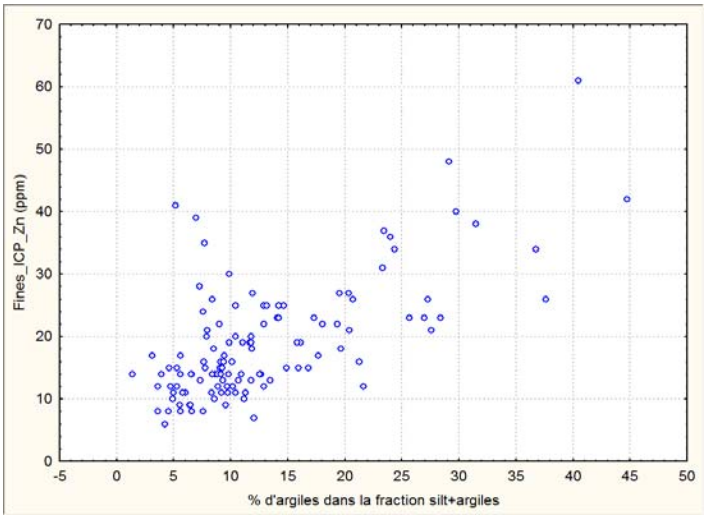
2010-05: Optimisation of till data for exploration

Till is the most common surface material in Quebec. However, several questions arise about the use of till data in exploration. For example, which till fraction should be chosen and what type of analysis should be carried out for a given mineralisation? What is the actual performance of the different types of data for detecting mineralisation? How to process data to define the best anomalies? The purpose of this project was to examine these questions in order improve the processing of existing till survey data and the planning of future surveys.

The project was carried out in three phases: 1) separation/classification of tills and implications for exploration 2) using tills in base metal exploration 3) using tills in gold exploration.



Influence of clay proportion on zinc content in the fine fraction of till, from Open File 3675, GSC (McClenaghan, 1999)

The first phase of the project showed the importance of analysing the lithological composition of the pebbles in the till and comparing the results with local geology. The objective was to identify the source of the sampled till as local or exotic. The presence of exotic till shows that the till does not represent the local bedrock well because the till can be non-anomalous even if mineralisation is present in the bedrock. This component also highlighted the importance of careful identification of the oxidised vs unoxidised nature of the till by stating its colour. Oxidised tills lose sulphides (and metals) present in the heavy mineral concentrates to the fine fraction. When a till is sampled near the surface, we must consider analysing the fine fraction instead of the heavy mineral concentrate for metals present as sulphides (Cu, Zn, As, Ni).

The second phase focused mainly on the use of fine fraction data in the exploration for base metals. Data compilation from the literature and an examination of various survey results indicate that the base metal content of the fine fraction of tills is strongly correlated with the amount of clay-sized particles in the samples. In the past, some authors proposed simple corrections such as dividing the raw values by the aluminium or the magnesium content. However, these corrections have never been tested using known mineralisations. As an alternative, a model for predicting metal values in tills using neural networks was developed. The quantitative data performance evaluation from three different surveys (Timmins, Abitibi in Quebec and Manitouwadge) has shown that the corrections significantly improve the detection of base metal mineralisations.

The third phase compared the advantages, disadvantages and limitations of the main analytical measurements of gold in tills (fine fraction, heavy minerals, characterisation of the grains). Each method has its advantages and disadvantages. They have to be considered carefully before planning sampling campaigns. The project also showed that direct geochemical analyses of gold in the till (as much the fine fraction as the heavy minerals) are usually not reproducible (strong nugget effect) and that the quantity of material actually analysed in the laboratory must be increased if possible.

Project 2010-05: Summary	
Objectives	• To review the main processing methods of tills, focusing on Au and Zn-Cu mineralisation. • To assess the true effectiveness of the various methods of analysing tills to detect Au and base metal mineralisations. • To assess anomaly enhancement methods for better detecting mineralisation. • To propose improvements in the planning of future surveys.
Results	• Review of the main methods of processing and analysing tills in exploration (report). • Using case studies to demonstrate the importance of carefully taking into account petrographic descriptions (exotic vs local tills) and colour description (amount of oxidation) of tills in exploration. • Quantitative assessment of the best methods for finding mineralisations for different surveys/substances: Zn-Cu and Au for the Abitibi survey of the MRNF, Zn-Cu for Manitouwadge, Zn-Cu for the Timmins survey. • Assessment of the main advantages and disadvantages of data processing for gold (fine vs heavy vs number and characteristics of gold grains). • Highlighting of the low reproducibility (strong nugget effect) of geochemical analyses for gold in the fine fractions and heavy minerals in tills --> must increase the amount of material actually analysed in the laboratory. • Au and Zn-Cu exploration targets identified from the 1971 MRNF survey in the Abitibi based on best indicators.

Innovations	• New performance evaluation method for till data, combining geomatics, statistics and Quaternary geology.
	• New methods for processing base metal data (Zn, Cu) in the fine fraction of tills, quantitatively shown to be more effective than raw values.
	  ◦ Method for evaluating background noise and metal anomalies in the fine fraction of tills (Zn, Cu, Pb, Ni) using neural networks.
	  ◦ Metal / Aluminium ratios.
	• First comparative assessment of the nugget effect on gold analyses in tills between the fine fractions, heavy minerals and gold grain counts.