Evaluation of alkali fusion method for precise determination of 28 trace elements in silicate rocks by LA-ICPMS

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Precise and accurate determinations of trace elements of various geological samples are important for understanding their origin, source materials and genetic processes. Combined microbeam and alkali fusion techniques have merits in determining trace level elemental concentrations. In general, laser-ablation inductively coupled plasma mass spectrometry (LA-ICPMS) enables rapid and accurate determinations of trace element concentrations even in the sub-ppm level. Compared with the acid digestion method, the fusion method with mixed alkali flux is more effective to decompose insoluble accessory minerals such as zircon, magnetite, rutile having rare earth and high field strength elements. In this study, we evaluated the reliability of trace element abundance data measured from four silicate rock references (JR-3, LG-3, JGb-1, and JB-1b) using glass discs made by alkali fusion (lithium metaborate : lithium tetraborate = 1 : 2). For 28 elements including rare earth elements (V, Ga, Rb, Sr, Y, Zr, Nb, Cs, Ba, La, Ce, Pr, Nd, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, Hf, Ta, Pb, Th and U), relative standard deviations (RSD) are better than 7% in cases when concentration of the elements in the rock samples are greater than 10 ppm. RSD are somewhat worse for concentrations less than 10 ppm, but never exceed 25%. Comparing with recommended values, our data display satisfactory results for the most cases with differences less than 10%. We suggest that LA-ICPMS analysis using fused glass discs is a reliable, precise and timesaving method of trace element analysis for the silicate rocks ranging in composition from mafic to felsic.