

A catchment analysis approach to the interpretation of regional stream sediment data: Examples from the Canadian Cordillera

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The geochemistry of a stream sediment sample reflects the integrated effects of eroding lithological units within the catchment basin from which it has been derived, their relative contributions to the stream sediment load, the de-coupling of elements during weathering and hydrodynamic sorting, and deposition/precipitation of secondary minerals. These processes all have the potential to mask subtle responses from commodity and pathfinder elements derived from mineral occurrences within a catchment. In addition, the catchment area relative to the area of exposed mineralisation within the catchment determines the degree to which a geochemical response related to that mineralisation is diluted.

Over the past 10 to 15 years, both Geoscience BC and the Yukon Geological Survey have undertaken re-analysis of archived stream sediment samples collected by government regional stream sediment surveys through the Canadian cordillera. Samples were collected on a relatively consistent basis using standardised collection methods over a 30- to 50-year period. Re-analysis of the archived material has been undertaken following a modified aqua regia digestion in most cases, using a mixture of ICP-OES and ICP-MS instrumentation. These re-analyses were undertaken over a relatively short time period compared to the original analyses and provide a high-quality data set in which laboratory and analytical variability has been minimised.

These studies, involving nearly 50 000 samples, indicate that a variety of data processing approaches can be used to generate improved predictive models for mineral exploration, but that the performance of different interpretive approaches varies depending on the geological terrain and data set. This conclusion highlights the need for exploratory data analysis (EDA) of each data set to understand the main processes influencing the geochemical data rather than the routine application of a specific interpretive methodology in all circumstances.