A tentative synopsis of dating the loess in Southern Romania over the last half-century. New results and older ages

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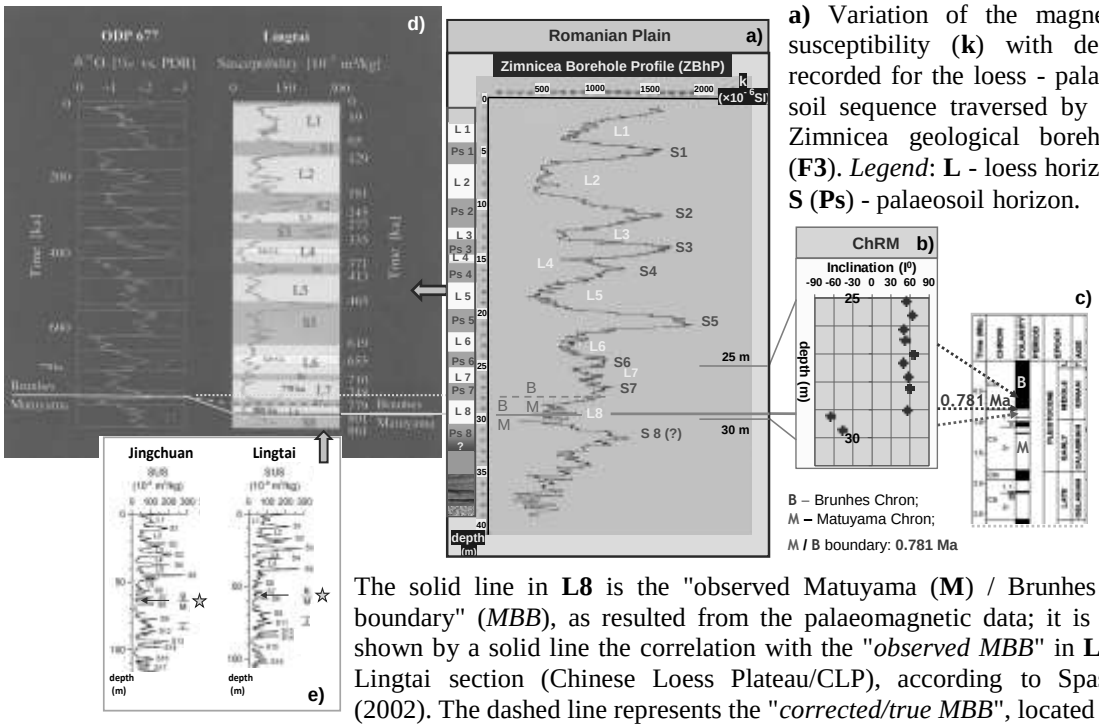
Abstract: Firstly, it is performed a tentative synopsis which mainly focusses on the aspects of dating the Pleistocene loess - palaeosoil sequences from the Romanian Plain and Dobrogea. It is a short review of important achievements concerning the estimation or evaluation of the loess age, starting ca. 120 years ago, with a tentative to systematising the significant contributions of the last half-century (Rădan, 2012, 2013). Implicitly, the authors and methods through time are mentioned. In most of the sections, ages up to 781 ka are determined (the loess - palaeosoil horizons are assigned to the Brunhes Chron). The principal steps in the evolution of the Romanian loess investigation, passed since 1961 till present, are synthetised within a comprehensive table, with the following structure: (1) author/year; (2) methods; (3) location of profiles/sections; (4) investigated loess - palaeosoil sequences; (5) derived/ confirmed ages of the loess/palaeosoil horizons. The table is supported by several examples concerning the multi-proxy magnetic approach undertaken by the author in the Romanian Plain and Dobrogea, during the last 30 years. The results are discussed in a magnetostratigraphic context. Moreover, a special attention is given to some new data achieved for a loess - palaeosoil borehole profile (ca. 30 m thick), located in the first mentioned area. The recent interpretation of these data points out the possible identification of the Matuyama/Brunhes boundary (*MBB*; 0.781 Ma) (Rădan, 2012, 2013). The correlation of our results with the **MS** records for two loess - palaeosoil sequences from the Chinese Loess Plateau (Spassov, 2002; Yang & Ding, 2010), one of them being calibrated to the "marine oxygen isotope stages" (MIS) of the benthic $\delta^{18}O$ record at ODP site 677 (Shackleton *et al*., 1990), is presented, as well. The "observed" MBB location within the loess **L8**, and of the "corrected" *MBB* within the palaeosoil **S7** of the borehole profile from the Romanian Plain, as well as the calibration to MIS (location at the base of the MIS 19) (Rădan, 2012) are commented. In conclusion, it must be remarked the loess - palaeosoil sequences are relevant for geosciences, they are Quaternary archives for palaeoenvironmental and palaeoclimatic reconstruction.

Keywords: Romanian Plain and Dobrogea, loess-palaeosoil sequences, Matuyama/ Brunhes boundary, magnetosusceptibility stratigraphy, Pleistocene.



a) Variation of the magnetic susceptibility (**k**) with depth recorded for the loess - palaeosoil sequence traversed by the Zimnicea geological borehole (**F3**). *Legend*: **L** - loess horizon; **S** (**Ps**) - palaeosoil horizon. The solid line in **L8** is the "observed Matuyama (**M**) / Brunhes (**B**) boundary" (*MBB*), as resulted from the palaeomagnetic data; it is also shown by a solid line the correlation with the "*observed MBB*" in **L8** of Lingtai section (Chinese Loess Plateau/CLP), according to Spassov (2002). The dashed line represents the "*corrected/true MBB*", located in **S7**, taking into account the delayed remanent magnetisation, whilst the dashed line shows the correlation with the *MBB* located at the *MIS 19* level in the marine oxygen isotope $\delta^{18}O$ record at the ODP site 677 (Shackleton *et al*., 1990); **b)** Variation with depth of the inclination of the Characteristic Remanent Magnetisation (**ChRM**), after thermal cleaning, for a fragment of the Zimnicea borehole loess - palaeosoil profile (between 25m - 30m depth); **c)** A fragment from the Pliocene - Pleistocene Geomagnetic Time Scale [ATNTS 2004 (Lourens *et al*., 2004; ATNTS 2012 (Hilgen *et al*., 2012)]; **d)** Correlation between the marine oxygen isotope $\delta^{18}O$ record at the ODP site 677 and the magnetic susceptibility variations with depth for the loess - palaeosoil sequence (a fragment) at Lingtai (CLP). The solid line in **L8** is the "*observed MBB*", whilst the dashed line in **S7** represents the "*corrected MBB*". The age of the *MBB* is 778 ka according to Tauxe *et al*. (1996), cited by Spassov (2002) (figure reproduced from Spassov, 2002). *Note*: The *MBB* is located at 781 ka, according to ATNTS 2004 / ATNTS 2012; **e)** Fragments of the magnetic susceptibility (**SUS**) records of the "red clay" - loess sequences at Lingtai and Jingchuan. The soil units (**Si**) and loess beds (**Li**) are here indicated up to the soil **S19** (Lingtai section) and **S17** (Jingchuan section) only, respectively. The *MBB* (located in the loess unit **L8**, *i.e.* between **S7** and **S8**) is shown by an arrow and a star in both the two sections (the magnetic susceptibility/**SUS** records and the associated data are according to Yang & Ding, 2010).

Figure 1: Composite model showing a tentative correlation of the integrated magnetic susceptibility and palaeomagnetic signatures recovered from the Zimnicea borehole profile (Romanian Plain) with the Lingtai section from the Chinese Loess Plateau (CLP) (Spassov, 2002), the marine oxygen isotope $\delta^{18}O$ record at the ODP site 677 (Shackleton *et al*., 1990) and a fragment from the Pliocene – Pleistocene Geomagnetic Time Scale [ATNTS 2004 (Lourens *et al*., 2004); ATNTS 2012 (Hilgen *et al*., 2012)].

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