Goldschmidt 2000
September 3rd–8th, 2000
Oxford, UK.

Journal of Conference Abstracts
Volume 5(2), 546

Sm-Nd and Pb-Pb Isotopic Characterization of the Late Archean La Grande Subprovince, Quebec: Significance to the Crustal Development of the Eastern Superior Craton

Hélène Isnard (d225310@er.uqam.ca), **Clément Gariepy** (clem@uqam.ca) &
Ross K. Stevenson (r13611@er.uqam.ca)

GEOTOP. Université du Québec à Montréal, CP8888, H3C 3P8, Canada (QC)

The Archean La Grande subprovince is part of the north-eastern Superior Province of North America, which forms one of the largest and best preserved remnants of late Archean (2.7-3.1 Ga) continental crust. The La Grande subprovince is a typical granite-greenstone terrane, with an east-west lithological fabric parallel to the main structural trend of the Superior Province. The tectonic evolution of the eastern Superior Province is currently viewed as a series of primitive oceanic assemblages accreted onto a prograding northern continental margin (Card 1990). In the southernmost "greenstone" region (Abitibi), the arc-accreted materials are juvenile and of oceanic affinity, with only limited evidence for the influence of older crustal components. In contrast to the Abitibi belt, the La Grande subprovince exposes some of the oldest rocks (2.8-2.9 Ga) in the eastern Superior craton; in addition, inherited zircons as old as 3.8 Ga are present in some sedimentary units. We present Sm-Nd and Pb-Pb (K-feldspar minerals) isotopic results obtained on plutonic and volcanic rocks of the La Grande subprovince in order to gauge the influence of older crustal component in the make-up of younger, ca. 2.7 Ga, orogens. All of the isotopic analyses were carried out on rock samples which were previously dated using the U-Pb geochronometer.

The lithologic succession in the northern part of the La Grande consists of "basement" tonalitic gneisses (2.88-2.78 Ga), two volcanic sequences respectively dated at 2.73 and 2.70 Ga with coeval sedimentary units, and numerous intrusions of tonalitic, granitoid, ultrabasic and gabbroic magmas which were emplaced between 2.72 and 2.62 Ga. The older tonalitic gneisses are solely exposed in the northern part of the subprovince. In the southern part (area of Eastmain River), no rock units older than 2.73 Ga have been found.

The older tonalitic gneisses yielded initial ε_{Nd} values between +1 and -1; their initial Pb isotopic compositions are radiogenic, with model $^{238}U/^{204}Pb$ (μ) values for the source region at ~9.5. Actually, these rocks yield the most radiogenic initial $^{207}Pb/^{204}Pb$ compositions ever recorded in the eastern Superior Province. In order to account for these ε_{Nd} values and Pb isotopic compositions, a crustal precursor to the tonalitic gneisses as old as 3 Ga is definitively required. The syn- to post-tectonic granitoids can be divided into two groups based on their measured $^{207}Pb/^{204}Pb$ ratio and ε_{Nd} values; this division does correspond to their geographical location within the subprovince. Plutons in the south (Eastmain River area) have the most radiogenic Nd isotopic composition between +1.5 and +2.5 and the lowest $^{207}Pb/^{204}Pb$ ratios, between 14.5 and 14.6. Plutons in the north yielded ε_{Nd} values between -1 and +1 and more radiogenic $^{207}Pb/^{204}Pb$ ratios, between 14.6 and 14.7. These results are in agreement with previous geophysical, geochronological and fieldwork studies showing a tectonic discontinuity between the volcanic sequences of the La Grande and Eastmain River areas. The mafic and ultramafic sequences in the 2.73 and 2.70 Ga volcanic belts have ε_{Nd} isotopic compositions between +2 and +4, which is consistent with a depleted mantle origin.

The principal conclusion of this study indicates the presence of crustal precursors as old as 3.0 Ga in the central and northern parts of the eastern Superior Province. This is in agreement with model involving the presence of an older continental margin in the north (Kimura et al. 1993). This original basement has not been preserved, but zircons with upper intercept ages >3.0 Ga are found. It is the likely source for the radiogenic Pb isotopic compositions and the evolved Nd signatures of the 2.8 Ga crust. A simple two-component mixing model between the late Archean depleted mantle and 2.8 Ga old crust produces a linear mixing curve in Nd-Pb isotopic space showing that approximately 50% of old crust was recycled during the genesis of syn- to post-tectonic plutons. Thus, crustal recycling was an important process during the construction of the eastern Superior Province which contrasts with results from the southernmost belts where the production of juvenile 2.7 Ga crust was predominant. We will present new Lu-Hf isotopic results obtained on the very same samples in order to fine-tune the scenario outlined above.

Card KD, *Precambrian Research*, **48**, 99-156, (1990).
Kimura G, Ludden JN, Desrochers JP & Hori R, *Lithos*, **30**, 337-350, (1993).