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Age of Magmatism and Eurekan Deformation in North Greenland

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The alpine mountains of Northernmost Greenland are composed of Phanerozoic sediments and volcanic rocks that make up a broadly East-West striking orogenic belt. The major components include: 1) Cambrian–Devonian sediments deposited in the Franklinian Basin; 2) Ellesmerian (365-345 Ma) deformation of these sediments into a fold belt; 3) renewed extension and deposition of Carboniferous–Cretaceous sediments and Cretaceous–Paleogene volcanic rocks of the Kap Washington Group; and 4) Eurekan deformation of sediments and volcanic rocks.

We present results of 40Ar-39Ar, U-Pb and Rb-Sr dating of volcanic rocks of the Kap Washington Group. This volcanic succesion is part of the High Arctic Large Igneous Province, exceeds 5 km in thickness, and is composed of bimodal alkaline flows, agglomerates and ignimbrites including peralkaline compositions typical of continental rifts such as the East African Rift. Based on zircon U-Pb and amphibole 40Ar-39Ar ages most volcanics were emplaced at 71-68 Ma, but activity continued down to 61 Ma. A thermal resetting age of 49-47 Ma is also identified in 40Ar-39Ar whole-rock data for trachyte flows. Patch perthite feldspars and coeval resetting of Rb-Sr isotopes by hydrothermal fluids provide further support for thermal overprinting, interpreted as a result of Eurekan compressional tectonism.

It is striking that North Greenland volcanism terminated at about the same time (c. 61 Ma) as magmatism in the North Atlantic Large Igneous Province began. We suggest that this was a corollary of a change from extensional to compressional tectonism in the High Arctic. In the period when Greenland moved together with Eurasia (>60 Ma), the separation from North America resulted in rift-related alkaline magmatism in the High Arctic. When Greenland subsequently moved as a separate plate (60-35 Ma), overlapping spreading on both sides pushed it northwards and volcanism in the High Arctic stopped due to compression. Evaluation of plate kinematic models shows that the relative northwards movement of Greenland culminated in the Eocene, coinciding with thermal resetting. We conclude that compression in North Greenland peaked at 49-47 Ma and coincided with the Eurekan Orogeny in a belt across the Canadian Arctic Islands and western Svalbard.