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Groundwater Flow System in Monoclinal Sand and Mud Alternation in Tectonically Active Zone – Introduction to Yoro River Project

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Yoro River Basin(YRB), Japan, is located at the edge of Kanto Tectonic Basin. Monoclinal sand and mud alternation sloping to Tokyo Bay contains vast amount of groundwater resources. Tokyo Bay at the lower end of the basin is one of the center of subsidence of Kanto basin-forming movement, and Kazusa Hill in the upper stream is the upheaval region with maximum annual rate of 2mm/year.

The study area is famous for "Kazusa-bori", that dig tube well to the depth of several hundreds meters by fully manpower using tools made by bamboo. Many of the Kazusa-bori wells are flowing condition in this region. Yoro River forms incised meander in Kazusa Hills. Flowing wells are existed even on the cutoff spurs at several tens of meters above river bed.

The subjects to be solved in the YRB are, (i) what is the formation mechanism of artesian condition, and (ii) the high underground pressure can be explained by current boundary conditions or not. We just started the synthetic project taking YRB as a target basin. At the presentation, previous outcomes by our group are summarized and express recent findings.

The mechanism of flowing condition can be generally explained by geology-limited and geomorphology-limited concepts. Our previous study reveals that the geomorphology is the dominant factor governing the groundwater flow system (GFS) in YRB, and anisotropy in permeability originating from alternation structure is contributed to high underground pressure.

Although topography mostly controls the nature of GFS, the geologic structure also affects the motion of groundwater. The massive mud layer intervened between sand and mud alternation have a role to transport deep groundwater to shallow part. It was revealed by distribution of stable isotopic content and water temperature, and also numerical simulation. This is very important to consider the utilization of deep geologic section in future.

The guidelines for following research are the measurement of groundwater age by several radioactive isotopes, and the linkage of surface and subsurface processes to understand GFS comprehensively.

Keywords: groundwater flow system, the Yoro River Basin, monoclinal structure, sand and mud alternation, isotopes, tectonically active region