

Interactive comment on “A high-resolution multi-proxy record of late Cenozoic environment change from central Taklimakan Desert, China” by X. Wang et al.

J. Vandenberghe (Referee)

jef.vandenberghe@falw.vu.nl

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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

C1474

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 μm 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.

-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

C1475

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).

-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).

-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'.

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

1. -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 (Vandenbergh, J. 2013 Grain size of fine-grained windblown sediment: a powerful proxy for process identification. *Earth Science Reviews* 121, 18-30).

Minor comments:

- Despite linguistic improvement acknowledged by the authors, a linguistic correction will be necessary. -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 l 15; p 2665 l 7; p 2666 l 24; p 2667 l 14; p 2671 l 1, caption of fig .4). -p 2663 l 26: I suggest to explain and locate the Tarim basin in relation to the Taklimakan desert. -p

C1476

2663 l 25: difficult to see on Fig. 1a. Write '1A' instead of '1a'; also at other places in the text. -figs. 2-3: it is conventional to indicate the depths below surface starting from the top downward. -p 2664 l 5: indicate the position of the Mazatagh Mountain on fig. 1A. -p 2667 l 14: I did not find 'Sun et al 2011c' in the Reference List. -p 2668 l 20: write correctly the name of Béget, also in Reference List -p 2668 l 21: Zan et al 2011: in Reference List it is written Zan et al 2010. -p 2669 l 17: where can the sections Xifeng and Lingtai be found on fig. 4? -Not in reference List : Prell et al 1992, Porter & An 1995, Lisiecki & Raimo 2005. -Caption fig. 1 better: 'Topography of northwestern China projected on digital elevation model (A) and schematic geological section of the HBS section (B).' 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. figs. 3 and 4: what is the meaning of the grey bars?

Jef Vandenbergh

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C1477