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Phanerozoic record of northern Ellesmere Island, Canadian High Arctic, resolved through $^{40}Ar/^{39}Ar$ and (U-Th)/He geochronology

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Geochronological studies illuminate our understanding of the tectono-stratigraphic evolution of the Arctic Ocean, submarine features, continental shelves and adjoining landmasses. The Franklinian and Sverdrup basins of the Canadian High Arctic preserve a near-continuous Phanerozoic succession detailing the geologic evolution of the northern Laurentian margin from the Neoproterozoic to Cenozoic. Whereas previous studies have documented the structural and stratigraphic record of several episodes of orogenesis and first-order depositional cycles related to Circum-Arctic evolution, supporting geochronological data are sparse because the logistical challenges associated with fieldwork at high latitudes resulting in poor temporal resolution on the magnitude and timing of: 1) accretion of the Pearya terrane to the Laurentian margin; 2) the Devonian to Carboniferous Ellesmerian orogeny; and 3) Paleogene Eurekan deformation. In an effort to constrain the age of these tectonic episodes, we applied $^{40}Ar/^{39}Ar$ and (U-Th)/He low-temperature geochronology to major polydeformed NE-SW trending strike-slip fault zones that bisect the Pearya terrane and Franklinian Basin of northern Ellesmere Island, Canada. Total fusion $^{40}Ar/^{39}Ar$ dating was conducted on 165 single muscovite grains from 22 samples. Age dispersion was sample dependent, with some samples exhibiting robust Paleozoic ages corresponding to the assembly and accretion of the Pearya terrane, and other samples yielding intra-sample date dispersion that spanned the late Paleozoic and Mesozoic, indicative of a previously unreported post-Ellesmerian and pre-Eurekan history. Zircon (U-Th)/He dates from 11 samples (n: 73) and apatite (U-Th)/He data from 6 samples (n: 21) are largely Eocene in age, with dominant populations of c. 48 Ma and c. 41 Ma, respectively. Inverse thermal history modelling of (U-Th)/He data indicates episodic Mesozoic burial and unroofing that coincide with changes in the regional stress regime from dominant N-S to WNW-ESE compression, and rapid cooling during the nascent (>53 Ma) and initial (53 Ma to 47 Ma) phases of Eurekan deformation. The improved geochronologic resolution of the eastern Canadian High Arctic will allow better correlation to offshore structural features and to deformation events on the Greenland plate and Svalbard archipelago.