The age of the Wiborg batholith

A. Heinonen[1*], O.T. Rämö[1], I. Mänttäri[2],

T. Andersen[3], and K. Larjamo[1]

[1]*Division of Geology and Geochemistry (DiGG), Department of Geosciences and Geography, Gustaf Hällströmink. 2a, PO Box 64, FI-00014, University of Helsinki, FINLAND (*correspondence: aku.heinonen@helsinki.fi)*

[2]*Geological Survey of Finland, PO Box 96, FI-02151, Espoo, FINLAND*

[3]*Department of Geosciences, University of Oslo, PO Box 1047, N-0316, Oslo, NORWAY*

Recent studies on upper crustal granitic plutons suggest that igneous processes in silicic volcanic systems with shallow plutonic roots develop in two distinct time scales: incremental buildup stage of up to several m.y. and subsequent rapid remobilization/eruption stage of possibly even less than 1 k.y. High-precision geochronological data demonstrate that zircon can saturate at multiple points during the lifetime of a subvolcanic system and is able to record this history.

Six samples were collected from different localities of representative rapakivi-textured rock types of the Paleoproterozoic Wiborg rapakivi batholith in southeastern Finland to acquire detailed knowledge of their crystallization history. Zircon was sampled using a micro drill technique from within the rapakivi-texture forming alkali feldspar ovoids and by standard crushing and separation methods from the groundmasses of the corresponding samples.

U-Pb SIMS ages and LAQ-ICP-MS trace element analyses of these texturally controlled zircon populations reveal that the ovoid material of rapakivi granites was most likely crystallized earlier (by up to several millions of years) and from magmas with dissimilar compositions than their respective groundmasses. The groundmass ages of all the samples are at ca. 1628 Ma (weighted mean $^{207}Pb/^{206}Pb$ age 1628±1.5 Ma; n = 134; MSWD = 1.1).

These observations suggest that: a) a substantial amount of the batholith volume was accreted incrementally through successive injections of magmas into the upper crust and b) the actual emplacement and final crystallization of the batholith took place during a rather narrow time interval. The minimum magmatic flux estimated based on these data (ca. 30% groundmass volume over 3 Ma; 70% ovoid volume over 20 Ma) was substantially higher during final crystallization (> 0.01 km^3/a) than amalgamation (< 0.01 km^3/a), which points to a relatively large magmatic event that may have led to a silicic supereruption at the late stages of Wiborg rapakivi magmatism.