SUPPLEMENTARY FILE 1

**TECHNICAL DETAILS**

Coarse-medium quartzites and quartz sandstones were chosen for study and 1 kg reduced to gravel size at the outcrop avoiding further reduction with laboratory jaw-crushing or disc mills. A representative sample (200-400 g) was crushed several times, for a few seconds, in a tungsten carbide mill to <300 micron size. Fine (mud-size) components were removed in water. Neither a Wilfley Table, superpanner or a magnetic separator were used, to avoid any potential zircon differentiation and retention into low-gravity or high-magnetic residues. A heavy mineral concentrate was acquired using *only* sodium polytungstate liquid at specific gravity 2.98 (and checking that the light SG residue did not contain zircons). This mineral concentrate was spread on to a microscope slide at 50x magnification to display about 100 grains in the field of view, from which all zircons of all shapes and sizes were then taken. This was repeated by random movement of the slide until all zircons were removed. About 100 were mounted and polished for U-Pb analysis on a grid pattern such that zircons only occupied grid intersections (thus clearly identifying any ‘accidental’ grains).

U-Pb zircon were determined at the Department of Earth and Environmental Sciences, Macquarie University, Sydney, on an Agilent 7700 LA-ICPMS instrument and Photon Instruments 212 nm laser (40 micron spot size, 5Hz and approx. power 5 J/cm2 power). Instrumental protocols (calibration, standardisation, data treatment) are those of Jackson et al., (2004). Principal calibration was with GJ zircon standard (206Pb/238U age 609.3±0.7 Ma) and then secondary MT Mud Tank (206Pb/238U age 732.4±1.4) and 91500 (206Pb/238U age 1062.4±0.4). Zircon standards were run repeatedly during several analysis periods and ensuring that any measured values were within 1% of accepted values before proceeding. In all reported datasets analyses were routinely determined close to crystal terminations but, for example TAK1, TAK2 samples, a second dataset was also obtained from the grain centres (not necessarily cores) namely TAK1c, TAK2c.

Isotopic analyses were checked in real time to identify any 207Pb/206Pb age departures (at 99% confidence limits) from the Concordia curve. Only zircons with concordant 207Pb/235U and 206Pb/238U ages were accepted (95% confidence limit), and the latter (with their lower errors) were used in subsequent interpretation. In some cases where, very rarely, common-Pb was encountered, corrections were made using the treatment of Andersen (2002). If present, common-Pb was invariably less than 2% total and the consequent age corrections trivial. The age population at a midway stage (about n=30) was compared with that upon completion and invariably, final age components in the latter were always emergent in the former, indicating that the analysed grains were being drawn from a truly random sample set.

Full U-Pb abundances, isotopic ratios and 207Pb/206Pb, 207Pb/235U and 206Pb/238U age data and common-Pb percentages are tabulated in Supplementary Data File (SDT), together with zircon grain characteristics. Zircon characteristics were assessed immediately before analysis: SIZE: large >100 micron, medium 40-100 micron, small <40 micron; SHAPE length/width approx. 1 (square), 1-2 (oblong), 2-4 (long), >4 (needle); MORPHOLOGY: euhedral, pristine edges and terminations observed; subhedral, faces discernible but faces and terminations abraded; round, no crystal faces discernible. All these data are tabulated in SDT.

Note that in this work, a ‘group’ is a cluster of grain ages in a sufficiently broad range to suggest that it has several age components. A ‘component’ is a cluster of grain ages with errors commensurate with a single source. Zircon age components recognised in the populations from their ISOPLOT-3 probability density curves (Ludwig 2003) were regarded as significant if the zircons included had (1) concordant 207Pb/235U and 206Pb/238U ages, (2) form an overlapping group of 4 or more 206Pb/238U zircon ages (at 99% confidence limits) and (3) comprise >4% total population. The 206Pb/238U significant age components were mostly calculated as simple weighted averages, but where some overlap of components was apparent, broad age groups were deconvoluted using the ISOPLOT-3 ‘Unmix Ages’ subroutines. These are then collated in the SDT as ‘accepted sets’. Note that youngest isolated individual zircon ages are regarded as of uncertain interpretation unless specifically observed in associated samples. This full dataset is abbreviated in a SDT that tabulates only the final accepted 206Pb/238U age data but retains grain morphology characteristics (size, shape, abrasion). This table also locates individual zircon ages within early Gondwana (GA), Rodinia (RA) and Nuna (NU) (here informally including >2200 Ma) supercontinent categories. Summary inset boxes show percentages of accepted ages and the zircon morphology data falling within the above supercontinent categories and selected geological intervals. Combined probability/histogram diagrams of 206Pb/238U ages using ISOPLOT 3 software (Ludwig, 2003) are then shown. The zircon age percentages falling within selected geological intervals and zircon morphology characteristics within Gondwana, Rodinia and Nuna supercontinent categories are also collated.

*Version2: 240225*

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