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A massif-type anorthosite lens for studying Proterozoic crust-forming processes

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Temporal trends in the formation of different igneous rock types hold important information about how Earth's crust-forming processes function and have changed over billions of years. Massif-type anorthosites are a crust-forming lithology subjected to much scrutiny because of their extreme mineralogy and restricted formation in time (only during the Proterozoic eon and several hundred million years before and after). What type of magmas these giant plagioclase cumulates formed from, and in what settings, remain open questions that leave gaps in our understanding of how crust-forming processes worked during Earth's middle age. We present new isotopic datasets (Nd, Sr, O, and B) for the ca. 1.15 Ga Marcy and Morin massifs (Grenville orogen, U.S.A. and Canada) that, alongside geochemical modelling, reveal a prominent role for the melting and devolatilization of subducted slabs to generate the mafic magmas that formed the anorthosites. We posit that major slab melting during the Proterozoic can explain the chemical systematics of massif-type anorthosites and their restriction in time. This hypothesis offers new angles from which to study Earth's Proterozoic crust-forming processes and those of the Phanerozoic and Archean by comparison.