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Interpretation of geophysical well logs in coastal aquifer, Yeonggwang-gun, Korea

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In order to assess the saltwater intrusion, various geophysical well logs including temperature and conductivity of fluid log, and radioactive logs (i.e. natural gamma log, neutron log and gamma-gamma (density) log), electromagnetic log, caliper log, and image logs and so on were obtained in twenty-nine boreholes during about 7 year period from January 2000 till September 2007. The survey area comprises a paddy and dry field mainly. The survey area is about 24 km^2. From the drilling the geologic structure shows a mud layer from surface to 10-15m, a sand layer to 23-25m, and a bedrock layer comprising granite below 23-25m approximately. Electrical conductivity logs were carried out to understand the salinity change of coastal aquifer related to the saltwater intrusion. Electrical conductivity logs in boreholes YK-4, -5, -7, and -9 drilled the depth of about 50 meters and located the saline water area progressively increased with the time. These results indicated that saltwater intrusion progress of survey is affected the fractures connected with seaside, and agreed with long-term monitoring data such as groundwater level. Natural gamma logs conducted to identify the geology of bedrock. Geology of boreholes YK-21, -23, -25, -28, and -29 mainly consists of granite, but several intervals were andesite. Natural gamma logs were used to identify between granite with high natural gamma count and andesite with low natural gamma count. Electromagnetic induction logs, neutron logs and gamma-gamma (density) logs were used to estimate the pore water electrical conductivity of unconsolidated formation, and the pore water conductivities were used to interpret the vertical electrical sounding data. *in situ* physical properties by geophysical well logs and estimated pore water conductivity by vertical electrical sounding also were used as input parameters of numerical groundwater modeling to simulate the prediction of saltwater

intrusion. Image logs such as acoustic and optical televiewer log were performed to characterize the fractures. Although the drill core showed several fractures, we didn't identify the minor fractures using 3-arm caliper logs because of small aperture size of fractures. So image logs and drill cores were used to identify the permeable fractures estimated by heat-pulse flowmeter and fluid replacement conductivity logs. However there were so many fractures detected by acoustic televiewer logs. So in order to identify the applicability and the limitation of acoustic televiewer for the characterization of the fractures, 3 inches physical aluminum borehole model has been specially manufactured. The maximum resolving power for fracture aperture of acoustic televiewer by physical model showed about 3 mm.