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Making and shaping of South Greenland: Assessing crustal growth and evolution of the Ketilidian Orogen through the lens of U-Pb-O-Hf isotopes in zircon

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Elucidating the mechanisms and rates of silicic continental crustal growth and preservation is essential to understand the geochemical differentiation of Earth. The Ketilidian Orogen in South Greenland represents one segment of the Great Proterozoic Accretionary Orogen, which was a long-lived external convergent margin stretching from Laurentia through Baltica and potentially beyond that contributed to the formation of the supercontinent Columbia/Nuna. The Ketilidian Orogen represents a continental arc bordering Archean crust of the North Atlantic Craton. It is subdivided into the Central Domain, which is dominated by high-K, calc-alkaline gabbroic to I-type granites of the 1.85-1.80 Ga Julianehåb Igneous Complex (JIC), and the Southern Domain, which comprise fore-arc sediments that were metamorphosed to amphibolite and granulite facies at ca. 1.79-1.76 Ga and then intruded by rapakivi granitoids and related mafic units of the Ilua Suite (ca. 1.75-1.73 Ga). This study presents the first detailed, coupled U-Pb-Hf-O isotope analyses in zircons from igneous and metamorphosed sedimentary rocks from the west parts of South Greenland. New geochronological data indicate that the JIC grew in two chronologically discrete magmatic events with most JIC granitoids in SW Greenland emplaced during the second growth phase at ca. 1.80 Ga. Nd and Hf isotope compositions of the JIC are predominantly positive (although not as radiogenic as model depleted mantle), and O isotope compositions of zircon in the JIC are primarily mantle-like, indicating juvenile crustal growth. Some samples have negative Hf and Nd close to the NAC suggesting some older crust may be involved towards the north. Detrital zircons in the metasediments of the Southern Domain are dominated by ages and Hf isotope compositions similar to JIC, consistent with derivation by erosion of the continental arc. However, distinct populations of older zircons (up to 2.8 Ga) indicate likely lateral input from older crustal sources. Moreover, the zircons in the metasediments have relatively heavy O isotope compositions ($\delta^{18}O$ = +8-9 ‰) in contrast to JIC. Zircons from the Ilua Suite show similar O isotope compositions as the zircons in the metasediments, suggesting these formed in part through reworking of Southern Domain metasediments.