Evidence for differentiation of High Arctic Large Igneous Province basalt at depth

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Mesozoic HALIP sills on Ellesmere Is. are evolved (MgO<6%) tholeiitic to weakly alkaline basalt to andesite. An undifferentiated 17m sill at Hare Fiord has ~10% coarser grains. Olivine (Fo85.6) phenocrysts are in approximate equilibrium. Plagioclase phenocrysts (Type 1) have euhedral weakly-zoned cores (An 72-66) and strongly normally/oscillatory-zoned rims; also forming glomerocrysts with olivine and augite. Antecrysts record replenishment and mixing processes in the magma chambers where low-MgO HALIP magmas formed. Both primitive (An74-83) and evolved (An63-43) antecrysts have rounded edges indicating dissolution prior to mantling by Type 1 feldspar. Reverse growth zoning in antecrystic glomerocrysts implies admixture of primitive magmas upstream. Sieved plagioclase cores imply compositional breakdown/reequilibration through immersion in a primitive melt. Some antecrysts have proto-cumulate textures, with aligned, sutured grains, suggesting longer residence times in holding chambers. Globular pyrite clots formed as replacements of plagioclase, mimicking groundmass laths and coarser phenocrysts. Isotope data imply S is from metasediments but there are no veins or connecting structures. The globules may sample hydrothermal replacements of gabbro at depth, subsequently entrained.