Three stages to form and stabilize an arc-collisional batholith – an example from the Svecofennian orogen

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Arc-collisional batholiths may record their magmatic history from an arc to arc-collision zone, hence the batholiths mirrors the underlying crustal evolution. Change in the geochemical composition, age and structure can give direct and indirect information of the changing tectonic setting. We have used the Central Finland granitoid complex (CFGC) in the central part of the Paleoproterozoic Svecofennian orogen as a proxy for a batholith, which has evolved in an arc-continent collision and has experienced gravitational spreading. The CFGC can be divided into three groups based on geochemistry and geochronology: 1) calcic group at ca. 1890 Ma, 2) calc-alkalic group at ca. 1884 Ma and 3) alkalic to alkali-calcic group at ca. 1880 Ma. The degree of deformation varies from undeformed to local or pervasive deformation within the three groups and is not dependent on U-Pb zircon ages. Therefore deformation was omitted in the group division.

We suggest that Group 1 granitoids represent the first arc-collisional crustal melts. Emplacement age of Group 1 suggests that there was approximately 20 my delay in the partial melt formation after the collision at 1910 Ma. Group 2 granitoids represent the partial melts of middle crust that was weakened by collision and crustal thickening. The Group 2 underwent lateral flow during crystallization, hence we propose that gravitational spreading was already active at that time. Group 3 represents new phase of melt formation, which emplaced during gravitational spreading. We suggest that the Group 3 plutons were transported from lower crust via arc and terrane boundaries, and were deformed by localized shear zones at 1975-1860 Ma due to the gravitational spreading. Overall, gravitational spreading was active in the CFGC area up to 24 my. Variation on degree of deformation likely reflects different exhumation levels.