



Could luminescence signals in Dune sands be sufficiently bleached ?

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The choice of different dating grain-size fractions is an important question for Optically Stimulated Luminescence (OSL) dating, because different grain-size fractions might have experienced different transporting history so as to have different bleaching extent. However, aeolian sediments are usually thought to have been well bleached before buried, and most grain-size fractions between 4 μm to 250 μm are usually used for OSL dating. The Qaidam Basin (QB) is an important region for aeolian geomorphologic studies, and OSL dating showed the linear dunes in the central QB were accumulated at 3.0-0.8 ka based on fine grain quartz [1]. To reveal the origin of these linear dunes, detailed OSL dating study were conducted with both coarse grain (150-180 μm) quartz and k-feldspar (KF). However, our BSL and fading-corrected IRSL ages based on coarse grains were all much younger than the former published fine grain BSL ages [1]. For example, some samples dated to ca. 3 ka by fine grains quartz were only dated to ca. 0.3-0.4 ka by coarse grain KF. This obvious difference might be caused by insufficient bleaching of the fine grain sediments. To reveal the bleaching (i.e. residual dose) of different grain-size fractions (4-11, 11-38, 38-63, 63-90, 90-125, 125-150, and 150-180 μm), six modern samples were taken from both linear dunes and barchan dunes in Qarhan Salt Lake region.

Des from quartz BSL, KF IRSL50 and post-IR50 IRSL225 (pIRIR225) were compared on each fraction of 4-11, 11-38, 38-63, 63-90, 90-125, 125-150, and 150-180 μm , respectively. The quartz BSL signals are the easiest to be bleached, while the KF pIRIR225 signals the most difficult, so no residual pIRIR225 signals indicate the sediments are sufficiently bleached. The results show that: (1) KF (pIRIR225) of >90 μm fractions could be well bleached, and quartz of >38 μm could be well bleached with ignorable residual dose; (2) The fine grain (4-11 μm) sediments were poorly bleached, even the residual age of quartz could be nearly 3 ka, and residual ages of pIRIR225 are about 5.5 ka with the highest values of over 25 ka for some aliquots .

This study indicates that even for the dune sand, OSL signals of the fine and medium grain-size fractions might be difficult to be sufficiently bleached, which could cause severely overestimation, especially for the Holocene samples. This might be because the finer grains are more likely to be transported as aggregates (or they are difficult to be deposited on dunes synchronously with coarse grains), and additionally, these fine grain aggregates were mainly eroded from the nearby old yardangs, i.e. short distance transport. As a result, the coarse grain-size sediments might be more suitable for OSL dating in most cases, and sources of sediments should be analysed as well.

References

[1] Zhou, J., Zhu, Y., Yuan, C., 2012. Origin and lateral migration of linear dunes in the Qaidam Basin of NW China revealed by dune sediments, internal structures, and optically stimulated luminescence ages, with implications for linear dunes on Titan. *Geological Society of America Bulletin* 124, 1147-1154.