APPLICATION OF QUARTZ OSL STANDARDIZED GROWTH CURVE FOR DATING OF BRAZILIAN SEDIMENTS

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Introduction: Determining the absorbed dose, or equivalent dose (D_e), in quartz grains is fundamental for optically stimulated luminescence (OSL) dating of sediments. Standardized growth curve (SGC) has been proposed to facilitate and speed up the D_e estimation through a general dose response curve built by using quartz samples of presumed similar behaviour, without need of establish specific dose response curves for single aliquots. In this study, we test the use of SGCs for D_e estimation in quartz retrieved from Brazilian sediments.

Material and method: We used 27 sediment samples from fluvial, costal and eolian depositional contexts with D_e up to 80 Gy estimated by standard single-aliquot regenerative (SAR) dose protocols. SGCs were constructed using natural and regenerative dose OSL signals, both corrected by the test dose signal (T_x) and multiplied by the test dose (D_t). Natural signals were used to fit SGCs by exponential (SGC-1), exponential + linear (SGC-2) and linear ($D_e < 1$ Gy, SGC-3) functions. Regenerative dose signals were only adjusted by an exponential function (SGC-4). The D_e values estimated by SAR protocol of 25 sediment samples were compared with D_e obtained by SGCs, with 7 samples with D_e-SAR up to 1 Gy (linear function), 13 samples with D_e-SAR between 1 and 60 Gy (exponential function) and 5 samples with D_e-SAR higher than 60 Gy (exponential + linear function).

Results: The fitting functions of SGCs showed R^2 values above 0.98 and their parameters are in line with those found in the literature [1]. The average ratios between D_e values estimated by SGCs and by SAR protocols were 1.05 ± 0.02 for SGC-1(calculated only for D_e-SAR < 60 Gy), 0.83 ± 0.09 for SGC-2 (calculated only for D_e-SAR > 30 Gy), 1.03 ± 0.15 for SGC-3 (calculated only for D_e-SAR < 1 Gy) and 1.01 ± 0.01 for SGC-4 (calculated only for D_e-SAR < 60 Gy). The best results for doses lower than 1 Gy were obtained by SGC-4 (1.01 ± 0.01) while for doses between 1 and 20 Gy (1.00 ± 0.06) and doses higher than 20 Gy (1.03 ± 0.05), best results were obtained by SGC-1.

Conclusions: Results indicate that the D_e estimated by SGCs with linear and exponential functions are similar to those obtained by SAR protocol for doses up to 60 Gy. Thus, the use of SGCs represents a reliable and advantageous alternative for quartz OSL dating of Brazilian sediments, in a way that allows decreasing laboratory measurements time and with a possible reduction in the costs of OSL dating.

References:

1. H. M. Roberts and G.A.T. Duller, Standardised growth curves for optical dating of sediment using multiple-grain aliquots, Radiation Measurements 38, 2004, pp. 241-252.