

The 2.06–2.05 Ga Lappi-Sápmi LIP in northern Fennoscandia, a short-lived Cu-Ni-PGE event

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Recent geochronology work for mafic-ultramafic rocks in northern Fennoscandia has contributed to the recognition of a new Paleoproterozoic Large Igneous Province (LIP), referred to as Lappi-Sápmi. This LIP spans the Rhyacian and Orosirian periods (locally known as the 2.1–1.92 Ga Ludicovian period) at the final break-up stages of the supercontinent Kenorland and is coincident with the Bushveld LIP. It encompasses units extending from the Kainuu and Kuusamo belts in eastern Finland through the Central Lapland Greenstone Belt in northern Finland to the Karasjok Greenstone belt in northern Norway, and potentially to the Pechenga and Imandra-Varzuga Greenstone Belts in the Kola Peninsula in Russia. Intrusions, dykes, sills, and lava flows derived from komatiitic parental magmas (20–26 wt.% MgO) are particularly abundant in northern Finland and Norway (Figure 1). Geochemical fingerprints suggest an interconnected plumbing system for the parental magmas with contributions from both depleted mantle and crustal sources in their petrogenesis. The initial phase of the Lappi-Sápmi LIP event is characterised by komatiitic-picritic magmatism closely linked in space and time to the formation of magmatic Cu-Ni-PGE sulfide ore deposits in the region, such as at Kevitsa and Sakatti. Optimal degree of mantle melting was a key ingredient in the formation of the deposits, leading to suitably sulfur and metal-rich magmas. The magmas were emplaced in a succession of clastic and carbonate sedimentary rocks, which accumulated in a mature passive-margin rift basin between c. 2.38–2.05 Ga, and show varying textural and geochemical evidence of contamination. The contamination signatures are seen in fluctuating ϵ_{Nd} values and high LREE enrichment in spider diagrams, together with textural evidence of assimilation of spatially associated sulfidic-graphitic black shale and evaporite, emphasizing at their role as plausible sulfur sources for the Lappi-Sápmi LIP sulfide deposits. In addition, northern Fennoscandia features three slightly younger and older magmatic episodes: the mafic-ultramafic intrusions of c. 2.15 Ga (Rantavaara LIP), mafic-felsic magmatism of c. 2.02–1.98 Ga (Kittilä Suite) and mafic-ultramafic magmatism of c. 1.98–1.95 Ga (Pechenga-Onega LIP). Although these episodes are considered separate plume events, their close contemporaneity and link to Cu-Ni-PGE deposits present an intriguing area for study.

