

***In situ* garnet Lu–Hf dates and P–T conditions of the Lapland Granulite Belt, arctic Finland**

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The Paleoproterozoic (*c.* 1910–1880 Ma) Lapland Granulite Belt (LGB) extends across arctic Finland, Norway, and Russia's Kola Peninsula. Studied in detail initially by Eskola (1952) [1], the complex comprises extensive garnet-sillimanite metapelitic gneisses hosting mafic opx-bearing sheet-like intrusive bodies, plus anorthositic and pegmatitic bodies. Here we present (1) new field observations of the LGB and contact relations with adjacent units (focussing on the Inari, Ivalo, Kárášjohka, and Angeli areas); (2) *in situ* Lu–Hf garnet ages for several LGB samples (following the method of Simpson et al., 2021 [2]); and (3) the results of phase equilibria modelling using MAGEMin [3], utilising major element EPMA maps analysed with XMapTools [4]. *In situ* Lu–Hf geochronology yields robust garnet dates for Lapland Granulite Belt granulites (1919 ± 10 Ma; Fig. 1) and the adjacent Kaamanen Complex gneisses (1919 ± 16 Ma) that are identical within uncertainty, and consistent also with previously-reported U–Pb zircon ages for the same region (1919 ± 3 Ma; [5]). LGB granulites experienced peak P–T conditions of 830–900°C at 6.5–8.0 kbar, with the rocks cooling and decompressing initially to ~750°C at ~4–6 kbar (Fig. 2). Garnet–orthopyroxene cation exchange thermometry applied to a grt + opx mafic granulite from Kárášjohka suggests higher peak temperatures, greater than 900°C. Tectonic models involving underplating by anorthosites and their source rocks, and lithospheric extension by slab rollback, are explored as mechanisms for achieving hot and widespread granulite-facies conditions.

Fig. 1 – Lu–Hf isochron diagram, LGB granulite LL20-28, Skadnjárskáidi, Kárášjohka.

Fig. 2 – Summary of P–T path interpretations.

[1] Eskola, P., 1952, *American Journal of Science* 250.

[2] Simpson, A., Gilbert, S., Tamblyn, R., Hand M., Spandler, C., Gillespie, J., Nixon, A. & Glorie, S., 2021, *Chemical Geology* 577.

[3] Riel, N., Kaus, B.J.P., Green, E.C.R., & Berlie, N., 2022, *Geochemistry, Geophysics, Geosystems* 23.

[4] Lanari, P., Vidal, O., De Andrade, V., Dubacq, B., Lewin, E., Grosch E.G., Schwartz, S., 2014, *Computers & Geosciences* 62.

[5] Tuisku, P., & Huhma, H., 2006, *Bull. Geol. Soc. Finland* 78.

Fig. 1

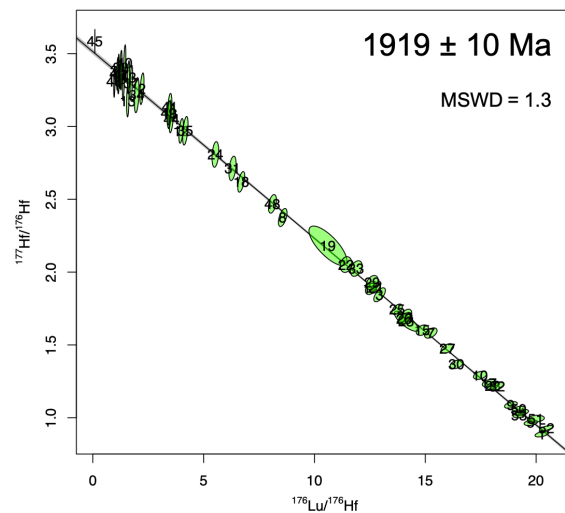


Fig. 2

