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Luminescence chronology of the loess record from the Tönchesberg section – a comparison of using quartz and feldspar as dosimeter to extend the age range beyond the Eemian

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Abstract

The loess-paleosol sequences of the Tönchesberg section, located in the East Eifel Volcanic field (Germany) provide an excellent climate archive of the late Middle and the Upper Pleistocene in the Middle Rhine area. Loess deposits from the last Glacial (Würmian) and the penultimate Glacial (Rissian) are up to 12 m and 15 m thick, respectively, and intercalated by palaeosols. Optically stimulated luminescence (OSL), thermally transferred optically stimulated luminescence (TT-OSL) and infrared stimulated luminescence (IRSL) measurements were carried out on 14 samples from the Tönchesberg section to determine the deposition age and to set up a more reliable chronological framework for the penultimate and last interglacial-glacial cycle. The fine-grained quartz OSL and polymineral IRSL ages are in good agreement with each other and also with the geologically estimated age, but the quartz TT-OSL ages are overestimated. The OSL and IRSL ages range from 16.8 $\pm$ 1.2 to 189 $\pm$ 16 ka indicating that the youngest loess and the weakly developed soils were deposited during marine isotope stage (MIS) 2 and 3 and that the two marker loess were most likely accumulated in the transition MIS 4/5. Loess and reworked loess postdating the Eemian soil yield ages of 110-115 ka indicating that these deposits very likely correlate to MIS 5d. Loess deposits taken below the Eemian soil are attributed to the transition MIS 6/7. A weakly developed soil above the Tönchesberg scoria yield an age of 189 $\pm$ 16 ka indicating an interstadial soil formation during MIS 7. This is in good agreement with preliminary 40Ar/39Ar-ages for the Tönchesberg scoria and the intercalated tephra layers. Reliable age estimates up to $\sim$70 ka could be obtained using quartz OSL and up to $\sim$190 ka using the pulsed post-IR IR signal from feldspar. Hence the infrared stimulated luminescence (IRSL) is considered as the best approach to date the loess from the Middle Rhine area > 70 ka.