

Relationship between residence time, water quality, and stable isotopes of spring water and groundwater in coastal area of Fukushima prefecture

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After the Great East Japan Earthquake occurred, the investigation near the coast area in northern part of Fukushima prefecture has been carried out to clarify the groundwater flow and residence time in this area. The measuring of EC, pH, water temperature, ORP and sampling of groundwater, spring water and river water have been carried out several times at Shinchi town, Soma city, Minamisoma city, Namie town, Okuma town, Iitate village and Date city since September in 2012. The inorganic ions, stable isotopes of oxygen and hydrogen, trace elements were analyzed for all samples by using the IC (ICS-3000), CRDS (Picarro L2130-i) and ICP-MS (Agilent 7500cx). For estimating the residence time, tritium concentration, CFCs and SF₆ measurements were made in several samples.

The water quality of river water and shallow groundwater indicates mainly Ca-HCO₃ type. In the part of the flooded area by a tsunami, the water quality of shallow groundwater and spring water is Na-Cl type. The Ca-SO₄ type and mixed type were also confirmed in some sites. In the case of deep groundwater, the water quality shows the Na-HCO₃ type and Ca-HCO₃ type. The concentration of Fe, Mn and Al were relatively high in some parts of deep groundwater. It is considered that the origin of these trace elements is soil.

The stable isotopes of oxygen and hydrogen ($\delta^{18}\text{O}$ and δD) in river water of Niida river, Mano river and Kamimano river indicate altitude effect. Because the stable isotopes in deep groundwater is relatively low, it is anticipated the recharge area of deep groundwater is about 300 m higher than that of shallow groundwater. It is expected that the recharge area of deep groundwater is around the Abukuma Mountains.

The average residence time of deep groundwater and spring water which indicate the Na-HCO₃ type is about 60 to 70 years. On the other hand, the average residence time of shallow groundwater which indicate the Ca-HCO₃ type is less than 10 years.

The information of groundwater flow is useful for considering the groundwater use with revival of the coastal area. We will continue the investigation of coastal area and make clear the groundwater flow system.

Keywords: Minamisoma city, Fukushima prefecture, CFCs · SF₆, residence time, water quality, stable isotopes, groundwater flow