Elemental analysis of basalt samples by multivariate analysis of tandem LIBS and LA-ICP- MS data

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A system that combines and compares the capabilities and analytical benefits of LIBS and LA-ICP-MS was evaluated for micrometer-scale, spatially-resolved, elemental analysis of basalt glass samples. The ablation system consisted of a Nd: YAG laser operated 266nm. A Czerny-turner spectrograph with ICCD detector and Quadrupole based mass spectrometer were selected for LIBS and ICP-MS detection, respectively. This tandem system allows simultaneous determination of major and minor elements (Si, Ca, and Al), and trace elements (Ce, Cr, Sr, Y, Zn and Zr) in basalt samples. The research focused on calibration strategies, specifically the use of emission and mass spectra for multivariate data analysis. Partial Least Square Regression (PLSR) was shown to minimize and compensate for matrix effects in the emission and mass spectra improving quantitative analysis by LIBS and LA-ICP-MS, respectively. The study provides a benchmark against which to evaluate results for more complex matrices including minerals.