

New Time Constraints on Mafic Intrusions from the Nuvvuagittuq Greenstone Belt, Canada

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The age of mafic cummingtonite-rich rocks called the Ujaraaluk unit in the Nuvvuagittuq Greenstone Belt (NGB) is still debated. The correlation between $^{142}\text{Nd}/^{144}\text{Nd}$ and Sm/Nd ratios found in these rocks suggests that they are ~4300 Ma old, however, an Eoarchean age has also been proposed. Confirmation of a Hadean age has important implications on the geological processes leading to the formation of the primitive crust. This study focuses on two generations of gabbro sills intruding the Ujaraaluk unit to better constrain a minimum age on the NGB. We present new Sm-Nd data for fine-grained sheared gabbro sills as well as Sm-Nd and Lu-Hf data for relatively undeformed coarse-grained gabbroic intrusions. The sheared gabbros are large differentiated sills on which previous Sm-Nd work suggested an age of ~4.1 Ga. New sampling for these gabbros has targeted their most evolved plagioclase-rich zones and amphibole-rich cumulative rocks in order to better constrain their age of magmatic differentiation. New Sm-Nd data for the sheared gabbros yield an isochron age of 4151 ± 290 Ma (MSWD=9, n=6). When combining all NGB sheared gabbros, the isochron age becomes 4114 ± 140 Ma (MSWD=14, n=19), providing strong evidence for Hadean mafic magmatism recorded in the NGB. Two gabbroic samples from the nearby Ukaliq belt fall on the same 4.1 Ga isochron suggesting that Hadean mafic magmatism was not restricted to the NGB. The coarse-grained gabbros yield younger Sm-Nd and Lu-Hf isochron ages of 2867 ± 210 Ma (MSWD=8.2, n=16) and 2755 ± 52 Ma (MSWD=1, n=6), respectively, consistent with a distinct Neoproterozoic mafic magmatism event. Their initial ϵNd value of +1.1 is almost identical to the Hadean gabbros ($\epsilon\text{Nd}=+1.5$) suggesting either a common source that evolved with a near chondritic Sm/Nd, or, that an older crustal component was involved in the source of the Neoproterozoic gabbros.