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The origin of enderbites and their role in the metamorphic and deformational history of the Lapland Granulite Belt

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The Lapland Granulite Belt (LGB) is a Paleoproterozoic complex in the northern Fennoscandian shield comprising granulite facies migmatites and mafic sills of norite and enderbite [1,2,3]The mafic bodies have been studied by field observations and geophysical data but lack microscopic-scale petrographic and geochemical analysis. Lahtinen and Huhma [3] and Cagnard et al. [1] have both proposed formation of LGB within a backarc basin, but with opposite directions of subduction. The whole area is overlain by a thick layer of till, making field observations and sample collection difficult. Highway 969 from Ivalo to Nellim was recently widened, offering new fresh rock surfaces in the form of roadcuts ideal for structural mapping and analysing contact relationships. This study utilises new data from structural and sample analysis to construct a refined deformational history of the LGB. The focus of this study is the role of the enderbitic sills. Structural measurements and observations were made in August 2024 during a field trip to northern Lapland, Finland. Previously made thin sections of enderbites have been analysed by electron probe micro analyser (EPMA) and X-ray fluorescence (XRF). XRF data show clear differences in whole rock composition and within certain elements, such as P_2O_5 and CaO, between enderbites and felsic granulites. This suggests a different origin for the rock types, coinciding with structural observations from the field, as well as observations made by Eskola [2]. Our working hypothesis is that the melt zone, where the Angeli Anorthosite accumulated from, is the source of the enderbite and norite sills, as well as the provider of the heat needed to induce granulite facies metamorphism. The whole unit has then experienced extension and shortening, leading to deformation of the unit to what we see today.

References

[1] Cagnard, Barbey & Gapais (2011), Precambrian Research 187, 127–142.

[2] Eskola (1952), American Jounal of Science Part 1, 133–171.

[3] Lahtinen & Huhma (2019), Precambrian Research 330, 1–19.