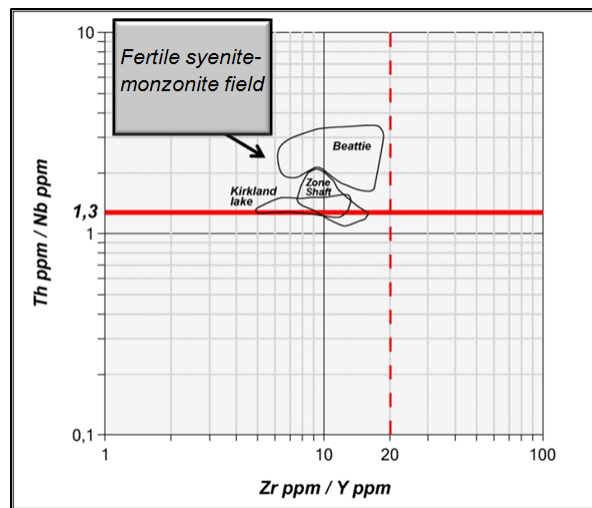


Project 2011-02: Types of intrusions associated with large deformation zones in the Abitibi and their relationship with gold mineralisation

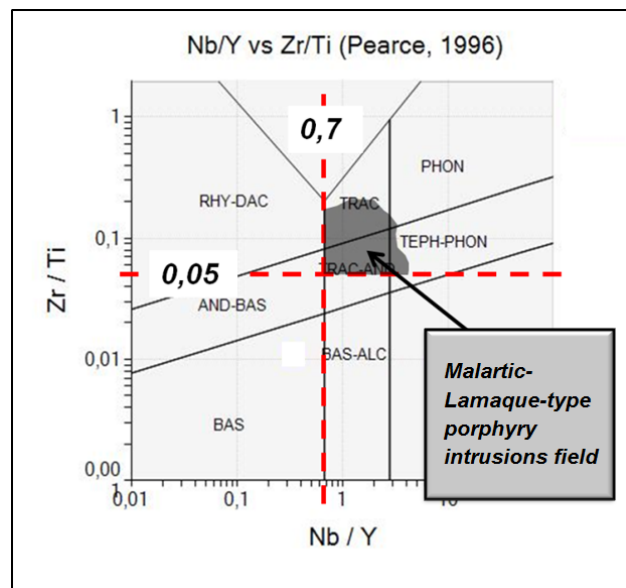
The large deformation zones in the Abitibi are characterised by several syn- to late deformation dykes, stocks or plutons with ages ranging from 2690 to 2672 Ma. In particular, this study aims to characterise the feldspar or quartz-feldspar porphyritic calc-alkaline intrusions (diorite, granodiorite, tonalite) and the alkaline intrusions (syenite-monzonite). The genetic link between gold mineralization and syenite-monzonites has been suggested by several authors, including Robert (2001) and Ispolatov et al., (2008). The porphyritic calc-alkaline intrusions from several mining camps (for example Val-d'Or, Timmins, Duparquet) are usually described as being only host rocks of mineralisation (MacDonald, 2010; Legault et al., 2005). However, some of the intrusions have recently been associated with porphyry-type mineralisation (Malartic). Therefore, the objective of the project is to characterise the various syn- to late-tectonic intrusion families geochemically in order to establish families that could have a genetic link with the gold mineralisation. The project used the case study method, analysing the geometry, cross-cutting relationships, geochronology and lithogeochemistry of the Timmins, Duparquet, Kirkland Lake, Malartic and Val-d'Or mining camp intrusions.

Based in part on the study of fertility in the Abitibi syenite-monzonites by Legault and Lalonde (2009), a new alkaline intrusion fertility diagram has been developed (**see the top Figure**). The advantage of this diagram is that it uses only immobile elements and is therefore not sensitive to hydrothermal alteration. Based on the lithogeochemical compilations, it has been established that the syenite-monzonites are favourable to gold mineralisation if they have a **Th/Nb ratio > 1.3** and a **Zr/Y ratio < 20**. This approach has identified 104 favourable samples in the Abitibi.

The study of porphyritic calc-alkaline intrusions has distinguished two geochemical families. The first family of clearly calc-alkaline affinity appears to be associated with 2690 to 2685 Ma old porphyry intrusions. Examples are the Pearl Lake, Paymaster and Duparquet porphyries, and the oldest phase of the Lamaque mine. The other affinity family has an alkaline trend which appears to be associated with 2685 to 2672 Ma year old porphyry intrusions. Examples are the main plug in the Lamaque mine (2685



New diagram of favourability for gold mineralisation in the alkaline intrusions (syenite-monzonite to quartz-monzonite) of the Abitibi.



Recognising Malartic-Lamaque-type porphyry intrusions on a Pearce diagram (1996).

Ma), the Pamour porphyry (2677 Ma) and the Malartic diorite porphyry. In the Zr/Ti vs Nb/Y Pearce diagram (1996), it is possible to isolate a field for Malartic-Lamaque-type intrusions ($Nb/Y > 0.7$). Although in the present study we cannot establish a genetic link between this type of intrusion and gold mineralisation, it is still possible to distinguish between the two families of diorite-granodiorite-tonalite porphyries. This is an interesting line of research and may help establish a possible genetic link. The method has identified 136 samples of Malartic-Lamaque-type porphyry intrusions in the Abitibi.

Project 2011-02: Summary	
Objectives	<ul style="list-style-type: none"> • To geochemically characterise the different intrusion families associated with deformation zones in the Abitibi. • To establish the genetic link between the different intrusion families and gold mineralisation. • To identify favourable areas in the Abitibi.
Results	<ul style="list-style-type: none"> • Exploration methodology. • New fertility diagram for alkaline intrusions in the Abitibi. • Identification of 104 favourable alkaline intrusion samples and 136 Malartic-Lamaque-type porphyry intrusion samples in the Abitibi. • Identification of two families of porphyry intrusion with different ages and different geochemical characteristics.
Innovations	<ul style="list-style-type: none"> • Development of a new reconnaissance tool to identify fertility in intrusions and to classify intrusions in the Abitibi.