

Optically stimulated luminescence dating sand-loess system in Mu Us and Otindag Deserts in North China

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The loess-sand transition zone in northern China is sensitive to reflect the monsoon climate changes, and it is one of the key sites to investigate past environmental changes. However, optically stimulated luminescence dating (OSL), which is a promising method to date aeolian deposits, has not been well used in this region besides a few works. The Single Aliquots Regeneration (SAR) method was used to measuring age of sand-loess system in Mu Us and Otindag desert in north China. Combining stratigraphy and sedimentological analyses, our results provide a preliminary chronology for wet-dry variations during the past 60,000 years: the dominant activity episodes occurs during the interval of 14–8.5ka BP, and between about 7ka BP and 2.4ka BP, common dunes are stability and soil development, which is comparable with the previous investigation, such as some radiocarbon results. From the dose recover experiment, it is hypothesized that the large scatter of De values and OSL signal may be related to heterogeneous microdosimetry, bioturbation etc, and, this needed to be further investigated. However, the OSL date should provide precise and reliable age constraints for dynamics of sand-loess system in this region.

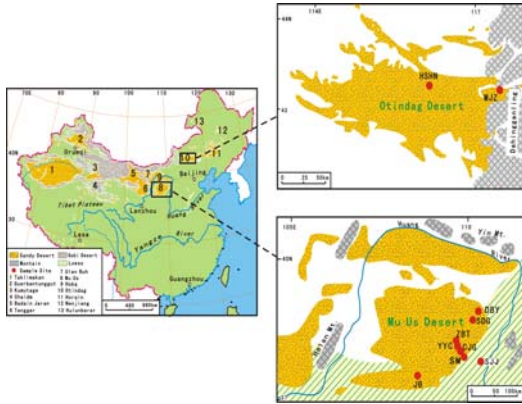


Fig.1 Location of Mu Us and Otindag deserts and the investigated sites located in desert-loess transition region, in particularly it is sensitive to the monsoon climatic. These sections are ideal to study environment changes in the sandfields during the late Quaternary.

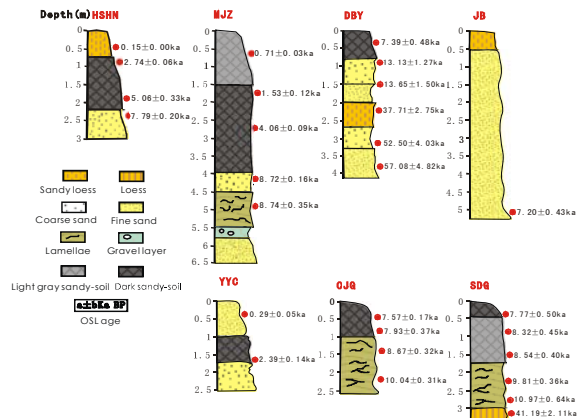


Fig.2 Stratigraphy, sampling strategy and OSL ages of the six sections in the Mu Us and Otindag sandfields. These show that sand dunes and sand-loess deposits typically contained alternating gray or dark sandy loam soils, sandy loess and sand layers, it indicates the significantly environment changes. Sandy stratum demonstrate relatively arid climate, while the dunes are mobile. However, gray or dark sandy soils indicate the relatively humid climate, while the dune-filled are stable with denser vegetation.

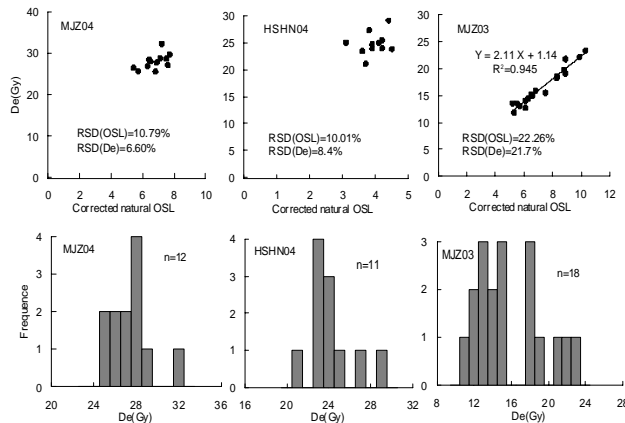


Fig.3 Date for 12 quartz aliquots from MJZ04, 13 aliquots from HSHN04 and 18 aliquots from MJZ03. TOP: plots of single-aliquots De versus sensitivity-corrected natural OSL signal. Bottom: histogram of De distribution. This figure shows that the scatter of De value of the other samples are smaller and the De values of all measured discs for each sample are homogeneous except CJG04 and MJZ03. The equivalent dose values were estimated from the average of all measured available discs at preheating 250°C.

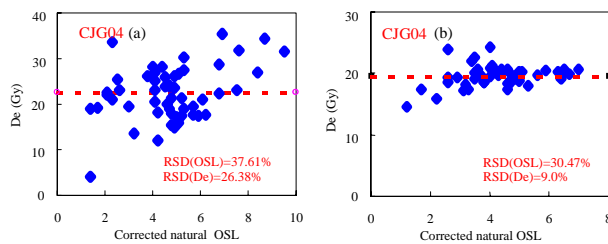


Fig.5 Plot of single-aliquot De versus sensitivity-corrected natural OSL signal. (a): the general SAR method, (b): the dose recovery experiment. It can be seen that the scatter of natural OSL decrease less than the scatter of De, while the RSD of De in the dose recovery experiment after irradiating the same beta dose reduce almost two of third comparing with the general SAR method. The preponderant factors contributing to the scatter is possible heterogeneous dose rate.

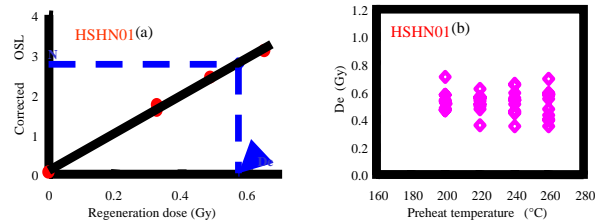


Fig.4 (a): Regeneration plot at preheat 220°C and (b): preheat plateau plot of sample HSHN01. HSHN01 was the youngest of all measured samples, the growth curve of HSHN01 almost passes through the origin at preheating 220°C, the De plateau was very well, so, the transfer of charge was negligible.

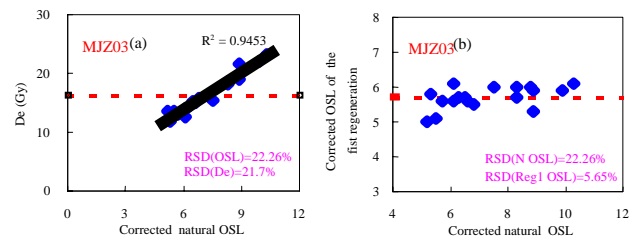


Fig.6 (a): Plot of single-aliquot De versus sensitivity-corrected natural OSL signal and (b): corrected OSL signal of the first regeneration versus sensitivity-corrected natural OSL signal. The scatter of the OSL signals responding to the first regenerated dose was less than the sensitivity-corrected natural OSL to be 5.65%, making clearly that the heterogeneous bleaching is the dominating causation begetting the large scatter. Combining the filed investigation, it is possible related to bioturbation.

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