Determination of major and trace elements in GSJ geochemical reference samples using galvanometric LA-ICPMS

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We have measured 10 major and 34 trace elements from the 34 Geological Survey of Japan geochemical reference samples (JB-1, JB-1a, JB-1b, JB-2, JB-2a, JB-3, JB-3a, JA-1, JA-1a, JA-2, JA-3, JR-1, JR-2, JR-3, JGb-1, JGb-2, JG-1, JG-1a, JG-2, JG-3, JH-1, JSl-1, JSl-2, JSd-1, JSd-2, JSd-3, JSd-4, JSd-5, JLk-1, JMS-1, JMS-2, JMS-3, JSO-1, and JCFA-1) by means of femtosecond-laser ablation-ICP-mass spectrometry coupled with galvanometric optics (GV-fsLA-ICPMS) [1]. Coupling of fs-laser and the galvanometric optics, further stabilized signals for the analytes can be derived in the the ICP-MS measurements.

Glass beads were prepared by mixing sample powder with a high-purity alkali flux with a 1:10 mixing ratio. The abundances of the major and trace elements were externally calibrated by the glass beads separately prepared from six geochemical reference materials (AGV-1, AGV-2, BCR-1, BCR-2, BHVO-2, and DTS-1) distributed by the United States Geological Survey. The resulting abundances for the most major elements in the 34 GSJ geochemical reference samples were consistent with previously reported values. All trace-element compositions of these reference samples were consistent with the reference values, suggesting high reliability of the present GV-fsLA-ICP-MS technique. Typical analysis repeatabilities for the GSJ geochemical reference samples were better than 3% for SiO_2, Al_2O_3, Na_2O, and K_2O; <5% for TiO_2, total Fe_2O_3, MnO, MgO, CaO, P_2O_5, V, Cr, Co, Ni, Rb, Sr, Y, Zr, Nb, Cs, Ba, La, Ce, Pr, Nd, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Lu, Hf, Ta, Th, and U; and <9% for Sc, Cu, Zn, Sn, Yb, and Pb [2]. These data clearly demonstrate that high analytical repeatability can be achieved by the GV-fsLA-ICPMS technique from the glass beads made from 0.5 g or larger sample sizes.

[1] Yokoyama, T.D. et al. (2011), *Anal. Chem.*, **83**, 8892-8899.
[2] Kon, Y. and Hirata, T. (in press), *Geochem. J.*