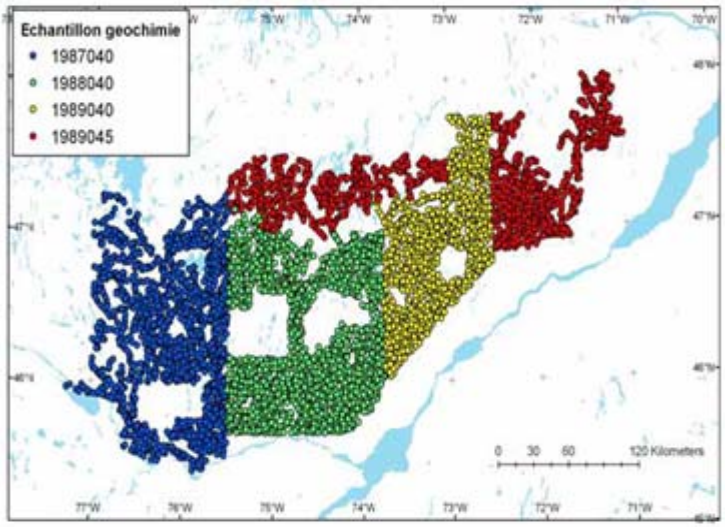
2008-09: Optimisation of stream sediment surveys for exploration

The geochemistry of stream sediments is an important tool in mineral exploration, but its use raises several questions, for example about the utility of stream sediments in different contexts, the choice of elements, the medium to be sampled and the establishment of thresholds. The objective of project 2008-09 was the optimisation of stream sediment data using anomaly boundary methods. The project addressed these aspects, first by a literature review then by a detailed study of the most complete database available in Quebec, that of the southwestern Grenville (figure attached).



Normalised stream sediment surveys of the southern Grenville, project 2008-09.

The statistical and spatial study of the Grenville database (1987 to 1989 surveys) indicate that grades in the fine fraction of the stream sediments are strongly influenced by variations in the proportions of organic matter, clays and secondary oxides in the sediments. On the other hand, the grades in the heavy mineral fraction are a lot less influenced by secondary environments because of an absence of organic matter and clays. They correlate much better with changes in bedrock lithology.

Two methods are proposed for obtaining anomalies more independent of geochemical background variations. The first method is based on residual values of multiple regressions having as explanatory values the factors of factor analysis. The second method is simpler. It consists of calculating the basic statistics for the groups identified by cluster analysis. These two approaches, and the calculation of simple percentiles on the entire database, are applied to the southern Grenville database (fine fractions and heavy minerals independently).

The detection of anomalies associated with deposits in the fine fractions most of the time requires values enhancement using statistical regression methods. For heavy minerals, the use of a simpler method such as percentiles calculated on raw values on analytical groups by cluster analysis seems sufficient. The efficacy of the stream sediment geochemistry for detecting mineralisation in the southern Grenville is demonstrated, provided that the sampling is sufficiently dense, that the sampled streams drain relatively small areas and that appropriate methods are used to identify the anomalies.

An index of anomalies was created from the cases studies which provides a series of exploration targets for Ni-Cu, Zn in the marbles and U-Th in the pegmatites. A number of targets show very favourable lithological contexts for Ni-Cu in the mafic intrusions of for Zn in the marbles.

Lastly, a method for modelling hydrographic networks from digital elevation models (DEM) was developed as part of this project. The modelling allows for a much better planning of sampling campaigns, identification of geochemical trends, establishing thresholds and planning the follow-up

campaign of anomalies. Note that the method was first developed for the processing of stream sediments in the Boutonnière du Kerdous in Morocco, an integral component of the present project.

Project 2008-09: Summary	
Objectives	• To update our understanding of the formation of geochemical anomalies of metals in stream sediments. • To optimise stream sediment data using appropriate methods to define anomalies. • To examine issues that may influence the planning of future public or private surveys.
Results	• Normalising data from the 1987 to 1989 stream sediment surveys in southern Grenville carried out by MRNF. • Modelling of hydrographic networks throughout the southern Grenville. • Identification of new exploration targets in southern Grenville - Cu-Ni, Zn, U. • Modelling of the hydrographic network in Kerdous, Morocco.
Innovations	• Two methods proposed for enhancing geochemical signals in stream sediments: - Multivariate analysis by clusters and calculation of threshold anomalies by percentile values of these groups. - Using multiple regression residual values (factors of a multivariate factor analysis as an explanatory variable and metals of interest as variables to model). • Modelling method of hydrographic networks using DEM.
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