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Geochemistry of extremely lithium-enriched zircons of Harvey Nunatak, Napier Complex in East Antarctica

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Zircon ($ZrSiO_4$) is a valuable accessory mineral for geochronometers and a powerful geochemical tool owing to its favorable properties, such as high physicochemical stability, adequate content of trace elements such as U, rare–earth elements (REE), and radiogenic Pb. Li concentration and isotope ratio in zircon have been focused on as a geochemical tool for investigating the contamination of weathered sediments and the timescale of magmatic processes (e.g., [1],[2]). We report on extremely lithium (Li)-enriched zircons in an orthopyroxene-felsic-gneiss collected from Harvey Nunatak in the Napier Complex, East Antarctica ([Li]: ~668 ppm; [3]). The Napier Complex is the regional ultra–high–temperature (UHT) metamorphism [4]. This region has experienced extremely high temperatures based on the mineral assemblage of sapphirine + quartz during the Neoarchean and Paleoproterozoic (e.g., [5]).

The U–Pb dating and rare earth element abundance of zircon indicated that zircon crystallization by regional metamorphism continued from 2567–2460 Ma, consistent with the previously proposed timing of UHT metamorphism. The zircon grains contained a large amount of Li (59–668 ppm). Based on the (Y+REE)/(Li+P) ratios in this study are clearly low ((Y+REE)/(Li+P) < 0.45; [3]). Therefore, the substitution reaction with REE [6] does not fully explain the high Li concentration. In contrast, the reactions unrelated to the substitution of P and REE were proposed [7]. The Li concentration was correlated with Cl, which suggests that Li was incorporated with Cl in the interstitial sites of the zircon structure. There was no correlation between the Li and F content, and Cl played an important role in Li incorporation.

[1] Ushikubo et al. (2008) Earth and Planetary Science Letters, 272, 666-676.

[2] Sliwinski et al. (2018) Chemical Geology, 501, 1.

[3] Takehara et al. (2023) Journal of Mineralogical and Petrological Sciences 118 (ANTARCTICA), 230331.

[4] Dallwitz (1968) Nature, 219, 476–477.

[5] Harley (2016) Journal of Mineralogical and Petrological Sciences, 111, 50-72.

[6] Hanchar, J.M. et al. (2001) American Mineralogist, 86, 667–680.

[7] Bouvier et al. (2012) Contributions to Mineralogy and Petrology, 163, 745-768.