

Stability of deep groundwater at coastal area in Japan

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Groundwater dating using isotopes and noble gases is one of the most promising method to evaluate very old groundwater for radioactive waste disposal [1,2]. On high-level radioactive waste disposal in Japan, “Nationwide map of Scientific Features relevant for Geological Disposal” was published and coastal area is the favourable from transportation point of view [3]. Therefore, stability of deep groundwater at coastal area have been investigated.

Over 70 groundwater samples were taken from 1,000 m class borehole. Major ions, ³H, ¹⁴C, ³⁶Cl were measured. It is difficult to estimate groundwater age directly. Considering sea-level change due to glacial and inter-glacial, deep groundwaters at coastal area can be categorized into four groups, which are modern meteoric water, modern seawater, glacial meteoric water, fossil sea water. Modern meteoric and seawater recharged after glacial period (maximum transgression). Glacial meteoric water recharged during glacial period. Fossil sea water is old seawater entrapped during sedimentation.

The relationship between Cl and ¹⁴C is useful for categorizing. Cl and ¹⁴C will be good indicator for seawater and modern water, respectively. The modern and fossil seawater can be confirmed by ³⁶Cl/Cl ratio because they have quite different groundwater ages. On contrary, there are uncertainties for categorizing modern and glacial meteoric water because the recharge temperature could not be applied using water isotope and noble gas temperature.

Over the half of groundwaters were categorized into glacial meteoric water and fossil sea water. The remained glacial meteoric water and fossil seawater will be key evidence to show the stability of groundwater flow at candidate formation.

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[1] Mahara et al.(2009), EPSL,287, 43-56.

[2] Hasegawa et al.(2016), GCA, 192,166-185.

[3] https://www.meti.go.jp/english/press/2017/0417_001.html.