Evaluation of digestion methods for Molybdenum concentration analysis for geological materials

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Molybdenum, one of redox-sensitive trace elements showing slightly chalcophile and moderately siderophile character, is recognized as a useful element for tracing chemical evolution of the Earth ranging from core-mantle differentiation to low temperatures surface processes. Despite this, determination of Mo concentration is frequently abandoned for the studies of rock samples dominated by silicate materials because formation of insoluble molybdenum oxides in hydrochloric (HCl) or nitric (HNO_3) acid solutions precludes accurate measurements of Mo concentration with ICP-MS in typical multi-element determination methods for other lithophile trace elements such as Rb, Sr, and rare earth elements (REE). Makishima and Nakamura (1999) and Lu et al. (2007) proposed that isotope-dilution ICP-MS (ID-ICP-MS) employing dissolution with hydrofluoric (HF) acid is a well-suited method for the simultaneous determination of Mo and other elements such as W, Sb and high-field strength elements (HFSE). However, most of these elements are hosted in acid resistant minerals such zircon and Cr-spinel in rock samples, high-temperature/pressure HF digestions with longer duration are sometimes required in order to achieve complete recovery of these elements. Here we develop a rapid and universal method for the determination of Mo in geological samples using ID-ICP-MS combined with fused-glass bead digestion (sample + lithium tetraborate). The fused-glass beads were properly dissolved into a diluted HF with spike solution. The optimized procedure and analytical capability using ICP-QMS with HF-resistant setting will be presented by showing results of replicate analyses for reference materials such as volcanic rocks (JB-1, JB-1a, JB-2, JB-3, JA-1, JA-1a, JA-2, JA-3, JR-1, JR-2, JR-3, BIR-1a, BCR-2, BHVO-2 and W-2a), plutonic rocks (JGb-1, JGb-2, WMG-1, JG-1, JG-1a, JG-2, JG-3 andJSy-1), ultramafic rocks (JP-1, JH-1, OKUM, GP-13 and UB-N), sedimentary rocks (SCo-1, SDo-1, Jdo-1, JLs-1, JCp-1, NIST694, JCh-1, JSd-1, JSd-2, JSd-3, JSl-1, JSl-2 and JLk-1) and ore-materials (JF-1, JF-2, JZn-1, JMn-1 and SARM32).

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