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Climate of the Past Discussions

Interactive comment on "Terrestrial mollusc records from Xifeng and Luochuan L9 loess strata and their implications for paleoclimatic evolution in the Chinese Loess Plateau during marine oxygen isotope stages 24–22" *by* B. Wu and N. Q. Wu

Y. Sun (Referee)

sunyb@ieecas.cn

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This paper presents an excellent mollusc study on the upper sandy loess layer (L9) of two classic loess sections. Based upon the abundances of different mollusc species, the authors suggest that the L9 developed under variable climatic conditions, characterized by large amplitude cold-dry and warm-wet climatic fluctuations spanning from MIS 24 to 22. Unlike previous studies, they argue that the L9 was not deposited under

the most severe glacial conditions by comparison with the mollusc data and other proxies from last glacial loess (L1). Two additional issues related to the L9 are addressed in the discussion section, i.e., "the feature of the 900-ka event in Chinese loess" and "the regional and global implications of the exceptional thick and coarse-grained L9 unit". Overall, this paper is well written and provides new insights into the paleoenvironmental conditions of the previously notable L9 in Chinese loess. I think it can be accepted for publication after the following concerns (particularly the carbonate dissolution) are fully addressed.

1. Carbonate dissolution (see second paragraph of Page 2773): Since carbonate dissolution is a key factor affecting the total number of mollusk shells and the abundance of difference species as well. First, Can the authors provide a rough estimation on the depth of carbonate dissolution either based on the development of carbonate nodule layer below the S8 or variation of the $CaCO_3$ content? Second, if strong carbonate dissolution happened, how to exclude the dissolution effect and obtain the real paleoclimate information from the mollusc data?

2. Implication of P. aeoli abundance (see third paragraph of Page 2773): The mollusk assemblages can be divided into three ecological groups, and the cold-aridiphilous group consists of V. tenera, P. aeoli, and P. cupa. However, even based on visual inspection on Figure 4, down-section variation of the P. aeoli abundance is different from other two cold-dry species, but rather similar to that of the G. Armigerella abundance (a thermo-humidiphilous group), why? Thus, a detailed discussion on different responses of these species to temperature and moisture will help the readers to understand the paleoclimatic implications of different mollusc fossils.

3. Climatic implications of L9 loess (see Discussion section 4.1): By comparison of mollusc results from L9 and L1, the authors argue that the last glacial climatic condition was colder and drier than the MIS 24–22, because of the relatively high mollusk biomass in L9 compared to L1. Firstly, this finding is different from conventional view derived from the magnetic susceptibility record, i.e., much higher susceptibility in L1

indicating a relatively warm and humid climate in last glacial than that of MIS 24-22. Can the authors provide a reasonable explanation for such a contradiction? Secondly, as mentioned in the manuscript, carbonate dissolution may dissolve a large number of mollusc shells. Why the low mollusc biomass in L1 is not due to strong dissolution under warm-humid climate conditions (if magnetic suscepiblity record is a reliable indicator of the summer monsoon intensity)?

4. 900-ka cooling event in the Chinese Loess (see Discussion section 4.2): The 900-ka cooling event refers to the exceptionally cooling during MIS 22 compared to previous glacials (MIS 28 to 24). In Chinese loess, this cooling event is evidenced by remarkable coarsening of the grain size data (See Lu et al., 2000; Ding et al., 2002; Sun et al., 2006). In this paper (lines 16-18 in Page 2278), the authors suggest that the one at 905–895 ka (the boundary of MIS 23 and 22) was the toughest in both intensity and extent (Fig. 4). Actually, as shown in Fig.4a, I would believe that the last one around 880 ka (relatively high percentage of V.tenera and P. cupa) is the toughest cooling event; this inference is consistent with other loess-based proxies (e.g., grain size). However, the high peak of V.tenera and P. cupa abundances at the Luochuan section occurred around 900 ka (Fig. 4b). What's the major cause for such a spatial difference? Strong carbonate dissolution at the Luochuan section? To better address the feature of 900-ka cooling event recorded in Chinese loess, I would suggest that the authors should try to synthesize all extant proxies of L9, such as grain size and FeD/FeT ratio.

5. Cause of formation of the L9 (see Discussion section 4.3): I agree that the L9 problem should be investigated more intensively, particularly regarding its regional and global significances. In the discussion section 4.3, the authors present a general review on the possible cause of the formation of L9. Based on the mullosc data, however, we cannot obtain new clue to understand why the L9 is exceptionally thick and coarse. Thus, I wonder whether the authors can remove this part from the main text.

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