Supplementary data file 1 to:
Olivarius, M., Friis, H., Kokfelt, T.F. & Wilson, J.R. 2015: Proterozoic basement and Palaeozoic sediments in the Ringkøbing–Fyn High characterized by zircon U–Pb ages and heavy minerals from Danish onshore wells. Bulletin of the Geological Society of Denmark 63, 29–43.

Analytical procedures of zircon U/Pb analyses by LA-ICP-MS

Zircon analyses were conducted at the Department of Petrology and Economic Geology, Geological Survey of Denmark and Greenland (GEUS). Hand-hammered chips from the rock samples were crushed directly in a tungsten-carbide disc mill. The crushed material was poured onto a Wilfley shaking table where the heavy mineral grains were separated. The heavy mineral fraction was transferred to disposable plastic Petri dishes using ethanol, and magnetic minerals were removed using a hand magnet. Zircon grains were subsequently hand-picked from the final heavy mineral concentrate in the Petri dish. The hand-picked zircon grains were cast into epoxy and polished to expose a central cross-section of each grain. The mount was documented prior to ablation using backscattered electron imaging in a scanning electron microscope or light imaging in an optical microscope. The mount was subsequently cleaned in an ultrasonic bath with propanol, and then loaded into the sample cell of the laser ablation system for age dating.

All U–Pb age data were acquired by laser ablation - magnetic sector field - inductively coupled plasma - mass spectrometry (LA-SF-ICP-MS) employing a Thermo Finnigan Element2 mass spectrometer coupled to a NewWave NWR213 laser ablation system. The principal setup is very similar to that described by Frei & Gerdes (2009) and is described as follows. The laser was operated at a repetition rate of 10 Hz and nominal energy output of 55%, corresponding to a laser fluency of 8 J cm^{-2}. All data were acquired with a single spot analysis on each individual zircon grain with a beam diameter of 30 µm and a crater depth of approximately 15–20 µm. For the spot diameter of 30 µm and ablation times of 30 s, the amount of ablated material approximates 200–300 ng. The ablated material was analysed on the Element2 single-collector, double focusing, magnetic sector ICP-MS with a fast field regulator for increased scanning speed. The total acquisition time for each analysis was 60 s, with the first 30 s used to measure the gas blank. The instrument was tuned to give large, stable signals for the ^{206}Pb and ^{238}U peaks, low background count rates (typically around 150 counts per second for ^{207}Pb) and low oxide production rates ($^{238}U^{16}O/^{238}U$ generally below 2.5 %). ^{202}Hg, $^{204}(Pb + Hg)$, ^{206}Pb, ^{207}Pb, ^{208}Pb, ^{232}Th and ^{238}U intensities were determined through peak jumping using electrostatic scanning in low resolution mode and with the magnet resting at ^{202}Hg. Each peak was determined at four slightly different masses and integrated sampling and a settling time of 1 ms for each isotope. Mass ^{202}Hg was measured to monitor the ^{204}Hg interference on ^{204}Pb where the $^{202}Hg/^{204}Hg \equiv 4.36$, which can be used to correct significant common Pb contributions using the model by Stacey & Kramers (1975). $^{207}Pb/^{235}U$ was calculated from the $^{207}Pb/^{206}Pb$ and $^{206}Pb/^{238}U$ assuming $^{238}U/^{235}U \equiv 137.88$. The elemental fractionation induced by the laser ablation and the instrumental mass bias on measured isotopic ratios were corrected through standard-sample bracketing using the GJ-1 zircon (Jackson *et al.* 2004). Samples were analysed in sequences where three standards bracket each set of ten samples. The raw data were corrected for instrumental mass bias and laser-induced U-Pb fractionation through normalization to the GJ-1 zircon using in-house data reduction software. All isotope data were plotted and evaluated using ISOPLOT/EX 3.71 (Ludwig 2008). Model age calculation and error propagation follow Sambridge & Lambert (1997). Long term external reproducibility was monitored by repeated analyses of the Plešovice zircon standard (Sláma *et al.* 2008), yielding an average $^{238}U/^{206}Pb$ age of 339.4 ± 1.5 Ma (2σ) (n = 351 zircons, MSWD = 0.44), which is in perfect agreement with the reported value by ID-TIMS of 338 ± 1 Ma (Aftalion *et al*. 1989).

The reported 'unmixed' ages in the probability density distributions are based on data after removal of zircons that are more than 5% discordant, whereas the concordia diagrams show all the data. Details of all data can be found in Supplementary data file 3 and the shot point locations in Supplementary data file 4. All reported ages are $^{207}Pb/^{206}Pb$ ages as these are considered to be more robust ages as compared to $^{238}U/^{206}Pb$ based ages that may be more susceptible to post-formation alteration and weathering processes. The 'unmixed' ages are calculated by Isoplot/Ex 4.15 (Ludwig 2008) after the number of components was estimated by the user and the simplest model that yielded the geologically meaningful ages was chosen. Plotting of Concordia diagrams and calculation of ages and their associated uncertainties from either weighted means or from unmixing of multiple age components were done in an off-line Excel sheet. All uncertainties are reported at the 2σ level or 95% confidence interval. Full analytical details are reported in Supplementary data file 2.

References

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