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Xenolith constraints on Archean construction of the Superior Craton

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Petrologic, thermobarometric, geochronologic, and isotopic data for granulite xenoliths from the Jurassic Victor kimberlite (Attawapiskat, Canada) are used to test two endmember models of Archean lower crust formation: underthrusting of crustal domains by convergence vs. magmatic thickening by underplating. Mafic garnet-clinopyroxene granulite xenoliths equilibrated at pressures and temperatures of at least 0.6–0.8 GPa and 700–800 °C. Rutile records U-Pb dates of eruption indicating that the samples derive from *in situ* lower crust. Coupled U-Pb and trace element data for zircon reveal a ca. 2.8 Ga group with heavy rare earth element (HREE) enrichments indicative of igneous crystallization from a melt in the absence of garnet and a second ca. 2.5 Ga group with HREE depletions that also occurs as rims the older zircon, indicating growth in the presence of garnet in the lower crust. Zircon Hf isotopic data show a shift from depleted mantle-like compositions in the older igneous group to less radiogenic signatures in the younger, granulite-facies group. The very unradiogenic zircon Hf data suggest the involvement of Mesoarchean (and potentially Eoarchean) components. These components are isotopically distinct from rocks exposed in the North Caribou superterrane and cannot be explained by mafic underplating. Rather, the zircon rims document partial melting of Eoarchean crust emplaced beneath the North Caribou at ca. 2.5 Ga and interaction of these melts with pre-existing juvenile mafic lower crust. The proposed scenario for the formation of the lower crust of the northern Superior Craton implies the operation of mobile-lid tectonic processes by at least 2.5 Ga.