Upper crustal record of migmatites exhumation: the South Armorican Domain

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The South Armorican Massif hosts a high-grade metamorphic domain mainly composed of medium to high-grade micaschists, migmatitic gneisses and anatectic granites [1]. At the end of the Carboniferous, these deep crustal units were exhumed rapidly during the extension associated with the collapse of the Hercynian chain [2]. To the North, this domain is limited by the listhospheric-scale South Armorican Shear Zone (SASZ). Giant quartz veins are associated with the SASZ and recorded important synmetamorphic fluid circulation [3]. Together with very low $\delta^{18}O$ values for some euhedral quartz, down to -2‰, low-salinity fluid inclusions argue for a contribution from meteoric fluids [3]. Corresponding $\delta^{18}O_{fluid}$ values estimated around -11‰ are probably related to the high palaeo-elevation of meteoric precipitation. Scarce, but significant, CO_2 fluid inclusions in euhedral quartz indicate also a metamorphic contribution. Metamorphic fluids were probably sourced from the exhumed metamorphic basement in the southern part of the Massif. Also, because of the synchronicity between the metamorphic event (exhumation) and the meteoric infiltration, it is proposed that the heat advected towards the surface by the exhumation of high-grade metamorphic rocks provided the driving force for meteoric fluid circulation on a regional scale.

The meteoric infiltration is recorded regionally by the mylonites which actually define the SASZ and by the syn-kinematic granites which emplaced along the SASZ. Low $\delta^{18}O$ values have been measured on some feldspar and zircon grains in the formers [4] while oxygen isotope disequilibirum was recorded by Qz-Fds pairs in the latters [5]. The muscovite Ar-Ar and monazite U-Th-Pb chronometers from these lithologies were highly disturbed [4,6]. In the Questembert granite, a classical example of a syn-kinematic granite, pervasive infiltration of oxydative meteoric water was facilitated by the penetrative character of the deformation (C/S planes are observed throughout the massif) and was probably responsible for the leaching of millions of tons of uranium while the granite was still at depth.

[1] Brown M. and Dallmeyer R.D. (1996) *Journal of metamorphic Geology* **14**, 361-379. [2] Gapais D. et al. (1993) *Comptes Rendus de l'Académie des Sciences* **316**, 1123-1129. [3] Lemarchand J. et al. (2012) *Journal of the Geological Society* **169**, 17-27. [4] Tartèse R. et al. (2012) *Journal of Geodynamics*, in press. [5] Tartèse R and Boulvais P (2010) *Lithos* **114**, 353-368. [6] Tartèse R. et al. (2011) *Terra Nova* **23**, 390-398.

Petrology, geochemistry and petrogenesis of the Beattie Syenite, Porcupine-Destor fault zone, Abitibi Subprovince, Québec

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Abstract

The Beattie Syenite is composed of five lenticular bodies of syenitic rocks that occur immediately north of the Porcupine-Destor fault zone in the town of Duparquet, approximately 32 km north of Rouyn-Noranda in the Abitibi Subprovince. The principal body is 3.3 km long and 425 m in width and is flanked by a series of smaller lenses to the south and northeast. The intrusion has yielded zircon ages of 2682 ±1 Ma and 2682.9 ±1.1 Ma and hosted the major part of the Au-mineralization of the now defunct Beattie mine; a major producer of gold in the area from 1933 to 1956 (9.66 Mt at 4.88 g/t Au). A total of 5 principal petrographic units are defined on the basis of field relationships, petrography, mineralogy, and textures:

1) The Beattie syenite porphyry unit is composed of 2-10% of tabular euhedral feldspar phenocrysts (2-10 mm) set in a red feldspathic and aphanitic matrix.

2) The unaltered syenite unit is composed of 2-10% of euhedral feldspar phenocrysts (2-10 mm) in a fine-grained matrix. It is characterized by unaltered phenocrysts of amphibole and titanite and is the only unit with relicts of pyroxene.

3) The Central Duparquet syenite porphyry containing between 2-25% of coarse equant euhedral feldspar phenocrysts (5-16 mm) in a red or sometimes grey aphanitic matrix.

4) The megaporphyritic syenite unit is composed of very coarse alkali feldspar phenocrysts, 1-6 cm across, in a red aphanitic matrix.

5) The feldspar lath dyke unit occurs as numerous thin dykes, on the order of a few meters in width, that cross-cut all other petrographic units. The lath dykes display a characteristic trachytoid texture defined by the preferential alignment of alkali feldspar laths (1-3 cm) in a grey or red aphanitic matrix.

From petrographic observations, there is evidence of a syenitic magma which is exhibited by the occurrence of syenite dykes with trachytoid flow textures. Detailed petrographical and mineralogical studies reveal a series of hydrothermal events including the precipitation of albite, sericite, chlorite and carbonate minerals. Initial geochemical results indicate that the Beattie Syenite is part of the alkaline series, as defined in the ($Na_2O + K_2O$) vs. SiO_2 diagram, and is feldspar normative. Whole-rock normalized REE patterns demonstrate that all the petrographic units are comagmatic. Furthermore, with selective trace elements, the tectonic setting of the syenite according to [1] would correspond to a volcanic-arc environment.

[1] Pearce, Harris and Tindle (1984) *Journal of Petrology* **25**, 956-983