

Composition and duration of Paleoproterozoic plume events: A case study of 2.45 Ga mafic dyke swarms in the Karelian Craton, Fennoscandian Shield

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The lithosphere of the Karelian Craton preserves information on several Paleoproterozoic intraplate magmatic events. The ca. 2.45 Ga event covers layered intrusions, mafic dyke swarms, and volcanics that vary in composition from komatiites to basaltic andesites. Dykes studied in the northern part of the craton include three geochemical types.

High-Mg olivine gabbrorites of 2450 ± 12 Ma characterized by MgO 16-18 wt.%, $[La/Sm]_n = 2.4-3.5$, $[Gd/Yb]_n = 1.6-2.1$, $Nb/Nb^* = 0.18-0.27$, $\epsilon Nd_{(2450)} = -1.7$. Low-Mg gabbrorites and diorites of 2452 ± 3 Ma characterized by MgO 7.3-3.6 wt.%, $[La/Sm]_n = 2.3-2.7$, $[Gd/Yb]_n = 1.3-1.5$, $Nb/Nb^* = 0.21-0.32$, $\epsilon Nd_{(2450)}$ values of -1.1 to -1.2. In addition to these well known for the 2.45 Ga event low-Ti high-Si high-Mg (SHMB) magmatic rocks we found high-Ti dolerites that vary in age from 2446 ± 7 Ma to 2456 ± 5 Ma and characterized by MgO < 7wt.%, $[La/Sm]_n = 1.4-1.6$, $[Gd/Yb]_n = 1.3-1.4$, $Nb/Nb^* = 0.70-0.91$, and positive $\epsilon Nd_{(2450)}$ values of +1.6 to +1.8.

This data indicate that melts with distinct geochemical characteristics have crystallized simultaneously, within measurement error. The occurrence of high-Ti melts among ca. 2.45 Ga mantle melts in the eastern Fennoscandia indicates a similarity with Phanerozoic CFB. New geochronological and isotopic data imply that duration of intraplate magmatic events of the Early Precambrian was probably the same as in Phanerozoic, and mantle plumes operated during several millions of years.

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