

# Geochemistry of sedimentary rocks around Tono uranium deposit, central Japan

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## 1. Objective and Method

Tono uranium deposit has been studied as natural analogue on geological disposal of high-level nuclear waste. However, the previous studies have focused on the migration of U in micro-scale and the migration of elements in the mining scale (several km x several km) has not studied. In this study, many samples were collected from top to the bottom of sedimentary rocks, and were analyzed for mineralogy by XRD, for major elements by XRF, and for minor elements by ICP-MS. Besides that, clay fraction of the samples was analyzed for minor elements by ICP-MS and for major elements (REE etc) by ICP-AES.

## 2. Major elements

Major elements contents of the samples analyzed by XRF indicate that sedimentary rocks of Toki were derived from basaltic rocks, and of Akeyo and Oidawara from dacitic rocks.

## 3. Smectite

Smectite is most abundant in the Toki overlying U deposit. Samples containing abundant smectite are rich in V and also rich in U in some samples. This implies that V precipitated in reducing environment.

Clay fraction of the sample containing abundant U is also rich in U. U was considered to have adsorbed or precipitated onto clay minerals

Major element contents of clay fraction analyzed by ICP-AES indicate smectite is derived from basaltic rocks.

L-REE of clay fraction is more abundant than bulk rock samples.

## 4. REE

The Eu anomaly value  $Eu^*/Eu$  decrease to deeper horizon. This indicates Toki granite component is contained in deeper part.

The Ce anomaly value  $Ce^*/Ce$  increase to deeper horizon. Oxidized Ce supposed to be precipitated.

$Dy_{CN}/Dy_{CN^*} = Dy_{CN} / ((Gd_{CN})^{2/3} + (Ho_{CN})^{1/3})$  shows the degree of tetrad effect. The value larger than 1 shows M-type tetrad effect, while less than 1 shows W-type. The values decrease to deeper horizon. Groundwater in the Tono area shows W-type tetrad effect. This suggests ground water affects REE pattern in deeper part.

SiO<sub>2</sub> correlates with REE in the samples containing heavy minerals. It is considered that most of REE are contained in feldspar and the migration of REE has not occurred.

## 5. Implication for natural analogue

L-REE are enriched in clay fraction. L-REE are chemical analogue elements of Am and Cm. Therefore, buffer materials (smectite) can be expected to retard migration of radioactive elements such as Am and Cm.

V precipitated in reducing environment. This implied that the migration of radioactive elements in high-level nuclear waste can be retarded in reducing environment.

Above results indicate that migration of LREE, U and V were retarded by the clay rich formation of basaltic origin containing abundant Fe-smectite.