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The loess-paleosol profile Datthausen, on the penultimate-glacial terrace of the upper Danube River: Luminescence dating and interpretation

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The loess-paleosol profile Datthausen is situated on the penultimate-glacial (Würmian) terrace of the upper Danube River in southern Germany. The sequence of reworked, mostly sandy loess deposits exhibits brownish, loamy paleosols in its lower part and slightly de-carbonated and hydromorphic horizons in its upper part. The stratigraphic bisection is interpreted as the transition from the terrestrial Middle Pleniglacial (Middle Würmian) to the Upper Pleniglacial (Upper Würmian). This interpretation is supported by the observation that the upper two of the loamy paleosols show an olive tint and features of sediment reworking at the top (see Sauer et al. in this session). A similar stratigraphic pattern was observed in other central European loess-paleosol sections (Schönhals et al. 1964, E&G 15: 199-206) and was recently corroborated for, e.g., Nussloch on the Upper Rhine and Schwalbenberg II on the Middle Rhine (Antoine et al. 2009, QSR 28: 2955-2973; Schirmer 2012, E&G 61: 32-47). However, the chronometric position of the terrestrial Middle Pleniglacial to Upper Pleniglacial (MPG/UPG) transition is still under debate, as are the palaeoclimatic triggers controlling loess and soil formation. Valuable information hereon may be gained by matching the terrestrial chronologies with the marine and Greenland ice-core records. The chronometry of the Datthausen section is based on blue-light stimulated luminescence (BLSL) dating of small aliquots (ca. 200-500 grains) of quartz coarse grains (125-212 μm), using a single-aliquot regeneration (SAR) protocol (Murray & Wintle 2000, Rad. Meas. 32: 57-73) and a minimum-age model (Galbraith et al. 1999, Archaeometry 41: 339-364). Formation of the paleosols was likely promoted during the warmer Greenland Interstadials (GIS). Luminescence dating on samples taken from these paleosols determines the time of sediment deposition that preceded the soil formation in the respective sediment. We sampled two horizons below and three horizons above the MPG/UPG-boundary. A BLSL-age around ca. 37-35 ka for the lowermost sampled paleosol (6Bg5) suggests soil formation during a period matching GIS7 to GIS5. Therefore, the paleosol could conform to the Lohne Soil at Nussloch and Schwalbenberg II. A BLSL-age around ca. 29 ka for the uppermost MPG-palaeosol (5Bg4) may indicate soil formation during GIS4 or GIS3. Fragments of snail shells in the lowermost dated UPG-horizon (3Bw1) point to a reworked soil sediment. BLSL-dating yielded an age around ca. 26-27 ka. Therefore, at Datthausen the MPG/UPG transition appears to conform to the transition from marine/oxygen isotope stage (MIS/OIS) 3 to 2. De-carbonated horizon 2Bg1 (around ca. 23 ka) may possibly match GIS2. Hydromorphic horizon Cg2 (around ca. 22 ka) fits in a later period of the last glacial maximum (LGM). Correlations between the loess-paleosol sequence and ice-core records are challenging as the luminescence ages have uncertainties of ca. 10 % (1-sigma). Further, the sediments appear partially bleached and, partly affected by bio- or cryturbation. Overall, the chronometry fits to the field observations and the results of the pedological analyses, but the MPG/UPG transition appears to start slightly later than at Nussloch and Schwalbenberg II, where it precedes the MIS3/MIS2 boundary.