LUMINESCENCE CHARACTERISTICS OF QUARTZ SEPARATES OF DIFFERENT ROCKS AND SEDIMENTS IN HUNGARY

THAMÓ-BOZSÓ, E., FÜRI, J. & BÁTORI, M.-né
Mining and Geological Survey of Hungary, Budapest, Hungary
E-mail: bozso.edit@mbfsz.gov.hu

Introduction

During the OSL (Optically Stimulated Luminescence) dating of Late Pleistocene and Holocene sediments it is observed that the OSL luminescence sensitivity and other luminescence characteristics of quartz show local differences. One cause of these differences may be the different source rocks of the quartz grains. Therefore the luminescence properties of quartz separates from some metamorphic, plutonic, volcanic, and sedimentary rocks and sediments in Hungary were studied in detail to gather complementary data to our previous investigation (THAMÓNÉ BOZSÓ *et al.*, 2020).

Samples, sample preparation and study methods

Quartz fractions were separated from Paleozoic metamorphic rocks: Tolvajárok Leucophyllite, Sopronbánfalva Gneiss and Vöröshíd Mica schist Formations; Carboniferous plutonic rocks: Velence Granite and Mórágy Granite Formations; Miocene volcanics: Gyulakeszi Rhyolite Tuff and Tar Dacite Tuff Formations; Permian, Oligocene and Miocene sedimentary rocks: Balatonfelvidék Sandstone, Hárshegy Sandstone, Törökbálint Sandstone and Kazár Sandstone Formations; and different sands from Eocene to Late Miocene–Pliocene.

First, rock samples were crushed and sieved, sand samples were only sieved, then the quartz was separated from the 0.1–0.16 mm grain size fraction using hydrogen peroxide, hydrogen chloride, heavy liquid prepared from sodium polytungstate (SPT), and then hydrogen fluoride in the same way as for OSL dating, but not in dark conditions. Finally, the quartz grains were mounted on stainless steel disks in 5 mm diameter using silicon oil.

OSL measurements were made according to WINTLE & MURRAY (2006) on RISØ TL/OSL DA–20 reader. The same or very similar luminescence measurement protocols were applied as during the OSL dating of the sediment samples.

Results

Most of the quartz separates were pure enough in terms of luminescence. A part of the quartz separates characterised by a fast decaying OSL signal dominated by the fast component, which is preferable for OSL dating. But the quartz separates from metamorphic and plutonic rocks were mainly dominated by non-fast components. OSL sensitivity measurements indicated that the quartz separates of sediments, sedimentary rocks and some volcanic tuffs are more sensitive than the quartz of the studied metamorphic and plutonic rocks. Due to growing radioactive radiation, most of the samples showed gradually increasing growth curves. But a few separates displayed first quickly increasing, then very slightly changing growth curves with the saturation of the OSL signal at relatively low radioactive doses (e.g. Sopronbánfalva Gneiss, Hárshegy Sandstone and Csatka Formations). Quartz of the Mórágy Granite behaved very differently from the quartz of the other rocks and sediments because its OSL signal was very dim and almost unchanged due to growing radioactive radiation.

Sensitivity change, which was measured after many repeated cycles of illumination, radioactive irradiation and thermal treatment of a few quartz separates, was very small. The thermoluminescence signals of the separates showed very different peaks.

The results of the OSL test measurements (dose recovery ratio, thermal transfer test, recycling ratio, recuperation) showed large scattering. This suggests that in the Late Pleistocene and Holocene sediments the quartz grains that are originated directly from metamorphic and plutonic rocks by erosion show unfavourable OSL properties. Only the quartz of a few formations has appropriate properties from the aspect of OSL dating. They are solely sands and sandstones, first of all sands from the Upper Miocene Kálla Gravel and Upper-Miocene–Pliocene Zagyva Formations.

References

THAMÓNÉ BOZSÓ, E., FÜRI, J., KOVÁCS, I. J., BIRÓ, T., KIRÁLY, E., NAGY, A., TÖRÖKNÉ SINKA, M., KÓNYA, P., MÉSZÁROSNÉ TURI, J. & VÍGH, CS. (2020): Földtani Közlöny, 150: 61–80.

WINTLE, A. & MURRAY, A. S. (2006): Radiation Measurements, 41: 369–391.