



Supplementary Figure 1: Cathodoluminescence images of analysed zircon grains from sites on the Antarctic Peninsula. Circles indicate the position of analysis. (a) R.2143.3 Engel Peaks; (b) N11.115.1 Mount Jackson; (c) N10.395.2 Eileson Peninsula; (d) N10.470.1 Eileson Peninsula; (e) BR.015.1 Roman Four Promontory; (f) R.7170 Mount Sullivan; (g) R.6308.1 Batterbee Mountains; (h) R.6157.1 Reluctant Island.

Supplementary text

Analytical methods: Sr and Nd isotope geochemistry

Samples were weighed into Savillex teflon beakers and spiked with mixed ^{149}Sm - ^{150}Nd and single ^{84}Sr isotope tracers, prior to dissolution using $\text{HF-HNO}_3\text{-HCl}$. Ion exchange columns packed with Eichrom AG50x8 cation exchange resin were used to separate Sr and a bulk rare-earth element fraction. Sm and Nd were separated from the REE concentrate using EICHROM LN-SPEC columns. Sm fractions were loaded onto one side of an outgassed double Re filament assembly using dilute HCl, and analysed in a Thermo Scientific Triton mass spectrometer in static collection mode. Replicate analysis of the BCR-2 rock standard across the time of analysis gave a mean Sm concentration of 6.34 ± 0.06 ppm (1-sigma, n=7). Nd fractions were also loaded onto one side of an outgassed double Re filament assembly using dilute HCl, and analysed in a Thermo Scientific Triton mass spectrometer in multi-dynamic mode. Nd data were normalised to $^{146}\text{Nd}/^{144}\text{Nd} = 0.7219$. Across the time of analysis, 19 analyses of the JND-i standard gave a value of 0.512102 ± 0.000005 (10.4 ppm, 1-sigma). All other standard and sample data is quoted relative to a value of 0.512115 for this standard. Seven analyses of La Jolla gave 0.511864 ± 0.000006 (11.5 ppm, 1-sigma). Replicate analysis of the BCR-2 rock standard gave a mean Nd concentration of 28.1 ± 0.3 ppm and $^{143}\text{Nd}/^{144}\text{Nd} = 0.512638 \pm 0.000006$ (11.9 ppm, 1-sigma, n=12). Sr fractions were loaded onto outgassed single Re filaments using a TaO activator solution, and analysed in a Thermo-Electron Triton mass spectrometer in multi-dynamic mode. Data were normalised to $^{86}\text{Sr}/^{88}\text{Sr} = 0.1194$. Across the time of analysis, 143 analyses of the NBS987 standard gave a value of 0.710250 ± 0.000006 (9 ppm, 1-sigma). Replicate analyses of the BCR-2 rock standard run with the samples gave a mean Sr concentration of 340.6 ± 5.1 ppm, and $^{87}\text{Sr}/^{86}\text{Sr} = 0.705041 \pm 0.00023$ (33 ppm, 1-sigma, n=15). The calculated Rb/Sr (weight) ratio for BCR-2 is 0.1379 ± 0.0013 (1-sigma).