The geodynamic setting of continental crust generation through Pb isotopes on mineral inclusions within zircon

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About 80% of the present day crust is generated in subduction settings, with the rest being mostly generated in intraplate settings. A major uncertainty in the rock archive is the balance between subduction and intraplate magmas in the generation of continental crust. Intraplate-related and subduction-related magmas have different trace element characteristics, but the trace element record in ancient rocks and minerals is often overprinted by secondary process, and hence difficult to interpret.

One way forward is to analyse a trace element ratio that (i) fractionates differently in intraplate and subduction magmas, and (ii) for which time-integrated parent/daughter ratios can be calculated. The U-Pb system is particularly relevant for that purpose, as subduction-related magmas have typical U/Pb = 0.09 (n=539) whereas intraplate magmas show markedly higher ratios, typically U/Pb = 0.33 (n=849; data compiled from the GEOROC database).

We present a new method for the determination of the time-integrated U/Pb ratio (i.e. $^{238}U/^{204}Pb = \mu$), based on the *in situ* analysis by SIMS of Pb isotopes on mineral inclusions in well-dated zircons. Two samples with Palaeozoic crystallisation ages and late Proterozoic model ages were investigated. Within each sample, inclusions have Pb isotope ratios that overlap within error, which validates the robustness of our approach. The two samples have different average Pb isotopes ratios and therefore different time-integrated U/Pb ratios. The sample from Antarctica (~500 Ma) reveals a subduction-related origin (U/Pb ~0.1), whereas the Australian sample has an intraplate origin (U/Pb ~0.5) at the time of their model ages (~1-2 Ga), i.e. at the time new crust was generated.