

## Lead isotopes of the Tono uranium deposits: uranium ore formation and radionuclides migration

# Kosei Komuro[1]; Masashi Yaguchi[2]; Eiji Sasao[3]

[1] Life Environment. Sci., Univ. Tsukuba; [2] Life and Environmental Sciences, Tsukuba Univ.; [3] JAEA

<http://www.geol.tsukuba.ac.jp/EarthResource/index.html>

The Tono sandstone-type uranium deposits occur as lenses or beds in the basal conglomerates of middle Miocene Toki lignite-bearing formation in the Mizunami group, which rest on the late Cretaceous granitic basement. In order to understand the age, origin, formation process, and radionuclides migration behavior of the deposits, lead isotopic compositions were measured for uranium ores and the associated sedimentary and granitic rocks.

The  $^{206}\text{Pb}/^{204}\text{Pb}$ ,  $^{207}\text{Pb}/^{204}\text{Pb}$ , and  $^{208}\text{Pb}/^{204}\text{Pb}$  of basement granitic rocks around the deposit are ranging in 18.44-18.64, 15.59-15.61, and 38.74-38.92, respectively. The  $^{206}\text{Pb}/^{204}\text{Pb}$ ,  $^{207}\text{Pb}/^{204}\text{Pb}$ , and  $^{208}\text{Pb}/^{204}\text{Pb}$  of sedimentary rocks around the deposit are similar, ranging in 18.35-18.57, 15.53-15.60, and 38.29-38.91, respectively. Lead isotopic compositions of rocks from this area are plotted in the region of that from the continental crust in the  $^{206}\text{Pb}/^{204}\text{Pb}$ - $^{208}\text{Pb}/^{204}\text{Pb}$  and  $^{206}\text{Pb}/^{204}\text{Pb}$ - $^{207}\text{Pb}/^{204}\text{Pb}$  diagrams, indicating that the origin of lead in these rocks was the continental crust.

The  $^{206}\text{Pb}/^{204}\text{Pb}$ ,  $^{207}\text{Pb}/^{204}\text{Pb}$ , and  $^{208}\text{Pb}/^{204}\text{Pb}$  of ores are ranging in 18.41-1011.50, 15.57-115.61, and 38.23-38.94, respectively. Two distinct different isochrons, i.e., about 20 Ma and 5 Ma, are found in the  $^{206}\text{Pb}/^{204}\text{Pb}$ - $^{238}\text{U}/^{204}\text{Pb}$  diagram. The data of many ore samples with lower uranium contents are plotted on the 20 Ma isochron, whose initial lead isotopic composition is identical to that of granitic rocks around the deposit, indicating that the origin of these uranium ores was granitic rocks. On the other hand, the data of ores with higher uranium contents are plotted on the 5 Ma isochron, whose initial composition was strongly radiogenic, suggesting that they are formed by re-deposition after dissolution of the pre-existing uranium ores with homogenization of lead isotopic compositions.

The Tono sandstone-type uranium deposits were formed by initial deposition caused by reduction of uranium in association with the decomposition of the plant materials at the time of the deposition of host conglomerates and sandstones in the Toki lignite-bearing formation, the uranium of which originated from the granitic basement. At the time of deposition of Seto group after the upheaval of this region, some parts of these ores dissolved by oxidative groundwater and the secondary ores were formed by the subsequent re-deposition by reduction.