

Presentation Time: 10:30 AM

3D FLOW PATTERNS IN A HETEROGENOUS LOWER CRUST: INSIGHTS FROM THE PROTEROZOIC GRENVILLE PROVINCE (Invited Presentation)

GERVAIS, Felix¹, JANNIN, Sophie², LAMBERT, Christopher W.¹, LABAT, Gaëlle Morgane³, CROWLEY, J.L.⁴, KAVANAGH-LEPAGE, Charles⁵ and MOUKHSIL, Abdelali⁶, (1)Civil, geological, mining engineering, Polytechnique Montreal, 2900, boul. Édouard-Montpetit, Campus de l'Université de Montréal, 2500, chemin de Polytechnique, Montreal, QC H3T 1J4, Canada, (2)Département des Génies civil, géologique et des mines (CGM), Polytechnique Montreal, 2900 boulevard Edouard Montpetit, Montréal, QC H3T 1J4, Canada, (3)Génie civil, géologique et des mines, Ecole Polytechnique de Montréal, 2500 chemin de Polytechnique, Montréal, QC H3T 1J4, Canada, (4)Department of Geosciences, Boise State University, Boise, ID 208-426-2220, (5)Mineral engineering, Polytechnique Montréal, 2900 blvd Edouard-Montpetit, Montreal, QC h3t1j4, Canada, (6)Ministère de l'Énergie et des Ressources naturelles, Quebec, QC G1H 6R1

Two-dimensional (2D) thermomechanical modeling predicts heterogenous flow patterns in a lower crust composed of blocks having different viscosities. In a natural 3D crust, one would expect even more complex patterns. This contribution presents interpretations derived from eight years of field-based studies conducted across the Grenville Province in Quebec that confirm these predictions and expectations. First, the Parautochthonous Belt (PB) adjacent to the foreland preserves evidence of Archean granulite facies deformation with limited evidence for Grenvillian overprinting, whereas it presents evidence of extensive Grenvillian partial melting further towards the hinterland. This confirms the hypothesis that the Grenvillian lower crust consisted of blocks with contrasting viscosities. The second finding is that channel flow was not limited to the first Ottawa phase of the Grenvillian Orogeny, but was widespread and extensive during the later Rigolet phase. Flowing rocks consisted of the partially molten Laurentian basement and its sedimentary cover that were initially thrust under the Allochthonous Belt (AB). These ductile rocks then flowed around stiff anorthositic plutons and lateral basement ramps leading to heterogenous patterns in structural elements (lineations and foliation) and strain levels. Furthermore, the flow of PB rocks over strong basement ramps detached slices of the overlying AB, which were, in turn, dismembered and incorporated in the flowing channel. Consequently, the most prominent tectonic boundary of the Grenville Province, the Allochthon Boundary Thrust, which separate the AB from the structurally underlying PB, may occur at different structural levels of a given transect. Geological mapping and tectonic interpretations are thus complexified, especially when working in northern Quebec known for poor rock exposure within its dense boreal forests.

Finally, heterogenous strain is also observed in the Manicouagan area where lower crustal, high-pressure nappes of the AB were forcefully expelled from the lower crust over a basement ramp and extruded into the partially molten rocks of the PB. Our structural studies indicate that this process was accommodated by a high level of constrictional strain within the nappes and by transverse folding of the PB host rocks.

Session No. 111

[T39. Granulite Terranes and Evolution of Continental Lower Crust: Insights from the Canadian Shield and Beyond I](#)

Wednesday, 28 October 2020: 10:00 AM-12:00 PM

Geological Society of America *Abstracts with Programs*. Vol 52, No. 6
doi: 10.1130/abs/2020AM-355702

© Copyright 2020 The Geological Society of America (GSA), all rights reserved. Permission is hereby granted to the author(s) of this abstract to reproduce and distribute it freely, for noncommercial purposes. Permission is hereby granted to any individual scientist to download a single copy of this electronic file and reproduce up to 20 paper copies for noncommercial purposes advancing science and education, including classroom use, providing all reproductions include the complete content shown here, including the author information. All other forms of reproduction and/or transmittal are prohibited without written permission from GSA Copyright Permissions.

Back to: [T39. Granulite Terranes and Evolution of Continental Lower Crust: Insights from the Canadian Shield and Beyond I](#)

[<< Previous Abstract](#) | [Next Abstract >>](#)