Electronic appendix A for the article: "Constraints over the age of magmatism and subsequent deformation for the Neoarchean Kukkola Gneiss Complex, northern Fennoscandia" by Skyttä et al. (2020). Bulletin of the Geological Society of Finland

Detailed description of the age determination sample preparation and analysis

Ca. 150 zircons from each geochronology sample were separated at the mineral separation laboratory at the Geology Section, University of Turku. This involved cutting approximately one kilogram of sample into 1.5 centimetres thick slabs, crushing the slabs into gravel sized chips using a rotary guillotine press, milling with a Swing mill and sieving to < 250 μm diameter powder. Subsequently, the finest and lightest material was washed away in a 3 litre decanter utilizing a whirlpool like motion, and approximately 95 % of the remaining material was hand-panned using a large amount of water. After careful drying, magnetic grains were removed from the samples by using a large hand magnet covered with a paper sheet. This was followed by separation using 3.7 g/cm³ methylene iodide, and the Frantz isodynamic mineral separator, where each sample was ran three times, with 0.45, 0.85 and 1.4 Amp currents. Finally, zircon grains from the >1.4 Amp fraction were handpicked by using a cross-polarized stereomicroscope and a human hair, placed finally in linear arrangements on a double sided tape. The double-sided tape with the zircon grains was cast into epoxy and polished at the University of Turku and then covered with a thin layer of carbon at the Finnish Geosciences Research Laboratory (SGL) at the Geological Survey of Finland, Espoo, to prevent any charging during SEM imaging.

Back-scattered electron images (BSE) images using JEOL JSM-7100F FE-SEM at the Finnish Geosciences Research Laboratory, Geological Survey of Finland, were taken from the zircons to target the spot analysis sites. U–Pb dating analyses were performed using a Nu Plasma AttoM single collector ICPMS at the Geological Survey of Finland in Espoo connected to a Photon Machine Excite laser ablation system. Samples were ablated in He gas (gas flows = 0.4 and 0.1 l/min) within a HelEx ablation cell (Müller et al., 2009). He aerosol was mixed with Ar (gas flow= 0.8 l/min) prior to entry into the plasma. The gas mixture was optimized daily for maximum sensitivity. Typical ablation conditions were: beam diameter: 25 μm, pulse frequency: 5 Hz, beam energy density: 2 J/cm^2. A single U–Pb measurement included a short pre-ablation, 10 s of on-mass background measurement, followed by 30 s of ablation with a stationary beam. ^{235}U was calculated from the signal at mass 238 using a natural ^{238}U/^{235}U=137.88. Mass number 204 was used as a monitor for common ^{204}Pb. In an ICPMS analysis, ^{204}Hg mainly originates from the He supply. The observed background counting-rate on mass 204 was 150-200 cps, and has been stable at that level over the last two-three years. The contribution of ^{204}Hg from the plasma was eliminated by on-mass background measurement prior to each analysis. Age related common lead (Stacey and Kramers, 1975) correction was used when the analysis showed common lead contents significantly above the detection limit (i.e., >50 cps). Signal strengths on mass 206 were typically 100000 cps, depending on the uranium content and age of the zircon.

Calibration standard GJ-1 (609±1 Ma; Belousova et al. 2006) and in-house standards A382 and A1772 (1877±2 Ma; 2711±3 Ma/TIMS, 2712±1 Ma/SIMS, respectively; Huhma et al, 2012) were run at the beginning and end of each analytical session, and at regular intervals during sessions. The 207Pb/206Pb age offset from concordant ID-TIMS ages for these in-house reference zircons does not exceed 0.5%. Raw data were corrected for the background, laser induced elemental fractionation, mass discrimination and drift in ion counter gains and reduced to U–Pb isotope ratios by calibration to concordant reference zircons, using the software Glitter (Van Achterbergh et al, 2001) and, for sample MKA-050, UranOS v.2.08a software Dunkl et al. (2009). Further data reduction including common lead correction and error propagation was performed using excel spreadsheet written by Y. Lahaye and H. O'Brien. Errors are propagated by quadratic addition of within-run errors (2 standard errors), the

reproducibility of the standard during the analytical session (2 standard deviations) and the overall error on the certification of the standard used for that session. To minimize the effects of laser-induced elemental fractionation, the depth-to-diameter ratio of the ablation pit was kept low, and isotopically homogeneous segments of the time-resolved traces were calibrated against the corresponding time interval for each mass in the reference zircon. Plotting of the U-Pb isotopic data and age calculations were performed using the Isoplot/Ex 3 program (Ludwig, 2003). All the ages were calculated with 2σ errors and without decay constants errors. Data-point error ellipses in the figures are at the 2σ level. Concentrations of U, Th, and Pb (total) on the unknowns were calculated from average blank subtracted mean counts rates for each element measured on the standard used for that session. Grain to grain concentration variations in the standards limits the quality of these concentration data to ± 20%.

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