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A Paleozoic accretion history: Igneous and detrital zircon signatures of the Kulutingwak and Danish River formations in the Yelverton Inlet-Phillips Inlet region, Ellesmere Island, Nunavut, Canada

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The Ordovician Kulutingwak Formation of Ellesmere Island, Nunavut, Canada is an enigmatic assemblage that occurs exclusively in fault-bounded panels in a critical 30 kilometer transect between the crystalline basement of the exotic Pearya terrane and clastic rocks on the Laurentian margin. The Pearya terrane is hypothesized to have accreted to the Laurentian margin during late Silurian to Devonian time. The Kulutingwak Formation includes metasedimentary, volcanic, and volcanoclastic rocks with local carbonate olistoliths and serpentinite-bearing lithologies that collectively represent a subduction-related assemblage formed in an accretionary prism. As such, this formation has been cited as evidence of an arc-continent collision, giving these rocks a significant role in shaping tectonic models for the accretion of the Pearya terrane, and subsequently, the assembly of the circum-Arctic region during the Paleozoic. Igneous and detrital zircon U-Pb and Lu-Hf data from 11 samples collected from the Kulutingwak and Silurian Danish River formations between the Petersen Bay fault zone (PBFZ) and the Emma Fiord fault zone (EFFZ) record a dynamic early Paleozoic tectonic setting at the northern Laurentian margin. Detrital zircon spectra from the Kulutingwak samples adjacent to the PBFZ show major age peaks at ca. 960 Ma that record affinity with the Pearya terrane basement, as well as peaks at ca. 1820 Ma and 2700 Ma that suggest a Laurentian margin source. Additionally, two samples record the presence of a 502–508 Ma source which is not well-documented in this region. Kulutingwak Formation volcanoclastic rocks further to the south in the EFFZ yield U-Pb zircon ages 456–465 Ma and $\epsilon_{\text{Hf}(t)}$ signatures of -5 to +10, implying association with volcanoclastic rocks of the newly redefined Ordovician Fire Bay Formation, a dismembered arc fragment equivalent to Ordovician arc-related rocks connected with the Pearya terrane. The data demonstrate that there are at least two distinctive components within the currently defined Kulutingwak Formation: one that records combined provenance signatures from the Pearya terrane and the Laurentian margin in the Paleozoic and another that signals the presence of an Ordovician arc at ca. 455–470 Ma. U-Pb detrital zircon data collected from the Silurian Danish River Formation in this region demonstrate

affinity with the Pearya terrane, with a major age peak at ca. 960 Ma. Composite signatures of ca. 960, 1820, and 2700 Ma in the Kulutingwak Formation suggest that the Pearya terrane had reached the Laurentian margin in Late Ordovician to Silurian time.