Over 1 Byrs of mantle-derived magmatism from the Saglek-Hebron Complex, Northern Labrador

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The Saglek-Hebron Complex (SHC) in Northern Labrador is one of the few Eoarchean terrains preserved on Earth. It is dominated by granitoids as old as ~3.9 Ga, but also includes several enclaves of mafic metavolcanic and ultramafic rocks and is intruded by at least two generations of mafic dikes, offering the opportunity to investigate the early geochemical evolution of the Earth's mantle. The mafic metavolcanic rocks have basaltic compositions with tholeiitic affinities and relatively flat incompatible trace element profiles. Their compositional variations can be explained by fractional crystallization, producing more evolved liquids and pyroxene-rich cumulate-liquid mixtures. The ultramafic rocks are divided into two groups based on their Fe contents and Al/Ti ratios. Their geochemical composition is consistent with olivine-rich cumulates produced by fractionation from two distinct komatiitic basalt parental magmas. The low-Fe ultramafic rocks appear to be co-genetic with the mafic metavolcanic rocks, whereas the high-Fe ultramafic rocks do not seem to be petrogenetically related to the SHC mafic rocks. Based on these petro-geochemical relationships, the mafic metavolcanic rocks together with the low-Fe ultramafic rocks yield a scattered Sm-Nd isochron age of 3819 ± 190 Ma and initial εNd= +2.3, similar to Sm-Nd ages previously obtained on SHC rocks. The high-Fe ultramafic rocks yield a younger age of 3433 ± 220 Ma with an initial εNd= +1.8. Rocks from both Eoarchean and Mesoarchean suites exhibit comparable positive $\mu^{142}Nd$ values, suggesting derivation from a common Hadean depleted mantle source. The SHC is intruded by mafic dikes called the Saglek dikes, for which new Sm-Nd isotopic data yield an isochron age of 3565 ± 120 Ma (MSWD=1.2) with εNd= +1.7. Undeformed mafic dikes previously thought to be Proterozoic in age define a Sm-Nd isochron with an age of 2694 ± 79 Ma (MSWD=3.2) and with εNd= +1.7, consistent with an older Neoarchean age. The SHC therefore recorded more than 1 billion years of mantle-derived magmatism with almost a constant εNd value, suggesting either the presence of a mantle source that evolved with a near-chondritic Sm/Nd or the involvement of an older crustal component in the source of the post-3.6 Ga rocks.