Reasearch and development on groundwater dating for very old groundwater in coastal area

TAKUMA HASEGAWA[1*], KOTARO NAKATA[1], YUICHI TOMIOKA[1], TOMOKO OTA[1]

[1]Nuclear Fuel Cycle Backend Research Center, Civil engineering Research Laboratory, Central Research Institute of Electric Power Industry
(*correspondence: *t-hase@criepi.denken.or.jp)

Groudwater dating using isotopes and noble gases is one of the most promising method to evaluate very old groundwater. It can be applied to site investigation for geological disposal of radioactive waste. On high-level waste disposal, groundwater flow in a candidate formation is important because a groundwater senario is one of the most important senario, which assess the radionuclide transported by groundwater flow. The radionuclides decay with time, thus slower groundwater flow yields lower radioactive toxicity. Therefore, we have been doing research and development on groundwater dating, which can evaluate long time, eg. ^{14}C, ^{36}Cl, ^{4}He, etc. We applied several methods simultaneously to obtain reliable ages[1,2].

Recently, a costal area seems to be favorable for candidate area due to tranportaion. In costal area, mobility of groundwater can be categorized into four types, which are modern and glacial freshwaters, modern and fossil seawaters. Modern and glacial freshwaters could be distinguished by ^{14}C, noble gas concentrations, δD&$\delta^{18}O$[3,4]. Modern seawater and fossil seawater could be distinguished by ^{14}C, ^{36}Cl and ^{4}He. Moreover, the remained fossil seawater has been freshend due to sea level lowering during glacial perid. Profiles of ions and isotopes formed by diffusion could be evidence of diffusion dominant. The separtion of water component (Cl and δD) and the fractionation of isotopes ($\delta^{37}Cl$) are expected due to the differnce of diffusion cofficients[5].

The remained fossil seawater will be key evidence to show the long term performance of the candidate formation.

This study was carried out under contracts awarded by the Japanese Ministry of Economy, Trade and Industry (METI) to Central Research Institute of Electric Power Industry.

[1] Mahara et al.(2009), EPSL,287, 43-56.
[2] Hasegawa et al.(2016a), GCA, 192,166-185.
[3] Nakata et al.(2011), CRIEPI report, N10036, 14p.
[4] Tomioka et al.(2010), CRIEPI report, N10005, 25p.
[5] Hasegawa et al.(2016b), GCA, 192, 279-294.