

## Integration of SEM based quantitative petrography with laser ablation ICPMS for *in situ* elemental and isotopic analysis of minerals

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Recent advances in laser ablation inductively coupled plasma mass spectrometry (LA-ICPMS) allow *in situ*, micron-scale mineral analyses for elemental concentrations and isotopic ratios with accuracies and precisions not thought possible a generation ago. Many of these analyses have revealed significant heterogeneities within and between mineral grains that were not expected or easily explained. Clearly, the value of *in situ* measurements by LA-ICPMS is greatly enhanced by a thorough, systematic and quantitative characterization of the morphologies, sizes, internal structures and grain boundary associations of the mineral phases analysed. At Memorial University, we have integrated LA-ICPMS measurements with quantitative petrography using the JKMRC<sup>®</sup> Mineral Liberation Analyser (MLA), which is a scanning electron microscope (FEI Quanta 400 ESEM) computerized with sophisticated software for automated, backscattered electron (BSE) image analysis and X-ray mineral identification. Samples are presented as polished thin sections or particle mounts of mineral concentrates. High-resolution (0.1-0.2 micron) images are produced from the BSE signals and used to discriminate mineral phases; and then X-ray mapping is carried out on a grid to determine mineral identity by reference to a mineral standards library and the modal abundances. This approach provides particular advantages for LA-ICPMS U-Pb geochronology of detrital zircons used for provenance studies of clastic sedimentary rocks, where age frequency histograms may be biased during sample preparation and analysis. Biases produced by magnetic separation and hand-picking of grains for LA-ICPMS analysis are eliminated by having the MLA automatically identify the positions and characteristics of all zircons present in a grain mount made from a random subsample of the heavy liquid mineral concentrate of the rock. BSE images of the zircons are easily assembled and compared using the MLA software: the images may be used to make appropriate selections for the position of the laser analysis within each grain; avoiding for example, inherited cores and metamorphic overgrowths, and zircons present only as crystal fragments.

## High Arsenic content of shallow groundwater in young basins

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### The Ground and the Goal of the Research

The goal of the research is to understand the genesis of the high arsenic of shallow groundwaters.

The arsenic content of both the shallow and the deep groundwater is considerably higher than the public health limit (10 µg/l) in many places in Hungary. This study is carried out in the frame of the "Genesis of the high arsenic content of shallow groundwaters in young basins" reserach, granted by the Hungarian National Research Fund (No. 67967).

The bulk of the Hungarian high arsenic content shallow groundwater can be found on those areas where the deep groundwater have also high arsenic concentrations. The relation between these two zones is not clarified. Their position in the flow system does not count in the As concentration distribution. The arsenic content of shallow groundwater can be high in areas, where there is no or there is only in small concentration arsenic in the deep aquifers too.

### Discussion

In the frame of this research the survey of the near surface sediments, mainly those which can be found close to the groundwater table, is carried out. Parallel to this the As dissolution conditions below the groundwater table, the role of hydrogeological and geochemical factors which determine these conditions are studied.

To study the effects of climate, precipitation and groundwater level changes, a monthly groundwater sampling is done for one year long period at 5 sites. The survey of the evaporation zones, which are connected to the local flow systems, is carried out in the Duna-Tisza interfluvial area.

The main and trace elements, and the arsenic speciation of groundwater are determined. Four arsenic species (As(III), DMA, MA, As(V)) were investigated. Field separation method with easy-to-use ion-exchange columns is used. Suitability, efficiency and reliability of the separation with different column types were checked.

Using field separation method, the different As types can be recorded at the moment of the sampling, and on this way the speciation analysis can be replaced with simple arsenic determination method.