Time resolved rutile U/Pb data derived from LA-ICPMS – a case study from the North Pamir

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Rutile is frequently found in metamorphic and less commonly in igneous rocks, as well as sediments derived from the former rock types. It may contain enough U (typically up to ~100ppm) to be dated by U/Pb geochronology. In detrital studies, rutile U/Pb ages supplement zircon U/Pb data, as zircon age peaks often reflect magmatic activity, while rutile U/Pb age peaks can be connected to metamorphic events. Using Zr-in-rutile thermometry, one could also estimate metamorphic facies of the terrane, from which detrital rutile grains are derived. Zircon U/Pb dating provides usually a crystallization age, while rutile gives cooling ages that are dependent on the size of the diffusion domain and its cooling rate. The closure temperature has been estimated at ca. 600°C. A major challenge of rutile U/Pb geochronology is the variable amount of common Pb present and most rutile dating requires the correction for common Pb. A widely used method is the Stacey & Kramers approach, which estimates a formation age for a group of rutile grains and assigns them an age-dependent initial Pb isotope composition from the terrestrial Pb evolution curve (Stacey and Kramers, 1975). We present detrital rutile U/Pb data measured by Laser Ablation Inductively Coupled Plasma Mass Spectrometry (LA-ICPMS) from Mesozoic and Cenozoic units in the North Pamir in Central Asia. The laser ablation system obtains a time resolved signal of all required isotopes. Using data reduction schemes in Iolite (Paton et al., 2011) and VizualAge (Petrus and Kamber, 2012), the signal is routinely integrated to a single spot age for each ablation pit. Following a similar approach for apatite (Stockli et al., 2017), we subdivided the signal of each single spot into several time-slices and obtained data that crosses diffusion domains or compositional zones within a single rutile grain. Time slices in most cases are aligned along a Discordia in the Tera-Wasserburg diagram, enabling us to calculate a lower intercept age and initial 207Pb/206Pb ratio. We also discuss similarities and differences between these internally corrected ages and the Stacey & Kramers approach-corrected ages.

