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Volcanic rocks and pyroclastica as time markers in sedimentary sequences – but how to date them? Examples from the Quaternary Eifel volcanism, German

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Volcanic rocks, in particular tephra, can serve as most valuable time markers in sedimentary sequences such as loess-paleosol sequences, lake sediments, fluvial sediments, etc. Young (Quaternary) volcanic products are often difficult to date with K/Ar or Ar/Ar methods, due to the long half-life of 40K and/or the lack of K-rich minerals in mafic volcanic products. 14C dating is problematic in volcanic environments and limited to < ca 50 ka. Direct dating of volcanic minerals by TL is strongly hampered by so-called “anomalous fading” of volcanic feldspars or pyroxenes.

We tested the orange-red (620 nm) R-TL emission of quartz extracted from crustal xenoliths of some Quaternary Eifel volcanoes which were heated during the eruption. The R-TL emission of quartz appears to be suitable because of its high saturation dose which should allow for dating >1 Ma, and because of the lack of anomalous fading as reported in literature. Comparing our first apparent TL ages with new laser Ar/Ar ages from small autogenic phlogopit crystals we found, however, unexpected age underestimations for some samples. Further test relate this observation to the so-called anomalous fading of the quartz separates. Apparently, the temperature experienced by the xenolithic quartz grains during eruption is relevant for their TL stability characteristics. By improving and adjusting R-TL measurement protocols we were so far able to reproduce some 14C and Ar/Ar ages in the range of ca 40 ka to ca 600 ka. Our continuing work will focus on establishing R-TL dating of heated xenolithic quartz as a reliable method for Upper and Middle Pleistocene volcanic events.