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Post-IR IRSL and radicarbon dating of late Holocne vegetated Dunes in the Qaidam Basin, NE Qinghai-Tibetan Pleateau

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Luminescence dating is the most important dating method for Late Quaternary aeolian sediments and has got widely application on aeolian sediments in the hyper-arid Qaidam Basin (QB). There are different types of dunes in the QB, e.g., linear dunes, barchan dunes, parabolic dunes, and vegetated dunes, which are important archives for aeolian geomorphologic and palaeoenvironmental studies. These dunes were all formed during the arid late Holocene, and most of them are younger than 1 ka or even decades of years. This make it difficult to be dated with quartz, because the sensitivity of quartz on the Qinghai-Tibetan Plateau (QTP) are very low, i.e. without enough signal to get a precise age. Additionally, it's difficult to get pure quartz by SPT separation and HF etching, which might be caused by feldspar inclusion within quartz crystals. Consequently, to increase the quartz OSL signal by increasing the aliquot size will cause more feldspar contamination. The alternative method is to use the feldspar with high sensitivity. The vegetated dunes are composed of aeolian sand and vegetation residual, mainly fine branches of Tamarisk which fall during winter to spring, so the aeolian sand and vegetation residual should have the same depositional ages. This makes it possible to compare the luminescence ages with the precise 14C ages and to check the reliability of luminescence ages. The aim of this study is to find a method of K-feldspar IRSL and post-IR IRSL dating to solve the problem of young dune sand dating in the QB, by comparing with their corresponding AMS 14C ages.

Over 20 pairs of OSL and 14C samples were taken from 12 vegetated dunes along the southern margin of the QB, including modern samples. Coarse grain (150-180 μm) K-feldspar and quartz were extracted with density liquid (SPT), and K-feldspar was not etched with HF. SAR protocol of pIRIR180 are used to date the K-feldspar. These preheat and stimulation temperatures are chosen based on dose recovery, preheat plateau, residual dose (on modern samples) tests, recycling ratio and sensitivity change check.

The results show that: (1) The vegetated dunes were accumulated since ca. 2.5 ka during the arid late Holocene when the sand supplement was adequate. (2) The IRSL50 and pIRIR180 ages are the same after fading correction, and could be compared with 14C ages within error, demonstrating the feldspar were sufficiently bleached and the dating method is reliable. (3) All the BSL ages of quartz are younger than the AMS 14C ages, IRSL50 and pIRIR180 ages by a few hundreds to over one thousand years, which might be because the BSL signals are too low to offer reliable ages.

These imply that the pIRIR180 (including IRSL50) dating of K-feldspar can offer reliable and accurate ages for late Holocene dune sand, and even for modern samples of decades of years. This offer the opportunity to date the young dunes and to reveal the detail dune accumulation processes for aeolian geomorphologic studies.