Mid-Proterozoic Evolution of the Fennoscandian Shield

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In the mid-Proterozoic (1.7–1.3 Ga), the Fennoscandian Shield was modified by (1) emplacement of the 1.65–1.50 Ga rapakivi granites and related mafic rocks and (2) intrusion of the ~1.3 Ga Postjotnian diabase dikes. Isotopic and geophysical data acquired on these rocks during the last ten years provide new insights into the evolution of the Shield and its concealed southern continuation.

Nd isotopic mapping of the rapakivi intrusions show that the deep crust varied considerably. The plutons in Finland (T_{DM} 2.0–2.1 Ga) and Baltic countries (T_{DM} 1.9–2.0 Ga) were derived from Paleoproterozoic protoliths. The plutons in Russian Karelia (T_{DM} 2.3–2.6 Ga) and central Sweden (T_{DM} 2.2–2.5 Ga) show a large Archean source component. The associated (mantle-derived) mafic rocks have quite similar Nd isotopic composition as the granites in any one area. The Postjotnian diabases in Finland (ε_{Ndi} ~+3) and Russian Karelia (ε_{Ndi} −11) show that both depleted and enriched mantle domains were involved.

The Fennoscandian Shield is characterised by thick crust with local ovoidal thinnings, circular regional Bouguer anomaly minima, and sharply-defined magnetic patterns associated with the rapakivi plutons. The upper and middle crust include listric reflectors that flatten out at 30–35 km. The lower crust is highly reflective and bows up under the plutons. This high reflectivity is interpreted as a result of mafic underplating and intraplating that caused melting of deep crust. The listric shear zones either detach at the lower-middle crust boundary or Moho and provided paths for the transit of the mafic and silicic (rapakivi) magmas. The Postjotnian diabase dikes form bright saucer-shaped reflectors in the upper crust and were generated in response to rifting that led to large-scale melting in the upper mantle with no associated silicic magmatism.