Reworking >1.5 billion-year-old crust to build Archean cratons

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Archean cratons are dominated by felsic Tonalite-Trondhjemite-Granodiorite (TTG) rocks. These felsic rocks however, cannot be directly produced by melting of the mantle but must instead be derived from the melting of an older mafic precursor. There are only a few occurrences of zircons older than 4.0 Ga and only after ~3.8 Ga does the zircon record become more prominent. This raises questions about the nature of the primordial crust and how, or if, it was involved in the formation of stable Archean cratons. The Nuvvuagittuq greenstone belt (NGB) provides a glimpse of what may have been Earth's primitive crust. The igneous protoliths of the NGB mafic rocks follow a chemical stratigraphy reminiscent of a modern convergent margin, yet the $^{142}Nd/^{144}Nd$ vs. Sm/Nd correlation they exhibit suggests an igneous age of ~4.3 Ga. These Hadean NGB rocks are surrounded and intruded by multiple generations of Eoarchean TTG produced at 3.76 Ga, 3.66 Ga, 3.51 Ga and 3.35 Ga. This Eoarchean / Hadean terrane is included in the Hudson Bay terrane, a terrane mainly composed of 2.88 to 2.69 Ga TTG. Deficits in ^{142}Nd compared to the terrestrial Nd standard have been measured in a number of Eoarchean and Neoarchean TTG surrounding the NGB area. The $^{142}Nd/^{144}Nd$ of these TTG however do not correlate with their Sm/Nd ratios, and all TTG analyses fall to the low Sm/Nd side of the NGB mafic rock isochron consistent with their derivation by partial melting of Hadean mafic crust. This is also supported by the εHf-zircon vs. time trend for the NGB TTG. Most analyzed Neoarchean TTG are within ~35 km of the NGB. One TTG sample that displays a deficit in ^{142}Nd however is located ~150 km from the NGB, suggesting that the Hadean crustal precursor was much more widespread than the surviving NGB remnant. Deficits in ^{142}Nd in the Eoarchean and Neoarchean TTG imply that the crustal reworking process occurred for at least a billion years, from 3.8 Ga to 2.7 Ga within the Northeastern Superior Province. The isotopic data also suggests a long quiescence period of over half a billion years (from ~4.3 to 3.8 Ga) before the mafic primitive crust began to be extensively reworked to produce widespread TTG magmatism.