

From macro to micro: Re-Os and HSE systematics at variable scales

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Understanding the formation and stabilisation of the Earth's first continents requires the input from a number of different techniques. Over the past decade the Re-Os chronometer has become a fundamental tool for dating partial melting events of the sub-continental lithospheric mantle. Accurately dating the time of partial melting beneath cratons is of great importance to our understanding of the history of formation and stabilisation of such terranes. Through the implementation of the Re-Os chronometer it has become evident that the Re-Os system is controlled by small, distinct mineral phases and that the information from such minerals provides greater insight into the partial melting history of the depleted mantle. Due to the nature of such minerals, and their potential formation during primary partial melting or from secondary re-enrichment, it is essential that the petrological information of the minerals is accurately assessed prior to dating and subsequent interpretation.

A single cratonic peridotite from the Bultfontein kimberlite pipe, South Africa, provides us with a unique opportunity to investigate Re-Os and HSE systematics at variable scales. We will present Re-Os and HSE data at the whole-rock, sulphide and sub-microscopic mineral scale. Utilising a new and novel technique for the extraction of sub-micron sized minerals for analysis, we will show how the Re-Os system is highly diverse at the micron scale. This heterogeneity becomes a large contributing factor at the whole-rock scale and highlights the importance of detailed study of peridotites prior to interpretation of results. Most importantly, through the combination of results from natural samples and experiments, we will show that an Archean age does not always correspond to ancient partial melting events and that as such, should not be used to infer the age of lithosphere stabilisation.