LUMINESCENCE DOSIMETRY APPLIED IN ENVIRONMENTAL STUDIES

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ABSTRACT

Luminescence methods are part of solid state dosimetry and encompass as applications: dating, retrospective accident dosimetry, environmental, personal and medical dosimetry.

Luminescence dating is providing support to climate change research through the provision of absolute age control. The loess paleosol sections in Romania are thought to represent the most continuous and high resolution archives of regional climate and environmental change during the Late and Middle Pleistocene, in this part of Europe, and a link between similar deposits in central Europe and China. Loess is generally considered an ideal material for luminescence dating. While intensive investigations have been carried out on loess paleosol section from Western Europe and China in the last couple of decades, loess research in Romania using absolute methods has been started only some years ago by our group. An overview of our research in establishing a reliable chronological framework of some of the most important loess-palaeosol sequences in Romania and Serbia is presented. Optically stimulated luminescence (OSL) ages obtained for representative sites in Romania using polymineral fine grains as well as by using different grain-size fractions of quartz are discussed from chronological and methodological perspectives. The potential of luminescence as a dating tool is examined through a comparison of methods and the investigation of sites where independent age control is available through the existence of a tephra layer assigned to Campanian Ignimbrite Y5 eruption. Moreover, intriguing evidence is presented showing that OSL dating different grain-size fractions of quartz can lead to discrepant depositional ages. The source of this discrepancy remains yet unexplained but is thought to reside in the different dose response observed for the two different fractions. Our previous studies indicated the presence of an additional function, besides a single saturating exponential, in the laboratory dose response curves constructed for both types of quartz grains. Morover, experimental evidence that showes that the field saturation of (natural) OSL signals in

quartz does not coincide to laboratory saturation of OSL signals is presented. These observations are challenging one of the basic assumptions of luminescence dating.

The application of **accident retrospective dosimetry** is vital in the aftermath of a radiological accident or terrorist attack. Rapid and accurate absorbed dose evaluation of exposed victims is of utmost importance. Although international emergency procedures have been published, the main concerns are still focusing on preventing the acute deterministic health effects occurring in persons exposed to high dose levels. Thus, developing new methodologies for accidental dose assessment using objects or materials, which can be usually found directly on exposed victims and/or in the contaminated area is necessary. With this purpose in mind we have investigated the dosimetric properties of household salt and electronic components from mobile phones available in Romania. All types of salt investigated displayed satisfactory TL and OSL characteristics and most mobile phones and phone card components have a significant potential as retrospective luminescence dosimeters. The low limit of detection in the case of these materials is of an order of magnitude of mGy. These results, alongside with the widespread availability of these materials are leading us to conclude they are suitable candidates for rapid dose assessment.

Regarding **medical and environmental dosimetry**, we have started investigations on the dosimetric properties of glasses in a search for new materials capable of measuring high doses. A dosimetric system based on MCP-7 (LiF:Mg,Cu,P) TL detectors has been set up and a high resolution map of Cluj county for gamma dose rates was developed according to the European Environmental Policies as a first step into mapping gamma dose rates at national level.