Integrated structural and petrological observations constraining the Paleoproterozoic polymetamorphic evolution of the Newton Fiord region Hall Peninsula, Baffin Island, Nunavut

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The Canada-Nunavut Geoscience office completed the first of two field seasons of a regional bedrock and surficial mapping project on Hall Peninsula, eastern Baffin Island, during the summer of 2012. Hall Peninsula is situated within the core of the Himalayan-scale Paleoproterozoic Trans-Hudson Orogen. The Newton Fiord study area on the southwestern coast of Hall Peninsula comprises two regions of contrasting styles of deformation within close proximity (ca. 4 km^2). The eastern study area lies on the limb of a regional F_2 fold and the western study area lies in the hinge zone of the regional F_2 fold; both consist generally of metasedimentary rocks, primarily pelite, intruded by orthopyroxene monzogranite and late garnet leucogranite.

Linked field observations and microtectonic analysis have revealed two main tectonometamorphic events each of which can be further characterized based on relative chronology of mineral growth and fabric formation. The first event, D_1/M_1, is characterized by weakly to strongly aligned fine- to medium-grained sillimanite (M_{1a}) only preserved as inclusion trails in garnet and cordierite porphyroblasts, followed by voluminous garnet-cordierite-bearing leucosome formation (M_{1b}). Field evidence for D_1 fabric elements is subtle but convincing where S_1 is recorded in the orthopyroxene monzogranite but is cut by the garnet leucogranite. Within the pelitic rocks, the M_{1a} assemblage is preserved in garnet porphyroblasts and consists of garnet + sillimanite + K-feldspar + spinel + ilmenite + quartz ± rutile, whereas the M_{1b} melt assemblage is plagioclase + cordierite + K-feldspar + quartz ± sillimanite,± garnet; both represent equilibration above the biotite dehydration melting reaction. The second event, D_2/M_2, consists of moderately to shallowly west-dipping gneissosity (S_{2a}) defined by interlayered leucosome and sillimanite-biotite mesosome in the pelites. Progressive D_2 deformation resulted in moderately west-inclined F_{2b} folds associated with a strong hinge-parallel lineation defined by biotite and very coarse matrix sillimanite (L_{2b}). The M_2 mineral assemblage associated with both phases of D_2 deformation consists of garnet + sillimanite + biotite + ilmenite + K-feldspar + plagioclase + quartz ± melt, indicating equilibration below the biotite dehydration melting reaction and the addition of H_2O most likely from the breakdown of cordierite and crystallization of melt.

These data suggest a relative chronology of events beginning with the development of a weak S_1 foliation at granulite facies, likely synchronous with orthopyroxene monzogranite emplacement, which led to voluminous partial melting and emplacement of the garnet leucogranite. Progressive D_2 deformation at upper amphibolite to lower granulite facies evolved from the development of a strong flattening fabric into regional-scale, east-vergent folding and eventual shearing of F_2 fold limbs.

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