

# Late Quaternary aeolian activity in Mu Us and Otindag sand-fields (north China) and lagged response to insolation forcing

Huayu Lu<sup>1,4,\*</sup>, Xiaodong Miao<sup>2</sup>, Yali Zhou<sup>1,5</sup>, Joseph Mason<sup>2,\*</sup>, Jiafu Zhang<sup>3</sup>, Liping Zhou<sup>3</sup>, Shuangwen Yi<sup>1,5</sup>

1) State Key Laboratory of Loess and Quaternary Geology, Institute of Earth Environment, Chinese Academy of Sciences, Xi'an 710075, China;  
 2) Department of Geography, University of Wisconsin Madison, WI 53706, USA;  
 3) School of Earth and Space Science, Peking University, Beijing, 100871, China;  
 4) Institute for the Environment, Brunel University, Uxbridge, Middlesex, UB8 3PH, UK;  
 5) Graduate School of the Chinese Academy of Sciences, Beijing 100039, China.  
 \* Corresponding authors: luhy@loess.llq.ac.cn, mason@geography.wisc.edu

## ABSTRACT

Arid and semiarid dunefields and sand sheets cover an area of around 1,000,000 square kilometers in north and northwest China. Vegetation cover and aeolian activity in these drylands are highly sensitive to climate change, especially to the monsoon precipitation variations. However, paleoclimatic change in these regions during the late Quaternary remains poorly understood, partly because of the scarcity of high quality age controls. In this study, 13 sites with aeolian sand dune and sand/loess deposits in Mu Us and Otindag sand lands in north China were sampled for optically stimulated luminescence (OSL) dating, and other measurements. The OSL age constraints and stratigraphic analysis, integrated with results of previous studies, suggest that the sand dunes were active in the last few hundred years, between 14 ka and about 7-8 ka, and between 50 ka and 60 ka. The sand dunes were mainly stable during the mid-Holocene, as indicated by the soil development that occurred between about 7-8 ka and 2.4 ka at multiple sites. Assuming that aeolian activity is largely controlled by monsoon precipitation through its effects on vegetation cover, these results imply a lag of several thousand years between the sandfield stabilization after 7-8 ka, and the peak of insolation at 10-11 ka. Thus, the monsoon climate may not be directly responsible to solar insolation changes induced by orbital forcing over millennial time scale, boundary conditions such as glacial cover, vegetation and soil feedback etc may be accounted for this.

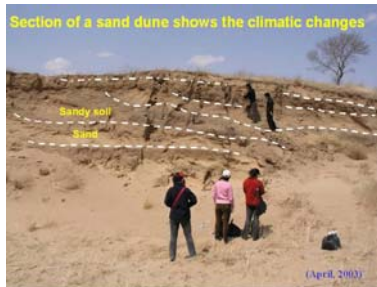


Fig. 2 (right) Stratigraphy, OSL ages and proxy indicators of sanddunes and sand-loess sections along the Mu Us and Otindag sandfields. The organic content (%), magnetic susceptibility (SI) and grain-size distribution (>63 μm %) of these sequences are correlated with the stratigraphy changes, and can be employed as proxy indicators of monsoon precipitation in this investigated region. The sand layers are responsible to phases of sanddune activity. Most of the aeolian sequences are located at lower relief with hiatus, but these representative records by absolutely dating can form relatively high-resolution of wet-dry changes in the arid and semiarid regions.

Fig.3 (right) Active and inactive phases of sand dune in Mu Us and Otindag sandfields. Integrate our OSL and proxy data and previous data (Dong et al, 2002; Xiao et al, 2002; Li et al, 2002; Jin et al, 2004). The green strip indicates an active wetter period and the yellow strip indicates a phase with activity of sanddunes, which should be caused by less monsoon precipitation and sparse vegetation cover.

Fig.4 (right) Comparison of wet-dry variations in Chinese eastern deserts and the solar insolation changes. The wet periods are mostly lagged to the solar insolation maximum at 35°N, especially at 10-11 ka, indicating the lag of the monsoon precipitation to solar insolation forcing induced by the Earth orbit perturbation.

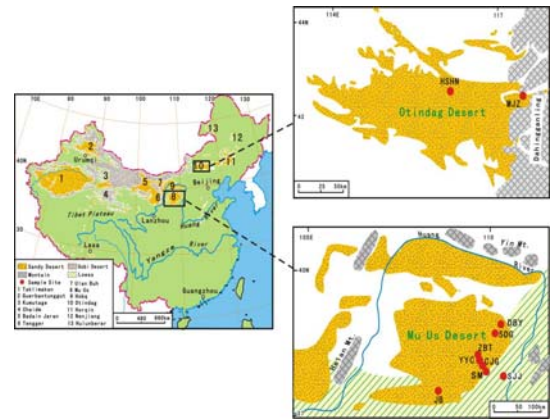
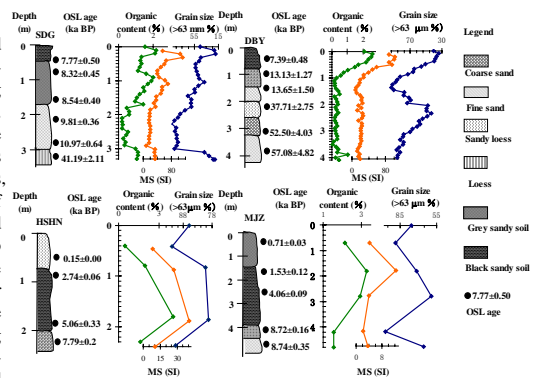
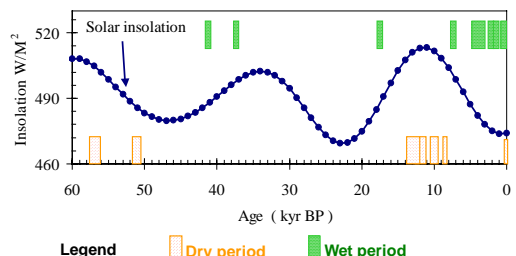
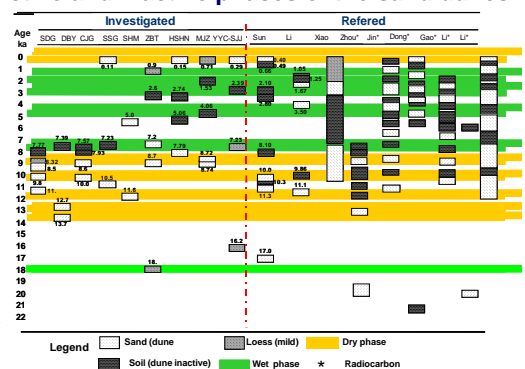


Fig.1 (up) Location of Mu Us and Otindag sandfields and the investigated sites. Our sampling sites are located in desert-loess transition region, where is sensitive to response to changes of the monsoon climate changes. These sections are ideal to study environment changes of the arid and semiarid regions during the late Quaternary.



## Active and inactive phases of the sand dunes



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