Field observations on D_1 and D_2 deformation fabrics and metamorphic mineral growth in the Newton Fjord region on Hall Peninsula, Nunavut, Canada

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Hall Peninsula, located on southeastern Baffin Island, Nunavut, represents an underexplored region of Canada's North owing to outdated geoscience knowledge. The Canada-Nunavut Geoscience Office in Iqaluit undertook the first of two field seasons of regional bedrock and surficial mapping during the summer of 2012. Hall Peninsula comprises three main tectonostratigraphic domains, an eastern domain of Archean tonalitic gneiss, a central domain of Palaeoproterozoic metasedimentary rocks, and a western domain of ca. 2860 Ma orthopyroxene-bearing monzogranite. The earliest recognizable Paleoproterozoic deformation (D_1) is characterized by a foliation that in most outcrops is near bedding-parallel and accentuated with a partial melt phase. The second deformation (D_2) transposes bedding and earlier fabrics and controls the N-NW trending regional map pattern. This study focuses on a small region (ca. 4 km^2) straddling Newton Fjord in the central metasedimentary domain where two areas with contrasting deformation styles were mapped in detail. The areas are termed "Sillimanite Ridge" in the east and "Barrow Peninsula" in the west. Rocks in the Sillimanite Ridge area consist of interbedded pelite and psammite with minor crosscutting orthopyroxene-bearing monzogranite. All rocks are cut by leucocratic garnet-bearing monzogranite. D_1 is characterized by a bedding-parallel foliation defined by sillimanite–biotite–garnet–K-feldspar and melt. D_2 is characterized by the reorientation, or transposition, of D_1 fabric elements on the limbs of tight to isoclinal F_2 folds. In the hinges of F_2 folds D_1 fabric elements are preserved and crenulated. Sillimanite defines the L_2 lineation but it is unclear in outcrop if the sillimanite is new growth or reoriented. The Barrow Peninsula area consists of interbedded pelite, semi-pelite, and psammite with minor calc-silicate lenses and subordinate cross-cutting orthopyroxene-bearing monzogranite and leucocratic garnet-bearing monzogranite. This area is composed mainly of inhomogeneous diatexite hosting rafts of psammite, which is more competent and has a higher melting temperature. The bedding-parallel D_1 foliation is moderately transposed by D_2 shortening and folded into steeply south-dipping open to close F_2 folds. Areas with extensive melt are deformed by D_2, but not by D_1, which constrains the timing of the melt to late D_1. Initial observations suggest that the inhomogeneous diatexite and the leucocratic garnet-bearing monzogranite at Barrow Peninsula are related and likely late D_1 in origin. The contrasting D_2 structural styles between and within the two areas indicate a D_2 varies in strain intensity from east to west. However, D_1 and D_2 metamorphic mineral assemblages appear to be similar and therefore may reflect comparable thermal conditions. Future work will involve detailed lithological descriptions from both areas, careful analysis of mineral-fabric relationships, and mineral chemistry studies.

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