## 2004-2: The PER-GH: a new classification index for felsic volcanics for the recognition of fertile environments

The present project is a follow-up to project 2003-5A on the geochemical classification of favourable felsic volcanic environments. Project 2003-5A focused on classification based on trace elements; this project led to the development of a new classification method for rhyolites based on the relationship of the Pearce ratios of major elements (PER for Pearce Element Ratio). This new felsic volcanics classification tool can efficiently discriminate felsic environments associated with volcanogenic massive sulphide (VMS) mineralisation from those that are not.

Geochemical classifications of rhyolites based on trace elements (e.g. Lesher et al. 1986) show that the fractionation of certain elements (La-Yb, Zr-Y) is associated with the likelihood of finding VMS mineralisation. Petrogenetic processes considered to explain this association invoke fractionation of mineral phases such as garnet and hornblende. This imprint, highlighted by the sensitivity of trace elements in petrogenetic processes, is undetectable using the major element contents (raw or inter-element ratios). However, they become obvious when using indices that respect the stoichiometry of the fractionated phases.

PER-GH involves a suite of seven major elements (Fe, Mg, Ca, Na, Si, Al and Ti) contained in the minerals that play a leading role in the petrogenetic processes, that is to say garnet and hornblende. Using lithogeochemical databases found in the literature and a variety of other sources, discriminant analysis tests allowed the efficient classification of the source environment of rhyolites as being non-fertile, fertile or very fertile.
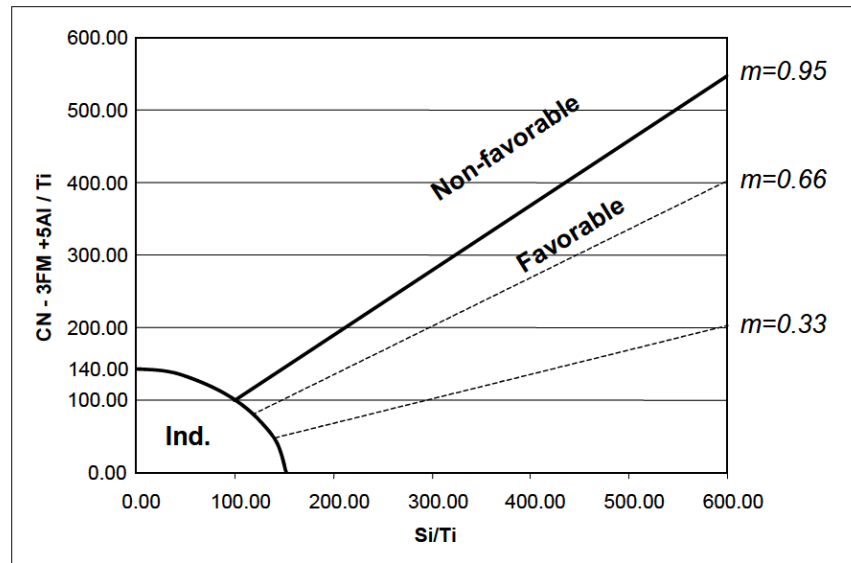
Definition of the main fields of the PER-GH diagram.

The new tool can be used on huge databases consisting mainly of major element analyses. In addition, a classification using the neural networks also gave positive results.

Summary: Project 2004-2

Objectives	• To reassess the lithogeochemical characteristics of favourable felsic volcanic environments. • To develop a method for determining fertility based on major elements. • To identify new favourable areas.
Results	• Compilation of a public database (literature) of Archean rhyolites from mineralised and non-mineralised environments; • Comparison of three databases (CONSOREM, public database, proprietary database belonging to members of CONSOREM); • New method of favourability classification based on PER (Pearce Element Ratio) analysis of major elements; • Favourability classification using the neural network method on the public database (major elements).
Tools and Innovations	• Validating two new tools to establish the fertility of rhyolites: PER analyse and neural networks.