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Supplementary file 1 – Figures and extended methods

Mantle heating at ca. 2 Ga by continental insulation: evidence from granites and eclogites

Tamblyn, R., Hasterok, D., Hand, M., & Gard, M.

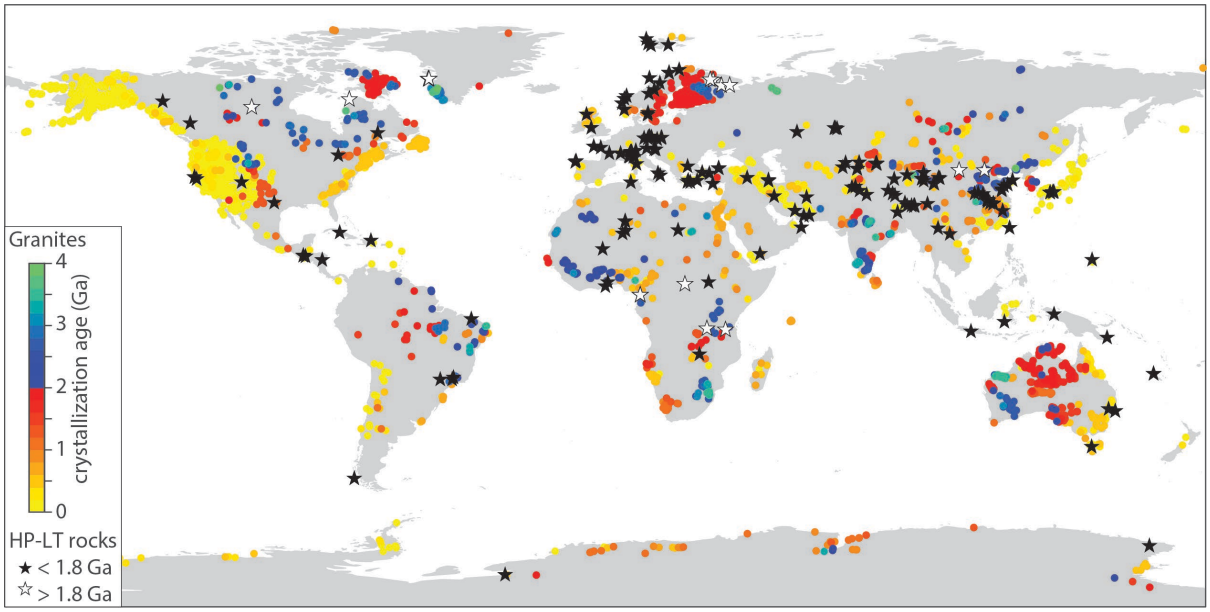

Figure S1: Locations of granites (circles) and high-pressure low-temperature (HP-LT) rocks (stars) in the databases of this study. Some HP-LT rocks were added to the pre-existing database. The granite data has good spatial coverage across the continents, with some bias towards younger (< 200 Ma) igneous systems.

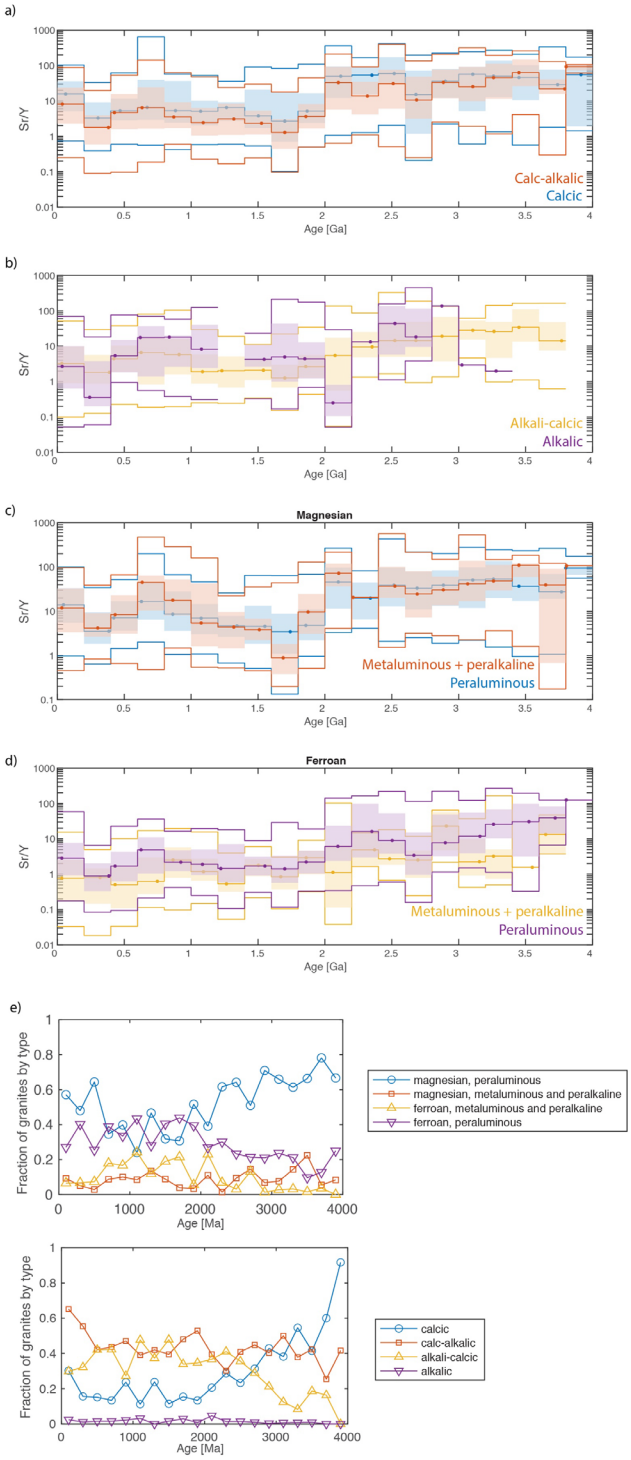

Figure S2: a-d) Time-resolved chemical data for granites split into different classifications. Pettitt's tests identify step changes at 2 Ga for all compositions with the exception of ferroan (metaluminous + peralkaline), where it is located at 1.8 Ga (p-value = 0.0165), and the alkali-calcic granites, where it is located at 2.2 Ga (p-value = 0.0032). The alkalic granites do not contain enough data to calculate a step change. e) Fraction of granite types in each classification.

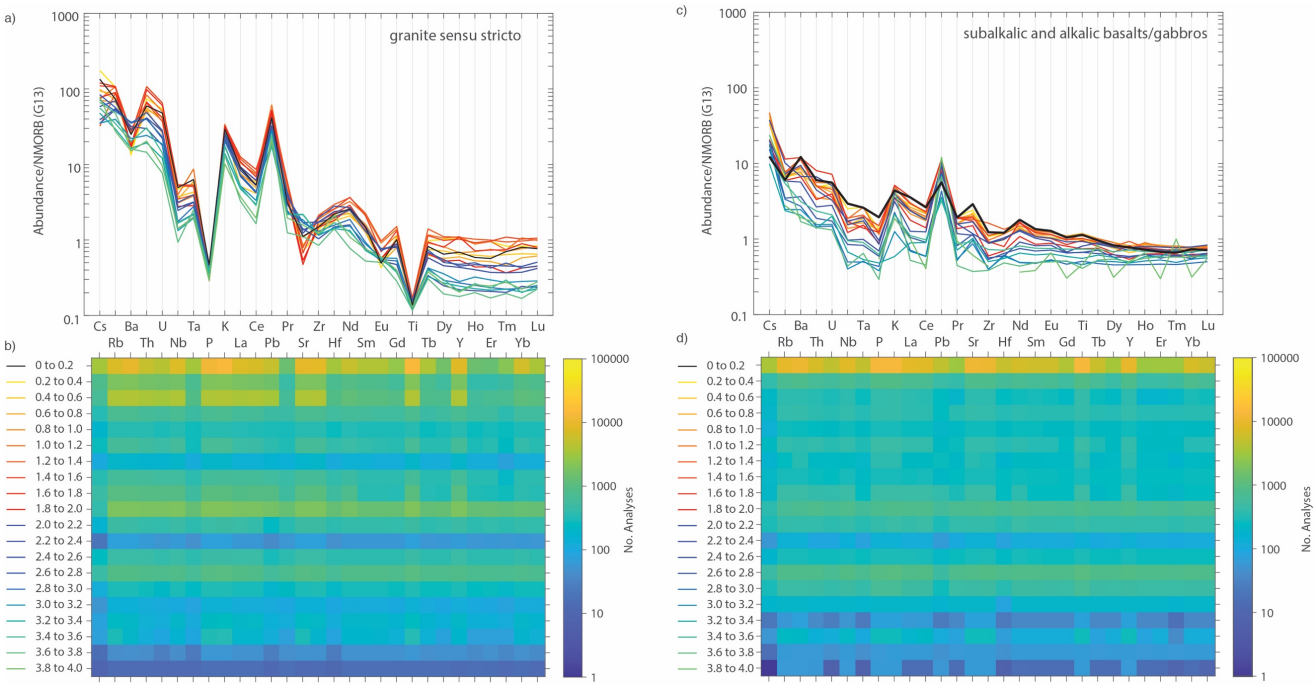

Figure S3: a) Trace element compatibility plot (or spider plot) of granite chemistry from 4 Ga until present, in 0.2 Ga age bins, normalised to MORB (Gale et al., 2013). The colours of the trace element patterns correspond to age as shown in b) and d). Note the development of Sr and Eu anomalies at ca. 2 Ga, and the corresponding increase in Y and HREEs. b) Number of data in each 0.2 Ga age bin for each element. c) Trace element compatibility plot of basalt chemistry. All basalts show a positive Pb anomaly. c) Number of data in each 0.2 Ga age bin for each element.

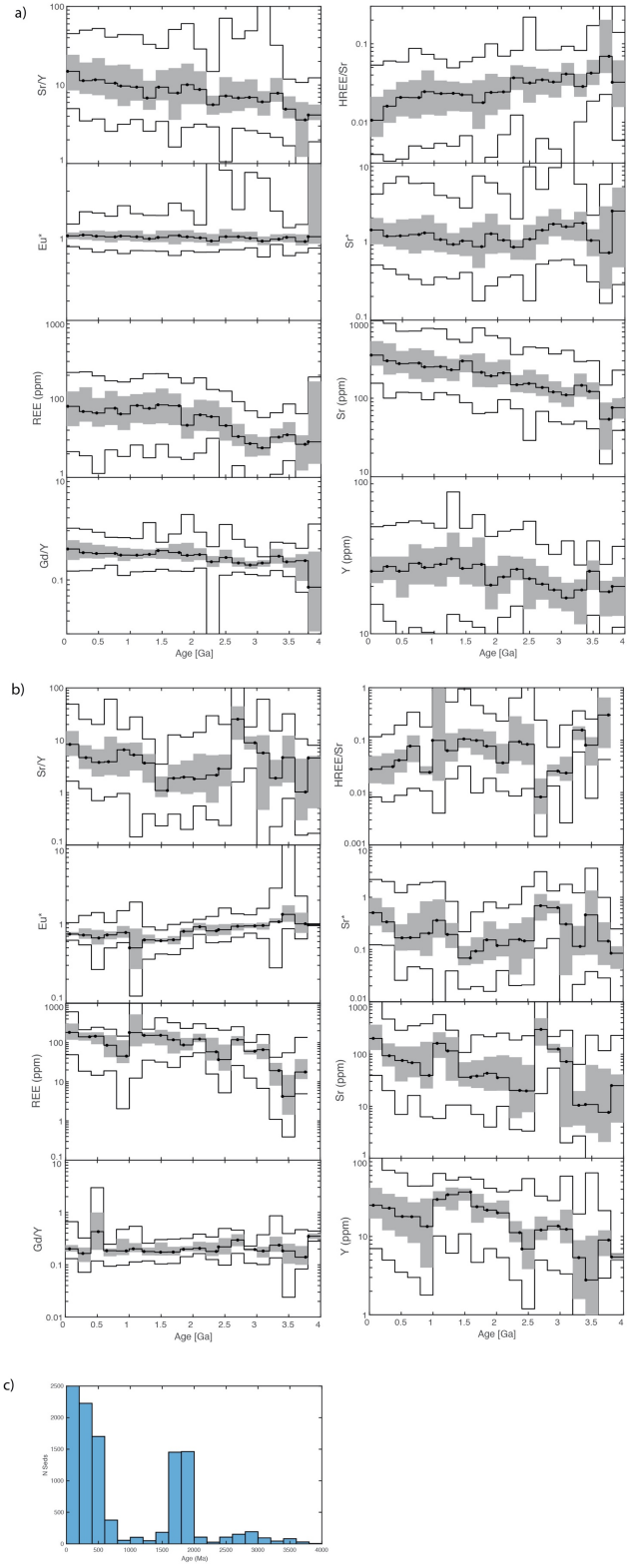

Figure S4: Ratios, anomalies and elements of interest in a) basaltic and b) sedimentary rocks through time. The heavy centre line represents the median value, and the grey field the interquartile range (25th to 75th quantiles). The point shows the median age of each 0.2 Ga age bin. No change points were identified by Pettitt's tests at 2 Ga. c) The number of data for each age bin for sedimentary rocks, with only small numbers of analyses in the database. Sedimentary rocks include non-chemical lithologies. For numbers of basalts in each age bin, see Fig. S3.

Extended methods

Geochemical analyses and filtering

The geochemical database by Gard et al. (2019) used in this study is a whole-rock database of major and trace elements and age. The data originate from the GEOROC compilation, a number of national and provincial survey datasets and open-file reports, and numerous individual publications. The dataset supplements GEOROC data particularly in Precambrian terranes and geographic regions outside of the United States.

The database was processed in Matlab® by first converting all Fe to Fe2+ and then normalizing to the following major elements without LOI: SiO2, TiO2, Al2O3, Cr2O3, FeOT, NiO, MnO, MgO, CaO, BaO, Na2O, K2O, and P2O5. The normalized compositions of igneous and metaigneous rocks were then assigned total-alkali silica (TAS) plutonic names using a the IUGS classification scheme. From these samples, we then extract all the granites and (alkalic+subalkalic) basalts for analysis. Only continental samples of basalts were used in our analysis. While granites are typically assigned names based on their modal mineralogy and the quartz-alkali feldspar-plagioclase (QAP) method, we opt for the TAS geochemical classification method because it ensures a like-for-like comparison of samples based on chemistry and the modal data do not generally exist to perform a QAP analysis. Furthermore, names provided by authors do not always relate to the QAP scheme, or the estimation of modal mineralogy on hand samples typically has significant uncertainty. For normalization of Eu* and Sr* and the trace element compatibility diagram (Supp. Fig. 1) we use NMORB by Gale et al. (2013).