NIST SRM 610-614 matrix induced unique element fractionation in laser ablation ICP-MS at high spatial resolution analysis

Z.C. HU*, L. ZHOU, Y.S. LIU, L.S. ZHAO AND S. GAO

State Key Laboratory of Geological Processes and Mineral Resources, China University of Geosciences, Wuhan, 430074, PR China (*correspondence: zchu@vip.sina.com)

The greatest strength of the LA-ICP-MS technique is its application to microsampling in which extremely small pits are obtained. The results of this study highlight some significant different laser-induced fractionations between widely used external reference materials NIST SRM 610-614 and natural silicate reference materials (e.g., USGS reference glasses (GSE-1G, GSD-1G), MPI-DING glasses, USGS basalt glasses and zircon reference material GJ-1) at high spatial resolution analysis. For the sample matrices and analytical conditions used in this study, the laser-induced elemental fractionations for 63 selected isotopes are negligible at the spot sizes of 160-44 μm. However, the laser-induced elemental fractionations of Li, Na, Si, K, V, Cr, Mn, Fe, Co, Ni, Cu, Rb, Cs and U (with respect to Ca) increase significantly with decreasing spot sizes from 44 μm to 32 μm, 24 μm and 16 μm in these natural silicate reference materials. Unlike in these sample matrices, laser-induced elemental fractionations of these elements in NIST SRM 610-614 are unique in that they are almost not affected by the change of spot sizes from 44 to 32 to 24 μm, with only slight increase at the spot sizes of 16 μm. The much less significant laser-induced elemental fractionation in NIST SRM 61X in comparison with other natural silicate materials makes them nonideal as external reference materials at high spatial resolution analysis. Alternatively, this NIST SRM 61X-specific matrix effect for Li, Na, K, V, Cr, Mn, Fe, Co, Ni, Cu, Rb, Cs and U can be minimized by using Si for internal standardization. U and Pb in zircon GJ-1 are exceptions, which are zircon-specific.

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Single-grain muscovite Rb-Sr age of Xushan W deposit, central Jiangxi, China, and its geological implication

R.M. HUA[1]*, G.L. LI[1], X.L. WEI[2], X.D. WANG[1] AND X.E. HUANG[2]

[1]State Key Laboratory for Mineral Deposits Research, Nanjing University, Nanjing 210093, China (*correspondence: huarenmin@nju.edu.cn)

[2]Jiangxi Bureau of Nonferrous Metal Exploration, Nanchang 330001, China

The Xushan tungsten deposit in central Jiangxi province, China, comprises three types of ore-bodies, i.e. quartz vein type, skarn type, and altered granite type. Rb-Sr micro-isochron method [1] is first applied to determine the ore-forming age by using single grain of muscovite growing at the edge of the wolframite-quartz vein. Six pieces of muscovite are used for Rb-Sr isotope analysis. Result shows that the mineralization age is 147.1 ± 3.4Ma, with MSWD = 0.71. This ore-forming age is similar to many tungsten deposits in southern Jiangxi. The very high I_{Sr} value (0.849 ± 0.026) may suggest that the ore-related granite was a melting product of highly evolved and highly saturated crust material, and the ore-forming fluid had extracted the strontium of extremely high $^{87}Sr/^{86}Sr$ ratios from the granite through water-rock interaction. It also suggests that there was almost no contribution of mantle material during the formation of either ore-related granite or tungsten mineralization, which is also proven by some He-Ar isotope studies [2, 3].

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