



Single-grain OSL dating of Early Middle Palaeolithic deposits at Cuesta de la Bajada, Ebro Basin, Spain

Lee Arnold, Martina Demuro, Manuel Santonja, Alfredo Perez-Gonzalez, and Josep Pares

Centro Nacional de Investigación sobre la Evolución Humana, CENIEH, Paseo Sierra de Atapuerca s/n, 09002 Burgos, Spain. (lee.arnold@cenieh.es)

The open-air site of Cuesta de la Bajada comprises a 2-2.5 m-thick sequence of fluvial-lacustrine sediments inset into the +50-60 m terrace deposits preserved along the south-eastern margins of the Alfambra river valley, Teruel, Spain. The main archaeological horizons lie ~20 m above the present-day river level and consists of an upward-fining sequence of massive fluvial silts and fine sands with dispersed gravels, detritic marls and shales that collectively overlie a series of planar bedded fluvial gravels. These units have yielded ~3000 lithic artefacts displaying reduction techniques characteristic of an early Middle Palaeolithic techno-complex, as well as a multitude of faunal remains indicative of a late Middle Pleistocene origin. The paucity of open-air Palaeolithic sites in the interior eastern sector of the Iberian Peninsula, and the relatively low number of documented early Middle Palaeolithic archives in this region, means that Cuesta de la Bajada is of key importance for understanding the coexistence/transition of Iberian Acheulean and Mousterian techno-complexes during the Middle Pleistocene period. Establishing reliable absolute chronologies at Cuesta de la Bajada remains essential for understanding the regional significance of this site.

In an attempt to redress the existing chronological uncertainty we are undertaking an interdisciplinary dating study of the Middle Palaeolithic deposits using OSL dating, ESR/U-series dating of teeth and ESR dating of sedimentary quartz. Here we present results obtained using quartz single-grain OSL dating of 4 samples collected from a 7 m vertical profile bracketing the archaeological horizons. 2 samples were collected from the archaeology-bearing silt and fine sand horizons, while the remaining samples were obtained from well-bedded fine-sands and silts 3.5 m above and 3 m below the main excavation.

The measured quartz grains are characterised by relatively bright OSL signals and typically display dose-response curves with very high saturation limits. The latter offers the advantage of extending the age range over which single-grain techniques can be applied in this Middle Pleistocene context. Dose-recovery tests performed at high doses of 470 Gy yielded accurate equivalent dose (D_e) results with low overdispersion, providing reasonable confidence in the chosen measurement conditions. Three of the samples display single-grain D_e distributions with low levels of dispersion indicating that the sediments were adequately bleached prior to burial and remained undisturbed thereafter. The fourth sample displays higher D_e dispersion and a younger subpopulation of grains, which could be explained by beta-dose heterogeneity associated with interspersed gravels within the basal archaeological horizon. We apply various statistical age models to derive final chronologies and compare the resultant single-grain ages with those obtained using different absolute dating methods. We also report on experiments performed using 'synthetic multi-grain aliquots' created from the single-grain D_e datasets, and discuss their implications for the reliability of multi-grain OSL dating techniques in this context.