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X-ray spectrometry and microtomography techniques in geological applications

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The well known X-ray spectrometry and diffraction techniques: WDXRF, TXRF, XRPD and X-ray microtomography, allow the study of materials in broad range of research interest [1-4]. A particular issue is the application of these techniques in studies of the multielemental sample composition in a wide range of concentrations (samples with different matrices) and characterized with different grain size. Typical examples of these kind of samples are soil or geological samples (soil, till, sand, sediment, mineral). The elemental and chemical analysis of soil and geological samples is in the interest of many fields of science as for example agriculture, biology or geography. Analysis of these samples is however difficult due to the matrix effects and grain size effect [1].

The aim of the study is analysis of the samples with soil and geological matrix using WDXRF, TXRF, XRPD and X-ray microtomography techniques. The samples will be characterized additionally by different grain sizes and different kind of material packing. The main motivation of undertaken this research topic is the improvement of the qualitative and quantitative analysis of the materials with a particular kind of matter, namely, the soil and geological matrix materials. The WDXRF and TXRF measurements give information about elemental concentration of the samples. The XRPD technique gives information about the chemical sample composition and allows study mineralogical effects i.e. the influence of the mineral type in which the analysed element occurs on the intensity of its characteristic X-ray. In the case of TXRF measurements choice of internal standard needs optimization in such a way that its presence in a sample does not make difficulty in measurement of characteristic radiation of the element analysed in the sample. The result of the study will be also development of the calibration curves for TXRF spectrometer for samples with soil and geological matrices. More complex interpretation of the elemental and chemical composition analysis of the samples will be possible using X-ray microtomography. Morphology of each sample can be in this way characterized in micrometers scale especially in the context of the information about grains size. The obtained results of analysis of the samples with soil and geological matrices will be interpreted using the statistical method BIPLOT, which is practical tools for the compositional data analysis [5].

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