**OSL Methods Used for Hatch Point Samples**

Single aliquot regeneration (SAR) protocols (Murray and Wintle, 2003) were used in this study to estimate the apparent equivalent dose of the 4-11 polymineral and quartz fractions for 19 to 30 separate aliquots (Table 2) adhered to a 1 to 2 millimeter circular diameter of grains on a 1 cm diameter circular aluminum disc. This aliquot size was chosen to maximize light output for the natural with excitation; smaller aliquots often yielded insufficient emissions (<400 photon counts/s). Initially fine grains (4-11 micron) were extracted by suspension settling following Stokes Law after organics and carbonate were removed by soaking in H2O2 and in HCl, respectively. Quartz extracts on the fine-grained fraction were isolated subsequently by digestion in hydrofluorosilicic acid (silica saturated) for six days.

An Automated Risø TL/OSL–DA–15 system (Bøtter-Jensen et al., 2000) was used for SAR analyses. Blue light excitation (470 ± 20 nm) was from an array of 30 light-emitting diodes that deliver ~15 mW/cm2 to the sample position at 90% power. Optical stimulation for all samples was completed at an elevated temperature (125 °C) using a heating rate of 5 °C/s. All SAR emissions were integrated over the first 0.8 s of stimulation out of 40 seconds of measurement, with background based on emissions for the last 30- to 40-second interval. The luminescence emission for all quartz sands showed a dominance of a fast component (see Murray and Wintle, 2003) with > 90% diminution of luminescence after 4 seconds of excitation with blue light.

A series of experiments was performed to evaluate the effect of preheating at 180, 200, 220, 240 and 260 °C on isolating the most robust time-sensitive emissions and thermal transfer of the regenerative signal prior to the application of SAR dating protocols (see Murray and Wintle, 2003). These experiments entailed giving a known dose (20 Gy) and evaluating which preheat resulted in recovery of this dose. There was concordance with the known dose (20 Gy) for preheat temperatures above 200 °C with an initial preheat temperature used of 200 °C for 10 s in the SAR protocols. A “cut heat” at 160 °C for 10 s was applied prior to the measurement of the test dose and a final heating at 260 °C for 40 s was applied to minimize carryover of luminescence to the succession of regenerative doses. A test for dose reproducibility was also performed following procedures of Murray and Wintle (2003) with the initial and final regenerative dose of 9.8 Gy yielding concordant luminescence responses (at one-sigma error).

Calculation of equivalent dose by the single aliquot protocols was accomplished for 19 to 30 aliquots (Table 2). Aliquots were removed from analysis because the recycling ratio was not between 0.90 and 1.10, the zero dose was > 5% of the natural emissions or the error in equivalent dose determination is >10%. Equivalent dose (De) distributions were log normal and exhibited overdispersion values ≤ 25% (at two-sigma errors) (Table 2). An overdispersion percentage of a De distribution is an estimate of the relative standard deviation from a central De value in context of a statistical estimate of errors (Galbraith et al., 1999; Galbraith and Roberts, 2012). A zero overdispersion percentage indicates high internal consistency in De values with 95% of the De values within 2σ errors. Overdispersion values ≤ 20% are routinely assessed for small aliquots of quartz grains that are well solar reset, such as eolian sands, and this value is considered a threshold metric for calculation of a De value using the central age model of Galbraith et al. (1999).

A determination of the environmental dose rate is needed to render an optical age, which is an estimate of the exposure of quartz grains to ionizing radiation from U and Th decay series, 40K, and cosmic sources during the burial period (Table 1). The U and Th content of the sediments, assuming secular equilibrium in the decay series and 40K, were determined by inductively coupled plasma-mass spectrometry (ICP-MS) analyzed by Activation Laboratory LTD, Ontario, Canada. A significant cosmic ray component between 0.24 and 0.29 mGy/yr was included in the estimated dose rate taking into account the current depth of burial (Prescott and Hutton, 1994). A moisture content (by weight) of 5 ± 2 %, was used in dose rate calculations, which reflects current field moisture conditions. The datum year for all OSL ages is AD 2000.

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