



Research Paper

K-feldspar IRSL dating of a Pleistocene river terrace staircase sequence of the Lower Tejo River (Portugal, western Iberia)

António A. Martins^{a,*}, Pedro P. Cunha^b, Jan-Pieter Buylaert^c, Sébastien Huot^d, Andrew S. Murray^c, Pedro Dinis^b, Martin Stokes^e^a Centro de Geofísica, Dep. Geociências, Univ. Évora, 7000-671 Évora, Portugal^b Dep. of Earth Sciences, Marine and Environmental Research Centre, Univ. Coimbra, Portugal^c Nordic Laboratory for Luminescence Dating, Aarhus University, Risø DTU, Denmark^d Département des Sciences de la Terre et de l'Atmosphère, Université du Québec à Montréal, CP 8888, Succursale Centre-Ville, Montréal, QC, Canada H3C 3P8^e School of Earth, Ocean and Environmental Sciences, University of Plymouth, UK

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ABSTRACT

We present the results of K-feldspar IRSL dating of the four lower terraces (T3–T6) of the Portuguese Tejo River, in the Arripiado–Chamusca area. Terrace correlation was based upon: a) analysis of aerial photographs, geomorphological mapping and field topographic survey; b) sedimentology of the deposits; and c) luminescence dating. Sediment sampled for luminescence dating gave unusually high dose rates, of between 3.4 and 6.2 Gy/ka and, as a result, quartz OSL was often found to be in saturation. We therefore used the IRSL signal from K-feldspar as the principal luminescence technique. The K-feldspar age results support sometimes complex geomorphic correlations, as fluvial terraces have been vertically displaced by faults (known from previous studies). Integration of these new ages with those obtained previously in the more upstream reaches of the Tejo River in Portugal indicates that the corrected K-feldspar IRSL ages are stratigraphically and geomorphologically consistent over a distance of 120 km along the Tejo valley. However, we are sceptical of the accuracy of the K-feldspar ages of samples from the T3 and T4 terraces (with uncorrected D_e values >500 Gy). In these cases the Dose Rate Correction (DRC) model puts the natural signals close to luminescence saturation, giving a minimum corrected D_e of about 1000 Gy, and thus minimum terrace ages; this may even be true for those doses >200 Gy. Luminescence dating results suggest that: T3 is older than 300 ka, probably ca. 420–360 ka (~ Marine Isotope Stage [MIS]11); T4 is ca. 340–150 ka (~MIS9–6); T5 is 136–75 ka (~MIS5); T6 is 60–30 ka (MIS3); an aeolian sand unit that blankets T6 and some of the older terraces is 30–≥12 ka. Collectively, the luminescence ages seem to indicate that regional river downcutting events may be coincident with periods of low sea level (associated, respectively, with the MIS10, MIS6, MIS4 and MIS2).

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1. Introduction

The Tejo River is one of the major fluvial systems in south-western Europe. It is ~1000 km long with a catchment of 86,000 km², and drains a significant area of the Iberian continental interior. The sedimentary and geomorphic records of this long-lived (ca. 3.6 Ma) fluvial system are important for understanding late Cenozoic tectonic, climatic and eustatic controls on Iberian landscape development.

In previous research (e.g. Martins, 1999; Cunha et al., 2005, 2008; Martins et al., 2009) we have documented spatial and

temporal patterns of river terrace development along some of the upstream Portuguese reaches (I, III and IV; Fig. 1). Here, the Tejo River is superimposed onto uplifted blocks of metamorphic basement, developing wide fluvial terraces in areas of soft substratum and narrow valleys in the hard substratum. In this paper we explore the application of luminescence dating to a single fluvial terrace staircase sequence and associated aeolian sediments within a relatively unstudied reach of the Tejo River that lacks absolute age control. The luminescence dating results from this study complement the existing luminescence chronologies of Cunha et al. (2008) and Martins et al. (2009) from elsewhere in the Tejo system. As in the earlier work, sediment dose rates were unusually high (3.4–6.2 Gy/ka); so, we have also chosen to use the IRSL signal from K-feldspar as the principal luminescence dating technique. Integration of new and existing luminescence age data enables us

* Corresponding author. Tel.: +351 266745301; fax: +351 266 745397.
E-mail address: aam@uevora.pt (A.A. Martins).