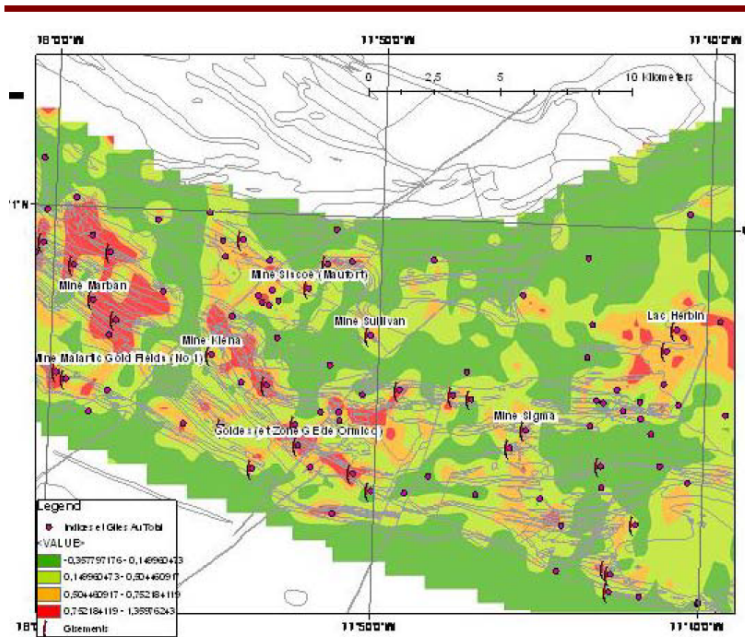


## 2004-7: Neural networks and mineral potential



*Mineral prospectivity map for gold for the western part of 32C04 sheet.*

Neural networks represent a powerful method for optimizing the outcome in the field of artificial intelligence. Progress in this field has been particularly important since the early '90s with the development of information technology. However, the method remains little known and little used in the field of mineral exploration in Quebec. This project aims to show its key capabilities and limitations, using various concrete examples of use in Quebec.

Neural networks are mainly used to evaluate complex function. A classic application is the evaluation of the mineral prospectivity of a region from the location of known deposits and a series of available geoscience data layers. Neural networks are one of the so called empirical ("data driven") mineral potential evaluation methods as opposed to strictly conceptual methods ("knowledge driven"). Nevertheless, even in the case of an

empirical method such as neural networks, conceptual knowledge about mineralisation controls must still be used when selecting the information layers to be provided to the system.

The first example of application is the evaluation of mineral prospectivity for gold in the Val-d'Or – Malartic region in the Abitibi, from different layers of lithological, geophysical and structural information. These layers were chosen by considering the proposed metallogenic models for gold in this region. Prospectivity maps produced using this method delineate very efficiently the known mineralised areas. An examination of the relative importance of different layers as input in the mathematical model developed by artificial intelligence shows good agreement with the known controls of orogenic gold mineralisation.

Finally, the favourability for kimberlite intrusions across North America was assessed. This treatment is based on 3D seismic tomography data as well as on gravity and aeromagnetic data. The favorability map shows the major possible areas for these potentially diamondiferous intrusions. Detailed examination of different favourable zones in Quebec shows a positive correlation between the shape of the favorability zones and the main directions of known kimberlite fields, particularly in the Otish Mountains, in the Torngats and in James Bay.

### Summary: Project 2004-7

<b>Objectives</b>	<ul style="list-style-type: none"> <li>• To test the neural network method for mineral prospectivity.</li> <li>• To identify the advantages and limitations of the method.</li> <li>• To create a mineral prospectivity test for the orogenic gold deposits in the southern area of Abitibi (Val-d'Or – Malartic).</li> </ul>
<b>Results</b>	<ul style="list-style-type: none"> <li>• Very successful application of the neural network method.</li> <li>• Demonstration that the neural network method must be monitored and controlled using well defined geological constraints.</li> <li>• Creation of a mineral prospectivity map for orogenic gold in the Val-d'Or region by integrating multilayer data (geology, geophysics, etc.).</li> <li>• Creation of a mineral prospectivity map for kimberlites across North America using lithospheric data (craton and kimberlite project, in collaboration with Stéphane Faure).</li> <li>• Very effective classification of rhyolite fertility using major and rare earth element and HFS analyses using the neural network method (see project 2004-2).</li> </ul>
<b>Tools and Innovations</b>	<ul style="list-style-type: none"> <li>• Development of an in-house tool for data processing using neural networks.</li> <li>• Development of a new approach to mineral prospectivity in the Abitibi based on neural networks.</li> </ul>