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Climate of the Past Discussions

Interactive comment on "Major dust events in Europe during marine isotope stage 5 (130–74 ka): a climatic interpretation of the "markers"" *by* D.-D. Rousseau et al.

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General comments

This paper is an important contribution which presents a paleoclimatic interpretation of long-recognized, distinctive "marker silts" in a classic Central European loess section. It is based on new OSL dating and stratigraphic investigation that allows correlation with other European loess sections as well as Greenland ice core and speleothem records. Stratigraphic and sedimentological data from the Dolni Vestonice section and correlations with other loess sites have been presented in detail in an excellent paper by Antoine et al. (2012), and the OSL ages are reported in a paper in press; there-

fore, this paper focuses on paleoclimatic interpretation. In general, the interpretation is reasonable, but I would like to suggest some issues that should be given more consideration, and there are also some parts where the explanation could be clearer.

1.The marker silts (MS) and eolian silts (ES), as labeled in this paper, are not very different lithologically, especially in grain size and MS. In fact, it seems Antoine et al 2013 identified them all as MS and numbered them accordingly, which makes comparison between that paper and this one confusing (the difference in labeling and numbering should be clearly noted somewhere in this paper). Del 13C values are similar between MS and ES layers. The ES have high carbonate content, but couldn't this be pedogenic carbonate associated with the dark A horizons just above, not a sedimentary difference? Overall, I do not see a clear sedimentological basis for distinguishing MS and ES except for consistency with the earlier terminology of Kukla.

2.This leads directly to another point. The authors present a plausible scenario in which polar air outbreaks, channeled by topography, allow continent-wide dust storms and a depositional pattern of relatively fine dust corresponding to the spatial distribution of MS. This reflects more frequent blocking patterns and enhanced meridional flow at the times of MS deposition. As I understand the discussion in 3.2.3, 3.2.4, and the Conclusions, it is suggested that the ES are associated with a different circulation pattern, with more zonal flow and greater moisture transport from the west. However, if the ES are also deposits of far-traveled dust deposited in large dust storms (as certainly suggested by similarity to the MS), then what allows this to happen in the absence of frequent polar air outbreaks? This point needs more discussion. Furthermore, I think there should be more acknowledgement that the conclusion that MS and ES are associated with different circulation patterns is quite speculative. It seems to be based mostly on the specific correlation with the NALPS speleothem record, and on the interpretation of the hiatuses in that record as indicating lack of moisture supply from the west; it cannot be inferred from any characteristics of the MS and ES themselves.

3.The interpretation of the MS and ES as predominantly far-traveled dust can be made

in a more direct and convincing way by focusing more on grain size, rather than the abrupt boundaries with under- and overlying beds. Especially considering the data on sand content and size fraction ratios reported in Antoine et al. but not here, the pleniglacial loess in the upper part of the section is clearly coarse proximal loess, mainly from local sources. The MS and ES are much finer, requiring either greater predominance of far-traveled dust, or local source material during MIS 5 that contain only finer particles (which seems unlikely). The sharpness of the boundaries with adjacent layers does not seem like a convincing argument, since it would generally reflect the balance between loess sedimentation rate and bioturbation rate. In fact, the sharpness is somewhat curious given that there should be significant, deep bioturbation in the steppe environment of the adjacent paleosols.

4.More consideration should be given to dust source material availability in explaining the different nature of the MS and ES and the overlying loess. In full-glacial conditions, there was clearly abundant source material locally, but as the authors note, this was probably not true in the MIS 5 stadials. Conditions favoring dust emission were probably present in much smaller areas, mostly some distance from the major loess sections where the MS are found. This factor is also important in explaining the fine-grained MS and ES, not just changes in climate and atmospheric circulation.

5.The abstract states that the MS layers are "dated at about 109-111 ka. . ." etc., but this is not really correct. The sediments are dated to much broader time ranges, considering the errors of the OSL ages. These statements should be revised to reflect the OSL ages with their errors. I think the age of the silts and uncertainties are discussed in a much more satisfactory way in section 3.2.1.

Specific comments

1.Page 6, lines 18-20. Grain-size analysis should be mentioned here as another important tool, with one or two references such as Vandenberghe's recent paper in Earth-Science Reviews.

2.Page 11, lines 17-18. This sentence on clay content should be replaced with a more comprehensive discussion of the differences in grain size between the MS and pleniglacial loess, using data from Antoine et al. Clay content is not an especially good index of particle size to use in studying dust transport, since it is often carried as grain coatings or in aggregates.

3.Page 15, line 18. Replace "veal" with "calve"

4.Page 17, line 14. There was a major dust storm in the Great Plains, produced by strong winds associated with a cold front in October 2012, following severe drought in the previous summer. See: http://earthobservatory.nasa.gov/IOTD/view.php?id=79459

5.Figure 5. Please check that clay content is the black line, not the red line. The caption here does not seem consistent with the figure showing these data in Antoine et al.

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