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The early Paleoproterozoic Baltic large igneous province of the siliceous high-Mg (boninite-like) series

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The early Paleoproterozoic (2.5–2.3 Ga) Baltic large igneous province (BLIP) of the siliceous high-Mg (boninite-like) series (SHMS) is located in the eastern Fennoscandian Shield, the Kola–Karelian region, and is about 1 mill. sq. km in area. This type of magmatic activity is very typical for the early Paleoproterozoic all over the World and defines the transition to the cratonic stage of the Earth's evolution.

The BLIP is situated within the Archean Kola and Karelian cratons and two mobile belts that edge a coeval granulite belt which divides the cratons. SHMS rocks on the cratons comprise different volcanics in riftogenic belts, dyke swarms, and large basic-ultrabasic layered intrusions; in the mobile belts there are numerous small synkinematic basic-ultrabasic intrusions. SHMS rocks are absent from the granulite belt. The Karelian part is the youngest of the two: its development began about 50 myr later than the Kola part. This suggests that at least two superplumes generated the BLIP. The SHMS activity in both parts of the BLIP lasted till c. 2.32-2.35 Ga without essential breaks.

The SHMS volcanics vary in composition from low-Ti picrite and high-Mg basalt via andesite to dacite and rhyolite, and basic rocks predominate. Geochemically the rocks are close to the boninite series. In the rare occurrences where fresh glassy lavas survived, high-Mg olivines and pyroxenes as well as high-Cr spinel are associated with volcanic glass of andesite-dacite composition, which is also typical for boninites. However, instead of the Phanerozoic subduction-related boninites, the SHMS magmas were formed in within-plate tectonic settings and, consequently, had another genesis. According to isotopic data, their origin was probably linked to large-scale assimilation of lower-crustal material by high-temperature mantle melts during their ascent to the surface.

The ore-forming potential of the BLIP lies mainly within large layered intrusions and comprises mainly PGE and chromite, more rarely Cu-Ni sulfides. All have a magmatic origin, and their presence and size in any intrusions are presumably linked with the contents of the ore elements in the melting sources, both mantle and crustal.

The characteristic feature of the early Paleoproterozoic BLIP is the boninitic composition of the melts which is in contrast to the Phanerozoic LIPs where tholeiitic basalts predominate. It may thus be argued that the composition of the superplumes was drastically different also, perhaps highly depleted ultrabasic material.

5.2.P18

The Seiland Igneous Province: Provenance and geodynamic significance

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The recognition of Pre-Caledonian deformation in the Finnmark region of Northern Norway has long relied on the intrusive relationships within the Seiland Igneous Province (SIP). However, the SIP itself, comprising gabbroic, ultramafic and alkaline intrusives, has remained enigmatic. It has been proposed as Andean-style magmatism, rift-related magmatism, hotspot activity, and as a large igneous province. Much of the confusion arises from the Sm-Nd dating of the different intrusions, which postulated a period of 300 Myr (830 Ma to 530 Ma) for emplacement[1].

Dating by U/Pb zircon geochronology has allowed the provenance of the SIP to be reassessed. The Øksfjord gabbro and its felsic differentiates yield ages of 558-565 Ma, and intrusives on the island of Sørøy yield overlapping ages between 556 and 577 Ma. These ages coincide with titanite age determinations from carbonatites in the area. With the new ages indicating a short time period for intrusion, it is possible to reassess older provenance data.

The gabbroic and ultramafic rocks of the area show significant crustal contamination in their Sm-Nd isotopic ratios. The alkaline rocks of the complex possess a different provenance. This indicates two separate magmatic events occurred in the same geographic location, making hot spot activity an unlikely intrusive source. As the current structural framework for the area indicates a compressional regime operated at the time of emplacement, rifting is also unlikely. The favoured interpretation of the available data is thus that the SIP represents the remains of a large igneous province

References

[1] Daly *et* al. (1991). Geochronological evidence from discordant plutons for a late Proterozoic orogen in the Caledonides of Finnmark, northern Norway, *Geol. Soc. London*, **148**, 29- 40.