CONSOREM
Consortium de recherche en exploration minérale

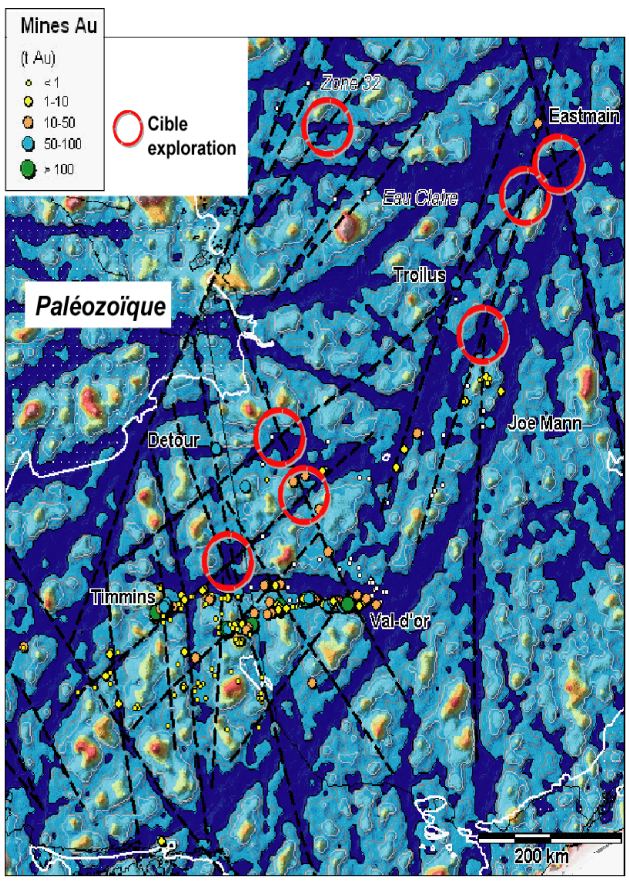
Project 2002-3: Geophysical megalineaments and mineralisation in the Superior Province

The main objective of Project 2002-3 is to analyse the spatial relationships between significant geophysical lineaments (megalineaments), and known deposits and showings in an attempt to predict the position of new deposits or mining camps in Quebec.

Geophysical maps (magnetic field and gravity) can be used to interpret lineaments that can be correlated with major structures. The challenge is to interpret large lineaments that could have played a role in the various mineralisation episodes. However, the interpretation of a geophysical lineament is influenced by several factors, among them the observer (personal experience and bias), processing (enhancement), scale of observation and sequence of observation (the influence of early interpretations on the later ones).

This project concerns geophysical megalineaments in the Archean Superior Province in Quebec and Ontario. Spatial relationships between lineaments and showings, deposits as well as mines are presented. Two different approaches were used: 1- the multi-observer approach that consists of integrating the interpretations of geophysical lineaments made by several people on multiple layers and the results of the processing of the magnetic and gravimetric data; and 2- the single observer approach that consists of integrating the geophysical lineament interpretations made by a single person on multiple layers and the results of the processing of magnetic and gravimetric data.

The multi-observer method shows that the megalineaments correspond to major known geological discontinuities in Quebec and Ontario: geological provinces, greenstone belts, paragneiss belts and crustal faults. It also highlights transverse lineaments oriented N-S, NE and NW that don't always have a geological equivalent. Their meaning remains to be clarified.



Megalineaments of the southern Superior Province, Quebec section, and their relationship with gold mineralisation.

Most of the mines and deposits are located along the edges of megalineaments near or at the intersection with cross-cutting lineaments. The meeting of greenstone belts with E-W and N-S (NW and NE) lineaments appears to be a good metallotect. Most gold mines are associated with megalineaments near or at the intersection with cross-cutting lineaments. Most base metal mines are located in areas with a lower density of lineaments, but along the edges of or at the intersection of megalineaments (e.g.: the Selbaie, Matagami, Normétal and Amos mining camps).

The single observer-multilayer magnetic, gravimetric and topographic lineaments method allowed us to differentiate the main lineaments in Quebec. There is good agreement between known geological faults and the interpreted lineaments (60%).

In the Quebec portion of the Superior Province, lineaments favourable for structurally controlled deposits emphasize the extension of mineralised corridors and generate new areas of interest for gold and base metal exploration.

The study shows that 64% of the structurally controlled showings and deposits are located at ≤1 km from only 0.06% of the geophysical and topographic lineaments of the Superior Province, preferably along E-W and NW-SE oriented lineaments. The number of deposits decreases exponentially away from the geophysical and topographic lineaments. All structurally controlled deposits with evaluated tonnage are located <3 km from a magnetic lineament. Most mineralisations are located in greenstone belts and at the intersections of E-W, NE-SW and NW-SE oriented lineaments.

Summary: Project 2002-3	
Objectives	• To analyse the spatial relationships between large geophysical lineaments (megalineaments) and known deposit and showings in an attempt to predict the position of new deposits or mining camps in Quebec.
Results	• The majority of the interpreted lineaments are similar with both approaches, but there are lineaments that are found in only one of these two interpretations. • The majority of the lineaments correlate with known major faults or deformation corridors in the Superior Province. • The two interpretations show a good spatial correlation between lineaments (especially at the intersections of lineaments) and mineralisation, be it mining camps, deposits or showings.
Tools and Innovations	• A new method of integrating lineaments based on multi-layered observations and multi-observers.