Trace potassium determination for K-Ar dating

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One of our facilities, the K-Ar dating equipment, is applied for wide range age determination with K-Ar dating, which ranges from several hundred million years to several ten thousand, in JAMSTEC, IFREE. In the K-Ar dating, determination of argon and potassium are carried out respectively and the uniform condition in both determinations is required for the quantitative evaluation of sample heterogeneity. Noble gas mass spectrometer is used for argon analysis and our facility is in high sensitivity condition that we can analyze with 20% of usual quantity, about 50-100 mg for whole rock or about 3-10 mg for mica. Therefore, our potassium determination should be performed with equivalent amount of sample, and about 100 mg of powder sample was required practically, however, because of requirements from a precision on quantitation and a suppressed contamination. There is another inconvenience on K-Ar dating, the potassium element is contained various rocks as a section of groundmass or any limited kinds of phenocrysts, and the dating is performed with such a potassium enriched section. The potassium low contents are sometimes expedient for radiometric dating, to suppress the effect of alteration or other probable reasons, however. There are some other advantages in K-Ar system, like that potassium is more abundant and widely distributed than other dating elements hopefully, such as alkaline series elements, in low potassium minerals.

In atomic absorption analysis, there are roughly two methods of atomization. One operates a flame chamber and the other operates an electric graphite furnace. Higher sensitivity can be obtained for the latter. The target element in sample solution is atomized by force of high temperature in both methods and makes atomic steam. The steams absorb light of specific wavelength and the absorbance is proportional to the concentration. The procedure is almost same as the usual absorption photometry, is different in the absorber that is solution or high temperature atmosphere, or in the light source, which is dispersed white light or monochromatic lump. The deuterium lump method and the polarized Zeeman method are major background correction method in atomic absorption photometry. The model of the Hitachi Z-5010, which employs double-beam polarized Zeeman method for background correction, is used in this study. The high precision in analysis enables that the highly matrix effect separated from signal from background.

For Atomic absorption analysis, normal analyses with flame chamber need several ten ml of solution samples. The new optical system and the improved graphite furnace power supply circuit ensure high sensitivities. (50 µL of standard solution having Se concentration of 1 ppb was introduced into the graphite furnace, and measurement was made under identical conditions).

In order to determine trace amount of potassium, we produced a clean room laboratory (less than class 10,000) last year to prepare solution samples for micro low contents of potassium, without contamination. When for atomic absorption photometry of double-beam polarized Zeeman is used, we can determine more than 0.01% of potassium in rock samples with flame chamber. However, we can set to work with determining trace potassium less than 0.01 (min 0.0001%) contents of potassium in rock samples with graphite furnace method. The analysis with graphite furnace need 10µl-100µl of solution sample and can be analysed with high sensitivity.

We are able to analyze difficult samples with low contents of potassium such as low potassium rock samples, plagioclase and peridotite recently.