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Three stages to form a large batholith during terrane accretion – an example from the Central Finland granitoid complex, Svecofennian orogen, Northern Europe

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The magmatic history of accretional batholiths mirrors the evolution of the underlying crust from island arcs to accretion and collapse. Chemical composition, age and structure give information on magma source and emplacement depths. The crustal sources of partial melting may change, partly due to the stress regime that has changed from contraction to extension during the process.

The Central Finland granitoid complex (CFGC) in the central part of the Paleoproterozoic Sveco-fennian orogen (ca. 1910 Ma), Baltic Shield, Northern Europe has been used as an example of a batholith, whose magma composition has evolved as the orogen evolves from arc terrane accretion and collision to orogenic collapse. A three-stage magmatic evolution model for an accretional batholith is suggested.

In the first stage, the lower crust of the thickened crust partially melts and produces calcic tonalitic melts that are emplaced above the upper-middle crustal detachment zone (*Group 1*; ≥1887± 3 Ma). In the second stage, the middle crust begins to melt coeval with the stage one. This produces calc-alkalic granodioritic melts that are emplaced close to the surface (*Group 2*; 1890-1886 Ma), and in close proximity to the upper-middle crustal detachment zone (*Group 2*; 1884-1883 Ma). In the third stage, the lower crust remelts and produces bimodal, calc-alkalic gabbroic and alkali-calcic to alkalic granitic magmas (*Group 3*; 1881-1880 Ma), which are emplaced above the upper-middle crustal detachment zone. This kind of crustal differentiation produces a mafic lower, an intermediate middle, and a felsic upper crust. The third stage represents the last magmatic event of the CFGC, during which a high-velocity layer is formed at the bottom of the lower crust.

Crustal thickening and widespread mid-crustal partial melting have allowed lateral flow after or concurrently with the emplacement of the Group 2 granodiorites. The lateral flow has reactivated large scale shear zones allowing the transportation of the Group 3 magmas from lower crust to the upper parts.

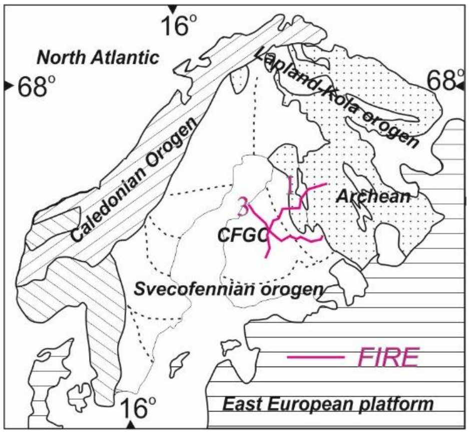

Figure. 1. Location of the study area.

References:

[1] Nikkilä, K., Mänttäri, I., Nironen, M., Eklund, O. and Korja, A. (2016); Prec. Res. (Subm.)