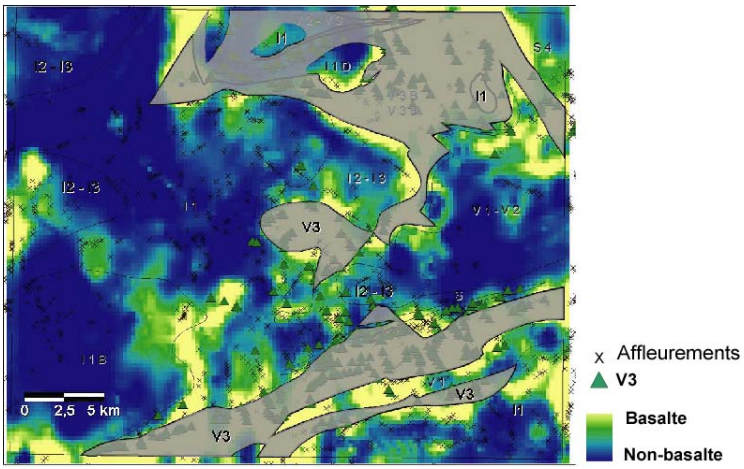
Project 2005-6: Data integration method for forecasting geology for mapping

Neural networks were used to predict the geology of an unmapped region. The network was trained on a mapped territory having a similar geological context. Data used in the training were obtained from continuous variables such as the magnetic field, relief and other similar data of this type. To conduct the test, two 1:50 000 map sheets were used from the James Bay region, both recently mapped by the *ministère des Ressources naturelles et de la Faune du Québec*. Map sheet 33B-04 was used for the training and validation of the neural network. Adjacent map sheet 33B-03 was used to apply the predictive model.



Application of the method using opposing groups

Two methods were used with the neural network method. The first consisted of training the network using data from geological map polygons, regardless of outcrops. This approach has the advantage of providing a large amount of data, but its disadvantage is having less control on the quality of the data. Therefore, it is more interpretative. The second method used only data points from outcrops identified at the time of mapping. This approach is more realistic because it is not influenced by the geologist interpretation and the mapping model. Results predicted by the network were validated using a known map (33B-04). The network recognised the nature and the shape of the main lithological units.

Lithological information classified in terms of relative composition (felsic, intermediate, mafic) as well as the use of opposing criteria such as “intrusions versus volcanics” or “mafic versus felsic rocks” gave excellent results. Some areas of the map showed differences between the mapping model and the prediction of the neural network. Results obtained using only the lithologies were poorer.

Some conditions must be met for the application of the method. In particular, the geology should be similar between the training map and the application map, and the geophysical contrasts should be of the same order of magnitude. It is possible to target better certain problems and geological hypotheses from the start, based on the predictive map, before mapping. The tool also allows one to validate the mapping model after the field season.

Summary: Project 2005-6	
Objectives	• To develop a method and an approach to establish a predictive geological map.
Results	• Development of predictive methodology using neural networks; • Affirmative production of an unmapped predictive map (33B-03) based on the adjacent mapped geological map (33B-04) ; • Better results using an opposing lithological approach and based on learning on data points from mapped outcrops;
Tools and Innovations	Two construction methods were developed for the predictive maps using neural networks: 1. From interpreted geological maps: • Using the lithology given on the map; • Using opposing groups; 2. From outcrops: • Individual outcrops; • Collected outcrops and opposing groups.