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Zircon trace element, Lu–Hf and U–Pb record from the Archean Lewisian Gneiss Complex, NW Scotland

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The Lewisian Gneiss Complex (LCG) of NW Scotland is dominated by tonalite–trondhjemite–granodiorite (TTG) and granitic gneisses, and it is traditionally regarded as a contiguous block of Archean crust. The LGC is divided into a granulite-facies central region bounded by amphibolite-facies northern and southern regions. Recent studies proposed that the LGC is composed of discrete terranes that were amalgamated in the late Archean to Paleoproterozoic. This work aims to better understand the relationships between these terranes by combining Laser-Ablation-Split-Stream trace element, U–Pb and Lu–Hf analyses on zircon cores from twenty-seven gneissic granitoids from all three regions.

Zircon U–Pb crystallization ages range between 2.82–2.63 Ga in the northern, 3.11–2.63 Ga in the southern, and 3.0-2.7 Ga in the central region. With few exceptions, zircon Hf isotopic compositions from all three regions are broadly chondritic (εHf_i = +2.5 to -1.2). Zircons also feature similar rare earth element (REE) patterns, although in the central region zircon have more pronounced negative Eu and positive Ce anomalies, and lower LREE contents. Positive Ce anomalies may reflect more oxidizing conditions of the TTG-producing magma, or higher zircon/melt partition coefficients of Ce^{4+} in lower-temperature melts[1]. Negative Eu anomalies indicate that the magmas experienced plagioclase fractionation before zircon crystallisation, or that the magmas were derived from partial melting of a plagioclase-rich source. Zircon from all regions have elevated HREE patterns and low Nb/Yb attributed to the absence of garnet during melting of the source. Although several U-poor zircons with suprachondritic εHf_i values indicate their crystallization in melts derived from depleted sources, average εHf_i is dominantly chondritic suggesting a mixing between crustal and more juvenile material. At present, our data indicate that TTG magmatism in all three regions was broadly coeval and that TTG formation involved similar processes and sources.

[1] Loucks, Fiorentini & Henriquez (2020), *Journal of Petrology* 61, 1–25.