In situ isotopic measurements on mineral inclusions as a new window on crustal evolution studies

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A recurring challenge in crustal evolution studies is to address the variations in the composition, and the conditions and tectonic setting(s) of formation, of new/juvenile continental crust through time. The traditional approach has been to work on samples of new crust preserved in the geological record, but the amount of well-preserved rocks remains extremely small, especially back into the Archaean. An alternate approach is to interrogate the composition of the sources of granitic magma, by estimating the time-integrated parent/daughter ratios of isotope systems in crustal melts derived from that new crust.

The time-integrated Rb/Sr in whole rock samples with Nd model ages ranging from the Hadean to the Phanerozoic suggest, along with recent continental growth models, that new continental crust was principally mafic and generated in an intraplate setting over the first 1.5 Ga of Earth's evolution; and that it subsequently took on a more evolved composition from the inferred onset of plate tectonics ca. 3 Ga ago. A key test for these models is to obtain high precision time-integrated ratios from mineral inclusions in well-dated archives, such as zircon.

We propose a new approach for the determination of time-integrated Rb/Sr and U/Pb ratios, based on the development of analytical techniques for *in situ* analyses of mineral inclusions in the mineral zircon. Time-integrated Rb/Sr can be determined using laser ablation MC-ICP-MS on apatite inclusions; and time-integrated U/Pb is estimated from SIMS analyses of Pb isotopes on feldspar inclusions. This approach, along with our preliminary results on selected test samples, open new perspectives in crustal evolution studies.