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Quartz-zircon de-coupling in sandstone: petrography and quartz cathodoluminescence of Triassic continental Buntsandstein Group in Germany

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We illustrate how de-coupling of quartz and zircon can be used advantageously in provenance research. Thirty-eight fine-grained to coarse-grained arkose samples of the Early Triassic intracontinental Buntsandstein Group from the Central European Basin in Germany were analysed for their petrography and 1200 grains in 23 of these for their detrital quartz cathodoluminescence characteristics. The samples represent the Hessian and Thuringian subbasins and the Eichsfeld-Altmark Swell separating them. The Hessian Subbasin includes more metamorphic lithoclasts than further east in the Thuringian Subbasin with a larger content of plutonic grains. More than 90 % of the detrital quartz from the eastern Thuringian Subbasin produce medium to bright blue cathodoluminescence colours and corresponding spectra that are typical for igneous or high-temperature metamorphic origin. Differently, the quartz from the Hessian Subbasin mostly luminesces brown and dark to medium blue, typical for low-temperature metamorphic origin. Quartz from the Eichsfeld-Altmark Swell and the western Thuringian Subbasin is a mixture between these origins. The quartz indicates different catchments for the subbasins, possibly the Bohemian Massif and the Massif Central, with converging transport routes on and close to the eastern fringe of the swell. Taking published zircon data from the same samples into account, light mineral-zircon grain-size shifts are 0.7-2 Φ units. That can be explained by mineral de-coupling due to different transport modes for quartz and zircon and different zircon-size availability in the source areas, exaggerated by combined aqueous-aeolian transport, as well as sample preparation-induced sorting. We conclude that submerged highs significantly can influence continental sediment transport. Hence, vast, flat continental areas with submerged morphological highs and a seemingly straightforward transportation pattern may be more complex than expected. The results also illustrate that analysis of detritus that has been affected by different dominating transport modes and further sorting during sampling and preparation can reveal additional source information.