Hydrological Study of Groundwater flow system with Multi Tracers at The Sendai Plain, Northeast Japan

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It is important to understand the groundwater flow system in plain part to manage groundwater quality and quantity as water resource, because groundwater is the most important and useful water resources for living and industrial in Japan.

The Sendai plain located in southeast part of Miyagi prefecture is a coastal plain. The Sendai plain is one of the largest plain in north part of Japan, and has large longitudinally: Distance from coast to mountain or hill area is about 10km, on the other hand, length of coastline is about 40km. In this area, groundwater had been pumped out in large quantities for agricultural and industrial use. These large pumping has caused land subsidence at inland part and salinization of groundwater at coastal part.

The purpose of this study is to clarify the groundwater flow system in the Sendai Plain using multi tracers; hydraulic potential, subsurface temperature, chemical components and isotopes. In this study, hydraulic potential and subsurface temperature was measured with observation wells. Water samples were collected from observation wells, pumping wells, springs and rivers, then, chemical components and stable isotope of oxygen and hydrogen were analyzed.

From the result, these each tracer had the characteristic of distribution. Subsurface temperature is increased with the depth. The thermal gradient is relatively constant in peripheral area of the plain and hills. On the contrary, it is changed with the depth in plain part. In the plain part, Quaternary sediments have low thermal gradients, then it increase in Tertiary rocks. The chemical components of surface water and groundwater in Quaternary sediments show Ca-HCO3 type mainly, however, Na-HCO3 type in Tertiary rocks. Further, some another parts show Na-Cl type. Stable isotope ratio of oxygen and hydrogen of groundwater are increased with the concentration of chloride. From the spatial distribution of these tracers, it is estimated that the groundwater flow system in the Sendai plain is divided into shallower flow system in the Quaternary sediments and deeper flow system in the Tertiary rocks.