Bulk differentiation of the Archaean crust: A regional view from the NE Superior Province, Canada

C. AZEVEDO[1], J.-F. MOYEN[2*], M. JÉBRAK[1] AND O. VANDERHAEGHE[3]

[1]UQàM, Montréal, Canada
[2]Université de Lyon, Laboratoire Magmas et Volcans, UJM-UBP-CNRS-IRD, Saint Etienne, France (*correspondence: jean.francois.moyen@univ-st-etienne.fr)
[3]Université Paul-Sabatier, GET, UPS-CNRS-IRD-CNES, Toulouse, France

Most domains of Archaean continental crust formed by initial accretion of a sodic (TTG) crust, followed by reworking of this crust and formation of potasic granites. This results in the formation of a stable cratonic nucleus. In the North-Eastern Superior Province (Canada, NESP), this pattern is observed in the late Archaean.

Crustal-scale partial melting is commonly observed in many post-collisional modern crust, or in most of the Archaean crust. Melting affects all but the uppermost crust, with a melting front possibly as shallow as 5-10 km below the surface, resulting in flow of the partially molten crust, decoupling of the brittle upper crust and thin-skinned tectonics. Melts can be extracted from the molten layer and emplaced as upper crust plutons; alternately, the partially molten layer can be exhumed in domes raising between portions of shallower crust. As a result, a partially molten crust undergoes bulk differentiation and chemical separation in different layers: an upper brittle crust that may be intruded by plutons; a mid-crustal partially molten layer, with net melt gain or loss in different domains; a typicallly melt-depleted lower crust.

The NESP is made of a variety of TTG intrusive, TTG gneisses, migmatites, granites and granulites. Using the existing database of gneisses compositions compiled by the MERN of Québec in the NESP, we identified different types of rocks and propose a model of bulk crustal accretion and differentiation by (1) formation of a ca. 2.74—2.72 Ga TTG crust, by polybaric melting of a mafic precursor, and (2) melting and melt segregation within this crust, resulting in the formation of migmatites, melt-depleted gneisses and granites that follow regional discontinuities. Furthermore, we identified key geochemical indicators that allow to map different crustal domains in identify region of melt-depelted/enriched crust, or high/low pressure TTGs. These domains correlate with known mineral indices.