

# Rapid Analysis of Uranium and Thorium Concentrations in Powder Rock Samples by a Delayed Neutron Counting

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A delayed neutron counting system installed at the HANARO research reactor in the Korea Atomic Energy Research Institute was applied to the analysis of elemental uranium concentrations in the rock samples collected at the Samcheok area, northeastern Yeongnam massif, South Korea. For the accurate determination of uranium, the correction of thorium interference was carried out. The resultant values are consistent with the values determined by the ICP-MS. The DNC method was proven to be a very rapid and excellent method for the quantification of the uranium concentration in the geological samples. Detection limit and determination limit determined by a background count of 60 seconds are 92.2 counts and 326.6 counts, respectively. These values can be converted into a uranium concentration of 17.7 ng and 62.8 ng, respectively. Because uranium as an incompatible element tends to dissolve into a melted rock, sample S6, which is considered as a rock produced in the last stage of magmatic differentiation, includes the relatively high concentration of uranium. Sample S10 has high biotite content. Biotite has a texture where zircon and monazite are densely embedded. Zircon and monazite are essential ores for the sorption of uranium and thorium. Zircon is known to contain uranium and thorium in the range of 10 ppm to 10 wt% [7]. The concentration of thorium in the rock is highly related to the monazite content. Monazite is known to have at least 4 chemical compositions among which monazite-Ce(Ce,La,Pr,Nd,Th,Y)PO<sub>4</sub> is an indicator of the containment of thorium. Table 2 shows the results for the concentrations of Ce, La, Pr, and Nd determined by ICP-MS [2] along with that of uranium and thorium by DNAA. Samples of S3, S8, S9, S10, and S12, which have high monazite content, show a high concentration of thorium along with La, Ce, Pr, and Nd. The concentration of uranium is less related to the monazite content than that of thorium. Sample S6, which is a metamorphic igneous rock, has high thorium content although the monazite and zircon contents are low.

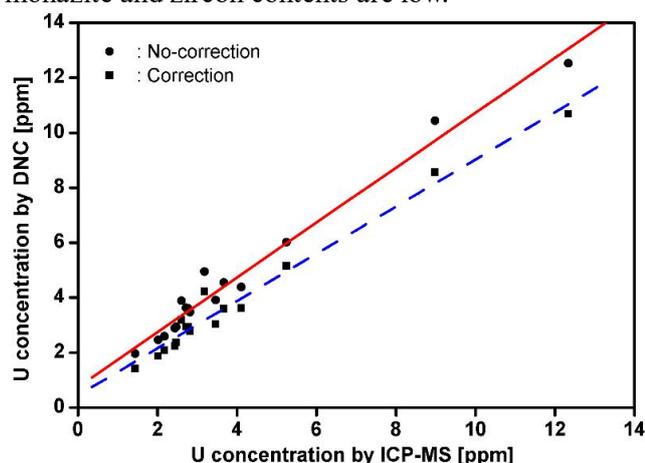


Fig. 1. Uranium concentration determined by DNC with and without correction of thorium interference according to the uranium concentration by ICP-MS.

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