# Geochemical and mineralogical characterization of fill materials from a negative archaeological structure, and relations with luminescence and dosimetric behavior.

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The aim of this work is to investigate the geochemistry and mineralogy of fill materials from an archaeological structure and relate this to their luminescence and dosimetric behaviour, in order to better understand changes produced by human activities and environmental factors, and their effect on luminescence dating results. The archaeological site of Monte do Carrascal – Ferreira do Alentejo (Portugal), consists of ditches and hypogeos cut into calcareous metasediments (caliches), continental Miocene deposits overlying gabbros. Sampling was conducted in a profile down a section of ditch fills to the substrate, exposed during archaeological excavations by ERA Arqueologia Lda. This contained two distinct archaeological contexts: a deeper and oldest context of circulation floors and a more superficial and recent context associated with closure of the ditch. Geochemical characterization was conducted on bulk material and the clay fraction (<2μm), using Instrumental Neutron Activation Analysis (INAA) and X-Ray Fluorescence (XRF) to determine trace, minor and major elements, and in situ gamma spectrometry measurements to determine K, Th and U contents. These were combined with evaluations of water retention characteristics to assess environmental dose rates to the samples during their burial. Mineralogical characterization was based on X-Ray Diffraction (XRD) of the bulk sample and of the clay fraction. Luminescence analyses of quartz and polymineral fractions were used to estimate the sensitivity of samples to radiation and the absorbed doses since they were buried, using IRSL, OSL and TL signals. The dominant mineralogical association of the bulk sample is calcite, followed by phyllosilicates, quartz and feldspars, with occasional appearance of traces of dolomite and hematite. It was possible to find a relationship between rare earth elements and phyllosilicates, as well as between Hf, Zr, Cs and, Ba concentration and plagioclase abundance. The levels of K, Th and U in the samples are relatively low, as a function of the high content of calcite: the precipitation and/or dissolution of calcite in these deposits since their accumulation may have altered the environmental dose rate over time. The high content of clay minerals in the samples also helps protecting their constituent mineral grains from interaction with light. Both these effects lead to overestimates in luminescence ages. Therefore, by better defining the relationship between the composition (chemical and mineralogical) and dosimetric behavior in carbonated materials, it is possible to understand the influence of anthropogenic and/or environmental processes (occurring during and after the use of ditch) on the composition of archaeological fill materials as well as on the results of their luminescence dating

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