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|--------------|-----------------|----------------|
| 105L | 105K | 105J |
| GLENYON | TAY RIVER | SHELDON LAKE |
| 105E | 105F | 105G |
| LAKE LABRARE | THIS MAP | FINLAYSON LAKE |
| 105D | 105C | 105B |
| WHITEHORSE | TESLIN | WOLF 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 accompanying open file report (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 Quiet Lake area (NTS 105F) were collected at a reconnaissance scale in 1978 as part of the Federal Uranium Reconnaissance program. The sediment samples were analysed in several stages and the geochemical data was released in Geological Survey of Canada (GSC) Open Files 564, 734, and 1290 (Goodfellow & Lynch, 1978; Coker et al., 1981; Hornbrook et al., 1985). A recent re-analysis program conducted by the Yukon Geological Survey (YGS) has generated new geochemical data from analysis of archived sample material as described in YGS Open File 2015-8 (Jackman, 2015). The reader is referred to these reports for detailed descriptions of sampling techniques, analytical procedures, and quality control measures. Not all samples have been analysed for gold using preferred Fire-Assay or Neutron Activation methods. Given the uncertainty in quality of ICP-MS analysis of gold stream sediments, as described by Arne & MacFarlane (2014), no attempt has been made to incorporate data by this method.

MINERAL OCCURRENCES

The main mineral occurrences within the Quiet Lake area are classed as polymetallic Ag-Pb-Zn (Au) veins (Groundhog and Ketzakey deposits), replacement/manto-style Au (Ketzakey River Deposit) and W skarn (Stormy and Risby deposits). Other deposit types represented in the map area include Cu-Pb-Zn volcanogenic massive sulphide (VMS) and Tub prospects, Mo skarn (Molly prospect), quartz-vein Au (Seagull Creek prospect), high sulphidation Au-Ag-Cu (Beautiful prospect), and sedimentary exhalative Zn-Pb-Ag ("High-grade" and Angie prospects). The Anvil SEDEX and Finlayson Lake VMS districts are located in the adjacent NTS map sheets to the north and east, respectively. Notably, the Red Mountain porphyry Mo deposit is located less than 2 km from the southern boundary of the map area.

WEIGHTED SUMS MODELING

As described in the methodology report (Mackie et al., 2015), two approaches have been used to subdue the influence of background lithological variations and secondary absorption on the composition of stream

sediments. One uses data levelled by the dominant geology mapped within each catchment, while the other uses residuals calculated from regression against principal components. Weighted sums models (WSM) have been generated using the processed data. The importance rankings used in WSMs are summarized in Table 2 for a variety of deposit types. 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. Given that not all samples have been analyzed for Au, models using Au data present results for fewer catchments.

Exploratory data analysis using both raw element data and principal components reveals that the distribution of many commodity and pathfinder elements is strongly influenced by lithological variation. The first principal component, accounting for ~39% of the total variation, shows high positive loadings for Sb, Ag, Cd, Zn, Se, Ca, Ba, Cu, and Zr and high negative loadings for Rb, Li, Ti, Al, Ca and Ce. These groupings form spatially coherent trends that match, respectively, the distribution of sedimentary rocks, including shale and slate horizons, of the St. Cyr and Eam groups and Jones Lake Formation, and felsic intrusive rocks of the Cassiar Suite. The second principal component, accounting for ~14% of the total variation, shows high loadings for Co, Cr, Ni, Sc, Cu and Mg, and negative loadings for U, Mo and Y. These groupings form spatial trends matching the distribution of ultramafic rocks and some carbonate units, and felsic intrusive rocks, respectively. Regression analysis of selected metals against the relevant principal component(s) effectively filters these terrain-effects while preserving responses related to known occurrences.

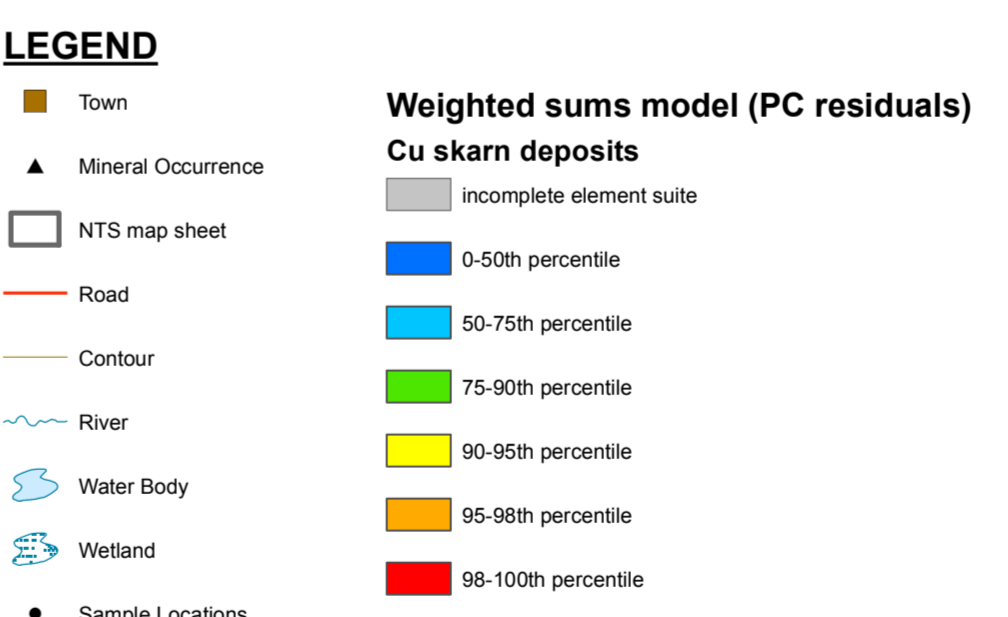
Leveling by the dominant mapped geology has a more subdued effect on filtering the interpreted lithological control for certain elements (e.g., Ag, As, Ba, Hg, Mo, Sb and Ti). In order to reduce this impact in the WSM these elements were given low importance rankings (or were omitted) for certain deposit types. Negative rankings were assigned to certain variables to help differentiate deposit types with similar metal associations and also to dampen 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 (12 km²). 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 could also be of interest in large catchments.

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

| Target Deposit Type ^a | Other Deposit Type ^a | Mn | Fe | Co | Ni | Cu | Mo | Zn | Pb | Ag | Au | As | Ba | Cd | Sn | Sb | Te | Hg | Tl | Bi | W |
|----------------------------------|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| Polymetallic Ag-Pb-Zn | SEDEX (high Ag); VMS; Pb-Zn skarn | | | | | 1 | 4 | 3 | 2 | | | | | | 1 | 1 | | | | 1 | |
| VMS (Zn-rich) | SEDEX (low Ag); Pb-Zn skarn | | | | | 2 | 4 | 2 | 1 | | | | | 1 | | | | | | | |
| Intrusion-related Au | Epithermal Au | | | | | | | | | | 3 | 1 | | | | 1 | | | | | |
| Epithermal Au-Ag | Intrusion-related Au | | | | | | | | | | 3 | 2 | | | | 1 | | 1 | | | -1 |
| Porphyry Mo | Porphyry Cu-Mo; W skarn | | | | | 1 | 3 | | 1 | | | | | | | | | | | | 1 |
| Cu skarn | Porphyry Cu-Mo; VMS (mafic); Cu-Ag Vein | | | | | 4 | 1 | | 2 | | | | | | | | | | | | 1 |
| W skarn | Sn skarn; Porphyry W | | | | | 1 | 1 | | -2 | | | | | | 1 | | | | | | 2 |

^aPolymetallic Ag-Pb-Zn type includes vein and manto styles; SEDEX = sedimentary exhalative; VMS = volcanic-hosted/associated massive sulphide deposits
^bRaw data following a log₁₀ transformation.



RECOMMENDED CITATION

MACKIE, R., ARNE, D. AND BROWN, O., 2015. Weighted sums model for Cu skarn deposits using principal component residuals. In: Enhanced interpretation of stream sediment geochemical data for NTS 105F. Yukon Geological Survey, Open File 2015-28, scale 1:250,000, sheet 8 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.

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.

REFERENCES

Arne, D. and MacFarlane, B., 2014. Reproducibility of gold analyses in stream sediment samples from the White Gold District and Dawson Range, Yukon, Canada. *Explore*, No. 164, p.1-10.
 Coker, W.B., Ellwood, D.J. and Goodfellow, W.D., 1981. National Geochemical Reconnaissance, Quiet Lake, southern Yukon Territory (105F). Geological Survey of Canada, Open File 732.
 Goodfellow, W.D. and Lynch, J.J., 1978. Regional Stream Sediment and Water Geochemical Reconnaissance data, Yukon Territory. Geological Survey of Canada Open File 564.
 Hornbrook, E.H.W., Goodfellow, W.D. and Friske, P.W.B., 1985. Regional Stream Sediment and Water Geochemical Reconnaissance Data (NTS 105F). Yukon Geological Survey of Canada, Open File Report 1290.
 Jackman, W., 2015. Regional stream sediment geochemical data, Quiet Lake area, southern Yukon (NTS 105F). Yukon Geological Survey, Open File 2015-8.
 Mackie, R., Arne, D. and Brown, O., 2015. Enhanced interpretation of regional stream sediment geochemical data from Yukon: catchment basin analysis and weighted sums modeling. Yukon Geological Survey, Open File Report 2015-10.

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Open File 2015-28

Weighted sums model for Cu skarn deposits using principal component residuals (NTS 105F) Sheet 8 of 15

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