CHRONOSTRATIGRAPHY OF UPPER PLEISTOCENE DEPOSITS IN CENTRAL EUROPE BY LUMINESCENCE DATING

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The loess formation in Central Europe shows a close relationship with cooling and warming trends of the Northern Hemísphere although there are important regional differences when the record is examined in detail. A reliable time scaling of the terrestrial loess record is needed. For the last and penultimate glaciation the correlation of the terrestrial loess record with the marine oxygen isotope record is mainly based on extrapolations because dating methods have not been accessible.

Eolian sediments such as loess and dune sands are particularly suitable for the application of luminescence dating methods. The eolian dust is likely to have travelled large distances and thus been well exposed to light before deposition. Systematic luminescence dating shows that reliable ages can be obtained up to approximately 100,000 years enabling regional correlations, a land sea correlation and providing a chronological framework for the paleoclimatic development of the last glacial cycle. For older loess deposits the reliability of the luminescence data is unknown due to saturation of the signal and lack of independent dating results.

The objective of the present work is to test this hypothesis by applying the thermoluminescence (TL) and infra red optical stimulated luminescence (IRSL) dating method to loess layers from well studied Middle and Upper Pleistocene sites in the Middle Rhine area, Neckar Main Area and in Bohemia.

In the Middle Rhine Area volcanic crater sections like Toenchesberg and Wannenkoepfe are investigated in detail, as well as sites on river terraces like Metternich and Ariendorf Loess layers and their derivates, which are subdivided by a thick redbrownish Bt of an interglacial soil ("Parabraunerde"), occur within the inter– and intracrater depressions. On the top of the interglacial soil (stage 5e) loess and interstadial dark coloured soils and soil sediments from the lower part of the last glaciation (5d–a) are well preserved and reflect climatic and environmental development after the last interglacial optimum. The sediments from the middle part of the last glaciation (stage 4 and 3) are reworked loesses which are intercalated by two weak interstadial soils. The loess of the upper part of the last glaciation (stage 2) is intercalated by a weak pseudogleyed horizon and terminated by an interstadial soil, during the Alleröd. The soil is covered by a pumice layer due to the eruption of the volcano Laacher See 11,000 years ago. The unusually complete loess paleosol sequences within crater sections allows a detailed chronological, paleoclimatic and paleoecological reconstruction for the last 200,00 years.

In the Neckar–Main–Area the well stratified and investigated loess sections Böckingen and Bönnigheim have been investigated showing a good agreement with the loess/paleosol sequences from the Middle Rhine Area for the last and penultimate glacial loess deposits.

In Czech Republic the classical Pleistocene key sections Sedlec (Praha), Dolní Věstonice, Modřice, Kutná Hora, Červený Kopec and Stránská Skála have been investigated. Section Kutná Hora is one of the best Upper Pleistocene loess profiles in Bohemia. A light brown soil (PK I) is covered by three weak tundragleys (frostgleys). The classical site Dolní Věstonice with pedo complexes PK III, PK II and PK I has been dated by several independent dating groups. The results are stratigraphically consistent but the age estimations are slightly younger in comparison to dates from the Middle Rhine and Neckar Main Area.

Luminescence age estimates have been obtained for typical soil horizons of the last 100,000 years and marker loesses interpreted as European wide dust storms which have also been found in the Middle Rhine Area. Middle Pleistocene loess samples have been taken below the Brunhes/Matuyama boundary from section Červený Kopec and Stránská Skála near by Brno to testify the saturatíon level and potential of luminescence dating. The study exemplifies the potential of systematic luminescence dating in linking paleoclimatic events from different localities but also in linking marine and terrestrial palaeoclimate records for the last 100,000 years. But it is clear that only a combination of different investigations such can solve the problem as well as getting new aspects.