3th Technoheritage2017 International Congress
21-24 May 2017, Cádiz, Spain

In situ gamma-ray spectrometry (GRS) use for non-destructive archaeological exploration

J. Sanjurjo-Sánchez[1], C. Arce Chamorro[1], C. Alves[2], J.C. Sánchez Prado[3], R. BlancoRotea[3]
[1]Instituto Universitario de Xeoloxía "Isidro Parga Pondal", Universidade da Coruña, A Coruña, Spain
[2]Lab2PT (FCT UID/AUR/04509/2013; FEDER COMPETE POCI-01-0145-FEDER-007528) and Earth Sciences Department, School of Sciences, University of Minho, Braga, Portugal
[3]Landscape, Heritage and Paleoenvironment Laboratory, University of Santiago, Spain

Geophysical prospection methods are used in archaeology to locate features of archaeological sites before excavation. Among geophysical methods, those mostly used in archaeology are seismic methods, electromagnetical surveys, and georadar. All of them allow assessing properties of soil, sediment and/or rock, providing cross section of soil properties that can be related to buried archaeological structures and objects. Gamma-ray spectrometry (GRS) is a technique used for different geological purposes including mineral exploration and mapping. However, it has not been applied in archaeology: the only study case known by the authors was successful (Moussa, 2001) but no later reports or more extensive studies have been found. In situ GRS is a non-destructive method that allows direct assessment of potassium-40 (^{40}K), uranium-238 (^{238}U) and thorium-232 (^{232}Th) and daughter radionuclides of their decay chains on rock outcrops and soils. Such radionuclides are ubiquitous in most rocks and soils and the main causes of natural gamma radiation. The technique allows assessing their concentration in topsoil, being of potential use for archaeological exploration but two assumptions must be made: the archaeological buried objects must contain a different concentration of radionuclides than the surrounding sediment or soil, and they must be buried in the topsoil (25-30 cm depth). Thus, it is potentially applicable for exploration of shallow structures or objects. However, it does not provide cross-sections of the ground, but maps of the structures and objects buried. In this work, we have tested in situ GRS in an archaeological site that was partially excavated. In the site, remains of walls made of stone have been excavated, being buried in other parts of the site, but near the ground surface, being the top of the structures at 10-30 cm depth. We have tested in situ GRS in small parcel of 10 x 7 m, located beside nearby excavated areas which wall remains are partially buried in the studied parcel. The purpose of the study is to assess if the technique is reliable for the exploration of structures. Rocks used as building materials in the walls are mostly metamorphic rocks of very low radionuclide content with negligible ^{40}K. However, the sediment that buries the structures contains significant amounts of K, U and Th radioisotopes. Results showed reliable results for surface exploration where shallow structures exist, despite the low radioactive content of the archaeological materials in the site.