Hydrogeology and Groundwater flow system in R.Chikugo-gawa Plain, Fukuoka Prefecture, Japan

Satoshi HASEGAWA, Akira OISHI, Seisuke MIYAZAKI

Yachiyo Engineering Co., Ltd. 2-18-12, Nishiochiai, Shinjyuku-ku, Tokyo, 161-8575, Japan,
e-mail: st-hasegawa@yachiyo-eng.co.jp http://www.yachiyo-eng.co.jp/

Background of the study

The Chikugo-gawa alluvial fan has been inhabited since the Yayoi Period, and was used for rice fields which were irrigated from the spring waters and irrigation ponds on the alluvial fan until the 1950's.

Cropland abandonment and urbanization increased recently, although the arrangement of the irrigation networks and the arable land holdings were upgraded by the construction of Dams were made into rice fields in the 1960's.

Therefore, it is important to understand that the river and groundwater interact.

The authors attempted to clarify these interactions by a survey of the hydrogeological structure of the area.

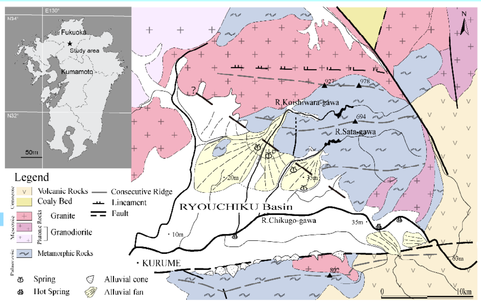

Fig.1 Geological map on the study area

Geological setting

◆The Cretaceous granites and the Triassic Sangun Metamorphic Rocks are distributed widely in the surrounding area of the Ryochiku Basin, and the volcanic rocks of Plio-Pleistocene age are distributed in the upstream area.

◆The Ryochiku Basin is a half graben rift basin formed by faulting in E-W and NW- SE directions. This basin is filled with debris flow deposits and flood plain to marsh sediments.

◆From the fact that a potential falls in the depths at Aso-4, We defined gravel bed of a shallower than Aso-4 as 1st aquifer.

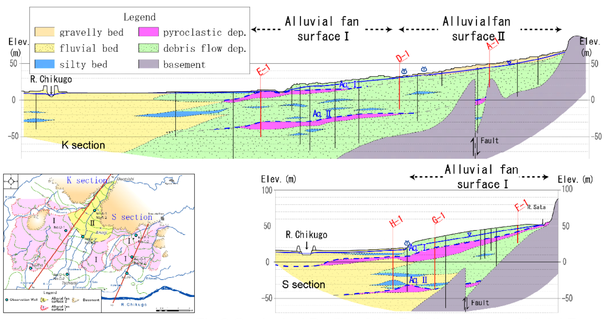

Fig.2 Geological Profile of the R.Chikugo-gawa Alluvial Fan

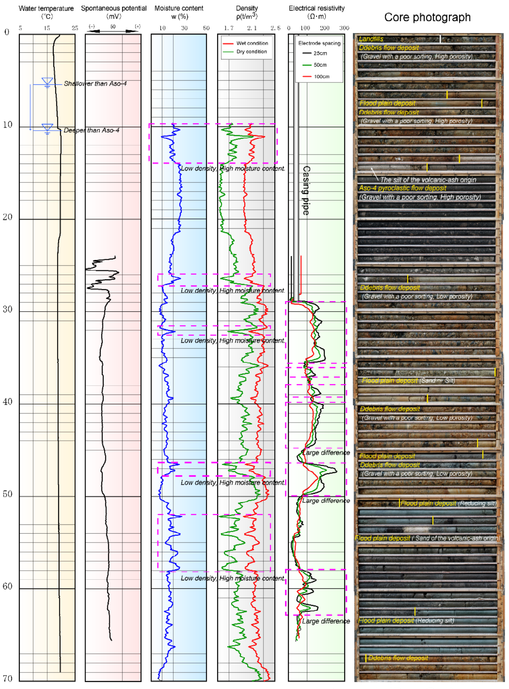

Fig.4 Well-logging result and core photograph (Bor. G-1)

Supply of sediments

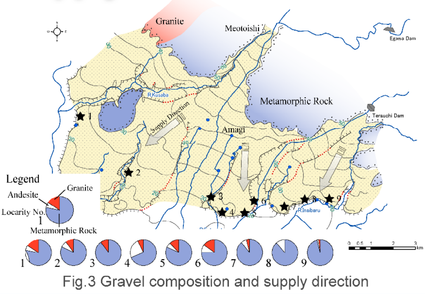

Fig.3 Gravel composition and supply direction

◆The gravel composition of the surface outcrops includes granite on both banks of the R. Koishiwara-gawa, that is hardly present on the left bank of the R. Sata-gawa.

◆In the fan surrounded by the R. Koishiwara-gawa and R. Sata-gawa, this figure shows that the sediment originated from the R. Koishiwara-gawa.

Groundwater condition (1st Aquifer)

◆Groundwater table harmonizes with a geomorphic surface. Groundwater flows toward a low place from a height.

◆It is left bank of the R. Sata-gawa that seasonal change of a groundwater level is a maximum.The rise of an irrigation term is large.

◆In an observation well, groundwater level of the 1st Aquifer is always higher than that of the 2nd Aquifer. Groundwater is shown to have permeated below.

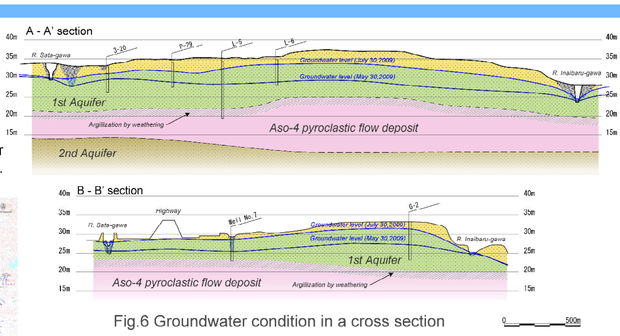

Fig.6 Groundwater condition in a cross section

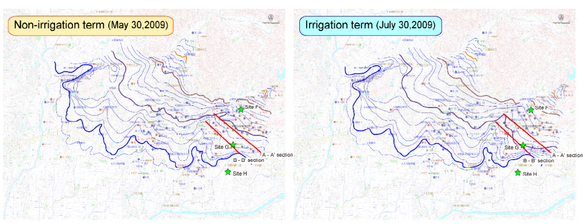

Fig.5 Groundwater table of a different season

Groundwater quality

◆Groundwater quality is stable, and one of 1st has the characteristic of High-NO_3, Low-HCO_3 type.

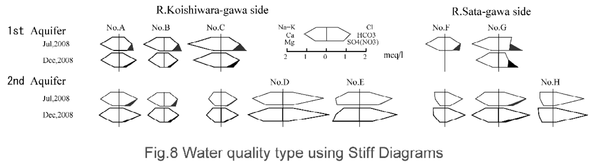

Fig.8 Water quality type using Stiff Diagrams

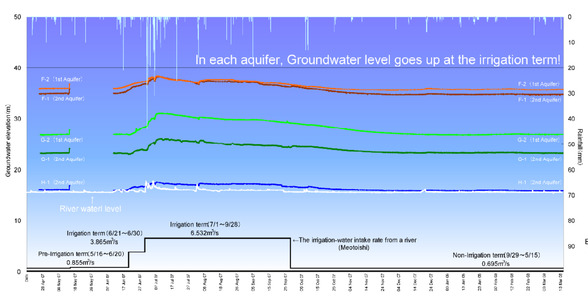

Fig.7 Fluctuation in groundwater level (Left bank of R.Sata-gawa)

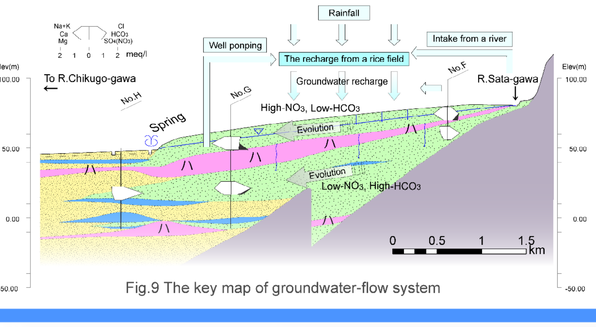

Fig.9 The key map of groundwater-flow system

Groundwater flow system

◆The main recharge to the 1st aquifer is supplied from a rice field, and NO_3-enrichment may come from cultivated soils.

◆Groundwater quality evolves from a upstream to a downstream. According to the distribution of a potential, there is percolate concern from 1st aquifer to 2nd aquifer.

Future subject

Generally, due to the rise in temperature in the future, the amount of evapotranspiration and river outflow will increase due to the change in the rainfall patterns and the amount of recharge to groundwater is expected to decrease.

Additionally, further demand for 'fresh water' is expected due to improvements in human quality of life and the resultant changes in the industrial structure.

Therefore, it is important to understand that the river and the groundwater have interacted with one another. And, it is advisable to manage the river water and the groundwater in a unified concerted manner in order to utilize effectively the groundwater, which is a stable freshwater resource, after taking into consideration the hydrogeological structure of the Chikugo-gawa alluvial fan and the groundwater flow characteristics in this region.

The 50th Niigata University school festival, 17-18 October 2009