Radiogenic isotope constraints on the origin of the 1.64 Ga Ahvenisto rapakivi granite – massif-type anorthosite complex, southeastern Finland

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The Ahvenisto complex belongs to the classic Wiborg rapakivi granite terrane of Finland and covers 350 km^2 of which 70% comprises silicic rocks (subalkaline biotite±hornblende granites) and 25% gabbroic rocks (mainly leucogabbronorite, some olivine-bearing gabbroic rocks, and rare anorthosite); minor monzodioritic rocks and silicic and mafic dike rocks are also found. On outcrop, the silicic rocks are usually found to cut the monzodioritic rocks but the silicic and monzodioritic rocks always cut the gabbroic rocks.

Our U-Pb zircon and baddeleyite data show that the Ahvenisto complex was emplaced into the 1.9 Ga Svecofennian crust 1630–1645 Ma ago. There barely exists a measurable age difference between a leucogabbronorite (1643±3 Ma) and a late quartz-feldspar porphyry dike (1632±5 Ma).

Nd isotopic data on the different rock types of the complex show initial ε_{Nd} (at 1640 Ma) values that span a relatively narrow range (–2.2 to +0.5) and average at +0.5±0.5 (gabbroic rocks, n=4) and –1.5±0.5 (granites, n=5). In the ε_{Nd} vs. Mg# diagram, the gabbroic and granitic rocks fall clearly apart and the monzodiorites (ε_{Nd} [at 1640 Ma] –0.7±0.4, n=4) form a fractionating series with the gabbroic rocks.

We favor different protoliths for the gabbroic rocks (mantle) and granites (lower crust) of the Ahvenisto complex. The monzodiorites probably represent late fractionates of a gabbroic precursor but may also have incorporated some material from the concurrent silicic magmas.