

The Exposed Mystery of Metasomatism along the Heney Shear Zone, Grenville Province, Quebec

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Abstract

The Heney Shear Zone, located in the Mont Laurier terrane is a ca. 980–940 Ma extensionally reactivated thrust fault, associated with orogenic plateau collapse during the Grenvillian orogeny. Analysis of marbles, syenites, monzosyenites, metamonzogabbro and quartzites/quartz sweat collected along the HSZ as well as 10 km to east and 20 km to the west of HSZ, revealed evidence of preferential concentration of fluids along the shear zone. The deformation of these rocks did not exceed upper-amphibolite to lower-granulite grade, with maximal metamorphism associated to the Shawinigan pulse of the orogeny. Irregularly zoned titanites from granite-syenite complexes (skarns) Mont Laurier terrane of the Otter Lake area have been dated with laser ablation ICP-MS U-Pb geochronology. Their origin is equivocal, including high grade metamorphism, anatexis (partial melting) and fluid flow. Single spot analyses yielded a quasi-bimodal age distribution with a main age population at 1040-1020 Ma and another at 1090-1060 Ma. The former age is associated with Skootamatta-Kensington plutonic suite, and likely caused some potassic alteration. The granite-syenite complexes lack any amphibolite grade metamorphic textures and display primary recrystallization. Stable isotope ¹³C and ¹⁸O analysis of calcite and dolomite crystals from the marbles, revealed similar values for the eastern and western areas, with respect to the shear zone, with a mean $\delta^{13}\text{C}$ composition of +2.88‰ and $\delta^{18}\text{O}$ composition of +24.14‰ versus a mean $\delta^{13}\text{C}$ composition of +0.34‰ and $\delta^{18}\text{O}$ composition of +20.57‰ in the shear zone. Maximum strain and depleted $\delta^{13}\text{C}$ and $\delta^{18}\text{O}$ values were observed at the center of the HSZ and define a broad zone of 4-5 km wide. The granite-syenite complexes display lowest Ti, P, Nb and Ta values and highest Rb, Ba and Th values, further confirming substantial interaction with magmatic/meteoric fluids along the HSZ at ca. 1040-1020 Ma.