High-P metamorphism in the Mesoproterozoic: petrochronological insights from the Grenville Province

Caroline Lotout*[1,2], Aphrodite Indares[2], Etienne Deloule[1], and Jeffrey Vervoort[3]

[1]Centre de Recherches Pétrographiques et Géochimiques – Institut National des Sciences de l'Univers, Université de Lorraine, Centre National de la Recherche Scientifique – France

[2]Memorial University of Newfoundland = Université Memorial de Terre-Neuve [St. Johnś, Canada] – Canada

[3]Washington State University – États-Unis

Résumé

The thickness of the orogenic crust in the Mesoproterozoic times is highly debated. In this context, high-P rocks exposed in the Grenville Province (Canadian Shield) are an essential puzzle piece to Mesoproterozoic geodynamics. The high-P Manicouagan Imbricate Zone (MIZ, Central Grenville) is located between the Parautochthonous Belt to the North and the orogenic hinterland to the South, metamorphosed during the 1005–980 Ma Rigolet and 1080–1020 Ma Ottawan orogenic phases, respectively.

In the Western MIZ, the Lelukuau Terrane (LT) mostly consists of Labradorian-age (_˜1650 Ma) mafic suites. Investigated metamafic samples from its Western and Eastern parts display a peak assemblage of garnet, clinopyroxene, plagioclase, rare pargasite or edenite, and quartz ± kyanite. Pseudosection modelling suggests high-P granulite peak conditions at ca. 14 to 16 kbar and 800–900∘C, with the scarcity of hydrous phases and quartz explaining the lack of evidence for partial melting. Zircon cores from the Western LT sample show a maximum magmatic age of ca 1.6 Ga. Lu–Hf and Sm–Nd dating on garnet from this sample yield ages of 1020±7Ma and 1005±13Ma, overlapping within error and inferred to represent peak metamorphic conditions followed by fast cooling. In the Eastern LT sample, garnet Lu–Hf dating yields two ages that are consistent with a petrographically preserved two stage growth, at 1033±6Ma and 1013±6Ma, while the Sm–Nd age indicates cooling at 1003±8Ma.

The recorded high-P granulite facies conditions highlight a late Ottawan to Rigolet-age localized crustal thickening at the margin of the hinterland during the propagation of the orogen to the NW, with a possible younging of the high-P granulite-facies metamorphism from Eastern to Western LT. These new results demonstrate that the high-P belt in the Central Grenville does not represent the exhumed base of an Ottawan age orogenic plateau, as traditionally proposed, and that no tectonic hiatus exists between the two orogenic phases, as previously thought. Finally, this presentation highlights the diversity of the high-P domains in the Grenville Province.

Mots-Clés: Garnet petrochronology, Zircon petrochronology, Metamorphism, Grenville Orogeny

*Intervenant