Invisible daughters. Survival of Pb in minerals.

Principal Investigator: Monika A. Kusiak

The number of studies requiring absolute time constraints has risen in recent years, and the number of research that integrate multiple dating methods has escalated. The reliable dating of radioisotope-bearing minerals such as zircon ($ZrSiO_4$) depends on a basic assumption, that the proportion of daughter (Pb) to parent (U, Th) isotopes is preserved through the 'lifetime' of the mineral. In other words, the radiogenic Pb has accumulated in the mineral since the time of zircon formation to the present day. However, recent studies provided proof of the mobilisation of radiogenic Pb in zircon affected by metamorphism. Instead of being accommodated in a damaged zircon matrix, as in unmetamorphosed zircon, radiogenic lead is sequestered as nanoinclusions in restored crystalline zircon.

This project aims to answer following research questions that arise from the discovery of this phenomenon:

RQ1. Are Pb nanoinclusions also present on a smaller scale where microbeam measurements are not scattered?

RQ2. Is the presence of 'unsupported radiogenic Pb' associated with the presence of lead nanoinclusions?

RQ3. How Pb nanoinclusions were formed in zircon rims:
-did they migrate from cores?
or
-are they stationary 'markers' indicating solid-state replacement of core zircon by rim zircon?

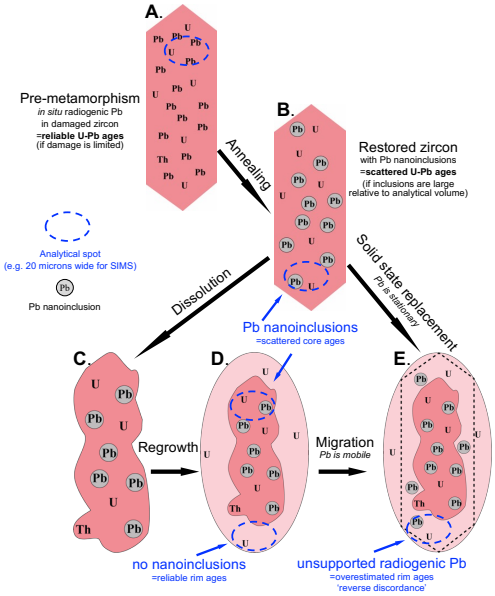

Figure 1. Hypothetical mechanisms of radiogenic Pb sequestration in zircon affected by high-temperature metamorphism.

The ultimate goal of this project is to determine from microstructure and nanoinclusions

- **What processes led to the redistribution of Pb?**

&

- **How widely is this phenomenon present in zircon?**

The retention of radiogenic lead is a basic aspect of the reliable measurement of ages of mineral growth and modification. This project will investigate newly discovered ways in which such retention is affected by metamorphic events. Successful completion of this project will therefore enable a better understanding and interpreting complex geochronological and geological data.