Strenght and weakness of zircon and monazite as geochronometers during ultra-high temperature granulite facies metamorphism

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Zircon and monazite U–Th–Pb data are routinely used to trace the dynamics and duration of melting events within crustal rocks. Commonly, concordant analyses define a spread of ages over several tens of Myrs that may reasonably be interpreted to result either from episodic growth through time or reflect post-crystallization disturbance. In Rogaland, Norway, a polyphase ultra-high temperature (UHT) granulite-facies domain surrounds late-Sveconorwegian (930 Ma) anorthosite magmatic complex. Monazite and zircon define a continuous range of U–Pb ages between 1040 and 930 Ma. In monazite grains, consistent and synchronous changes in major- and trace-elements composition at the regional scale allow to identify discrete metamorphic events. The examination of monazite–xenotime–huttonite phase relationships coupled to Y-thermometry further lead to the recognition of two ultra-high temperature (UHT) metamorphic events at c.1030–1005 Ma and c. 940–930 Ma. On the contrary, zircon changes in chemistry and associated CL-pattern are not correlated with their apparent U–Pb ages. "Inverse age zoning", consisting of rims older than cores, is consistently observed in some samples. We propose that zircon age resetting is mostly controlled by the level of amorphization, enhancing Pb loss during long-lived thermal annealing (1005–940 Ma). The identification of zircon and monazite respective strengths and weaknesses as geochronometers at these extreme conditions finally allows to draw a geological history in which the Rogaland crust remains molten (> 750 °C at 0.7–0.4 GPa) at least during 60 My between the two identified UHT excursions.