

We are very grateful for the constructive comments, suggestion and questions from Jef Vandenberghe. The following text gives our point-by-point replies and explanations (in black) to the issues listed (in blue and italics).

*This paper provides information on the climate system at the upwind side of a wind system (the Taklimakan desert) and makes the link with the environmental conditions in the downwind areas (Loess Plateau and North Pacific). The new information is obtained from a high-resolution, multi-proxy analysis (grain size, magnetic susceptibility and color index) of a long section (>400 m) in the Taklimakan desert covering a time span between c. 4.2 and 1 Ma. The authors conclude on a consistent climate evolution between upwind and downwind regions, probably driven by the uplift of the Tibetan plateau and the northern hemisphere glaciation. The research question is relevant as often such palaeoclimatic reconstructions are limited to the region with thickest sedimentary cover and what is happening in the source region is generally 'neglected'. The basic material on which this study is built seems of excellent quality, the used proxies are adequate and the measured data appear to be of good quality. Therefore, this paper looks very valuable.*

*Nevertheless, in my opinion, some comments for improvement may be made especially regarding the interpretation of the results:*

*1. Major comments on the structure of the paper and the scientific content: -The structure of the paper looks a bit odd as the 'Geological setting' with sedimentological interpretations comes very early in the paper (before the Methods) missing the arguments or using results that are discussed only later in the paper (section 3 Results). Sedimentary interpretations, therefore, are premature in section 2 or even missing any ground. For instance, the interpretations of the siltstone and sandstone of unit 1 as fluvial facies followed by aeolian reworking (page 2664, lines 12-19) are not based on arguments; similar for the interpretation of the mudstone as lacustrine (line 22). Referring to a grain size of 50-250  $\mu$ m is not sufficient for an*

*interpretation as 'typical aeolian dune sand' (lines 27-28; why is that sediment not fluvial?), while the interpretation of 'aeolian sand intercalated with fluvial sand and lacustrine clay' (p 2665, l 1-3) is even given without any argument. Finally, it would be fine to know the arguments for a 'pedogenic' origin for the ultrafine component (in contrast, for instance, to a background aeolian dust, more particularly an originally pedogenetic product that has been transported as background dust by the wind) instead of only referring to previous work of the authors (p 2665 l 5-7; p 2666 l21). Concluding, I advise 1/ to restructure section 2, removing the methods described on p 2665, l 13-24 to an earlier position, and 2/to give the sedimentological interpretations only after good arguments supported by analytic results.*

Reply: Agree.

Explanation: Section 2 has been reconstructed following the reviewer`s suggestions. In the revision, we focused on lithology description and sedimentary facies analysis in Section 2. We additionally provided six representative lithology photos in Fig. 2 and crucial sedimentological references to strength our sedimentary facies interpretations.

P4, Line: 13.

We removed the grain-size distribution of representative samples to Section 3.1 after Method, which allows us to make the arguments by analytic results. P6, Line: 13-P7, Line: 4.

More sedimentological evidence was provided to strengthen the interpretations of the siltstone and sandstone of unit 1. P4, Line: 16-36.

Detailed discussion of the 'pedogenic' origin for the ultrafine component was presented at Section 3.4. P7, Line: 13-24.

*-I feel uncomfortable with the simple relation made by the authors between the % of the ultrafine component and the weathering intensity (p 2666, l 21-23 and further). This is too simplistic as the amount of ultrafine material is also a function of the*

*depositional processes in the lake. It is important as the authors use the proportion of ultrafine sediment as an indicator for regional moisture conditions (p 2667 l 1-3 and further).*

Reply: Agree.

Explanation: More detailed information about the origin and paleo-environmental implication of the proportion of the ultrafine component was provided in the revision. P7, Line: 13-24. Based on the fact that the proportion of the ultrafine component is systematically higher in the hydraulic sediments than the aeolian sediments, we argued soil moisture level plays an important role in driving the variabilities of the proportion of the ultrafine component, and used it as a proxy for regional moisture conditions. The good correlations between the proportion of the ultrafine component and frequency-dependent magnetic susceptibility further support our interpretation. See Fig. 4 for correlations.

*-Is the magnetic susceptibility mentioned at the beginning of section 3.4 (p 2668) not simply and essentially determined by the clay component? and similarly for the frequency-dependent magnetic susceptibility (section 3.5) equalling the intensity of soil formation (and related aridity).*

Reply: Agree.

Explanation: The sentence was changed to “Magnetic susceptibility is a function of categories, concentration and particle size of the magnetic minerals, which may be of post-depositional or detrital origin (e.g. Dearing, 1994; Liu et al., 2013 and references therein).”. P8, Line: 274.

Our data from the HBS section suggest the appearance of polydomain magnetite in Unit 3, rather than variations in superparamagnetic ferrimagnets, played the leading role in driving the long-term magnetic enhancement in magnetic susceptibility. P9, Line: 12-P9, Line: 18. By contrast, frequency-dependent magnetic susceptibility

reflects the concentration of viscous-superparamagnetic ferrimagnets that is mostly produced during the pedogenesis processes after deposited. P7, Line: 3-6.

*-In the first sentence of section 4 (Discussion) the authors conclude the 'land was dry from 4.2 to 3.4 Ma as indicated by the occurrence of aeolian deposits and gypsum'. In the previous section (Results), however, gypsum occurrence is not mentioned while the corresponding unit 1 is interpreted as fluvial. This seems in contradiction with 'dry land'.*

Reply: Agree.

Explanation: The occurrence of gypsum and aeolian deposits was presented in Section 2 along with the detailed lithology descriptions and sedimentological interpretations. P4, Line: 20-26.

Ephemeral river and lake can be developed in the semi-arid to arid areas, for instance, there are several rivers (e.g. Hetian River) in the Taklimakan Desert at present. To make a more clearly statement, the sentence was changed to “was dominated by ephemeral fluvial-lacustrine environment under dry climate conditions.”. P: 10, Line: 18-19.

*-The ages as derived from the magnetic polarity are not discussed at all. However, this is essential in the discussion on climate evolution.*

Reply: Agree.

Explanation: A brief introduction of the ages of sedimentary boundary and samples that derived from the paleomagnetic and ESR dating of two parallel sections (HBS and Mazhataghe Sections) was presented in the revision. P: 5, Line: 12-16. The correlation between our polarity sequence and GPTS was displayed in Fig. 2.

*-Similar to the correct interpretation of the weathering proxy (ultrafine sediment), the*

*interpretation of the aeolian origin for sediments in unit 1 is crucial for the climate conclusions on p 2670 l 11-21.*

Reply: Agree

Explanation: Sedimentology (P4, Line: 20-26), and grain-size distribution (P6, Line: 15-20.) evidence were provided to support the interpretations of the aeolian origin in unit 1. **P: 4, Line: 19-21.**

*-Since grain-size is an important proxy used by the authors to reconstruct the sedimentary processes, I suggest to use most recent work on that topic for fine-grained aeolian sediments (Vandenberghe, J. 2013 Grain size of fine-grained windblown sediment: a powerful proxy for process identification. Earth Science Reviews 121, 18-30).*

Reply: Agree.

Explanation: The newly published paper was cited in the revision. P:19, Line 16-17 and corresponding citation in the text.

*Minor comments:*

*Despite linguistic improvement acknowledged by the authors, a linguistic correction will be necessary.*

Reply: Agree.

Explanation: We have checked and corrected the linguistic errors in the last months (see corrections throughout the revision), and we hope the English usage can reached the language standard requested by Climate of the Past.

*-referencing to authors named 'Sun' and 'Wang': I advise to mention also the initial of the first name where confusion is possible (for instance on p 2663 / 15; p 2665 l 7; p 2666 l 24; p 2667 l14; p 2671 l 1, caption of fig .4).*

Reply: Agree.

Explanation: All the citations related to 'Sun' and 'Wang' that maybe result in confusions were added initial of the first name throughout the revised manuscript. For instance, "Sun et al." has been replaced with "Sun D. et al.", "Sun J. et al.", and "Sun Y. et al.".

*-p 2663 l 26: I suggest to explain and locate the Tarim basin in relation to the Taklimakan desert.*

Reply: Agree.

Explanation: This sentence was changed to "The Taklimakan Desert in the Tarim Basin, ...". P: 3, Line: 8. Location of the Tarim Basin has been labeled in Fig. 1A to show the relation.

*-p2663 l 25: difficult to see on Fig. 1a. Write '1A' instead of '1a'; also at other places in the text.*

Reply: Agree.

Explanation: Location of the Mazhatagh Mountain was illustrated in Fig. 1B. "1a" was replaced with "1A" in the text. The similar problems were corrected accordingly. P: 3, Line: 27; P: 4, Line: 1; P: 4, Line: 8; P: 4, Line: 9.

*-figs. 2-3: it is conventional to indicate the depths below surface starting from the top downward.*

Reply: Agree

Explanation: The height series of the strata were changed to the depth series. All the locations of lithology boundary and samples in the text were corrected accordingly.

*-p 2664 l 5: indicate the position of the Mazatagh Mountain on fig. 1A.*

Reply: Agree.

Explanation: An additional Fig. 1B showing the location of the Mazhatagh Mountain was added in the revision.

*-p 2667 l14: I did not find 'Sun et al 2011c' in the Reference List.*

Reply: Agree.

Explanation: “Sun et al., 2011c” has been provided in the Reference List. P: 18, Line: 25-28.

Sun, D., Zhang, Y., Han, F., Zhang, Y., Yi, Z., Li, Z., Wang, F., Wu, S., AND Li, B.:  
Magnetostratigraphy and palaeoenvironmental records for a Late Cenozoic  
sedimentary sequence from Lanzhou, Northeastern margin of the Tibetan Plateau,  
Global and Planetary Change, 76, 106-116, 2011c.

*-p 2668 l 20: write correctly the name of Béget, also in Reference List.*

Reply: Disagree.

Explanation: It is “Begét”.

*-p 2668 l21: Zan etal 2011: in Reference List it is written Zan et al 2010.*

Reply: Agree.

Explanation: “Zan et al., 2011” was replaced with “Zan et al., 2010” in the revision. P:  
9, Line: 21.

*-p 2669 l 17: where can the sections Xifeng and Lingtai be found on fig. 4?*

Reply: Agree.

Explanation: “Xifeng” and “Lingtai” were labeled as abbreviation of “XF” and “LT”  
in Fig. 5. The section locations were illustrated in Figure 1A.

*-Not in reference List : Prell et al 1992, Porter & An 1995, Lisiecki& Raimo 2005.*

Reply: Agree.

Explanation: These references were added in the reference List. P: 17, Line: 2-6; P: 15, Line: 22-23.

Porter, S., and An, Z.: Correlation between climate events in the North Atlantic and China during the last glaciations, *Nature*, 375, 305-308, 1995.

Prell, W.L., Kutzbach, J.E.: Sensitivity of the Indian monsoon to forcing parameters and implications for its evolution, *Nature*, 360, 647-652, 1992.

Lisiecki, L., and Raymo, M.: A Plio-Pleistocene stack of 57 globally distributed benthic  $\delta^{18}\text{O}$  records, *Paleoceanography*, 20, 522–533, 2005.

*-Caption fig. 1 better: 'Topography of northwestern China projected on digital elevation model (A) and schematic geological section of the HBS section (B).'*

Reply: Agree.

Explanation: Modified. **P: 21, Line: 8-10.**

*-Fig. 2: I suggest to present the right column with grain size distribution curves BELOW the left column since in the present configuration of the figure it looks as the four curves correspond with the photos at the left side (which is not the case). Indicate also the location of these grain-size samples.*

Reply: Agree.

Explanation: The right column with grain-size distribution was replaced with six representative lithological photos to provide more detailed information on the sedimentary facies. Grain-size distributions of representative samples were removed to Fig. 3 in the revision.

*-figs. 3 and 4: what is the meaning of the grey bars?*



Reply: Agree.

Explanation: The grey bars indicate the boundary of the most dramatic changes in lithology and the multi-proxy records. This has been added in the figure caption in the revision. P: 24, Line: 4-5; P: 25, Line: 7-8.