

Magmatic age of the Norra Kärr alkaline complex determined by U–Pb and Lu–Hf isotopes of metasomatic zircon in fenite

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The Norra Kärr alkaline complex in southern Sweden is a small igneous intrusion of agpaitic nepheline syenites, which is characterised by complex magmatic Na-Ca-Zr-Ti-REE silicate minerals instead of conventional zircon and titanite. The wall rock—originally a TIB granite—was strongly affected by syn-magmatic alkali metasomatism (fenitisation) and now consists largely of albite and aggregates of biotite and aegirine(-augite). Here, abundant anhedral zircon (100–500 μm) and zircon inclusions (<10 μm) are associated with fluorite, aegirine(-augite), andradite, bastnäsite, xenotime, fluorapatite, and magnetite. We characterised zircon in the fenite to indirectly date the agpaitic magmatic activity.

U–Pb and Lu–Hf isotopic compositions of zircon and eudialyte (only Lu–Hf) were determined by LA-MC-ICP-MS at the Department of Geosciences, University of Oslo.

A reliable upper concordia intercept age of a mostly-concordant group of zircons gave 1488 ± 8 Ma (2σ , $p = 0.86$, $n = 23$), within error of the weighted mean ^{207}Pb – ^{206}Pb age (reworked data, previously reported by Sjöqvist *et al.*, 2014).

Lu–Hf systematics of zircon in the fenite and eudialyte in the nepheline syenites—in addition to mineral associations in the fenite—agree with a genetic link between the magmatic and metasomatic activity by showing identical initial $^{176}\text{Hf}/^{177}\text{Hf}$ ratios. The ε_{Hf} for the fenite zircon at the time of formation (1.49 Ga) is 6.44 ± 0.5 (2σ), which is significantly above the expected signature of Svecofennian crust at that time (*ca.* -5 ± 2), but is similar to a “mildly-depleted mantle”.

References:

Sjöqvist, A.S.L., Cornell, D.H., Andersen, T., Andersson, U.B., Christensson, U.I., Ranjer, S.J.E., Holtstam, D. and Leijd, M., 2014. Geochronology of the Norra Kärr alkaline complex, southern Sweden [Abstract]. 31st NGWM, Lund.