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# Monazite and microstructures as a monitor for timing of melt-rock interaction

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The timing of metamorphic processes is important in understanding the evolution of the earth. Absolute dating can be done by e.g. U-Pb laser ablation analysis of accessory minerals such as zircon and monazite. However, relying solely on geochronological analyses of these important geochronometers would provide little more than timing of crystallisation or timing of recrystallisation of these minerals. Much more powerful is the interpretation of ages and/or trace element data acquired from zircon and monazite in relation to the microstructures in which they are observed. Combining petrography, mineral compositions, accessory mineral occurrence and internal texture with geochronology and trace element concentrations provides a powerful strategy to resolve temporal processes within metamorphic rocks.

Here we apply this strategy on monazite from high-temperature metamorphic metasedimentary rocks from the Reynolds Range, central Australia. The metasedimentary sequence here comprises cordierite–garnet–biotite gneisses that contain orthopyroxene-bearing and orthopyroxene-free quartzofeldspathic leucosomes. First order observations led us to believe that partial melt was present and reacted with the host rock. Analysis of monazite is used to provide the chronological context of these events. Using solely U–Pb ages did not solve the order of metamorphic events these rocks experienced. Rather the interpretation of in-situ analysed monazite within the rocks microstructural context provided the temporal resolution of events. We argue that analyses of various internal monazite textures, their age, composition and overprinting relations, allows us to identify the absolute chronology of events following the metamorphic peak. Here we link retrograde reactions involving garnet, orthopyroxene and K-feldspar to melt-rock interaction that is subsequent to partial melting and crystallisation of the partial melt. Retrogression is reflected in the development of compositionally distinct monazite textural domains. This allows us to tie metamorphic processes to specific times in the evolution of these rocks within the Reynolds Range, central Australia.