

5-8 Determining Groundwater Flow on a Regional Scale

— A Study of a Regional Groundwater Flow System in a Sedimentary Rock Area —

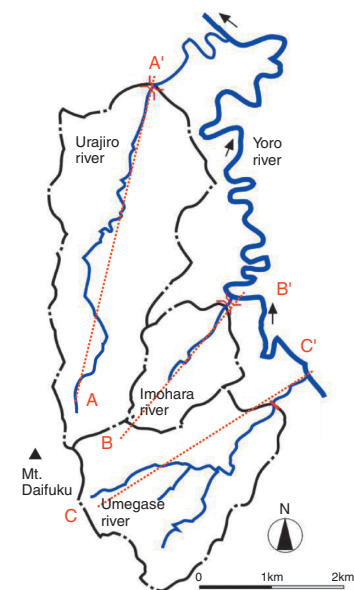


Fig.5-18 Map of position of 3 rivers (Urajiro, Imohara and Umegase River)

Flow rate and chemical compositions of water are investigated in 3 rivers. These 3 rivers flow down from Mt. Daifuku in the north, northeast, and east direction.

In the safety assessment for geological disposal of long-lived radioactive waste, it is important to estimate radionuclide migration to human environments through groundwater flow. We are studying regional groundwater flow systems.

In order to understand a regional groundwater flow system on a 10-100km scale, it is necessary to validate a conceptual representation of flow system from the recharged area to discharged area comparing with the observed data. Therefore, we investigated a sedimentary rock area in the Yoro river basin (Fig.5-18) and constructed a conceptual flow model of the region using the observed data of flow rate, chemical composition of groundwater, and isotopic ratios of hydrogen and oxygen in water samples collected from wells, rivers and springs.

From the observed flow rates, analyzed results of water samples and Mt. Daifuku's spatial characteristics, it is found that the groundwater recharged at Mt. Daifuku flows toward the east-northeast which is the direction in which the sandstone and high permeability mudstone strata run, and is discharged in the Imohara river and the Umegase rivers. In addition, it is estimated that a part of groundwater flows down deeper than 100m where the stratum tilts, and then flows out to the surface layer basin through fractures in a

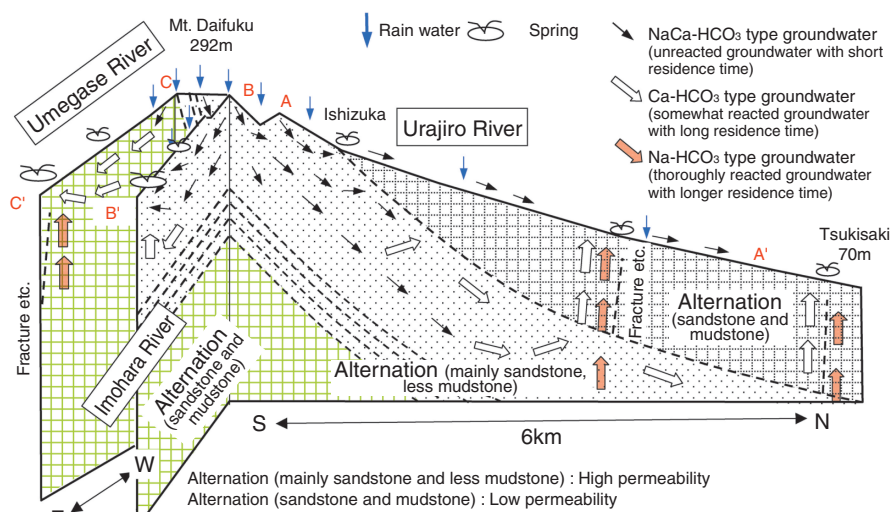


Fig.5-19 A conceptual representation of a three-dimensional groundwater flow in a research area

Groundwater is recharged at Mt. Daifuku which consists of a highly permeable sandstone. The groundwater flows through a shallow stratum and flows out at a relatively early stage into the Umegase and the Imohara rivers.

sandy-mudstone stratum with low permeability (Fig.5-19).

Chemical composition and isotopic data indicated that most of the groundwater is precipitation recharged at Mt. Daifuku, and that the groundwater is of the NaCa-HCO₃ type which is chemically unreacted groundwater with short residence time or of the Ca-HCO₃ type which is reacted groundwater with long residence time. The groundwater discharged into the downstream of the Urajiro river and the Umegase river was found to include the Na-HCO₃ type groundwater which has been reacted to a great extent, and which rose from a deep stratum.

Considering the above results, we conclude that a hydrological approach (measuring the flow rate of river and estimating underground flow) combined with a geo-chemical approach (analyzing the groundwater composition including isotopic ratios) is a useful method for evaluating the relationship between surface water, shallow groundwater and deep-seated groundwater which needs to be determined in order to establish a regional groundwater flow model.

The present study was conducted in FY2006 as part of the "Study of Influence of Hydrologic/Geological Changes Related to Geological Disposal" commissioned by the Nuclear and Industrial Safety Agency (NISA) of the Ministry of Economy, Trade, and Industry (METI).

Reference

Sakai, R., Munakata, M. et al., Study on Groundwater Flow System in a Sedimentary Rock Area (Part 2): Case Study for the Yoro River Basin, Chiba Prefecture, JAEA-Research 2007-083, 2008, 38p. (in Japanese).