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Luminescence geochronology and evaluation of the environmental dose rate for the Neanderthal deposits at Vindija Cave (Northern Croatia)

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Optically stimulated luminescence (OSL) dating of individual sand-sized grains of quartz has advanced significantly over the past decade opening up new vistas in luminescence geochronology (1). Today, single-grain OSL dating can be used to constrain the burial ages of many deposits, including fluvial sediments (2), glaciofluvial material (3) and archaeological sediments (4). It also provides a means of examining the stratigraphic integrity of archaeological sites where sediment mixing might have occurred (5–7). An OSL age is calculated by dividing the burial dose (the dose absorbed by the grain since it was last exposed to sunlight) by the environmental dose rate (the rate of supply of ionizing radiation to the grain over the period of burial). To obtain reliable OSL ages, therefore, an accurate estimate of the dose rate is required for each sample.

Here we describe our OSL dating campaign at Vindija Cave, a key archaeological site in central Europe that contains a 12 m-thick sequence of cave-mouth sediments spanning the Middle to Upper Palaeolithic. The cave is famous for its Neanderthal and modern human remains, and Neanderthal DNA has been retrieved from several of the bones, but the chronology and interpretation of these records remain a matter of lively discussion. Here we focus on the dosimetry of Vindija Cave and give a detailed account of the environmental dose rate using in-situ and high-resolution gamma-ray spectrometry, alpha- and beta-particle counting, and XRF spectrometry. We also discuss the cave sedimentology, as post-depositional disturbance of the cave-mouth sed-

iments has been recognised.

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