EGU22-12050
https://doi.org/10.5194/egusphere-egu22-12050
EGU General Assembly 2022

Development of a new rapid method for quartz purity control by luminescence for cosmogenic nuclide dating

Christopher Lüthgens[1], Stephanie Neuhuber[2], Ágnes Novothny[3], and Zsófia Ruszkiczay-Rüdiger[4]
[1]Institute of Applied Geology, Department of Civil Engineering and Natural Hazards, University of Natural Resources and Life Sciences, Vienna, Austria (christopher.luethgens@boku.ac.at)
[2]Institute of Applied Geology, Department of Civil Engineering and Natural Hazards, University of Natural Resources and Life Sciences, Vienna, Austria (stephanie.neuhuber@boku.ac.at)
[3]Institute of Geography and Geology, Department of Physical Geography, Eötvös Loránd University, Budapest, Hungary (agnes.novothny@ttk.elte.hu)
[4]Institute for Geological and Geochemical Research, Research Centre for Astronomy and Earth Sciences, Eötvös Loránd Research Network, Budapest, Hungary (rrzsofi@geochem.hu)

Applications of *in situ* produced cosmogenic ^{10}Be and ^{26}Al for age determination of rock surfaces and sediments use quartz containing lithologies, because these nuclides are produced and retained within the crystal lattice of this mineral. To be able to calculate reliable ages, it is essential to work with pure quartz grains. The most problematic contaminant is the mineral feldspar for three reasons: 1) ^{10}Be and ^{26}Al can also be produced in feldspar but at a different production rate 2) feldspar contains copious amounts of Al and can thus contribute stable Al (^{27}Al) in high amounts 3) it is ubiquitous and often intergrown with quartz. This leads to problems during sample processing and during Accelerator Mass Spectrometry measurement where the rare nuclide ^{26}Al may reach its detection limit.

During sample processing the crushed and sieved rock samples are subject of physical (magnetic-, shape- and density separation) and chemical (leaching in acids) cleaning steps in order to remove all minerals (e.g. feldspars, mica, amphiboles, etc.) and have the quartz grains concentrated and purified. If the sample is sufficiently clean (i.e. the Al content is below 200 ppm) the purified quartz can enter total dissolution as the next step of nuclide extraction.

Several methods are used to check the mineralogical composition and the quality of the purified quartz sample. 1) Optical investigation using a binocular microscope, 2) X-ray diffraction (XRD) analysis of mineralogy, 3) Al content analysis after digestion and element detection as high Al content is indicative of the presence of Al containing minerals like feldspars or mica within the pure quartz fraction.

Each of those methods has individual limitations. Optical investigation may be hindered by the etched surface and quartz may look surprisingly similar to feldspar after etching. XRD has its detection limit at c. 5%, and with respect to Al content analysis, some quartz-types may naturally contain larger amounts of Al. Besides, chemical analysis as well as XRD – if not available in house – may have a long waiting time and high costs.

Here we report first results of exploring the potential of luminescence as a fast and cost-efficient alternative method to determine the content of contaminant feldspars in quartz as infrared stimulation only excites feldspars, but not quartz. The experimental setup consists of a parallel analysis of the samples using XRD to detect the bulk mineralogy, element analysis by ICP-OES analysis, and luminescence analyses, in order to develop a short, efficient luminescence measurement sequence reliably detecting feldspar contamination in samples for cosmogenic dating. While some results are promising for individual samples, the results for other samples are still ambiguous. The respective data will be presented at the conference.

This study was supported by the following projects: OMAA 105ou4, NKFIH 124807.