

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

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General comments

Chinese loess deposit are regarded as one of the best continental archives of past climate changes and have been extensively investigated over the past ~20 years. However, there are still outstanding questions regarding the loess record to be addressed. This paper attempts to address one of these such enigmas: why are the two loess

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units L9 and L15 so conspicuous in the loess sequences? For a long time the L9 and L15 sandy loess units in the typical loess-paleosol sequences in the central Chinese Loess Plateau were suggested as indicating extremely cold and dry climates, such as by Liu (1985) and references thereafter, although most of these results were based on the physical or chemical proxy indices of palaeoclimate. This new research, however, provides fresh biological evidence that may challenge this long-held view. According to the new interpretation the L9 loess unit was not formed in the coldest and driest climate of the Pleistocene but was formed under a normal “glaciation” climate and its variations were in pace with global climatic changes. This is an interesting result and the conclusion is supported by the laborious separating and counting of molluscs recovered from the loess. Moreover, the authors analyzed variations of the paleoclimate by the molluscs counting during the L9 loess deposition in detail, and concluded that the first long-term glaciation of Pleistocene observed in the marine record (the 900 ka cooling event) may have its counterpart in the Asian monsoon climate region with more variable. This is an interesting finding that may prompt renewed interest in investigating “land-sea correlations” and the forcing mechanism of Asian monsoon climate changes during Quaternary. Therefore, I think this is a timely and interesting paper and recommend publication on *Climate of the Past*.

Before the formal publication, I would suggest the authors to consider the following issues.

Specific comments

1. There is a great change in mollusc numbers in the samples. For example “in Xifeng section, the maximum count (2151/15 kg shells) is at the bottom of L9SS1 (80.6m at the depth) whereas the minimum (only 1 individual) is at the top of L9LL1 (74.5m at the depth). In Luochuan section, the highest value of mollusc shell individuals reaches 4156/15 kg in L9SS1 (59.3m at the depth), and the top of L9LL1 (55.3m at the depth) just contains one individual (the minimum).” The authors simply explain that “It should be pointed out that a large number of mollusc shells were dissolved at the upper part of

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L9LL1 due to strong carbonate dissolution as the upper S8 soil formed.” Since the “dissolved” process is very important in interpreting the data of this research, I would like to see more evidence concerning how the dissolution influenced the preservation of the fossil mollusc shell. Has the great diversity of numbers of the fossil mollusc individuals in the loess/paleosol units only been influenced by dissolution or also influenced by palaeoclimate and depositional environment?

2. Much new evidence points to the possibility that the Tibetan Plateau and the Himalaya uplifted much earlier than the previously suggested (please see the review Molnar et al., 2010 and many other references). However, the authors have ignored these new results and used outdated references (p.2780, line 4-9) to support their interpretations. I suggest that the authors should mention the new results, or alternatively explain their results in more detail in light of this, rather than evoking “a tectonic movement of Tibetan Plateau named “Kunlun-Huanghe” happened during the depositing time of L9 loess (Li, 1991; Cui et al., 1998)” to interpret their result. In addition, because this part is not well evidenced by the authors’ work, I suggest weakening these statements in the Conclusion section.

3. The general cooling experienced by the Earth during the Middle Pleistocene Transition (MPT) may also strengthen high-mountain weathering and the Asian winter monsoon intensity, which in turn may increase general dust transport capability and therefore rapid loess accumulation. As such, it is possible that global cooling can be a cause of the higher rates of loess accumulation. This may be an alternative interpretation of the formation of L9 and has been discussed in a recent paper published in the Geological Society, London, Special Publications (Lu et al., 2010).

4. The loess grain size distribution, which is suggested as a direct proxy index of the winter monsoon strength, indicates that L9 is one of the coldest and driest periods during the Pleistocene in north China, as the authors mention on p.2779 line 25-28. However, the question over how to reconcile the grain-size and the mollusc records needs more focus. Although I believe the mollusc record is a more reliable method

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for revealing past climatic changes than grain size distribution, the interpretation of the coarsening of the L9 is still rather weak in this paper. In addition, the Tibetan Uplift forcing has been reported in the previous paper (Sun and Liu, 2000), it is not an important part of this paper and the descriptions could be significantly shortened.

Technical corrections (suggestions)

p.2769, line 10, “the severest glacial conditions” to “the coldest and driest climate”

p.2769, line 19, “weak glacial” to “weak glaciation”

p.2769, line 22, “extreme climate” to “the extreme climate”

p.2770, line7, “the behavior of 900-ka event” to “behavior of the 900-ka event”

p.2772, line 4, “All levels” to “All the sampling levels”.

p.2774, line 9, “during MIS 24” to “in L9LL2”, and, please check thereafter. In Fig.4 and Fig.5, the L9LL1, L9SS1, L9LL2 and the L1LL1, L1SS1 and L1LL2 should be labeled.

p.2775, line 6, “the interglacial” to “the interglacial period or the interglaciation”

p.2775, line 11, “in values of” to “in number of”

p.2776, line 2, “that climatic conditions changed from” to “that climate changed from”

p.2776, line 17, “a bigger climate gradient” to “a greater climate gradient”

p.2778, line 12, “happened” to “occurred”

p.2787 Fig.1, the “Lanzhou” and “Xi’an” in the Fig.1 (right) could be removed.

p.2791-2793 Fig.5, The title of the Y-axis should be edited like that of Fig.4. The (a, b) of Fig. 6 and Fig. 7 could be inserted into the figures, rather than put them at the left of the figures.

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