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A study of quantitative analysis of Korean granite using ICP-AES/MS/XRF

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Geological reference material is essential for analytical research and has been widely used for a chemical analysis to obtain accurate geochemical data. Also, it is useful to evaluate the accuracy and precision of the analysis, to develop and improve analytical techniques. Although there is a trend that demand for these geological reference materials is increasing but development of Korean geological reference materials has been ceased since the 1990s. In this study, therefore, as a preliminary part of research for development of Korean geological reference materials, we selected granites that can represent Korean rocks and determined the concentration of major/minor/trace elements of granite sample using various analytical instruments. The major elements of the granites were obtained by XRF analysis, and concentration of minor/trace elements were measured using ICP-MS/AES. For the selection of a candidate of Korean reference materials, following options should be satisfied; represent the Korean rocks, chemical compositions are homogeneous, not include structure like fissure or fold, fresh rock is available in a large volume. Based on these options, we selected two Jurassic granites and one Cretaceous granite which are representing Korean rocks. XRF (Bruker, S8 Tiger) was performed at the Center for Research Facilities of Gyeongsang National University. X-ray fluorescence (XRF) analysis has the problem of volatilization of volatile elements like alkali metal, Pb, Cs and Zn during melting at high temperature when glass bead produced. In order to minimize these problems, glass beads were prepared at 1020℃ for 10min. In addition, ICP analysis was carried out at the Korea Basic Science Institute in Ochang. Inductively coupled plasma mass spectroscopy/atomic emission spectroscopy (ICP-MS/AES) are most widely used analytical techniques to determine the concentration of major and trace elements in the rock samples. The complete dissolution of rock samples is, however, difficult when they contain refractory minerals such as Zr, Hf, and REEs. Generally, in the case of a granite sample, there are methods for complete dissolve including acid digestion, glass bead digestion, microwave assisted procedure, high-pressure bomb procedure. In this study, we digested three granites using mixed acid (HNO3:HF:HClO4=4:4:1), aqua resin, 1% v/v HNO3 for complete dissolution of granite samples. Precision and accuracy of the analytical techniques are evaluated by using reference materials supplied by USGS and GSJ and then we calculated concentration of chemical composition of granite rocks. Based on these results, the possibility of development as a Korean reference material will be examined by comparing the results of analysis carried out by other analytical institutions and determined the reference value. We expected that these reference materials are to be utilized in various field such as research institutes like a universities and laboratories, as well as in analytical institute supporting analysis study.

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