Observation of an effect of interstitial water saturation and water quality on changes in formation resistivity

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In this observational study, effects of interstitial water saturation and water quality of pore water on formation resistivity were investigated, in order to estimate hydraulic geological structure from changes in formation resistivity. First, we compared formation resistivity under different conditions of antecedent precipitation rate. Relationships between the changes and ground permeability by geological reconnaissance were observed. Next, laboratory investigation of formation resistivity was carried out using samples taken at the study site. Effects of interstitial water saturation and water quality were measured for the adjusted test samples. The result showed a clear change in the formation resistivity around the depths with high permeability. After carefully considering possible influences such as measurement errors, the comparison of formation resistivity with different amounts of antecedent precipitation was regarded to show changes in the condition of pore water. Furthermore, another result of laboratory investigation indicated that interstitial water saturation and water quality have non-negligible impact on changes in formation resistivity. In particular, it was duly interpreted that a clear change can appear in response to the effects of precipitation recharge, since there was a large change between water quality of precipitation and mountain runoff water. The obtained relations among factors are useful for better estimation of hydraulic geological structure such as distribution of aquifers based on changes in formation resistivity.

Keywords: formation resistivity, pore water, antecedent precipitation rate, interstitial water saturation rate, water quality

