# Monazite single grain trace element analysis and dating by XRF milliprobe

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Monazite is stable in sedimentary environments and its detrital populations could reflect provenance. Such techniques as LA-ICP-MS, EMP and SIMS commonly are applied to study a monazite composition. They have good analytical characteristics but require expensive hardware and time-consuming sample preparation. Single-grain milliprobe XRF analysis (XRF-MP/SG) is a new promising technique for trace elements (Sr, Y, Pb, Th, U) determination and chemical U-Th-Pb dating of monazite. This technique was designed on a base of original XRF installation with two thin X-ray beams (collimated to 0.5 mm) from two independent X-ray tubes with Mo and Fe anodes and energy-dispersive spectrometer with Si(Li) detector. Detection limits for grains with masses 1-10 μg are: Sr, Y – 5-10, Pb, Th, U – 10-20 ppm. The fluorescence intensity of elements vs. shape and mass of grains as well as their matrix effect were calculated to calibrate the quantitative element analysis. The statistical uncertainty is defined by counting statistics in spectrum peaks. It depends on grain mass, element concentrations and measurement time (Fig. 1).

Figure 1: Experimental statistic uncertainty of fluorescence intensity for spherical monazite grain (m≈1.1 μg, Ø≈0.07 mm).
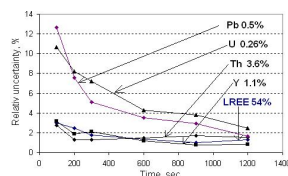
Up to then unknown 'young' stage of significant formation of monazite within the East European Platform has been discovered as a result of XRF-MP/SG application (Fig. 2).

Figure 2: Age spectra of detrital monazites from sediments sampled within the Ukrainian Shield.
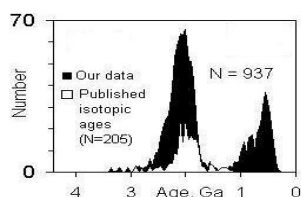
XRF-MP/SG can be regarded as nondestructive technique that permits fast and cheap obtaining of great number of trace element analyses. If nessessary, grains may be reanalysed by means of LA-ICP-MS or SIMS.

Study of the copper reactivity in organic soils

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The acumulation of heavy metals in soils can cause adverse effects in natural systems due to their mobility and bioavailability. The study of heavy metals speciation in such systems can be controlled by the presence of different types of sorbent materials. Until now, several studies have deal with the interaction of heavy metals with isolated soil fractions such as natural organic matter which has been proved to bind strongly to metal cations. In the present work a comparative study was carried out between the copper binding on a peat sample and on a peat humic acid. A widely used model for describing the metal binding to humic substances is the NICA-Donnan. We have checked the possibility of using this model with the peat sample which is expected to exhibit a similar behaviour to that observed for humic substances in solution.

The effect of pH and ionic strength observed for the peat sample shows the same trend as in the peat humic acid. In both cases the copper binding is enhanced by an increase in pH or decrease in ionic strength. The main difference between both samples could be attributed to different binding sites content. The peat shows higher complexation capacity than its humic fraction.

An acceptable prediction of the experimental results for the peat sample was achieved with the NICA-Donnan model. The fitted parameters were quite similar to those obtained for the peat humic acid (Gondar et al., 2006) and also to the generic NICA-Donnan parameters for copper-humic acids binding published by other authors (Milne et al., 2003)

References

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