ARCHEAN TO PROTEROZOIC MAGMATISM IN THE FENNOSCANDIAN SHIELD – OBSERVATIONS FROM THE FINNISH PRECAMBRIAN

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RESUMO: The Fennoscandian (formerly Baltic) shield in northern Europe (Finland, Sweden, Norway, and far northwest Russia) exposes well over 1 million km^2 of Precambrian continental crust that was differentiated from the Earth's mantle in Mesoarchean to Mesoproterozoic times. This paper gives an up-to-date account of due magmatic events that register almost 3 b.y. of the Earth's history, and focuses on two major crust-building events (Meso/Neoarchean and Paleoproterozoic) in the central part of the shield (present Finnish territory). These two events are both characterized by a prolonged crust-building orogenic phase (generation of the Archean Karelian and Proterozoic Svecofennian orogens, respectively) and a subsequent cratonic phase. The two events have magmatic traits that bear important similarities but also record a substantial secular variation that reflects the tectonic evolution of the Earth through the geologic time.

The Archean Karelian orogen (or province) includes several crustal terranes with varying division of lithologic assemblages (TTGs , greenstone belts) and magmatic evolution. The West Karelian terrane is characterized by 3.2 to 2.8 Ga TTG orthogneisses and amphibolites and also bears evidence for Meso- to Eoarchean crustal evolution (3.5 Ga trondhjemite gneiss with 3.7 Ga inheritance in the U-Pb isotope system of zircon). The Central Karelian terrane is mainly composed of Neoarchean (2.75 to 2.70 Ga) TTGs and greenstone volcanic rocks as well as sanukitoids. The latter are positive evidence for Neoarchean subduction processes. A rare Archean carbonatite (2.61 Ga) marks the last Archean magmatic event in the Finnish Precambrian.

The Paleoproterozoic (composite) Svecofennian orogen also includes several distinct crustal terranes ("arc complexes") that can be distinguished by the age of arc magmatism and on general (Nd, Pb) isotope geological grounds. These terranes were amalgamated in the course of complex tectonic processes that were characterized by varying subduction events and docking of several exoting terranes and microcontinents onto the pre-existing Karelian nucleus. Important magmatic markers include the 1.95 Ga Jormua ophiolite, 1.93 to 1.92 Ga island arc basalts, 1.91 to 1.89 Ga calc-alkaline basalts, 1.93 to 1.86 Ga calc-alkaline (plus minor alkaline) granitoids (I-, C-, and A-type), and 1.86 to 1.79 Ga (crust-derived) leucogranites.

Varying post-orogenic (mainly mantle-driven) magmatism was an important follow-up of the crust-forming events in both the Archean and Proterozoic orogens of the Fennoscandian shield and it resulted in (locally thorough) reorganization of the continental crust. These include, in the Archean realm, (1) the 2.44 Ga layered mafic intrusions that mark subsequent rifting of the Archean Karelian orogen, (2) the 2.2 to 1.97 Ga mafic dike swarms, and (3) 1.10 Ga and 1.00 Ga diabase dikes that sharply crosscut the Archean Karelian bedrock. In the Proterozoic realm, there are (4) the 1.65 to 1.54 Ga *locus classicus* rapakivi granites and related (more mafic) rocks, (5) the 1.46 Ga and 1.27 Ga mafic dike swarms and associated CFB-type lavas with tholeiitic and transitional signatures in southern Finland and vicinity, (6) the 1.81 to 1.77 Ga high-K granitoids with shoshonitic affinity, and (7) the 1.20 Ga, 0.75 Ga, and 0.63 to 0.59 Ga ultrapotassic rocks (diamondiferous kimberlites and lamproites) that were emplaced within or along the margin of the Archean Karelian orogen.