

Igneous rocks of the Fury and Hecla Group and Franklin intrusions, northwestern Baffin Island, Nunavut

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The Mackenzie (1272–1267 Ma) and Franklin (723–712 Ma) large igneous provinces (LIPs) emplaced vast volumes of mafic intrusive and extrusive rock across arctic Canada. The Mackenzie LIP includes the Muskox layered intrusion, the Coppermine River flood basalts and a massive radiating dyke swarm in north-central Canada. The Franklin LIP includes the Natkusiak sills and basalts on Victoria Island, the Coronation sills, and a dyke swarm spanning much of the Arctic Archipelago. Many more far-flung mafic rocks across northern Canada and Greenland have been attributed to the Mackenzie and Franklin events, including basaltic flows, sills and dykes in the late Mesoproterozoic Bylot basins in northeastern Nunavut and northwestern Greenland (i.e., the Fury and Hecla, Borden, Hunting-Aston and Thule basins). However, most of these units have not been directly dated radioisotopically nor studied in detail, meaning their correlation with the Mackenzie and Franklin LIPs is unverified, limiting our ability to quantify the original extent of these events and their role in the tectonic evolution of Laurentia and in perturbations to the global environment.

Here we present new U-Pb zircon LA-ICP-MS ages, Nd isotope ratios, and elemental data from mafic rocks that are interstratified with and cross cut the Fury and Hecla Group on northwestern Baffin Island. We use these data to interpret the petrogenesis of these mafic rocks, test for crustal contamination, and test their linkage to Mackenzie and Franklin LIPs. Our new data confirm that the Nyeboe basalt and Hansen sill in the lower Fury and Hecla Group can both be attributed to the Mackenzie event, though initial ϵ_{Nd} values, while similar to those for the Muskox Intrusion and displaying evidence of crustal contamination, are distinctly less radiogenic than the Coppermine River basalts. The Dybbol sill, which intrudes the uppermost Fury and Hecla Group, and a suite of NW-trending dykes yielded overlapping ages and relatively unradiogenic initial ϵ_{Nd} values that are similar to the Natkusiak sills and basalts and imply limited upper crustal contamination. High-precision U-Pb TIMS dating will be used to verify the temporal connection of the Fury and Hecla mafic rocks with the Mackenzie and Franklin events.