Deeper meaning of the compositionally diverse Neoarchean magmatism in the Karelia Province?

P. Mikkola* and E. Heilimo

*Geological Survey of Finland, P.O. Box 1237, 70211 Kuopio, FINLAND (*correspondence: perttu.mikkola@gtk.fi)*

Over the last decade significant amounts of new geological data and interpretations concerning the various Neoarchean plutonic suites of the Lentua complex of the Karelia Province has accumulated. Lentua and adjacent parts of the Karelia province display archetypical evolution from uniform "TTG-only" granitoid magmatism (aged mainly 2.84–2.78 Ga, some 2.75–2.72 Ga) towards a compositionally significantly more diverse system of plutonic suites (aged 2.75–2.65 Ga). TTG suite rocks of the Lentua complex do not display any subduction signature and have been interpreted as partial melts of amphibolites bearing variable amounts of garnet.

During Neoarchean the Lentua complex was intruded by several magmatic suites derived from variable mantle sources: sanukitoids (mainly 2.72 Ga, some 2.695 Ga), quartz diorites (mainly 2.70 Ga, but up to 2.74 Ga), alkaline enriched gabbros (2.75–2.70 Ga) and syenitic rocks (2.74–2.65 Ga). These suites have been interpreted as a result of partial melting of unevenly metasomatized lithospheric mantle, with variable input also from the astenospheric mantle as well as possible crustal contamination. These suites were followed, and partially overlapped by anatectic leucogranites (mainly 2.71–2.69 Ga) following a continental collision.The different suites display certain differences in areal distribution and composition (LILE, HFSE enrichement), but also show overlap in both aspects. This is likely linked to heterogeneous sources due to differences in degree of metasomatism due to varying distance from the active Neoarchaean arc system(s) further east and/or differences in amount of input from astenospheric mantle and/or differences in amount of input from alkaline upwellings. In large scale the partial melting of the mantle continued for 80 Ma and progressed from east to west below the Lentua and adjacent complexes, at the same time evolving from sanukitoids to quartz diorites.

Modern analogue of the Neoarchean evolution of the Lentua and adjacent complexes could be the Tibetan plateau, area which also shows sifts in the place and composition of the alkaline magmatism, interpreted as result of slab roll back, slab breakoff and crustal delamination, following change from subduction to collisional setting. These processes in variable combinations affecting a heterogeneous source provide the most plausible solution for the observed complexity of compositions in both cases.