (2)

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Yukon Geological Survey  
Energy, Mines and Resources  
Government of Yukon

Open File 2013-16  
**Yukon Geochemistry Weighted Sums Model  
for NTS 105M: Cu (Levelled)  
(1:250 000 scale)**

by  
David Heberlein