Improved resolution and precision for elemental imaging of geological samples using LA-ICP-MS

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The combination of sample preparation techniques, separation techniques and sample introduction techniques with ICP-MS provides multidimensional information about various sample types.

Hyphenated techniques are more often part of the routine work in laboratories and there is an increasing need for lower detection limits and better resolution. The application of laser ablation for elemental mapping requires a fast transport and wash-out of the laser generated aerosol from the ablation cell and at the same time also a complete acquisition of all isotopes of interest in the ICP-MS. Since the material available for the analysis is limited and there is a clear tendency towards smallest possible spot sizes – the combination of high sensitive and fast data acquisition is the key for better data quality. New instrumental developments allow resolutions to single-digit μm spots and new ablation cells show improved transport characteristics. The presentation descibes the layout of an ICP-MS instrument that offers unmatched high sensitiv and fast scan speed for this kind of application. Preliminary results on reference materials NIST 612 show more than 2Mcps for Th and U (ø65μm, 10J/cm2, 20Hz) at very low oxide formation of 0.3% ThO/Th. Limits of detection are calculated to 0.04 and 0.08 ppb for Th and U. The laser ablation parameters were optimized for the ablation of geological. The ICP-MS instrument was optimized to high sensitivity to allow the ablation with small spot sizes. Results from a topological mapping experiment on an ammonite sample showed a very detailed distribution of Ca and Sr but also trace elements like Sc, Y and Zr.

The work presents results of the quantitative and isotope ratio analysis of various samples types. Parameter including spot size, sample introduction, 3D-ion focusing and scan speed are discussed.